Becoming a uCity: The Case of Chicago

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ABSTRACT. The concept of a 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 spread more quickly than its implementation, which relies on a complex set of interrelated technologies, practices, and actors, including but not limited to the provision of ICT infrastructure, the availability and accessibility of information and services, and the adoption of mobile communication devices by a variety of users. To aid in measuring and implementing a uCity, we explore ways to measure the "ubiquity" of a city, with particular attention given to the first "A" above – i.e., "anyone". Empirical findings from Chicago highlight: 1) ICT access, 2) the connectivity of institutions and individuals, and 3) the ubiquity of virtuality. A socio-technical perspective and social network and social capital theories guide this study. The underlying social and motivational processes are essential to all aspects of becoming a uCity.

KEYWORDS. ***Ubiquitous city, urban planning, community informatics, Chicago***

1. INTRODUCTION: USING METAPHORS TO DEFINE THE ICT-BASED CITY

There has been no shortage of metaphors used to describe the new urban life and environment that emerge with information and communication technologies (ICT) and infrastructures (Maeng and Nedović-Budić, 2008). The concept of an ICT-based city goes back almost three decades to Toffler's 1981 vision of an electronic cottage accompanying the information revolution. It has appeared in various permutations such as the intelligent city, informational city, invisible city, network city, and wired city. It has also acquired such suggestive labels as technoburb, digital place, e-topia, telecity and city of bits. Now, it has arrived in 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, such as the ability to access information without the need for physical proximity and the overcoming of distance as a barrier. Some emphasize the economic advantage, independence, and services facilitated by ICT. Others point to the qualitative societal changes, wherein networks and the flow of information provide for different kinds of interaction between members—individuals, households, and public- and private-sector organizations. Although a physical city is assumed in all of these definitions, only a few authors have made relatively explicit connections to the physical environment to suggest that ICT will help achieve better (i.e., more sustainable, healthy, and green) cities (Berg, 2002; Mitchell, 1999), or asserted that place will remain key in the relationship between people and technology. Indeed, 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 view is appropriate for a field that assumes a critical socio-technical perspective and is concerned with social inequalities.

According to Merriam-Webster's dictionary, **ubiquitous** is an adjective that characterizes an entity "existing or being everywhere at the same time; constantly encountered; widespread" (Merriam-Webster Online, 2009). True to this term, a ubiquitous city attempts to provide all of the following:

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

This last aspect introduces the temporal dimension that Crang et al. (2007) alerted us to as missing from the discourse on ICT and cities. At the same time, perhaps because of its 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. However, given the continuing realities of class inequalities, this is not so much the technopole or specialized IT city of Castells and Hall (1994) as it is the dual city of Castells' later writing (1999a). In other words, not every sector of society has crossed the digital divide. We are interested in the process of overcoming digital inequality—thus, our uCity is one where ICT is accessed for anything, from anywhere, at any time, and by anyone. Cities, even those on the forefront of integrating ICT across their environments and activities, have yet to become uCities in the full sense of the word.

In a way, the case study reported here is based closely on theorizing by Castells (1999a, 1999b). Castells (1999a) explained how the information society gives rise to "dual cities" of valued and devalued spaces and people. He proposed that the e-included (i.e., the digitally connected) might reach out and include all residents, even those in the delinked spaces that he called the "forbidden zones." Castells (1999b) observed that people—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 created 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 that we have briefly traced the history and enriched the concept of the uCity—a city where ICT is accessed for anything, from anywhere, at any time, and by anyone—the question is, what experience do we have to frame and measure 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.

2. FRAMES AND DIMENSIONS OF A UCITY

The uCity metaphors listed above have rarely been tested empirically. Their main purpose has been 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 them. If an 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 must happen outside the physical spatial realm in order for a city to become invisible? Does a technoburb achieve 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 problems and opportunities of a uCity, a small body of empirical literature identifies four aspects of the uCity:

(1) Access to ICT
(2) Connected institutions
(3) Connected individuals
(4) 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 that 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 businesses and households
Informational city	Castells, 1989	A city where networks play a central role in the informational society and the "space of flows" shapes the networked society
Intelligent city	Batty, 1990a	A city that is fully equipped with ICT networks to gain competitive advantages
Telecity	Fathy, 1991	A concentration of individuals, households, firms, and public agencies that are 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 the physical and virtual worlds
Network cities	Townsend, 2001	A new type of global city with high levels of Internet usage 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 any time."
Augmented city	Aurigi, 2006	A mix of physical (visible) and virtual (electronic, invisible) space

2.1. 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 to the global level. 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 from 2000 (Miniwatts Marketing Group, 2010). While the Internet now reaches homes and businesses in every country, there are differences or digital divides that persist 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 a measure that takes into account the infrastructure, affordability, knowledge, quality, and actual usage of ICTs in 181 countries. Among various economic, demographic, and infrastructure variables, Chinn and Fairlie (2007) found cross-country differences in Internet use to be associated with differences in income, regulatory environments, and telephone density—a pattern very similar to that of computer use.

2.2. Connected institutions

In addition to measuring the extent to which 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 the uCity because our economies, politics, and cultures are all directed across the ICT networks, via what Castells (1999b) calls the space of flows. Taylor (2004) and Sassen (2001), for example, analyzed the network of the so-called "global cities," whose functions and prominent leadership role within the world's economic regime are enabled by ICT.

Turning to the regional level, Occelli (2008) examined the case of Italy's Piedmont region. She bases her research on 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 use the Internet for online purchases, 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 one-dimensional measures, Occelli calculated 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 differentiated between the digital interaction potential of a province and its proximity to provinces with higher or lower digital interaction potential scores.

Aurigi (2005) provided city-level measures from a study of Europe. To assess the scope and scale of the digital city phenomenon, he started with the number of websites per city and then measured the:

- Ownership of websites
- Provision of web spaces to firms and the 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 and the commercial offering of web spaces
- Availability of public forums and discussion areas, and the 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 websites with access restricted to local or specially selected people
- Use of local and/or foreign languages (usually English) on the website
- Provision and overall depth of local information and services, and the provision of free web spaces for at least local non-profit organizations (p. 71).

With the survey results, Aurigi developed a typology of city-related web sites, including ideal types of informative, participative, and grounded sites, roughly corresponding to kiosks, cyber malls or squares, and embedded digital cities, respectively.

Complementing Aurigi's work focusing on the public sphere, our own past work on Chicago (Nedović-Budić and Maeng, 2009) proposed an extended conceptual framework for understanding what we called an eCity that goes beyond the public sphere. This framework is comprised of four elements: individual access to ICT (citizen's private realm), applications in

governance and public services (the city's public realm), an ICT-based economy (societal production realm including industry and commerce), and urban space (spatial realm). We used demographic data on ICT access and economic indicators and illustrated the other constructs through empirical descriptions of related public- and private-sector activities.

2.3. Connected individuals

While these studies do include individual connectivity in their data, the empirical studies of connected individuals that we found most useful were conducted by Inkinen (2006, 2008), who examined individual ICT use and the effects of ICT in the realm of social relations and governance. His expectations of the information society go beyond the practical uses of ICT; instead (or in addition), they concern citizenship, wellbeing, happiness, and the expansion of the social sphere (2006). Inkinen was interested in discovering what citizens on the other side of the digital divide are missing and whether their exclusion is due to a lack of affordability or a 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-based 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 to create new social relations, and are these relations national or international? Do the respondents believe that the 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) was primarily concerned with e-inclusion impacts of the eTampere project. He cross-tabulated Internet access at home against employment status, income, and demographic variables (i.e., education and family size) and looked into the use of online content and services developed by the city. He also asked where the city should focus on developing online sfervices and to what extent citizens feel a need for further computer and Internet education.

2.4. The ubiquity of virtuality

Going beyond measures of ICT access and socioeconomic connectedness, the fourth aspect of the uCity is the extent to which 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 overlay of physical space and virtual space: either starting from virtuality or from actuality. Zook and Graham (2007) provide an example of the former. They examined geographically referenced Internet searches to understand their result: the DigiPlace that reflects the use and navigation of information in cyberspace. The authors found an interesting relationship between the search and map codes and the physical places they represent. They observed that the software code underlying the 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 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) took the opposite approach, examining how physical space is augmented by virtuality. She examined our experience of everyday life and the notions that are central to that experience: sociality (embodiment), spatialization, and temporalization. She reminded 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 aimed to introduce the social and cultural realms into technology design and development—a mission that has yet to be accomplished. This goal is about bringing computers to the user's world rather than adjusting the user to the technology; in other words, domesticating the computer rather than allowing it to domesticate us.

Galloway defines current ubiquitous computing as comprising 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 suggested 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, simultaneously material and immaterial. In addition to performing time and space, this process involves embodiment and identification (i.e., being).

2.5. Summary

The works that we have reviewed have investigated humanity's progress towards a uCity via surveys and other large socioeconomic datasets, records of ICT infrastructure development and use, analyses of social networks and interactions, and high-concept design projects. All of these methods are important in measuring the various aspects of a city according to the extent to which ICT can be accessed for anything, from anywhere, at any time, and by anyone.

3. BECOMING A UCITY: THE CASE OF CHICAGO

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

(1) To what extent does the city have up-to-date 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 that are a mixed reality: ICT-enabled and thus virtual and actual at the same time?

Our recent study (Nedović-Budić and Maeng, 2009) concluded 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 research program 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" with strong ties and "bridging social capital" with weak ties. This approach relies on two related bodies of theory: social network theory, which conceptualizes human society as a network of nodes connected by unique patterns of strong and weak ties, and social capital theory, which holds 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 tends to be the source of emotional support; weak ties or bridging social capital tends to be the source of 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 define strong ties as those between residents in their neighborhoods and their daily lives.

For the first question (i.e., "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) defined 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).

For the second question (i.e., "To what extent are 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.

For the third question (i.e., "To what extent do the city's residents—all of them—use it to connect?"), we find that strong ties play a significant 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 (i.e., "Does the city include environments that are a mixed reality: ICT-enabled and thus virtual and actual at the same time?") is one we have just begun to ask.

Earlier works that focused on two post-industrial cities, Toledo, Ohio, and Manchester, England, form the basis for this case study of Chicago, which is rooted in the eChicago academic research and public discourse project. Toledo (Alkalimat and Williams, 2001) and Manchester

(Williams, 2005, 2011a) demonstrated the agency of people with fewer ICT resources to mobilize 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 public library branches.

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 the 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 up-to-date Internet technologies installed and operational?

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

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

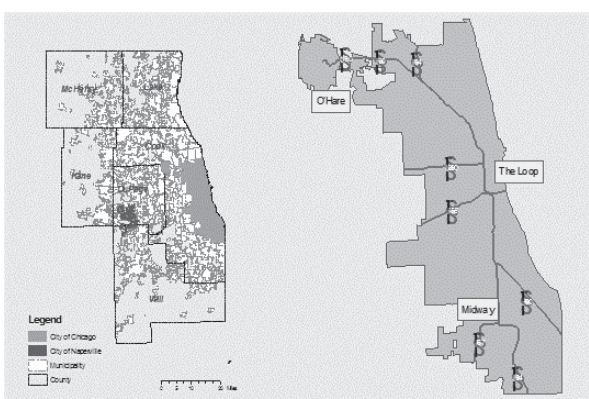

Figure 1. Left, the Chicago metropolitan area (Cook, Lake, McHenry, Kane, DuPage, and Will counties) Right, the city of Chicago (Northern Illinois Planning Commission, 1999)

Questions posed to four repeat participants in the eChicago conferences—three from public libraries and one from the Community Life Initiative—provide interesting insight into the mission, time horizon, and attitude, effort, involvement, and meaning that are embedded in the ICT projects by both local 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 with the skills for using technology and information infrastructures 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 respondents' organizations focuses on 'lifelong learning, discovery and enrichment,' based on sustainable support and convenient access to information resources and technologies. Ultimately, they contribute to community building and interaction 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 the early days of Internet in the mid-1990s, while others are more recent. What they have in common is the focus on introducing new technologies and services to the public by reaching out and enabling individuals and organizations to use the Internet and other ICT resources.

An important aspect of the local ICT projects is the staff's investment and commitment to providing wide access to information technology and services. They see the projects as an opportunity for teaming up with various community actors and for identity building. The staff is also aware of the broad societal implications and benefits of their endeavors, including but not limited to providing assistance for issues such as housing, jobs, and family health and wellbeing. The ICT services are considered successful only if they are 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 referencing 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 19th century marker might be the Great Chicago Fire of 1871, when the city's libraries burned to the ground and its civic leaders mobilized people from as far away as England, including Queen Victoria, to donate money 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 the late 1990s, Chicago had established itself as a global and national leader in the high-technology economy. It was considered a global city alongside New York and Los Angeles and categorized as a "first-tier" digital city in the United States with excellent backbone capacity, a high number of commercial domain names, substantial employment in the ICT sector, and businesses well connected to high speed lines. Since the 1990s, Chicago has managed to maintain this status, 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. The proximity of excellent educational institutions contributes to Chicago's prosperity as a high-tech employment center. However, around 2010, high-tech firms have employed only 43 out of every 1,000 private-sector workers, thus ranking Chicago in the 47th place in the United States. This data suggests that Chicago may be a cybercity by volume of activity 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 in the context of the United States is that today, Illinois ranks fourth in the country in the number of corporate headquarters, behind California, New York, and Texas, with 28 of its 31 largest corporations headquartered in metropolitan Chicago—19 of the 28 outside the city limits (Table 2; Fortune, 2010).

Table 2. The largest corporations headquartered in metropolitan Chicago (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

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 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, and Interactive Maps (Aviation Sound Insulation, Bike Trail Map, Interactive Zoning Map, Clear Map (Police), Division of Plats and Maps–Kiosk, Farmers Markets, and Landmarks).

ICTs are enabling and shaping urban activities, life, and space and should be incorporated into urban policy making (Horan and Jordan, 1998). Maeng and Nedović-Budić (2004) found it difficult to attribute physical changes exclusively to ICT because of the complexity and multiplicity of forces influencing urban and regional (metropolitan) development and the immaturity of ICT. 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 the form of new types of land use, including ICT-related industries, 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 Networks (City of Chicago, 2007). The title itself is a reference to industrial-age Chicago, which Richard J. Daley (Chicago's mayor from 1955 to 1972 and father of the current mayor) famously dubbed "the city that works."

The report declares the city's strive for digital excellence, which will set the conditions for the digital transformation of the city and its economy (Figure 2).

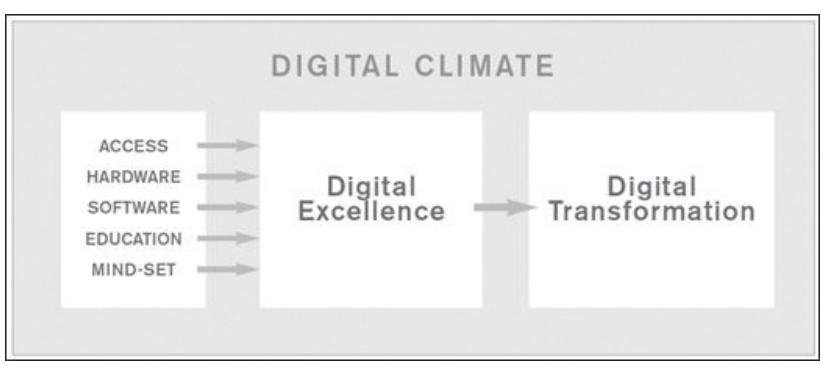

Figure 2. The vision spelled out in The City That Networks (City of Chicago 2007, page 1)

The report assigns tasks to the 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, allow 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 coordinate and continue their provision of computer/Internet access, low-cost continuing education computer classes, content development for teachers, and community services.

(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, cultivate a city mindset for digital excellence, and support and advance digital-age business opportunities.

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

A privately operated public wireless network was a cornerstone of the City That Networks plan, but responses to a city request for proposals foundered because the plan was too expensive. In selected neighborhoods, representatives of foundation-supported CBOs and city officials participated in a series of planning meetings to generate implementation plans following The City That Networks. 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 newly elected President Obama had enacted a stimulus funding program that included 1% for broadband fiber in underserved areas (< 40% household broadband penetration) and for vulnerable (low income, rural, and senior) populations. The city and its selected communities saw this funding stream as a way to implement its plan. By 2010, the city had won federal funds that it would invest in what it now calls "smart communities"—the "digital excellence demonstration communities" that the City That Networks recommended as test beds. This work is based on the weak-tie networks of city and community agency staff members.

Parallel to the city planning process was 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. Each eChicago symposium 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 resident s— 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 usable. Drawing on our own data on Chicago's ethnic communities in cyberspace, we found that at the people-to-people level of globalization, Chicago has also been a major hub. It has been a destination for immigrants since the mid-1800s with immigrant groups of all sizes showing particular patterns 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 the URL's owner, using a method developed by Zook (2001). Figure 3 shows the extent to which each of the eight collections maps back to the local ethnic community, to the rest of Chicago, to metro Chicago, to the United States, and to the rest of the world. The websites of ethnic groups which are larger and have been in Chicago longer 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 cyber-representation of these ethnic groups.

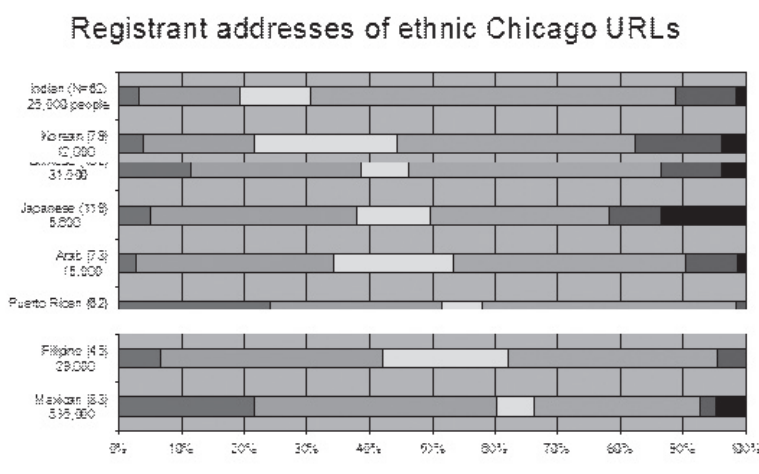

Figure 3. Websites about Chicago's ethnic communities, mapped to physical location

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

Q4. Does the city include environments that are a 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, which brought together local music leaders—the 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.

4. CONCLUSIONS

This paper explores the concept of a ubiquitous city or uCity, including 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 to provide people with access to anything, anywhere, and at any time. We add the user perspective to this trio of A's and consider uCity to mean that "anyone" (or everyone) can have ubiquitous access to ICT and related services. This study takes a socio-technical approach and draws on social network and social capacity theories to empirically examine 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, the connectivity of institutions, the connectivity of individuals, and the ubiquity of virtuality. We examined the former three dimensions and found that they all contribute in their own unique ways to the realization of uChicago. We present evidence of generally adequate access to ICT infrastructures and services in Chicago, despite the somewhat problematic issue of private supply and affordability relative to some other countries. We found that, in sum, 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 ties are needed to create a uCity. The best installation of technology cannot be functional, activated, or sustained, without overcoming the motivational and human agency aspects of technology introduction and use.

While this work does not achieve full operationalization of the uCity concept, it makes critical contributions toward an understanding of the process of the uCity's becoming and its manifestations in more concrete terms. We suggest that the concept and the process have multiple dimensions, which are often mentioned but rarely interrelated in previous studies. Access and institutional and individual connectivity are important aspects that allow a 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, manifestation, or impact. 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 to bring about more specific and quantifiable operationalizations of the uCity concept and its dimensions as well as the development of measures of its status and impact. Systematic, multi-city comparative analyses at multiple scales could provide additional insights on the process of the establishment (i.e., the becoming) of a 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 at the forefront of uCity initiatives, and other urban centers well positioned in the global-city network (e.g., London, New York, and Sydney), would allow for contrasting and isolating implementation approaches, goals, and their related outcomes. In the end, is "anyone" the most important criterion of ICT developments, or do societal benefits and economic efficiency take precedence?

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