Georgia Tech Serve-Learn-Sustain

Smart Cities, Connected Communities Fellows Blogs

Spring Semester 2017

Contents

SLS SCCC Blog Post

Dan Amsterdam, Assistant Professor
School of History and Sociology, Ivan Allen College of Liberal Arts

As an historian of cities and social policy in the modern United States, it was difficult not to view the presentations and discussions during my time as an SLS Smart Cities Fellow through an historical lens.

More specifically, I am an historian who primarily investigates the relationship between politics, power, and policy outcomes broadly construed. While thankfully few of the presenters discussed the potential of Smart Cities in overly Pollyannaish terms, I was nonetheless repeatedly reminded of how various policy initiatives have been deployed in U.S. history with excitement similar to what many current practitioners have for Smart City technology.

It was encouraging that nearly all of the presenters stated a clear commitment either to promoting equity through Smart City technology itself or at least to implementing that technology equitably. But for me these assertions begged a question: how can we ensure that equity remains a goal of such endeavors?

I do not question the commitment of the presenters to equitable processes and outcomes. But my understanding of history suggests that effectively promoting such outcomes almost always demands more than just the commitment of well-intentioned experts working with or even in government. Rather, it often demands sustained and empowered coalitions of various constituencies – from individual voters to civic organizations.

Thus, I left the fellowship wondering whether such coalitions and constituencies exist in Atlanta. If not, how should they be formed?

And yet, in my mind, an even more fundamental question precedes that one: should building political coalitions around Smart Cities be made a priority at this point in history given the array of challenges facing inhabitants of cities like Atlanta? Or, as they leave their offices and laboratories to engage in the public sphere, should Smart City experts who care about equitable outcomes instead do their part to build coalitions that seek to promote equity in general and then suggest ways to deploy Smart Cities technology to serve the ends that those popular coalitions are striving to achieve?

My sense from studying history is that the latter path might lead to the most equitable outcomes in the end. Without broad, empowered coalitions committed to social justice, the equitable deployment of technological expertise, including potentially around Smart City technology, risks becoming a matter of noblesse oblige. As the history of American politics and public policy suggests, such an approach leads to highly inconsistent outcomes at best when it comes to equity.

Teaching Smart Cities

Jennifer Clark, Associate Professor, Director of the Center for Urban Innovation
School of Public Policy, Ivan Allen College of Liberal Arts

Smart cities present a very interesting challenge to teaching and to curriculum development in universities. This is a technology-intensive field which is fundamentally interdisciplinary and necessarily rooted in the social sciences. What *makes* cities are people — the choices they make, the places they go, the things they buy, and where they live and work. The built environment shapes those choices and urban systems facilitate or aggravate both movement across and living in cities. But at their core, cities are complex political, economic, and social systems. So, the challenge of smart cities is not one of technology alone. Indeed, most of the relevant technologies exist and currently operate in other contexts like manufacturing and defense. The question then becomes — beyond a grasp of the underlying technologies — what does one need to know to be a smart cities expert?

What are the prerequisites for studying smart cities? Does it require a background in data analytics? Civic computing? Civil engineering? Or, does the mastery of smart cities require knowledge of cities themselves? Stated another way, could you effectively study biotechnology without mastering organic chemistry or biology? Could you study astrophysics without an understanding of physics and mathematics?

I began teaching university-level courses about how to study cities in 2004 at Cornell University. The first course I taught was an introduction to urban fieldwork tailored to undergraduate urban studies students. The course was intended to prepare students for careers that required understanding the actors and processes that shape the urban environment.

Since then, I have taught many other courses on urban policy and urban and regional economic development at Georgia Tech. I have also coordinated a graduate concentration of the MSPP degree in public policy specializing in urban policy and anchored by a two semester course sequence PUBP 6604: Urban Policy Analysis and Practice and PUBP 6606: Urban Development Policy. And, in my experience, every year these courses change at the margins if not in their core content. These courses change because cities themselves are dynamic — what cities do and why and how changes over time and thus, so does the study of them. After teaching these courses for more than a decade, I see them now through the lens of the evolution of the field itself from urban policy to urban innovation.

In February 2016, the President's Council of Advisors on Science and Technology (PCAST) released a major report "Technology and the Future of Cities." The report outlined a strategy to guide federal investment and engagement in smart cities initiatives. Although the future of these initiatives and the impact of the original PCAST report in influencing investment is uncertain, the report itself revealed some interesting absences. Only a small number of the more than 100 contributors to the Future of Cities Report represented the perspective or expertise of the social sciences focused on cities and the urban scale: urban policy, urban planning, urban geography, urban history, urban economics, or urban administration.

Historically, the array of social science fields focused on cities are sub-fields of much larger disciplines — economics, political science, geography, history. After decades of deindustrialization and disinvestment in cities, these sub-fields are not always the most popular or publicized. However, urban planning — to varying degrees — is the exception to the sub-field rule. Within urban planning, the consensus opinion has long been that urban planning is a discipline of its own. Its disciplinary boundaries run parallel to architecture in that there is a core curriculum, a professional master's degree, professional certifications, and a clear professional practice. One is trained as an urban planner to work in urban planning. In other words, urban planning has rarely identified as an interdisciplinary project.

As a consequence, "smart cities" as a domain, has emerged into the world of degrees and disciplines in which its home is likely to be fluid rather than fixed. Teaching smart cities will likely be a collaborative and interdisciplinary project with its core knowledge claims rooted in an understanding about the workings of cities and its novel value claims oriented around its interdisciplinarity and its integration of knowledge about not just technology but how technology can be used in the urban context.

For me and the curriculum I teach, the promise of urban innovation is exciting. I look forward to teaching urban policy as the landscape changes and smart cities becomes a centerpiece of investment and administration. Cities have never stood still. There is no reason why the curriculum about them should either.

SLS SCCC Blog Post

Russell Clark, Senior Research Scientist
School of Computer Science, College of Computing

This Spring I had the opportunity to participate as a Serve-Learn-Sustain Fellow in the Smart Cities and Connected Communities program. While we have been actively ramping up our work in the Smart Cities area, the SLS program provided a great way to connect with others in the Georgia Tech community and identify opportunities for collaboration.

The focus of our project group was to look at platforms and services that could be identified, curated, and/or developed to support research and education programs across campus. We had a good mix of people from different academic units as well as campus services.

An important outcome of this experience for me is the recognition of the opportunities we have at Georgia Tech to treat our own campus as a first class smart city. We have long talked about campus as a living lab for prototyping and testing. But the reality is that we have the ability to move this work beyond research and into the production and operational domain in order to have real impact on the way our campus operates.

I look forward to working with our colleagues to bring the real operational challenges and resources such as building inventory and utility datasets to students across campus. This will give students the opportunity to have real impact on the community in which they live.

K-12 Curricula and Teacher Professional Development Related to Smart Cities

Lizanne DeStafano, Professor, Associate Dean, Executive Director of CEISMC
School of Psychology, College of Sciences

As Atlanta and Georgia Tech collaborate to make Atlanta a "Smart City," it seems important to think about educating K-12 students and teachers about the Smart City concept and teaching them skills and dispositions necessary to thrive in a Smart City. For schools in disadvantaged communities, cameras and other monitoring technology are perceived negatively as "surveillance" and residents generally believe that this information is not available or useful to them. By incorporating information and activities on Smart Cities into K-12 curricula, teachers, students and families can become more aware of and engaged in the data collection and use. The ultimate outcome is empowerment and understanding that will increase the impact and effectiveness of Smart Technology to improve quality of life.

SLS SCCC Blog Post

Betsy DiSalvo, Assistant Professor
School of Interactive Computing, College of Computing

As part of the 2017 SLS Smart Cities Fellows, the Education SLS affinity group represented a diverse set of interests. We worked to develop a cohesive project during the spring of 2017. Initially we found that the idea of producing a dialogue and paper to identify the educational issues that might be addressed would be of interest to the whole group. Dan Amsterdam was interested in developing educational programs using historical evidence to explore how urban data shapes public policy and social structures. Yanni Loukissas was interested in understanding how digital media and visualizations shaped our perceptions of data gathered through smart city technology. Linda Wills saw the potential in developing educational outreach programs that leveraged the hardware used in smart city sensors – to make learning about computer engineering relevant and authentic. Marilyn Goodson was interested in developing summer camps around the idea of smart cities. I was interested in developing educational tools about smart cities to empower the public to protect their privacy and leverage data for grassroots social change.

We had multiple discussion and brainstorming session to find a way to fuse these diverse ideas that ranged from historical perspectives for undergraduate and graduate students to summer camps for middle school students. In the end, we struggled to identify the most critical aspects for teaching citizens and students about smart cities. Dr. Amsterdam, Dr. Loukissas and myself identified that we were more focused on undergraduate education and chose to develop cross over classes for the fall 2017.

In my course on the design of educational technology, I will leverage Dr. Amsterdam's and Dr. Loukissas' expertise to inspire students to design educational websites, workshops, and visualizations that will engage citizens to learn about smart cities. This semester long project will begin with the teams of students developing a needs assessment to identify both the aspect of smart cities that are most critical for the public to learn about and specific audiences that will be impacted by smart city approaches to gathering data and decision making based upon data collected. After completion of the needs assessment, teams will identify learning goals, audiences, a learning theory or approach. Based upon this the teams will design an educational technology that will help them meet the learning goals. The goal for the students is to have a concrete problem that has enough constraints to push their creativity and meet learning goals for the course, and enough freedom so they can develop a project that is meaningful to them. My goal is to use the student project to begin to outline what are crucial learning goals for smart city public engagement.

SLS SCCC Blog Post

Ameet Doshi, Director, Service Experience & Program Design
Georgia Tech Library

I was so honored to be part of the Participation, Access, Community and Equity SLS affinity group during spring 2017 with Neha Kumar, Todd Michney, Juan Carlos Rodriguez, and Emma French. Our discussion and effort over the course of the semester resulted in a highly engaging, participatory panel discussion about issues of participation and equity as they relate to smart cities. The event was held in Clough Commons and attracted members of the Georgia Tech community as well as (and importantly) many community members who do not have a formal affiliation with GT. The discussion was recorded and is available here: https://smartech.gatech.edu/handle/1853/56666

I co-host a weekly podcast about libraries called "Lost in the Stacks" with my colleagues (and radio raconteur), Charlie Bennett. Each week we pick a theme related to libraries and free associate an hour of discussion and theme-related music. We recently did two episodes of "Lost in the Stacks" about Smart Cities. The first episode is called "Smart Cities, Smart Libraries" and includes an interview with the new executive director of the Atlanta Fulton Public Library System, Dr. Gabriel Morley. Dr. Morley eloquently and passionately describes the evolving role of public libraries in the urban environment. He also talks about the planning and design currently underway for the new downtown branch of the AFPLS. You can hear the discussion here via the Georgia Tech SMARTech repository:

https://smartech.gatech.edu/handle/1853/56656

The second episode in our series about Smart Cities is called "Town, Gown, Cardigan" and includes an interview with Debra Lam. Debra is the new managing director of Smart Cities and Inclusive Innovation with the Institute for People and Technology (IPaT) at Georgia Tech. She discusses her experience working within city government and (now) academia, and also expresses her hopes for how research libraries can support smart cities and inclusive innovation. The full episode is here:

http://traffic.libsyn.com/lostinthestacks/LITS_Episode_341.mp3

Finally, I had the wonderful experience of supporting Stuart Romm's "Ecological Practice" course in the College of Design during spring 2017. In case you don't already know Stuart, he is a principal architect with the Praxis3 architectural design firm here in Atlanta and is also a Professor of the Practice with the GT School of Architecture in the College of Design. One of the student teams in our class built a "little free library" in the structure of a geodesic dome and installed their project on the Atlanta BeltLine. Their "Freedome Library" is an impressive example of tactical urbanism in the service of improving the social ecology of the city. The students discussed the design, construction and ecological principles inherent to their "Freedome Library" on the Lost in the Stacks podcast a few weeks ago.

SLS SCCC Blog Post

Scott Duncan, Research Engineer
School of Aerospace Engineering, College of Engineering

Team: Russell Clark, Scott Duncan, Mary Hallisey Hunt, Ben Mason, Iris Tien

I am a Research Engineer in the School of Aerospace Engineering (AE) with a long-running interest in how my primary field of research, systems engineering, can be applied to address challenges in sustainable development. The SLS Smart Cities Fellow Program provided me with a great opportunity to explore that by introducing me to other like-minded GT faculty members and staff as well as local leaders to discuss the latest issues regarding Smart Cities and brainstorm how to collaborate on projects going forward.

Although my home is in AE, my research focus is the design and analysis of large scale terrestrial energy systems: gas turbines for electricity generation, combined cycle power plants, electric grids, district heating and cooling, and building energy systems. The impact of these systems on climate change and natural resource consumption are a key concern of mine. Yet, while my engineering work exposes me to the technical, environmental, and economic components of sustainability, I craved more opportunities to understand its *social* components, especially at the city scales that affect the populace most. How are the increases in data and connectivity empowering or complicating the sustainability of cities? This is a vast area for investigation, and it requires collaboration, making the SLS Fellows program is a great entry point.

In the program, the two main modes of interaction were with guest speakers as well as with a subset of SLS Fellows in side discussions. The speakers were all local to Atlanta, passionate, and skilled at overviewing the opportunities and giving a sense of the "wicked" problems underlying them. From Torri Martin, I learned about Atlanta's SmartATL program, comprising funding mechanisms, partnerships, processes, pilots, and data platforms. I got the sense that there is a real opportunity, especially for Georgia Tech, to get involved early as this unfolds, e.g., in the North Avenue Corridor. From speaker Ryan Gravel's presentation (which had many slides in common with this one), I gained an appreciation for the story telling component of city planning and how that clarifies the scale and interconnectedness of the systems involved. From me, that top-level framing is needed for motivation and for setting the stage for many "lower level" technical ways forward in realizing the vision. These are the types of things I sought in the Fellows program—answers to the questions "What is going on currently? How can we think about these ideas? Where might an engineer begin to dig in?"

The second mode of interaction was with our SLS Fellows sub-team, who was challenged to devise a project for the semester. The Systems Group, of which I was a part, decided that developing ideas for proposals was appropriate, and we hashed out a couple of ideas. One involved a GT campus-level "story mapping" activity, the type of thing that could be presented via a visualization platform such as ArcGIS. We were inspired by previous Story Map examples, e.g., the Georgia Coastal and Marine Planner. At some point in the future, I can foresee an effort to piece together—and tell a story around—the issues, opportunities, and disparate data sets relating to “city” scale themes such as water. This could focus on Georgia Tech at first and later situate its data and stories within the larger context of Atlanta and its more aggregate data sets, e.g., for watersheds.

Our SLS Fellows team will certainly stay in touch and probably collaborate in the future. The summer should offer more time to evaluate where to take these ideas forward. Perhaps this could be the focus of a future SLS blog post.

Toward Living Cities through Interactive Smart Communities

Ceyhun Eksin, Postdoctoral Researcher
School of Biology, College of Sciences
School of Electrical and Computer Engineering, College of Engineering

Over the last decade many socio-technical systems have seen the emergence of new tools for sensing, communication, and computation. These tools are tailored to the needs of socio-technical systems offering unprecedented opportunities for increased performance, reliability, and automation. A smart city is one such socio-technical complex system where new emerging cyber elements such as sensors, data storage and processing units interact with the physical aspects of the city, e.g., electricity resource, transportation etc., with humans in the loop. There are fundamental questions on what a smart city should entail and how it should operate. To find answers to these questions we need to consider the societal problems we currently face, and identify "smart" ways to address them. As a team of SLS fellows from diverse backgrounds, we identified emergency response to natural disasters such as earthquake, flood, or disease outbreak as a common problem faced by all cities. The question that is of interest was: How should emergency response be in a smart city? In particular, how can we design or use the existing cyber capabilities of a city to improve performance during, e.g., an epidemic outbreak? This kind of challenge can only be addressed via interdisciplinary research and training thrusts like the SLS Fellows program on Smart Cities & Connected Communities. The discussions in our team were influential in outlining core perspectives of a research initiative around the questions above. Our success in answering these research question relies on our ability to understand the intercoupling of the social, biological, and technological components of the city. For instance, the public response to flu vaccination campaigns, or to outbreaks like the recent Zika epidemic have shown that comprehensive understanding of the dissemination of opinions on social networks together with disease dynamics is consequential in disease forecasting and public health policies. In this case, initial efforts need to focus on modeling and understanding of social networks, and their impact on human behavior during a disease outbreak. Based on the findings of the modeling efforts, the next research thrust considers the design and improvement of performance during an epidemic. In particular, we can use data-driven optimization approaches to design or shape social networks to incentivize human behavior during an epidemic for a better overall system performance given limited resources and communication access.

Similar to the approaches taken by SMARTATL municipal office that visited one of the SLS meetings, we proposed to develop proof-of-concept models and tests first on a building, then for the university campus, and then potentially scaling up to the city level. The project will help identify key metrics of performance and resilience during an emergency in a smart city considering multiple stakeholders, and develop data-driven approaches to measuring them. Overall, the research project will produce state-of-the-art models of emergency response from a holistic perspective taking into account social, technological and biological aspects of the city. The systems approach to these problems will provide insights for smart public health policies as well as for implementation and design of cyber capabilities of the city in responding to emergencies.

SLS SCCC Blog Post

Mary Hallisey Hunt, Senior Research Associate, Director of Research and Business Operations
Strategic Energy Institute

As I considered what to blog about as part of my Smart Cities Fellows Program, my ideas were all over the map –- Should I share my thoughts about technology innovations, sustainable economic development, higher quality of life issues, or a myriad of other potential applications? How should I translate and write about my journey through the many aspects of this topic? Research associated with Smart Cities and Connected Communities is extensive and diverse so instead of reflecting on the many facets or even just one facet, I decided to share my experience over the course of the Fellows program.

My original proposal was built upon other projects I have been involved with over the past few years. The concept was to use an ArcGIS StoryMap platform to identify and share (via the web) safe and informative walking pathways between Georgia Tech and its neighboring communities. Story maps involve just that – communicating something – a story, a process, a journey – using a web based interactive map that condenses lots of data into an easy to read viewer. Once you choose your topic, identify your data strategy (what to include), and create your web map, you share it on the web with interested communities. Obviously, there is a lot more work that goes into the design and execution of a story map so if you're interested in learning more about the concept, information can be found at www.arcgis.com and examples of Arc GIS StoryMaps developed at Georgia Tech can be found at the GT Center for GIS webpage found at https://cgis.gatech.edu/maps.

As our team considered ideas for a project, each of us in the SLS Systems Group realized that we defined the term Smart Cities a bit differently. We looked at potential projects based on our own understanding of what it means to be a Smart City. As we moved through the program, gaining background about how Atlanta is approaching Smart Cities and its efforts to create more "connected communities" within the city, ideas for our group project began to take shape. Based on the interest of several group members, we selected an overarching plan to outline a project examining watershed issues on the Georgia Tech campus that would connect campus facilities and other research based groups using an ArcGIS StoryMap platform. A few examples of ideas that grew out of our smart city/watershed discussions included water challenges for the new Living Building Project, flooding susceptibility and the impacts to communities beyond GT's boundaries, and storm water management and recycled water applications for campus.

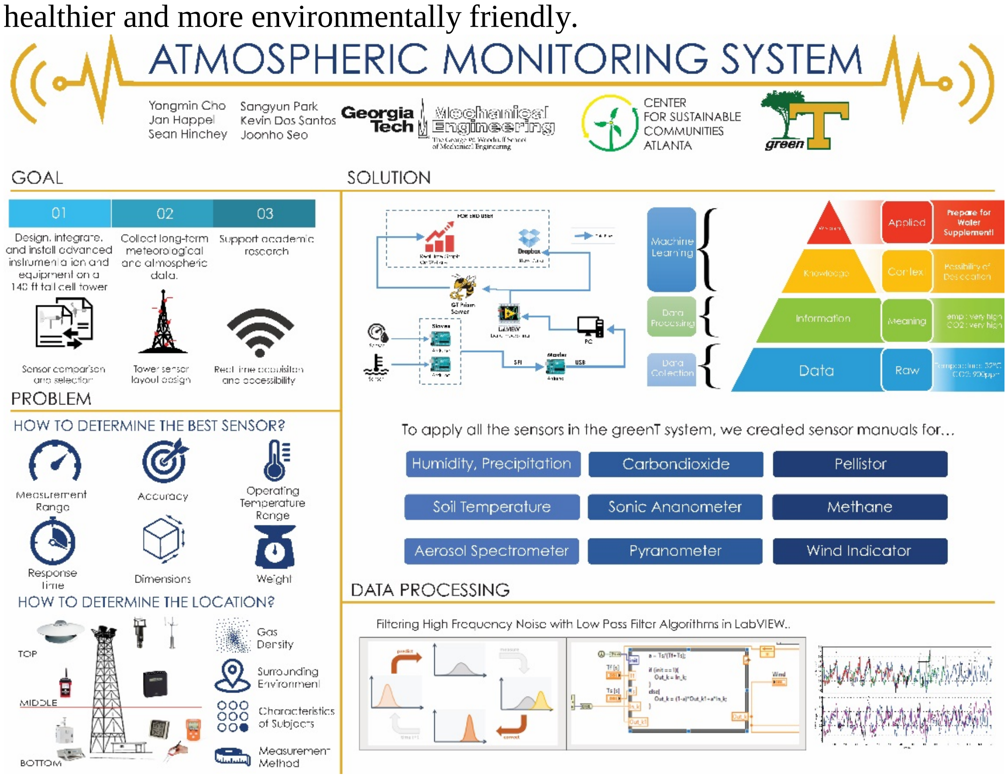
Although we have not formalized a proposed project on this topic, members of our team continue to work on various projects within our disciplines that may result in further work in this area. As new projects evolve, the network of potential campus collaborators that were developed over the course of our work with the Fellows Program will more than likely turn out to be one of the most valuable components of the experience.

Design and Systems Thinking for Sustainable Communities

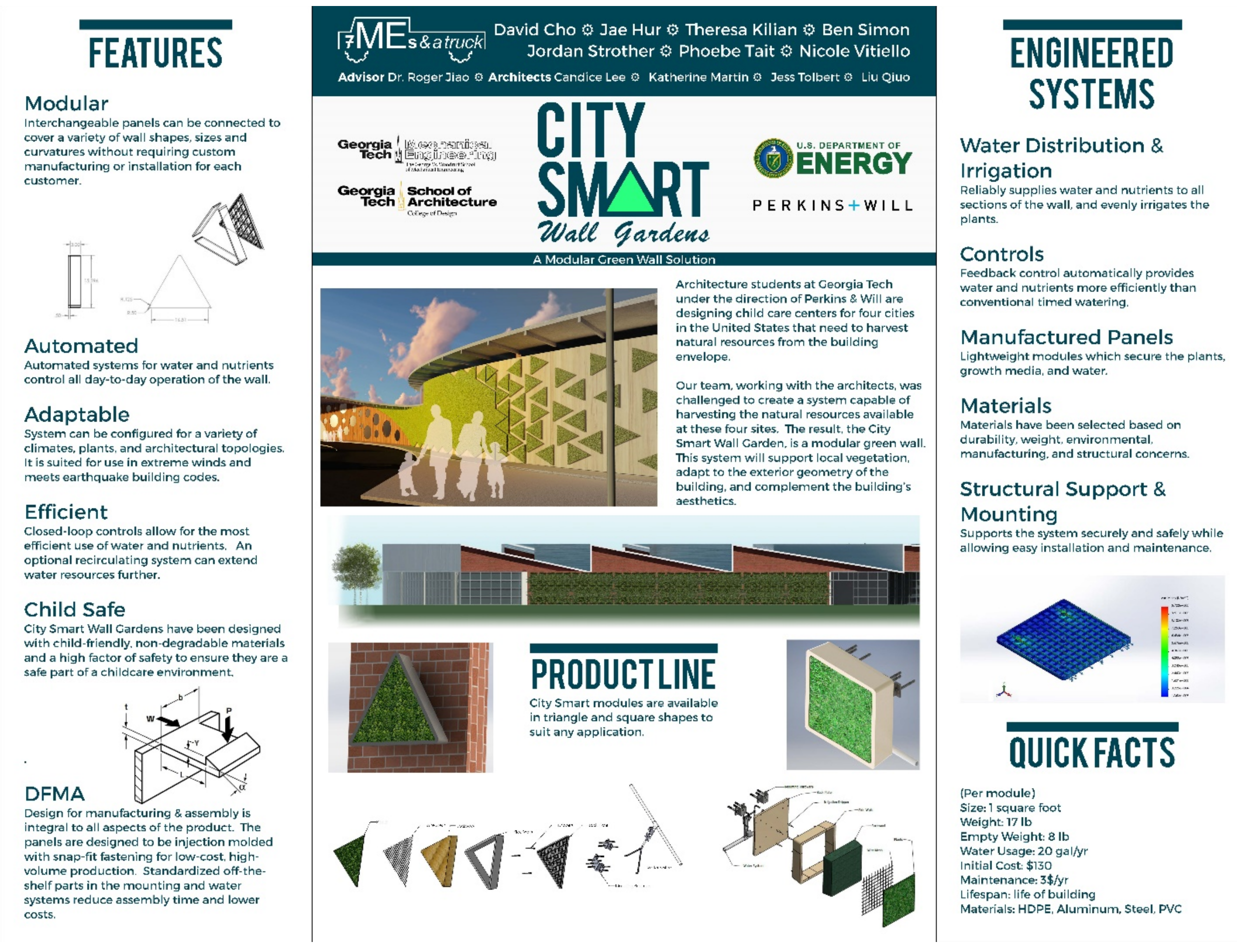
Roger Jiao, Associate Professor
George W. Woodruff School of Mechanical Engineering, College of Engineering

We taught students systems thinking of sustainable community development through the Mechanical Engineering capstone design course (ME4182 - C & D) in Spring 2017. Bearing in mind the broader implications of sustainable communities, the students worked through the design stages of problem definition, data acquisition, evaluation of design alternatives, selection of a preferred alternative, and design development. The students were inspired in their designs by examining the multiple dimensions of sustainable community development, including local economic diversity, self-reliance, reduction of energy and waste, protection of local ecosystems and stewardship of natural resources, and social justice. The three posts below showcase how our students innovated their designs by going beyond traditional engineering systems design specifications and incorporating the sustainable community issues:

***Post 1: Cloud-based Atmospheric Tele-Monitoring System**,*
by Joonho Seo, Sangyun Park, Yongmin Cho, Kevin Dos Santos, Jan Happel, and Sean Hinchey – In collaboration with the Center for Sustainable Communities in Atlanta, this project aimed to establish an atmospheric monitoring station that is capable of recording a large variety of meteorological and atmospheric data and detecting trends across long periods of time. The project delivered a cloud-based system design that integrates the desired censors to the system and the installation of the instrumentation to a 140 foot-tall cellular tower located in Atlanta empowers the capabilities of collecting and monitoring long-term data. The long term goal was to provide communities with the resources and education to make their living environment healthier and more environmentally friendly.

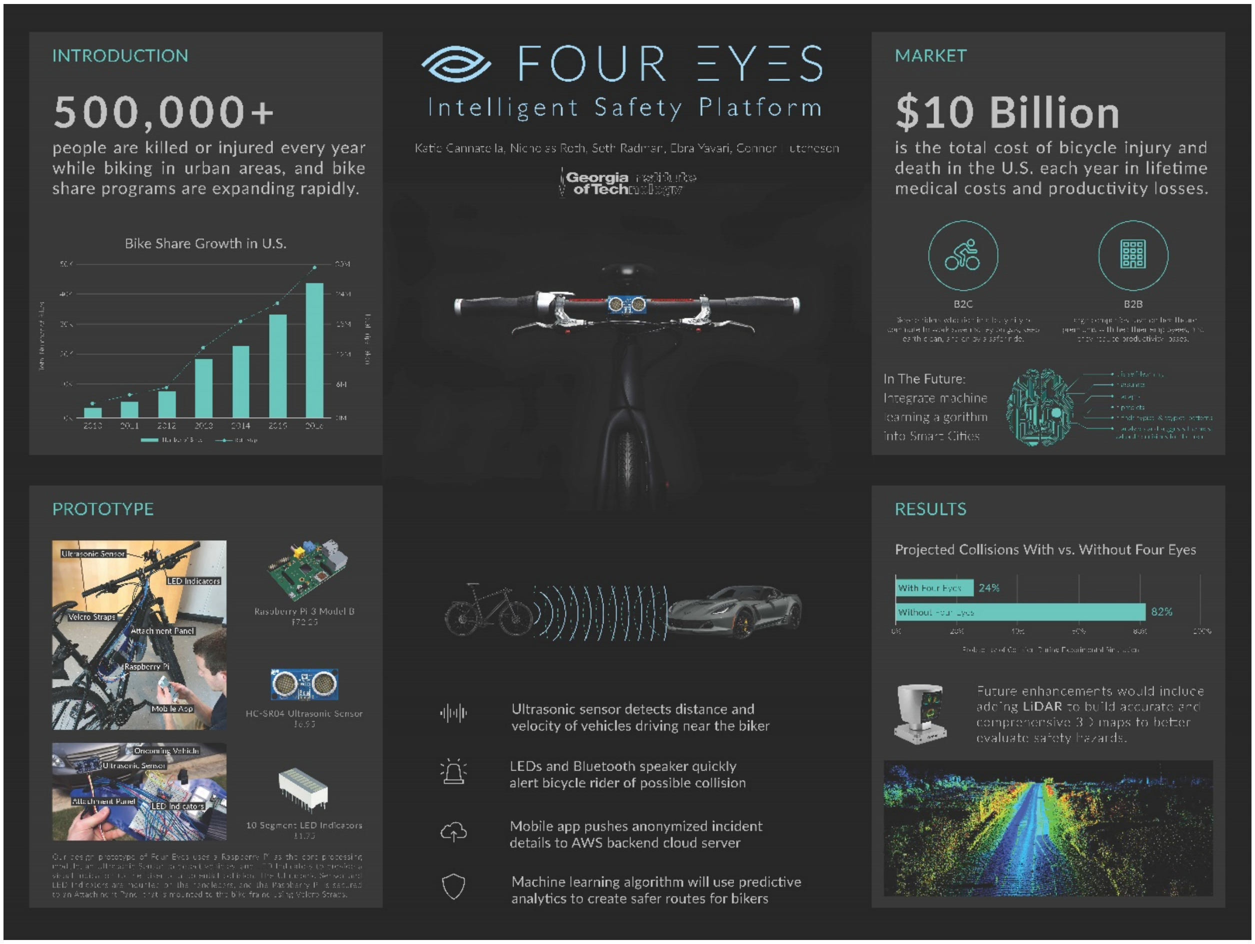


Post 2: Smart Modular Mounting Systems for Building Green Wall*, by David Cho, Jae Hur, Theresa Kilian, Ben Simon, Jordan Strother, Phoebe Tait, and Nicole Vitiello* – The students collaborated with School of Architecture students, working on a project of designing child care centers for four cities in the United States that need to harvest natural resources from the building envelope. The students managed to design a smart modular green wall mounting system. The system supports local vegetation, adapts to the exterior geometry of the building, and complements the building's aesthetics. They addressed a few technical issues related to minimization of plant maintenance in such a tech-ecosystem, being durable in the weather of the four cities that include Los Angeles, Boston, Minneapolis, and Miami, meeting building codes, and being self-sustaining. This system must also accommodate small to medium sized plants, have a sensor-based plant monitoring system, be easily repairable, and can be integrated into other building systems.



Post 3: Smart Four Eyes: An Intelligent Bicycle Safety Platform through Shared Helmets*, by Seth Radman, Connor Hutcheson, Katie Cannatella, Nick Roth, and Ebra Yavari* – This project envisions sustainable community development through shared bicycles in cities. Bicycle safety in metropolitan cities is of high importance to an urban society. The project aimed to reduce

bicycle accidents by streamlining user access to bicycle helmets. The system also considers a sustainable business model of the shared economy through financial viability options by creating the means for public advertising on the helmet distribution system and the individual helmets. A smart sensor-based helmet distribution system was developed with such features as solar powered roofs, wireless locking mechanisms, and Wi-Fi enabled vendor stations. The helmet distribution project inspired a proactive approach towards resolving the bicycle safety issues.



Smart Cities: Panacea or Distraction?

Alex Karner, Assistant Professor
School of City & Regional Planning, College of Design

The idea that technology can solve the problems of the modern city—air pollution, noise, traffic congestion, parking, crime, and refuse collection, among others—has been encapsulated in the notion of the "smart city." Smart city proponents envision a future in which sensors become ubiquitous. Cameras would be embedded into traffic signals and garbage cans, providing a steady stream of information that can be used to provide real-time control and monitoring, ideally pushing the entire system towards greater efficiency.

While it's true that some technology could improve certain aspects of city life, the notion that smart cities are a necessary or even desirable step in the evolution of our urban areas should be questioned. Importantly, technology and sensors would do little to address the fundamental injustices that inhere in contemporary cities and regions. At worst, smart city technologies could distract from more radical changes to governance and finance needed to redress prior inequities. Throughout the course of the past semester, as an SLS Smart Cities, Connected Communities Fellow, I was able to discuss and develop these critical perspectives on smart cities with my colleagues.

One concrete example of a problem that smart cities are ill-suited to address is traffic congestion. Traffic congestion is caused by many people wanting to be in the same location at the same time. It is an indicator of economic productivity and success. But in the absence of viable alternatives to driving, single occupancy vehicles become the preferred mode and roads become choked with traffic. Additionally, many different factors play into the decision to buy or rent a home in a certain location. For families with children, public school quality often looms large. But the location of "high quality" school districts has been shaped by the post-World War II "white flight" that saw affluent white families move out of central cities and into their own suburban jurisdictions. Through restrictive housing policies, these enclaves have largely remained exclusive. Low-wage workers employed in these areas cannot often afford to live there and must commute vast distances to get to work. High-wage workers that live in suburban communities often commute to another suburb or to central cities.

Thus, decisions about housing location also dramatically affect transportation and contribute to congestion. Will smart city technologies break down these exclusionary barriers, or provide low-income families with access to opportunities like high-quality education? Will they provide viable commute alternatives so that people who wish to can forego driving?

The solutions to these problems are already known and have been for some time. Construct affordable housing in prosperous suburban areas, so that quality schools can be accessed and commutes for low-wage workers can be shortened. Make driving more expensive, and invest heavily in public transit with dedicated road space so that users save travel time that can be used productively. Provide opportunities to live densely near high-quality public transit. Unfortunately, these solutions require funding, political will, and the ability to see beyond the current situation, where alternatives to automobile dependence appear unimaginable. Only if technology is leveraged to produce the political will necessary to redress prior inequities can our cities truly be considered "smart."

Is a Smart City a Feminist City?

Neha Kumar, Assistant Professor
The Sam Nunn School of International Affairs, Ivan Allen College of Liberal Arts
School of Interactive Computing, College of Computing

According to the United Nations, more than 3.5 billion of the world's population lives in cities and this number is slated to rise by 2.5 to 3 billion by the year 2050. Recent years have seen a growing focus to turn several of these urban developments into "smart cities". The metrics for assessing a city's smartness are not universal, however, aside from an uncontested enthusiasm towards improving infrastructures that support "Internet of Things" in order to more effectively manage the city's existing resources. Beyond the always online access that this notion of a smart city is linked with, my research seeks to examine whether a smart city is also a feminist city? In other words, do its values align with feminist values such as those of pluralism, participation, and advocacy? And if they do not, how might they be brought into greater alignment?

A recent essay by Ankita Rao titled "Sexism and the City" states that most cities were designed around men and their work, suggesting that urban planning could have a big role to play in improving safety for women, especially in undoing/redoing planning as it was conceived of in less progressive eras. Survey data included in this article highlights that while 60% of women survey respondents felt unsafe in multi-¬story parking structures, only half that number of men felt unsafe. Other data shared in the article also emphasizes that as times change and the roles played by women evolve, there is a greater need for us to think about how cities could be planned to support this new and growing mobility of women, and how infrastructures could be put in place to back necessary safety measures.

Research we conducted recently in New Delhi (Karusala & Kumar, 2017) also highlights the role that city infrastructures and transportation in particular have on women's safety. Looking at gender equity alone, how might we ensure that smart cities are also safer cities, particularly for women? Understanding this would require understanding how women are and could be participating in the transition to smart cities, whether there are particular literacies that they must acquire in order to have their voices heard, and if there are specific needs (such as those of safety) that must be dealt with differently than they have in the past.

1. Rao, Ankita. 2017. "Sexism and the City" Motherboard. May 15, 2017. Available on: https:// motherboard.vice.com/en_us/article/sexism--and --the --city?utm_ source=tnyb

2. Karusala, Naveena & Kumar, Neha. 2017. "Women's Safety in Public Spaces: Examining the Efficacy of Panic Buttons in New Delhi." In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Sys tems (CHI '17). ACM, New York, NY, USA.*

Designing “Data Walks” on the Atlanta Beltline

Yanni Loukissas, Assistant Professor of Digital Media
School of Literature, Media, and Communication, Ivan Allen College of Liberal Arts

What do sustainable communities look like through public data? Today, data on communities in Atlanta are increasingly available. Micro and macro changes in the makeup of local neighborhoods can be tracked through tax records, demolition and construction permits, and community surveys, among other sources; all of which might be easily downloaded by anyone with an internet connection. But data can be available, without necessarily being accessible. As an SLS “Smart Cities, Connected Communities” fellow in the Spring of 2017, I have been working on how to help Georgia Tech students think critically about local communities through their data, but also to intervene in public discourses about the future of our city.

With that goal in mind, I am developing a new course for the fall term, which I call “Data Walks,” although the formal title is LMC 6312: Technology, Representation and Design. The course invites graduate students from across disciplines to examine how public data can be made accessible and interpretable through interventions in the form of digitally-enhanced walks through the city, designed to put data into meaningful physical contexts. In the course, our data walks will take place along the Atlanta Beltline and open dialogue about the future of communities along its path.

The Beltline is one of the most important ongoing works of city infrastructure in Atlanta. The project is currently under construction along a loop of disused railroad tracks that circumvent the city, stitching together some of Atlanta’s most historic neighborhoods and bringing with it new facilities for recreation, transportation, and housing greatly needed by a growing Intown population. But does the Beltline make its neighboring communities more sustainable?

The course will continue an ongoing collaboration with the Housing Justice League, a grassroots organization with a mission to encourage equitable development. I am already working with its members to develop a public report on the Beltline. We have acquired a database of relevant housing data and are now in the process of compiling complimentary demographic and health information. The course will turn the same data towards pedagogical ends.

Data Walks will combine aspects of a seminar, focused on discussion, with elements of a studio, involving hands-on design. Early in the term, students will read and discuss theories of sustainability and unorthodox approaches to information design.

Thereafter, students will develop their own data walk projects using sidewalk installations, projections, audio or even augmented reality in order to create opportunities for critical reflection on Intown communities, but also on public data. I look forward to working closely with SLS staff to make this course a success.

Designing a Forward-Looking Synergistic Future in our Smart Cities

Molly Nadolski, Research Associate
Georgia Tech Research Institute

Today, we are beginning to witness the potential of how smart city initiatives will increase the efficiency of an urban environment. Some of these initiatives, such as connected cars and intelligent transport networks, with the potential application of new sensors, data analytics, and measurement strategies will aid public transport to better understand and plan the system.

However, smart cities and smart city design are about more than just technology and data. Transformations that smart cities can bring will enable more innovative business models and allow decision-makers to prioritize challenges and obstacles that need to be overcome. This is important when considering how major metropolitan cities and regions should think and strategize for the future. While we now recognize the critical importance of understanding how new information technologies will change urban city design, there is still great uncertainty in terms of how this will materialize.

Here in Atlanta, the regional network faces many challenges, including unsustainable urban sprawl, income and job growth, coupled with ongoing shifts in technology. Meanwhile, these new technologies for smart city connectivity and sensor applications are entering the marketplace at an astonishing rate, bringing a diverse set of challenges and opportunities, which are not yet fully explored. These technologies have the potential to transform urban planning. The internet of things (IoT) creates a paradigm of social connectivity wherein everything is interconnected through billions of small internet-enabled embedded devices. This will redefine the way humans and machines interface, and the way they interact with the world around them.

It is vital that developers use this as an opportunity to start building a synergistic future in our cities that is forward-looking, in both technology and areas of social well-being. However, in the smart city domain, the futures of rapid technological change and long-term planning for infrastructure investment are not often addressed in a synergistic way, and there is great uncertainty about how new technologies will change urban infrastructure with their potential to reinvent how we use and think about urban planning and its occupants.

Smart Cities as a System-of-Systems
To understand pathways to making a smart city become "alive," it is essential to take the interplay of the different elements into account to get insight on the city's natural and built environments. As such, more research is needed in order to understand the dynamics that are currently at work in the smart city system and the way users adapt to changes in the long term. The research must provide insight into how IoT and smart technologies will impact urban infrastructure planning and regional development in the future, by capturing the interconnectedness and behaviors of broad complex system components such as IoT design, infrastructure, urban transport space, enabling environment and uptake, community and social factors, and public policy.

By taking a systems-of-systems approach, this will create better understanding of the context for change, which will aid communities, city officials, and stakeholders with the design for the connectedness and sustainability of future cities. This will inform the guidelines, approaches, and timelines for defining the requirements for network functions, for system management, growth, and network composition and variability, in dealing with future urban growth and IoT application.

In order to make plans and strategies for the future, we have to think of what the future will look like. However, this is much harder than many can conceptualize, especially when considering the complexities between information technologies, built environment, and urban planning.

The Winding Path to Serve, to Learn, and to Sustain

Usha Nair-Reichert, Associate Professor
School of Economics, Ivan Allen College of Liberal Arts

Surprisingly, it was not easy for me to find synergies between my own research and my desire to engage with Serve-Learn-Sustain. Why the use of the word surprisingly? Over the course of my life, I have done all three (S, L and S) in some measure. Serve meant working in the community on various projects, sometimes with my husband, Tom, and at other times on my own. Tom and I are from very different academic disciplines and lived experiences, and I learned a lot from him. Over time, I also learned a lot from the other very talented and deeply engaged people I have been fortunate to work with. We have always collaborated with communities with the idea of sustainability in the background. Perhaps, because I went about it in an intuitive manner, working from a strong knowledge base but without deliberating on how the SLS pieces all fit together, I felt it was valuable work but without a satisfying sense of cogency. Hence, despite my strong interest in SLS and participation in the Service Learning project as part of Georgia Tech's strategic plan implementation, I hesitated for a good while to participate actively in SLS. Thankfully, Jenny Hirsch did not give up on me and continued to include me in her emails and SLS events!

The call for applications for the "Smart Cities, Connected Communities" fellowship intrigued me. I have done research on the impacts of concentrated poverty. I also learned first-hand about many of the deep-rooted and persistent problems the community faced when I taught financial literacy classes at English Avenue. At the forefront were issues of access – to better education, better opportunities, better jobs, better quality food, better healthcare and better mobility. Again, I had not been able to find synergies between my research and these community engagement efforts at that time. However, the lack of neighborhood gathering spaces where people could develop a stronger sense of community and social capital and the fact that the area was a food desert deeply troubled me. The inadequate and rather expensive bus system made it difficult for community members to seek jobs that were in other parts of the city and to access supermarkets. The access issues were much more amplified for the most vulnerable segments of the population such as seniors, people with disabilities, the poor and children. The data-centered smart cities initiative seemed to offer the promise of relating better with my research, and perhaps even creating other synergies. Hence, while I desired to engage with the community, my initial interest in this fellowship was the data driven approach.

My ideas slowly morphed as I went to several "Smart Cities, Connected Communities" meetings and heard from many practitioners about the problems they were grappling with and the strategies they were adopting. Specifically, my attitude changed from focusing on data, methodologies and technology to placing the community at the center. Data and technology derive their value from how they can be used to better humankind. Now, my understanding of the community's real needs through deeper and direct community engagement influence my research questions, and how I think about using the smart cities data, concepts and tools to address these needs. Although it was initially difficult to develop a group project, Jon Sanford and I together with a graduate student and the Georgia Farmers Market Association are exploring issues of access to serve and sustain the community. Many thanks to Beki Grinter, Carl DiSalvo, and Jenny Hirsch for leading the "Smart Cities, Connected Communities" fellowship program.

A Political Side Effect of "Bigbelly" Smart Garbage Cans

Robert Rosenberger, Assistant Professor
School of Public Policy, Ivan Allen College of Liberal Arts

Through a fellowship with the SLS program on smart cities, I have had the opportunity to learn about on-the-ground initiatives to bring computerized technologies to urban spaces and especially to Atlanta. One topic that appears to me to require more attention is how issues of social justice might get swallowed up by the march of smart cities technology development.

Bigbelly smart garbage cans on North Ave., Atlanta, GA.

The term “smart cities” is sometimes used as a shorthand for a handful of specific digital and “connected” technologies, such as smart traffic lights and smart traffic meters. One paradigmatic example is smart garbage cans, such as the “Bigbelly” cans that are appearing in Atlanta and many cities across the world.

Bigbelly cans feature internal trash compactors, enabling them to hold several times the quantity of garbage. The cans also monitor their own contents, and they send a wireless signal to indicate when they are full. The idea is that cities can more efficiently deploy their sanitation manpower; since we’ll know when they’re full, sanitation workers will not be required to physically check in on the cans, and will only need to empty them when they are ready. The aggregated data provided by the cans is also potentially valuable, providing information about usage rates throughout the city. The Bigbelly units are powered by solar panels atop the cans.

These things are all well and good, with the potential for cities to save money on sanitation work, and to save as well on fuel which of course also would have ecological benefits. But these designs are also not above criticism. Here I want to raise a particular issue, one relevant to most public-space garbage cans: possibilities for trash picking.

Garbage cans in public spaces sometimes perform a particular role in the lives of homeless people. They provide a place to find bottles that can be exchanged for money at recycling centers. And some search through garbage cans for discarded food. And yet it is also often the case that garbage cans in public spaces are fitted with “rain hoods,” lids that function to keep precipitation from falling inside. These lid designs often additionally function to discourage animals from entering the can. But the side effect of rain hoods and other restrictive lids, especially when combined with locks built into the can casing, is that they also keep human trash pickers from accessing the can.

The politics of such anti-pick garbage cans must not be understood in isolation. They play into a larger anti-homeless agenda at work in many cities around the world. Such agendas can include a wide variety of anti-homeless designs that make surfaces uncomfortable for sitting or resting, as well as anti-homeless laws that target everyday behaviors of homeless people. Bigbelly garbage cans serve this same anti-pick function, and thus play a part in this fraught anti-homeless agenda.

Smart cities technologies must all be considered in terms of the larger political agendas in which they may play. They have the potential to pour public-space data into city governments. And they include the introduction of hyper-designed—if possibly overdesigned—objects into those spaces. As this happens, it will be important to continuously consider how these data and these objects reshape power relations in the city, and to evaluate their effects on the already disadvantaged.

SLS SCCC Blog Post

Jon Sanford, Director, Center for Assistive Technology & Environmental Access, Professor School of Industrial Design, College of Design

Serve, Learn, Sustain. Interesting concepts, but their connection to aging, disability and universal design was not clear. Nonetheless, while serve and learn were a mystery to me, I could clearly see that sustain was built upon sustainable design, which, by way of a not so humongous stretch, I could equate with universal design. Clearly, albeit through some fuzzy logic, objects, spaces and technologies that are usable by all people are also sustainable across users and across one's lifespan. Nonetheless, while sustainable design and universal design are conceptually similar, they required a context within which my own research could find meaning. Enter a semester focusing on Smart Cities and…well, now 2 plus 2 began to add up (at least for the moment) to at least 3. As people age, loss of community mobility is a huge problem. Therefore, I rationalized that using data to make cities smarter would not only make them more sustainable, that same data could be used to inform individuals with disabilities to make decisions about where to go and what to do.

Although a seed had been planted, I struggled throughout the semester to get it to grow. Through the first 3 SLS fellows meetings I found the conversations stimulating, the presentations inspiring and the snacks, well, they left something to be desired. I thought I understood the key concepts, but not the links between them. The working group to which I was assigned was not much help either. With one exception, other members seemed disinterested in pursuing a group project, let alone one that focused on providing information to enhance community mobility. Then, at the fourth and last SLS meeting this past semester, the DUH moment happened. Listening to the Executive Director at the Center for Civic Innovation, which is located in the old Rich's Department Store in Downtown Atlanta, describe how the Rich brothers helped their struggling community survive through the depression, I knew what I had been missing. Being an environmentalist rather than a behaviorist, blinded me to the obvious. Sustainability was about people not places. Technology and environment were the means to an end, not the end themselves. I didn't even see the obvious parallel to my own interests, which are focused on sustaining communities of seniors as they face age-related losses that limit their ability to drive, walk and continue to engage fully in their social relationships.

In seeing what was staring me in the face the entire time, I also found the meaning of "learn." So all that was left was "serve." The final SLS meeting also enabled me to engage with the Georgia Farmers Market Association, a small organization that promotes farmers markets and trying to overcome barriers of community acceptance. What better way to engage seniors with limited mobility, access to healthy foods and neighborhood places to gather? What better way than to gain community acceptance than data that show the value of farmer's markets to a community's sustainability? Along with my other "interested" working group member, Usha Nair-Reichert, one of my doctoral students who wants to develop a farmer's market app and the Georgia Farmers Market Association, we are beginning the process of "serving" the community. Details will be forthcoming.

SLS SCCC Blog Post

Martin Short, Assistant Professor
School of Mathematics, College of Sciences

Going into the program, my idea of what would be considered a "smart city" was already quite broad. I would consider a city to be "smart" if they, i) had a well-formulated list of priorities for where they wanted their city to evolve toward or to achieve and, ii) employed scientifically sophisticated methods to attempt to achieve these goals. So, a city that was using low-tech but nonetheless scientifically sophisticated methods to address their needs would be "smart," while a city that was employing all sorts of fancy technology but with no clear goal in mind would not be considered "smart."

Through this program, though, I believe that I was made more aware of another aspect of "smart" cities that I hadn't considered as much before, which is also hinted at by the second part of the program's name: connected communities. That is, I would now amend my definition of a "smart city" to state that, while doing parts i) and ii), they also iii) make sure that the methods and goals are both just and desirable by the communities living in the city, and that they attempt to connect (not necessarily literally, but metaphorically) the various communities present in the city. Examples of this that were presented during the program were the proposed citizen comment kiosks and the work of Atlanta City Studio. A smart city should empower its citizens to be a part of the process and state of being "smart," and should place great value on methods and goals that increase cohesiveness of its residents not only as members of their smaller communities, but as citizens of the city as a whole.

My Experiences with the SLS Fellows Program

Andy Sun, Assistant Professor
H. Milton Stewart School of Industrial & Systems Engineering, College of Engineering

My research background is in data analytics (especially optimization) and energy systems. I have been very curious to learn more about the smart city movement and its meaning and impact. I'm very honored to be selected as an SLS fellow. The program has provided excellent opportunities for me to learn from practitioners, other academics, who are passionate and knowledgeable about various aspects of smart city. I particularly enjoyed learning from my team members in the SLS Systems Group on stormwater management on the campus-level. I also really liked the interaction session with social entrepreneurs on urban farming.

We brainstormed various ways to collect useful data to quantify various positive impacts of urban farming on the city environment, economy, job creation, education, and beyond. This has been an eye opener for me to see how smart city/data analytics can benefit community building. I would like to sincerely thank the leaders and staff members in the SLS program for their passion, vision, and care of the program. I wish this program will continue to flourish and expand its impact on campus and beyond.

Toward a Living Campus

John E. Taylor, Professor
School of Civil and Environmental Engineering, College of Engineering

I was fortunate to participate as an SLS Smart Cities, Connected Communities Fellow in Spring 2017. As a relatively new faculty member who joined Georgia Tech in Fall 2016, this was an excellent opportunity for me to meet a group of faculty with related research interests in the area of smart cities. I found the placement of Fellows into even smaller sub-groups with shared specialized interests to be particularly impactful. My sub-group of Fellows had a strong affinity for research, pedagogy and outreach in the area of multi-layer network systems. We had a number of exciting research conversations about how our various disciplinary perspectives from the areas of Civil and Environmental Engineering, Biology, Building Construction, Industrial and Systems Engineering, and Community Integrated Modeling could be combined to contribute a new perspective on Smart Cities and Connected Communities.

We decided to develop a funding proposal to broadly examine the potential for the Georgia Tech campus to evolve as a Living Campus. I had been separately collaborating with SLS to help think through how to implement the Equity Petal in the Living Building which is currently in the design stage to be constructed at Georgia Tech beginning later this year. Our SLS Fellows sub-group wondered how the ideas underlying the Living Building Challenge might influence the ability for the various networked systems on campus—buildings/occupancy, energy, communications, etc.—to work harmoniously in a natural disaster to provide safe haven to students and neighboring community alike in the case of a tornado or a pandemic flu.

As a sub-group, we will continue to develop these ideas and I am looking forward to the various spill-over collaborations that have developed between myself and members of the sub-group, but also other pairings and small groups. I think this will lead to exciting interdisciplinary research contributions in this critical research area. I am also adapting the interdisciplinary discussions we had to merge with and extend the research range of my Lab's analytics, visualization, and network dynamics foci. I am excited to have just been awarded seed research project grants by the Living Building Challenge organization on campus and by SLS to develop an approach to collect broad-scale community stakeholder input on: (a) how the Living Building can better achieve the objectives of its seven petals (Place, Water, Energy, Health+Happiness, Materials, Equity, and Beauty), and (b) how the Georgia Tech campus could evolve to become more of a "Living Campus." The image included with this blog post is a mock-up of our proposed interactive augmented reality viewer that we hope to deploy this Fall at the project site as part of the aforementioned Living Building Challenge seed project. Look for more postings in the Fall and/or Spring on our progress.

In a Smart City, Committing to Sustainability Means Protecting Privacy

Jesse Woo, Research Associate
Scheller College of Business

The smart cities movement is generating a great deal of excitement in growing, tech savvy communities like Atlanta. Smart cities, with their emphasis on internet of things (IoT) sensors and processing data, have the potential to create fantastic opportunities for better policy, design, and quality of life in cities. However, when data pertains to people, there are potential risks and issues with how it is collected, stored, and used. Further, smart technology will transform cities from mere physical spaces into digital platforms with new avenues for policy makers to engage and interact with citizens. At the same time, those avenues may become tools for regulation and nudging that challenge traditional notions of fair and democratic governance. Finally, the use of algorithmic decision making may usher in an era of smart, data driven policy that will optimally allocate resources, combat discrimination, and generally compensate for messy human biases. On the other hand, algorithmic bias or discrimination is a well-documented problem that is exacerbated by the fact that algorithms operate as a black box with little or no accountability. These three issues I call data governance, digital manipulation, and algorithmic decision making, respectively. Each one is an aspect of privacy in a broad sense because they affect the autonomy of the individual in relation to the government. If we take sustainability to also include concepts of equity and justice, which I think we should, then privacy is an integral aspect of smart and sustainable cities. In each case, the proposed benefit of smart city technology is inextricably linked to the related privacy issue; you cannot implement one without creating risks of the other. It is impossible, for example, to install cameras on street lamps without creating data governance risks. The good news though, is that every risk can be managed. But only if the manager sees it coming.

Data Governance

What I call data governance is probably the most familiar privacy issue that people think of when they hear about smart cities. Smart city programs are data driven and tend to collect a great deal of data on people. They may include cameras on street lights, facial recognition technology, or location tracking systems. The privacy implications of such pervasive tracking and data collection are obvious to most people. Even so, many cities rush to implement them without considering basic privacy-protective measures such as data minimization, retention, or use policies.

Data minimization basically means having a plan to collect only as much data as you need, no more. Is it necessary to collect the exact pick-up and drop-off location of every taxi and ridesharing service in the city, or can the same goals (measuring driving time to prevent driver fatigue) be accomplished with less granular information? Data retention (how long to keep the data before deleting it) and use (who has access to the data, how may data sets be combined) policies follow a similar logic. That is, to minimize privacy risks, plan carefully the life cycle of the data. The ideas are straightforward, but they require commitment and sustained effort to implement properly.

Moreover, smart cities do more than just collect data. Many smart city programs involve "open data" portals, where municipal governments make their vast stores of data available to the public over the web. Open data portals can be valuable resources for civic hackers and citizen groups, but they also allow large data sets to be combined in ways reveal sensitive information. (Whittington, et al 2015) This "mosaic problem" can reveal information previously thought to be hidden or anonymized, such as when Latanya Sweeney famously linked hospital records to voter registration rolls, including for the governor of Massachusetts. (Sweeney 1997)

Digital Manipulation

The move from analogue to digital has caused all sorts of challenges for law and policy; think about what happened with the advent of the internet to creative industries that relied on copyright. There is no reason to think that embedding digital technology into cities will have any less dramatic an impact. An emerging body of scholarship examines how digital platforms create the potential for digital manipulation. (Calo, 2014) The owners of digital platforms have an unprecedented power and information asymmetry versus their users. They collect vast stores of data on users, and they have the power to alter the platform at will in ways that can exploit user biases or subtly push them toward outcomes that they would not otherwise choose.

Granted, governments have always held tremendous power over their citizens. It is for this reason that modern societies place constitutional, legislative, and democratic constraints on them. But governments do not only express their power over citizens by passing statutes and regulations. Scholarship in the last two decades has demonstrated how governments can regulate through architecture (that is through design of a system), and through nudging (subtle interventions that exploit human biases to channel behavior). (Lessig 1999, Thaler and Sunstein 2008) When governments regulate through these mechanism, they are generally not subject to the same constraints as when they govern in traditional modes. Yet design architecture and nudges are both potent forms of regulation.

As with the move from the physical department store to the Amazon marketplace, the transformation of cities into digital platforms will create new opportunities for manipulation. Law and policy may struggle to cope with this new digital reality.

Algorithmic Decision making

Algorithms are poised to revolutionize many disparate aspects of our lives, from the way we work to the way we drive (or don't, as it may turn out). This revolution includes our government, especially on the city level. Algorithms are being applied to predictive policing and bail decisions to allocate scarce police resources or remove ability to pay as a factor in deciding who languishes in jail while awaiting trial. And cities run vast reams of data collected from smart city programs or elsewhere through data analytics to combat housing or employment discrimination.

In this context, there are two big concerns with algorithms as decision makers. The first, is that far from eliminating bias, algorithms may incorporate or perpetuate the human bias of their creators. The algorithm's designers may do this completely unwittingly. For example, a facial recognition program famously misclassified black users as gorillas, or identified Asian users as having their eyes closed. These mistakes likely resulted in deficiencies in the "training data," basically the algorithm was not proficient at identifying black or Asian faces, having been trained on predominantly white subjects.

Such mistakes are mostly just embarrassing when the stakes are low, as with a Facebook photo. They are invidious when stakes are high, as with bail decisions and policing. Charges of racial bias have dogged both systems. If the data that feeds these algorithms reflects the real world, it will reflect biases and imperfections that also exist in that world. The criminal justice system is notoriously discriminatory, so it should come as no surprise that algorithms reflect those issues. The problem is exacerbated though because applying an algorithm gives a decision a veneer of scientific infallibility which can insulate it from critical scrutiny just when it is most needed.

The second concern goes to this issue of scrutiny. Algorithms tend to operate as black boxes; their inner workings may be closely guarded trade secrets. However, even if we are able to peel open the box in the name of transparency, doing so may not provide a satisfactory answer. This is because in many cases, not even their designers know why or how the algorithm makes the decisions it does. The reason is that modern machine learning algorithms train themselves to recognize patterns in data by looking at large data sets. The decision making process arises from these patterns in the training process, not from specific rules set by the designer. This feature of algorithms will challenge notions of transparency and accountability upon which democratic governance depends.

Risk Management

Rather than despair of all the potential privacy problems brought on by smart cities, I prefer to think about how to manage the risks associated with smart city technology while still capturing the benefits. Data governance risks can be handled with, as the name implies, good governance structures and policies. That means having and enforcing data minimization, retention, and use policies, and carefully considering the standards for opening data to the public. Cities with the resources to hire a privacy officer should do so. For cities that cannot, the privacy advisory commission model pioneered by Oakland is a possible alternative. Ideally, cities would have both.

Risks of digital manipulation relate to the potential to circumvent democratic accountability and transparency, so the obvious solution is to lean into these values, not run away from them. Cities could publicize lists of such interventions and their reasons for making them, and let the public decide on their value. Finally, the risks associated with algorithms are still emerging, as is the technology itself, but cities should be aware of these risks and careful with implementation. An iterative process that continually tests and audits this new technology will allow cities to respond to problems quickly, which will in turn legitimate the technology.

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SLS SCCC Blog Post

Yao Xie, Assistant Professor
School of Industrial & Systems Engineering, College of Engineering

During the SLS fellowship program, I have been working with my group to develop a research plan to incorporate my research with Smart City. In particular, we examined the emergence response to epidemics and how to make Georgia Tech a resilient system for such emergent situations. We submitted a proposal to SPAG, an internal funding opportunity at Georgia Tech. Although the proposal was not funded, we have brainstormed many research opportunities and venues for funding. Moreover, during the fellowship, I have built a relationship with the Georgia Tech Smart City Program Manager and established a collaboration with the Atlanta Police Department to develop a project for crime data real-time analysis, which was subsequently funded. The SLS fellowship program has broadened my horizon and helps me to work in the area of Smart City related big-data analytics.

People-Centered Planning in Smart Cities

Emma French, Sustainability Project Manager
Center for Urban Innovation

Emma French is a researcher with the Center for Urban Innovation and was a third year dual masters student studying public policy and city and regional planning at Georgia Tech during Spring 2017. SLS supported Emma's research on the role of smart city technologies on participatory planning in the Proctor Creek Watershed through the Smart Cities Fellowship Program.

The SLS Smart City Fellowship Program has given me the opportunity to pursue my own research while at the same time gaining inspiration and new ideas from an interdisciplinary group of scholars and practitioners. Through our work sessions and small group projects I have been exposed to new ways of thinking about "smartness" and "public participation," and have met local leaders who are envisioning the future for Atlanta and beyond. It has been an exciting learning experience and networking opportunity thus far.

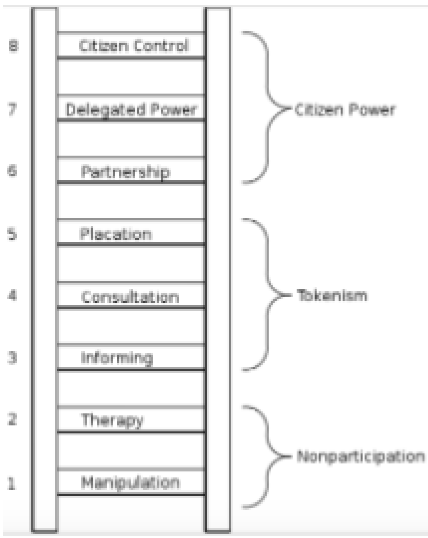
The term "smart city" has become common parlance in city planning circles in recent years. While there is no universally agreed upon definition, descriptions of smart cities typically refer to integrated and interoperable networks of digital infrastructure and information and communication technologies (ICT) that collect and share data and improve the quality of urban life (Allwinkle and Cruickshank 2011; Batty et al. 2012). However unlike related concepts such as the digital city, the intelligent city and the ubiquitous city, the smart city is not limited to the diffusion of ICT, but also commonly includes people (Albino, Beradi, and Dangelico 2015). Many of the technological enhancements propelling the smart city revolution require re-designing and in some cases re-building the underlying infrastructure that holds cities together. City planners will therefore play a significant role in the creation and implementation of many smart city initiatives. In a 2015 report on smart cities and sustainability, the American Planning Association (APA) purported that new technologies will aid planners by creating more avenues for community participation in policy and planning processes (APA 2015).

Public Participation in Planning

Widely-held conceptions of planning have shifted over the last century from normative, rational models that position planners as technical experts, toward a theoretical pluralism characterized by the political nature of planning, competing interests of stakeholders, and decisions as negotiated outcomes facilitated by planners (Lane 2005). These more contemporary models, most of which were first conceptualized in the 1960s and 1970s, view citizen participation as a key part of the planning process. Smith (1973) argues that participatory planning increases the effectiveness and adaptability of the planning process and that citizen participation strengthens our understanding of the role of communities in the urban system.

Meaningful public participation in planning has been found to better planners' understanding of the community context (Myers 2010), improve decisions through knowledge sharing (Creighton 2005), increase trust in political decision making (Richards, Blackstock, and Carter 2004; Faga 2010), produce long-term support of plans (Levy 2011), enhance citizenship (Day 1997; Smith 1973), build social capital (Layzer 2008). and address complex problems through collaboration and consensus (Innes 2010; Godschalk 2010).

While these more contemporary planning models emphasize the importance of citizen engagement, achieving meaningful participation has proved difficult. Challenges preventing meaningful citizen participation include funding and resource constraints (Creighton 2005), literacy and numeracy (Community Places 2014), disinterest (Cropley and Phibbs 2013), lack of access to necessary resources (Cropley and Phibbs 2013), the prescriptive role of government (Njoh 2002) power inequalities within groups (Reed 2008), jurisdictional misalignment (Layzer 2008), and lack of respect for public opinion (Day 1997).



In her seminal 1969 article, "A Ladder of Citizen Participation," Arnstein uses examples from federal urban renewal and anti-poverty programs to illustrate different manifestations of participation in practice (see figure above). Arnstein defines citizen participation as "the redistribution of power that enables the have-not citizens, presently excluded from the political and economic processes, to be deliberatively included in the future" (Arnstein 1969, 216). Arnstein's examples show how some efforts to include citizens in planning and decision making can perpetuate existing systems of power and actually further disenfranchise marginalized communities.

Glass (1979) attributes the dearth of meaningful citizen participation in planning and policy making processes to lack of attention to the design of participatory programs and a mismatch between objectives and techniques. Glass concludes that if the goal is just to get citizens to participate then almost any technique will be seen as sufficient. He argues that one technique alone is never enough and that meaningful citizen participation requires a continuous, multifaceted system of engagement (Glass 1979).

Technology-aided Participation

For decades scholars have been exploring ways that technology can enable meaningful participation in planning and policy making. Recent hype around "smart cities" has fueled the debate about the role of technology in these processes. Technology has been found to support citizen participation in planning by increasing participants' understanding of issues and proposed plans (Salter et al. 2009), supporting collaboration (Jankowski 2009), strengthening the role of low-income residents (Livengood and Kunte 2012), and enabling alternative, informal manifestations of civic engagement (Asad and Le Dantec 2015). Simply adding technology to the planning equation, however, does not always guarantee meaningful participation (Sylvester and McGlynn 2010; Epstein, Newhart, and Vernon 2014; (Holgersson and Karlsson 2014). While the use of technology may address some barriers to participation in planning processes, it may actually exacerbate other barriers that stem from structural social, economic and environmental inequities.

Equity, Planning and Smart Cities

Despite the emphasis of meaningful citizen participation in planning, low-income, urban communities of color often still suffer from poor infrastructure, environmental degradation and exposure to toxins, and potential displacement due to rapid gentrification. A concern voiced by many critics of smart cities is that, like previous attempts to use technology to engage the public, the existing digital divide will likely limit use of smart city technologies to certain groups of people with certain resources and skills.

Using 2007 Pew survey data, Sylvester and McGlynn (2010) conducted four logistical regression models that try to explain the factors leading to individuals having "low access" to the Internet and how internet usage and physical location influence civic participation. They find that living in a rural area and being African American or Hispanic increase the probability that you will have low access to the Internet. Age was found to have a significant, negative effect on Internet access—meaning that the younger you are the more likely you are to have access to the Internet. The results also showed that people living in urban areas were more likely to contact the government by phone (Sylvester and McGlynn 2010).

The recent hype around smart cities is fueled to some degree by the rapid migration of people into cities. In 2014, fifty-four percent of the world's population lived in urban areas and the World Health Organization estimates that by 2030 that number will be closer to eighty percent (WHO 2017). Atlanta is expected to grow by about 2.5 million people in the next 25 years; however, income inequality in the city is increasing and poor urban residents are being displaced by millennials and baby boomers (Coleon 2016).

This brings up a major concern regarding smart cities. Namely, who are we making cities smart for? If our efforts to make cities more efficient, safe, and clean result in the displacement of marginalized communities, are these cities really smarter than the ones in we live in now? No sensor can substitute for public engagement and responsive leadership. Agyeman and McLaren (2016) advise against the creation of tech hubs without a simultaneous strategy to protect and invest in affordable housing, basic services, and infrastructure.

Adam Greenfield presents a similar, albeit more in-depth, critique in *Against The Smart City*, where he investigates three major international smart city urban developments and argues that the marketing materials and promises of the sponsors highlight their interest in this top-down, data-rich urban management system (Griffiths 2013).

The Role of Planners in the Smart City

In the APA's Smart City and Sustainability Task Force survey, planners ranked socio-economic disparity as the second most important topic for planners working in smart cities (after green building and site design), suggesting that planners are aware of the importance of socio-economic stratification. But what can planners do to ensure that investments in smart city technologies are benefiting everyone equally, rather than sucking away financial and political resources needed to fix basic infrastructure issues? How can planners use these technologies to support more meaningful community engagement?

The existing literature suggests that even where technologies enable greater understanding of the planning issues or more meaningful engagement, they must be used in tandem with traditional modes of planning such as in person meetings and design charrettes. Scholars also emphasize the need for ongoing, participatory mechanisms. Especially where institutionally-mediated participation falls within the first five rungs of Arnstein's ladder, perhaps ICTs can play a role in supporting alternate, illegitimate forms of civic action that have a greater impact.