

Health Technology Design and Innovation at Intel

In 1999, Intel began to explore how technology could address the challenges of an aging global population. Intel's ethnographic researchers completed field work in the US and Europe (the research continues elsewhere), returning with a wealth of information about the needs of the aging. Today Intel's design engineers are translating the output of that ethnographic research into innovative design concepts for health technologies that could one day move onto the product roadmap. Designers work closely with technology and ethnographic researchers to ensure that their ideas are both technically sound and relevant to end users.

In developing concepts for new health technologies, Intel's design engineers strive for ease of use and effectiveness. They also focus on broader design goals that motivate people to use the technology, such as making it aesthetically pleasing, helpful, and rewarding (Figure 1).

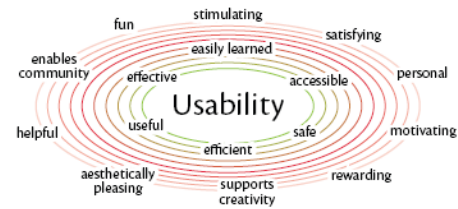


Figure 1: User Design Experience

The Design Process

The design process begins with the development of an “opportunity map” that segments the broad categories of need identified through field research, such as supporting cognition, enabling social interaction, and helping people to find care. Intel designers develop the map in close collaboration with ethnographic researchers.

Designers then brainstorm high-level concepts for health technologies that address the categories of needs that were mapped, working with a cross-functional team that includes ethnographic researchers, engineers, and marketing experts. Concepts are fleshed out on storyboards, as the team envisions how a technology might look and work, and discuss scenarios in which the technology would be used.

In one session, for instance, the team developed the concept of a memory bracelet and sweater with embedded electronics that would help an aging person with a failing memory to remain independent. The team created the following usage scenario:

Carlo, an older man who lives alone, makes a trip to the grocery store at 9:00 a.m. As he leaves the store, his memory bracelet vibrates, reminding him that he's scheduled to do something else this morning. After a moment, Carlo recalls that he has a doctor's appointment, but he doesn't remember when. Minutes later, an electronic display integrated into the fabric of his sweater shows him the details of his appointment.

In the doctor's waiting room, Carlo's bracelet vibrates once more, and his sleeve displays a text message sent by his friend Julian, inviting him to a round of chess that evening. Carlo accepts the invitation. His bracelet will remind him of the appointment a half hour before he's due at Julian's. Before leaving the doctor's office, the nurse schedules another appointment for Carlo, and synchronizes the date and time with his bracelet.

Health Technology Design Principles

Intel's health technology designers distill design principles from the findings of ethnographic research into how people interact with their existing technology devices and environment. These principles drive the development of design concepts. Following are general principles for health technologies that support independent living:

- 1. Create non-intrusive technology.** Intel's research found that technologies such as alarms and security cameras are quickly abandoned by users because they disrupt people's normal routines and make them feel uncomfortable at home.
- 2. Provide enough (but not too much) support.** Help users to accomplish tasks without making them reliant on technology for things they could do themselves..
- 3. Build on existing metaphors of how things work.** People are more likely to use new technology if it comes in the form of a familiar device, such as a remote control.
- 4. Keep it simple.** Use one-mode/one function devices when possible (e.g., a wall-mounted CD player that plays when a user pulls a string).
- 5. Foster trust.** A device with a well known brand or with independent, third party certification will have a greater chance of being adopted.
- 6. Adapt to changing needs.** As people age and change, so do their needs (in the case of Alzheimer's disease, needs can change weekly or even daily). Technology should adjust in response.
- 7. Don't stigmatize.** Design devices that anyone, not just an older or disabled person, might use. (For instance, Intel designers are experimenting with a pill box and reminder system disguised as jewelry.)
- 8. Facilitate, don't replace, social connections with technology.** Focus on concepts that foster connection, such as the presence lamp and the memory bracelet described in this article, rather than technology that replaces social interaction (e.g., virtual worlds).

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Some concepts evolve into working prototypes. One example is the “presence lamp”— a device that could be placed in the homes of older people and their children or caregivers, to signal that they are home. When the lamp goes on in a caregiver’s home, it could mean that mom is sitting in her favorite chair, or dad has returned from the movies. When the lamp turns on in an older person’s home, dad knows that his son or daughter is home and available if needed. More sophisticated presence lamps could keep caregivers informed about the status of an elder throughout the day (Figure 2).

Piloting Design Concepts

Once a design concept evolves into a prototype technology, Intel conducts pilots to test the viability and desirability of the concept. Two pilots currently underway are focusing on a medication reminder system and a technology to reduce stress and help to prevent cardiovascular disease.

Context-aware Medication Prompting (CAMP) The CAMP pilot tested technology to assist older adults who forget to take their medications—a problem that’s estimated to result in 10% of all hospital admissions, costing \$15.2 billion and leading to roughly 125,000 deaths annually.¹ While many older adults have difficulty remembering to take their medications, few use reminder systems, according to Intel’s research. Instead, they arrange their home environment and the placement of medications to facilitate access and provide informal memory prompts.

The pilot tested a prototype prompting system that sends medication alerts to televisions or wrist watches, based on the location and activity of the user. The pilot was conducted among a group of older adults (most over 80 years of age) in a continuing care retirement center, and initial results are promising. Now designers are leading focus groups to test reaction to a CAMP system in the form of a wallet that would hold pills and remind users to take them.

Mobile Heart Health Another pilot underway is testing a mobile phone-based technology that continuously monitors stress and intervenes to reduce it. The interventions are inspired by cognitive behavioral therapy and mindfulness practices. The goal is to provide support, when and where it is needed most, to help alleviate emotional distress.

Mobile therapy is triggered by physiological, contextual and self-reported stress indicators. Stress is monitored by sensors worn on the body and placed in the environment, linked to mobile phone-based applications. Self-monitoring occurs via a touch-screen translation of a mood questionnaire and a “panic button” on the phone. A variety of interventions are available, such as stress-reducing music and imagery, animated breathing exercises—even phone calls, triggered by the panic button, that enable users to remove themselves from high-stress situations (Figure 3).

Conclusion

Designing health technology concepts that will engage users and motivate healthy behavior requires creativity and a deep understanding of people’s needs. Intel’s design engineers combine ethnographic research results with creative applications of technology to develop design concepts that could one day evolve into innovative health technology products. We recognize that technology is not a magic bullet to address the challenges of an aging global population, but Intel believes it could be an integral part of the solution, helping to enhance quality of life while reducing the cost of medical care.

For more information about health technology design and innovation at Intel, visit <http://www.intel.com/healthcare/>



Figure 2: A “presence lamp” can be placed in the home of children or caregivers to keep track of the health status of the older persons in their care. A series of lights indicates the status of the older person throughout the day. Each light represents a two-hour interval, from left to right. If the far left light is on, this signals that the elder has been active in the last two hours. If the light next to it is off, this means she was not active in the previous two hours, and so on.



Figure 3: Pressing a “panic button” on the mobile heart health device expresses fiery rage and initiates the “exit strategy” intervention—a phone call that takes the user away from a conflict. The goal is to improve emotional regulation.

¹ Osterberg, L., and Blaschke, T. Adherence to medication. *N. Engl. J. Med.*, 353. 487-497.

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