Digital Family Portraits: Supporting Peace of Mind for Extended Family Members

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ABSTRACT
A growing social problem in the U.S., and elsewhere, is supporting older adults who want to continue living independently, as opposed to moving to an institutional care setting. One key part of this complex problem is providing awareness of senior adults' day-to-day activities, promoting *peace of mind* for extended family members. In this paper, we introduce the concept of a digital family portrait that provides qualitative visualizations of a family member's daily life. Leveraging a familiar household object, the picture frame, our design populates the frame with iconic imagery summarizing 28 days. In a final implementation, the digital family portrait would gather information from sensors in the home.

Keywords: awareness, ubiquitous computing, light-weight interaction, aging, visualization, home

INTRODUCTION
The world's population is aging, and this aging will have far ranging social, emotional and financial effects. According to the U.S. Census Bureau, in 1996 there were approximately 550 million adults over age 60, and this number is expected to approach 1.2 billion by the year 2025. In the U.S. alone, there were nearly 44 million adults over age 60 in 1996, and the projected number for 2025 is approximately 82 million (over 20% of the total population).

A growing social concern is the support of aging adults in a manner that allows them to continue an independent lifestyle in their own homes, rather than moving to some form of institutional care. For economic reasons alone, increasing the length of time that individuals can avoid institutional care is valuable. According to the Administration on Aging (1997), there are many factors that contribute to the independence of older individuals including marital status (married or not), living arrangements (alone or with others), household status (head of household or not), education, economic dependency, and income. A variable that has not been studied is the degree to which the house itself is supportive of the functioning of the individual.

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For more than just economic reasons, a primary goal of many older individuals is to maintain an independent lifestyle [15]. Thus, many older adults live in private homes, typically either alone or with family [13]. While there are benefits to living in an institutional setting, many new residents report a profound sense of loss. Our research addresses those who wish to remain in the family home, where the many benefits afforded by living in familiar surroundings outweigh the benefits that can be derived from institutional living.

The aging adult's desire to remain in the familiar setting of the family home frequently must be balanced with their extended family's desire to keep them safe. Clearly this balance becomes more precarious as age increases. An aging couple can support one another, but if one becomes incapacitated, can the other support himself? No longer can family members have the peace of mind that derives from knowing that one aging parent can support the other. Additionally geographic distance between extended family members exacerbates the problem by denying the casual daily contact that naturally occurs when families are co-located. Providing a means of remaining aware of a distant family members' day-to-day activities, what could be called surrogate social support, can promote the *peace of mind* necessary for those senior family members to *age in place*.

Our goal is to support awareness of the long-term health, activity, and social well-being of senior adults living by themselves, answering questions such as "Has she been eating enough?" and "Is he active or sedentary?" For example, a display on an adult child's bookcase could provide a qualitative sense of the activity of his elderly mother. We believe that this day-to-day awareness is key to providing peace of mind for family members concerned about an elderly relative who potentially lives far away from them.

To meet this need, we introduce our design of a digital family portrait, providing a qualitative sense of a person's daily activity and well-being from available sensor information. Like a traditional portrait, it is designed to be hung on the wall or propped on a mantle, blending with household decorations. Instead of a static frame, the digital frame changes daily, reflecting a portion of the person's life. From general measurements of activity, to indications of the weather, the portrait attempts to capture the observations that would naturally occur to someone living in the same home or next door.

Most awareness interfaces only provide a snapshot of the present. Since many questions about an elderly parent refer to trends over time, such as "Is she becoming more socially isolated?," we provide representations of the past, as well as the present.

Overview

In this paper, we describe our successive designs along with laboratory and field studies of the digital family portrait. We first provide background information about the umbrella project, Aging in Place (AiP), that investigates technologies to support elderly individuals wanting to live independently in their own homes. One key resource in this work is the Broadband Institute (BI) Residential Laboratory, a *living laboratory* for designing, deploying and evaluating future home technologies.

We next introduce the concept of the digital family portrait, describing how it would be integrated into a future home. The goal of the portrait is to provide surrogate social support while respecting the privacy of the senior adult.

We employed a number of research methods to guide our design. First, we describe our initial field observations and interviews that were instrumental in helping us identify and understand the need for supporting peace of mind for family members, who do not have daily contact with their elderly parents or grandparents. Our first design was borne out of those interviews and our internal iterative design process.

In our first field study, we created daily digital portraits for a grandmother and her two grandchildren using phone interviews to simulate sensing infrastructure in their homes. We summarize the results from that study, including their ability to accurately "read" the changing information, and their qualitative response to the design and its potential use in their family.

Following that field trial, we embarked on another round of iterative design, exploring many design options that would reduce much of the information overload now apparent in our first design. During this process, we also validated portions of the design using empirical laboratory studies. We close by discussing related research as well as our plans for future investigations.

BACKGROUND

Aging In Place

This research began with simple curiosity about the problems facing senior adults as they continue to live in their own homes, coupled with a motivation to employ future computing technologies in the home. We began our investigation by visiting assistive living facilities, and interviewing the chaplains whose responsibility it is to counsel families considering a move to assistive care for an aging family member.

Our study focused on understanding *why* people left their homes for an institutional care setting. Based on our understanding of this complex issue, we are addressing three key problem areas:

- **Crisis recognition**: From the immediate crisis of a fall to an impending crisis of a broken heater in the winter, house systems must recognize potential problems and notify the residents and, as appropriate, outside support.
- **Everyday cognitive support**: Changes in memory capabilities of senior adults lead to difficulties in remembering tasks (e.g. taking medication) and handling interruption [12]. Future systems can recognize forgotten or interrupted tasks, and assist the occupant in resuming these tasks.
- **Awareness of daily life and long-term trends**: Difficulties in the home (e.g. decreasing mobility, isolation) may not be an immediate crisis or a forgotten task, but may still be a significant hurdle for the long-term health and happiness of the resident. Additionally, daily contact between family members, as opposed to the lack of an alarm, can provide a sense of security for the senior adult, provide peace of mind for the extended family members, and lower the barriers for more direct communication between the two.

This paper focuses on our efforts to provide awareness of daily life and long-term trends for the extended family members of a senior adult living alone.

The Broadband Institute Residential Laboratory

A key resource for this research is the Residential Laboratory on the Georgia Tech campus managed by the Broadband Institute (BI). The facility is shown in Figure 1. Initial funding for the building of this house came from the State of Georgia's Georgia Research Alliance. Construction was completed in April, 2000. The house is about 5000 gross square feet, and has two identical floors, each equivalent to a typical three bedroom apartment, allowing comparison studies. It is built with all the functional and design requirements of a normal home, as well as with facilities for instrumenting each and every room with sensors and displays to support ubiquitous interactions between the residents and the house.

As part of a multi-disciplinary group of researchers, we are installing a wide range of sensing equipment (cameras, microphones, IR, RF, sonar, tactile), including general metering on utilities, as well as specific instrumentation on appliances. The goal is to automatically and unobstrusively measure activities of the residents and provide support for their daily needs and activities.

FIGURE 1. Broadband Institute Residential Laboratory

Research is underway to equip this home with advanced computing and networking infrastructure to support the

wide array of sensing and display equipment. It should be noted that there have been previous efforts at building a smart and adaptive home. Similar to our efforts, Mozer [8] built a neural net-based home that he himself lived in, where the home learned his patterns and attempted to control lighting and other environmental sensors according to his daily routines. Our interest in the Residential Laboratory is more ambitious as we aim to support informal human activity via sensing, computing, networking, HCI, and machine learning. This house is serving as living laboratory [7] for various research projects that combine technological innovation with the study of how these technologies can enhance the everyday activities of the residents.

THE DIGITAL FAMILY PORTRAIT

In this paper we present the concept of a digital family portrait, a qualitative visualization of daily life that is meant to take its place alongside other family pictures on the fireplace mantle. Leveraging a familiar household object, the family picture frame, our design leaves the photograph held by the frame untouched, while the frame itself is populated with icons that are updated daily. These icons represent, not only the current conditions in the remote location, but they also carry a history of previous conditions. This history is represented so that possible developing trends might be more readily seen.

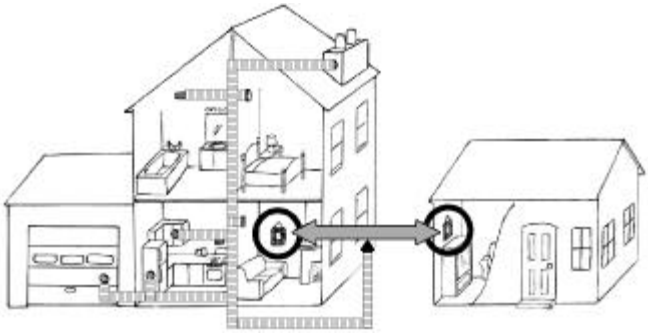

FIGURE 2. Sensing and Displaying Daily Life

As can be seen in Figure 2, data about the resident is being collected in their home. This data is used to create a display that is updated once a day. This display is presented to the intended audience, the extended family living in a remote home, as well as presented locally to the resident.

This qualitative visualization in many ways parallels the natural activities undertaken to keep an "eye out" for your Mom if she lived next door. Rather than glancing out the window from time to time to see if "things seem O.K. at Mom's house," by noting that Mom has picked up the morning newspaper, the family member would glance at the digital family portrait to be reassured that "life is proceeding as usual at Mom's." In this way, the digital family portrait is meant to be intentionally engaging and provide some of the back-story that goes missing when people are geographically distant. This back-story lowers the startup threshold of a conversation by providing a context in which new conversations can be started.

Surrogate Social Support

Surrogate social support is a form of mediated awareness intended to re-establish certain aspects of naturally occurring social support that have been disrupted, in this case, by the introduction of geographic distance into the extended family. If for no other reason than that of limited bandwidth, this mediation cannot be an entirely faithful re-establishment of that social support and as such it will leave certain aspects of that support lacking. On the other hand, mediation brings certain advantages to the mix that a naturally occurring social support system cannot.

In particular, surrogate social support can provide a history that supports human introspection. While looking out the window to see if Mom has picked up the morning mail (naturally occurring social support) provides the current state of the system (e.g. yes, she has vs. no, she hasn't), a surrogate social support system can provide the current state, and a history of that activity (e.g. no, she has not yet picked up the morning mail, but in the past week she has not picked up the morning mail until later). In addition to supporting human introspection, this display can include computational analysis. Trends that develop over time can be detected, and brought to the attention of the human observer.

Privacy

Privacy is clearly an issue of concern when working within the confines of a private home. A great deal of private information can be collected by sensors in the home, but how should this information be filtered to maintain privacy while providing enough data for a meaningful display? In this research, we have attempted to address these concerns by interviewing families so that we could identify common ground for sharing and receiving key information. We have investigated the use of reciprocal displays, and we always provide senior adults with a local copy of their portrait as it appears to their extended family.

NEEDS ANALYSIS

Throughout this research, we have interviewed families as they grapple with the aging in place challenge. These interviews have been the basis for our design work, by underlining the desire to remain in familiar surroundings of the family home, by drawing attention to the difficult task a family member faces when assessing the well-being of a senior adult, and by describing the characteristics of everyday life that should be conveyed in our display.

"A Profound Sense of Loss"

Many of the aspects of life at home are lost when one moves to any form of institutional living. Often pets are not allowed. One's schedule is dictated to a large extent for the convenience of the institution. The efforts to help the resident within the time constraints of an institution mutate *support of* the resident into *control over* the resident. Further, moving to an institutional setting causes social connections to their previous, more heterogeneous community to be lost.

Aging, social support and geographic distance

As a person ages their physical and cognitive abilities change. Barring accidents and other crises, these changes generally occur gradually over time. In a perfect world,

there would be capable spouses, or caring family members, living near enough that these changes could be watched as they unfold. The ebb and flow of the naturally occurring small changes would be noted. Possible intervention would be contemplated over a period of time and, if warranted, action could be taken.

In many cases, however, economic mobility has dispersed extended family members across wide geographic areas, leaving aging family members to care for themselves. The extended family of such aging adults is privy only to sporadic information that has been gathered by occasional, intentional contact, such as the weekly phone call. Long periods of silence may only be punctuated by the appearance of a crisis. This lack of daily contact creates a void that escalates normal concern for well-being into nightmare "what if" scenarios. Geographic distance has raised the threshold of social communication to such a height that often only the most urgent communications flow across it.

What needs to be sensed?

What kinds of information is needed to provide day-to-day assurance of an extended family members well-being? In some cases, one simple indicator provides enough information to support the adult child in the belief that his aging parent is "doing just fine." One subject reported that knowing that his father has picked up the mail in the morning is enough to provide the necessary peace of mind, and make him comfortable with his decision to allow his father to remain at home.

Interviews with adult children and their aging parents, some living in institutional care settings and some living independently, led us to formulate general categories of information about daily life that are often shared between family members. These categories serve as a guide to what kinds of information support peace of mind.

- **Health**: In general terms how they are feeling that day. Did they sleep well? Eat regularly? Get enough exercise?
- **Environment**: The "health" of the environment. Has the weather been pleasant? Is something in the house broken?
- **Relationships**: Interaction with other people is important to one's emotional well-being. This category includes a range of social interactions, whether in person, on the phone, or through written correspondence.
- **Activity**: The general level of physical activity can be a good indicator of the caliber of a person's day in both extremes. A low level of activity may indicate declining health, while a high level of activity may indicate the onset of incessant wandering behavior.
- **Events**: The occurrence of special events is an indication of the richness and variety in a person's life. This category includes activities both planned and unplanned, as well as special outings.

Clearly these categories are not mutually exclusive. For example, a planned hiking trip with friends is a combination of three categories: activity, relationships and events. And a subsequent twisted ankle would show up under health and activity. Our goal was not to create orthogonal categories, but rather to outline the kinds of things people talk about when they check in with each other.

DESIGNING A SINGULAR PORTRAIT

From our initial field work, we set these high-level goals for our design:

- The design should convey relevant information about a person's daily life to support low-level awareness of that person's well-being.
- The design should depict trends over time for the different categories of information represented.
- The visualization should provide a *qualitative* view respecting privacy concerns.
- The visualization should be aesthetically pleasing, a typical home decoration.
- The visualizations should be emotionally appropriate, conveying "negative" information (e.g. a bad day) in an appropriate manner.

Because we are interested in depicting trends in a person's daily life, we rely on the notion of measurement. At some point in the system, a *quantitative* value is calculated based on the collected information. However the intent of the interface is to provide a *qualitative* sense of that information underlying that number. This choice represents a middle ground between displaying numbers, and displaying snapshots of daily life.

Examples of the first version of the digital family portrait are shown in Figure 3. Wanting to augment a traditional picture frame, we chose to represent health, relationships, activity and events (one category for each of the frame's four sides). Health is represented by the right side of the frame and moving clockwise are representations for relationships, activity and events. A typical photograph occupies the center.

How to represent time

In this digital family portrait, time is not represented as a continuous flow, but rather the past eleven days are divided across three distinct bands. The band that is closest to the photograph represents one day, the current day. Outside that is a second band that represents an average of the three days prior to the current day. The third and final band lies at the outermost portion of the frame and represents an average of the seven days previous to the days represented by the inner two bands. Simply put, the closer you are to the photograph, the more recent the information, and the less compressed it is. To reinforce the idea that time passes as one views the outer portions of the frame, the background of each band gets progressively darker and narrower, and the icons diminish in size.

How to represent the levels

The density of icons in a band represents the measurement for that category, for that time period. The greater the density of icons, the higher the measurement is for that category. For example, viewing the granddaughter's portrait in Figure 3, it can be seen that there are few recent events (shown by the inner band at the top of frame) although there were a greater number of events in the past (shown by the outer band at the top of the frame). This difference indicates a decrease in the event category over recent history. Inversely, it can be seen that relationships (shown at the bottom of the frame) is currently at a greater level than it has been in the past.

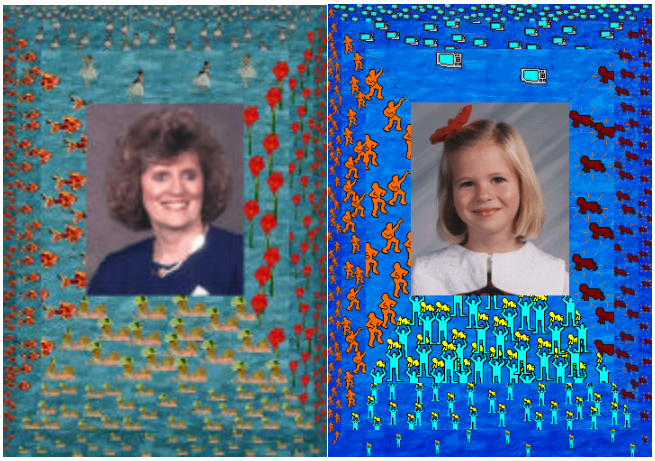

FIGURE 3. Digital Family Portrait Examples

Representation style reflects the represented person

Just as traditional picture frames reflect the person represented in the photograph that they surround, the imagery in the digital family portrait's frame has been chosen to reflect the person being represented in a way that is consistent with their own self image. This choice is akin to how people use picture frames today (e.g. rattles or storks with a newborn portrait), the frames are matched to the contents, not to the viewer. For example, the grandmother's digital family portrait uses images from Impressionist paintings, with colors that are subdued, in harmony with the image a grandmother might like to project. In contrast, the frames for the grandchildren use images derived from paintings by Keith Haring, creating a more playful image that is indicative of the image a child might project.

FIELD TRIAL: GRANDMOTHER & GRANDCHILDREN

Since this display is intended to be a surrogate social support system, we needed to test our initial display design in the field with real families. In the process of reviewing possible subjects, we found a grandmother who had two grandchildren, one male, the other female, all of whom lived at some distance from one another.[1] In this nine day field trial [10], we created daily digital family portraits for a grandmother (Constance) and her two grandchildren (Mark and Caitlin).

We wanted to test the first version of the display with people in their own homes as the subjects, even though there was no deployable sensing infrastructure currently available. We opted to create a simulation of the output of a possible future sensing infrastructure by hand. We did this by conducting daily telephone interviews with the three subjects. During these daily interviews, we asked questions to elicit information relevant to the four chosen categories of health, relationships, activity and events. From their responses, we assigned a rating of between 1 and 10 to represent the level for that category for that day. From this interview-based simulation, we were able to hand-build the digital family portrait for each subject, each day of the trial.

For this field trial, each subject was provided a laptop, modem and Internet accounts so that they could view the digital family portrait as a WWW page. After the interview, each subject viewed their digital family portrait for that day, and answered a daily questionnaire providing their qualitative impressions.

Field trial results

Although the design was intended to be read "at a glance," it was nevertheless too complex. In particular, redundant cues for time (icon size, location, the width of the band and the background color) did not fuse well and instead caused contradictory interpretations. Additionally, we were overly optimistic that we could convey ten levels of information. Constance was able to notice and interpret gross changes in the data. From the data, it is clear that the grandkids were not judging activity by the density of icons displayed in the frame, but rather were simply counting the number of icons, an approach that led to erroneous results.

An interesting discovery of the study was the way in which the different subjects used the digital family portrait. The grandkids usually came in from school and looked at their portraits to "see what grandma was up to," while the grandmother reported that she went back to the portrait several times during the day, even though she knew that the portrait was only updated once a day. This observation supports the notion that designs should be tested in authentic surroundings. It would have been difficult to predict that someone would engage a *static* display several times in the same day, except that, in retrospect, that is exactly what people do with portraits hanging on a wall.

During the field trial, it was challenging for us to map information about daily activities gathered during interviews to our four categories. Mapping one event to multiple categories was common. For example, a sporting event counted as relationships, activity and as a special event. We anticipate that our inability to map information to single categories is not a fault in the design, but a reflection of the richness of everyday life.

It is clear that individual lives are varied and that there are few canonical behaviors that all people share. We anticipate that the final system will need to individualize the components (e.g. gardening or tennis) that make up the more general categories. Finally, some information will always be out of the reach of any sensor, such as the aforementioned sporting event. Even though calendars, and other sources of information, can be construed as sensors, the portrait will always be incomplete.

During this field trial, the subjects reported that changes in the portrait led to the initiation of phone conversations that were grounded by the shared artifact (e.g. "You have lots of dancers today.") Of interest is whether phone conversations will still be affected with the long-term use of the digital family portrait. Also of interest is Constance's habit of viewing the portrait multiple times a day, even though she knew that the data changed once a day. The portrait's

1. One reason for choosing a grandparent - grandchild pair was that the senior adults were highly motivated to share information with, and learn about their grandchildren. In this study the adult child was also an observer, and could view the information about his parent.

persistent, yet "fresh" representation, seems to be a nice match to transitory, and often rushed phone calls. Although unable to interpret all the information encoded in the frame, it seems clear that Constance found the frames emotionally engaging.

DESIGNING A SET OF PORTRAITS

Following this initial field study, we set the following as goals for our next round of design in addition to our original goals:

- Reduce the display's complexity.
- Create a stratified design allowing a typical day's display to be as simple as possible, and adding interface layers for less common display needs.
- Develop designs that are appropriate for male and female senior adults. (Many of our icons seemed particularly feminine).
- Focus on elderly parent to adult child communication.

More is Better Than One

One result from our first field study, as well as from informal canvassing in our lab, was the overall positive reaction to the notion of a dynamic picture frame. People seemed enthusiastic about embedding relevant information in the frame while leaving the photograph unaltered. However, in our first design, there was simply too much information in one frame. As the practice of having multiple pictures of loved ones is common, we opted to distribute the different information categories across multiple frames. The frames could be physically connected or arranged separately. Users could also opt for only one category of information, such as general activity, and have only one frame displayed.

The 80% design

We focused our design efforts on creating what we affectionately came to call the "80% design" (see Figure 4). This design establishes the principal cues in the interface, and is indicative of what would commonly be displayed most of the time, or approximately 80% of the time. The principal components of the 80% design are: the icon for the information category, the level of measurement for that category, and the availability of information about previous days.

Icons for Activity, Health and Relationships

Even though each frame could potentially include a textual description of the category it represents, we nevertheless wanted the icons in the frame to carry the meaning for the frame. Based on external reviews of our design in our laboratory, we realized that we needed to provide both gender-appropriate and gender-neutral icon options. Further our experience converting interview data into category levels led us to the conclusion that the event category was not as useful an indicator as the other three so events were dropped from the second design. Selecting icons from a clip-art database, we created an initial collection of 18 icons that seemed like good matches for the three remaining categories (health, relationships and activity) and gender options (male, female and neutral). Using a paper questionnaire, we asked twenty respondents[1] to match each icon to one of the three

1. We included a mixture of ages and gender in this sample.

FIGURE 4. An "80% Design" for Activity

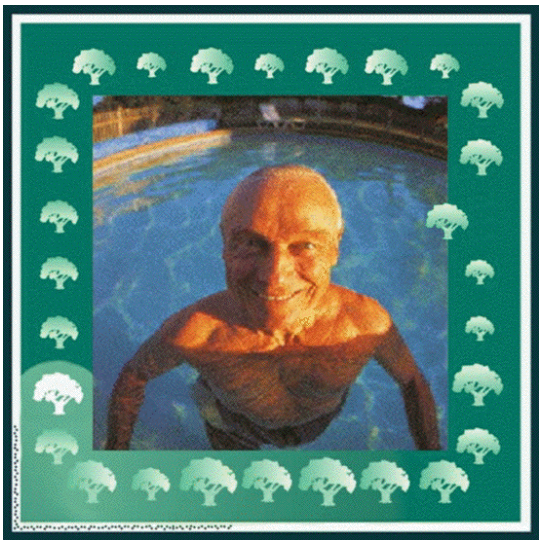

FIGURE 5. A Trend and an Unusual Day are Highlighted in a Portrait for Health

categories, and also rank it on a seven point scale from very masculine to neutral to very feminine.

This method was effective in identifying the most appropriate icons. Active animals (e.g. butterflies and fish) were high matches for activity. Representations of health include a daisy, an apple, and a large tree. Pairs of animals (parrots, swans) proved to be a good match for relationships. The most difficult challenge has been finding a male, relationship icon as all icons in this category tend to be rated feminine. Although not entirely satisfactory, in the end we chose the telephone icon to represent male relationships.

Level of Measurement

In the field trial, users had difficult perceiving ten levels of measurement for each category, as well as interpreting what ten different levels could mean. We also had difficulty mapping interview data into ten different levels. For this re-design, we decided to limit the number of levels to four, two middle levels that represent normal fluctuations in day-to-day life, and two more extreme levels.

Reacting to our first design, many assumed that the size of the icon was mapped to its level. Following this intuition, in this design we map size to level, bigger icons for higher measurements. Working from the set of icons selected using the paper questionnaire, we chose four different sizes of each icon and then empirically verified that users could discriminate them using a fixed-choice, computer-based experiment. Using random presentation with a between-subjects design, 15 subjects indicated whether a target icon was larger, smaller, or the same size as the stimulus. Since the aspect ratio of an icon affects how it is perceived in vertical and horizontal presentation the experiment presented icons in both horizontal and vertical presentations.

Histories

While the initial field study indicated that users wanted historical information to help them identify trends, as well as to help them interpret the current day's icon, the goal of having older information slowly fade to the edge of the frame did not seem tenable. Borrowing a different metaphor for time, in this design, the icons are ordered around the frame in a clockwise motion. Instead of aggregating information, 28 days (4 weeks) are arranged on the four sides of the frame. We try to reinforce this clockwise motion using multiple cues. First, the current day is colored white, making it distinct. Second, the current day and the recent past is highlighted using a gradient of background color, creating a "wave" of the forward progress of time. Finally the color gradients of all but the current day icons match the clockwise motion.

Marking Trends and Alarms

In addition to the 80% design, we needed visual elements to denote less common pieces of information. One example is when the computer has noticed a trend in the sensor data. Since many variables contribute to the visualization, a specific variable could be consistently abnormal, but masked by other sensor data. A trend is marked by a succession of dots outlining the frame. For example, in Figure 5, a trend of poor sleeping is indicated. In future designs, the user can request more information about this trend.

Although the portrait is not intended to alert the user to a crisis, it nevertheless should reflect when a crisis has occurred. In this case, the icon for that day is notched to the center, breaking the natural flow around the frame. In Figure 5, a crisis is followed by two days of poor health, and then a rebound.

RELATED RESEARCH

Awareness

Research in human-computer interaction has often addressed the notion of awareness; creating light-weight forms of interaction that allow users to monitor something of interest without causing undue distraction or incurring substantial effort. Interfaces for social awareness of other people include explicit representations such as media spaces [2] and abstract representations such as pinpoints of light on a wall, the sound of waves washing up on the beach [6], and balloons floating across the screen [11]. Likewise, interfaces can provide awareness of physical objects such as a bottling factory [3] and virtual objects such as email [9].

Much of the research using computational systems to support awareness within the context of a complex, social environment has been carried out in the domain of workplace [2][9][11]. These studies provide the necessary backdrop as researchers examine these issues in the context of a different complex, social environment, that of the home and the extended family.

Ishii's work in "Tangible Media" clearly demonstrates the connection between computation and physical form [6]. One distinction between this work and previous efforts is our focus on portraying trends over a period of time. There has been substantial research is visualizing complex, time-varying data [1]. Most efforts have used abstract representations (e.g. color, dots, lines) to depict trends and to enable the visualization to be read at a glance. Our decision to use potentially more engaging visual icons hampers our ability to directly leverage previous visualization designs. However there is commonality in issues regarding using spatial location and color.

Emotional Connections, Families and Seniors

This work is inspired by various designs that demonstrate connecting people in light-weight, emotional ways. One clear example is the "feather" [14] that shoots up and slowly floats back to the floor of its container whenever a (physically) distant family member views a photograph of the feather's owner. Like the feather, our goal is to create an emotionally-engaging, albeit light-weight connection between family members engendering a sense of security and well-being.

Familyware [5] provides specific support for sharing a "feeling of connection" between extended family members separated by geographic distance. Various objects, such as a plush toy, can by manipulated to send a signal to a family member. This requirement for manipulation separates this form of interpersonal communication from surrogate social support that automatically re-establishes the naturally occurring awareness that is lost when geographic distance is introduced.

In his talk at IDSA 1999, Bruce Tharp, director of The Netherlands Design Institute in Amsterdam, makes mention of the Nonogatchi, a device built around a pair of communicating tamagatchi-like devices. This device is intended to enable grandchildren to support their grandparents by providing medication reminders. While this device does support social connections between extended family members, it too requires active input by its users.

Recent work by Gaver et al. examines computing technology to help link older adults with their local communities [4]. Our work complements these efforts, focusing on strengthening the connections between older adults and their extended family. In both efforts, the question of how to represent an older adult to an outside viewer is key.

Finally there are a variety of commercially available Internet-connected picture display devices on the market that are similar to the Family Tree device of Philip's 1996 Vision of the Future. These devices are fundamentally different from the digital family portrait in that these

merely display loaded pictures. They require authoring, are not connected to any remote sensing devices, and are not collecting or displaying history.

CONTRIBUTIONS AND FUTURE WORK

The decision to move to an institutional care setting is often painful and difficult, accompanied with a profound sense of loss. In this work, we call attention to the primary role played by extended family members in negotiating whether senior adults should continue to live independently in their own home. When daily contact is not feasible, the decision to move a senior is often driven by fear and uncertainty for his or her's daily well-being.

Our goal is to create a surrogate support system that resurrects this informal daily communication. A surrogate support system is a form of mediated awareness intended to re-establish certain aspects of the naturally occurring social support that is disrupted, in this case, by the introduction of geographic distance into an extended family.

In this paper, we have presented the concept of the digital family portrait. By augmenting a common household object that is typically associated with close family members and friends, our goal is to leverage these emotional connections and the role that portraits already play in decorating a household space.

Using a combination of methods including interviews, iterative design, empirical laboratory studies, questionnaires and field trials, we have designed the form, content, and visualization techniques for the portrait.

During the course of this investigation, we discovered that the information required to provide day-to-day awareness of a family member's well-being falls into general categories that include health, environment, relationships, activity and events. The current version of the digital family portrait addresses each of these categories individually, each with its own portrait, that can be arranged as one would arrange framed family portraits on a fireplace mantle or bookcase.

While the digital family portrait's feasibility as a means of conveying information about a family member, and its appropriateness as a display device for the home, has been evaluated during the course of this study, its role as surrogate social support within an extended family still needs to be assessed. Therefore, one of our future efforts is a longer term field study with families that are beginning to consider assistive care for a senior adult. We are in the process of interviewing candidate families now.

We are also in the process of connecting the digital family portrait design to multiple sensing systems in the BI Residential Laboratory. At this point, we are using simple heuristics to combine these disparate information sources. We anticipate exploring more sophisticated algorithms that attempt to create a model of daily home life.

At this point, the visual design of the digital family portrait is geared to daily glances and casual visual inspection. We are investigating providing detailed information stemming from active interaction via voice or touch. This second stage of interaction may help personalize the display by conveying pertinent details about an individual, such as whether he watched his favorite television show, or went on her morning walk.

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