

## HOT RESEARCH

### Virtual Worlds for the Real World

ISR Prof. **Crista Lopes** was never much of a gamer, and she still isn't. And yet she has been spending a good part of the last year and a half driving her virtual world avatar in immersive 3D environments similar to Second Life™. "Virtual Worlds are fascinating platforms for improving many processes in the real world," Lopes said. "Although they have their origins in on-line gaming,

MUDs in particular, recent Virtual World platforms are so much more than that. They have become platforms for mashing up traditional 3D modeling and simulation work with the



connective and collaborative nature of the Web."

Lopes was first attracted to Second Life™ by a colleague who played it for fun. Immediately she discovered the powerful programming capabilities of that Virtual World. In Second Life™, people not only build 3D constructions, but they can associate programmable behavior with those objects via in-world scripting. A visit to any place in the large universe of Second Life™ shows a myriad of imaginative objects, systems, and environments that have been developed by people all over the world. Second Life™ seemed like a viable tool for simulation of Ubiquitous Computing applications of the kind Lopes had been working on before. "One of the major problems about developing experimental sensor- and actuator-rich systems is the lack of good and inexpensive modeling and simulation tools," said Lopes. She continued, "The really good tools out there are expensive, specialized for specific domains, and still work according to the desktop model of computing. There isn't a general-purpose tool that can accommodate a variety of uses, and that makes the

## RESEARCH BRIEFS

Prof. **Walt Scacchi**, **Alfred Kobsa**, **Cristina V. Lopes**, **Gloria Mark**, **Bonnie Nardi**, **David Redmiles**, and **Richard N. Taylor** – ISR Director, have received a grant for \$3 million from the NSF for research on "Decentralized Virtual Activities and Technologies: A Socio-Technical Approach." For more on this grant, see Message from the Director, page 3.

Prof. **Walt Scacchi** has received two awards from Intel, totalling \$60,000, for his research on "Virtual Simulations for Factory Training" and "Computerized Business Office Training Games." For more on Scacchi, see Focus on Faculty, page 2.

Prof. **Nenad Medvidovic**, Associate Professor at USC, has been named as the new Director of the USC Center for Systems and Software Engineering (CSSE), effective January 1, 2009.

Prof. **James A. (Jim) Jones**, Donald Bren School of ICS, and Prof. **John Georgas**, Northern Arizona University and an ISR alumnus, have joined the ISR faculty.

Prof. **Bonnie Nardi** gave a keynote talk at the Information Seeking in Context conference, in Vilnius, Lithuania in Sept. The talk highlighted her research in China on the "mixed realities" of Internet cafes in which the virtual and physical come together in interesting ways.

Prof. **André van der Hoek** gave an invited tutorial on Improving Software Engineering Education at the Software Engineering Educators Symposium at SIGSOFT 2008 in Nov.

*More Research Briefs on page 5.*

data easily shareable. This generalization, as well as the on-line presence of the data using an intuitive visualization, is what I saw in Second Life™."

During the summer of 2007, Lopes and her students **Lorraine Kan** and **Anton Popov** embarked on a project with a local company, Unimodal Inc., to model and simulate Unimodal's Personal Rapid Transit (PRT) system in Second Life™. According to Wikipedia,



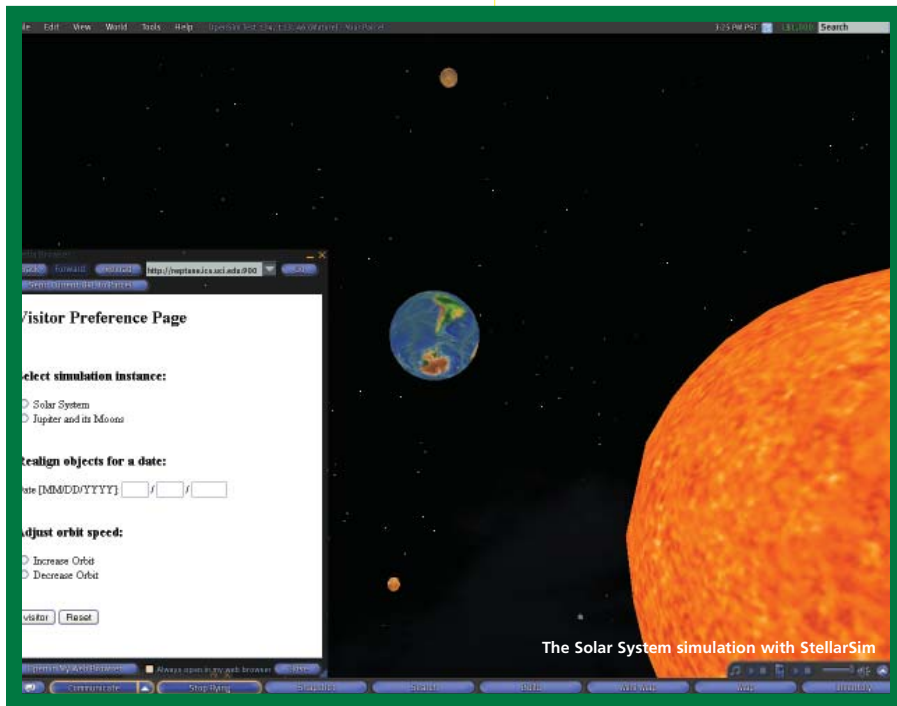
PRT is "a public transportation concept that offers automated on demand non-stop transportation, on a network of specially built guideways." This concept accommodates a variety of hardware solutions that range from cars on rubber wheels guided by a supporting guideway, to cars suspended on guideways through magnetic levitation. Unimodal's system, called SkyTran, uses suspension through magnetic levitation on guideways made of large numbers of special "bricks". The first physical prototype being developed by Unimodal consists of a simple loop with one single station, and that was the

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system that Lopes and her students modeled. “Unimodal approached ISR in order to get some help with the software for controlling the movement of the podcars on the guideway,” said Lopes. “They had some really good ideas for how to do that control, and they wanted some help with distilling those ideas into implementable software components. What I did was to first model their system in Second Life™, down to the individual bricks, and then simulate the control

Another application domain Lopes is exploring is the use of virtual worlds for scientific visualizations. The use of virtual worlds for this domain offers many benefits such as real-time interactivity with the data and with other people. Along with student **Amy Henckel**, Lopes developed a framework for visualizing any astronomical data that can be represented as a static part (the bodies themselves) and a dynamic part (the movement). The framework is called StellarSim.



using in-world scripting.” In the end, Lopes and her students produced a demonstration of SkyTran in Second Life™ that is both useful for the engineering process as well as for public awareness. For the engineering design process, it allowed the Unimodal engineers to think through the architecture and the details of the control by having to do it first for the virtual podcars so that they don’t crash into each other. For public awareness, the SkyTran demonstration allows people to ride the podcars and experience the ride under all possible angles. Said Lopes: “The control system in the virtual SkyTran is an accurate representation of what the real control system will be, and anyone with a good Internet connection can ride these virtual podcars. The combination of these two things is really exciting from a research perspective. We are almost at a point where engineering design can be done almost exclusively in virtual reality, experienced there, and then simply copied from there to the physical hardware.”

For the last year, Lopes moved her virtual worlds work out of Second Life™ and into a platform called OpenSim (<http://opensimulator.org>). OpenSim is an open source server that is compatible with the Linden Lab client-side viewer. In the process of exploring these new applications of virtual worlds, Lopes became a regular contributor to the platform itself, having recently made an important architectural contribution called the Hypergrid – an architecture for linking different virtual worlds and exchanging agents (i.e. users) among them, effectively supporting the emergence of a web of virtual worlds (<http://opensimulator.org/wiki/Hypergrid>).

For more on Prof. Lopes’ research, see: <http://www.isr.uci.edu/~lopes/>

Lopes can be reached at [lopes@ics.uci.edu](mailto:lopes@ics.uci.edu), (949) 824-1525.



## FOCUS ON FACULTY

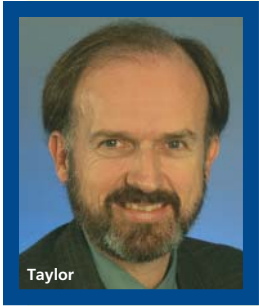
### Meet Walt Scacchi, Open Source and Virtual World Champion

ISR Prof. Walt Scacchi has been engaged in empirical studies of software development teamwork for the past 30 years. Along the way he has examined different kinds of software development activities, processes, work practices, projects, and communities both within and beyond the boundaries of a single enterprise. Since joining ISR in 1999, he has engaged in studies of free/open source software development (FOSSD) in a variety of domains including astrophysics, bioinformatics, higher education computing, networked computer games, and military computing, as well as mainstream FOSSD projects and project communities. Together with many faculty associates, researchers and graduate students here at ISR, their efforts are internationally recognized as a global leader in FOSSD research, as well as offering the most prolific record published of research studies in the area. See the ISR Web page on Open Source Software Development research for more information: <http://www.isr.uci.edu/research-open-source.html> and **ISR Connector** Spring/Summer 2008.

“I find that FOSSD teamwork occurs in decentralized settings where developers work in information spaces with online artifacts that are network-centric and logically collocated, rather than in centralized work places where people and artifacts are physically collocated”, says Scacchi. “Building from this, my current research also includes the development and use of decentralized systems and virtual world environments as possible new places for engaging in collaborative work activities. A decentralized virtual activity system (DVAS) is a networked computer sup-

## MESSAGE FROM THE DIRECTOR

The National Science Foundation has recently awarded ISR a grant of \$2,997,936 for support of research into decentralized virtual activities and technologies. The project, entitled "HCC-Large: Decentralized Virtual Activities and Technologies: A Socio-Technical Approach," NSF Award # 0808783, is under the direction of Dr. **Walt Scacchi**; participating faculty include Professors **Alfred Kobsa**, **Cristina Lopes**, **Gloria Mark**, **Bonnie Nardi**, **David Redmiles** and myself. In addition to work at ISR, the investigators will be also be engaged with several industrial research partners, such as The Aerospace Corporation, Avaya Labs, Discovery Science Center, Northrop Grumman, and Unimodal Inc.



Beginning this fall and lasting through second quarter 2011, the investigation is focused on decentralized virtual activity systems (DVAS) employing an empirical socio-technical research approach. The research team sees growing, widespread interest in the development and use of decentralized systems and virtual world environments, such as Second Life™, as possible new places for engaging in collaborative work activities. DVAS's are attractive since they may be resilient to environmental disruptions, as collaboration can be conducted from anywhere, anytime, using representations of people, artifacts, and activities. The Gartner Group recently declared that within five years 80% of Internet users and Fortune 500 companies will have an online presence in a virtual world of some kind. Elsewhere, there is widespread interest in stimulating new technological innovations that enable people to come together through social networking, file/media sharing, and massively multi-player online game play. Given that computing has long history of failed or problematic efforts to develop and deploy computing systems due to

lack of understanding of the ways people's work and social activities are situated in organizational and technological contexts, the team will engage a large multi-site, multi-partner research endeavor to provide the greatest opportunity for broadly useful results. These results will emerge from comparative analyses of both *in-situ* field studies and technology prototyping efforts.

ISR's research partners serve multiple roles in this project. First, they serve as a source of real-world problems for the team to tackle. Second, as organizations facing the daily problems of distributed development, ISR's partners view these as very practical problems to be tackled, and will engage directly with UCI in identifying strategies and solutions. Third, the partners can serve as test-beds for early evaluation of proposed new solutions. In other words, continuous engagement with real world settings is planned at all stages of the project. In addition to its intrinsic research merit, the study has economic value as it will help organizations determine how to carry out decentralized work effectively with smoother coordination, so they can better compete in the global market.

We believe this grant will determine how emerging technologies can be used or modified to support serious group work. While many technologies have emerged from computer-based games, the essential concepts appear to have real value potential. This research will enable us to know.

Look for updates on our DVAS research in future issues of the *ISR Connector*. For more on ISR Director **Richard N. Taylor**, see Software Architecture Textbook, page 5; for more on Scacchi, see Focus on Faculty, page 2; for more on Lopes, see Hot Research, page 1.

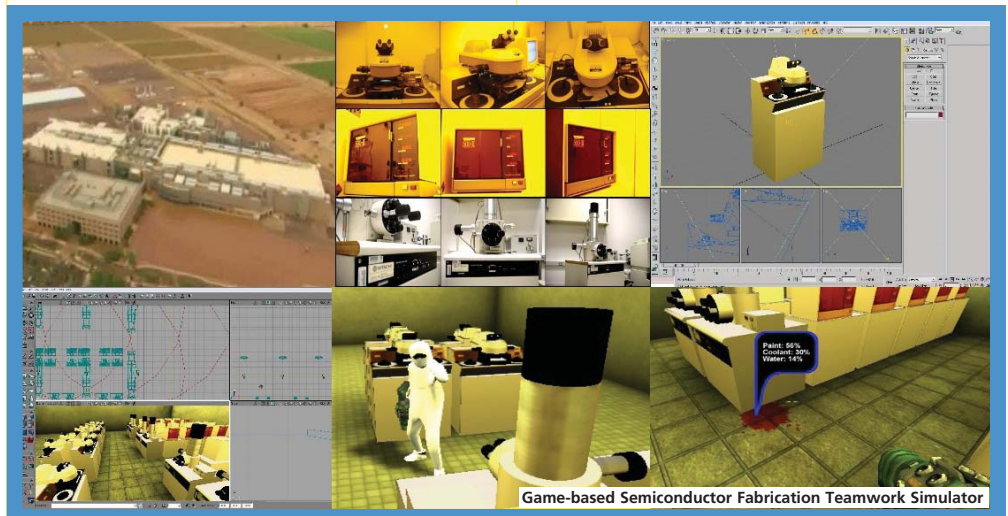
ISR Director Richard N. Taylor can be reached at [taylor@uci.edu](mailto:taylor@uci.edu).

ported work/play system whose elements can be both virtual and decentralized. Massively multi-player online games (MMOGs) like World of Warcraft™, and online virtual worlds like Second Life™ are each popular examples of a DVAS, as are FOSSD projects. Accordingly, I am looking into the development and deployment of distributed teamwork environments that employ virtual/mixed reality interfaces or networked computer game play." Some examples of his recent studies in this area follow.

In the first case, Scacchi is leading an effort to develop game-based virtual work environments that can be used to create teamwork simulators for activities associated with semiconductor or nanotechnology fabrication facilities. In such settings, virtual collocation of teamworkers, especially new, untrained workers, is perceived as less costly

and potentially more effective than physical collocation with actual fabrication facilities.

Similarly, virtual collocation in a simulator offers the potential for remote diagnosis of



## ISR STUDENT NEWSBRIEFS

**Chris Jensen** (W. Scacchi, advisor) presented his paper, "Computer Support for Discovering OSS Processes," at the 3rd International Workshop on Public Data about Software Development, held in Milan, Italy, in September with OSS 2008. The paper was co-authored by his advisor **Walt Scacchi**.



**Sushi Bajracharya** (C. Lopes, advisor) interned at IBM T.J. Watson Research Center in the Multichannel Web Interaction Research Group. He worked with researchers Charles Wiecha and Rahul Akolkar on a project involving exploration of higher level, declarative, programming languages and associated runtimes (both client and server) for Web 2.0 applications.



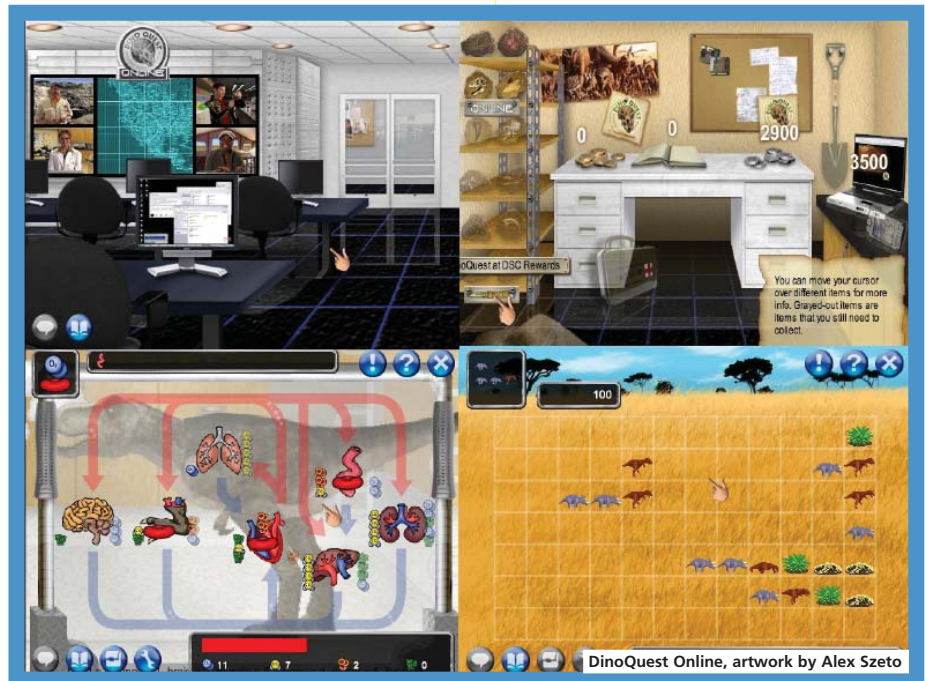
**Rosalva Gallardo Valencia** (S. Sim, advisor) also interned at IBM T.J. Watson Research Center this summer. She worked in the Data Access and Language Integration (DALI) group, with Michael G. Burke and Igor Peshansky. Rosalva conducted research on impact analysis of object-oriented source code with respect to database schema changes using slicing and static analysis. For more on Gallardo Valencia, see *ISR Connector* Spring/Summer 2007.



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<http://www.isr.uci.edu/people.html>

fabrication problems or breakdowns that may arise in facilities that are geographically and culturally dispersed.

<http://www.DQOnline.org>. It was created to complement and interoperate with a mixed reality, game-based science exhibit address-



In another project, along with ISR faculty associate **Robert Nideffer** and artist and game programmer Alex Szeto, their research team developed a game-based virtual world called *DinoQuest Online* (DQO). DQO is designed for informal science education in the area paleontology and life science for K-6th grade students. DQO is deployed and publicly available to use on the Web at

ing similar issues at the Discovery Science Center in Santa Ana, California. During design activities, their focus was to create what they call "science learning games" that are both fun and scientifically grounded. Critical to the design of this game world was the embodiment of national and California science education standards for the life sciences in grades K-6, as well as creating affor-



## RESEARCH BRIEFS

Prof. **Alfred Kobsa** and Computer Science dept. Prof. Gene Tsudik have been awarded a \$460,000 collaborative grant from the NSF Cybertrust program for a project titled "User-Aided Secure Association of Wireless Devices." The cybertrust project is being conducted in collaboration with Nitesh Saxena, at NYU Polytechnic Institute.

Prof. **Bonnie Nardi** and second-year Ph.D. student **Yong Ming Kow** have been awarded \$100,000 from the National Science Foundation to conduct a cross-cultural study of the development of end user modifications for games, examining "mods" in China and the United States.

Prof. **Bonnie Nardi** and second year Ph.D. student **Ruy Cervantes** have been awarded \$36,000 from Agilent Technologies to conduct an ethnographic study of engineers' experiences with a range of user interfaces from games to work applications.

Prof. **David Redmiles** has received a \$20,000 IBM Jazz Innovation Award for his project titled "Towards a Socio-technical Dependency Visualization Infrastructure for Jazz."

Prof. **Walt Scacchi** has been named as an Editor-in-Chief of the new International Journal of Social and Humanistic Computing. The inaugural issue was released in November.

Prof. **Paul Dourish** gave a keynote talk, "Madness in our method: combining ethnographic inquiry and technological design," at the British HCI conference in Liverpool, UK in September.

dances that enable collaborative game play and science problem solving.

The last example focuses on results from a study to investigate new capabilities and services in virtual world environments 2-5 years from now. This is a time when advanced multi-core microprocessor technologies enabling more powerful personal computers may be assumed to be in widespread use to support virtual worlds. Again collaborating with Nideffer and Szeto, the new virtual world capabilities they envisioned include: computer-assisted mobile user interfaces; personality profiling engines; computer controlled avatars; recognition, mining, and synthesis based analytical services; and real-time video analysis for avatar control. Emphasis in this exploratory study, *Virtual Life in 2010+*, was on showing how new end-user experiences in future virtual worlds can arise from new computational and business services predicated on multi-core processing that go beyond what can be realized in current virtual world and personal computing technologies.

For more information on Prof. Scacchi's research, visit:

<http://www.isr.uci.edu/~wscacchi>

<http://www.isr.uci.edu/research-games.html>

Scacchi can be reached at [wscacchi@ics.uci.edu](mailto:wscacchi@ics.uci.edu), (949) 824-4130.

## ISR Faculty Write First Comprehensive Textbook on Software Architecture

ISR Director **Richard N. Taylor**, ISR faculty associate Prof. **Nenad Medvidovic** of the University of Southern California, and ISR alumnus, Dr. **Eric Dashofy** of The Aerospace Corporation, have written the first comprehensive textbook and professional reference

### SOFTWARE ARCHITECTURE FOUNDATIONS, THEORY, AND PRACTICE



Richard N. Taylor • Nenad Medvidovic • Eric M. Dashofy

in the field of software architecture. The text, entitled *Software Architecture: Foundations, Theory, and Practice*, is published by John Wiley & Sons and came off the presses on December 18, 2008. At over 700 pages, the book provides a comprehensive treatment of the subject, showing how software architecture serves as the intellectual centerpiece of software development and evolution. Critically, the text focuses on supporting creation of real, implemented systems. Hence it details not only modeling techniques, but design, implementation, deployment, and system adapta-

## ISR STUDENT NEWSBRIEFS

**Norman Makoto Su** (G. Mark, advisor) spent his summer as an intern at PARC in Palo Alto. His work involved shadow-



Su

ing support staff to examine how people engaged in "routine" tasks. Working with Bo Begole and Oliver Brdiczka, they developed a measure of the "routineness" of routines to see how routines differed across days, and how they affect people psychologically and in their productivity.

**Nicolas Mangano** (A. van der Hoek, advisor) spent his summer as an intern

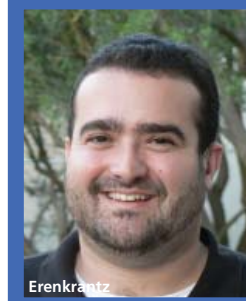


Mangano

in the Services Department at IBM T.J. Watson Research Center. Working with Noi Sukaviriya, he focused on providing tools and methods for consulting companies, for improving their business processes.

For more on Mangano, see *ISR Connector* Fall/Winter 2007.

**Justin Erenkrantz** (R. Taylor, advisor) gave the opening keynote at the Apache Meet Up Beijing 2008 in December. He also served on the program committee for the 3rd International Workshop on Public Data about Software Development (WoPDaSD 2008), held in



Erenkrantz

September in Milan, Italy with OSS 2008. For more on Erenkrantz, see *ISR Connector* Spring/Summer 2007 and Fall/Winter 2007.

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tion—as well as a host of other topics—putting the elements in context and comparing and contrasting them with one another.

The text includes chapters on the following: The Big Idea (what software architecture is all about); Architectures in Context: The Reorientation of Software Engineering; Basic Concepts; Designing Architectures; Connectors; Modeling; Visualization; Analysis; Implementation; Deployment and Mobility; Applied Architectures and Styles; Designing for non-Functional Properties; Security and Trust; Architectural Adaptation; Domain-Specific Software Engineering; Standards; and People, Roles and Teams. Several case studies from the practice are included to illustrate concepts. Particular attention is paid to the architecture of the World Wide Web; other examples discussed include Skype, grid applications, and robotics applications. Designing for product lines is a recurrent theme of the text.

Prof. Taylor can be reached at [taylor@uci.edu](mailto:taylor@uci.edu).

Prof. Medvidovic can be reached at [nen@ucsc.edu](mailto:nen@ucsc.edu).

Dr. Dashofy can be reached at [edashofy@antconcepts.com](mailto:edashofy@antconcepts.com).

## Visitor from Fuji Xerox and ISR Researchers Focus on Multi-tasking Awareness

ISR visiting researcher **Hideto Yazawa**, from Fuji Xerox in Japan, has been conducting research on supporting multi-tasking in the workplace with his faculty host, Prof. **Gloria Mark**, and several undergraduate students. Their project is called *TIMA—Task Information for Multi-tasking Awareness*.

Their group built a prototype system designed to help people manage interruptions by indicating their availability for their projects.



The *TIMA* prototype is designed as a “Japanese Garden” where users can move rocks in a desktop garden, representing their projects, to signal whether they are actively working on that project and thus available for interruptions about it.

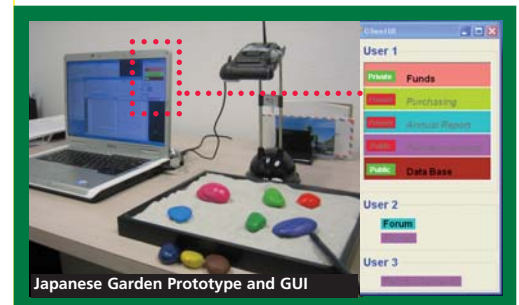
Researchers have found that multi-tasking involves more than just managing one’s individual tasks.



It is actually a complex interplay of switching between solitary work and interactions with others. While interruptions from other people can be beneficial, e.g. in gaining

information, they can also be distractions if they cause people to switch contexts.

Prof. Mark and Mr. Yuzawa are concerned with designing technical support for information workers to enable them to have more control on the context of their interruptions and to enable them to control their privacy, e.g. when they want to keep their concentration focused on their task-at-hand.



Their *TIMA* prototype consists of two parts: a tangible interface to manipulate users’ own availability for interruptions and a GUI that displays one’s current project context to distributed colleagues. The tangible interface is inspired by a Japanese Garden design, a “tranquil sanctuary that allows individuals to escape from the stresses of daily life.”

The interface is made up of a small sandbox with colored rocks, each rock representing a user’s different project. The sandbox surface is divided into four quadrants to indicate different statuses: public/active, public/inactive, private/active, and private/inactive.

If the rock is positioned in one of the private quadrants then it is only displayed to the user. If the rock is positioned in the public quadrant, then the project name is displayed on a GUI to all users who subscribe to this information.

The prototype was tested with users *in situ* in their real work settings to see how the tangible rock icons were used to indicate user

## ISR Technical Reports Available Online

ISR technical reports present information resulting from student and faculty research carried out under the auspices of the Institute. They showcase early results not available in print elsewhere. ISR technical reports are available in PDF on the ISR website. Recent reports include:

### “Decentralized Virtual Activities and Technologies: A Socio-Technical Approach”

Walt Scacchi, Cristina V. Lopes, Gloria Mark, Bonnie A. Nardi, Richard N. Taylor, David Redmiles, Alfred Kobsa  
UCI-ISR-08-4, December 2008

### “Surveying the Usability of Requirements Approaches using a 3-Dimensional Framework”

Kristina Winbladh, Hadar Ziv, Debra J. Richardson  
UCI-ISR-08-3, August 2008

### “Security Requirements Engineering: A Survey”

Jose Romero-Mariona, Hadar Ziv, Debra J. Richardson  
UCI-ISR-08-2, August 2008

### “XE (eXtreme Editor) - Tool Support for Evolution in Aspect-Oriented Programming”

Wiwat Ruengmee, Roberto Silveira Silva Filho, Sushil Krishna Bajracharya, David F. Redmiles, Cristina Videira Lopes  
UCI-ISR-08-1, June 2008

All ISR technical reports are available at:

<http://www.isr.uci.edu/tech-reports.html>

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Support Level	Annual Contribution	Contribution goes to:
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Affiliate—Research	\$30,000	A designated ISR research area.
Affiliate—Visiting	\$40,000	Faculty host's research area.
Affiliate—Grad Student	\$60,000	Graduate student fellowship.
Partner	\$100,000 or more	Large-scale research project.

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**Debra A. Brodbeck**  
brodbeck@uci.edu  
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availability for interruptions and how this affects the timing of external interruptions.

Observations revealed that placing the icons in the public/active area did not influence the timing of interruptions from colleagues. Interrupting others seems to follow a double standard: while information workers would like to restrict interruptions from others, they want to interrupt colleagues on their joint projects at the time they need information.

Other observations include: users did not often change the position of the rocks; there was variability with how often different rocks were moved; and some users kept multiple rocks in the public/active quadrant simultaneously.

Prof. Mark and Mr. Yuzawa continue their work on the Japanese Garden prototype. Issues they are focusing on include exploring how they might help users define project granularity more clearly and how they might exploit the private areas for personal task management.

Mr. Yuzawa is with the Corporate Research Group, Fuji Xerox Co., Ltd., in Kanagawa, Japan where he conducts research on human behavior using an eyetracker and creates software to support office workers. He has engaged in behavior analysis of office workers who have multiple tasks and the development of software for them to work effectively.

Mr. Yazawa is visiting ISR through June 2009. He can be reached at hyuzawa@uci.edu.

Prof. Mark can be reached at gmark@uci.edu.

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and an employment agency, all rolled into one. More importantly, when you sponsor ISR you become part of a friendly group of folks who speak the same language and are eager to work with you to solve your current technical problems in the most cost-effective way possible.

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Brodbeck

## ISR STUDENT NEWSBRIEFS

**Jose Romero-Mariona** (D. Richardson, advisor) presented his paper titled “A Recommendation System for Security Requirements” at the International Workshop on Recommendation Systems for Software Engineering (RSSE 2008) in Atlanta in November, held with SIGSOFT 2008/FSE-16. The paper is co-authored by ISR Profs. **Hadar Ziv** and **Debra J. Richardson**.



Romero-Mariona

**Steve Abrams** (G. Mark, advisor) presented his paper “Multi-Tiered Design Social Networking in Organizations: The Network-Centric Organization,” at the Workshop on Social Networking in Organization in November. The workshop was held with CSCW 2008 in San Diego.



Abrams

**Yang Wang's** (A. Kobsa, advisor) work in collaboration with Intel Research's Dr. Scott Mainwaring on virtual currency use in China was covered in “Il Sole 24 Ore”, the major Italian financial newspaper (circulation: 375,000 copies, website:



Wang

<http://www.ilssole24ore.com>).

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## Architecture-Centric Software Traceability Tool Available for Use

ISR Ph.D. student **Hazel Asuncion** (R. Taylor, advisor) has developed a tool to assist

with software traceability. She is looking for organizations to use her tool and provide feedback.

Numerous artifacts are created during the software development life cycle and

these artifacts are related to each other in complex ways. Software traceability is the ability to capture and use these relationships in order to support software development. Software traceability aids in system comprehension, impact analysis, and system debugging. Software traceability also enables lower maintenance costs as well as better assessment of product quality. Despite the benefits, software traceability continues to be difficult to achieve in practice. Factors, such as high overhead in establishing and maintaining traceability links, numerous relationships between artifacts, heterogeneous artifacts and tools, make it difficult to achieve software traceability in practice.

Architecture-Centric Traceability for Stakeholders (ACTS) is Asuncion's approach to effectively achieve software traceability. "We center our traceability links to the architecture since it resolves various concerns (e.g. domain constraints, user requirements, regulations) and forms the nexus between artifacts in the problem space and artifacts in the solution space (e.g. code, tests)," says Asuncion. "We empower users to drive the collection and usage of trace links, enabling them to directly benefit from their traced artifacts. Our approach is also undergirded by a combination of mechanisms that support the capture, management, and traversal of links (i.e. prospective link capture, concepts from open hypermedia, and rules). Prospective link capture enables the capture of links *in situ*, while artifacts are generated or modified, enabling the capture of implicit contextual relationships that are not possible with trace recovery techniques (e.g. information retrieval techniques). Open hypermedia concepts enable linkages across tool bound-

## ISR EVENT SCHEDULE

Mark your calendars now!

October 31, 2008

**ISR Distinguished Speaker: Matthew B. Dwyer**

Professor, Dept. of Computer Science & Engineering, University of Nebraska–Lincoln  
"Residual Monitoring of Safety Properties"

November 21, 2008

**ISR Distinguished Speaker: Peter Pirolli**

Research Fellow, PARC  
"From Solo to Social Information Foraging Theory"

February 6, 2009

**ISR Distinguished Speaker: John L. King**

Professor, School of Information and Vice Provost for Academic Information, University of Michigan  
"Society as Software"

February 13, 2009

**ISR Distinguished Speaker: Ben Shneiderman**

Professor, Dept. of Computer Science, Founding Director of the Human-Computer Interaction Laboratory, University of Maryland – College Park  
"Information Visualization for Knowledge Discovery"

March 13, 2009

**ISR Distinguished Speaker: William G. Griswold**

Professor, Department of Computer Science & Engineering, University of California, San Diego  
"Saving the World through Ubiquitous Computing"

June 5, 2009

**2009 ISR Research Forum**

<http://www.isr.uci.edu/events/forum.html>

TBD

**Graduate Student Research Symposium (GSRS): For Students By Students**

For more information: <http://www.isr.uci.edu/events.html>

aries while rules enable the automatic capture of link semantics (e.g. link relationships)."

If you are interested in using Asuncion's ACTS tool or in learning more about how it can potentially benefit your organization, please contact her at: [hasuncio@uci.edu](mailto:hasuncio@uci.edu).

For more information on Asuncion, visit: <http://www.isr.uci.edu/~hasuncio/>

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