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UbiComp 2013

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The 2013 ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp 2013) was the result of a merger between two renowned conferences in the field of ubiquitous computing: Pervasive and UbiComp. UbiComp 2013 was held on the campus of ETH Zurich from 8–12 September (see Figure 1 for a photo of the local organizers). The number of attendees—more than 700—reflected the success of the merger. Furthermore, for the first time, UbiComp had three parallel tracks and was colocated with the International Symposium on Wearable Computers (for more information on ISWC 13, see this issue's Wearable Computing department).

Figure 1. The local organizers were excited at the opening of UbiComp 2013. From left to right: Marian George, Anwar Hithnawi, Elisa Rubegni, Matthias Kovatsch, Leyna Sadamori, Christian Remy, Christian Beckel, Simon Mayer, Hông-Ân Cao, Hossein Shafagh, Wilhelm Kleiminger, Paul Baumann, Gabor Sörös, and Silvia Santini.

KEYNOTES: FROM ANIMATION TO GOOGLE GLASS

UbiComp 2013 featured keynotes by Markus Gross, of ETH Zurich and Disney Research, and Thad Starner of Georgia Institute of Technology, Technical Lead on Google's Project Glass.

Gross reminded the audience that Disney had its first revolutionary patent on synchronizing sound and moving images approved as early as 1931. Since then, the audience has changed considerably: spectators aren't satisfied by simple cartoon movies anymore but demand customized digital and physical experiences that involve a variety of devices and social media integration. Challenges for the animation industry, however, provide new opportunities for computer scientists. These range from facilitating 2D animation (for example, simplifying or even automating the creation of in-between frames for smoother transitions) to "customizing through digital fabrication"—that is, creating digitally customized physical products and making them interactive.

While Gross introduced a new topic to the ubicomp community, Starner gave a historical overview of a project that's tightly linked to Mark Weiser's vision of ubiquitous computing. He covered his work on wearable computing from the early days (1990s) to the current Google Glass project. Starner explained that his work and Glass were inspired by old ideas—for example, Vannevar Bush's "As We May Think" article from 1945 that described doctors wearing small cameras on their forehead that would regularly take pictures of patients to help monitor symptoms.[1]

To convince those who wonder why they should have a wearable computer instead of a smartphone, Starner performed an experiment on "reducing the time between intention and action." He challenged the audience to quickly get the statistics of baseball player Mickey Mantle, a task he himself was asked to do in the *60 Minutes* TV show back in 1997. Starner's wearable devices helped him win the challenge; the next-place

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participant took a minute longer to load the data using a mobile phone. This example showed that by being closer to the body, wearable computers can reduce the time between intention and action. Throughout the talk, Starner showed videos to illustrate the potential of Glass to help users in everyday life: from supporting vision-impaired people to helping tennis players improve their game. These small excerpts showed how Glass weaves itself into the fabric of everyday life.

WIDESPREAD COVERAGE

UbiComp 2013 received approximately 400 submissions, of which 92 were accepted and spread across three days and 31 sessions. The paper sessions were accompanied by 28 demos and 81 posters.

Five papers received a best paper award and another nine got honorable mentions (see www.ubicomp.org/ubicomp2013/program.php for more information). Donald J. Patterson received the 10-year impact award for his 2003 article, "Inferring High-Level Behavior from Low-Level Sensors" (see Figure 2).[2]

The program's widespread coverage highlighted topics at the core of pervasive computing. The issues discussed ranged from creating exciting new hardware across completely novel interfaces for "disappearing" computers to inferring user behavior from data and understanding the implications of ubiquitous technology on the society. This shows the richness of themes that the ubicomp field covers, which makes it compelling as well as challenging.

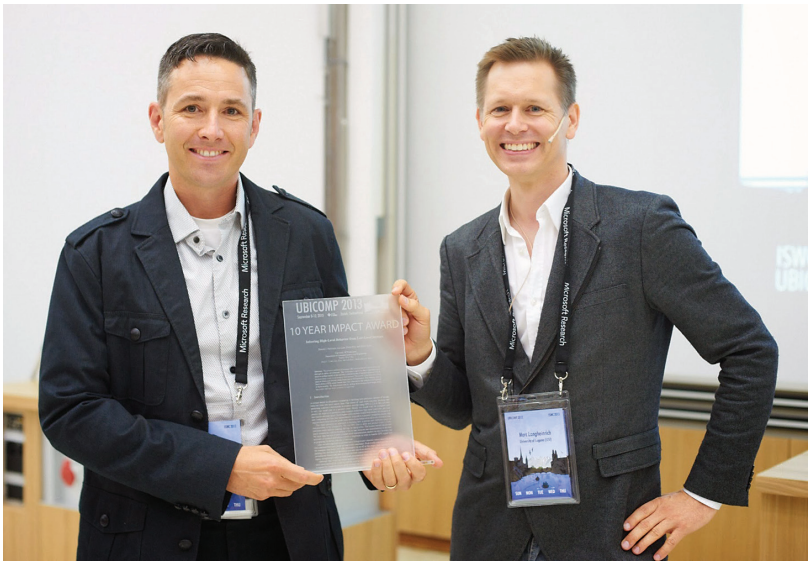

Figure 2. Program co-chair Marc Langheinrich (right) presenting Donald J. Patterson with the UbiComp 2013 10-year impact award for "Inferring High-Level Behavior from Low-Level Sensors."[2]

Hardware

New and innovative hardware was the topic of one of the most well-attended sessions at UbiComp 2013. In a highly engaging talk about his paper "Instant Inkjet Circuits," Yoshihiro Kawahara, from the University of Tokyo, presented an approach to print electronic circuits using off-the-shelf inkjet printers and publicly available silver nanoparticle ink. The system's advantage over existing do-it-yourself tools is its high speed and that it doesn't require polychlorinated biphenyls (PCB) milling or vinyl cutting. Prior to printing, the circuits can be modeled with any drawing software—have a look at the paper for the optimal printer settings.

Yoshihiro's second paper, "Power Harvesting from Microwave Oven Electromagnetic Leakage," challenges the widespread notion that microwaves don't leak energy. Yoshihiro and his colleagues used the energy leaked through microwave front doors to wirelessly power devices such as thermometers, door bells, and an MSP430 (heating up a glass of milk every 2.5 hours gives it enough energy to take a measurement every 30 minutes). As a sneak preview to their next paper, Yoshihiro mentioned that he and his colleagues were even able to classify the food being cooked from the leakage fluctuations of the microwave—stay tuned for self-configuring microwave ovens and nutrition analytics based on their approach.

Thomas Kubitza, from the University of Stuttgart, talked about WebClip in "Connector for Ubiquitous Physical Input and Output for Touch Screen Devices." Kubitza and his colleagues created a communication protocol between external devices and smartphones by emulating touch events. WebClip works with all capacitive touchscreens and doesn't even require a mobile phone application. It has already been used to remotely monitor plants and control a water pump.

Novel Interfaces

Hardware creates the basis for ubicomp systems, but novel and intuitive interfaces give them a face. During the Novel Interfaces session, Sidhant Gupta, from the University of Washington, presented AirWave, a new noncontact haptic feedback interface using air vortex rings. However, one of the problems when using "thin air" for haptic feedback is precise targeting. Therefore, Sidhant and his colleagues investigated fluid dynamics and vortex formation theory and

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uncovered that precision in targeting air vortex rings comes down to the volume of air displaced and the size of the aperture of the device producing the ring. Their results from a user study with 10 participants showed that by adjusting the ratio between the two parameters, they could obtain a 93.7 percent success hit rate with a precision of approximately 10 centimeters when shooting with an air vortex ring from a distance of 2.5 meters.

In the same session, Melodie Vidal, from Lancaster University, presented Pursuits, a novel eye-gaze-based interaction technique for public displays. The technique is meant for use in dynamic interfaces that have moving objects on the screen. Pursuit tracks peoples' eye movements and correlates these with movements of an object on the screen. Unlike traditional eye-gaze systems, it doesn't require calibration and is independent of user and target or object size. A lab study and follow-up deployment in the wild demonstrated the feasibility of using Pursuits in the real world.

Inferring User Behavior from Data

Once the hardware and user interfaces are in place and the technology leaves the laboratory, it's important to understand how users integrate the new systems into their everyday lives. This understanding is a key factor driving the design and creation of even better systems.

During the Location-Based Services session, John Krumm, from Microsoft Research, presented "Placer: Semantic Place Labels from Diary Data," focused on machine-learning techniques that can automatically label semantic places, such as "home" or "work." The proposed technique uses two huge government diary studies to create an algorithm for automatically labeling the places. Krumm highlighted one experiment that gives a 14 percentage point increase in accuracy performance when properties of nearby businesses are considered during labeling in addition to demographic and time features.

Understanding how people move and how we can build better services based on their movement was the topic of the Mobility session. Raghu Ganti, from IBM, presented the idea of inferring user mobility data from taxicab GPS traces. His article, "Inferring Human Mobility Patterns from Taxicab Location Traces," focused on the identification of pick-up and drop-off points to infer user mobility data. Ragu and his colleagues propose using the stretch factor, a concept from graph theory, to identify these pairs of points with a hidden-Markov-model-based algorithm. This combination performs significantly better than previous work in terms of precision and recall.

Irina Shklovksi and her team developed a prototype system that lets family members post information on a hub—a medium-sized display placed in the home.

In the same session, James McInerney, of the University of Southampton presented "Modeling Heterogeneous Location Habits in Human Populations for Location Prediction Under Data Sparsity," addressing the issue of needing a critical mass of historical data to work with users' mobility. McInerney and his colleagues presented a model that shares temporal parameters between users by keeping the spatial parameters specific to individuals to overcome this deficiency. The proposed model outperforms another state-of-the-art approach by a factor of 2.4 in location prediction performance when training on only 20 hours of observations. Furthermore, they demonstrated that 10 auxiliary users in the model achieved the maximum performance.

Understanding Implications of Technology on Society

Using technology to understand how people behave is one strand of uncovering the effects of technology on the society. Another strand is looking into how technology is influencing and changing society—for example, how it changes the way we interact with each other and with technology, and how it's used in everyday life.

In the Social Computing session, Irina Shklovksi presented how we can better situate social media, such as Facebook, Twitter, and Instagram, within families in her talk, "Making a Home for Social Media." Shklovksi and her team developed a prototype system that lets family members post information on a hub—a medium-sized display placed in the home. Their user study with three families uncovered that the hub raised the communal spirit in the family. Unlike most of the devices that were considered personal, the hub was viewed as family-owned and thus inspired a sense of connectedness.

In the Computing in the Home session, Fahim Kawsar, of Bell Laboratories, Alcatel-Lucent, presented "Home Computing Unplugged: Why, Where and When People Use Different Connected Devices at Home." This study logged the Internet use of 86 Belgian households and surveyed and interviewed members of these households about their different devices. The study shows that both the nature of a planned activity and the context in which the activity takes place determines the choice of device, as well as the ability to spend time with others while using the devices.

In the session on Domestic Computing, a best paper award was given to "There's No Such Thing as Gaining a Pound: Reconsidering the Bathroom Scale User Interface,"

Figure 3. A fleeting glimpse of the popular chocolates bearing the conference logo.

presented by Matthew Kay, of Microsoft Research. Here, four complementary studies—analyzing online product reviews of scales, a weight-tracking study, expert interviews, and a scale-perception study—showed that the perception of what scales can do doesn't always match what they actually do. For example, the weight-tracking study showed weight fluctuations of up to 4.56 lbs in a day. A key point of Matthew's talk was that scales should reflect data uncertainty appropriately to avoid the impression of false precision in single-point measurements.

TOWN HALL MEETING

Every year, the community is given the chance to openly discuss any concerns related to the UbiComp conference in the context of the Town Hall meeting. Judy Kay, head of the UbiComp steering committee, chaired this session. One of the discussions was whether UbiComp should have a journal on its own and if and how it would be linked to the conference—for example, similar to ToCHI papers being presented at the CHI conference.

Another important part of the Town Hall meeting was a discussion on best paper and 10-year impact awards. For the best paper awards, one suggestion was to have a dedicated "Best Paper Session" that would let attendees to vote for the winner. Some perceived this as a stark aberration from the idea of writing focused best paper awards, another idea was to bring back the best presentation award.

Another discussion was on the use of telepresence at the conference, which would let people present their papers remotely. A.J. Brush, general cochair of UbiComp 2014, used this opportunity to announce that UbiComp 2014 would most likely support remote participation.

During the closing session, the UbiComp 2014 general chairs assured the community that there will be as much chocolate in Seattle as there was in Zurich (see Figure 3). For more information on next year's UbiComp, see http://ubicomp.org/ubicomp2014. Finally, it was announced that UbiComp 2015 will be held in Osaka, Japan.

If you didn't get a chance to attend UbiComp 2013, you can check out a short video at www.youtube.com/watch?v=1UAT_XtLMbY, which the organizers created to capture the spirit of the conference.

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