Design & Health in Interactive Architecture

Jasmine Jones
School of Information
University of Michigan
Ann Arbor, MI
jazzij@umich.edu

CHI'14. April 26, 2013, Toronto, Canada. Workshop on Interaction and Architectural Space.
http://interactioninspace.blogspot.co.uk

Abstract
Architectural interaction opens an intriguing realm of design possibilities for critical social problems like public health. HCI practitioners and architects have begun, to great fanfare, to develop innovative solutions to health challenges using approaches from their respective fields. Both fields, however, face difficulties in enabling adaptation to health needs in the design process. This paper gives examples from previous projects to highlight some of these issues and asks,
"How can creativity in interactive architecture enable environments that adapt to support health?"

Introduction
Health is an integral part of the experience of an architectural environment. Purposeful design processes and methods, like feng shui and biophilic design, place the health and wellness of the inhabitants of a space as their foremost priority. Complex public health issues, like the obesity epidemic, have found correlations between features of the built environment and community health outcomes [1]. In a more subtle way, the design of public spaces can reify social attitudes around the inclusion of people with disabilities, both in the positive and negative [2].

HCI & Health is a growing field where computing researchers tackle challenging health and wellness

problems by operationalizing social and behavioral theories of health and innovating new medical tools and systems. Products range from personal mobile apps that encourage physical activity [3], to e-home environments that monitor and assist frail aged users living independently [4].

Echoing the holistic definition of the World Health Organization, I characterize “health” as an optimal state of complete wellbeing rather than the “mere absence of disease or infirmity” [5]. This frame, in the context of design, regards *healthiness* as the best-possible scenario relative to the constraints of a person’s biopsychosocial reality. A key consideration is that conceptions and ideals of health can vary widely between communities and among individuals, and even those ideals which are shared change over time. When thinking about the future role of design in health, especially regarding interactive environments, we must account for the dynamics of health itself, and how these relate to design processes.

In this paper I offer three issues of adaptation in architecture and interaction design, from the perspective of health promotion. The first issue is how to reconcile temporal differences between the dynamics of physical artifacts, software, and the changing needs of human health. The second issue considers how to integrate a multiplicity of personalized health technologies into the interaction ecology of the built environment. Third, I raise a question of role of design in handling conflicting values of health in shared spaces.

These issues are linked by their relevance to the question of how interactive architecture adapts to change: over time, in unforeseen circumstances, and with diverse inter-actants. This paper discusses opportunities for collaborative solutions in interaction, architecture and health to integrate health into the structures and spaces of everyday life.

Temporal Dynamics

Health, in all its conceptions, changes over time. At the individual scale, a person's bodily health improves and declines throughout their lifetime. At the social level, society's standards of health fluctuate with scientific discoveries and shifting cultural values.

Take for example, ongoing conversations in design for the future of aging. The UN estimates that as modern medicine enables people to live longer, the number of people worldwide over age sixty-five will almost triple by 2050, and people living to see 100 will increase over 1000% [6]. The increase of aged people necessitates living spaces that can help them maintain quality of life as they face the new conditions of old age. In 2011, I collaborated on *Project 2061,* an interdisciplinary design project to imagine how design would impact the daily lives of the elderly in the future [7]. We built a prototype of an augmented home equipped with features like walls that functioned as ambient displays for information and entertainment; floors that sensed when a person tripped and softened to prevent broken bones; and a safety-conscious spa bathroom that proactively monitored water temperature to prevent burns, while creating a relaxing multi-sensory environment to calm them in their current mood.

This design was well received, yet its implementation warrants consideration. Ninety percent of elderly people wish to age in their own homes [6]. With current design

processes, when a home is adapted for an elder, it then becomes only useful for someone in the same condition. There is no easy way for the home to return to its base state after modification.

The changeability of health requires adaptive systems in the built environment that can change *and* change back. Software is inherently adaptive, with allowances for constant updates and revisions built into the system itself and the product flows. However, the expected legacy of architectural spaces is, in contrast, relatively permanent. Buildings can adapt over time through renovation, but it requires destruction of the current space to create the next. How then can interactive architecture, composed of interwoven elements of fluidity and permanence, respond to the temporal dynamics of health?

As interactive elements become integral parts of the architecture, renovation would not only need to reimagine the space within the constraints of the existing structure, but also the interactive capabilities of the space given current technology and interaction needs. Perhaps some of intrinsic malleability of software can translate into the design of flexible interactive spaces able to be repeatedly renovated for different inhabitants without losing their value or integrity.

Unanticipated Users

Advancements in medicine and medical technologies enable people with previously debilitating conditions to fully participate in society. These advancements, along with increasing customizability of technologies and devices mean that interactive architecture must be prepared to accommodate a multiplicity of uniquely atypical devices.

Consider this illustration: In an ongoing study I am conducting on school based health, an interviewee recounted her efforts to enable a new student to attend her school. The 7th grader was wheelchair-bound and needed a ventilator to breath. Her classes were in a part of the building that required her to use the elevator. However, her power wheelchair and the attached ventilator cart (also equipped with a car battery to keep it running in case of a power outage) were far too large to fit into the school's ADA-standard elevator. When school officials were told of the problem and were asked to install a ramp as an alternative path, they told the girl to get a new $250,000 wheelchair.

The wheelchair + ventilator was an inconvenient and unanticipated arrangement of devices that made existing accommodations useless. The administrators regarded the girl's system as an exception to the norm, but the shift to customized and individualized consumer health devices and systems is expanding as cost decreases and democratized design tools become more available. Adaptive interactive spaces can work together with an individual's personal technology systems to create a comfortable environment for any person that enters.

Enabling Choice

Unlike personally adopted technologies, architectural features and interactions are imposed on the occupants of the space. Usually, the owner of the space makes decisions about the design based on their own values. The occupants of the space may not share the same

values, but are still subjected to interactivities embedded into their built environment.

A value-sensitive design approach [8], ideal for considering sensitive issues of health, could mean adaptive interactions enable people to reject or ignore them. Take for example, the familiar experience of choosing to take the elevator rather than the stairs, even when the more heart-healthy option is made more prominent and inviting. Elevator users may have many reasons for rejecting the stairs, some which have nothing to do with health or even walking. For instance, a group of people having a conversation may choose to take the elevator where they can continue to talk face to face rather than break up the conversation to navigate the staircase. With adaptive elements, interactive spaces can allow users to exercise their preferences for experiencing the space.

Currently, rejecting or ignoring the interactivity of a space, most of which respond visually, requires little effort. But this ease does not carry over into other sensory modalities such as auditory or haptic responses, where assertive non-interaction might affect the experiences of others in the space. To respectfully account for the diversity of users in a space, adaptive spaces need allow people to opt-out of interactive experiences without disrupting the intention of the space for others.

Conclusion

As pervasive interactivity continues to embed itself into architecture in more creative ways, responsive environments will play an even more central role in the everyday activities of people. Using health as a lens, I have posed three questions which I believe are necessary considerations for adaptive systems as they expand beyond the realm of artistic novelty and enter into functional relationships with humans and existing technologies. Interactive architecture has the potential to create spatial experiences that promote and support health and which also enable spaces to adapt themselves to the changing needs of individuals.

Acknowledgements

I thank compatriots and faculty of the Taubman Design Health program, and all who helped spark ideas.

References

[1] James F. Sallis & Karen Glanz. 2006. The Role of Built Environments in Physical Activity, Eating, and Obesity in Childhood. *The Future of Children* 16.1: 89-108.

[2] Ruth Butler & Sophia Bowlby. 1997. Bodies and spaces: an exploration of disabled people's experiences of public space. *Environment and Planning D: Society and Space* 15(4) 411 – 433.

[3] Sunny Consolvo, et al. 2008. Activity sensing in the wild: a field trial of ubifit garden. In *Proc. Of CHI '08.* ACM, pp. 1797-1806.

[4] Julie A. Kientz, et al. 2008. The Georgia Tech aware home. In *CHI EA '08*. ACM, pp. 3675-3680.

[5] World Health Organization. 1948. “WHO Definition of Health.” http://www.who.int/about/definition/en/print.html

[6] National Institute on Aging. 2011. “Living Longer.” http://www.nia.nih.gov/research/publication/global-health-and-aging/living-longer

[7] “Project 2061.” 2011. Exhibit & Installation. *LeadingAge Conference on Design for the Future of Aging.* Washington, D.C.

[8] Batya Friedman. 1996. Value-sensitive design. *interactions* 3, 6 (December 1996), 16-23.