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# The Pervasive 2007 Workshops

*Gillian R. Hayes and Anind K. Dey*

Pervasive 2007 hosted an incredible full day of workshops before the main conference. One hundred twenty enthusiastic participants in eight great workshops discussed experiences and ideas on particular aspects of pervasive computing with like-minded researchers and practitioners. The variety of projects presented demonstrated how truly interdisciplinary the Pervasive conference has become. Even better, every workshop presented its results back to the conference through an interactive poster session. This session allowed for discussion between workshop organizers and participants and conference attendees who weren't able to attend every workshop. Here we present synopses of each workshop.

## CONTEXT AWARENESS

The International Context-Awareness for Self-Managing Systems Workshop (CASEMANS 07) focused on two major issues: the increased input that applications require and the increased number of user-managed devices, networks, and applications. It was organized by Waltenegus Dargie, Bruno Klauser, Johannes Helander, Michael Berger, Thomas Springer, Noriaki Kuwahara, and Kiyoshi Kogure.

The workshop started with an invited talk from Cisco Systems' Ralf Wolter. According to Ralf, computing was originally meant to help people manage their business. With pervasive computing's emergence, however, businesses are having to manage a plethora of computing entities. The idea of self-managing systems and devices promises to return computing back to its initial purpose.

**The need for different context granularity among context-aware systems limits context information's scope and usefulness.**

There were three groups of presentations. The first dealt with context acquisition, context modeling, and context representation. The presenters discussed how to identify a context of interest, model it, and capture or reason about it. The second group examined context-aware and self-managing middleware, collaborative environments, and applications. The third group looked at self-managing networks. The latter two groups demonstrated how context information can relieve users from the details of system management and reduce the amount of explicit input needed.

The workshop included group discussion on these issues:

- Appealing case studies are still missing.
- The need for different context granularity among context-aware systems limits context information's scope and usefulness. On the other hand, modeling, representation, and acquisition of context aren't straightforward.
- A system usually comprises several systems. At what level should you implement self-management or context awareness? How can this be visible?

CASEMANS 2008 aims to deal with these and other interesting research issues. For further information, visit http://z2.inf.tu-dresden.de/casemans/index.html.

## COMMON MODELS AND PATTERNS

The Common Models and Patterns for Pervasive Computing Workshop (CMPPC 07), organized by Rodger Lea and Mike Blackstock, was an offshoot of the UbiSys workshop series (www.ubisys.org) and a sequel to UbiSys06. At UbiSys06, the organizers and participants identified a need to reflect on lessons learned by the ubiquitous-systems community over the last 10 years. So, CMPPC focused on these activities:

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- identifying key research areas, particularly those that the community has solved,
- highlighting common patterns and best practices,
- listing systems that provide good examples of these best practices, and
- attempting to reach consensus on how best to evaluate ubiquitous-systems research.

The workshop was highly interactive, asking participants to prepare in advance and then engage in a series of roundtable discussions, breakout groups, and online editing of shared documents. Partly because of this approach and partly because of the energy that participants brought to the workshop, they were able to accomplish a significant amount of work. Initial workshop results are available at www.ubisys.org/index.php/Main/CmppcResults. One important result was the decision to create a portal (www.ubisys.org/index.php/Main/CommunityPortal) to be a repository of community knowledge and a place for online discussion. We encourage interested readers to check out the results and contribute to the portal.

### IMPROVING THE MOBILE USER EXPERIENCE

The International Workshop on Improved Mobile User Experience (IMUx 07), organized by Patrik Floréen, Petteri Nurmi, Greger Lindén, Péter Boda, and Ákos Vetek, focused on how to improve mobile-device usability and provide a better user experience. The devices' user interfaces should be more intelligent and require less explicit user input. Achieving these goals requires combining techniques from various fields, such as user modeling, user interaction, and user experience. IMUx brought together researchers from these fields with developers of mobile and ubiquitous applications. Participants were from the US, Canada, Chile, Finland, and South Korea.

The workshop featured three talks selected from the submitted papers:

- "Exploiting Context Information in Spoken Dialogue Interaction with Mobile Devices," presented by Mark Adler;
- "News-Feed Subscription Management for Intermittently Connected Environments," presented by Jason LeBrun; and
- "Modeling Mobile Problem-Solving Applications for the Blind from the Context of Use," presented by Héctor Flores, which also won the best paper award.

**We need easy-to-use development tools that work on multiple platforms, hide technical obstacles, and provide graceful error recovery.**

There were also two invited talks: "Useless Interfaces—Vision of User Interaction in a Context-Aware and Sensor-Rich World," by Péter Boda, and "Gathering Data with a Game: Experiences from the Manhattan Story Mashup," by Ville Tuulos.

At the workshop's end, the participants discussed research challenges related to the workshop themes. They formed these conclusions:

- Usability guidelines demand that users feel in control. This goal can clash with machine intelligence, where methods are often difficult to explain.
- We need to better understand how such factors as culture, age, socioeconomic status, and education influence the use and acceptance of ubiquitous computing systems.
- There's great potential to help people who really need help. We need sexy showcases that have business potential but also facilitate the lives of those people. One possibility is to target niche solutions.
- We need easy-to-use development tools that work on multiple platforms, hide technical obstacles, and provide graceful error recovery.
- Privacy and legal concerns hinder development. One approach is to look at games, which have fewer privacy and security constraints but can still provide valuable insights into the use of ubiquitous computing technologies.
- Evaluating the user experience is challenging. We must separate technical issues from application behavior.

Further information is available at www.hiit.fi/imux.

### DESIGNING FOR PALPABILITY

The Designing for Palpability Workshop, organized by Peter Anderson, Monika Büscher, Christian Heath, Mads Ingstrup, and Morten Kyng, focused on how to creatively realize pervasive computing's potential. For the organizers, "palpability," especially in its meanings of "plainly observable," "noticeable, "manifest," "obvious," and "clear," captures an important element of what's necessary to realize this potential. Palpability isn't a property but an effect of people's engagement with technologies, objects, and environments. This means that pervasive computing designers can't design palpability into technologies but can design for palpability, to help people make computing palpable.

Doing so challenges a number of concepts introduced with the original vision of pervasive computing. For example, "invisibility," "ambient intelligence," or "(de) composition" require respecification with regard to how people use technologies at work and in everyday life and play. Concepts such as inspection, experimentation, translation, emergent use, and breakdown become important.

During the workshop, organizers

and participants worked together to present and discuss ideas, prototypes, and studies. For more information, check out www.ist-palcom.org/palpable_pervasive_2007.

## PERVASIVE LEARNING

The International Workshop on Pervasive Learning: Design Challenges and Requirements was organized by Hokyoung Ryu, Marcelo Milrad, and Hiroaki Ogata. Learning is spreading from its traditional home in the classroom to a new home in computers and mobile devices that are everywhere. This shift comes in the form of e-learning, which is becoming more pervasive. The workshop aimed to discuss the latest learning environments beyond the desktop learning environment.

The workshop consisted of two sessions. Session I focused on diverse perspectives on pervasive-learning design challenges:

- "Integrating Interactive Learning Experiences into Augmented Toy Environments," by Matthias Lampe and Steve Hinske;
- "Pervasive Scale: A Model of Pervasive, Ubiquitous, and Ambient Learning," by Siobhán Thomas; and
- "Exploring How Pervasive Computing Can Support Situated Learning," by Arianit Kurti, Daniel Spikol, Marcelo Milrad, Martin Svensson, and Oskar Pettersson.

Session II focused on the design requirements and implementation of the new learning environments:

- "Is Mobile Learning a Necessary Evil? The Goodness-of-Fit of Mobile-Learning Situations," by Hokyoung Ryu;
- "LORAMS: Capturing, Sharing, and Reusing Experiences by Linking Physical Objects and Videos," by Hiroaki Ogata, Yoshiki Matsuka, Moushir El-Bishouty, and Yoneo Yano;
- "P-learning and E-retail: A Case Study and a Flexible Software Architecture," by Alain Derycke, Vincent Chevrin, and Thomas Vantroys; and
- "Adapted Activity Deployment and Configuration in a Pervasive-Learning Framework," by Carlos Celorrio and M. Felisa Verdejo.

Meeting the challenges and requirements of these new learning environments will be the key to successful development of future pervasive-learning applications. For more information on the workshop, visit www.massey.ac.nz/~hryu/PL2007/Workshop/Workshop.html.

**A novel mobile text-entry technique works through one-handed tapping on a nearby surface.**

## PERVASIVE MOBILE INTERACTION

The 3rd International Workshop on Pervasive Mobile Interaction Devices (PERMID 07), organized by Enrico Rukzio, Rafael Ballagas, Jonna Hakkila, Derek Reilly, and Andy Wilson, focused on leveraging mobile devices to interact with the surrounding environment. Increasing computing power, component miniaturization, device integration, and the technology's overall maturation have enabled the creation of new concepts and their employment in prototypes that can undergo field trials. Workshop participants discussed integrating the physical and digital worlds, using mobile devices to interact with smart environments, developing mobile user interfaces and input methods for pervasive applications, and charting end-user experiences.

The workshop consisted of paper presentations, a short discussion, and then demonstrations of work. Here are some highlights:

- a recursive, infrared bar-code system to enable fluid interaction with printed maps;
- a novel mobile text-entry technique that works through one-handed tapping on a nearby surface;
- an urban pedestrian mobile social navigation system, inspired by a divining rod, that leads people to their desired locations;
- an analysis of various biosensor data to support mobile fitness applications;
- a traditional Japanese cloth (used to carry personal belongings) augmented with RFID readers to keep track of what the user is carrying;
- a gesture recognition system that lets players interact with mobile phones to "cast spells" in a pervasive game;
- an analysis of the design space of using mobile phones as musical instruments;
- a sensing technology that detects devices' relative spatial arrangement, for presenting pervasive services to users;
- an analysis and comparison of physical tagging technologies; and
- "Magic lens" interaction that lets users access Wikipedia content by waving a mobile phone over a physical map.

For more information and workshop proceedings, visit www.permid.org/2007.

## PERVASIVE-INFORMATION-SYSTEMS DESIGN

David DeRoure and Geoffrey Fox organized the Principles of Pervasive Information Systems Design Workshop. The workshop had two goals. The first was to present experiences with the information and knowledge aspects of pervasive computing deployments. The second was, through reflection and synthesis, to identify the principles of pervasive-information-systems design: What are the architectures, models, patterns, and guidelines for future designers? What impact do these principles have on the design of pervasive infrastructures? What tools

## CONFERENCES

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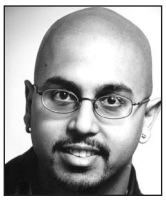

and services are needed? What's the future research agenda in this area?

The workshop had three sessions. The first included two design and deployment studies. Marlon Pierce reported on "Building a Sensor Grid for Real-Time Global Positioning System Data," and Mark Weal reported on "Observations on Pervasive-Information-Systems Design."

The second session focused on horizontal perspectives, including "Secure Pervasive Information Architecture," by Stewart Fallis, and "Designing a Pervasive Service Discovery System," by Vasughi Sundramoorthy.

The last session focused on establishing design principles, including two discussions of case studies. The first, led by Jamie Robinson, covered pervasive computing in the chemistry laboratory. The second, led by Nick Humfrey, focused on Semantic radio and Wi-Fi wireless.



The workshop closed with a summary of the design principles and a wrap-up. For more information, go to www.psc.ecs.soton.ac.uk/events.

### AMBIENT INFORMATION SYSTEMS

William Hazlewood, Lorcan Coyle, and Sunny Consolvo brought us the Designing and Evaluating Ambient Information Systems Workshop. The goal was to gather researchers from the rapidly emerging field of *ambient information systems* to

- explore the various technologies and smart materials with which to implement these systems;
- identify design, development, and evaluation problems; and
- derive new fundamental questions that we must address.

Participants discussed the relevance of AIS along with ideas on how to evaluate such technologies' effectiveness and acceptance.

David Rose, from ambientdevices.com, opened the workshop by describing his experiences as an entrepreneur working to turn ambient-information devices into commercial products. Zach Pousman asked the group to consider functionalist versus social-relativist viewpoints regarding AIS evaluation. John Stasko presented several interesting examples of AIS projects, including Ambient Trolley, Pirate Island, Aura Orbs, and InfoCanvas. Andrew Vande Moere provided the perspective that ambient devices are suitable as persuasive devices, and gave several examples from the public and private sides. Also, Andrew presented research led by his student Xiaobin Shen involving detailed evaluation of the adoption of an ambient display. Jörg Müller asked us to rethink the overall scope of AIS by considering how large public displays might benefit from using ambient principles and how these displays might impact advertising. Steve Neely described properties of information that's suitable for ambient displays. Frank Bentley described how Motorola Labs is applying AIS principles to mobile devices, and Martin Tomitsch presented a detailed taxonomy for categorizing ambient technologies, using a wide variety of relevant examples.

These presentations led to a lively discussion of the important questions for AIS research, such as how to evaluate technologies that are meant to be invisible or how to develop frameworks and taxonomies to represent the vast design space of AIS. This discussion raised more questions than it answered. However, the consensus emerged that the field is ripe for research and that a community of researchers is already engaged in the field.

To consolidate this community, the organizers have set up an announcements mailing list at subtletech-l@indiana.edu. They plan to grow this Web presence over the coming months and use it to announce upcoming workshops and conferences. If you're interested in getting involved, visit the Web page (www.informatics.indiana.edu/subtletech) and consider joining the mailing list.

All the workshop organizers and participants were energetic, involved, and exploring exciting new avenues of research and design. We thank the organizers for their great job in bringing together this dynamic group of individuals. In turn, each organizer has expressed his or her gratitude for the work that the participants put into generating their position papers, presenting their research, and participating in discussions. Many of the organizers and participants are thinking about Pervasive 2008 (www.pervasive2008.org/workshops). Position papers are due in January, and they hope to see you there.So, please start putting together ideas to make next year's workshops program as good as this one!