Becoming uCity: The case of Chicago

By Zorica Nedovic-Budic and Kate Williams
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Abstract

The concept of ubiquitous city, or uCity, is gaining attention worldwide. In a uCity, anyone is enabled by information and communication technologies (ICT) to do anything, anywhere, at any time. The uCity concept has diffused quicker than its implementation, which relies on a complex set of interrelated technologies, practices, and actors, including but not limited to provision of ICT infrastructure, availability and accessibility of information and services, and adoption of mobile communication devices by a variety of users. To aid in measuring and implementing uCity, we explore ways to measure the "ubiquity" of a city with a particular attention to the first 'A' above, anyone. Empirical findings from Chicago highlight 1) ICT access; 2) connectivity of institutions and individuals; and 3) ubiquity of virtuality. A socio-technical perspective and social network and social capital theories guide us. Underlying social and motivation processes are essential to all aspects of becoming a uCity.

Keywords: uCity, ubiquity, urban planning, community informatics, Chicago

Introduction: Using metaphors to define the ICT-based city

There has been no shortage of metaphors describing the new urban life and environment that emerge with information and communication technologies (ICT) and infrastructures (Maeng and Nedović-Budić, 2008). The concept goes back almost three decades to Toffler's 1981 vision of an *electronic cottage* accompanying the information revolution. It appears in various permutations such as the *intelligent city*, *informational city*, *invisible city*, *network city* and *wired city*. It acquires such suggestive labels as *technoburb*, *digital place*, *e-topia*, *telecity* and *city of bits*. And it arrives at the early 21st century as *ubiquitous city* (Table 1).

Many elements underlie the metaphors listed in Table 1. Most assume infrastructural support for human activities, i.e., access to information that defies the need for physical proximity and overcomes distance as a barrier. Some emphasize the economic advantage, independence and services facilitated by ICT. Others point to the qualitative societal change where networks and flows of information provide for different kind of interactions between members—individuals, households, public and private sector organizations. Although the physical city is assumed in all definitions, only a few authors connect more explicitly to the physical environment to suggest that ICT will help achieve better cities (i.e., more sustainable, healthy and green; Berg 2002, Mitchell 1999), or assert that place will remain key in the relationship between people and technology. Rather, place is where the virtual and the physical intersect (Horan 2000, Aurigi 2006). Here the field of community informatics (Alkalimat and Williams 2001, Williams and Durrance 2010) contributes a model whereby actual life enters into virtuality, and that virtual or online activity in turn changes actual life (A → V → A). This is appropriate for a field taking a socio-technical critical perspective and concerned with social inequalities.

According to Merriam-Webster's Dictionary, **ubiq·ui·tous** is an adjective characterizing an entity "existing or being everywhere at the same time; constantly encountered; widespread" (Merriam-Webster Online 2009). True to this term, ubiquitous city attempts to capture it all:

1. ICT facilitates anything, that is, all activities
2. ICT works anywhere, that is, from or at all places
3. ICT-based services are available at anytime.

This last aspect introduces the temporal dimension that Crang et al. (2007) alert us to as missing from the discourse on ICT and cities. At the same time, perhaps due to the comprehensiveness, the term could appear overambitious and even biased in its emphasis on omnipresent ICT access. We do not take this as a fault and believe that the term is positive (albeit normative too) in its aspiration to describe the current and future state of our urban world.

The uCity is a model of a city that has fully integrated ICT into its functionality at all levels. But given the continuing realities of class inequalities, this is not the technopole or specialized IT city of Castells and Hall (1994), so much as the dual city of later Castells (1999a). In other words, not every sector of the society is yet across the digital divide. We are interested in this process of overcoming digital inequality—thus our uCity is one of ICT for anything, anywhere, anytime, *by anyone*. The cities, even the ones on the forefront of integrating ICT across their environments and activities, are yet to become uCity in its full sense.

In a way, the case study reported here itself follows closely on theorizing by Castells (1999a, 1999b). Castells (1999a) identifies how the information society gives rise to "dual cities" of valued and devalued spaces and people. He proposes that the e-included, the digitally connected, might reach out and include all residents, even those in the delinked spaces that he called the "forbidden zones." Castells (1999b) observes that people themselves—in their everyday lives and by their own individual and social struggles—are "grassrooting the space of flows." The significance of this grassrooting is this: The space of flows (his term for the electronic information flows and the physical sites connected to them) originated as a space for and by elites. It exerts control over the space of place. And the space of place is the material basis for human life. His space of flows/space of place model is another rendition of the Actual-Virtual-Actual model from community informatics.

Now we have briefly traced the history and enriched the concept of uCity: a city where ICT is accessed for anything, from anywhere, at anytime, and by anyone. What experience do we have framing and measuring this multidimensional concept? In its purest form, closest to the originally conceived idea, the uCity has been realized through various national and municipal projects in Japanese, Korean and Scandinavian cities. However, our goal is to first explore the concept in generic terms and then examine it in the context of Chicago.

Frames and dimensions of uCity

The uCity metaphors listed above have rarely been tested empirically. Their purpose has been more to signal innovation, alert us to new trends, and inspire further study. It is difficult to operationalize concepts and decide what, when and how to measure. If IQ (intelligence quotient, Gould 1981) is an imperfect measure of a person's intelligence, can we find a good measure for a

city's intelligence? How smart is smart enough? How much and which activities have to happen outside the physical spatial realm in order for a city to become invisible? Does a *technoburb* achieve the independence from other cities once its entire workforce is either locally employed or telecommutes from their technoburb?
So, in addition to the literature that provides metaphors that present the problem and the opportunity of the uCity, a small body of empirical literature points up four aspects of the uCity:

1. Access to ICT
2. Connected institutions
3. Connected individuals
4. The ubiquity of virtuality

These four aspects are elaborated on below.

Table 1. Metaphors for the ICT-based city (Adapted from Maeng and Nedović-Budić 2008)

Electronic cottage	Toffler 1981	A new production system of a household with mixed activities (production, consumption, and leisure)
Technoburb	Fishman 1987	A suburb which is independent from cities through access to ICT
Wired city	Dutton et al 1987	A city where information highways provide all kinds of ICT services to business and households
Informational city	Castells 1989	A city where networks play a central role in informational society and the "space of flows" shapes the networked society
Intelligent city	Batty 1990a	A city fully equipped with ICT networks to gain competitive advantage
Invisible city	Batty 1990b	A city with a degree of invisibility of the economic and social activity based on ICT
Telecity	Fathy 1991	A concentration of individuals, households, firms, and public agencies interactively interconnected to one another via remote services
City of bits	Mitchell 1995	A digital network city
E-topia	Mitchell 1999	Lean, green cities with "dematerialization, demobilization, mass customization, intelligent operation, and soft transformation"
Digital places	Horan 2000	A city sharing space in both physical and virtual worlds
Network cities	Townsend 2001	A new type of global city with high levels of Internet adoption that "operate in an economy where the transport costs of information and knowledge are fairly insensitive to distance"
Ubiquitous city	Hwang 2005	A city where access to ICT is omnipresent; one can do "anything from anywhere at anytime."
Augmented city	Aurigi 2006	Mixing of physical (visible) and virtual (electronic, invisible) space

Access to ICT

With technological infrastructure underlying all the metaphorical and actual ICT-based activities, it is not surprising that access has been the most widely used measure from the local level to the global. Globally, the explosive growth of the Internet is an obvious indicator of the increased access to ICT. In 1996, less than 40 million people were connected to the Internet (Wheeler et al., 2000); by 2002, 553 million people had Internet access at home (Nielsen//NetRatings, 2002); by 2010 the number of users rose to over 1.9 billion, a fivefold growth since the year 2000 (Miniwatts Marketing Group, 2010). While Internet now reaches homes and businesses in every country, there are persisting differences or digital divides between and within societies, particularly with respect to rural and or poorer regions and people (van Dijk, 2005; Warschauer, 2004). The International Telecommunications Union's Digital Access Index (ITU 2003) is one of the measures takes into account infrastructure, affordability, knowledge, quality and actual usage of ICTs in 181 countries. Among various economic, demographic and infrastructure variables, Chinn and Fairlie (2007) find that cross-country differences in Internet use are associated with differences in income, regulatory environment and telephone density—a pattern very similar to computer use.

Connected institutions

In addition to measuring to what extent urban residents and institutions are connected to ICT, another approach to measuring the uCity relies on a city's connections to larger economic and social processes. This is a valid measure of uCity because our economies, politics, and culture are all directed across the ICT networks, via what Castells (1999b) calls the space of flows. Taylor (2004) and Sassen (2001), for example, analyze the network of so called "global cities" whose functions and prominent leadership role within the world's economic regime is enabled by ICT.

Turning to the regional level, Occelli (2008) examines the case of Italy's Piedmont. She bases her research in the concept of an innovation kernel that links three elements (ICT, information and functionality) and has three effects (substitution, co-evolution and recombination). The associated information and the wired environment is a novel socio-technical system envisioned as an "over-layered entity consisting of four interlinked constructs: technological convergence, network effects, system affordances, and systemic learning" (p.98). The empirical section of this study proceeds with such standard accessibility measures as households with access to the Internet, households with a broadband connection, citizens accessing online public services, citizens who used the Internet to buy online, enterprises with a broadband connection, enterprises with a website, enterprises using online public services, and broadband access by municipalities. Recognizing that the network effects are not captured by the one-dimensional measures, Occelli calculates the Digital Interaction Potential (a gravity/accessibility type formula; Haynes and Fotheringham 1984) by combining population and economic variables with broadband adoption rates for population and firms and web diffusion rates for municipalities. Occelli also differentiates between the digital interaction potential of a province and its proximity to provinces with higher or lower digital interaction potential scores.

Aurigi (2005) provides city level measures from a study of Europe. To assess the scope and scale of the digital city phenomenon, he starts with the number of web sites per city and then measures:

- Ownership of sites;
- Provision of web spaces to firms and presence of detailed tourist information related to hotels and other enterprises;
- Overall presence of facilities for interaction and participation;
- Presence of direct or indirect advertising, Commercial offer of web spaces;
- Availability of public forums and discussion areas, Provision of free web spaces for non-profit organizations and /or individuals;
- Availability of public forums and discussion areas geared to local issues, Free web spaces for local non-profit organizations and/or individuals;
- Areas of the sites with access restricted to local or specially selected people;
- Use of local and/or foreign languages (usually English) on the site;
- Provision and overall depth of local information and services, Provision of the free of charge web spaces for at least local non-profit organization (p. 71).

With the survey results, Aurigi develops a typology of city-related web sites, including ideal types of informative, participative and grounded sites, roughly corresponding to kiosk, cyber mall or square, and embedded digital city, respectively.

Complementing Aurigi's work focusing on the public sphere, our own past work on Chicago (Nedović-Budić and Maeng, 2009) proposes an extended conceptual framework for understanding what we called eCity that goes beyond the public sphere. The framework is comprised of four elements: individual access to ICT (citizen's private realm), applications in governance and public service (city's public realm), ICT-based economy (societal production realm including industry and commerce), and urban space (spatial realm). We use demographic data on ICT access and economic indicators and illustrate the other constructs through empirical description of related public and private sector activities.

Connected individuals

While these studies do consider individual connectivity as part of their data, the empirical study of connected individuals that we find most useful is Inkinen (2006, 2008). He examines individual ICT use and the effects of ICT in the realm of social relations and governance. His expectations of the information society are beyond practical uses of ICT; instead (or in addition), they are about citizenship, wellbeing, happiness, and expansion of the social sphere (2006). Inkinen is interested to find out what are citizens on the other side of digital divide missing, whether they are missing due to lack of affordability or lack of skills. His questions cover three domains:

1. Digital divides: What are the essential socioeconomic characteristics behind the existing divides and how big are the differences? How relevant to the respondents is their experience of the Internet and its contents? What is their level of interest in Internet self education via free or low-cost Internet courses provided by the city or other public organizations?
2. Social interactions: How much have Internet or e-mail communications been used in order to create new social relations, and are these relations national or international? Do

respondents believe that Internet and mobile communications have improved their quality of life?

3. Speeding up of life: Is there a connection between the amount of computer use and the experience of increased demands of work (stress)? To what extent has the line between home and work diminished with the growth of distance work? How large a proportion of the respondents could have the opportunity to do distance work if they wanted? (p. 57-58)

In the realm of governance, Inkinen (2008) is primarily concerned with e-inclusion impacts of eTampere project. He cross-tabulates Internet access from home against employment status, income and demographic variables (i.e., education, family size) and looks into the use of online content and services developed by the city. He also ask where should the city focus in developing online services, and to what extent do citizens experience a need for further computer and internet education.

The ubiquity of virtuality

Going beyond measures of ICT access and socioeconomic connectedness, the fourth aspect of the uCity is to what extent the two aspects of city life, virtual and actual, are overlaid so that people can experience both at the same time.

There are two ways to think of this over lay of physical space and virtual space: either starting from virtuality or from actuality. Zook and Graham (2007) provide an example of the former. They study geographically referenced Internet searches to understand their result: the DigiPlace that reflects the use and navigation of information in cyberspace. The authors find an interesting relationship between the search and map codes and the physical places they are representing. They observe that the software code underlying search "embod(ies) a range of political, economic, and cultural imperatives" (p. 480), but also obscures them via interfaces and procedures that are believed by most users to be value neutral. As a representation of the real, DigiPlaces carry an immense potential to influence the perception of the physical places as well as the course of activities and interactions with and within those places and their members (both individuals and businesses).

Galloway (2004) takes the other approach, examining how physical space is augmented by virtuality. She examines our experience of everyday life and the notions that are central to that experience: sociality (embodiment), spatialisation, and temporalisation. She reminds us of the history of the idea of ubiquitous computing, dating back to the 1980s and the "ubicomp" vision promoted by the researchers at Xerox Palo Alto Research Center (PARC) who wanted to see the technology transparent (invisible, calm technology) and supportive of true human experience: unsimulated, non-virtual, non-immersive, and non-enhanced. Both Ubicomp and Galloway aim to introduce the social and cultural realms into technology design and development—a mission still to be accomplished. It is about bringing computers to our world rather than adjusting the user to the technology: domesticating the computer rather than domesticating us.

Galloway defines current ubiquitous computing as comprising of any number of mobile, wearable, distributed and context-aware computing applications. She promotes "hybrid worlds" or so-called mixed reality technologies that are explicitly concerned with questions that have

long been in the arena of social and cultural discussions of everyday life. According to Galloway, "[m]ixed reality environments refer to spaces which combine elements of the physical and virtual worlds" (p. 390). She cites Milgram et al. (1994) who suggest that "rather than regarding the two concepts simply as antitheses, however, it is more convenient to view them as lying at opposite ends of a *continuum*, which we refer to as the *Reality-Virtuality (RV) continuum*" (p. 1). The explicit consideration of space and everyday practices within the space shifts the analysis toward *performativity* which unifies the time and space experiences into one essence and one flow, material and immaterial at the same time. In addition to performing time and space, this process involves embodiment and identification, i.e., being.

Summary

The efforts we have reviewed attempt to understand humanity's progress towards uCity via surveys and reuse of survey and other large socio-economic datasets, records of ICT infrastructure development and use, analysis of social networks and interactions, as well as high-concept design projects. All methods are important in measuring various aspects of a city according to what extent ICT is accessed *for anything, from anywhere, at anytime, and by anyone*.

Becoming uCity: The Case of Chicago

To recapitulate, our definition of uCity is a city where computers and internet are used for anything, anywhere, anytime, and by anyone. These are represented in four dimensions of framing an uCity: access to ICT, connectivity of institutions, connectivity of individuals, and ubiquity of virtuality. These four dimensions, laid out in the previous section, can now be represented as four questions:

1. To what extent does the city have current internet technologies installed and operational?
2. To what extent are the city's businesses and institutions embedded in global, regional and local networks that run on this technology?
3. To what extent do the city's residents—all of them—use it to connect?
4. Does the city include environments which are mixed reality: ICT-enabled and thus virtual and actual at the same time?

Our recent study (Nedović-Budić and Maeng 2009) concludes by affirming that uChicago, even if not designed and delivered as are some of the projects in Korea (Kim 2008) and Scandinavia (Inkinen 2008), is emerging in a fragmented but forceful and determined way. In this study, the challenge is to learn how to recognize Chicago when it becomes uChicago. An ongoing program of research in the Community Informatics Research Lab at the University of Illinois at Urbana Champaign Graduate School of Library and Information Science has been exploring these questions, validating our definition of the uCity and investigating how the uCity comes into being.

The overarching finding of this body of work is that two trajectories combine to create the uCity. One is driven by weak ties or bridging social capital, the other by strong ties or bonding social capital. As explicated in Williams and Durrance 2008, we equate the term bonding social capital to strong ties and bridging social capital to weak ties. This approach relies on two related bodies

of theory: social network theory that conceptualizes human society as a network of nodes connected by unique patterns of strong and weak ties, and social capital theory that explains that people share various resources with others in their social network according to the strength of their ties. For example, strong ties or bonding social capital tend to be the source for emotional support; weak ties or bridging social capital tend to be the source for effective job leads for managerial/professional jobs (Granovetter 1973); strong ties or bonding social capital tend to help people in strong ethnic networks get jobs (Lin 2001). The differences between strong and weak, bonding and bridging, are relative. In looking at Chicago as it becomes a uCity, we define weak ties as those between the businesses and institutions or between any given city resident and those businesses and institutions. We definite strong ties as those between residents in their neighborhoods and their daily lives.

On the first question, "To what extent does the city have current internet technologies installed and operational?" we find that weak ties provide the city with material access to ICT. Dijk (2005) defines material access as

> physical access and conditional access. Physical access is the entry to hardware, operational software, and services of computers, networks, and other digital technologies. Conditional access is the provisory entry to particular applications, programs, or contents of computers and networks. Increasingly, physical access is not enough. For particular applications, programs, and contents, not only special software and data carriers on CD or DVD are needed but also user names and passwords (p 48).

On the second question, "To what extent do the city's businesses and institutions embedded in global, regional and local networks that run on this technology?" our data suggests that strong ties play a role in embedding community based institutions in global, regional, and local networks.

On the third question, "To what extent do the city's residents—all of them—use it to connect?" strong ties play a leading role in creating motivational access to ICT. Motivational access entails overcoming a range of

> relatively simple lacks of interest, time, money, and skills to a difficult-to-grasp mixture of technophobia, computer anxiety, lack of self confidence, and a particular image of the self in relationship to the technology concerned (Dijk 2005, p. 28).

The fourth question, "Does the city include environments which are mixed reality: ICT-enabled and thus virtual and actual at the same time?" is one we are just beginning to ask.

Earlier work in two post-industrial cities, Toledo, Ohio and Manchester, England, lays the basis for this case study of Chicago that is rooted in the eChicago academic research and public discourse project. Toledo (Alkalimat and Williams 2001) and Manchester (Williams 2005, 2011a forthcoming) demonstrated the agency of people with fewer ICT resources mobilizing strong tie networks to "grassroot the space of flows" (Castells 1999b); work in Chicago elaborates the agency of people on both sides of various digital divides. We have examined settlement patterns and web representations of key ethnic communities, that is, their space and

cyberspace. We are in the fifth cycle of organizing annual research-policy-practice conferences under the rubric of eChicago. And we are finishing a study of how people use and are helped to use computers and the internet in the city's branch public libraries.

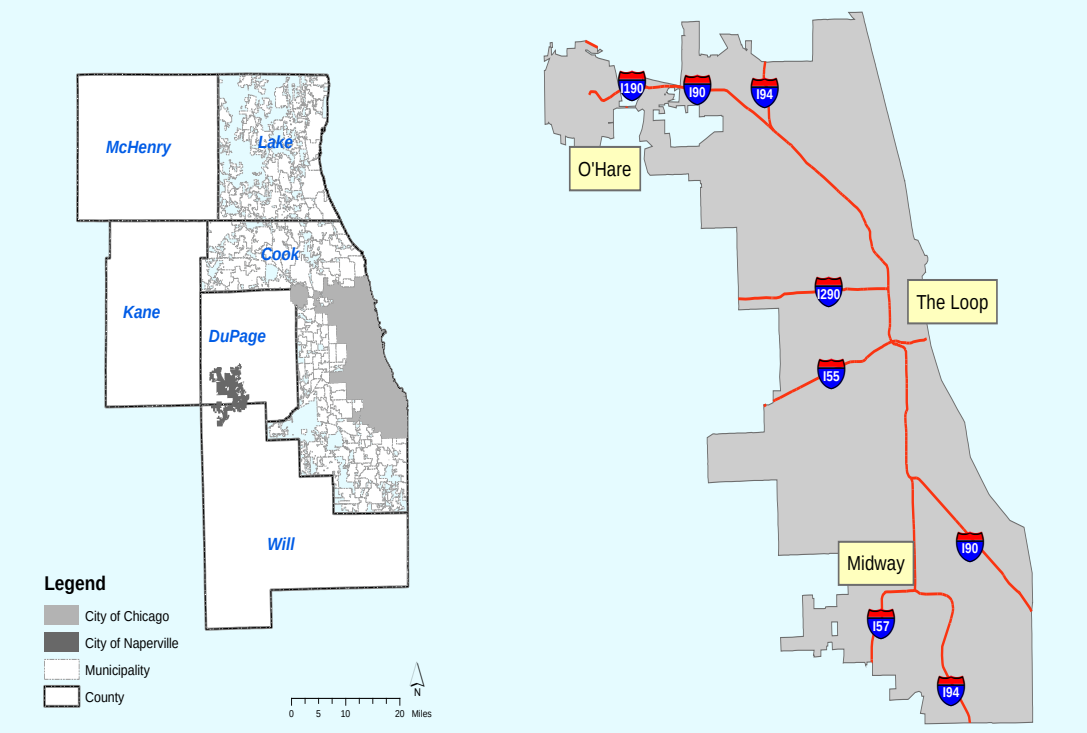
The city of Chicago is one of the largest in the United States with 228 square miles of area and 2.8 million people in 2007. It is located in Cook County which is one of six counties that comprise Chicago Metropolitan Area (CMA). The CMA is 3,750 square miles large and had a population of about 9.5 million in 2007 (Figure 1).

Q1. To what extent does the city have current internet technologies installed and operational?

The City of Chicago and its metropolitan area are generally well supplied with broadband infrastructure, with many providers, but some persistence of low-speed connections among the domestic web users and lack of access of the substantial segment of low income population (Nedović-Budić and Maeng, 2009).i

The role of public libraries cannot be overstated in the process of providing access to local population, disadvantaged and less affluent groups in particular. The city's public libraries provide networked computers and wifi internet access at all 73 locations. This affords the public browser access. Three locations also provide office software. One location also offers teens digital media production tools; plans are underway to offer this media production at three other locations.

Figure 1. Left, the Chicago metropolitan area (Cook, Lake, McHenry, Kane, DuPage and Will counties) Right, the city of Chicago (Northern Illinois Planning Commission, 1999)



Questions posed to four repeat participants in the eChicago conferences—three from public libraries and one from the Community Life Initiative—provide interesting provide interesting insight into the local ICT projects – their mission, time horizon and attitude, effort, involvement, and meaning embedded in the projects by both organizational and human agency. The goals of the local ICT projects are strongly focused on raising awareness, literacy and access to digital communications and media. They engage in extensive outreach activities to provide their patrons the skills in the use of technology and information infrastructure and resources. They strive for broad availability of the services through additional access points and widely used technologies such as mobile phones.

The mission of the respondent organizations centers around 'lifelong learning, discovery and enrichment' based on sustainable support and convenient access to information resources and technologies. Ultimately, they contribute to community building and interactions among diverse population groups and individuals. The timeframe for achieving this mission is either ongoing or until regularity or full technological integration is achieved with respect to specific project goals. Some of the project endeavors are long-standing – dating from mid 1990s the early days of Internet and some are more recent. What they have in common is the focus on introducing new technologies and services to the public thorough outreach to and enabling of individuals' and organizations' presence on and use of the Internet and other ICT resources.

An important aspect of the local ICT projects is the staff's investment and commitment to the cause of wide access and use of information technology and services. They see the projects as an opportunity for teaming up with various community actors and for building of identity. The staff is also aware of broad societal implications and benefits of their endeavors, including but not limited to assistance with respect to housing and jobs, family health and wellbeing. The ICT services are consider successful only if they become integrated in the patrons' lives and fulfill their life needs. The economically disadvantaged population is of particular concern as additional educational and tutoring efforts are placed toward its ICT empowerment.

Q2. To what extent are the city's businesses and institutions embedded in global, regional and local networks that run on this technology?

We answer this question in two ways: 1) by reference to the literature and concrete measures of Chicago's global and regional role; and 2) by examining the city's own plan for what it calls "digital excellence."

Chicago's global and regional role

According to Abu Lughod (1999), Chicago has been an international city

> ever since the second half of the nineteenth century: (1) when it was British bond investments that funded the rail lines to open the prairies and the west to the New York port; (2) when midwest corn and wheat began to supply Europe's bakeries; and (3) when new techniques of curing and refrigeration permitted the delivery of Chicago's meat to distant and even foreign markets.

A fourth 18th century marker might be the Great Chicago Fire of 1871 when its libraries burned to the ground and its civic leaders then mobilized people as far away as England, including Queen Victoria, to donate to rebuild the city's public book collection. Each of these examples expresses the structural connectivity between Chicago on the one hand, and distant people and widely distributed economic processes on the other.

By late 1990s Chicago has established itself early as the global and national leader in high technology economy -- considered a global city alongside New York and Los Angeles and categorized as "first-tier" digital city in the U.S. with excellent backbone capacity, high number of commercial domain names, substantial employment in ICT sector, and business well connected to with high speed lines. Since 1990s, Chicago has managed to keep up although with somewhat less pronounced leadership. Today, using measures of technological and economic connectivity, the Globalization and World Cities Research Network places Chicago among the world's 19 most globalized cities (Ni et al 2010).

Chicago's structural connectivity can also be measured within the United States. Proximity of excellent educational institutions contributes to Chicago's prosperity as a high-tech employment center. However, high-tech firms employ only 43 of every 1,000 private sector workers, thus placing Chicago the 47th rank in the U.S. This data suggests that Chicago may be a cybercity by volume of activities, but not by their intensity. Cybercities that are top ranked have close to one quarter of their employees in the high-tech sectors. Another indicator of Chicago's impact and position on the U.S. context is that today Illinois ranks fourth among the 50 states in corporate headquarters, behind California, New York, and Texas, and 28 of its 31 largest corporations are headquarters in metropolitan Chicago—19 of the 28 outside the city limits (Table 2, Fortune 2010).

Fortune 500 Companies in Chicagoland	Revenues in $ millions	Ranking in 500
Boeing (Chicago)	68,281	28
Walgreen (Deerfield)	63,335	32
State Farm Insurance Cos. (Bloomington)	61,480	34
Sears Holdings (Hoffman Estates)	44,043	48
Kraft Foods (Northfield)	40,386	53
Allstate (Northbrook)	32,013	68
Abbott Laboratories (Abbott Park)	30,765	75
McDonald's (Oak Brook)	22,745	108
Motorola (Schaumburg)	22,063	110
Exelon (Chicago)	17,318	134
UAL (Chicago)	16,335	140
Illinois Tool Works (Glenview)	13,904	169
Sara Lee (Downers Grove)	12,881	180
Baxter International (Deerfield)	12,562	185
Navistar International (Warrenville)	11,569	202
R.R. Donnelley & Sons (Chicago)	9,857	240
Discover Financial Services (Riverwoods)	7,986	286
Aon (Chicago)	7,595	298
Integrys Energy Group (Chicago)	7,500	302
OfficeMax (Naperville)	7,212	313
W.W. Grainger (Lake Forest)	6,222	349
Fortune Brands (Deerfield)	6,205	351
Smurfit-Stone Container (Chicago)	5,574	374
Telephone & Data Systems (Chicago)	5,021	416
Anixter International (Glenview)	4,982	422
United Stationers (Deerfield)	4,710	439
Tenneco (Lake Forest)	4,649	446
Northern Trust Corp. (Chicago)	4,193	497

Table 2. The largest corporations headquartered in metropolitan Chicago (Fortune 2010)

Finally the institutional connectivity and embedding of ICT is also traceable at the local government level as the public organizations have started to use technology for communicating within the government offices (Intranet) and for posting information on the Internet for general public access and for managing and administering urban development. The City of Chicago offers many administrative public services via Internet, including: CPS School Locator, Building Stats (CNT), Chicago Landmarks, City Parking, Cook County Parcels, Encyclopedia of Chicago, Historical Maps, RTA Trip Planner, Zoning Map; Interactive Maps (Aviation Sound Insulation; Bike Trail Map; Interactive Zoning Map; Clear Map (Police); Division of Plats and Maps – Kiosk; Farmers Markets; Landmarks).

ICTs are both enabling and giving shape to urban activities, life and space and should be closely incorporated into urban policy making (Horan and Jordan 1998). Maeng and Nedović-Budić (2004) find it difficult to attribute physical changes exclusively to ICTs because of the complexity and multiplicity of forces influencing urban and regional (metropolitan) development and because of immaturity of ICTs. However, our research suggests that the ICT-related structures and uses are observable in central city areas as well as in the periphery of Chicago. These changes are in form of new types of land uses, including ICT-related industry, telecom hotels, cellular towers and ICT infrastructural easements. Infrastructural improvements are

probably the most important (although not necessarily the most obvious) aspect of the adjustment to and incorporation of new technologies in urban areas.

Chicago's plan and activity towards "digital excellence"

The agency of the connected in Chicago towards the uCity is best represented by the culminating planning document *The City That* Net*works* (City of Chicago 2007). The title itself is a reference to industrial-age Chicago, which Richard J. Daley (Chicago's mayor during 1955-1972 and father of the current mayor) famously dubbed "the city that works."

The report declares the goal to be digital excellence which will set the conditions for digital transformation of the city and its economy (Figure 2).

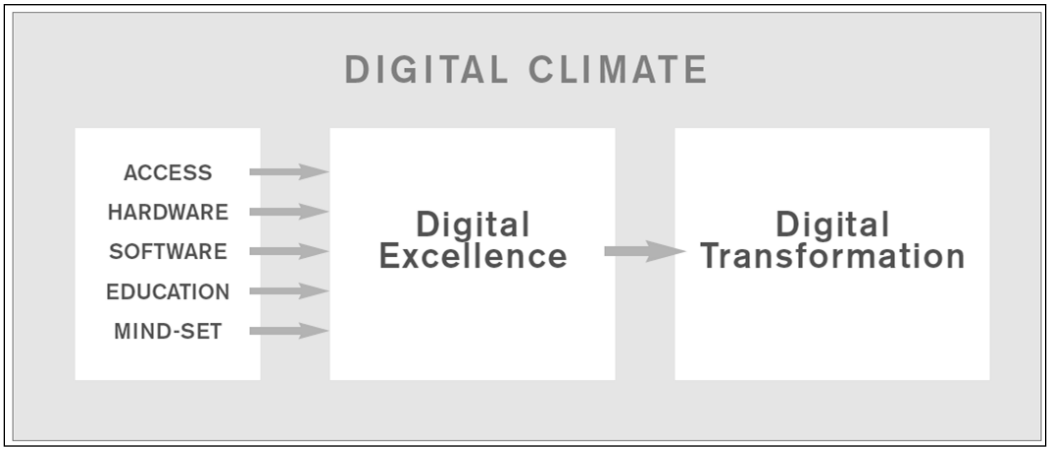


Figure 2. The vision spelled out in *The City That* Net*works* (City of Chicago 2007, page 1)

The report assigns tasks to institutions of four sectors:

1. **The public sector: city government, library, school system**. The city is to implement e-government, providing services online, managing its work online, practicing digital access to information and officials and "digital evangelism" (City of Chicago 2007, p 41). The library is to continue to "expand its current role as an information provider and become a key provider of digital access, training, and content." (p 42) The school system is to graduate all its high school students as "fully digitally literate" (p 43).
2. **Colleges and universities**. Higher education institutions are to continue and coordinate their provision of computer/internet access, low cost continuing education computer classes, content development for teachers, and community service.
3. **The private sector**. Corporations are to constitute a low cost channel for computer equipment and internet access; partner with nonprofit community based computer programs; establish IT competitions and awards and otherwise cultivate a city mindset for digital excellence; and support and advance digital-age business opportunities.

4. **Community based organizations and the nonprofit sector**. CBOs are to expand computer distribution, training, and outreach to less-connected and foundations are to direct funds to this project.

A privately operated public wireless network was a cornerstone of the *City That* Net*works* plan, but responses to a city request for proposals foundered as too expensive. In selected neighborhoods, representatives of foundation-supported CBOs and city officials participated in a series of planning meetings to generate ideas for implementation plans following from *The City That* Net*works*. These plans would be the basis for fundraising. The neighborhoods include three of the strongest ethnic communities in Chicago: Puerto Rican, to the near northwest of Chicago (Humboldt Park); Mexican on the near southwest (Pilsen); and African American on the South Side (Auburn Gresham, Chicago Lawn, and Englewood).

By 2009, the new U.S. President's stimulus funding included 1% for broadband fiber in underserved areas (<40% household broadband penetration) and for vulnerable (low income, rural, senior) populations. The city and its selected communities identified this funding stream as a way to implement its plan. By 2010, the city had won federal funds that it will invest in what it now calls "smart communities"—the "digital excellence demonstration communities" that the *City That* Net*works* recommended as testbeds. This work is based in the weak tie networks of city and community agency staffpeople.

Parallel to the city planning process comes a research and discourse process called eChicago (http://echicago.illinois.edu). This has consisted of research on Chicago communities' use of ICT and (since 2007) eChicago symposia. an eChicago has brought together practitioners, policymakers, and researchers to share their knowledge about Chicago's progress towards a digital and democratic future. This gathering is in effect a transnetwork discourse across public librarians, city leadership, community technology staffs, funders, university scholars, students, activists, and others. Such a discourse helps to educate and galvanize the day-to-day work in various sectors of the city, at the grassroots.

Q3. To what extent do the city's residents—all of them—use the available current internet technologies to connect?

While the weak tie networks have put internet technology within reach of Chicago's population, we found that strong tie networks are making sure it is useable. Drawing on our own data on Chicago's ethnic communities in cyberspace we find that at the people-to-people level of globalization, Chicago also has been a major hub. It has been a destination for immigrants since the mid 1800s until today with any immigrant group of any size showing particular pattern of settlement in and beyond the city limits. As in Aurigi (2005), we examined the online presence of these local ethnic groups by collecting websites by or about them. As an indicator of how locally based these websites are, we then used the global domain name registry to map each URL back to the physical address of its owner, in a method developed by Zook (2001). Figure 3 shows to what extent each of the eight collections maps back to the local ethnic community, to the rest of Chicago, to metro Chicago, to the US, and to the rest of the world. The websites of ethnic groups which are larger and have been longer in Chicago are more likely to map to a local physical address (red, orange, yellow in Figure 3 below). This suggests that strong (within group) ties support the cyberrepresentation of these ethnic groups.

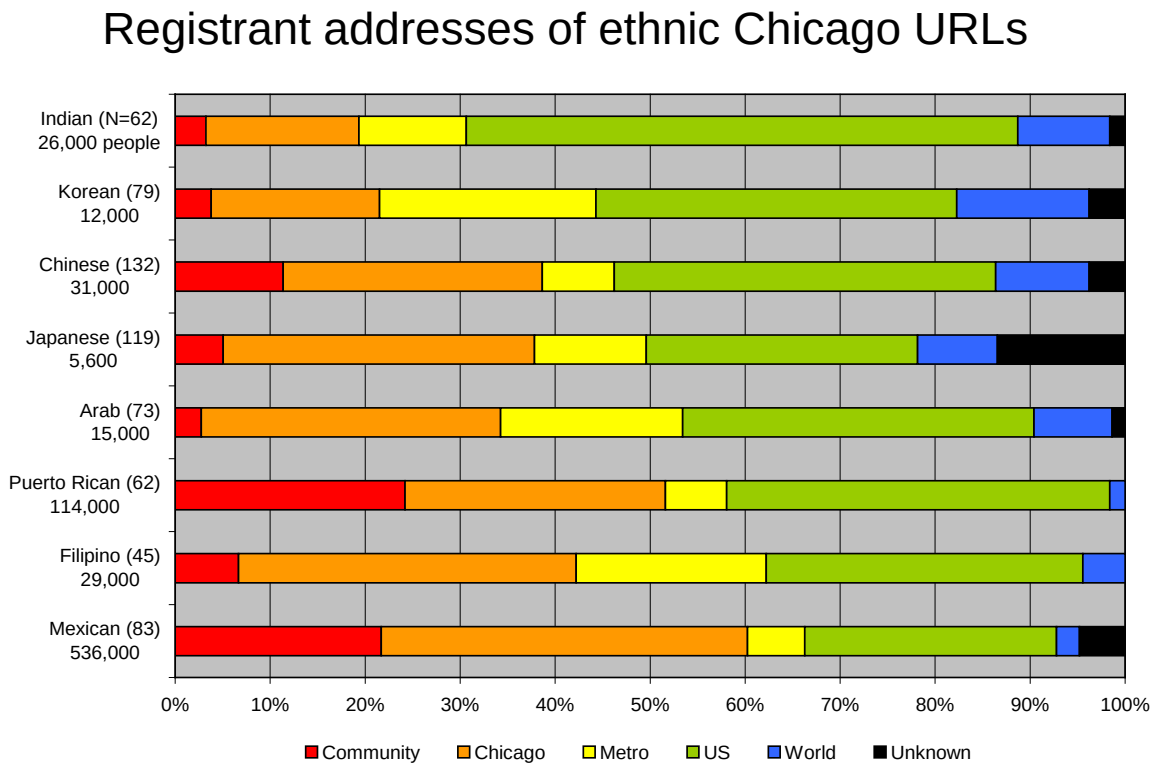


Figure 3. Websites about Chicago's ethnic communities, mapped to physical location

Second case, Chicago Public Library: The library staffs more than half its libraries with cybernavigators, Chicagoans who know enough computers and have the people skills and patience to teach others "just-in-time" computing. They are a key service for job seekers, because today virtually all job applications must be submitted over the internet, whether the job entails computer work or not. The cybernavigators are not professionally trained career counselors, but trusted peers who teach one on one or in small groups, advising Chicagoans on using Craigslist, obtaining government benefits online, even how to buy or repair a computer. They are the most visible nodes in a grassroots network of computer help for people who cannot afford to purchase commercial tech support. (Williams 2011b forthcoming)

Q4. Does the city include environments which are mixed reality: ICT-enabled and thus virtual and actual at the same time?

This is a question that we began to investigate in the fifth eChicago meeting by bringing together local music leaders—Association for the Advancement of Creative Musicians (AACM), David P. Kelly (Capital D), and accuradio.com—as well as several community media and community archiving organizations. So far these organizations affirm our A → V → A model. More work is needed to catalog and analyze these and other virtual representations of Chicago's social and cultural life.

Conclusion

This paper explores the concept of ubiquitous city or uCity, its definitions, framing and multi-dimensionality. The many definitions of ICT-based and ICT-enhanced cities amount to a substantial number of metaphors advanced over the past twenty years. uCity is its latest incarnation, claiming access to anything, anywhere and anytime. We add the user perspective to this triple of As and consider of uCity means that 'anyone' (or everyone) can achieve ubiquitous access to ICT and services. The work takes a socio-technical approach and draws on social network and social capacity theories in examining empirically the case of Chicago. It draws primarily on previous surveys and secondary data.

The literature review reveals four dimensions that frame the relationship between ICT and the city: access, connectivity of institutions, connectivity of individuals, and ubiquity of the virtuality. We examine the former three dimensions and find that they are all contributing in their own unique ways to the becoming of uChicago. We present evidence of generally adequate access to ICT infrastructure and services in Chicago, despite the somewhat problematic issue of private supply and affordability relative to some other countries. We find that in sum, the uChicago—a city reflecting ICT use for anything, anywhere, anytime, by anyone—is driven by two aspects: access, policy and institutional connectivity—top down (weak ties) and through community and individual connections and bottom up transformation (strong ties). It is clear that not only weak ties but also strong times are needed to create uCity. The best installation of technology isn't functional, isn't activated or sustained, without help overcoming the motivational and human agency aspects of technology introduction and use.

While this work does not achieve full operationalizaiton of the uCity concept, it makes important contributions toward our understanding of the process of its becoming and its manifestations in more concrete terms. We suggest that the concept and the process have multiple dimensions – often mentioned but rarely inter-related in the previous studies. The access, institutional and individual connectivity are all important aspects that contribute toward uCity to evolve through weak (institutional) and strong (social) networks. Limiting our inquiry to one of these dimensions is unlikely to lead to comprehensive and holistic determinations regarding the uCity's development, manifestations, and impacts. Ultimately, it is the uCity's impacts on the quality of life of urban residents of all backgrounds and means that matters the most.

Further study is needed toward more specific and quantifiable operationalizations of the uCity concept and its dimensions, as well as development of measures of its status and impact. Systematic, multi-city comparative analysis at multiple scales could provide additional insights on the process of establishment (i.e., becoming) of the uCity. We expect that the questions of the unit of analysis and context will gain substantial relevance in future research. The comparison between Asian cities, particularly those on the forefront of uCity initiatives, and other urban centers well positioned in the global city network (e.g., London, New York, Sydney), would allow for contrasting and isolating the implementation goals, approaches and their related outcomes. Is 'anyone' the most important criterion of all ICT developments after all, or do the societal benefits and economic efficiencies take precedence?

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[i] For original sources of information presented in this summary, see Nedović-Budić and Maeng, 2009.