

This forum is dedicated to personal health in all its many facets: decision-making, goal setting, celebration, discovery, reflection, coordination—even entertainment. We'll look at innovations in interactive technologies and how they help address current critical healthcare challenges.

Elizabeth D. Mynatt, Editor

Designing Interactive Systems in Healthcare: A Report on WISH 2011

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Health information technology (HIT) has the enormous potential to transform healthcare by positively affecting quality, efficiency, and cost-effectiveness. However, despite ongoing efforts by many government agencies, HIT continues to experience low levels of adoption [1]. Moreover, a growing body of research questions its impact on medical care [2], for example, by highlighting the unintended consequences of HIT [3] and medical errors that result from poorly designed computing systems [4]. Researchers argue that many of these negative consequences result from a mismatch between the reality of conducting clinical work and the structure of computing applications that are meant to support it [5].

To address these limitations and remove the barriers to the successful adoption of HIT, new research initiatives are focusing on a better alignment of HIT and clinical practices, and an approach to system design informed by best practices in

human factors and human-computer interaction (HCI). However, these efforts currently exist in several disjointed research communities, without established pathways for transfer of knowledge and expertise. These communities include but are not limited to biomedical informatics, HCI, computer science, social sciences, and medical anthropology. Each of these fields has its own venues for disseminating research results that rarely overlap. Therefore, researchers and practitioners interested in designing patient- and clinician-centric HIT have little opportunity to interact and develop a shared body of knowledge across these communities. As a consequence, there exists a largely untapped potential to create deeper and more profound connections among the biomedical-informatics, HCI, medical-sociology, and anthropology communities that would lead to the development of new methods, approaches, and techniques for removing barriers to the adoption of HIT.

To address this limitation, the American Medical Informatics Association (AMIA) and ACM co-sponsored the 2nd Workshop on Interactive Systems in Healthcare (WISH), which was co-located with the AMIA Annual Fall Symposium on Oct. 22, 2011, in Washington, DC.

The specific goals of WISH 2011 were to:

- develop research agendas for interactive systems in healthcare and identify strategies and mechanisms for studying them;
- discuss and develop consensus around existing technical and methodological challenges in the design and evaluation of interactive systems in healthcare;
- establish a new channel for the dissemination and implementation of research on interactive systems in healthcare;
- provide a forum for developing new partnerships between researchers and stakeholder organizations. Through these partnerships, we hope to build stakehold-

ers' capacity to participate in collaborative research activities and, ultimately, to develop usable and useful systems in healthcare; and

- establish a mentorship program for junior researchers and provide them with the opportunity to meet leading researchers in fields related to interactive systems in healthcare.

The WISH 2011 technical program included four types of activities: keynote presentations, invited panels, peer-reviewed short-paper presentations, and posters. To provide two diverse viewpoints on the role and future directions of interactive healthcare systems, we invited Elizabeth Mynatt, executive director of the Institute for People and Technology, and professor in the School of Interactive Computing at the Georgia Institute of Technology, and William Stead, MD, associate vice chancellor for health affairs and chief strategy and information officer at Vanderbilt University Medical Center to present the two keynotes. We also received more than 50 paper and poster submissions. Please see the WISH 2011 website (<http://wish2011.wordpress.com/>) for more information about the keynote presentations, accepted papers, and posters.

WISH 2011 Themes

Four themes were consistently present throughout the workshop keynote presentations, panels, papers, and posters: how to foster innovation in HIT; the benefits and challenges of theory-driven HIT design; the adoption and meaningful use of HIT; and conducting interdisciplinary research in HIT. We discuss these themes in greater detail here.

How to foster innovation in HIT.

Our opening keynote speaker,

Elizabeth Mynatt, introduced the first workshop theme. In her presentation, Mynatt described the slow rate of innovation in HIT and the even slower rate of adoption of novel technological solutions into standard healthcare practice. Indeed, it is a known fact that the healthcare industry is slow to adopt innovation; studies show that it takes on average 17 years for new treatments and procedures to become integrated into regular clinical practice [6]. In the case of technological innovation, the delay is even greater. Whereas the first electronic health record (EHR) systems were introduced more than 30 years ago, their adoption by clinicians remains extremely limited [7]. Mynatt challenged workshop attendees to consider whether healthcare is experiencing the *innovator's dilemma*: a state in which an industry becomes so set in its ways that it rejects anything that does not conform to established norms [8]. Using terms coined by Clayton Christensen, Mynatt suggested that one way to overcome this dilemma is by introducing *disruptive innovations* that go against the status quo and open up the space for new concepts and possibilities. Examples of such disruptive technologies in the healthcare domain include applications that empower patients by supporting wellness and health management, independent problem solving, and knowledge sharing within communities of people that have shared health concerns. Such technologies operate outside of the boundaries of the traditional medical system by challenging a model of healthcare delivery that features limited engagement between patients. By opening up new opportunities for patient-centered health management and promotion, these tools

have the potential to revolutionize modern healthcare.

The benefits and challenges of theory-driven HIT design. Another timely theme involved the use of theory in HIT research. Within HCI, researchers have increasingly used theories of behavior change to guide the design and evaluation of health systems. In one panel at WISH, researchers from both the HCI and biomedical-informatics communities described how they use theories and models to design system features, and the impact of these systems on users' health attitudes and behaviors. They described how they used well-established health-behavior theories to design and rigorously evaluate a range of systems, from sensor-based mobile tools and social networking applications that encourage physical fitness to educational games focused on nutrition.

Theories of behavior and attitude change provide a useful starting point for creating interactive tools: Medical frameworks and models can help designers identify empirically validated influences on behavior, as well as the factors that mediate those influences. However, while these models may be of potential use, an important challenge lies in choosing theories that are in line with the behavioral target of the system features being designed (i.e., the behavior that the tool is attempting to encourage or discourage). It is thus important to expand the repertoire of theories that designers employ [9]. Furthermore, in the ongoing effort to bridge the HCI and biomedical communities, theoretical frameworks can give researchers a common language for characterizing the health issues we focus on and for evaluating the impact of our tools.

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The Department of Computer Science at the University of Colorado Boulder (CU) seeks outstanding candidates in human-centered computing (HCC) at the level of Assistant Professor, although senior candidates at higher ranks may be considered. The position will help shape HCC initiatives at CU. Candidates working in human-computer interaction, computer-supported cooperative work, information visualization, and/or social computing are invited to apply. Candidates should have an orientation to computer science as their primary faculty research and teaching home. The University of Colorado Boulder is an Equal Opportunity Employer. Applications must be submitted on-line at www.jobsatcu.com/applicants/Central?quickFind=66808

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Adoption and meaningful use of HIT. Not surprisingly for the workshop on interactive systems, the central issues discussed were user adoption and acceptance. One discussion revolved around the concept of meaningful use that has been recently applied to EHR systems [10]. In this context, meaningful use represents a vision and a set of criteria for evaluating the level of adoption of EHR systems by their intended users. Recent government initiatives allocated considerable funds to foster adoption of EHR through incentives. However, to become eligible for such incentives, users—in this case, healthcare providers—will need to demonstrate that they not only purchased EHR software but also that they “meaningfully” integrated it in their practice. A Meaningful Use Committee, consisting of representatives of researchers, legislators, physicians, patient advocates, and others, has generated a set of criteria that define what it means for a clinic to meaningfully adopt an EHR system [10]. These criteria reflect a set of requirements for the vendors of commercial EHR systems for features and functions that their products must support.

The participants of the workshop, and particularly of the panel on meaningful use, raised a diverse set of issues relating to this concept. From the perspective of the government initiatives, having a clear and consistent set of criteria that help to fairly distribute incentives is critical for the success of these initiatives. From the perspective of clinical and hospital IT management, these criteria have the power to introduce much-desired consistency among vendor products. At the same time, as HCI research has highlighted, the adoption of tech-

nologies can be messy and unpredictable; users of technologies often find ways to reinvent and redefine the technologies through creative appropriation. Setting strict criteria for meaningful use too early in the adoption cycle may prevent users from creatively exploring the potential of EHR technologies and contributing to the shaping of these technologies in the future. In addition, such criteria may stifle innovation and prevent new entrepreneurs from entering the HIT market. The panelists agreed that although there are clear benefits to defining meaningful-use criteria, they should be approached with caution and may have a number of unintended consequences.

Conducting interdisciplinary research in HIT. A recurring theme in the workshop was the need for interdisciplinary approaches to HIT research problems. Both keynote speakers discussed the importance of having researchers from different disciplines collaborate on HIT problems. Their comments connect to the growing call from bodies such as the National Institute of Engineering and the Institute of Medicine [11] to address HIT issues from multiple perspectives. HIT research requires understanding not only the technical challenges but also the wide variety of users and the particular organizational and social contexts of these technologies. However, there are some important hurdles to conducting interdisciplinary research in this field. One that was raised by many participants was the different disciplinary languages. For instance, the term “adoption” could mean something very different to the HCI community and the biomedical-informatics community. Consequently, members of these different communities must come

together at events such as WISH so that they can learn about each other's languages and perspectives.

Furthermore, within HCI and also biomedical informatics, there is an increasing focus on designing technologies that will empower patients by providing them the ability to keep their own medical information, connecting them to a broader community of individuals who have the same problems, or motivating them to stay healthy. Hence, the importance of interdisciplinary research is growing because of the spread of health technologies outside of the traditional clinical settings and the changing nature of what constitutes a HIT. This requires not only HCI researchers but also biomedical-informatics researchers, healthcare researchers, and many others to successfully tackle the complex HIT challenges.

Conclusion

We believe that WISH 2011 successfully brought together disparate communities to address issues of mutual interest related to the design, implementation, and use of interactive systems in healthcare. We had more than 100 participants from both the HCI and biomedical-informatics communities. Furthermore, the variety of organizations that funded this event provides a strong indication that this workshop crossed disciplinary boundaries and interested corporate and academic organizations. These funding sources included industry sponsorship from Microsoft Research, academic sponsors such as Northeastern University and the Georgia Institute of Technology, professional society sponsors such as ACM SIGCHI, and federal funding agencies such as

the National Science Foundation and the Agency for Healthcare Research and Quality (AHRQ).

One of the key outcomes of WISH was the agreement that we need to foster greater collaboration between the various communities interested in the design, implementation, and use of HIT. It is important to transcend the mutual respect of one another's work and truly reach out and try to join forces with members of other communities. Attendees acknowledged that this is not a simple task, but one that we must attempt if we want to address the wide variety of issues in HIT specifically and healthcare more generally.

ENDNOTES:

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Researchers argue that many of these negative consequences result from a mismatch between the reality of conducting clinical work and the structure of computing applications that are meant to support it.



ABOUT THE AUTHORS

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