

SCIENCE AND TECHNOLOGY OF FEEDBACK 11/17/2014

mediaX half day conferences offer participants a whirlwind tour of a multifaceted theme, a glimpse into the many features and angles of an important, emerging topic.

Some of the very first questions asked at the inception of mediaX dealt with Feedback. Feedback is at the heart of mediaX - understanding people to make better technology, and understanding technology to improve the human experience. These issues and more were explored at the **Science and Technology of Feedback Conference** on November 17, 2014.

Thought leaders from academia and industry took conference attendees – onsite and online – on a tour that began by exploring the balance between design and technology in fostering behavioral change and ended with the analysis of algorithms measuring peer effects online. Along the way, presenters questioned how the time frames of feedback measurement influence theory. They also explored the influence of feedback from active social agents, the transformative social feedback potential in virtual reality, the power of feedback to fuel engagement in remote teams, the synergy of feedback between industry and academia, and the effectiveness of persuasion empowered by personalized feedback.

The Conference brought together many different perspectives, from many different departments, offering insights in the way that questions about feedback are asked by various disciplines, and the different approaches, tools and technologies for investigating them.

Stanford Computer Science Professor **James Landay** launched the Conference with an overview of projects that he has developed with the aim balancing technology and design to change behavior. Landay's work combines human and computer science centered approaches, most recently in two broad domain areas – Environment and Health. Within each area, he has asked questions that address ambitious long-term goals to develop human centered technologies that inspire behavior change – while simultaneously teaching researchers and developers about what makes humans tick. He tests technologies in the field, sometimes with surprising results about what features are effective and well-liked.

In the context of the Environment, Landay has led research and development projects that foster the reduction of household energy and water use. Tools such as “Hydrosense” serve as smart meters, measuring where and how water is being used in the home. Ambient displays of water use, designed and tested in a variety of formats, examine the types of interfaces that would inform, entertain and inspire, without overwhelming or irritating users. An interactive screen enables families to explore and engage with home energy use data, potentially moving from knowledge to action. Smart phone displays provide compelling visual illustrations documenting improvements in transportation use and physical fitness. An online study comparing the effect of positive and negative feedback on Chinese and American users reveals the cultural differences that underlie receptivity to different styles of feedback and interaction. In the field of Health, Landay has explored how

interactive displays can stimulate and improve physical fitness. The Ubifit project combines sensor data on human behavior with graphic displays of a growing garden, blossoming as behavior improves. Other projects have explored the potential for tactile communication through the use of meaningful vibration patterns to provide feedback and stimulus. One major lesson from his research, Landay explained, has been the insight into the power of stories and games for fostering long-term engagement and behavior change.

Stanford Communication Professor **Byron Reeves** has been studying human computer interaction for decades. Emerging technologies, Reeves explains, have enabled the collection of innumerable data points from one individual. Leveraging these tools, Reeves measures and aggregates behavior at the level of milliseconds –collecting data sets that log individual laptop use via screenshots every five seconds. The aggregate of these data sets provides pictures of multi tasking behavior patterns, which are as individual and unique as snowflakes – complex “fingerprints” of individual behavior. Multi-tasking is done, Reeves explains, on the Z-axis, moving in depth from screen to screen, with 75% of tasks done in less than one minute. Reeves’ research has revealed insights into patterns of interaction demonstrating that for Millennials at Stanford, the median time between switching from one task stream to another is 19 seconds. Moreover, biofeedback sensor data reveals a momentary spike indicating “anticipatory arousal” in advance of each switch. Insights at this granular level, Reeves argues, have a transformative effect on the value and application of theory in research. Theory has traditionally guided research – but with enough data and data analysis capability, one can iterate so quickly that theory can become less relevant. Exploration of social behavior at different time scales is, in effect, an exploration of many different things, Reeves concludes. Multiple data points from one person offer different insights than one data point from multiple people. “When you change the time scale,” Reeves argues, “you change the theory.” Feedback is an integral part of human computer interaction.

Communications professor **Jeremy Bailenson** explored how feedback from virtual reality tools can lead to a deeper understanding of oneself – as well as motivate a change ones behavior. Bailenson’s presentation began with an overview of the rapid innovations in scanning and sensor technologies that permit a generation of virtual “doppelgangers” - an avatar that, for the first time, allows people to see themselves doing things they have never actually done. Bailenson explained that such asynchronous self-reflection represents a fundamental change in what it means to “see oneself,” and presents a research opportunity, as well as concern. Coupled with the immersive experience of virtual reality, these “doppelgangers” have the potential to strongly influence behavior. Bailenson provided an overview of numerous research projects he has conducted, exploring how self perception can influence behavior. Projects include an investigation of how “doppelganger heroes” can foster altruism, of how seeing images of oneself becoming more or less healthy can influence fitness behavior, or of how visions of a future “you” can inspire savings and financial responsibility. Bailenson’s projects demonstrate how observing “oneself” performing tasks, and witnessing the consequences, has the power to transform self perception and motivate changes in entrenched behavior patterns.

Nik Martelaro, Stanford PhD student in Mechanical Engineering, shared his research into feedback from active social agents. The experiment, Martelaro explained, began with the question, “What if the thing that is being created takes the role of an active social agent in the creative experience itself?” This question sparked the development of an active instructional robot tested with students learning basic programming and design. The tool served as an instructional device with two settings – “Interested” with an emphatic face and interactive abilities and “Disinterested” with a silent, blank face. The device was either embedded in the tool, or set apart. The tool with active social presence raised the engagement level of students, sparked deeper interactions and revealing conversations, and raised students’ self confidence in their learning abilities.

Dr. Renate Fruchter, Director of the Project Based Laboratory at Stanford University, described her research into the power of feedback to stimulate engagement, productivity and wellness in the workplace – particularly in the context of remote collaborations. She provided an overview of the tools, concepts and insights developed from years of research into the work and behavior of transnational remote teams. “Feedback nudges,” Fruchter explained, help make invisible indicators visible, fostering mutual understanding and improved engagement, interaction and collaboration. Fruchter outlined her Six Steps to Engagement and explained how feedback can help team members manage choices in the workplace. By measuring and documenting levels of engagement, attention, and distraction in remote meetings, these tools provide methods for identifying and recovering drifting members. Cognitive Test Feedback provides a novel illustration of the engagement “afterglow” that can occur as a participant’s engagement improves over the course of the meeting – and afterwards.

Hiroshi Tomita, President of mediaX member company **Konica Minolta Laboratory, Inc., U.S.A.**, described the process of engagement between industry and academia – specifically, the R&D branch of Konica Minolta and Stanford University. Relationships with Stanford University scholars, Tomita explained, have been an integral part of the company’s journey into new markets and development of new technologies and products. Konica Minolta’s mission is to provide business solutions that optimize the office environment. In conjunction with mediaX at Stanford University, Konica Minolta has explored the potential of a new product – Project Box – which would facilitate group conversations and remote meetings and conferences. The collaboration integrates insights from research on gesture analysis tools, an automatic gesture analysis platform, and the ultimate aim of producing an interactive touch panel display that would improve collaboration, idea generation and information sharing.

Maurits Kaptein, Co-founder/Chief Scientist, Persuasion API, has explored how various online persuasion strategies influence different people. Emerging technologies, Kaptein explained, have enabled researchers to go beyond stereotypes, averages and generalizations and identify individual preferences for and against specific persuasion strategies. The result is an understanding of what types of messages will stimulate action, and an opportunity to tailor persuasive messages to audiences in real time. The next step,

according to Kaptein, is to discover how these “Persuasion Profiles” influence – and are influenced by - online behavior.

Dean Eckles presented his research as part of Facebook’s Data Science Team. At Facebook, Eckles explores peer effects - how ideas, images and other elements spread in networks. Eckles is interested in how social influence is mediated, amplified or directed by online technologies and intervention methods. His research develops algorithms and contagion models that describe and analyze the probability of the online spread and adoption of various behaviors. Eckles and his team have examined, for example, the online spread of rumors, as well as their repression, via posts that link to sites such as Snopes.com, which dispels urban myths. Other research projects described by Eckles include “graph partitioning,” the process of segmenting certain social network clusters in order to create groups for “control” or “treatment” with a particular message. A major research challenge when studying peer effects, Eckles explains, is determining causal influence.

The ubiquitous availability of feedback influences theory and practice. It impacts our perceptions of ourselves, and of others, as well as the ways in which we interact with technologies and with groups, both real and virtual, local and remote. The November 17, 2004 mediaX **Science and Technology of Feedback Conference** provided a snapshot of the diverse questions and perspectives in academia and industry. As we increase our dependency on the social intelligence embedded by humans into machines, the understanding of feedback, interaction and social learning become ever more important.