The breadth of faculty research in the Department of Human Centered Design & Engineering (HCDE) at the University of Washington continues to grow. This year Sean Munson and Kate Starbird joined HCDE as Assistant Professors and Andrew Davidson joined the department as a Senior Lecturer. The growth of our faculty enables us to expand our research and course offerings, and serve more students seeking degrees in Human Centered Design & Engineering.

Our Corporate Affiliates Program, beginning its third year, continues to grow and be a great success. Our faculty and students are working closely with industry partners, and many of our students go on to receive employment from our Affiliates.

This second issue of *Explorations* describes research agendas of HCDE faculty and their students. Professor Cecilia Aragon has been focusing on information visualization and visual analytics for eScience, collaborative creativity, educational games, and usability in daily life. Professor Cindy Atman has been continuing with her research to advance engineering education and engineering design processes. Professor David Farkas has been investigating information design with his projects on designing for selective reading and design patterns for creating consumer information labels. Professor Mark Haselkorn has been examining health care informatics with a goal of improving cognitive processes and workflows of users and raising the productivity and quality of healthcare. Also focusing on health issues, Professor Julie Kientz has been researching how to help parents and healthcare providers detect developmental delays in children, and how to improve sleep behavior and learning.

Professor Beth Kolko’s Hackademia Project, originally launched two years ago, is encouraging students to think outside the box. Kolko also continues to explore how technologists, social scientists, and scholars collaborate on technology-related development projects. Professor Charlotte Lee has been developing a framework to understand the sociotechnical relationships that comprise cyberinfrastructure, investigating the role of coordinating centers in collaborative cancer-epidemiology studies. Lee also continues to look at academic reading on e-readers, and the role of online calendars in helping users maintain relationships.

Professor Sean Munson designs, builds, and evaluates systems that nudge people toward socially desirable outcomes while respecting individual autonomy, and he has been researching exposure to political diversity online and the use of social software for health and wellness. I have been researching how the design of information affects the user experience with online information, and working with a student team to make WebLabUX (a remote user testing toolkit) into an open source product. Professor Kate Starbird focuses broadly on the use of social media during crises and mass emergencies, and specifically examines how digital volunteers and other members of the connected crowd help to organize information during disasters. Professor Michio Tsutsui has been examining effective feedback and reinforcement of correct usage forms through computer-assisted language learning materials. Professor Jennifer Tyurns has been studying the educational significance of asking engineering students to construct portfolios. Professor Mark Zachry has been exploring how people use digital technologies to engage in knowledge work and developing tools to understand these activities and inform the design of new systems.

I hope you find this second issue of *Explorations* as enjoyable as I have. You can learn more about our faculty research and our department online at hcde.uw.edu.

Happy reading,

Jan Spyridakis
Professor and Chair
Human Centered Design & Engineering
table of contents

4 Cecilia Aragon Scientific Collaboration and Creativity
6 Cynthia Atman Understanding Engineering Learning & Design Expertise
8 David Farkas Information Design
10 Mark Haselkorn Evidence-based Healthcare Informatics
12 Julie Kientz Computing for Healthy Living & Learning
14 Beth Kolko Design for Digital Inclusion
16 Charlotte Lee Computer Supported Collaboration
18 Sean Munson Nudging People Towards Better Behavior
20 Jan Spyridakis Remotely Assessing Users on Informational Websites
22 Kate Starbird Capacities of ICT-enabled Mass Participation
24 Michio Tsutsui Improving Global Communication
26 Jennifer Turns So What? Connecting Research and Practice
28 Mark Zachry Communicative Practices in Virtual Workspaces
30 Academic Programs
32 Corporate Affiliates Program
33 Research Laboratories
34 Faculty
35 Staff
Collaborative Creativity

In Scientific Research and Educational Games

What do astrophysicists operating a large telescope remotely and children building computer games collaboratively have in common? How do we design interfaces to facilitate creativity in groups? And can games be used to effectively teach students cyberinfrastructure and computing concepts?

In the SCCL, Cecilia Aragon and her students use visualization, machine learning, and qualitative techniques to study collaborative scientific creativity and how emotion is involved in the process. By doing so, they hope to find answers to the questions mentioned above. Their projects involve dynamic affect detection in chat logs, visualization of large data sets, usability in daily life, and the development of collaborative games to engage young people in STEM concepts.

Collaborative Creativity

Creativity is arguably humanity’s supreme achievement. Contrary to the popular belief of the “aha” moment of insight, recent work has indicated that creativity is often a series of incremental steps to discovery. As an idea is developed, it is amplified over time in its social context. Aragon and her colleagues are developing and evaluating a dynamical systems theory of collaborative creativity based on distributed affect and interfaces that facilitate socio-emotional communication. This theory is based on studies performed at three field sites comprising astrophysicists, children building computer games online, and engineers at a multinational company.

Dynamic Affect Detection in Collaboration Chat Logs

Geographically distributed collaborative teams frequently rely on text-based communication for social and task-oriented interactions between team members. Better understanding of affect expression in synchronous text-based communication of such collaborations could lead to many benefits, including improvements in team dynamics and productivity. However, automated detection of affect in text, although the subject of much previous research, is difficult.

The SCCL presents a new method of analyzing affect in large-scale electronic communications, utilizing a pipeline of natural-language processing and machine learning techniques. Their approach is based on an interpretation of affect as a dynamic process, and utilizes multiple independent classifiers to recognize different types of affect. They have applied this method to four years of chat logs from a longitudinal study of a multi-cultural distributed scientific collaboration. Using ground truth affect labels generated by a group of human coders, their approach can successfully identify many commonly-occurring types of affect in the chat logs.

Usability in Daily Life

Usability and Security

Do you remember all your passwords? Have you ever forgotten a password or written it down? Accurate, non-intrusive, and unforgeable identity recognition for desktop and online applications is an area of increasing concern to just about everyone in today’s networked world, with the need for security set against the goals of easy access. It is clear that password verification has major flaws in multiple areas, including usability, accuracy, and security. Aragon and her students are developing an eye-tracking digital signature, a method for biometric identification that combines physiological and behavioral traits and is grounded in a mathematical model of the muscles of the eye globe. They are conducting usability tests of the interface to this biometric technique in common applications.

This research is funded by the National Institute of Standards and Technology.

Thermostat Usability

Residential thermostats control about 10% of national energy use. In 1995, the Energy Star Program established technical specifications for “energy saving” programmable thermostats. Many building codes and government programs now require installation of programmable thermostats because of their assumed energy savings. However,
in 2008, Energy Star concluded that homes with programmable thermostats were using more energy than homes with manual thermostats.

As a result, Energy Star terminated the thermostat endorsement program in 2009 and decided that any future endorsement program must include specifications for minimum levels of usability. Aragon and her colleagues and students performed multiple lab and field studies of thermostats and developed an innovative usability metric for thermostats to facilitate energy saving behavior. This metric is currently being evaluated in Energy Star’s draft specifications for programmable thermostats. This work is funded by the US Department of Energy.

**Collaborative Games for Bioinformatics Education**

This project leverages recent research into the socio-emotional mechanics of online collaboration and multiplayer game development, and the existing social networking structure of BuddyPress, to create an educational game that incorporates bioinformatics and cyberinfrastructure concepts aimed at high school students. The SCCL is interested in the uptake of concepts of cyber problem solving specifically among young underrepresented minorities and women, and the production of conceptual models that will help them to better understand the larger relationships between people, educational games, and infrastructural computational technologies. Collaboration and creative strategies will be encouraged and integrated into the gameplay mechanics.

**Max Five** is a game based around a futuristic crime scene investigation scenario in which players must collaborate in teams and take on the roles of forensics experts, computing experts, and scientists to solve clues and recover data from a top-secret research project gone awry. The game integrates bioinformatic concepts with programming hacks, where players can use real code to modify game objects and character behavior. You can track our latest development updates at gamestem.com.

Aragon and her students are currently in the development phase of the game and are actively building partnerships with Seattle area public schools to involve student designers.
Understanding Engineering Learning & Design Expertise

Cynthia Atman

Dr. Cynthia J. Atman is a Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Center for Engineering Learning & Teaching (CELT).

In addition to directing CELT, Cynthia Atman also directed the Center for the Advancement of Engineering Education (CAEE). Her research focuses on engineering design learning and students as emerging engineering professionals. Through CELT and CAEE, Atman works with colleagues at the University of Washington (UW) and across the nation to advance engineering education.

CELT Leadership

CELT supports the UW College of Engineering’s mission by taking a leadership role in engineering education, both within the university and as the UW’s representative among engineering education researchers and policy makers around the world.

CELT focuses on two synergistic activities: research on engineering education and improving engineering teaching through a wide range of instructional development programs.

Research on Engineering Design

Atman’s research examines how engineering students and practicing professionals solve engineering design problems, as well as the effectiveness of current approaches to engineering design instruction. The broad goal is to more closely align the outcomes of engineering education with the needs of engineering practice. Atman and the CELT team’s recent contributions include innovative methods for representing engineering design processes and detailed analyses of undergraduate engineering students’ design abilities and how they develop during their academic careers.

Analysis and Representation of Design Processes

For over two decades, Atman has led empirical studies of engineering students’ and professionals’ approaches to open-ended design problems. Her design process timelines provide a compact but detailed representation of the many different activities involved in the design process. These timelines and the other representations developed by CELT have proven to be valuable tools for researching and teaching students about design processes. Current work includes augmenting the visual representations with multimedia and presenting processes as brief audio clips synchronized with timeline animations.

Class Exercise: In the design process timelines above, students were asked what similarities and differences they saw between the first-year and senior engineering students.

Comparisons of Student and Expert Designers

Atman and CELT colleagues have analyzed how novice and expert engineers solve open-ended design problems. Both solutions and design processes have been compared across three groups: beginning undergraduate engineering majors, graduating majors, and practicing professional engineers. Methods including the timeline analyses have led to a detailed understanding of the development of design skills, including the following findings:

- Engineering experts distinguish themselves from undergraduates in the effectiveness of their problem scoping, how much problem-relevant information they gather, and time spent on a wide range of design activities (e.g., generating and evaluating solution ideas).
- Graduating engineering majors are, as expected, more similar to experts than beginning majors are, with respect to design process and solution quality.

Selected Student Insights

“Problem definition is key to the overall project. Remind yourself of what you are doing and what is really being asked. Pick your head up from the paper (Modeling) and analyze the problem.”

“Realization of how the design process moves from one portion to the other was the best aspect of this talk. I didn’t realize how important the reiteration of certain aspects of the process [are].”

Another student compared the “Graduating Senior” timeline (below) to those of other students and concluded that an effective design process might be characterized as having a particular shape that he labeled an “Ideal Project Envelope.” The ideal project envelope is something our researchers previously identified and termed a cascade pattern, seen most often in experts’ timelines. This pattern contains a full range of design activities and suggests a way of moving through those activities over time.

The CELT team has collaborated with engineering instructors to improve student awareness of the components, complexities, and benefits of well-planned, well-executed engineering design processes. Students in one class exercise were asked to examine a set of freshmen and senior design activity timelines (facing page) and to tell us what they found.

More Information

Cynthia J. Atman is a Professor in the Department of Human Centered Design & Engineering, founding Director of the Center for Engineering Learning & Teaching (CELT), and the inaugural holder of the Mitchell T. & Lella Blanche Bowie Endowed Chair at the University of Washington.

Atman earned her doctorate in engineering and public policy from Carnegie Mellon University and joined the University of Washington in 1998 after seven years on the faculty at the University of Pittsburgh. Her research in engineering education focuses on engineering design learning with a particular emphasis on issues of design context. She is a fellow of AAAS and ASEE, was the 2002 recipient of the ASEE Chester F. Carlson Award for Innovation in Engineering Education, and received the 2009 David B. Thorud Leadership Award from the University of Washington.

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Dr. David K. Farkas is a Professor in the Department of Human Centered Design & Engineering (HCDE) who specializes in information design and technical communication.

QuikScan for Better Reading

QuikScan is an innovative document format that employs within-document summaries to improve retention and facilitate selective reading within a document. David Farkas worked with Quan Zhou (PhD 2008) on the original design. Since then, Farkas, Quan, other HCDE students, and researchers from the University of Twente in the Netherlands have further validated the benefits of QuikScan and expanded the design.

Readers of a QuikScan document can choose between reading summaries (gray box in the top figure on the right) and the corresponding sections of full text. Using the numbering scheme, they can scan quickly from an idea expressed in a summary to the full discussion of that idea in the text. If they read all the summaries and the complete text, retention increases dramatically (41%). Furthermore, because QuikScan improves information processing, reading time is no greater than reading the text without the summaries.

“QuikScan Views” is QuikScan optimized for the web. In addition to the QuikScan document (lower left in the bottom figure on the right), there is a hyperlinked table of contents (upper right), a structured abstract (upper left) to provide still more abbreviated summarization, and a scrolling window (lower right) that displays just the summaries without intervening text.

In the era of information overload, we need document formats that improve reading.

Proxy Caches

7) Proxy caches are used by large organizations to serve many users.
8) Users can request a proxy cache through a setting on their browser, or requests from browsers can be redirected automatically through “interception.”
9) Because proxy caches are shared caches, they re-use a single representation and reduce latency and network traffic.

Proxy caches work on the same principle as browser caches, but serve hundreds or thousands of users; large corporations and ISPs often set them up on their firewalls or as standalone devices (also known as intermediaries).

Because proxy caches aren’t part of the client or the origin server, but instead are out on the network, requests have to be routed to them in some manner. One way to do this is to use your browser’s proxy setting to manually tell it what proxy to use; another is using interception. Interception proxies have web requests redirected to them by the underlying network itself, so that clients don’t need to be configured for them, or even know about them.

Proxy caches are a type of shared cache; rather than just having one person using them, they usually have a large number of users, and because of this they are very good at reducing latency and network traffic. That’s because popular representations are reused a number of times.

QuikScan

QuikScan Views
A Pattern Library for Consumer-Information Graphics

Consumers are empowered by clear and informative point-of-purchase consumer-information graphics ("labels"). Jerrod Larson (PhD 2010), working with Farkas, designed and empirically validated an environmental impact labeling system with significant advantages over existing designs. Drawing on Larson’s work, students in Farkas’ Information Design course (HCDE 510) explored the design requirements for consumer-information labels encompassing health and safety, product quality, and other domains. Then they created 150 design patterns (enhanced guidelines) for creating these labels. Undergraduate students, with key contributions by Steve Naranjo (BS 2011), created a website (labelpatterns.org, now a working beta version) to host these patterns and make them available to the environmental policy and graphic design communities.

More Information

David Farkas is a Professor in the Department of Human Centered Design & Engineering who specializes in information design and technical communication. He has recent projects in the areas of software user assistance, slideware design, consumer-information product labeling, design patterns, and innovative document formats.

QuikScan is an innovative document format that employs within-document summaries to save time, increase reading comprehension, and improve the scannability of documents.

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证据驱动的医疗保健信息学

Mark Haselkorn

Mark Haselkorn 是 Department of Human Centered Design & Engineering (HCDE) 的教授和 Pacific Rim Visualization and Analytics Center (PARVAC) 的主任。Mark Haselkorn 持续作为国家认知信息学与决策制定中心的负责人（PI），该中心由美国卫生与公共服务部的国家协调员办公室所资助。HCDE 的 SHARP 研究侧重于设计能够提高临床医生认知过程和工作流程的电子医疗记录系统，可显著提高临床护理的效率和安全性。

需要

在全国范围内，医疗保健机构需要提高效率和质量，同时降低成本。虽然医疗信息学具有很大的潜力，但电子病历的采用率仅低于 15%。临床医生担心系统部署后对临床工作流程的干扰、治疗错误的增加、过度的培训和技术支持以及高昂的启动成本。

当下的情况

传统的医疗信息学开发是功能导向的，它将工作流程视为最终将出现的医疗信息学的响应。由于其高昂的启动成本和难以预测的影响，医疗信息学的实施决策往往被认为是具有风险的。Haselkorn 的团队正致力于使医疗信息学设计更加基于证据，以实施医疗保健领导和私人诊所的政策，例如提高工作效率和护理质量，或减少行政负担。

方法

与临床护理中的许多其他成果一样，工作流程可以使用客观证据来设计和验证。最近的科学研究已经澄清了信息在驱动决策和工作流程中的作用。MATH 是一个软件工具套件，用于 “构建” 显著优于现有工作流程的护理工作流程。
clinical care [1–4]. Putting the health care providers at the center of the design process, these principles can be exploited to make improved workflow a planned part of HIT development. Information flow and workflow can be developed as a pair of matched designs. When the workflow is measurably more efficient and/or of better quality, HIT development can become evidence-based instead of feature-based.

**Benefits**

The current situation createspent-up demand and tremendous opportunity for evidence-based HIT systems. HIT adoption rates will increase as health care leaders can participate in concept design, understand what they are paying for, and have the visibility of progress they need to direct investment.


Keith Butler, Principal Research Scientist, Department of Human Centered Design & Engineering, has been collaborating with Haselkorn on this research. Butler is Co-PI at the National Center for Cognitive Informatics & Decision Making. He has been the Director of User Experience at Microsoft and a Boeing Technical Fellow in Math & Computing Technology, where he was responsible for the core technology area of human-computer interaction.

He completed his PhD in cognitive psychology at Tufts University in 1980 and began working at Bell Telephone Labs, where he developed user-centered methods and prototypes for maintenance information systems. Working with John Bennett and John Whiteside, he was one of the originators of Usability Engineering. He is past chair for the ACM SIGCHI conference on computer-human interaction, and currently serves on the steering committee for software product usability at the US National Institute for Standards & Technology.

**More Information**

Mark Haselkorn is a Professor in the Department of Human Centered Design & Engineering. Haselkorn leads University of Washington (UW) partnerships in the National Center for Cognitive Informatics and Decision Making in Healthcare, funded by the Office of the National Coordinator for Health Information Technology, as well as the DHS-funded Center of Excellence on Visual Analytics for Command, Control, and Interoperability Environments.

He is Director of the Pacific Rim Visualization and Analytics Center (PARVAC), which has the mission of advancing visual analytics for the enhancement of distributed, collaborative cognition and decision-making for public safety and security. He also founded and directs the UW’s Interdisciplinary Program on Humanitarian Relief, a cross-campus program of research and education that works with the international humanitarian sector to improve logistics and service systems. In this area, one of Haselkorn’s current PhD students, Robin Mays, has received a four-year National Science Foundation Graduate Fellowship (2012–2016).

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Dr. Julie A. Kientz is an Assistant Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Computing for Healthy Living & Learning (CHiLL) Lab.

Julie Kientz and her students design, develop, and evaluate applications to support individuals and families in pursuing their health and education goals. They explore how novel technologies, such as ubiquitous and collaborative computing, can help with record-keeping, data review, and behavior change. The main research focuses on healthy living, healthy learning, and new approaches to doing research in this space.

**Healthy Living**

Kientz and her students design technologies to support preventive healthcare, as well as help individuals try to meet their goals for health on their own and in collaboration with their doctors. The two main projects in this space are Baby Steps and supporting healthy sleep behaviors.

**Baby Steps**

In Baby Steps, Kientz and her research group are designing technology to help detect, record, and track developmental progress in children during their first five years. They aim to help parents and healthcare providers detect developmental delays such as autism or emotional disorders earlier, which can improve the effectiveness of interventions. Recent work has focused specifically on adapting technology for Latino populations. This work is sponsored by the National Science Foundation on a Faculty Early Career Development grant.

**Healthy Learning**

Education is another major component of healthy living. In their research, Kientz and her colleagues have aimed to develop new technologies for helping individuals learn better and improve the delivery of education to students. The primary projects in this space are in education for children with autism and designing computing interfaces that make people think.

**Autism Education**

Kientz has developed a software tool, Abaris, which supports therapists and teachers who perform Discrete Trial Training therapy, a current best practice intervention for children with autism. The system uses pen, speech, and video indexing to help improve access to data and aspects of the treatment.
Julie Kientz is an Assistant Professor in the Department of Human Centered Design & Engineering. She is also Director of the Computing for Healthy Living & Learning (CHiLL) Lab and is active in the University of Washington’s Design Use Build (DUB) Group alliance. Her research interests are in the areas of human-computer interaction, ubiquitous computing, and health informatics.

In particular, Kientz is interested in determining how novel computing applications can address important issues in health and education and evaluating those applications through long-term real world deployment studies using a balance of qualitative and quantitative methods. Her most recent research involves the design and evaluation of computing technologies to support parents tracking the developmental progress and health of their newborn children, individuals with sleep disorders, and families with children with autism.

Kientz received her PhD in Computer Science from the Georgia Institute of Technology in 2008 and her BS in Computer Science & Engineering from the University of Toledo in 2002.

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Design for Digital Inclusion
Beth Kolko

Dr. Beth Kolko is a Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Hackademia Project and Design for Digital Inclusion (DDI) Lab.

Both Hackademia and the DDI Lab are rooted in a commitment to technology and diversity, and they both try to ensure that the benefits of technology are available to all populations.

Hackademia
Hackademia has been running for about two and a half years; it started as the Makerbot group through DDI and grew into a larger project. Hackademia is a directed research group that involves undergraduate and graduate students from HCDE and across the University of Washington (UW); Beth Kolko worked closely with HCDE student Alexis Hope (MS 2012) to build the project. Students join the group and embark on an open-ended, peer-based, hands-on learning adventure where they gain basic hardware and/or software skills. It is an experiment in engineering literacies and creating functional rather than accredited engineers. With Hackademia, Kolko harnesses the joy of curiosity, encouraging students to be makers and hackers, learn to make LEDs blink, and believe that, even as non-experts, they can still be innovators.

Hackademia grew out of the work Kolko had been doing in DDI, which took her around the world and into a variety of low resource communities. Through that work, she built an appreciation of the kind of building and innovating done by people with no formal training. Hackademia introduces that same spirit of innovation to UW students, encouraging them to think about elementary engineering skills like soldering or three-dimensional (3D) modeling as a basic literacy—kind of like first-year composition, but for the tangible world.

This past year, Hackademia received a grant from the Awesome Foundation and support from Microsoft Research. Coming up, new groups will work with 3D modeling and printing and arduino programming, and the group will reach out beyond the UW community to conduct workshops.

Design for Digital Inclusion
DDI researchers think about the other six billion potential users of the Internet and emerging technologies. The group focuses on innovative approaches to technology design throughout a product lifecycle from ideation to use—with the goal of emphasizing diversity of users and usage contexts.

The group's most current work focuses on technology development for resource constrained environments in order to counteract what could be called a failure of imagination in terms of how devices, software, and services are designed. With the advent of newer, smaller, and cheaper technologies, the user base and use scenarios for information and communication-centric technologies has expanded to include a broader base of the global population. Kolko and her students are also doing groundbreaking work on research methods, helping individuals and organizations adapt user-centered design methodologies so they produce reliable results when deployed in different and challenging research contexts.

Global Health as a People Problem as Well as a Technology Problem: Portable Midwives’ Ultrasound

Ultrasound imaging is an effective tool for identifying maternal mortality risk factors, but it’s also a complex and expensive technology that requires extensive training. As a result, ultrasound is nearly absent in many rural healthcare facilities in developing regions.

To meet the challenge of how to effectively incorporate ultrasound technology into existing healthcare systems, Kolko’s lab, partnering with colleagues in the UW Departments of Radiology and Computer Science & Engineering (CSE), tackled the central issue of the ultrasound user interface. They have taken off-the-shelf components—including a USB ultrasound probe and a touchscreen netbook—with a total cost of around $3,500, and created a functional ultrasound device that reframes the challenge of ultrasound use in terms of people rather than technology. Compared to currently available ultrasound devices that cost around $40,000, their device simplifies the user interface while maintaining functionality to allow midwives to detect...
Beth Kolko is a Professor in the Department of Human Centered Design & Engineering. She started her academic career in the humanities, and she uses that grounding in theory to inform her current work on technology design. She leads the Design for Digital Inclusion (DDI) Lab, which researches diversity and technology from a design perspective. Kolko also directs the Hackademia Project.

With the advent of newer, smaller, and cheaper technologies, the user base and use scenarios for information and communication-centric technologies has expanded to include a broader base of the global population. At DDI, researchers think about the other six billion potential users, about computing beyond the workplace or the desktop, and about technologies that can help address the challenges of everyday life.

Central to Professor Kolko’s work is research on how technologists, social scientists, and humanities scholars can collaborate on technology-related development and implementation projects. She is also conducting research on new educational models that can foster innovation outside traditional boundaries of expertise.

More Information

Beth Kolko is a Professor in the Department of Human Centered Design & Engineering. She started her academic career in the humanities, and she uses that grounding in theory to inform her current work on technology design. She leads the Design for Digital Inclusion (DDI) Lab, which researches diversity and technology from a design perspective. Kolko also directs the Hackademia Project.

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Computer Supported Collaboration

Charlotte Lee

Dr. Charlotte P. Lee is an Assistant Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Computer Supported Collaboration (CSC) Laboratory.

The mission of the CSC Lab is to understand how sociotechnical systems evolve in order to better design the systems and processes that are required to achieve major innovations in science and, no less profound, innovations in everyday life.

Cyberinfrastructure and eScience

Interacting with Cyberinfrastructure in the Face of Changing Science

This research is developing a framework to understand the set of sociotechnical relationships that comprise cyberinfrastructure (CI). Projects are often unable to reflect on how CIs are used and created in the current state of rapid scientific change where multidisciplinary approaches are putting pressure on disciplinary boundaries. This project is investigating the following questions. How do scientists and engineers decide which CI resources (e.g., databases and tools) to use and under what circumstances? Under what circumstances do scientists and engineers decide to create their own resources? How do scientists and engineers mix disciplinary practices within their own laboratories? When do scientists and engineers adopt hybrid identities (e.g., computational biologists and bioinformaticists)? This project is funded by NSF Award OCI-083860.

The Role of Coordinating Centers in Collaborative Cancer-Epidemiology Studies

Although it is tacitly recognized that a good Coordinating Center (CC) is essential to the success of any multi-site collaborative project, little study has been done on what makes a good CC successful, why some CCs fail, or how to build a CC that meets the needs of a given project. Collectively, there is a great amount of knowledge on CCs in the scientific community, yet that knowledge is not being recorded and shared in a systematic, scientific way. The long-term goal of our research is to make collaborative biomedical research, especially cancer-epidemiology research, more efficient and effective through greater understanding of how the research is done and how it can be better supported. This project is funded by NIH R03CA150036.

Understanding University Students’ Facilitation of Articulation Work on Collaborative Engineering and Design Projects

Alexander Thayer, HCDE PhD Candidate and member of the CSC Lab, is conducting dissertation research into the decisions that engineering and design students make to use specific information sources, technologies, and artifacts in order to externalize the thinking around how to approach a collaborative project. The goals of the project are as follows:

- Examine engineering and design students’ collaborative information practices and artifact production processes while engaged in group work.
- Understand how engineering and design students rely on the knowledge work artifacts they produce while working together to inform their choices about the final design products they submit.
- Understand engineering and design students’ reasons for using

This ongoing project is undertaking an unprecedented comparative ethnographic study of two large CI building and research organizations: the National Center for Supercomputing Applications and the San Diego Supercomputer Center. Each of these organizations participates in multiple CI projects of varying size and complexity. The CSC Lab researchers are using qualitative research methods to understand how work practices change and develop over time. In particular, this project is studying the sustainability of software development in organizationally dynamic environments that support innovation such as in scientific research. This project is funded by NSF Award OCI-0954088.

Leveraging Development Expertise Across Cyberinfrastructures

This ongoing project is undertaking an unprecedented comparative ethnographic study of two large CI building and research organizations: the National Center for Supercomputing Applications and the San Diego Supercomputer Center. Each of these organizations participates in multiple CI projects of varying size and complexity. The CSC Lab researchers are using qualitative research methods to understand how work practices change and develop over time. In particular, this project is studying the sustainability of software development in organizationally dynamic environments that support innovation such as in scientific research. This project is funded by NSF Award OCI-0954088.
Charlotte P. Lee is an Assistant Professor in the Department of Human Centered Design & Engineering at the University of Washington and Director of the Computer Supported Collaboration (CSC) Laboratory. She has a BA in Sociology from the University of California, Berkeley, an MA in Sociology from San Jose State University, and a PhD in Information Studies from the University of California, Los Angeles.

Lee’s research is in the fields of computer supported cooperative work (CSCW), social informatics, design studies, and science and technology studies. Her work focuses on empirically describing and theorizing the informational practices, artifacts, and collaborative structures of communities of practice working towards a shared goal: collaborative design. Lee has received awards from Google and Nokia Research. She has also received a National Institutes of Health (NIH) grant and three National Science Foundation (NSF) grants, including a Faculty Early Career Development Award, to study aspects of collaboration in the development of information systems for science. Lee is also an Associate Editor of the Journal of Computer Supported Cooperative Work (JCSCW).

Online Calendars as Social Media: Calendaring as Relationship Work

Investigating the Role of Online Calendar Use in the Cultivation and Maintenance of Relationships

Relationship work and negotiations of the most personal kind play out in calendaring practices and in discussions around calendar usage. Sharing an online calendar requires a time commitment and often causes others to adjust their behavior based on what, when, and how information is shared. This project is studying how relationships play out through online calendars, and how people use their calendars to manage their relationships. This project is funded by a Google Research Award.

Recently Completed Projects

The Academic Potential of E-readers

This project investigated the sophisticated academic reading practices of college students, and how the introduction of an e-reader helps and hinders these practices with the research study spanning several months. This project investigated how graduate students accomplish their academic reading and integrate an e-reader, the Amazon Kindle DX, into their academic reading practices. By building on literature describing how students read and by taking a more holistic view of reading practices and how they play out with, through, and around an e-reader, the research team uncovered an array of sophisticated and idiosyncratic ways of reading that are essential for adequately supporting academic reading practices. By understanding not only reading tasks, but also reading goals and techniques, as well as how students switch between these, the team rethought approaches to e-reader design.

Collaboration in the Development of Cyberinfrastructure

CIs are large-scale distributed scientific enterprises supported primarily through advanced technological infrastructures such as supercomputers and high speed networks. This project systematically studied the actual practices of CI development and use, and also examined the transformations that it is created to engender. Ethnographic methods were used, including participant-observation and semi-structured interviews. A nascent metagenomic CI project, Community Cyberinfrastructure for Advanced Microbial Ecology Research Analysis, served as the field site. This project continued into 2011 and examined the effects of an altered human infrastructure on the operation of a CI project. This project was funded by NSF Award IIS-0712994.

Online Calendars as Social Media: Calendaring as Relationship Work

This work is funded in part by an award from the Nokia Research US University Collaboration funding program.

Online Calendars as Social Media: Calendaring as Relationship Work

My goal, and the mission of the CSC Lab, is to understand how sociotechnical systems evolve so that we can better support and design the complex systems that are often required to achieve major innovations.”

Charlotte P. Lee

More Information

Charlotte P. Lee is an Assistant Professor in the Department of Human Centered Design & Engineering at the University of Washington and Director of the Computer Supported Collaboration (CSC) Laboratory. She has a BA in Sociology from the University of California, Berkeley, an MA in Sociology from San Jose State University, and a PhD in Information Studies from the University of California, Los Angeles. Lee’s research is in the fields of computer supported cooperative work (CSCW), social informatics, design studies, and science and technology studies. Her work focuses on empirically describing and theorizing the informational practices, artifacts, and collaborative structures of communities of practice working towards a shared goal: collaborative design. Lee has received awards from Google and Nokia Research. She has also received a National Institutes of Health (NIH) grant and three National Science Foundation (NSF) grants, including a Faculty Early Career Development Award, to study aspects of collaboration in the development of information systems for science. Lee is also an Associate Editor of the Journal of Computer Supported Cooperative Work (JCSCW).

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Nudging People Towards Better Behavior
Sean Munson

Dr. Sean Munson is an Assistant Professor in the Department of Human Centered Design & Engineering (HCDE) who researches the use of software to support positive behavior changes.

Sean Munson designs, builds, and evaluates systems that nudge people toward socially desirable outcomes while respecting individual autonomy. In particular, he focuses on applications that help people make behavior changes that enhance their health and wellness, and applications that increase the diversity of news and opinions to which people are exposed. He studies the application of several social influence tactics and theories—including public commitments, social proof, and social comparisons—to the unique affordances of technology-mediated settings by building prototypes and conducting field experiments.

This work helps researchers and designers better understand how to apply social influence in their system designs. As technology increasingly mediates daily interactions, it becomes more important to understand how systems persuade or influence their users. Because any system in which users make choices is an environment with its own particular influences, these considerations are important whether designers are deliberately trying to nudge people toward certain behaviors or whether those nudges are unintended consequences.

Exposure to Political Diversity Online

The Internet gives individuals more choice in political news and information sources and more tools to filter out disagreeable information. Citing the preference described by selective exposure theory—that people prefer information supporting their beliefs and that they avoid counter-attitudinal information—observers warn that people may use these tools to access agreeable information and live in ideological echo chambers, increasing the polarization of different political groups and decreasing society’s ability to solve problems.

Munson’s research examines political information exposure in two types of online spaces: online news aggregators, where people’s political preferences will shape their exposure; and non-political spaces, where preferences other than politics shape people’s behavior, but where people may still serendipitously encounter political information.

For online political news access, this research addressed mixed results within the selective exposure literature. People are neither inherently challenge-averse nor inherently diversity seeking; there are individual differences. To increase challenge-averse individuals’ exposure to diversity, researchers defined and evaluated the Sidelines algorithm, which can generate more representative collections from user results, and are assessing several presentation techniques, such as visualizations of news reading history, intended to motivate people to seek more diverse viewpoints in the news they read.

In nonpolitical spaces, Munson found substantial political discussion on non-political blogs, where people may have serendipitous encounters with diverse views. Moreover, blog readers do not treat these posts as taboo and they engage with the posts’ political content. This argues that serendipitous encounters with mixed viewpoints will still happen, even if not in news aggregators. Thus, even if efforts to intervene and increase the diversity of exposure on news websites fail, scholars should not be so alarmed.
Social Software for Health and Wellness

This stream of work focuses on how social software, particularly existing social network sites, can support health and wellness. It includes studies to identify people’s existing practices and preferences and studies that test new features in the field. These include systems to help people live more happily, to follow through on commitments, and to be more physically active.

3GT

One application, 3GT, is based on the positive psychology exercise “Three Good Things,” and encourages people to record positive things that happen to them every day and the reasons why they happen. People who participate in this activity can train themselves to focus more on the positive aspects of life and dwell less on the negative. Offline, individual participation in this activity has been shown to reduce symptoms of depression and increase happiness.

Unlike the original activity, 3GT users can share their positive experiences with other users of the application or post them to their Facebook Timeline. Will social interaction around positive experiences shared on the site or on the Timeline cause people to focus even more on what is going well, to feel more accountable to other members of the site to keep up the activity, or help them receive positive reinforcement from friends?

In this project and others, researchers have identified several challenges and issues with how current social network sites and health and wellness applications support sharing and goal achievement. These include how people build and shape the network of people with whom they share health information; how, where, and when they share; and how to use public commitments effectively. If designers of health and wellness applications continue to adopt social features—as they are doing at a rapid rate—they will benefit from a more nuanced understanding of when and how these features can help.

3GT, based on the positive psychology exercise “Three Good Things,” helps people live more happily by recording and sharing positive things that happen to them every day.

More Information

Sean Munson is an Assistant Professor in the Department of Human Centered Design & Engineering. Munson received his PhD in 2012 at the University of Michigan’s School of Information, where he studied the use of software to support positive behavior changes. Munson’s work primarily focuses on the domains of political news and opinion access, and health and wellness. He was an Intel PhD fellow.

Munson completed his BS in Engineering with a concentration in Systems Design at Olin College in 2006. At Olin, he was one of 30 students who spent a year developing the new college’s curriculum and student life programs before becoming part of the first-ever class. He has been a political blogger and, while working at Boeing, designed concepts for future passenger airplane interiors.

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Remotely Assessing Users on Informational Websites
How Differing User Goals Drive Study Design

Jan Spyridakis

Dr. Jan Spyridakis is Chair and Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Internet-Based User Experience Laboratory (IBUXL).

Front-end website designers are increasingly expected to justify their designs using empirically derived evidence. This issue concerns students working with Jan Spyridakis in IBUXL. Researchers in this lab have been conducting remote user studies to investigate how web design features affect users’ comprehension, task performance, perceptions, and navigation behavior on informational websites. They have also been developing an open source tool—WebLabUX—to facilitate these studies.

### Assessing Different User Situations

The design of any remote user study will vary given different user situations and goals. WebLabUX makes use of three common patterns of goal driven user activity: using to learn, using to do, and using to learn to do. The users’ situations in these three contexts differ along with their goals, and this impacts data collected when studying users. For example, with a *using to learn* study, WebLabUX helps the researcher collect comprehension, perceptions, and navigation behavior data. But with a *using to do* or a *using to learn to do* study, task performance (e.g., speed, accuracy) becomes another dependent measure of interest, and comprehension often becomes less important.

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### Sample Studies

In a typical study, users enter an experimental website remotely from the platform and web browser of their choosing. Users first encounter a consent form, instructions, and usually pre-surveys that ask about demographics. Next, they browse or interact with a website that displays one of the many website conditions defined by the researcher. After sufficiently browsing or interacting with the study website, users complete various tasks and/or perception and comprehension surveys. Some of IBUXL’s most recent work has focused on:

- Text previews and navigation menus, a *using to learn* study
- Menu taxonomy, a *using to do* study
- Application Programming Interface (API) document structure, a *using to learn to do* study

What is most noticeable in these studies is the differing nature of the designs (in terms of the users’ goals, tasks, and resulting dependent measures). In the *using to learn* study, users browsed one of six website conditions that varied in text previews (with/without embedded links) and hierarchical tab menus (present/absent). Users were assessed on comprehension, perceptions, and navigation behavior. IBUXL discovered that previews with embedded links aided inferential comprehension and repeating link titles in hierarchical tab menus increased browsing.

In a *using to do* study, users interacted with one of two mobile phone shopping sites, varying in terms of whether their menus were categorical or detailed (containing previews of the next level of the navigation hierarchy). They were given three shopping tasks and were measured on task performance.
Jan Spryidakis is Chair and Professor in the Department of Human Centered Design & Engineering. Her current research interests include internet-based user research methods, and assessment of the effect of information design variables on users.

Spyridakis’ Internet-Based User Experience Lab (IBUXL) researches how design features of online information affect users’ behavior, task performance, comprehension, and perceptions. Her lab has been developing open source software to support the conduct of remote user testing: WebLabUX, a software package that allows researchers and website stakeholders to measure user behavior and performance on instrumented websites as well as test various site designs. Spyridakis has been honored by receiving eight awards for her research and six for her pedagogy. She is a Fellow in the Society for Technical Communication, and a member of the IEEE Professional Transactions on Communication advisory board.

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**A using to learn study of the effect of text previews and tab menus.**

A using to do study of the effect of categorical vs. detailed menus.

(e.g., success rate, navigation path) and perceptions. Results are forthcoming.

To measure the effects of document structure in API documentation in a using to learn to do pilot study, users interacted with one of four variations of API documentation that differed in terms of whether introductory information was present or absent on the home page and whether the reference topics were chunked together on one page or separate pages. Users were expected to learn the API from the documentation and apply their new knowledge in three programming tasks. They were assessed on such measures as task success rate and time, and navigation path.

**WebLabUX**

The IBUXL research team has been developing a methodology for remote automated assessment of the user experience with informational websites and developing a tool to support that work. WebLabUX helps construct A/B or multivariate testing of web designs, deliver unmoderated experimental conditions, administer surveys and instructions, record navigational behavior (including types of links clicked) and survey responses, and identify disingenuous user behavior.

Recently, the IBUXL team has been incorporating a study template system into WebLabUX such that it will allow web designers to match user situations with specific study designs. This should allow web designers to easily create high quality research designs and help them answer real world questions about the effectiveness of information design on their websites.

**Intro. Present, Reference Topics on One Page**

A using to learn study of API documentation variations.

**A using to do study of API documentation variations.**
Dr. Kate Starbird is an Assistant Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Emerging Capacities of Mass Participation (emCOMP) Laboratory.

Kate Starbird and her emCOMP Lab investigate the dynamics of massive participation and interaction enabled by new and social media. Focusing on specific events and issues that bring people together on a large scale, researchers both examine the flow of interactions and explore possibilities for applying online participation to problem-solving on a massive or even global scale. Situated within human-computer interaction (HCI) and computer supported cooperative work (CSCW), as well as the emerging fields of collective intelligence, crowdsourcing, and human computation, the lab's research integrates qualitative, quantitative, and computational analysis of social media interactions and seeks to identify and pursue design opportunities to support and harness mass participation within relevant contexts.

**Mass Convergence Within Disaster and Humanitarian Response**

The emCOMP Lab will continue to explore mass participation in the context of crisis (i.e., large-scale, natural, and man-made disasters). Disaster events have long been catalysts for physical convergence behavior by both formal responders and spontaneous volunteers. Digital convergence is occurring in the wake of disaster events, whereby people all over the world come together in social media spaces, participating in a number of capacities, including sharing information about the unfolding event and helping to process information. Spontaneous as well as formally organized digital volunteerism, mediated by social media platforms, has quickly become a recognized feature of the informational landscape after disaster events. The emCOMP Lab pursues empirical research and design opportunities in this space, seeking to find ways to support and leverage digital volunteerism and other forms of social media participation during crises, and to integrate the products of these activities into formal response.

**Tweak the Tweet**

Though originally designed as a tool for citizen reporting, the “Tweak the Tweet” project currently encourages digital volunteers to help filter, process, and map information about active crisis events—using the Twitter platform. Tweak the Tweet (TrT) is a “microsyntax” through which Twitter users can submit, via public tweets, structured reports of an unfolding crisis event that can be easily collected and processed by (remote) computer algorithms.

Goals of the TrT project are to:
- Design and build infrastructure to support TrT as a sustainable tool.
- Integrate TrT into digital volunteer communities.
- Enable end-users to launch and support TrT for a specific event.
- Design and implement an application to facilitate (mobile) creation of TrT tweets.
- Identify methods of making TrT information accessible and useful to emergency and humanitarian responders, as well as affected people.

**Future Directions in Crisis Informatics**

The emCOMP Lab is currently exploring other research directions within the field of crisis informatics. One of these involves identifying the informational needs of emergency and humanitarian responders as they relate to the use of social media as information channels for both incoming and outgoing information. Related to this, emCOMP seeks to design new methods of processing and delivering information to meet the needs of affected people and responders.
New and Social Media Use During High Visibility Events

The emCOMP Lab is looking to expand its focus to examine mass participation related to other types of events, including major news events (e.g., Bin Laden’s assassination), major sporting events (e.g., Olympics, World Cup, Superbowl), entertainment events, protests, and elections.

The lab plans to explore various themes within this interaction, including:

• Dynamics and flow of participation
• The interface between on-the-ground participants and remote participants
• Global demographics of participation
• Politics and affiliations
• Confrontation
• Enforcing and changing norms

Social Media as a Tool for Mass Disruption and Change

Another research area of the emCOMP Lab looks at social media as a tool for mass disruption and change. Here the lab examines the use of social media to instigate and coordinate collective activity applied towards social, political, and/or environmental change.

Possible research topics in this area include:

• Explore the tools of the occupiers, the social media services that protesters within the “Occupy” movement used to coordinate and promote their cause.
• Pursue design opportunities for catalyzing crowd participation in collective problem-solving activities.

Tweet Streams from Highly Retweeted Users During the 2011 Egypt Uprising

User streams of #Egypt #jan25 Twitterers showing the remote crowd acting as a recommendation filter for on-the-ground Twitterers.

Tweets graphed by Twitterer (vertically) and time (horizontally, left to right). Local users’ tweets colored aqua. Non-locals’ tweets colored orange. Twitterer streams sorted top to bottom by ratio of number of times retweeted / number of followers.

Those who were retweeted often, but had relatively few followers, were more often locals.

More Information

Kate Starbird is an Assistant Professor in the Department of Human Centered Design & Engineering and Director of the Emerging Capacities of Mass Participation (emCOMP) Laboratory. The emCOMP Lab examines the dynamics of and applications for massive interaction facilitated by social media and other online platforms. The lab also considers how connected, collective intelligence manifests and can be supported within contexts of emergency and humanitarian response, political disruption, and other events of large-scale interest (e.g., major news, sporting, and entertainment events).

Starbird received her PhD in 2012 from the University of Colorado, Boulder. Among her accomplishments, Starbird co-created “Tweak the Tweet,” utilizing the Twitter platform as a two-way communication method to get on-the-ground help where it is most needed. This was first deployed just in time for the Haiti earthquake disaster. She is also a volunteer with Humanity Road, a digital volunteer organization.

Starbird has received several awards—an NSF Graduate Research Fellowship, an Alliance for Teaching Learning and Society Graduate Research Fellowship from the University of Colorado, Boulder, as well as multiple best paper nominations.

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Improving Global Communication

Michio Tsutsui

Dr. Michio Tsutsui is a Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Technical Japanese Program (TJP).

Although English is the common language of the global marketplace, it is not used universally. In addition, while technologies for inter-language communication (e.g., machine translation) are advancing, they are still not sufficient. Thus, effective foreign language learning remains a central issue for professionals worldwide. Michio Tsutsui is conducting research that addresses this issue; specifically, his research focuses on effective feedback and on the reinforcement of correct usage forms.

Computer-Assisted Learning for the Reinforcement of Correct Forms

To be able to generate grammatically correct sentences, learners must first have accurate knowledge of each grammar item and, second, must internalize that knowledge through oral production and other types of practice. Tsutsui's ongoing Japanese linguistics research to reveal the usage rules of individual grammar items is geared in part to help learners achieve the first step (i.e., accurate grammar knowledge). His publications in this area include a three-volume grammar series published by The Japan Times, which covers basic through advanced grammar items.

To help learners achieve the second step (i.e., internalization of what they have learned), Tsutsui is currently developing computer-assisted learning materials for the reinforcement of correct usage forms. For example, the materials under development enable learners to: (1) practice target grammar forms orally with the aid of sounds, text, and graphics; (2) practice them orally in context in an interactive fashion; and (3) listen to dialogues or passages that contain target forms and determine the appropriate meaning when forms have multiple meanings.

A recent experiment confirmed that these materials heighten learners' awareness of their problem areas and enhance the automatization of the use of correct forms.

The research shown in the figures below is a collaborative project with faculty from the University of Michigan and Nagoya University of Foreign Studies, Japan.
Delayed Feedback

Feedback is an essential part of second language learning. Copious amounts of research have been done on feedback in language learning, but most of that research has been on feedback given interactively. Interactive feedback, however, cannot be used for presentations and speeches where learners do not interact with an instructor during their performance.

Tsutsui's research focuses on what is called delayed feedback—that is, feedback given to the learner in written or oral form after a performance. Although this method is widely used, classroom experience suggests that it is often not effective. Prior to Tsutsui’s research, however, very little research had been conducted to find more productive methods for delayed feedback.

Tsutsui’s preliminary research suggests that: (1) errors can be categorized into several types according to the level of the learner’s linguistic and sociocultural knowledge and the level of internalization of that knowledge; and (2) the way of giving feedback should be different depending on the type of error. Language Evaluator is a delayed feedback tool developed by the Technical Japanese Program under his leadership. This application demonstrates that technology can provide different kinds of feedback according to the type of error.

Significantly, Language Evaluator’s application areas are not limited to foreign language education; this tool can be used for any performance training, including speeches and presentations, acting, and music.
So What? Connecting Research and Practice

Jennifer Turns

Dr. Jennifer Turns is a Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Laboratory for Human-Centered Engineering Education.

What can be done to catalyze the rate by which research informs human-centered practice? How does research currently inform practice? What does research offer practitioners? What do practitioners need from research?

These are questions that have long interested Jennifer Turns. In her career, Turns has observed both researchers and practitioners struggle with these issues, and she has made contributions to addressing these research-to-practice questions, such as through a paper entitled “Bridging From Research to Practice in Undergraduate Engineering Design Education.” In recent years, she has come to embrace the idea that these questions deserve even more attention.

Turns is not alone. These questions are of interest to the National Science Foundation (NSF) and other organizations that fund research, and are related to the medical field’s interest in translational research and evidence-based practice. Such questions are also being raised on the Human Centered Design & Engineering (HCDE) home court, such as through Dourish’s 2005 “Implications for Design” article, in which he explored what ethnographic research can and cannot offer human-computer interaction (HCI) practitioners, and Stolterman’s 2008 article, “The Nature of Design Practice and Implications for Interaction Design Research,” where he explored what HCI practitioners need from research given their practice.

What makes the research-to-practice issue particularly challenging is its scope. To address such questions, one has to consider what is meant by research. What if the research is ethnographic? Large scale experiments? Discourse analysis? What is it that each type of research can offer practice? One also needs to think about practice. What if the practitioners are designers? Educators? Entrepreneurs? What does each need? What would help each type of practitioner and in what way?

Across her career, Turns has engaged in activities related to this issue. For example, she has had the opportunity to study the cognitive and social processes associated with two forms of practice: engineering design and engineering teaching. Equally important, across her career, Turns has used many different research methods as well as worked with many different theoretical perspectives. Moreover, one of her core teaching assignments involves introducing graduate students to the diverse research traditions in HCDE.

What is currently emerging is her emphasis on problems focused on the intersection of research and practice. The following two projects, both in Turns’ specific domain of engineering education, represent approaches to the challenge of figuring out how to do research in this broad space.

**Research**

**Practice**

Connecting research and practice.

Sample persona. Turns and her colleagues are exploring personas as tools to bring research on engineering students to engineering educators.

**UW Engineering Student Persona**

**Penny: Strong skills but low confidence**

Penny entered the UW as a first-year student with good high school grades (mostly As and a few Bs) and a very eclectic set of electives that covered music, literature, science, and art. Penny had very minimal understanding of engineering as a profession but she knew that engineers “designed and built stuff” that people used every day. Her dorm roommate, however, was a first-year student already committed to engineering as a degree path and a profession – the roommate’s parents were both engineers and she felt she had a reasonably clear picture of what life as an engineer would be like. Through conversations during their first couple of quarters at UW, Penny began to understand the idea of engineering as a degree path. She began attending information sessions and taking more math and physics courses. At the end of her sophomore year, she applied and was accepted to the bioengineering program. Penny felt a bit intimidated initially as she began her major coursework since she had maintained her eclectic course taking during her first two years in college and had not focused entirely on pre-engineering courses. She felt her understanding of engineering generally, along with the specialized bioengineering knowledge and vocabulary required, was lagging. Her confidence in her skills flagged during this period and she felt that she had to prove to the other students—in particular the men—that she deserved to be in the program and that she was “just as smart.” She relied on a group of other women in the bioengineering program who got together to study and tutor each other to help fill in gaps in her understanding as she didn’t feel comfortable revealing to the male students, or the professors, that she needed help in some areas. During her junior and senior years, Penny did develop the appropriate vocabulary and skill set and through persistence and hard work her grades were consistently high (high Bs and As) up through graduation. Even so, her confidence lagged even though her actual performance to an outside observer was more than satisfactory.
Explorations | 27

More Information

Jennifer Turns is a Professor in the Department of Human Centered Design & Engineering and Director of the Laboratory for Human-Centered Engineering Education. She researches the intersection of engineering education, cognitive/learning sciences, and user-centered design. Her engineering education work has focused on engineering design learning, knowledge integration, and disciplinary understanding, and has involved the use of a wide variety of research methods including verbal protocol analysis, concept mapping, and ethnography.

Turns’ ground-breaking research makes her one of the most highly-respected specialists in the engineering education field.

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Pushing on Personas

In a current NSF-funded project, Turns and her colleagues are exploring personas as tools to bring research on engineering students to engineering educators. Over the next year, they will be conducting (and researching) a series of workshops inviting educators to map specific teaching decisions to research results from a large NSF-funded study of the engineering student experience. This project is building on prior work by HCDE alumna Cynthia Putnam (PhD 2010), who focused her dissertation on empirically documenting how designers used personas during the design process.

Researching Research Publications

Over the past year, Turns and a number of graduate students have been developing a technique for analyzing research publications in terms of how the authors articulate implications for practice. Their idea is that the language patterns associated with implications for practice statements will provide clues about what makes connecting research to practice difficult and will lead to ideas about how to catalyze the use of research for practice. In a current analysis of the most recent year of the Journal of Engineering Education, they noted variation—variation in the extent to which implications for educational practice were emphasized and the location of the implications in the journal article, and variation in who was implicated. Their discussions of these findings have led Turns and her students to explore ideas for extending the set of implications identified for a given research study. One such idea involves a crowdsourced system associated with a journal issue or conference proceeding that provides a place for practitioners or others to think about potential connections to practice.

With projects such as these, Turns and her students are seeking better ways to embrace the “so what” question, so that the considerable effort spent on human-centered research can be taken up by human-centered practitioners.
Communicative Practices in Virtual Workspaces

Mark Zachry

Dr. Mark Zachry is an Associate Professor in the Department of Human Centered Design & Engineering (HCDE) and Director of the Communicative Practices in Virtual Workspaces Laboratory.

Working with students in the Communicative Practices in Virtual Workspaces Lab, Mark Zachry oversees projects investigating emergent uses of digital technologies to coordinate work activities. These projects seek to understand how people act and interact through digital technologies, developing tools to understand such activities and informing the design of new systems. The investigations focus specifically on how individuals engaged in varied forms of knowledge work (e.g., engineers, technologists, project managers) use online systems to work together.

Working on the Web
In studies of how knowledge workers use the web, Zachry and his students conduct investigations that reveal the emerging patterns of work in new, digital environments. Studying how people work toward common ends through such environments as chat systems, file sharing tools, collaborative authoring and editing forums, and similar web-based applications, the lab develops knowledge to support the design of flexible, distributed work. Primary research projects in this area include a longitudinal study of uses of online web services and the development of a system to support sense-making about participants in massive online contributor environments.

Networked Knowledge Workers on the Web
In this project, Zachry and his students conduct an annual, national survey (starting in 2008) of knowledge workers that examines usage of publicly available online services, such as Stack Overflow, Instagram, and Twitter, for work purposes. The project offers a view of types of online services used in rapidly changing patterns of contemporary work. The annual snapshot of web-based knowledge work articulates the changing relationship between different application types and classes of work activities.

Social Translucence in Online Environments
Working with students and a University of Washington colleague in the Information School (David McDonald), Zachry is developing a system that enables users of massive online contributor systems such as Wikipedia to understand other users through system-embedded visualizations of those other individuals based on their history of activities in the system itself. Such a system, supporting social translucence in online work environments, is designed to support more productive collaboration by helping people identify valuable contributors. An additional study extends this investigation to understanding voluntary, virtual teaming on the web. These projects are sponsored by the National Science Foundation.

Sensemaking about Online Interactions
In virtual workspaces, which are often geographically distributed and populated by large numbers of interactants, researchers and designers have difficulty arriving at principled understandings of the work people are engaged in. Such knowledge, however, has great potential value for the development of new interaction technologies that could harness the potential contributions of people organized in more intelligent, appealing forms of computational work. To aid in the process of understanding online interactions, Zachry and his students have developed tools like Qbox, GEMviz, Haystack Exchange, and Indicoder.
Collaborative Coding of Digital Artifacts

Qbox is a flexible tool to support traditional and innovative forms of analysis for web-based and digital material. Qbox integrates three functional areas of work associated with content analysis: consolidating and presenting source data, performing coding or classification work, and analyzing data. QBox has been used to conduct studies such as an examination of interaction behaviors in collaborative editing and the classification of web-based technologies.

Visualizing Mediation in Work Activities

GEMviz is a tool for researchers to translate data about communicative behaviors of a group of interactants into rule-based models. Such models allow for comparison of multiple interaction episodes, providing analysts with insight into work patterns.

Zachry and his collaborators also created Re:Flex, a web-based application that allows people to explore editor behaviors in Wikipedia. Driven by a toolbar that is integrated into the Wikipedia interface running on a proxied version of the online encyclopedia, Re:Flex allows users to investigate the work activities of contributors to Wikipedia since its beginning. Users can explore, for example, the group of editors that a given editor has interacted with most when editing, including the frequency of those co-editing interactions. Or, the user can adjust the settings in Re:Flex to discover the categories of articles that a given editor has specialized in while contributing to the encyclopedia.

Re:Flex gives visitors to Wikipedia the ability to visualize different types of relationships between editors and their collaborators or the article contributions they have made since the beginning of the popular online encyclopedia.
Putting people first, faculty and students in the Department of Human Centered Design & Engineering (HCDE) research, design, and engineer interactions between humans and technology.

About HCDE

The Department of Human Centered Design & Engineering offers seven academic programs:

- Bachelor of Science in Human Centered Design & Engineering
- Master of Science in Human Centered Design & Engineering
- Doctor of Philosophy in Human Centered Design & Engineering
- Inter-Engineering Master of Science in Technical Japanese
- Certificate in User-Centered Design
- Certificate in Global Technology & Communication Management
- Certificate in Technical Writing & Editing

These programs give students the opportunity to pursue areas of specialization, attend classes while working, or earn a degree or certificate in the day or evening. Students in HCDE learn to research human needs and interests as they solve design problems and build engineering solutions. HCDE offers a wide range of courses. Class sizes are small, and students work closely with faculty members and other students.

HCDE is housed within the College of Engineering at the University of Washington (UW). Students in the College of Engineering learn to focus on multifaceted grand challenges as identified by the National Academy of Engineering (NAE).

Degree Programs

Bachelor of Science

Students in the Bachelor of Science in Human Centered Design & Engineering program build a strong foundation in designing user experiences and interfaces, creating information visualizations, conducting user research, designing for the web, and building web technologies. HCDE students also have direct access to faculty through research groups, addressing a wide range of research and design challenges. The program culminates with a capstone experience, in which students integrate what they have learned into a final project.

Master of Science

The Master of Science in Human Centered Design & Engineering fosters students’ knowledge and skills in the design and evaluation of technologies and user interfaces. The curriculum, offered in the evening to accommodate both full- and part-time students, prepares students for leadership roles in information design, user interface design, user research, human-computer interaction, and related specializations. In addition to cutting-edge coursework, students may work in research groups with faculty on real-world projects. The program culminates with a capstone experience, in which students integrate what they have learned into a final project and portfolio.
Doctor of Philosophy

The Doctor of Philosophy in Human Centered Design & Engineering prepares students for notable careers in academia, industry, and government. Students study and conduct original research in the design and engineering of systems to support human endeavors in broad contexts, ranging from ubiquitous computing to scientific collaboration, from humanitarian relief to games for learning. While working toward their degree, students learn about the broad range of ideas that influence our field and develop demonstrable expertise in an area related to their specific research interests.

Inter-Engineering Master of Science in Technical Japanese

The Inter-Engineering Master of Science in Technical Japanese is a two-year degree program that combines the study of one of ten engineering disciplines at the UW and Japanese. Students learn to read Japanese technical journals, give research presentations in Japanese, and communicate effectively in a Japanese work environment.

Certificate Programs

User-Centered Design

The HCDE User-Centered Design (UCD) Certificate is an evening graduate-level program for students seeking to explore issues in user research and user-centered design.

Global Technology & Communication Management

The Global Technology & Communication Management (GTCM) Certificate is an evening graduate-level program for students looking to master management challenges in localization.

Technical Writing & Editing

The Technical Writing & Editing (TWE) Certificate is an evening program for students interested in learning practical applications and fundamental concepts in technical communication.

Research Groups

Faculty direct small research groups in which students focus on contemporary research questions. These groups have included work funded by the National Science Foundation and the National Institutes of Health. Research groups have addressed a range of topics such as design for digital inclusion, internet-based research, digital games, virtual workspaces, visualizations to support organizational analysis, and engineering education. HCDE students also participate in the Design Use Build (DUB) group, an interdisciplinary, university-wide, human-computer interaction group.

More Information

For more information about HCDE degree programs, visit our website at hcde.uw.edu.
corporate affiliates program

The Department of Human Centered Design & Engineering (HCDE) Corporate Affiliates Program is designed to enhance interaction between industry partners and HCDE. Affiliates enjoy a special connection with HCDE that fosters long-term relationships, leading to technical exchange, collaboration, and interaction with faculty, students, and alumni.

Corporate Affiliate Benefits

Corporate Affiliates receive exclusive access to a generous package of benefits:

- Attendance at the annual Corporate Affiliates Day on the University of Washington (UW) Seattle campus, including the following activities:
  - In-depth research presentations and demonstrations by faculty and students on current work.
  - Access to recruit students and alumni at the HCDE Career Fair.
  - Opportunities to host individual interview sessions with prospective employees on the UW campus.
- Access to hold recruitment and interview sessions with HCDE students and alumni on campus throughout the year.
- Ability to post job openings on HCDE’s AfterCollege.com webpage for free (non-Affiliates must pay a fee to post job openings).
- Access to online résumés submitted by HCDE students and alumni at all degree and program levels.
- Complimentary Corporate UW Libraries Card ($200 value). This card offers access to all UW Libraries and can be shared among organization employees.
- Invitations to seminars, workshops, and other events of interest held on the UW campus.
- Interaction with other industry members.
- Access to summaries of research activities in the department.

Opportunities for Collaboration

In addition, HCDE also works with Affiliates to identify opportunities to pursue sponsored research collaborations beyond the scope of the Corporate Affiliates Program. The affiliate relationship can also become a mechanism for arranging faculty presentations at the affiliated organization as well as faculty participation in symposia and problem-solving sessions.

Opportunities also exist for Affiliate representatives to present guest lectures in HCDE classes and at other forums.

Membership

Membership in the HCDE Corporate Affiliates Program requires a qualifying contribution to the department. Contributions are used to further the overall efforts of HCDE at the discretion of the Chair.

More Information

For more information about the Corporate Affiliates Program, visit our website at hcde.uw.edu/cap, or contact us at hcdecap@uw.edu.
The Department of Human Centered Design & Engineering (HCDE) supports 14 laboratories and centers. For more information, visit our website at hcde.uw.edu/labs.

**Center for Engineering Learning & Teaching (CELT)** Directed by Cynthia Atman
The Center for Engineering Learning & Teaching (CELT) researches engineering education and improving engineering teaching through instructional development.

**Communicative Practices in Virtual Workspaces Laboratory** Directed by Mark Zachry
The Communicative Practices in Virtual Workspaces Laboratory investigates emergent uses of digital technologies to coordinate work activities.

**Computer Supported Collaboration (CSC) Laboratory** Directed by Charlotte Lee
The Computer Supported Collaboration (CSC) Laboratory researches the design of information systems for collaboration.

**Computing for Healthy Living and Learning (CHiLL) Laboratory** Directed by Julie Kientz
The Computing for Healthy Living and Learning (CHiLL) Laboratory designs and develops mobile, persuasive, and collaborative technologies that help individuals, families, and teachers record and review their educational and health goals.

**Design for Digital Inclusion (DDI) Laboratory** Directed by Beth Kolko
The Design for Digital Inclusion (DDI) Laboratory researches how to design and implement technologies to address the needs of underserved communities and resource-constrained environments in the US and around the world.

**Emerging Capacities of Mass Participation (emCOMP) Laboratory** Directed by Kate Starbird
The Emerging Capacities of Mass Participation (emCOMP) Laboratory examines the dynamics of and applications for massive interaction facilitated by social media and other online platforms.

**HCDE UX Laboratory** Directed by Andrew Davidson
The HCDE UX Laboratory enables students to conduct user research and practice research methods as part of their studies.

**Internet-Based User Experience Laboratory (IBUXL)** Directed by Jan Spyridakis
The Internet-Based User Experience Laboratory (IBUXL) studies how online information affects users’ behavior, comprehension, and perceptions.

**Laboratory for Human-Centered Engineering Education** Directed by Jennifer Turns
The Laboratory for Human-Centered Engineering Education applies the practices of human-centered design to the challenges of helping engineering students learn more effectively and helping engineering educators teach more effectively.

**Laboratory for Influence in SocioTechnical Systems (LISTS)** Directed by Sean Munson
The Laboratory for Influence in SocioTechnical Systems (LISTS) designs, builds, and evaluates systems designed to nudge people toward socially desirable outcomes while respecting individual autonomy.

**Laboratory for Usability Testing and Evaluation (LUTE)** Directed by Andrew Davidson
The Laboratory for Usability Testing and Evaluation (LUTE) assists researchers who study usability engineering and user experience design.

**Pacific Rim Visualization and Analytics Center (PARVAC)** Directed by Mark Haselkorn
The Pacific Rim Visualization and Analytics Center (PARVAC) has the mission of advancing visual analytics for the enhancement of distributed, collaborative cognition and decision-making for public safety and security.

**Scientific Collaboration and Creativity Laboratory (SCCL)** Directed by Cecilia Aragon
The Scientific Collaboration and Creativity Laboratory (SCCL) conducts research on human-computer interaction in scientific collaborations, collaborative creativity, cyberinfrastructure, and information visualization.

**Technical Japanese Laboratory** Directed by Michio Tsutsui
The Technical Japanese Laboratory is part of the Technical Japanese Inter-engineering program.
The Department of Human Centered Design & Engineering (HCDE) faculty body is composed of 15 core teaching and research faculty, 7 adjunct faculty, 17 affiliate faculty, and 4 emeriti faculty. Below, HCDE’s core faculty are listed with their respective research areas.

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Research Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cecilia Aragon, Associate Professor</td>
<td>Human-computer interaction in scientific collaborations; eScience; visualization; visual analytics; eye tracking.</td>
</tr>
<tr>
<td>PhD, University of California, Berkeley</td>
<td></td>
</tr>
<tr>
<td>Cynthia Atman, Professor</td>
<td>Engineering education; engineering design learning; students as emerging professionals; education research to improve learning.</td>
</tr>
<tr>
<td>PhD, Carnegie Mellon University</td>
<td></td>
</tr>
<tr>
<td>Andrew Davidson, Senior Lecturer</td>
<td>Interaction design; human-computer interaction; physical computing; STEM and design education; secondary education outreach.</td>
</tr>
<tr>
<td>MS, University of Pennsylvania</td>
<td></td>
</tr>
<tr>
<td>David Farkas, Professor</td>
<td>Information design with a special focus on innovative documents for 21st century literacies; software user assistance; problems in slideware design.</td>
</tr>
<tr>
<td>PhD, University of Minnesota</td>
<td></td>
</tr>
<tr>
<td>Mark Haselkorn, Professor</td>
<td>Strategic management of information and communication systems; risk and resilience; safety and security systems; visual analytics.</td>
</tr>
<tr>
<td>PhD, University of Michigan</td>
<td></td>
</tr>
<tr>
<td>Masashi Kato, Senior Lecturer</td>
<td>Technology enhanced language learning; second language acquisition; sociolinguistics; international communication.</td>
</tr>
<tr>
<td>MS, University of Washington</td>
<td></td>
</tr>
<tr>
<td>Julie Kientz, Assistant Professor</td>
<td>Human-computer interaction; human-centered computing; supporting record-keeping and reflection; computing for healthy living and learning.</td>
</tr>
<tr>
<td>PhD, Georgia Institute of Technology</td>
<td></td>
</tr>
<tr>
<td>Beth Kolko, Professor</td>
<td>Design for digital inclusion; computer-mediated communication; educational/business/social gaming; information technology.</td>
</tr>
<tr>
<td>PhD, University of Texas</td>
<td></td>
</tr>
<tr>
<td>Charlotte Lee, Assistant Professor</td>
<td>Computer supported cooperative work; human-computer interaction; science and technology studies; design processes.</td>
</tr>
<tr>
<td>PhD, University of California, Los Angeles</td>
<td></td>
</tr>
<tr>
<td>Sean Munson, Assistant Professor</td>
<td>Social computing; selective exposure and political diversity online; systems to support health and wellness; persuasive technology.</td>
</tr>
<tr>
<td>PhD, University of Michigan</td>
<td></td>
</tr>
<tr>
<td>Jan Spyridakis, Professor and Chair</td>
<td>Information design in online spaces; remote user assessment methods; human-computer interaction; international communication.</td>
</tr>
<tr>
<td>PhD, University of Washington</td>
<td></td>
</tr>
<tr>
<td>Kate Starbird, Assistant Professor</td>
<td>Human-computer interaction; computer supported cooperative work; crisis informatics; human computation; crowdsourcing.</td>
</tr>
<tr>
<td>PhD, University of Colorado, Boulder</td>
<td></td>
</tr>
<tr>
<td>Michio Tsutsui, Professor</td>
<td>Technology-enhanced language learning; second language acquisition; Japanese linguistics; international technical communication.</td>
</tr>
<tr>
<td>PhD, University of Illinois, Urbana-Champaign</td>
<td></td>
</tr>
<tr>
<td>Jennifer Turns, Professor</td>
<td>User-centered design; design processes and strategies; human-computer interaction; engineering education; educating reflective practitioners</td>
</tr>
<tr>
<td>PhD, Georgia Institute of Technology</td>
<td></td>
</tr>
<tr>
<td>Mark Zachry, Associate Professor</td>
<td>Human-computer interaction; workplace studies; communication design in organizations; rhetoric of technology.</td>
</tr>
<tr>
<td>PhD, Iowa State University</td>
<td></td>
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</tbody>
</table>
selected faculty honors

The Department of Human Centered Design & Engineering (HCDE) is proud of the accomplishments of its faculty. Below are selected awards and distinctions that HCDE faculty have received.

4  Career Awards from the National Science Foundation
4  Jay R. Gould Awards for Excellence in Teaching from the Society for Technical Communication
2  Ronald S. Blicq Awards for Distinction in Technical Communication from the IEEE Professional Communication Society
2  William Elgin Wickenden Awards from the American Society of Engineering Education
2  Ken Rainey Awards for Excellence in Research from the Society for Technical Communication
1  Presidential Early Career Award for Scientists and Engineers (PECASE)

staff

HCDE staff are valued members of the department and integral to HCDE’s successful operation.

Gian Bruno  Director of Student Services
Keith Butler  Principal Research Scientist
Emily Gunther  Program Assistant
Anne Hilton  Communications Manager
Allen Lee  Fiscal Specialist

Jaime Luce  Assistant to the Chair
DJ Miller  Administrator
Elaine Shelley  Grants Coordinator
Stephanie White  Academic Advisor
The Department of Human Centered Design & Engineering at the University of Washington in Seattle offers degree programs at the undergraduate and graduate level, as well as certificate programs in user-centered design, global technology and communication management, and technical writing and editing.

Putting people first, we research, design, and engineer interactions between humans and technology. Join us. Change the world.

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