IPaT

Research
Digest

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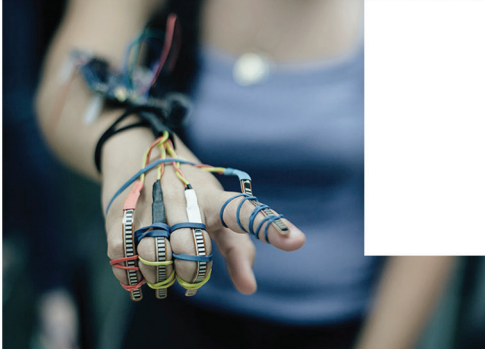
Letter from the Director

Innovation in media, information, and computing technologies has the potential to transform complex, human-driven enterprises such as healthcare, education, entertainment, business, civic, urban and humanitarian systems. However, influencing these people-intensive systems (aka socio-technical systems) also requires basic and applied research in design, psychology, architecture, policy, and business, and the wherewithal to integrate these insights into transformative approaches, services and tools.

Georgia Tech's Institute for People and Technology (IPaT) was created in 2011 to embrace these opportunities and needs, to create a networked research ecosystem of GT faculty and industry partners, and to amplify their combined thought leadership and on-the-ground results to create positive economic and societal impact in these critical systems that define much of everyday life: how people communicate, learn, heal, make decisions and take care of their communities.

The IPaT Research Digest is a bi-annual collection of summaries from a selected set of our faculty publications. Although it's only a small sample of our research, the digest showcases Georgia Tech's thought leadership in scholarly journals and research conferences.

Our interdisciplinary teams of computer scientists, system scientists, architects and engineers collaborate with doctors, designers, teachers, government officials, architects and others to change our community and our world.

The publications summarized in this digest span a wide range of topics from more than 50 Georgia Tech researchers from 2013-2015. Topics include the development of wearable computers for service dogs; improving the lives of children with asthma; helping students create innovative products and experiences through mentorship; and imagining future campuses and "smart" cities through the lens of innovations in media and mobile technologies.

Through these living laboratories and multidisciplinary projects, we continue our mission of bringing innovations in information, computing and media technologies to address challenges in healthcare, education, civic and humanitarian systems and business enterprises. Glimpse the future today.

Enjoy!

Beth Mynatt

Beth Mynatt
Executive Director, Institute for People and Technology

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MEDIA

Facilitating Interactions for Dogs with Occupations

The FIDO project is an ongoing research project at Georgia Tech's Animal Computer Interaction Lab. It researches ways to improve communication between working dogs and the humans they assist. This work has included canines serving as guide, hearing, service, skilled companion, search & rescue (SAR), and police dogs.

FIDO Project Improves Communication with Service Dogs

FIDO, or Facilitating Interactions for Dogs with Occupations, is a high-tech vest for service dogs designed to help the dogs communicate with their handlers. By activating one of the sensors on the vest, dogs can send either audible cues or text notifications to their handler's smartphone.

With the goal of supporting communication between working dogs and their handlers, we created four different dog-activated sensors and tested them with three service dogs. The sensor designs are based on the natural capabilities of dogs – biting, tugging, and touching with the nose. The results of the pilot study show that with a smaller, more robust design and comprehensive training for dogs, it is possible to create reliable wearable electronics for dogs. In addition to assisting people with disabilities, police departments could also use the technology with their bomb and drug-sniffing dogs. Military working dogs could also use FIDO to communicate the location and type of Improvised Explosive Devices (IEDs).

Citation
Melody Moore Jackson, Clint Zeagler, Giancarlo Valentin, Alex Martin, Vincent Martin, Adil Delawalla, Wendy Blount, Sarah Eiring, Ryan Hollis, Yash Kshirsagar, and Thad Starner. 2013. FIDO - facilitating interactions for dogs with occupations: wearable dog-activated interfaces. In Proceedings of the 2013 International Symposium on Wearable Computers (ISWC '13). ACM, New York, NY, USA, 81-88. DOI=10.1145/2493988.2494334 http://doi.acm.org/10.1145/2493988.2494334

Touchscreens in the Home for Working Dogs

An important new research area is computer-mediated interaction for working dogs. Using touchscreens in the home, dogs can communicate vital information to humans.

We researched how a dog could interact with touchscreens by watching their interactions, noting obstacles and comparing it to what is expected of humans' touchscreen interactions. Hardware issues are solved by adjusting screen and projection styles to make a touchscreen usable with a dog's nose. We also compared canine touch data to touch data by humans on the same touchscreen. Our eventual goal is to understand the clues provided by dogs and use them in the design of touchscreen interfaces in domestic settings.

Citation
Clint Zeagler, Scott Gilliland, Larry Freil, Thad Starner, and Melody Jackson. 2014. Going to the dogs: towards an interactive touchscreen interface for working dogs. In Proceedings of the 27th annual ACM symposium on User interface software and technology (UIST '14). ACM, New York, NY, USA, 497-507. DOI=10.1145/2642918.2647364 http://doi.acm.org/10.1145/2642918.2647364

New System Eliminates Complex Encryption Software

A new technique for encrypting emails gets rid of the complicated, mathematically generated messages usually associated with encryption software. Instead, emails are made vague by leaving out key words.

We introduce a technique called Open Book designed to address encryption's social usability problems. It uses data mining and NLP to make messages more vague than the originals. The prototype uses a Google Mail plug-in called Read Me, which works by substituting specific words with ambiguous ones. In our study, email recipients using Open Book were able to correctly decipher the sender's missing words or phrases 95% of the time. When we showed the same vague email to strangers, only two percent of were interpreted correctly.

Citation
Gilbert, Eric. "Open Book: A Socially-inspired Cloaking Technique that Uses Lexical Abstraction to Transform Messages." In Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, pp. 477-486. ACM, 2015

Language Determines Success on Kickstarter

How do people decide which projects to fund on the global crowdfunding website Kickstarter? The language used in the project is shown to affect whether or not a project meets its funding goal.

We analyzed more than 45,000 Kickstarter projects and found that successful campaigns were often associated with certain phrases. The phrase "also receives two" was linked to the most successful campaigns, meaning, offering a gift in return for a pledge. We also found that failed campaigns revealed key words and phrases. "Not been able" was the phrase most associated with a campaign's failure. The main conclusion from this study is that Kickstarter project creators have control over how they pitch their projects, and ultimately the campaign's success.

Citation
Mitra, Tanushree, and Eric Gilbert. "The language that gets people to give: Phrases that predict success on kickstarter." In Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing, pp. 49-61. ACM, 2014.

Revealing What Drives Activity on Pinterest

Statistical data can help us understand the flow of information and activities that attract followers on social curation sites like Pinterest. For example, sharing diverse content increases a user's number of followers, but only up to a certain point.

In collaboration with the University of Minnesota, our study of more than 200,000 "pins" reveals: female Pinterest users have more re-pins, regardless of location; men typically have more followers than women; and, four verbs set Pinterest and Twitter apart – "use," "look," "want," and "need". These verbs show that consumerism is at the core of Pinterest. We also learned that – compared to Facebook and Twitter – Pinterest users click through to e-commerce sites and spend significantly more money.

Citation
Chang, Shuo, Vikas Kumar, Eric Gilbert, and Loren G. Terveen. "Specialization, homophily, and gender in a social curation site: Findings from pinterest." In Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing, pp. 674-686. ACM, 2014.

Wearable Computing: Working Collaboratively for the Greater Good

As the market for wearable devices continues to expand, there will continue to be a cultural and social impact. When it comes to public policy, these shifts present significant challenges as well as opportunities.

Designers, technologists, and policymakers often work independently, resulting in products that are out of sync, or are impeded by obstructive policy. Based on initial trials at Georgia Tech's multi-disciplinary collaborative engineering center, the Wireless Rehabilitation Engineering Research Center, we propose a collaborative policy design framework. We foresee a collaborative policy design process complementing the development of wearable devices. It will also guide interdisciplinary collaborators as they research social and cultural implications of wearable devices in public policy.

Citation
Baker, Paul, Maribeth Coleman, and Clint Zeagler. "Innovation and Wearable Computing: A Proposed Framework for Collaborative Policy Design."

EDUCATION

Video Game Testing Helps Students Learn Computer Science While Navigating Multiple Identities

The desire to be a good student, while at the same time rejecting "geeky" subjects like computer science in order to save face among friends and family, can impact a student's motivation to learn. To better understand this internal conflict faced by students, we studied African-American males in the Glitch Game Testers program.

High school students worked as a quality assurance team on digital games and spent time in computer science workshops. We discovered that these students continued with computing education because they were able to navigate around perceived learning barriers by creating many "face-saving" tactics to explain their involvement with Glitch. For example, they would tell family members that they "like getting experience being on a college campus." While at school, they might say that it was a good way "to meet the ladies." Results show that after participating in Glitch, more than 65% of the participants went on to study computing after high school.

Citation
DiSalvo, Betsy, Mark Guzdial, Amy Bruckman, and Tom McKlin. "Saving face while geeking out: Video game testing as a justification for learning computer science." Journal of the Learning Sciences 23, no. 3 (2014): 272-315.

Bridging the Gap in Digital Inequality

Parents play an important role in enriching their children's educational experience by providing them with learning opportunities. Free, informal online learning resources are available, but research shows that the people who may need them the most are not able to find them.

In this study, we examine technology practices and level of access to information technologies among African-American parents in financially depressed communities in westside Atlanta. We found that access to information technology is critical in improving educational attainment, economic status and social capital. We propose a hyper-local community for parents to be able to engage in neighborhood discussions and communicate available learning opportunities within the community.

Citation
Parisa Khanipour Roshan, Maia Jacobs, Michaelanne Dye, and Betsy DiSalvo. 2014. Exploring How Parents in Economically Depressed Communities Access Learning Resources. In Proceedings of the 18th International Conference on Supporting Group Work (GROUP '14). ACM, New York, NY, USA, 131-141. DOI=10.1145/2660398.2660415 http://doi.acm.org/10.1145/2660398.2660415

Solving Complex Problems by Mimicking Nature

When most of us have a quick question, we consult an Internet search engine. It's fast, and if you find a reliable source, provides tried and true answers. But when scientists and engineers face complex problems, they sometimes need more innovative solutions, something that's never before been considered.

In the book, Biologically Inspired Design: Computational Methods and Tools, we outline biologically inspired design (BID), an emerging research area in design, biology, computing, and engineering which seeks sustainable solutions by copying nature's time-tested strategies. For example, studying flamingos' beaks to design a better water filter. To promote BID research, the United States National Science Foundation (NSF) sponsored two workshops, which served as an impetus for this book. We reviewed the workshop's discussions and outline a research program on computer-aided BID. The book also introduces and develops several methods and tools for BID.

Citation
Goel, Ashok K., Daniel A. McAdams, and Robert B. Stone. Biologically inspired design: computational methods and tools. Springer Science & Business Media, 2013

Job Satisfaction Among Teleworkers with Disabilities

Despite its flexibility, telework is not as prevalent among people with disabilities as compared to the general population. This study of employment and accommodation use patterns of people with disabilities examines the connection between functional abilities, work location and nature, and accommodation use.

We surveyed nearly 400 people with disabilities across the country and found that those in white-collar and knowledge-based jobs were twice as likely to telework as other worker types, and teleworkers were twice as likely to use flexible scheduling. Our study also showed that only 47% of teleworkers viewed telework as a job accommodation. Of those, only 57% were satisfied with telework, while 76% viewed it as important to completing their job tasks. We concluded that among those who view telework as an accommodation, the primary benefit of this type of work is to reduce pain and fatigue-related barriers of traditional employment. Since telework also has relatively low satisfaction numbers, this suggests that there are other employment-related barriers to consider.

Citation
Linden, Maureen, and Karen Milchus. "Teleworkers with disabilities: characteristics and accommodation use." Work (Reading, Mass.) 47, no. 4 (2013): 473-483.

Mentorship Program Fosters Success in STEM

Georgia Tech and the University of Georgia have developed BreakThru, a virtual mentoring community sponsored by the National Science Foundation that provides students with support in STEM subjects. The project pairs students with learning disabilities or who are struggling with STEM coursework with mentors from colleges, K-12, and industry.

BreakThru uses the virtual world Second Life as well as other communication platforms to connect mentors and mentees. We begin working with students once they've entered high school, which prepares them for STEM at the post secondary level. Our mentorship activities continue through college and graduation when mentees transition into STEM careers. Student mentees must complete project modules and routinely meet with their mentors. Mentors report progress on a monthly basis, detailing the steps taken by students to meet their education and career goals.

How Geographic Access Impacts Children with Asthma

Asthma is a common childhood condition, with over 7 million children affected. An important factor in health and healthcare disparities among pediatric asthma patients is insufficient access to healthcare services.

Supported in part by a seed grant from the Institute for People and Technology and Children's Healthcare of Atlanta, we studied the relationship between access to medical care and severe pediatric asthma outcomes. We measured emergency department visits and hospitalizations for children in Georgia and North Carolina diagnosed with asthma, and found the association between access and outcomes depends on various factors such as type of care. Results show that in Georgia, access to primary care plays a larger role in outcomes for pediatric asthma, while in North Carolina, access to both primary and specialist care are significant. The study concluded that intervention must be tailored by region to gain maximum benefit and impact.

Building Better Activity and Sleep Trackers

While older consumers are excited about the potential benefits of activity and sleep trackers, these devices lack design and utility features that promote long-term use. This gap presents an opportunity to better serve those who are 50 and older.

Working with Project Catalyst, we gave 92 older consumers a popular activity or sleep-tracking device to use at home for six weeks. At the end of the trial, a majority of of participants reported increased awareness of activity, sleep or eating habits and that the tracker was beneficial, while nearly half reported increased motivation and/or a change in behavior. Recommendations for improvement of sleep and activity trackers include: trackers that are able to share information on health goals important to 50-plus consumers, simplify set up, a less obtrusive design, and

more features like alerts and instant access to information. With the support of other organizations, we are working to improve products and services for those who are 50 and older, the largest consumers of healthcare.

Citation
"Activity And Sleep Trackers Show Promise For Improving Overall Health Of Older Consumers Despite Some Usability Challenges." PR Newswire, 2015., General OneFile, EBSCOhost (accessed September 18, 2015).

Older Adults and Activity Monitoring Use

Older adults are a quickly growing segment of the population that could benefit from activity monitoring technologies. This study investigates how older adults integrated activity monitoring products into their lives, and their attitudes toward the technologies.

Study participants used one of four technologies – Striiv, Fitbit®, Nike+, FuelBand, and MyFitnessPal- in their homes for two weeks. Prior to use, all of the participants were positive and excited about using the technologies. We found, though, that the number of days the technology was worn or accessed varied greatly between participants, from one day to the maximum 15 days. There were no difficulties reported with using the technologies, which is positive feedback for technology designers. However, our research suggests that more effort is needed on communicating the benefits of activity monitoring technologies.

Citation
Fausset, Cara Bailey, Tracy L. Mitzner, Chandler E. Price, Brian D. Jones, Brad W. Fain, and Wendy A. Rogers. "Older Adults' Use of and Attitudes toward Activity Monitoring Technologies." In Proceedings of the Human Factors and Ergonomics Society Annual Meeting, vol. 57, no. 1, pp. 1683-1687. SAGE Publications, 2013.

Assistive Touchscreen Technology for Dementia Patients and Caregivers

Few assistive technologies are available to people with dementia and their family caregivers to help manage neuropsychiatric symptoms (NPS). Researchers tested the feasibility and adoption of a touch screen technology, which delivers psychosocial, nondrug interventions to people with dementia in the home.

Interventions using the Companion touch screen technology were personalized and delivered in home for at least three weeks. Results show that the technology was easy to use, aided meaningful and positive engagement, and simplified the lives of caregivers. People with dementia

used the Companion system on their own, but were limited by cognitive and physical impairments. The touchscreen system can help manage neuropsychiatric symptoms and offer downtime for caregivers. This data can provide guidance for the future design and deployment of home care technology.

Citation
Kerssens, Chantal, Renu Kumar, Anne E. Adams, Camilla C. Knott, Laura Matalenas, Jon A. Sanford, and Wendy A. Rogers. "Personalized technology to support older adults with and without cognitive impairment living at home." American journal of Alzheimer's disease and other dementias (2015): 1533317514568338.

Robot Assistance for Older Adults

Although many adults over 65 years of age require some assistance, it's important to them that they also maintain their autonomy. Technology in the form of robotics could enhance autonomy and quality of life for older adults.

We studied the living situations of older adults and the predictors of residential moves to higher levels of care. We also looked at older adults' need for assistance with daily living activities and medical conditions when living independently or in a long-term care residence. Robotics has the potential to assist older adults across a spectrum of need, and enhance their feelings of independence. Mobile manipulator robots, which are similar in size to a human, can manipulate objects and navigate in human environments. They may reduce unwanted moves driven by need to residences with higher levels of care.

Citation
Mitzner, Tracy L., Tiffany L. Chen, Charles C. Kemp, and Wendy A. Rogers. "Identifying the Potential for Robotics to Assist Older Adults in Different Living Environments." International journal of social robotics 6, no. 2 (2014): 213-227.
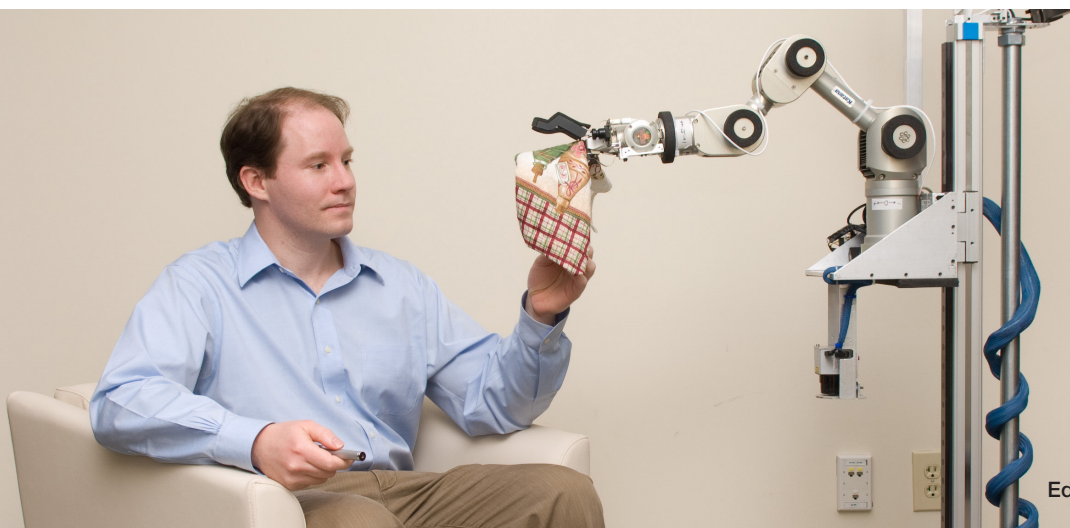
HEALTH

Integrating Healthcare Data and Informatics in the Cloud

Healthcare applications providers and population health researchers face significant challenges in integrating and sufficiently analyzing healthcare information, due to the sheer amount and variety of their data. Integration is key, though, to developing advanced healthcare applications.

Health information technology systems like electronic and personal health record systems use different technical and semantic standards to represent and store data, each having a different language and database technology. Meanwhile, cloud-based systems allow data storage on external servers for easy access by developers, but interoperability is still a challenge. We have extended our work in creating a cloud-based approach for the design of interoperable EHR systems, to include a cloud-based information integration and informatics framework that uses proven open source, cloud-based technologies. One advantage of this framework is its use of technologies for clinical data integration and analysis that leverage the

benefits and economies of cloud computing environments already in use.

Citation
Bahga, Arshdeep, and Vijay K. Madisetti. "Healthcare Data Integration and Informatics in the Cloud." Computer 2 (2015): 50-57.

Managing Healthcare Through Organizational Simulation

Systemic changes addressing the cost and quality of healthcare are difficult to study, evaluate, and implement. In order to empirically study alternative means of healthcare delivery, researchers designed and developed Health Advisor, a web-based game using organizational simulation.

Players take on the role of a health advisor and manage people through the healthcare system by making tradeoffs in information, cost, and quality of care. Scores are based on health outcomes and acquired costs. Our paper reports on Health Advisor evaluations and the knowledge gained from these studies. Overall, players responded favorably to the game concept, usability, and playability. The most compelling aspect of the simulation was the ability to test out strategies before implementing them. However, physicians did not relate well to the role of health advisor, preferring to treat patients instead of managing clients.

Citation
Basole, Rahul C., Douglas A. Bodner, and William B. Rouse. "Healthcare management through organizational simulation." Decision Support Systems 55, no. 2 (2013): 552-563.

A Review of Patient Engagement in Hospitals and Other Inpatient Settings

Although engaging patients in their healthcare is a growing trend, one patient engagement area has been limited – hospitals. Researchers summarized existing scientific literature about patient engagement in inpatient settings, specifically focusing on the use of health IT.

We searched databases for studies that discussed patient engagement, involved health IT, and took place in a hospital or other inpatient environment. We identified 17 articles that described inpatient patient engagement, as well as a few articles that identified design requirements for inpatient engagement technology. The remainder of the articles outlined interventions in entertainment, generic health information delivery, patient-specific information delivery, advanced communication tools, and personalized decision

support. We concluded that there are extensive gaps in knowledge about patient engagement in the hospital setting, as well as conflicting use of terminology. More research is needed, specifically about the impact of patient engagement on health outcomes and cost-effectiveness.

Citation
Prey, Jennifer E., Janet Woollen, Lauren Wilcox, Alexander D. Sackeim, George Hripcsak, Suzanne Bakken, Susan Restaino, Steven Feiner, and David K. Vawdrey. "Patient engagement in the inpatient setting: a systematic review." Journal of the American Medical Informatics Association 21, no. 4 (2014): 742-75

My Journey Compass: Patients Take Control of Their Healthcare

My Journey Compass is a research program to investigate the use of mobile devices as a care management tool for patients dealing with long-term, serious medical issues. For the study, we focused on newly-diagnosed breast cancer patients.

230-thousand Americans are diagnosed with breast cancer each year. Diagnosis and treatment of breast cancer, and other serious diseases, requires a lot of work on the patient. Many times, the patient is unfamiliar with all that is expected of them, including monitoring their condition, logging it, and following complex regimens of treatment and medications. In addition, many of these issues require sharing with family members and other caregivers. My Journey Compass developed a set of tools that run on a 7-inch tablet device to allow portability, so the patient can take and use the device wherever they go. Education and applications about breast cancer, treatment, nutrition, etc were provided through the tablet. Our findings show that patients used the device for health tasks at first, but then

started using the devices for relaxation and fun as well. They were better connected to their care, and better informed on what they were doing, why, and what to expect next. The deployment study provided several areas that are leading the team currently working on the next version.

Citation
Jacobs, Maia L., James Clawson, and Elizabeth D. Mynatt. "My journey compass: a preliminary investigation of a mobile tool for cancer patients." In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 663-672. ACM, 2014.

Health Mashups: Connecting Wellbeing Data to Promote Behavior Change

From step trackers to calorie counting apps, people now have access to multiple sources of data about their health and wellbeing. The Health Mashups system takes that data and, over time, identifies links between weight, sleep, step count, food intake, and other factors. It answers questions such as, "do I sleep better on nights after I work out?"

We performed a pilot study of Health Mashups, made improvements based on the results, and then conducted a 90-day trial. Results show that by aggregating different types of wellbeing data, individuals can become more aware of what impacted their mood, food intake, sleep patterns, and activity, and target a change in behavior based on those observations. Reminders and other notifications are necessary, though, to keep individuals engaged enough to create useful data. Once enough data was provided to the Health Mashups system, the observations provided were easy to understand by participants with a wide range of educational levels and technical knowledge. This system is a first step toward examining the connections between wellbeing and context over time.

Citation
Bentley, Frank, Konrad Tollmar, Peter Stephenson, Laura Levy, Brian Jones, Scott Robertson, Ed Price, Richard Catrambone, and Jeff Wilson. "Health Mashups: Presenting statistical patterns between wellbeing data and context in natural language to promote behavior change." ACM Transactions on Computer-Human Interaction (TOCHI) 20, no. 5 (2013): 30.

Managing Adolescent Type 1 Diabetes Through Text Messaging

In between clinical visits every three months, adolescents with Type 1 diabetes may not frequently document diabetes-related issues, which limits their knowledge about the condition. Researchers have designed a text-messaging system to address this problem.

We examined the effects of text messages about diabetes symptoms and other information on participants' glucose control and quality of life. The participants who received more text messages between clinical visits reported a significant increase in quality of life. They also worried less about the perceived impact of diabetes on their lives, and reported a decrease in diabetes distress. Although adolescents found the system easy and enjoyable to use, they recommended more variety in the questions asked by the text message system. They also requested more personal questions regarding day-to-day management of their diabetes.

Citation
Han, Yi, Melissa Spezia Faulkner, Heather Fritz, Doris Fadoju, Andrew Muir, Gregory D. Abowd, Lauren Head, and Rosa I. Arriaga. "A Pilot Randomized Trial of Text-Messaging for Symptom Awareness and Diabetes Knowledge in Adolescents With Type 1 Diabetes." Journal of pediatric nursing (2015).

Tongue-Powered Wheelchair Control for People with Spinal Cord Injuries

In the United States, about 1 in 50 people live with some form of paralysis in their upper or lower extremities. The Tongue Drive System (TDS) is a wireless, wearable assistive technology that allows those with paralysis to access their environment using voluntary tongue motion.

We studied the efficiency of TDS for controlling a computer and driving a powered wheelchair. Two groups of able-bodied subjects and one group consisting of people with spinal cord injuries participated in the study. We found that those with spinal cord injuries were more easily able to use TDS as compared to a sip-and-puff device or a keypad. The flexibility of TDS, along with characteristics of the human tongue enabled people with motor impairments to access computers and drive wheelchairs at a faster speed than with traditional assistive technology. Accuracy proved to be comparable to traditional devices.

Citation
Kim, Jeonghee, Hangue Park, Joy Bruce, Erica Sutton, Diane Rowles, Deborah Pucci, Jaimee Holbrook et al. "The tongue enables computer and wheelchair control for people with spinal cord injury." Science translational medicine 5, no. 213 (2013): 213ra166-213ra166.

Eliminating the Guesswork in Pediatric Heart Surgery

Of the approximately 1% of children born with moderate to severe congenital heart defect, half need one or more

surgeries to fix it. Georgia Tech researchers have developed software that allows pediatric cardiac surgeons to manipulate a digital 3D model of the patient's actual heart and explore surgical options before operating.

Using the SURGEM software, surgeons have a better understanding of each child's unique heart defect and greatly increase the likelihood that they will have a smoother recovery and an improved quality of life after the operation. Many scientists believe that simulation-based planning of cardiovascular treatments could also lead to lower morbidity and mortality. In this study, we describe the solid modeling and graphical user interface challenges that we have found while developing support for three types of heart defect surgeries. We investigated and developed several solutions to address these challenges and to improve the performance, reliability, and usability of SURGEM for these surgeries.

Citation
Luffel, Mark, Mukul Sati, Jarek Rossignac, Ajit P. Yoganathan, Christopher M. Haggerty, Maria Restrepo, Timothy C. Slesnick, Kirk R. Kanter, Pedro del Nido, and Mark A. Fogel. "SURGEM: A solid modeling tool for planning and optimizing pediatric heart surgeries." Computer-Aided Design (2015).

Using Visual Analytics in Pediatric Asthma Care Processes

Human-directed healthcare delivery processes can have significant variations in cost, quality, and outcome, presenting challenges in process analysis, conformance testing, and improvement. Researchers have designed and
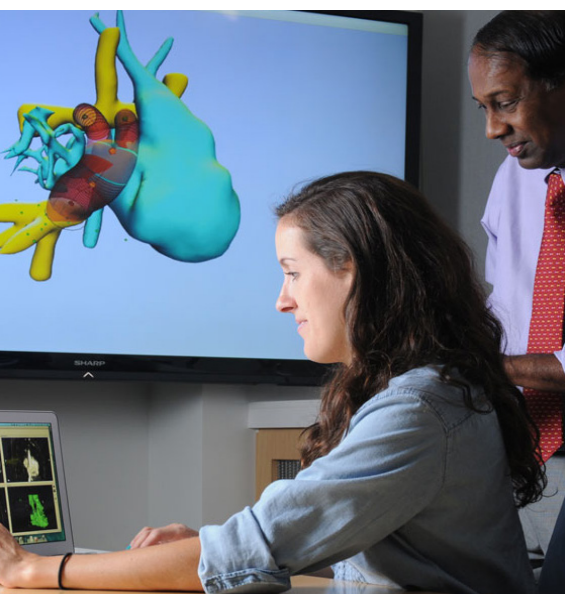
developed an interactive visual analytic process exploration and discovery tool to address these challenges.

Collaborating with the Scottish Rite Emergency Department of Children's Healthcare of Atlanta, we used the tool to explore clinical data from over 5,700 pediatric asthma emergency department patients. Georgia's pediatric asthma rate is one of the highest in the nation, affecting more than 200-thousand children age 18 or under. Our browser-based tool enables users to interactively explore care processes for a patient population, which can be filtered based on patient, provider, and care process characteristics. Visual analytics can play an important role in healthcare process analysis by enabling users to better understand pediatric asthma care processes. Our tool can help improve care quality programs, provider comparison and benchmarking, and provide a way to make sure providers are conforming to existing care protocols.

Citation
Basole, Rahul C., Mark L. Braunstein, Vikas Kumar, Hyunwoo Park, Minsuk Kahng, Duen Horng Polo Chau, Acar Tamersoy et al. "Understanding variations in pediatric asthma care processes in the emergency department using visual analytics." Journal of the American Medical Informatics Association 22, no. 2 (2015): 318-323.

Cloud-Based Predictive Modeling System

Predictive modeling is a time consuming process, requiring clinical researchers to handle complex electronic health record (EHR) data in restricted computational environments. To address this challenge, researchers developed a cloud-based predictive modeling system.

The system combines a secure private server with the Amazon Web Services (AWS) Elastic MapReduce platform. EHR data is preprocessed on a private server, with the resulting de-identified event sequences hosted on AWS. The secure private server aggregates results and displays them via interactive visualization. We tested the system on a pediatric asthma readmission task on a de-identified EHR dataset of 2,967 patients. A larger scale experiment of 2 million patients was conducted on the CMS Linkable 2008-2010 Medicare Data Entrepreneurs' Synthetic Public Use File.

Citation
Chen, Robert; Hang Su; Mohammed Khalilia; Sizhe Lin; Yue Peng; Tod Davis; Daniel A. Hirsh; Elizabeth Searles; Javier Tejedor-Sojo; Michael Thompson; Jimeng Sun. Cloud-based Predictive Modeling System and its Application to Asthma Readmission Prediction. Scheduled for publication in Proceedings of 2015 Annual Symposium of the American Medical Informatics Association (AMIA). San Francisco, CA. November 2015.

Supporting Autism Diagnosis Using Home Videos

A delayed diagnosis of autism can prevent early interventions that have been shown to improve developmental outcomes. Our research team developed a mobile phone-based telehealth application that allows parents to easily collect in-home videos of their child's behavior and share them with a diagnostician for remote diagnostic assessment for autism. Using a web portal, diagnosticians can guide the video collection, access the child's developmental history, review and tag the videos, and complete the diagnostic assessment.

Interviews with clinicians and families guided the initial design of the smart phone based video recording application and the diagnostician portal. The system was subsequently refined based on the experiences of families who were asked to use it in a controlled home-like laboratory setting. An in-field evaluation of the system was conducted with three diagnosticians and five families, four with a child with a previous diagnosis on the autism spectrum and one with a typically developing child. Results showed that 96% of the in-home videos were rated as clinically useful in supporting a remote diagnosis of autism. For ten of the eleven remote diagnostic assessments that were completed via the web portal (91%), the clinician arrived at a diagnostic outcome that matched with the child's previous diagnosis. This telehealth approach to remote autism diagnosis is currently being validated in a larger trial with families referred for a diagnostic evaluation.

Citation
Nazneen, Nazneen, Agata Rozga, Christopher J. Smith, Ron Oberleitner, Gregory D. Abowd, and Rosa I. Arriaga. "A Novel System for Supporting Autism Diagnosis Using Home Videos: Iterative Development and Evaluation of System Design." JMIR mHealth and uHealth 3, no. 2 (2015).
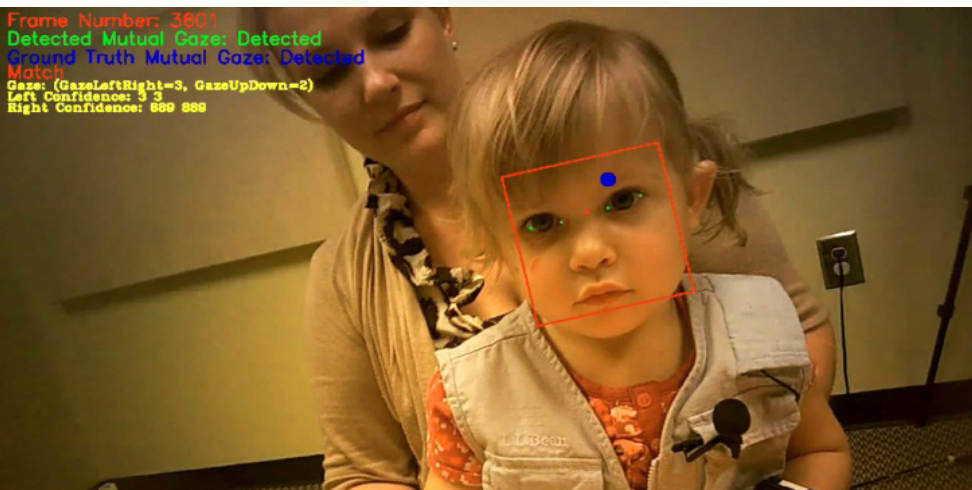
Engaging Students with Autism Using Motion-Based Games

Individuals with autism all experience varying levels of difficulty with social and communication skills, especially school-aged children who struggle with peer interactions and friendships. In a nine-month-long observational study in a classroom setting, researchers explored the impact of motion-based activities on students' engagement, peer-directed social behaviors, and motor skills.

The goal was to explore technology-mediated activities that could be used by teachers in the classroom to increase students' engagement and peer interactions. Based on classroom observations and teacher interviews, we designed three Kinect activities, including a game that could be played by one or two children in the presence of their classroom peers, mediated by the teacher. This game was deployed by teachers in two classrooms over a period of three months. Based on our observations, teacher feedback, and analysis of recordings of game play sessions, we found strong evidence that motion-based activities promote strong positive affect and engagement, as well as initiations and responses to peers. We also found collateral effects on the ability to produce novel movements, turn-taking, and self-regulation. Our findings suggest that motion-based activities deployed in classroom settings create a more natural social contexts for peer interactions for students with autism.

Citation
Bhattacharya, Arpita, Mirko Gelsomini, Patricia Pérez-Fuster, Gregory D. Abowd, and Agata Rozga. "Designing motion-based activities to engage students with autism in classroom settings." In Proceedings of the 14th International Conference on Interaction Design and Children, pp. 69-78. ACM, 2015..

Preventing Healthcare-Associated Hospital Infections

Although hospital contamination in common, the development of healthcare-associated infections due to the hospital environment is unclear. Researchers looked at the role hospital environments play in the spread of pathogens by direct and indirect contact, plus the prevention of transmission through interventions involving the built environment.

Prompted in part by the development of technologies designed to enhance environmental cleaning or prevent

contamination, research into the environmental role of healthcare-associated infections has increased. Reviewing recent literature, there's growing evidence that contaminated surfaces in patient care areas assist in transmitting pathogens and resulting infections. Single-patient rooms, alcohol hand rub dispensers and other design features can lessen the risk of infection. Touchless technologies and self-cleaning surfaces can reduce environmental contamination and could prevent infections.

Citation
Steinberg, James P., Megan E. Denham, Craig Zimring, Altug Kasali, Kendall K. Hall, and Jesse T. Jacob. "The role of the hospital environment in the prevention of healthcare-associated infections by contact transmission." HERD: Health Environments Research & Design Journal 7, no. 1 suppl (2013): 46-73.

Healthcare Associated Infection Design Project

Using previous multidisciplinary literature and industry findings, researchers studied the link between the built environment and healthcare-associated infections. The results could inform design decisions and advance the evidence base.

The Healthcare Associated Infection (HAI) Design project explores the research linking design interventions to healthcare-associated infection. We evaluated over 3,800 articles and interviewed stakeholders including CEOs, architects, designers, physicians and other healthcare experts. We found that direct or indirect contact between human and environmental sources and susceptible patients in the most common mode of HAI-transmitted pathogens. Meanwhile, the effect of ventilation system design on HAIs is less clear. Regarding the prevention of infection from water sources, the benefits and risks of water features should be considered. We recommend increasing the number of multidisciplinary collaborations between infectious diseases/hospital epidemiology and quality improvement communities, designers, and evidence-based design researchers in order to develop meaningful solutions.

Citations
Zimring, Craig, Megan E. Denham, Jesse T. Jacob, Douglas B. Kamerow, Nancy Lenfestey, Kendall K. Hall, Altug Kasali, David Z. Cowan, and James P. Steinberg. "The role of facility design in preventing healthcare-associated infection: Interventions, conclusions, and research needs." HERD: Health Environments Research & Design Journal 7, no. 1 suppl (2013): 127-139.

CIVIC INNOVATION & HUMANITARIAN SYSTEMS

Expressing Matters of Concern Through HCI Design

In the 21st century, many artists and designers are uncertain about how to create the modern day version of democracy in order to demonstrate and represent the current social conditions and expected futures. Within five years of research through crafting, design researchers Bruno Latour and Peter Weibel examined the shift in contemporary democracy from "matters of fact" to "matters of concern" and studied the role human-computer interaction (HCI) design has in this shift.

The central purpose of our research is to determine how the concept of "design things" functions to express matters of concern, which are conditions considered as objective data. Matters of concern are observed situations and their consequences. We instinctively evaluated five design projects, each of these projects emphasizing

different design strategies used to find and communicate the many aspects of a topic. We used an assortment of setups, including media design, visualizations, workshops, and hackathons. Our conclusion is that the role of design contributes to the formation of publics and HCI design could be used to bring awareness to the qualities and factors that encompass present-day social conditions.

Citation
DiSalvo, Carl, Jonathan Lukens, Thomas Lodato, Tom Jenkins, and Tanyoung Kim. "Making public things: how HCI design can express matters of concern." In Proceedings of the 32nd annual ACM conference on Human factors in computing systems, pp. 2397-2406. ACM, 2014.

The Role of Participatory Design in Constituting Publics

Researchers developed a new theoretical perspective for the role of participatory design in community settings. Through the presentation of two case studies from community-based participatory design projects, the authors develop the theoretical frame of publics and discuss how the concepts of issues, attachments, and infrastructuring are key to their constitution and guide how we understand design's role in such settings.

We considered the differences between the practices of enabling participation and infrastructuring by focusing on the ways that constituting publics foregrounds an engagement with authority structures and unknown futures through the participatory design process. Our goal is to further explore and explain some of the ways that publics form around and through participatory design. We focused on two recent community-based projects. Our findings show that as the scope of design increases, so does the scope of participatory design. Increasingly, PD is being practiced in neighborhood centers, schools, museums, and with communities of interest. Although the methods and theories from PD are still valuable in these contexts, there is room for new perspectives that take into account the different values and relations in these settings.

Citation
Le Dantec, Christopher A., and Carl DiSalvo. "Infrastructuring and the formation of publics in participatory design." Social Studies of Science 43, no. 2 (2013): 241-264.

Supporting On-the-Ground Community Activism

Community activism often functions outside of formal political and institutional means. The way Information and

Communications Technologies (ICTs) support these efforts is examined.

We worked with local housing justice activists to find out how ICT's play a role in complementing forms of civic engagement that challenge institutional authority. We found that ICT's are conducive in supporting and shaping three alternate information practices- situating, codification, and scaffolding. Each of these practices serves the goals of direct democratic engagement. We observed how Occupy Our Homes Atlanta (OOHA) used ICT's at a housing justice action, which allowed us to find ways in which systems can support on-the-ground forms of civic engagement and allows us to envision different kinds of political support, participation, and communications.

Citation
Asad, Mariam, and Christopher A. Le Dantec. "Illegitimate Civic Participation: Supporting Community Activists on the Ground." In Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing, pp. 1694-1703. ACM, 2015.

Nextdoor: Examining Community Social Media

Nextdoor is a social media system designed to support local neighborhoods. Although not unique, Nextdoor has a number of features that separate it from other systems designed to support community engagement.

Unlike Facebook, Craigslist or similar sites, Nextdoor verifies members' residential addresses, giving members confidence that others on the site are actual residents of the neighborhood. Our study focuses on three communities in Atlanta. We illustrate some of the ways in which neighbors are using Nextdoor as a tool in their civic media ecosystems, such as connecting people with existing civic organizations. We also discussed the opportunities and challenges of community-based social media platforms. System design, the scale of communication in supporting large and small conversations, defining boundaries, and the type of information that is appropriate to share are all items to consider.

Citation
Christina A. Masden, Catherine Grevet, Rebecca E. Grinter, Eric Gilbert, and W. Keith Edwards. 2014. Tensions in scaling-up community social media: a multi-neighborhood study of nextdoor. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14). ACM, New York, NY, USA, 3239-3248. DOI=10.1145/2556288.2557319 http://doi.acm.org/10.1145/2556288.2557319

LIVING LABORATORIES & URBAN INNOVATION

Midtown Buzz: Bridging the Gap Between Concepts and Impact in a Civic Computing Initiative

Georgia Tech and Midtown Alliance, an organization representing the major stakeholders in Midtown Atlanta are working together to establish Midtown as an innovation district.

Georgia Tech was able to use Midtown, an urban, mixed-use community, as a laboratory for civic computing research. The project began with brainstorming amongst stakeholders from the community, and then progressed to hack-a-thons and hands-on developer support for building tools and experiences that the brainstorming uncovered as key needs of the community. We gained valuable insights from the project that will drive future developments in the Midtown community.

Citation
Gandy, Maribeth, Laurie Dean Baird, Laura M. Levy, Amy J. Lambeth, Elizabeth Mynatt, Russ Clark, and Matt Sanders. "Midtown buzz: bridging the gap between concepts and impact in a civic computing initiative." In Human-Computer Interaction: Users and Contexts, pp. 303-313. Springer International Publishing, 2015

GT Journey: The Importance of Accessible Rich Data Sources to Enable Innovation

GT Journey is an initiative at Georgia Tech to enable and support students to build sustainable applications and services needed by them and their fellow students on campus. The process is entirely bottom-up, other than funding and opening of previously closed data silos on campus.

First, students are challenged to validate their perspectives, by talking to all affected parties in a system. Students are also challenged to look at problems through the lens of other attempts to improve them. Data is an important element of any successful application or service, and false assumptions on the availability or appropriateness of data frequently occur. Policies, value, and control of data and derivatives of it often become issues, and students are helped to understand these issues and work around them. Finally, sustainability of the services is crucial, and students need to build in ways to keep applications fresh and up-to-date.

Citation
Sanders, Matt, Russ Clark, Brian Davidson, and Siva Jayaraman. "GT Journey: The Importance of Accessible Rich Data Sources to Enable Innovation." In Human-Computer Interaction: Users and Contexts, pp. 82-91. Springer International Publishing, 2015.
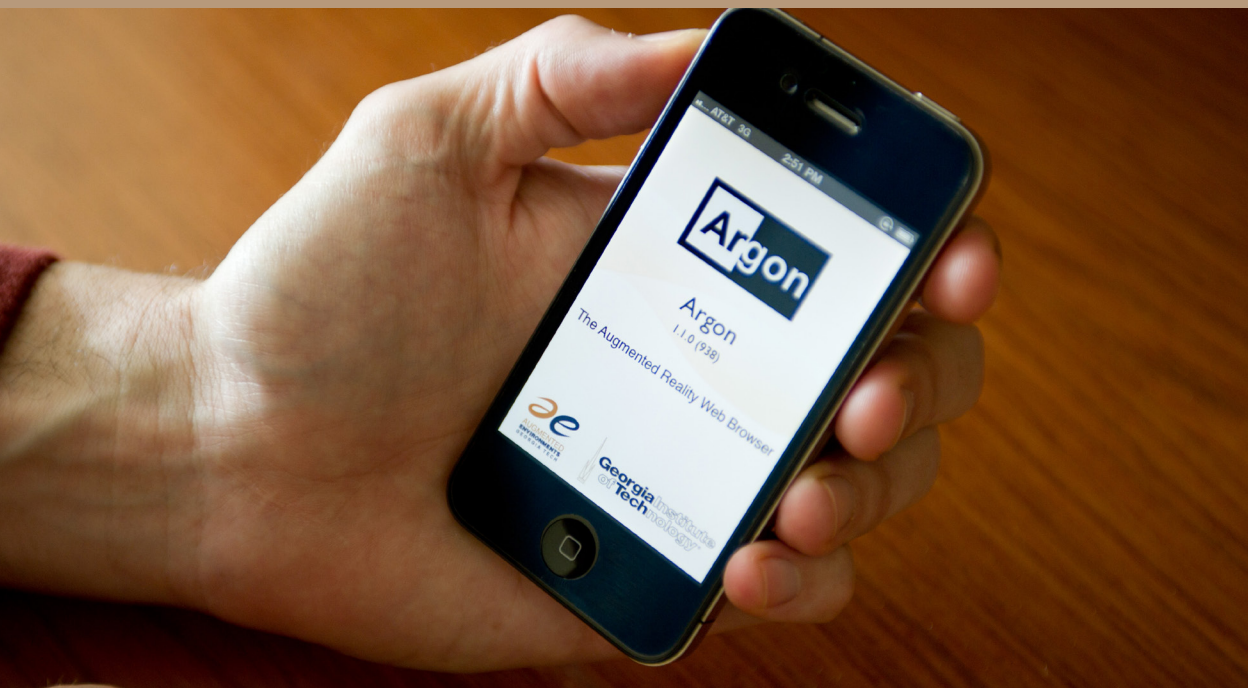
The Convergence Innovation Competition: Helping Students Create Innovative Products and Experiences via Technical and Business Mentorship

The Convergence Innovation Competition is an annual student competition on campus to encourage innovation and entrepreneurship among students. Each year, a new set of competition categories is created in consultation with our industry partners that support the competition with technical support, student mentoring, and money.

The students enter into judging a working prototype as well as a business case, plus a 2-3 minute video pitch. These typically are applications that run on a smartphone, but can take other forms, depending on the category and the student's ideas. Industry partners judge the entries during a live judging event held every Spring, and winners are named in all categories. Students retain all intellectual property, and some teams have commercialized their applications.

Citation
Clark, Russ, Matt Sanders, Brian Davidson, Siva Jayaraman, and Carl DiSalvo. "The convergence Innovation Competition: helping students create innovative products and experiences via technical and business mentorship." In Human-Computer Interaction: Users and Contexts, pp. 144-153. Springer International Publishing, 2015

The Evolution of the Argon Web Browser through its Use Creating Cultural Heritage and Community-based Augmented Reality Applications

The Argon augmented reality browser is an open-source browser for AR applications built using web technologies. It allows for easy creation of many kinds of AR applications and experiences, and, using Midtown Buzz Mobile, allows members of the Midtown community to build their own mixed reality stories about a particular place in Midtown.

We have built several AR apps in Argon; they informed the design of Argon2 and the requirements of Argon3. "The Voices of Oakland" is an AR tour of Atlanta's historic Oakland Cemetery, where many civic leaders and leading citizens are buried. "The Lights of Saint Etienne" was led by students at Georgia Tech Lorraine in Metz, France, and tours the historic cathedral in Metz. "InfrastructAR" is an AR app that allows the user to explore the hidden Wi-Fi infrastructure in campus buildings. Argon2 apps include

a tour of Atlanta's Auburn Avenue historic district, and a tour of Neptun, a historic Swedish Navy Submarine.

Citation
Speiginer, Gheric, Blair MacIntyre, Jay Bolter, Hafez Rouzati, Amy Lambeth, Laura Levy, Laurie Baird et al. "The Evolution of the Argon Web Framework Through Its Use Creating Cultural Heritage and Community–Based Augmented Reality Applications." In Human-Computer Interaction: Users and Contexts, pp. 112-124. Springer International Publishing, 2015.

Cycle Atlanta and OneBusAway: Driving Innovation through the Data Ecosystems of Civic Computing

Two distinct projects underway in the metro Atlanta area, Cycle Atlanta and OneBusAway, explore the broader issues of digital democracy and smart cities. Researchers look at the idea of app-driven and data-driven civic computing.

Cycle Atlanta is an app that can be downloaded by cyclists and run whenever they take a bike ride. Their routes are recorded and uploaded to a central database. This data is then utilized by transportation planners to learn where cyclists choose to ride, and in some cases, where they choose not to ride. This data can help inform cycling improvements to the city transportation infrastructure. Following the launch of the app, over 1500 cyclists provided data to the system, whereas a public meeting on new bike improvements might draw at best 50 people. OneBusAway turns this model around; it provides real-time data on bus and train arrival times to riders of the public transit system. This provides improved service to end-users, improving rider satisfaction, and making them more likely to choose transit over other less-efficient modes of transport (private car, taxi)

Citation
Le Dantec, Christopher A., Kari E. Watkins, Russ Clark, and Elizabeth Mynatt. "Cycle Atlanta and OneBusAway: Driving innovation through the data ecosystems of civic computing."

Planning with Crowdsourced Data: Rhetoric and Representation in Transportation Planning

Researchers examined how data, collected as part of the Cycle Atlanta mobile phone app of bicycle riding patterns in the City, were used as a part of a three-day urban planning event. Data can be used in three ways: data as authority, data as evidence, and data as ambivalent.

We found that the use of this data was successful in helping the design process, but the exercise did open up new issues that will inform future design activities.

Citation
Le Dantec, Christopher A., Mariam Asad, Aditi Misra, and Kari E. Watkins. "Planning with Crowdsourced Data: Rhetoric and Representation in Transportation Planning." In Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing, pp. 1717-1727. ACM, 2015.

Quantifying the Impact of Real-Time Information on Transit Ridership

Looking at data from three cities – Atlanta, Tampa, and New York City – researchers examined whether real-time information increases transit ridership.

The idea behind using real-time information in a transit system is that access to such data will improve the public perception of the reliability of transit systems. However, in a study undertaken, only New York City had increases in ridership corresponding to the access to real-time data. We believe this is due to relatively low service on the routes in Atlanta and Tampa, versus a much higher capacity system in New York.

Citation
Brakewood, C. "Quantifying the impact of real-time information on transit ridership." PhD diss., PhD dissertation, Georgia Institute of Technology, 2014.

Rethinking Atlanta's Regional Resilience in an Age of Uncertainty: Still the Economic Engine of the New South?

This book chapter examines the nature of Atlanta as a Global City, and its dual nature as a 20th century growth engine, as well as a goal to become a 21st century high-tech regional R&D dominated economy.

We also examined possible cracks in the foundation, felt in the aftermath of the global recession, as well as other unsolved challenges, such as lower than average educational systems. Atlanta is a highly diversified economy, which provides both strengths and weaknesses.

Citation
Clark, Jennifer (2014) Rethinking Atlanta's Regional Resilience in an Age of Uncertainty: Still the Economic Engine of the New South? In Harley Etienne and Barbara Faga, Eds. Planning Atlanta: Ruins and Resurgence. American Planning Association Press*

Putting Innovation in Place: Georgia Tech's Innovation Neighborhood of Tech Square

What are the elements underlying the success of Georgia Tech's innovation district, Technology Square?

Researchers analyzed the key actors in such a district, the entrepreneurial university, industry, and government partners. This article looks at the creativity required to enable such efforts in a time of dwindling public financial support for universities. The projects of peer institutions are also examined, including those at MIT and Penn, anchored at or near the university; south Boston and South Lake Union, where an area is re-imagined as a urban innovation district, as well as more suburban models such as Research Triangle Park.

Citation
Giuffrida, Greg; Jennifer J. Clark; Stephen E. Cross. "Putting Innovation in Place: Georgia Tech'sInnovation Neighbourhood of Tech Square." in M Massaro (Ed.), Proceedings of the 10th European Conference on Innovation and Entrepreneurship. . Aug 2015.: 214-222.
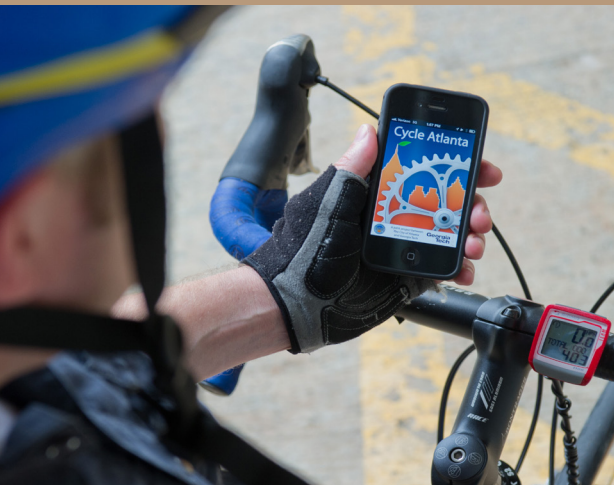
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