

HOT RESEARCH

Game of Trust

A software engineer in Mountain View needs trust to collaborate with his peer in Bangalore efficiently. But they may never have the opportunity to meet each other physically. Technology is not yet good enough to produce a mini-wormhole for them to enjoy a coffee break together, but it is good enough for them to share

fun images of their lattes and chat about everyday topics while they enjoy their lattes remotely, using applications such as Facebook Messenger. Managers



often distress when team members interact this way, thinking it a waste of time. But does informally ‘talking’ about everyday things in such ways help team members to build trust, or does it just squander valuable development time?

The answer is: it builds trust. Through the lens of evolutionary game theory, ISR Professor **David Redmiles** and his Ph.D. student **Oliver Wang** have investigated how trust emerges from such informal,

non-work-related *cheap talk* that takes place over the Internet. Their research adapted the game theory classic Rousseau’s Stag Hunt, a natural



description of mutual cooperation, to a model of globally distributed software

RESEARCH BRIEFS

Prof. **Alfred Kobsa** has been awarded \$666,343 by the National Science Foundation for his research on user privacy decision support. The proposal, “A User-Tailored Approach to Privacy Decision Support,” seeks to realistically empower users for privacy choices, through personalized default settings and through rationales for disclosure that best suit users’ anticipated decision-making. Throughout his research, Kobsa will work with industry to deploy solutions for privacy decision support.

Prof. **André van der Hoek** delivered a keynote address titled “Software Design Sketching” at the 28th Brazilian Symposium on Software Engineering (SBES) in October in Maceió, Alagoas, Brazil.

Prof. **Bonnie Nardi** gave a keynote address titled “Activity Theory and Imagination: Possible-Worlds Artifacts and Practices” at the 4th Congress of the International Society for Cultural and Activity Research (ISCAR) in October in Sydney, Australia.

Prof. **Alfred Kobsa** is the recipient of a \$60,000 Google Faculty Research Award for his research on Predicting People’s Privacy Preferences for Ubiquitous Personal Data Disclosure. Kobsa will investigate the predictability of user privacy preferences in a ubiquitous personal data disclosure scenario.

Prof. **Walt Scacchi** hosted a visit by research fellow Klaas-Jan Stol from LERO, the Irish Software Engineering Research Center. At ISR, Stol explored Open Source Software (OSS) and Computer Games interests with Scacchi and Ph.D. student Michael Gorlick.

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development, and then analyzed the long-term dynamics of the resulting model. They conducted empirical studies of two open source projects (Apache Lucene and Chromium-OS) and found support for their game theory deductions.

Software Development as Stag Hunt

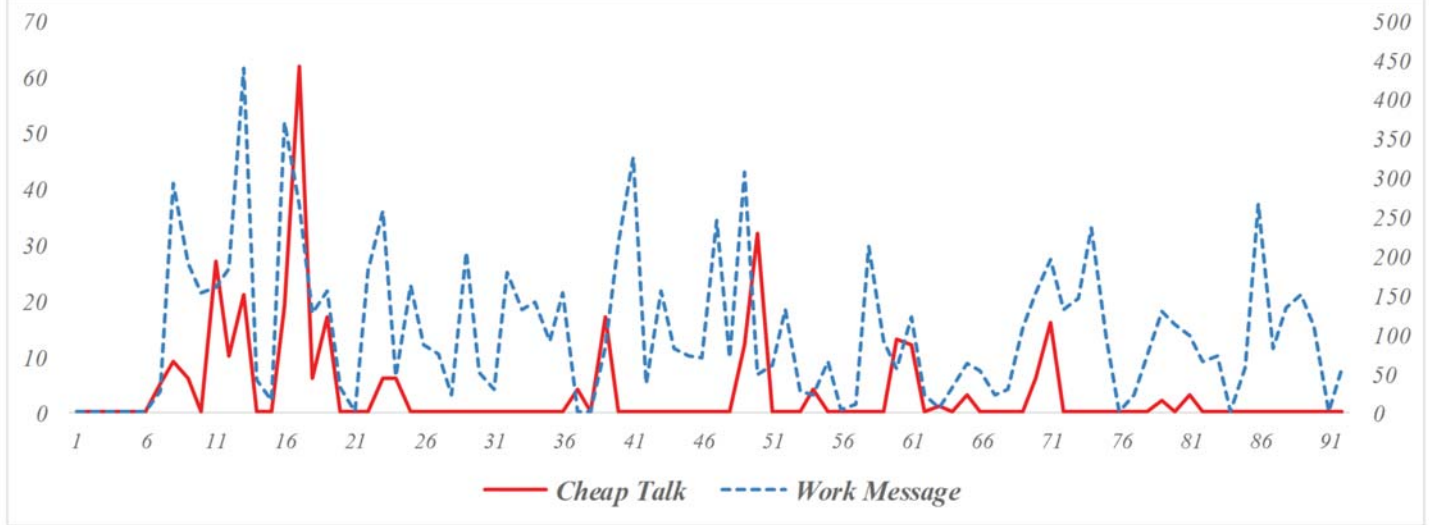
In their model, software development is abstracted as a type of Stag Hunt game. In the Stag Hunt game, two players go out on a hunt and choose to go after a

stag or a hare. To capture a stag, the two players must cooperate. If the players choose to work independently, they can instead individually capture a hare—which is worth less. If one player decides to cooperate but the other ‘defects’, the well-behaved, cooperative player will get nothing, but the defector can still hunt a hare independently. It is thus risky to be cooperative.

Similar situations occur in globally distributed software development. In many cases, developers do not necessarily need to cooperate with others to get their jobs done (‘receive a hare’), even when their work items are highly interdependent. However, less cooperation may influence the quality of their work. Communication among developers can have significant influence on the quality of a software system even though work items can be finished independently. Thus, collaboration can

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The dynamics of *cheap talk* and work-related messages over time (left axis: *cheap talk*; right axis: work messages, bottom: days).

produce higher quality work (‘receive a half stag’). When developers decide to cooperate, they take the risk that the others may not cooperate. Thus, they may experience some “unfavorable” results (e.g., fail to deliver a commitment on time) due to the others’ uncooperative behavior.

By simply adding a new strategy that allows individuals to *cheap talk* with low cost before concrete cooperation begins, the whole team is very likely to reach a status where all team members become cooperative. After reaching this point, interesting things happen. Wang and Redmiles’ model shows that the amount of *cheap talk* drastically decreases to almost zero. Their model also suggests under which conditions trust can emerge.

Software Engineers Are Good Economists

“Software engineers are good economists; they are much more sensitive to their gain and loss than people usually are,” Wang commented. Talk over the Internet is cheap, but not free. It’s not the same as informal talk during an everyday working lunch or coffee break. “It takes extra work time or effort to chat on IM, to share pictures. But once software engineers know they can trust somebody and can expect them to behave cooperatively, they reduce the *cheap talk*,” says Wang. Empirical analyses conducted by Wang and Redmiles of the two open source projects’ IRC channel records reveal that the frequency of *cheap talk* quickly

decreases after a relatively short period of time after the project starts (see figure above).

This research establishes a plausible explanation for why informal talk over the Internet helps increase globally distributed developers’ trust and cooperation. Cooperation with remote colleagues requires at least moderate trust. Without trust, individuals may not expect others to choose the cooperate strategy in their interactions, and thereby “defect” to avoid risk. Analysis of their case study finds a strong correlation between *cheap talk* and cooperation. With *cheap talk* acting as a catalyst, trust emerges from the collaboration and ensures cooperation. *Cheap talk* guarantees that the loss in a failed “cooperation trial” can be offset, leading to increased willingness to explore cooperation. So while *cheap talk* is not free, this type of interaction is *cheap* when compared with the benefits gained from the resulting cooperation.

Software engineers at different sites may not have “friendship” style trust to make them want to share everything in their life, but they can trust the others rationally. It seems good enough to “hunt a stag.” Wang adds, “So there’s no need to worry if you see your employees IM-ing about their favorite Indian food with their Bangalore colleagues.”

Future Directions

Redmiles and his team are planning to

continue this work in two directions. Their current work focuses on incorporating a social network into the model they developed. They plan to add more social factors (e.g., social identity) into the model to improve its expressiveness, and more importantly, validate the model with empirical evidence.

They also have a very ambitious research agenda to develop a set of tools to help globally distributed teams improve collaboration. These tools will be built on a game theory dynamic modeling and simulation engine that can generate meaningful and actionable recommendations to help teams with decision making. It is a long-term plan, requiring true interdisciplinary collaboration.

Wang and Redmiles’ *cheap talk* research, has been supported by National Science Foundation grant 1111446.

For more information on Wang and Redmiles’ research, visit:

<https://sites.google.com/site/oliverwangyi/>
and

<http://cradl.ics.uci.edu>

Contact Oliver Wang at oliver.wangyi@gmail.com, and Prof. David Redmiles at redmiles@ics.uci.edu.



Debra Richardson

ACCESS to Computer Science Education Vital for the Digital Age

Professor **Debra Richardson** is passionate about students' access to computer science education, which is not just about access to computers, but about innovation of computing technology. According to Richardson, "Computer science education builds students' computational and critical thinking skills enabling them to create—not simply use—the next generation of computationally-oriented devices, tools, and games." This fundamental knowledge is needed to prepare students for the 21st Century, regardless of their ultimate field of study or occupation, giving them the tools they need to make further contributions to technology as well as its application in society.

Over the years, Richardson has undertaken a number of leadership roles with respect to computer science education in California and beyond. As a long-time advocate of increasing the participation of women and other underrepresented minorities in computing, she has served on the leadership team of the National Center for Women and Information Technology (NCWIT) since its inception in 2004, and currently leads UCI's NCWIT PaceSetter team. She chairs the Advisory Council for ACM's Computer Science Teachers Association, serves on the ACM Education Board as well as on CRA's Computing Community Consortium Council.

As part of her leadership, Richardson chaired Computer Science Education

Week (CSEdWeek) in 2010 and 2011. CSEdWeek is a call to action that raises awareness about the need to elevate computer science education at all levels and to underscore the critical role of computing in all careers. Since 2010, CSEdWeek has continued to grow. In 2013, CSEdWeek was adopted by Code.org, which introduced the Hour of Code and set

a goal of introducing 10 million students of all ages to various levels of "coding"—a fundamental skill in computer science—raising awareness about the critical nature of computer science education.

Richardson currently chairs the Alliance for California Computing Education for Students and Schools (ACCESS – <http://www.access-ca.org>), which is a statewide network of computer science education leaders dedicated to providing all California K-12 students with high-quality computer science education and ensuring access to all students, specifically targeting students under-represented in computing—girls, low-income students, and students of color. ACCESS convenes K-12 teachers, administrators, and leaders; computer science professors from community colleges through universities; education school faculty and CS teacher professional developers; interested industry professionals; and educational policy advocates.

The mission of ACCESS is to advocate for equitable access to high quality computer science education for all K-12 students in California and for the requisite educational reform in California to reflect the importance of computer science in educating students in 21st century skills for college and career readiness and global citizenship. ACCESS's goals are to:

- secure and elevate the status of K-12 computer science education so that California industry, parents, students, and policymakers prioritize, engage, and provide resources for quality computer science education;
- ensure equitable access to computer science education for all K-12 students in California, especially for students traditionally underrepresented in the field such as girls, African-American, Latino/a, and low-income students;
- scale up successful computer science education models in K-12 schools, such as Exploring Computer Science and CS Principles, which can be emulated throughout California, and in other states;
- establish a computer science certification pathway for K-12 teachers in California, and ensure that quality professional development is available to these teachers;
- update state standards for computer science education and advocate for computer science to count for core credit (math or science) for high school graduation and UC/CSU admissions; and
- streamline computer science educational pathways for students entering com-

RESEARCH BRIEFS

Prof. **Alfred Kobsa** co-chaired the 8th ACM Conference on Recommender Systems (RecSys 2014), held October 6-10 in the Silicon Valley's Foster City. This conference is the premier international forum for presentation of new research results, systems, and techniques in the broad field of recommender systems.

Postdoctoral research associate **Thomas LaToza** co-chaired the Fifth Workshop on Evaluation and Usability of Programming Languages and Tools (PLATEAU) at the ACM SIGPLAN Conference on Systems, Programming, Languages and Applications: Software for Humanity (SPLASH 2014) held in October in Portland, OR. LaToza also presented a paper titled "Harnessing the Crowd: Decontextualizing Software Work" at the 1st International Workshop on Context in Software Development (CSD), held with the ACM SIGSOFT International Symposium on the Foundations of Software Engineering (FSE 2014) in Hong Kong in November. The paper was co-authored by W. Ben Towne (CMU) and ISR Prof. **André van der Hoek**.

ISR STUDENT NEWS

Bart Knijnenburg (A. Kobsa, advisor) presented his paper titled “Increasing Disclosure Without Reducing Satisfaction: Finding the Best Privacy Settings User Interface for Social Networks” at the



International Conference on Information Systems (ICIS) in December in Auckland, New Zealand. The paper is co-authored by his advisor, Prof. **Alfred Kobsa**. Knijnenburg

presented another paper, titled “Inferring Capabilities of Intelligent Agents From Their External Traits,” at the Pre-ICIS Workshop on HCI Research in MIS. The paper is co-authored by Martijn Willemsen of TU Eindhoven. Knijnenburg has also been hired by Samsung as a part-time consultant on a project regarding “Privacy in Recommender Systems.”

Caitie Lustig’s (B. Nardi, advisor) paper titled “Algorithmic Authority:



The Case of Bitcoin” has been accepted to the Hawaii International Conference on System Sciences (HICSS) held in Kauai in January. The paper is co-authored by her

advisor, Prof. **Bonnie Nardi**.

Maryam Khademi (C. Lopes, advisor) spent her summer as an intern at Konica in San Mateo, CA where she worked on 3D sensing user interfaces and hand gesture recognition.



Alumnus Publishes Software Design “Smells” Book

Alumnus **Girish Suryanarayana’s** book “Refactoring for Software Design Smells: Managing Technical Debt” (co-authored by Ganesh Samarthyam and Tushar Sharma; published by Morgan Kaufmann/Elsevier; with forewords by Grady Booch and Dr. Stéphane Ducasse) has been released. According to Suryanarayana (Ph.D. 2007; R.



Taylor, advisor), this book is a must-read for software developers, designers, and architects who are looking to improve the quality of their design. It includes a collection of 25 structural design smells, and discusses how smells uncover mistakes made while designing, reveals what design principles were overlooked or misapplied, and identifies what principles need to be applied properly to address those smells through refactoring. Organized across common areas of software design, each smell is presented with diagrams and examples illustrating the poor design practices and the problems that result. The book describes how the overall quality of software can be improved significantly and technical debt can be reduced by finding and addressing smells in the design. The book also includes a number of anecdotes based on experiences in real-world projects. The book is available on Amazon (<http://bit.ly/DesignSmells>).

community college and preparing for careers in computer science and/or transitioning to four-year colleges and universities. ACCESS is about ensuring opportunities for all students to explore computer science.

ACCESS originated in February 2011 at the first NSF Computing Education in the 21st Century (CE21) community meeting in New Orleans. At this meeting, Richardson was enthusiastically selected to lead the effort and serve as chair of the steering committee. She was able to devote a good deal of time to the effort as she had recently concluded her term as the founding dean of the Bren School of ICS and was then on sabbatical; she has served as chair of ACCESS ever since. Richardson obtained partial funding for ACCESS in October 2012 as part of the Expanding Computing Education Pathways Alliance, with California as a partner state and Richardson serving as the California principal investigator. Building on five years of work by the Commonwealth Alliance for IT Education and Georgia Computes! in the Broadening Participation in Computing community, ACCESS joins other states, sharing best practices and effective statewide strategies for scaling up computer science education.

In her role with ACCESS, Richardson is active in shaping state policy around computer science education. She analyzed and advocated for computer science related bills brought before the California legislature in the last session. According

to Richardson, “The state legislature has heard the message that computer science is what drives innovation and economic growth in California, and that the demand for computer science graduates in California far exceeds supply. There are simply not enough students prepared or preparing to join this high tech workforce. The legislature is attempting to affect change to computer science education in California, and for all the right reasons.” Of seven bills introduced, three were forwarded to and signed by Governor Brown:

- SB 1200 (Padilla) requests UC/CSU to establish guidelines for CS courses that satisfy college admission requirements;
- AB 1764 (Olson/Buchanan) allows school districts to count a qualified CS course toward advanced math credit in districts that require more than two math courses for graduation; and
- AB 1539 requires the Instructional Quality Commission to consider developing K-12 computer science content standards for adoption by the State Board of Education.

In addition, AR 108 (Hagman) recognized the week of Dec. 8, 2014 as Computer Science Education Week; the CSEdWeek 2014 program was held December 8-14. According to Richardson, “These bills have the potential to expand opportunities and increase participation in computer science education, though hard work remains to ensure these opportunities are equally

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Affiliate—Collaborative	\$20,000	Collaborative efforts.
Affiliate—Research	\$30,000	Designated ISR research area.
Affiliate—Visiting	\$40,000	Visitor at UCI.
Affiliate—Grad Student	\$60,000	Graduate student research.
Partner	\$100,000 or more	Large-scale research project.

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accessible for underrepresented students in computer science – girls, low-income students, and students of color.” ACCESS will continue that work.

A problem exacerbated by this legislation is that there are not enough K-12 teachers in California prepared to teach computer science. Richardson has developed a new authorization for credentialed teachers focusing on the fundamentals of computer science. She will present this supplementary authorization for approval before the California Commission on Teacher Credentialing in February 2015.

Richardson is also actively working to “Make CS Count” in California. Despite the legislation discussed above, for the most part computer science classes only count as elective credits towards graduation and admission to public universities in California – that is, they are not considered part of the “core” requirements, such as math and science. Richardson states, “Research shows that the ability to count a computer science course as a math or science graduation credit is a primary factor in a student’s decision to take computer science in high school, which is especially true for students traditionally absent from these courses and the opportunities they provide.”

To find out more about ACCESS or Richardson’s work toward ensuring California students access to quality computer science education, contact Richardson at debra.richardson@uci.edu.

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Brodbeck

ISR STUDENT NEWS

Alegria Baquero (R. Taylor, advisor) presented her poster titled



Baquero

“Enabling Secure, Customizable, and Dynamic Personal Information Services with COAST” at the Grace Hopper Celebration of Women in Computing

Conference (GHC) in October in Phoenix, AZ. The poster is co-authored by her advisor ISR Director **Richard N. Taylor**.

Baquero was awarded a GHC scholarship grant to participate in the conference. Baquero graduated with her Ph.D. in December.

Ankita Raturi (D. Richardson, advisor) has been awarded a \$2,500



Raturi

fellowship from UC President Janet Napolitano’s Global Food Initiative Student Fellowship Program. Raturi will focus on developing a

software program that models the environmental impact of agricultural systems.

Nicole Crenshaw (B. Nardi, advisor) presented her paper titled



Crenshaw

“What’s in a Name? Naming Practices in Online Video Games” at the ACM SIGCHI Annual Symposium on Computer-Human Interaction in Play (CHI

PLAY) in London in October. The paper is co-authored by her advisor Prof. **Bonnie Nardi**.

ISR STUDENT NEWS

Arthur Valadares (C. Lopes, advisor) presented two papers this Fall. The first, “A Framework for Designing and Evaluating Distributed Real-Time Applications,” was presented at the Distributed Simulation and Real Time Applications conference in Toulouse,



Valadares

France in October. The paper is co-authored by his advisor Prof. **Crista Lopes**. The second, “Enabling Fine-Grained Load Balancing for Virtual Worlds with Distributed Simulation Engines,” was presented at the Winter Simulation Conference (WSC) in December in Savannah, GA. This paper is co-authored by Lopes and Huaiyu Liu of Intel Labs.

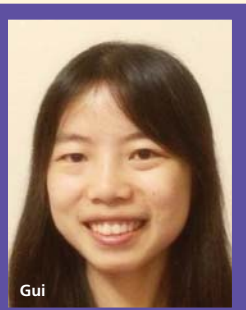
Nicholas DiGiuseppe (J. Jones, advisor) interned this summer at Google in Mountain View with the Google Analytics team where one of his projects was to automate an end-to-end, push-button performance test infrastructure for backend



DiGiuseppe

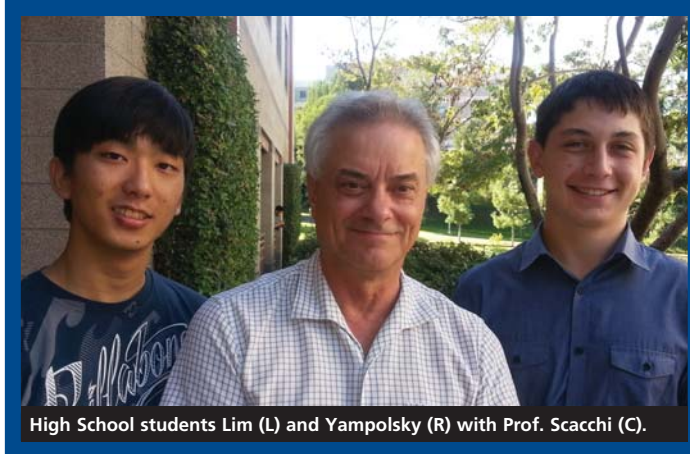
analysis.

Xinning Gui (B. Nardi, advisor) spent her summer conducting an ethnographic study of civic engagement on sustainability in a city in China. The study investigated how economic, political, and cultural contexts in China have shaped



Gui

local citizens’ collective sustainable practices.



High School students Lim (L) and Yampolsky (R) with Prof. Scacchi (C).

Mentoring High School Students in Game Software Engineering

At ISR, we regularly engage graduate students, postdoctoral students, and sometimes undergraduate students to work as research assistants directed by ISR faculty. We have not previously worked with or mentored high school students in ISR research projects, so this is something new – in this case, taken on by Prof. **Walt Scacchi**. In Spring 2014, Scacchi was approached independently by two students from Northwood High School in Irvine who were seeking a summer research project to work on while being mentored. It turned out that the two students, **Ryan Lim** and **Mark Yampolsky**, didn’t know each other, but Scacchi decided that a two student effort made sense as an interesting challenge for a student research team that he could mentor and direct.

Lim and Yampolsky are new to computer science and software engineering research, but they considered themselves skilled computer game players who are also accomplished students in their high school science, technology, engineering, and math (STEM) coursework. As Scacchi was already completing a new book with colleague Kendra Cooper at the University of Texas, Dallas titled “Computer Games and Software Engineering” (CRC Press, to appear 2015), he invited Lim and Yampolsky to meet with him to discuss a research problem he felt would be appropriate to their interests and skill level. Specifically, he gave them the task of playing and systematically comparing a sample of two dozen computer games. Computer game “playtesting” addresses problems in non-functional requirements

validation, software testing, and software usability (user experience). Large commercial game development companies such as Microsoft Studios employ dozens of researchers to conduct empirical studies that playtest new games or games in development, with hundreds to thousands of game players. Game playtesting is a new problem area that

has arisen at the intersection of computer games and software engineering.

The games selected for the study were focused on either informal science education or on engaging “citizen scientists.” Scacchi refers to this genre of computer games as science learning games – games that help players learn and do science. Citizen science game play results, in particular, contribute to the solution of authentic scientific research problems, such as identifying the structure and folds of complex proteins. The games vary in the scientific domain knowledge required to master play, ranging from 5th grade science basics through undergraduate level scientific expertise. After explaining their task, Scacchi suggested a summer-long (10+ week) study duration that would culminate in the documentation and publication of their findings. The project was a success, with Lim and Yampolsky successfully completing their respective sub-tasks, as well as the overall final report.

The report is publicly available on the ISR website as an ISR technical report. The report, “Making Learning Fun: An Analysis of Game Design in Science Learning Games,” is 74 pages in length. It includes a description and link to a new HTML5-based game developed by Yampolsky called Beam, which implements simple, multi-level play mechanics for solving basic problems in optical beam pathway design, which are fundamental to emerging problems in photonics research and quantum teleportation studies.

Lim and Yampolsky were each personally responsible for playtesting, assessing, and documenting 13 games (out of 26 in the final sample), and for compiling and completing the final report. Yampolsky went

on to also try out and apply his new knowledge in game development, the result of which is also documented in the final report. Admittedly, Scacchi provided the outline of the report, and contributed to the framing, introduction, and final report section, as well as some light editing of the report and discussion of research problems in photonics and quantum teleportation that might be amenable for demonstration in a computer game. But overall, Scacchi's time on the report was modest compared to Lim's and Yampolsky's.

Lim and Yampolsky elected to continue to work with Scacchi in the Fall and beyond on this project, as well as some extensions to the Beam game and a new game being developed by Lim. Scacchi believes it possible to develop one or more separate research papers suitable for publication in a computer game conference or research journal in the months ahead, which is something both Lim and Yampolsky are eager to do before they graduate from high school in Spring 2015. Lim and Yampolsky are applying for college admission for Fall 2015 to top CS programs at Carnegie Mellon, Columbia, Stanford, Yale, UCI, and elsewhere, having completed and published the results of their first software research project.



Presenter speaking at OpenSimulator Conference.

The 2nd OpenSimulator Community Conference (OSCC'14)

Building on the success of last year's conference, the 2nd OpenSimulator Community Conference took place on November 8-9. OSCC is an entirely virtual conference focusing on online virtual reality, and is hosted on an OpenSimulator virtual environment running on a server at UC Irvine. Attendance this year climbed to nearly 450 participants from multiple global timezones on Earth.

ISR's Prof. **Crista Lopes** is one of the main architects of OpenSimulator. This year's conference was partially sponsored by UC Irvine's Institute for Virtual Environments and Computer Games, and featured demos and posters showing UC Irvine's research in virtual environments, includ-

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:

“Project Cognatio: Developing a System for Medication Adherence (Evaluation of Requirements Engineering for Sustainability)”

Joseph Mehrabi, Birgit Penzenstadler, Debra Richardson
UCI-ISR-14-4, October 2014

“Making Learning Fun: An Analysis of Game Design in Science Learning Games”

Walt Scacchi, Ryan Lim, Mark Yampolsky
UCI-ISR-14-3, October 2014

All ISR technical reports are available at:

<http://isr.uci.edu/publications/>

ISR STUDENT NEWS

Eugenia Gabrielova (C. Lopes, advisor) is the recipient of the SMART Fellowship, a funding opportunity from the DoD which provides graduate funding and a post-graduate placement in a DoD research lab. The fellowship matches a student with a DoD lab for summer intern-



Gabrielova

ships and a service agreement (1-to-1 years of funding to post-grad research). Gabrielova will be joining SPAWAR Systems Center Pacific, a Navy R&D lab in San Diego.

Vijay Krishna Palepu (J. Jones, advisor) presented his paper titled “Discriminating Influences among



Pelapu

Instructors in a Dynamic Slice” at the IEEE/ACM International Conference on Automated Software Engineering (ASE 2014) in September in Vasteras,

Sweden. The paper is co-authored by his advisor, Prof. **James Jones**.

Hitesh Sajnani (C. Lopes, advisor) presented his paper titled “Is Popularity a Measure of Quality? An Analysis of Maven Components” at the



Sajnani

International Conference on Software Maintenance and Evolution, Victoria, Canada in October. The paper is co-authored by fellow Ph.D. student

Vaibhav Saini, ISR alumnus **Joel Ossher**, and Sajnani's advisor Prof. **Crista Lopes**.

ing ISR Prof. **Walt Scacchi's** projects.

ISR programmer analyst **Kari Nies** setup a number of computer game and virtual world applications that were designed by Scacchi, Nies, and UCI students, including online demonstrations of new interactive exhibitions and games for informal science education.

Scacchi noted, "OSCC is the premier global virtual world event that brings together hundreds of virtual world researchers and users, so it's a key place for ISR R&D results to be seen by the virtual world community."

The keynotes of this year's conference were by OculusVR Principal Scientist Steve LaValle and former Linden Lab CEO Philip Rosedale. Prof. LaValle talked about the challenges of achieving truly immersive virtual reality with the Oculus Rift and beyond. Rosedale's keynote was simultaneously broadcast to the virtual conference and to his new virtual platform High Fidelity. Besides the keynotes, the conference featured dozens of talks by members of the OpenSimulator community.

According to Lopes, "With this level of participation and technical reliability, virtual conferences are starting to become

serious contenders for holding meetings involving international communities. Granted, virtual conferences are not the same as physical conferences: there are some activities in

physical conferences that cannot be reproduced in virtual environments. But the contrary is equally true: some features of virtual conferences cannot be reproduced in physical conferences.

"More important, however, is the cost for participants and for the environment. OSCC did not charge a registration fee, but even if it did, that would be the only

ISR EVENT SCHEDULE

Mark your calendars!



January 23, 2015

ISR Distinguished Speaker: Sep Kamvar

Massachusetts Institute of Technology

"Self-Limiting Software and Social Ecosystems: Fostering Human-Scale, Deinstitutionalized, and Decentralized Systems of Production"

February 20, 2015

ISR Distinguished Speaker: Prof. Jan Vitek

Northeastern University

"The Case for the Three R's of Systems Research: Repeatability, Reproducibility, and Rigor"



April 3, 2015

ISR Distinguished Speaker: Prof. Mats Heimdahl

University of Minnesota

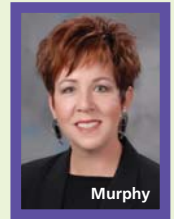
"Programs, Test Data, and Oracles: Revisiting the Foundations of Software Testing"

May 1, 2015

ISR Distinguished Speaker: Prof. Robin Murphy

Texas A&M University

"Disaster Robotics: Capturing Diverse Human-Robot Interaction"



We look forward to seeing you!

For more information, visit: <http://isr.uci.edu/isr-events>

expense for participants; there is no travel or lodging, which tend to be the main expenses when attending conferences. And, above all, the carbon footprint of OSCC'14 was a small fraction of what it would have been if the conference had been held in physical space."

For more information about OSCC'14, visit the conference website:

<http://conference.opensimulator.org/2014/>

Archived videos of talks are available at: <http://www.ustream.tv/channel/oscc3> (main track; others at oscc2, oscc1, oscc4, and oscc5).

SPECIAL THANKS

The UCI Institute for Software Research is generously supported by:

**Bloomberg
The Aerospace Corporation**

Contact Prof. Lopes at lopes@ics.uci.edu.

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