The Internet of Things: Making Cities — And The Way They Use Technology — Smarter

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Minerva Tantoco was named New York City's first chief technology officer last year, charged with developing a coordinated citywide strategy on technology and innovation. We're likely to see more of that as cities around the country, and around the world, consider how best to use innovation and technology to operate as "smart cities."

The work has major implications for energy use and sustainability, as cities take advantage of available, real-time data – from 'smart' phones, computers, traffic monitoring, and even weather patterns — to shift the way in which heating and cooling systems, landscaping, flow of people through cities, and other pieces of urban life are controlled.

But harnessing Open Innovation and the Internet of Things can promote sustainability on a much broader and deeper scale. The question is, how do you use all the available data to create a more environmentally sound future? The term "Internet of Things" was coined in 1999 by Kevin Ashton, who at the time was a brand manager trying to find a better way to track inventory. His idea? Put a microchip on the packaging to let stores know what was on the shelves.

CITIES AND MAKING THEM SMARTER –

Technology has had real successes in changing city life — Medellin, Colombia, was chosen as City of the Year by the Urban Land Institute in 2013 in recognition of its turnaround from a symbol of the drug wars into a high-tech hub promoting civic engagement and innovation. The ability to limit the amount of energy and other resources we waste has real value. But the constant monitoring involved in collecting Big Data across urban areas also raises the specter of Big Brother, and those concerns shouldn't be ignored.

Think about the Nest Thermostat, which "learns" what temperature you like, and when you're home to need that heat or air conditioning.

Systems across an urban area can use the same principles, considering vehicular patterns and individual habits to balance energy supply and demand. Electric grid operators already do that on a broad scale – they know demand will be higher on a hot August day than on a mild autumn evening.

As architects and designers, we look at ways to generate smart cities, reducing carbon and moving to smart ways of digital mapping. We know Open Innovation and the ubiquity of networked electronics and other devices are affecting the world of architecture and design, construction and real estate development. But too often, we have found, city planners, designers, policymakers and others start their work in a vacuum. If we are to scale up the successes of smart cities, to truly take advantage of so-called Open Innovation by engaging knowledge and ideas across a wide spectrum, this work should be done cooperatively.

The environmental and financial costs of that can be great. Last month, the U.S. Department of Energy announced the economic potential for renewable power has more than tripled as a result of technological improvements and cheaper technology. If renewable energy is becoming less expensive, cities have fewer excuses not to take advantage of it. But that, too, should be decided with input from all stakeholders.

Tough questions remain, in addition to privacy issues. Intellectual property often stimulates creativity, but at the same time it can hold back innovation. Issues of ownership and authorship play a role within the active use of data and privacy within the digital age. Architects and designers, as much as planners and policy makers, need to be held responsible for detailing the opportunities offered by the use of open source data and Open Innovation.

Open Innovation and the data created by the Internet of Things can offer a way for engaged residents to participate in the future design of their cities.

INTELLECTUAL PROPERTY IN THE AGE OF OPEN SOURCING —WHO OWNS IT, AND HOW DO THEY GET PAID?

The Internet of Things, as you may have noticed, is changing the world. Architecture, design and construction aren't immune, as young

Figure 1. Image Source - Simcity 2015

architects no longer line up to work for the field's undisputed stars, instead launching self-directed crowdsourced projects and using Kickstarter campaigns as a means to fund their own projects and seeking collaborators for projects big and small.

With projects like WikiHouse and the Resilient Modular Systems 2.0 digital platforms, now people can use a smartphone to connect with a manufacturer to order their house.

In some ways, that makes sense. Design no longer lives in a locked filing cabinet. The conversation I'm interested in is the virtual estate – what becomes of the ownership of digital property? (Who owns digital property). If you design a digital system, do you lose ownership if it's widely reproduced in manufacturing?

The question arose in the 1990s with Napster, the internet company that allowed people to share music, in the form of MP3 files, with their peers. The industry panicked: Would people still pay for music if it wasn't in the form of a physical compact disc?

The answer to that is still evolving, although iTunes and other music streaming services suggest a qualified "yes."

But the details of how the internet and open source software changes who performs specific tasks and, perhaps equally important, who gets paid for that work, are still unresolved. Ownership at this stage in the contemporary digital conversation, therefore, becomes a more active concern than Authorship.

HOW DO YOU PROTECT YOUR WORK?

That already is disrupting traditional views of innovation, and the global movement toward building a more sustainable future – increasing use of alternative energy, designing "smart" buildings that automatically adjust lighting, heating and air conditioning to conserve power – is a key example.

Current intellectual property law favors the creator and suggests work can't be taken without payment or changed. That's outdated. (Current law favors creators with privatized venture funding, or corporate backing, with deep pockets, i.e.: Google and companies that have funds to patent and trademark their designs and ideas.)

What happens, for example, if a product is translated into code and produced on a 3D printer? Are digital footprints developable concerns for creators of the built environment? Organizations, including the U.S. Library of Congress, are dealing with the thorny issue of sharing digital properties while still protecting their value.

The implications are enormous for medical privacy, private property rights, energy efficiency and other areas.

So-called "smart" building systems are a hot topic of research, as scientists work to develop living buildings, which can learn how occupants behave and adapt to that behavior automatically, without the intervention of a building manager.

But the concept relies on data collected from sensors located throughout the building. To whom does that information belong? Similarly, what happens when an architect designs a house, and the plans end up online? It's easy, and common, for people to download the files and buy the plans. Common, too, for a contractor to copy the design of a house built and designed by someone else.

Figure 2. Image Source –Web. Data Center, 2015

John Locke, the 17th century English philosopher and political theorist, established common theories about ownership – back then, it was ownership of land, cattle and other physical properties – which influenced the founding fathers of the United States.

But there is no virtual line in the sand with digital property. You might own a building, but information harvested from that building detailing energy use and similar data, can be equally important. It's the same with data collected by toll road agencies about the use of your EZ Tag.

Who owns that? Maybe Elon Musk has suggested a middle ground, registering the Tesla battery as open source software, meaning anyone can access the information and work to improve or change it, while retaining the patent. Or, Alejandro Aravena's Elemental Open Sourced social housing construction plans, which open up the field of architecture for social good. Those allow for innovation without giving away the company.

"WE BELIEVE THAT TESLA, OTHER COMPANIES MAKING ELECTRIC CARS, AND THE WORLD WOULD ALL BENEFIT FROM A COMMON, RAPIDLY-EVOLVING TECHNOLOGY PLATFORM," MUSK WROTE ON THE TESLA WEBSITE. "TECHNOLOGY LEADERSHIP IS NOT DEFINED BY PATENTS, WHICH HISTORY HAS REPEATEDLY SHOWN TO BE SMALL PROTECTION INDEED AGAINST A DETERMINED COMPETITOR, BUT RATHER BY THE ABILITY OF A COMPANY TO ATTRACT AND MOTIVATE THE WORLD'S MOST TALENTED ENGINEERS. WE BELIEVE THAT APPLYING THE OPEN SOURCE PHILOSOPHY TO OUR PATENTS WILL STRENGTHEN RATHER THAN DIMINISH TESLA'S POSITION IN THIS REGARD."

Today's millennials share that sense of social good as they seek to make a difference. They are interested in creating products, but they want something bigger than an app or a new sneaker. A lot of people in their 20s and 30s think of design, product development and architecture as bigger than real estate.

So the culture shift is well underway. Even architecture, long a field that values ownership, originality and being the first to do something, is getting there.

The work itself is evolving, too, from traditional "architect" to more of a creative director, such as myself, where the responsibility of the architect becomes a conductor of a plethora of issues, not only for the design of a structure but for what happens within that structure, from heating and air conditioning to coding the technologies for a building to the storage of digital data within a building.

My students know they need more business savvy than architects of a past era in order to successfully work with the community.

The role of the architect continues to become an integrated design proposition. Architects have always been salesmen. Now we need to be hustlers and entrepreneurs.

SHARED CITIES AND OPTIMIZING DATA, AND THE PRIVATIZATION OF PUBLIC SPACES – HOW DOES CITIZENSHIP AFFECT ENERGY CHOICES?

Most American cities such as New York City, and San Francisco has millions and trillion of transient occupants and permanent citizens who are operating on the basis of shared information and smart phones that run their daily lives.

Figure 3. Image source – City Skyline. Forbes, 2016

Co-working, co-living, co-sharing of data has become a norm on the optimization of daily transactions, credit card exchanges, medical data recording, and privatization of information that is freely shared within the current sharing economy, inundating the internet and data packages of each citizen. However, what happens to these information exchanges when they are used to maximize the use of how cities are run, and how does policy makers and designers, such as architects, product developers, UI/UX designers, and the integrated practice of design start to utilize the privatization of public resources as in public space?

As the smart phone and most of the smart devices that citizens within a city become more accustomed and intimate to their devices than their romantic partners, City officials need to recognize the potentials that are operating amongst the users of their daily transportation systems, such as VIA, Uber, Lyft, and various other sharing economies, but also the various other deeply useful software such as CartoDB that work on the visualization of public data.

CartoDB for example has been able to use their data analytics to assist the MTA in its operations for "repairing the Canarsie Tunnel - which may include a full closure of the L train – (the software) started digging into open data to shed some light on how disruptive the shutdown would be for the 200,000 daily riders. Using predictive analysis different feasible alternatives were determined, based on demographics and behavioral patterns."

As cities become major forms of invisible networks and "clouds" of information and the gathering of data comes as at higher speeds and with greater ease, the larger decisions for city officials and citizens who operate within the mode of sharing their privatized information into the public forum, hence, becomes an ethical and internal dilemma. The larger realm of public then becomes the question of how public does one desire to operate their private information, and social media profiles.

Millennials on the other hand, who often operate fully in the world where transient information, on social media apps such as Snapchat and afterschool, often think that their information is only periodically stored and shared, may require to be schooled on the harsh reality of their cloud data.

Within the façade of freely distributed information and data storage in major cities, are the trillions of energy and cooling towers of the colocation centers and the extensive energy that costs cities require to operate, in the storing of these information systems – sometimes, costing more energy and landmass than anyone could imagine.

Many times, data centers, the infrastructures and buildings which store your cloud information and physical data are far from green, and worse, are major energy consumers of power, than one could fathom. Thus, if information and data costs citizens so much energy, how could we better utilize passive systems, and generate new methods of information exchange? What are the social implications, and positive impacts could designers and policy makers offer to integrate a better solution?

Figure 4. Image Source – Provided by Wendy W Fok, submarine cable
system, 2016

As designers and operator of various devices that consume large amounts of energy, the larger question for architects and policy makers, are not to further proliferate the generation of how big data could potentially save our cities, but how to better manage, and offer solutions on exchanging this information onto better use. Should the realities of the reveal of data centers become part of the landscapes of cities, citizens who operate in the world of data usage may also start to realize the real efforts to better function in the realm of energy that is relevant to "free" cloud space. At the end of the day, just as any economy of scale something always comes at a cost, nothing comes for free, and therefore, neither does physical or virtual data.

RESPONSIVE CITIES AND ITS URBAN RESOLVE

Substantive amounts of research of cities, provided by governmental research institutes such as the World Bank, various Harvard Research institutes, Parsons' School of Design Strategies, and various independent research centers such as the University of Toronto Global Cities Institute provide provoking and in-depth research capacities that look into the diversities of data analytics that are responding to the pivotal roles of urban resolve by strategic actors of building global sustainability, and governing cities with larger frameworks that combine extensive forms of data and governance, planning and design, and business and management within the larger respect of running effective cities.

Yet, the larger discussion that has not been further discussed are the pivotal roles of privatized crowd-sourced means of digital technologies that are enabling private projects to be executed in a larger public context to be realized. Such projects to bring to light, are projects such as the LowLine, New York's first underground park that has been contingently approved as of July 2016 as a National Park, and the Plus Pool, east river's revival of a public pool that utilizes recycled sea water. Both projects were conceived as privately funded publically accessible urban phenomena, mostly through online campaigns such as Kickstarter. In many ways, these such projects garnered public interest through the internet, even before official and authorized public hearings through traditional means of town hall conventions, were established.

The LowLine and Plus Pool begs to question the ownership of public knowledge through the age of digital distribution, but also how publicity through digital means allows policy changes within the issues that requires design renewal agenda and viewpoint of issues that bring the strength of designers, policy issues at stake, and the future of the practice of the architecture and design. Technology could be used smarter to design cities, but also allow policy makers to manage

expectations on how it complements the assurance of a new form of citizenship, formulated by a generation of citizens that are well adapted to the technological advancements and breeds a contemporary form of communication, beyond traditional public hearings within a brick and mortar City Hall setting.

Cities and urban strategist will be required to embrace a varied opportunity provided by the public, and digitally savvy occupant of cities, the reasonable doubt that their ability to promote social impact, is beyond the means of public good within their neighborhoods, but also through the environmental shifts generated by the Internet and the data analytics that are so easily accessible through the digital portals.

Running a city in the modern day of open innovation, open privacy, and open systems is no longer about the ability to open the information to the citizens themselves. In the modern technological responsive city, running a city is also allowing the citizens to adapt their knowledge, and tolerance for them to create ownership into their ability to adapt their point-of-views within the shared economy of the physical and digital world.

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