When Code Meets Place: Collaboration and Innovation at WiFi Hotspots

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ABSTRACT

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This dissertation examines the forms of organizing that occur when code – digital information, networks and interfaces – meets place. Over the past decade since the mainstream adoption of the Internet, there has been a growing body of scholarship about the role of media, communication and information technology in enabling the work of virtual organizations. However, the role of place has been significantly under-theorized. During the same period, our homes, offices and cities have become populated with a wide variety of mobile and wireless technologies – mobile phones, wireless fidelity (WiFi), radio frequency identification tags (RFID) and wireless sensors – that make up an invisible digital information layer in physical space. In order to describe emerging socio-technical arrangements, this dissertation analyzes the people and organizations for whom WiFi networks, and the spaces that they inhibit, play an important role. These include, for example, freelancers coworking from a Starbucks Coffee in New York, hacktivists innovating open source wireless protocols in a basement in Berlin and social entrepreneurs building bottom-up mesh networks in San Francisco. Drawing on theories from communications and science and technology studies, this dissertation applies network ethnography to analyze themes of social construction, sociality and locality. This dissertation argues that mobile and wireless technologies enable an ad-hoc, community or peer-to-peer form of organizing that is deeply embedded in physical location in contrast to current notions of virtual organizations. The concept of

codescapes -- the integration of digital networks with physical space -- is developed to capture the emerging modes of communication, collaboration and innovation that are occurring at the intersection of technology and place. This conceptual reframing of forms of organizing is essential in order to understand the ways in which organizations, architecture, policies and technologies themselves are being reshaped.

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A dissertation is not the mere pursuit of a single individual. While we tend to credit the work of individual authors, inventors and entrepreneurs, anyone who has participated in the creative and collaborative process of writing a dissertation will tell you that is it much more than that. Rather, a dissertation is the product of nearly a decade of conversations, ideas and meetings, all of which occur collaboratively with the participation of many others including colleagues, advisors, friends and parents. While, like any other doctoral student, I have spent many lonely months at home in front of my computer (and have an extensive pajama collection to match), there are many people that I would like to acknowledge for their participation in bringing this dissertation into existence. Drum roll, please.

First and foremost, I would like to acknowledge James W. Carey for founding a Ph.D. program in Communications at Columbia University that is truly interdisciplinary in nature and for allowing me to contribute to its shaping. I feel very fortunate to have studied with "Professor Carey" (never James or Jim), who I will always remember dearly for his character as well as his writing. On my first day as a doctoral student in communications at Columbia University, I remember Professor Carey beginning his Social Impact of the Mass Media course by showing a film clip about the first encounter between the French explorers and the Native American Indians. "There are times in history that are liminal times," he said in his unmistakable Rhode Island brogue and went on to talk about transition, in-betweeness, and times that are neither here, nor there. It was two days after September 11th.

Second, I am consistently amazed by the camaraderie of my peers, their dedication to improving the Ph.D. program, the quality of their ideas and their commitment to both scholarship and practice. In particular, John Kelly, Petra Sonderegger, Jeff Pooley, Gali Einav, Kristen Daly, Reuben Abraham, Chris Anderson, Pavel Shlossberg, Phil Kay, Hawley Johnson, Jane Turk, Joost van Dreunen, Olivier Sylvain, Rasmus Kleis Nielson and Lucas Graves have been incredible colleagues and close friends whom I will treasure for a lifetime. I credit the program's core faculty and steering committee, and, especially, Andie Tucher in bringing together such a great group of people to share in the unique experience that is the Ph.D. in Communications at Columbia. I can honestly say that, as an interdisciplinary scholar, I have never found a community with which I share more common values, pursuits and interests as I have with this group. We are very lucky to, in the tradition of Professor Carey, have a community that values both thinkers and doers, whether writing scholarly peer-reviewed journal articles, conducting research for clients or testifying on technology policy before the New York City Council.

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incredibly creative, fun and rewarding one. Along with David, my entire dissertation committee including Todd Gitlin, Eli Noam, Saskia Sassen and Jack Balkin made the defense a challenging yet memorable occasion, complete with a tele-present serenade of church bells sounding in Cologne, Germany, which I will long cherish. (Note: I will also remember the defense for another, more personal reason. Within five hours of my defense, after a celebratory dinner at an Italian restaurant on Avenue B in the East Village with my husband, José Chan, my face was completely numb from the nose down and I had broken out in terrible hives due to a recent but severe allergy to some tree nuts including pistachios, which had been in our dessert. Ironically, I had passed a grueling two-hour defense surrounded by a team of Harvard-trained scholars yet I had nearly met my demise by a brief encounter with a tiny nut.) I would like to express my gratitude to Todd, the chair of my dissertation committee, for his provocative questions, ongoing support and careful line-edits, to Eli for pushing me to express my ideas in more concrete and practical terms and to incorporate quantitative methods into the project, to Michael Schudson for his overall appreciation of the project and useful feedback; all have greatly improved the dissertation. Also, over the years, John Carey has been a generous and enthusiastic mentor to me at all stages of the project. I have learned a great deal from him about the process of ethnographic research, which has served me well both academically and professionally, during numerous memorable discussions over sumptuous lunches at the Penn Club.

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proud.

DEDICATION

For José Pablo Chan

who is happy to be the fashion police,

as long as I keep the wireless network running

PREFACE

This dissertation began on September 11 and, ostensibly, ended with a $700 billion dollar government bailout of Wall Street, the largest in United States history. In order to make sense of the dissertation process as well as the personal, national and international events that have marked the last seven years, I am reminded of a piece by Buckminster Fuller that I saw in July 2008 at the Whitney Museum in New York, in which he maps his own life along with corresponding national events including United States presidents, communications and transportation infrastructure and the invention of new musical forms and dance steps on a linear plane. I think it might be interesting to do something similar, but I'll save that for a future project.

Caught between these two almost unbelievable events, I embarked upon and completed this dissertation. Early on in this process, I distinctly remember a conversation in an elevator in Budapest in 2002 when a colleague told me that I could not study the wireless Internet because "You can't study something that doesn't exist." Or, another exchange, when a senior professor told me that using the wireless Internet was "Exactly the same as using the wired Internet but with a laptop in a park." And, finally, a senior professor that told me that ethnography was a waste of time because "You will be taking notes for a year about the ceiling and the floor without knowing what you are studying." Studying technological change while it is happening is often difficult. It is a kind of "search" that occurs when you don't know what you are looking for to quote David Stark.

Innovation, the subject of this dissertation, takes place when, individual authors, inventors and entrepreneurs believe in themselves and the validity of their ideas and seek out others who share their convictions about the world even when the outcomes of their endeavors are unknown. In his 2005 commencement address at Stanford University, Apple CEO Steve Jobs commented that it is always easier to connect the dots looking backwards. This is true with a dissertation project as well, for every choice along the way is an intensely personal one. Doctoral students often spend far too much time worrying about the implications for their choice of a topic, a theory or a method before they embark on their field research. However, it is only in retrospect, that these choices begin to make sense.

As I look back at the past seven years at Columbia University while considering the wider implications of my dissertation research, it seems fitting that the two world events that marked its beginning and, at least its formal end, signal the destruction of a hierarchical capitalist system dominated by large bureaucratic organizations and its replacement with an emergent networked economy based on sharing, peer-to-peer production and cooperation by small but coordinated ad-hoc groups such as those that I document in this project. My own contribution has been to argue that WiFi – a technology that, on the surface, seems to enable ubiquitous, 'anytime, anywhere' access to the Internet – has allowed for the emergence of a social format driven by the local innovation practices of lead users, which could not have otherwise occurred. As with any dissertation project, there are still many unanswered questions but, as they say, I'll save them for the book.

Chapter 1: Introduction

September 11, 2001, the day I began my Ph.D. in Communications at Columbia University, is perhaps the most significant day in recent United States history that speaks to the complex relationship between communication technologies, forms of organizing and the role of place. Millions watched as *the network form*, embodied by a handful of geographically dispersed terrorists enabled by mobile phones and the Internet, trumped *the hierarchical form*, symbolized by the death of 2726 people and the destruction of the twin 110-story World Trade Center towers. In fact, the mere construction of the WTC, enabled by older technologies such as telephones and elevators, attested to the supremacy enjoyed by the hierarchical form for over 100 years. In the months that followed, while attending economic sociologist David Stark's weekly seminar on "Organizations and Interactive Technologies," I grappled not only with the shock of the attacks but also with questions about media, communication and information technologies, forms of organizing and the role of place for collaboration and innovation.

Such questions are not new. In fact, they are a staple of scholarship on media and communications. In the post-World War II period, Canadian economic historian Harold Innis traced the history of Western civilization through the lens of the media and technology. Specifically, he chronicled the rise and fall of Western empires, arguing that empires – from ancient Egypt to Babylonia, Greece, Rome and, finally, to the United States in the late 1940s -- succeeded by balancing their need to extend themselves across space while simultaneously maintaining themselves throughout time.

Today, it is necessary to rethink these questions in light of emerging media, communication and information technology. For over ten years--since the mainstream adoption of the Internet with the introduction of the World Wide Web in 1995--researchers, businesspeople and policymakers have conducted studies, launched applications, products and services, and implemented new laws related to the virtual, online, digital and networked properties of the information society. There is evidence of the growing importance of virtual, networked, peer-to-peer and community forms of organizing. A new generation of organizations and companies has sprung up to allow communities to create content, software and applications; answer technical support questions and even design products. These include open source software applications such as OpenOffice, blogging tools such as WordPress and TypePad, collaborative resources such as Wikipedia, photo and video-sharing applications such as Flickr and YouTube and social networking sites such as LinkedIn, Facebook and MySpace. However, in this first decade of the Internet's adoption, the role of physical place has been significantly under-theorized.

We are at a turning point. A digital information layer is rapidly expanding throughout the physical spaces of our homes, offices, cities and towns. This digital layer includes mobile and wireless technologies such as WiFi hotspots, municipal wireless networks, cellular networks, Bluetooth headsets, wireless sensors and radio frequency identification (RFID) tags. For example, electronic access cards are increasingly being used to allow entry to apartment buildings (especially, in luxury condominiums) and offices, sensors are being deployed to measure pollution and credit cards have been equipped with one-

touch payment systems. Passports, consumer products and even Japanese children, have been outfitted with chips containing digital information. Over the last five years, mobile phones and laptop computers have become commonplace. There are already a host of mobile social software applications such as Dodgeball, Twitter and *Ima Hima*[1] (Japan) that make it possible to inform existing networks of individuals about one's status or location. WiFi hotspots can easily be found in coffee shops—including Starbucks—as well as in parks, airports and other public spaces. And, for the past several years, cities across the country and around the world have been planning to build wireless networks.

Physical spaces are quickly being mapped, located and layered with an invisible digital skin signaling a merger between the digital and the real, offline, analog worlds. The nexus between physical and digital space is both challenging and interesting because while both shape, and are shaped by human behavior, the ways in which they regulate may be different, and, even, conflicting at times. Marking this shift from the digital to the material realm, companies like ZipCar and Bag Borrow or Steal facilitate the sharing of physical artifacts such as cars and designer handbags. Such business models replace hierarchical, industrial forms of organizing focused on selling products, with service-based models focused on sharing them. These developments further emphasize the importance of peer-production, collaboration and community forms of organizing with one significant difference, geographic location and the role of physical place becomes increasingly important.

[1] The name of this application can be translated from Japanese as "Now [I'm] Free."

At its broadest level, this dissertation seeks to answer the question of what happens when code – digital information, networks and interfaces – meets place. Lessig's prescient book *Code* argued that software regulates behavior in a manner akin to physical architecture. Since then, scholars have sought to clarify the ways in which software regulates, arguing that software should be considered a separate category in itself. However, the merger of digital networks merge with physical spaces significantly complicates this analysis. Digital networks may maintain, contradict or reshape the organization of people, places and information in physical space. There is a need for a new theoretical concept to capture the integration of these two realms. What are the implications of this phenomenon for forms of organizing, collaboration and innovation?

In order to describe these emerging socio-technical arrangements, this dissertation analyzes the people and organizations for whom WiFi networks, and the spaces that they inhibit, play an important role. These include, for example, freelancers coworking from a Starbucks Coffee in New York, hacktivists innovating open source wireless protocols in a basement in Berlin and social entrepreneurs building bottom-up mesh networks in San Francisco. Drawing on theories from communications and science and technology studies, this dissertation applies network ethnography to analyze themes of social construction, sociality and locality.

WiFi networks are interesting for a number of reasons. First, they emerged, like the Internet, somewhat by accident. That is to say, the Internet--invented by the Defense

Advanced Research Projects Agency (DARPA) as a resilient backup communications network in case of nuclear attack—was not expected to achieve such a widespread commercial success. In a similar way, the technological standard that serves as the basis for WiFi relies on unlicensed electromagnetic spectrum or what is known as the 'junk band' to communicate. Second, they translate digital networks onto physical spaces. Third, they are the domain of a diverse group of volunteers, activists and organizations referred to as community wireless networks (CWNs). Fourth, WiFi and related technologies are currently at the center of a number of significant business and policy debates. For example, city governments are struggling to identify sustainable business models for municipal wireless networks. And, policymakers are continuing to set guidelines for issues including spectrum regulation, network neutrality, universal access and community media.

For the reasons stated above, research on WiFi networks is of great interest to scholars of in a number of academic disciplines and fields including management, communications, computer science and urban planning. It is at this nexus that there is valuable work to be done because WiFi networks, themselves invisible to the naked eye, conveniently fall between the cracks of these areas. As an interdisciplinary communications researcher, I am able to peek into these crevices in order to uncover the people, practices and places that animate WiFi networks.

I introduce theories from communications and science and technology studies in order to make arguments that address three interrelated debates--social construction, sociality and

locality—that are central to the study of communication technology and forms of organizing, collaboration and innovation. First, the social constructivist position states that science and technology should not be understood as objective facts but rather as political, economic, social and cultural constructions. On the other hand, technological determinists believe in the role of technology to shape specific outcomes in society. Second, there is considerable optimism over the ways in which new communication technologies may be used to enable sociality. At the same time, there is growing concern that these same technologies along with other socio-economic factors may lead to social isolation. Finally, researchers question the extent to which communications technologies may be used to extend global connections, or whether they enhance local, face-to-face communication.

With the above theoretical debates in mind, I posed the following research questions:

1) How are these technologies being socially constructed by the mass media as well as by users?

2) Do they support or inhibit sociality? What role might they play in communication, collaboration and innovation?

3) What is the role of locality? How might they change existing notions of place and community?

4) What new socio-technical arrangements and forms of organizing are emerging at the intersection of technology and place?

5) How do emergent technologies and forms of organizing speak to the historical time in which we live?

I approached this project as a network ethnography, a methodology that allows for the integration of multiple techniques and diverse sources of data. The project was organized into three parts: 1) a four-year ethnographic study of community wireless activists and their role in building, using and innovating local infrastructures in the United States and abroad; 2) a 40-question online survey on the use of WiFi in public spaces that was conducted simultaneously in New York, Montreal and Budapest, and garnered over 1300 responses; and, 3) 29 in-depth interviews with mobile professionals who use WiFi in public spaces including parks, cafes and other public spaces.

Each part of the project revealed a unique but interrelated set of findings that address the research questions above. First, in contrast to representations that overemphasize freedom and ubiquity, WiFi networks are constructed by their innovators and users as geographically-bounded sites of belonging and community. Community wireless activists are important innovators because they were early adopters of WiFi technology. Community wireless activists engage in peer-to-peer production however, unlike the open source community, they must work face-to-face, climbing towers and rooftops, in order to build their networks. These groups are also forerunners to the municipal wireless networks that are currently being proposed and implemented. These findings indicate that municipal wireless networks, which are currently struggling to identify sustainable business models, might benefit from drawing on the expertise and experience of community wireless activists.

Second, WiFi networks support sociality in that they bring people within close physical proximity of one another. There are important differences between the interactions between WiFi users in large urban spaces such as Bryant Park and more intimate café settings such as Starbucks or independent cafes. Park users were unlikely to recognize other regulars while café users were much more likely to recognize, and interact with, other regulars. In several cafés that I studied, groups of regulars became friends, provided each other with social support, enabled knowledge-sharing and even collaborated on projects together. These findings suggest that organizations are not benefiting from the communication, collaboration and innovation occurring outside of their offices.

Third, WiFi is a factor in determining where people go and the majority of people surveyed use WiFi to search for information relevant to their geographic location. Location matters a great deal for users of WiFi networks. The WiFi users profiled in this study emphasized the ways in which specific details of the soundscape, environment and people at the places where they used WiFi networks made them feel productive, comfortable or part of a community. These findings suggest that content, applications and services on wireless networks should be targeted at enabling local and contextually-relevant communication, collaboration and community-building. Currently, there are few companies focused on content, applications and services for WiFi networks. Since the majority of WiFi networks are provided by telecommunications companies, little has been done to enhance 'splash pages' with content, applications and services.

Fourth, in summary, in contrast to current notions of networked, virtual organizations that have dominated over the past decade, this study finds that mobile and wireless technologies enable an ad-hoc, community or peer-to-peer form of organizing that is deeply embedded in physical place. However, we currently lack sufficient theoretical concepts in order to understand the ways in which communication, collaboration and innovation are being reconfigured. The concept of codescapes -- the integration of digital networks with physical space -- is developed to capture the emerging modes of communication, collaboration and innovation that are occurring at the intersection of technology and place. This conceptual reframing of forms of organizing is essential in order to understand the ways in which organizations, architecture, policies and technologies themselves are being reshaped.

These findings have implications for businesses and organizations in that they describe possible scenarios for the future of work given current socio-economic trends. For example, freelance workers – one of the groups for whom WiFi networks are an important part of their daily life -- are estimated to make up one third of the economy. This shift, due to factors including individual choice, corporate downsizing and the prevalence of project-based work, has implications for the ways in which businesses and organizations communicate, collaborate and innovate. More and more people are spending significant portions of their days, weeks and lives as freelancers, remote workers or entrepreneurs. As a result, knowledge, collaboration and innovation is moving outside of traditional corporations and organizations. As businesses and organizations are reconfigured in light of socio-economic and technological changes,

architects, designers and urban planners are tasked with envisioning buildings, spaces and cities that can support emerging forms of organizing. Similarly, policymakers must rethink areas such as education, healthcare, the economy and national security. Finally, these findings have implications for technologists working on advances in mobile and wireless networking in terms of describing emerging social needs.

Overview of Chapters

Chapter 2 explains the theoretical frameworks, key concepts and methodologies applied in this dissertation. Chapter 3 describes the ways in which mobile and wireless technologies are socially constructed. Mainstream media representations are used to illustrate the common associations that are linked to these technologies. The affordances – possibilities and constraints -- of WiFi networks are described in detail. Chapter 4 introduces the work of community wireless activists as lead users and innovators of WiFi networks. Chapter 5 discusses the results of a comparative survey of WiFi users in New York, Montreal and Budapest. Chapter 6 describes the future of work, drawing on ethnographic observations and in-depth interviews conducted at cafes, parks and other public spaces, as illustrated by emergent occupations and work cultures. Chapter 7, the conclusion, summarizes the findings and arguments, discusses the implications of this research for business, design, policy and technology itself, and proposes future avenues for research on this topic.

Chapter 2: Theories and Methods

The current question of what happens when code meets place in the case of mobile and wireless technologies is, perhaps, best understood against a backdrop of scholarship detailing the socio-technical arrangements that have been described by scholars of earlier media, communications and information technologies such as the printing press, newspaper, telegraph, telephone, radio, television and Internet. This literature addresses key themes regarding social construction, sociality and locality, which are central to this discussion of the interaction between communication technologies, forms of organizing and the role of place in collaboration and innovation. As the following brief overview will illustrate, mobile and wireless technologies are both similar to and different from earlier communication technologies with respect to the ways in which they reshape everyday life in the context of current socio-economic trends.

With respect to the printing press, Eisenstein's work highlights an increase in the differentiation between private and public worlds as the result of the ability to read the news from one's own home rather than congregating in a public place such as a church (Eisenstein, 1968). Rather than differentiating between private and public, mobile and wireless technologies support a blurring of these two spheres. The most obvious example of this blurring is that of people carrying on private conversations on mobile phones in public spaces. However, as this study will illustrate in Chapter 6, WiFi users often work in public spaces in order to obtain privacy that they do not have at home. For example, a freelance public relations consultant working remotely for a Boston-based public relations firm explained that she used WiFi at the World Financial Center Winter Garden

for about three hours a day several times a week. This was because her husband, a management consultant, also worked from home in their small apartment and she required more privacy in order to focus on her work. This blurring of private and public sphere is highly personal and contextual. For one person, a public place may afford them greater privacy while, for another, it may afford them increased social interaction and, even, community as explained in Chapter 6.

Eisenstein's analysis also illustrates a number of important historical developments, which occurred after the invention of the printing press. These include the growth of Protestantism, censorship, literacy, science and mysticism; the rise of libertarian urges, the idea of history and progress and the development of the concept of intellectual property; the codification of law, development of national cultures, proliferation of disciplines, emergence of modern languages, separation of the sacred and the secular, disciplining of children and the creation of new professions and the restriction of domestic industry (Eisenstein, 1968). While it would be overly technologically deterministic to credit the printing press with all of the socio-economic developments that occurred following its invention, the printing press exhibited affordances and uses that enabled some of these transformations to occur. Similarly, as will be explained in later chapters, mobile and wireless technologies have affordances and uses that support a number of complementary socio-economic trends including the breakdown of traditional institutions and the growth of remote and freelance work, which are relevant for the purposes of this discussion of forms of organizing and the role of place in collaboration and innovation.

Anderson illustrates how the introduction of the newspaper broadened people's ideas of what it meant to belong to a community and paralleled the rise of the nation-state (1983). Mobile and wireless technologies have been associated with the formation and maintenance of small, intimate groups of close friends and family. Similarly, as the following chapters will show, WiFi use can be associated with membership in small, micro-local communities that inhabit geographically-bounded spaces. However, this space may not map directly onto physical architecture.

Carey's well-known article on the telegraph shows that it had the direct consequence of allowing information to travel faster than transportation and the indirect consequence of the creation of a futures market in commodities trading (1988). Mobile and wireless technologies have the direct consequence of allowing information to be accessible on laptops, mobile phones and personal digital assistants (PDAs) from a wider range of locations than merely from a wired, desktop connection to the Internet. While it is too early to fully understand the indirect consequences of mobile and wireless technologies, the following chapters describe some of the most interesting and important aspects of the first ten years of their adoption.

Marvin presents a social history of electronic media which treats media not as fixed natural objects but as constructions of habits, beliefs and procedures embedded in elaborate cultural codes of communication (1988). In the same way, this study addresses the way in which mobile and wireless technologies are socially constructed by their

creators, representations and uses. This focus on culturally-embedded uses resonates with Carey's ritual view of communications (1988), which will be explained in more detail in the next section of this chapter.

de Sola Pool shows that the telephone, like all technology, has multi-directional effects, which depend on its uses. For example, the telephone both increased centralization by making skyscrapers and dense business districts possible and decreased centralization by locating manufacturing and homes in the suburbs (1977). In this study, the multi-directional effects of mobile and wireless technologies are considered by studying macro-level deployments such as municipal wireless networks, local-level infrastructures such as community wireless networks as well as micro-local ecologies of individual WiFi hotspots.

Fischer underscores the importance of conducting in-depth ethnographic studies of communication technologies as they are being developed, adopted and used. Fischer laments the lack of research about the telephone due perhaps to the fact that sociology was in an early stage of development at the time of the telephone's invention and adoption by mainstream (1992). This study is a network ethnography (Howard, 2002), an approach that will be explained in more detail later in this chapter, which chronicles the development, adoption and use of mobile and wireless technologies during their nascent stages. For example, by studying the innovators and users of WiFi at the earliest stages of adoption from an in-depth ethnographic perspective, it is possible to describe an important moment in the history of this disruptive technology (Christensen, 1997) as well

as make unique arguments about the social, technical and spatial relationships that are being reorganized.

Putnam blames the television for the decline in social capital and community in the United States (2000). This argument is familiar in that communication technology is often either blamed for a decline in sociality and an increase in social isolation or lauded for enhancing democracy and community. In recent years, similar arguments have been made about the Internet and mobile phones. However, many of the major studies that find an increase in social isolation rely heavily on quantitative surveys rather than qualitative interviews and ethnographic observations. This study combines both qualitative and quantitative research methods and therefore presents a more holistic view of the ways in which mobile and wireless technologies enhance and, at the same time, inhibit sociality.

Research on the social implications of the Internet has emphasized networked, virtual organizations and communities. Wellman and Hampton studied the social implications of the Internet with respect to a real-world community dubbed Netville, a wired suburban neighborhood (Wellman & Haythornthwaite, 2002). Townsend has argued that while many scholars asserted that use of the Internet would result in the decline of cities, this has not happened (Townsend, 2005). Mobile and wireless technologies are often considered to be mere extensions of earlier communication technologies such as the land-line and wired Internet. WiFi is discussed as merely another form of broadband Internet such as cable, digital subscriber line (DSL) and fiber to the home (FTTH). However, the

nature of WiFi – specifically, that it is available in cafes, parks and public spaces – as well as the socio-technical network of artifacts -- routers, antennas, laptops, cell phones and PDAs – enable a different set of affordances and uses than wired telecommunications infrastructure. This difference is examined in detail in the following chapters of this dissertation.

Lessig (1999) argued that software regulated behavior in ways similar to that of physical architecture, which he popularized in the mantra "code is law." While more recent legal scholarship (Grimmelmann, 2005; Wu, 2003) has further clarified the ways in which software is similar to, and different from architecture, these discussions do not account for the current convergence of physical and digital spaces. Mobile and wireless technologies complicate this analysis by requiring an explicit discussion of the role of physical space.

There is a rapidly growing body of research on the way in which mobile phones are used (M. Ito, Okabe, & Matsuda, 2005; Katz & Aakhus, 2002; Pedersen & Ling, 2005). Katz and Aukhus argue that perpetual contact defines the mobile age of communications. Mayhew and Sidel argue that context rather than geographic location is the central concern for mobile marketers aiming to reach consumers on their mobile phones. Their study of mobile phone users in Japan shows that the heaviest use of mobile phones happens in the places were people spend most of their day i.e. work and home (Sidel & Mayhew, 2003). This reverses popular beliefs that the success of the mobile phone in Japan is driven primarily by long train commutes. Ito has described mobile phone use as

enabling co-presence, described as virtual rather than physical presence (2003). Other factors for the success of mobile phones in Japan include the large market share of NTT DoCoMo, the incumbent wireless provider, as well as the widespread adoption of mobile phones prior to the introduction of home computers and the broadband Internet.

In recent years, there have been a number of studies about community wireless networks in the United States and Europe (Bar & Galperin, 2004, 2006; Bar & Park, 2006; Gillett, 2006; W. Lehr, Sirbu, & Gillett, 2004; Longford, 2005; Medosch, 2006; Sandvig, 2004; Werbin, 2006). These studies have documented the emergence of community wireless networks in the United States (Bar et al., 2005; Chang, Jungnickel, Orloff, & Shklovski, 2005; Forlano, 2006; Meinrath, 2005; Sandvig, 2004), Canada (Longford, 2005; Powell & Shade, 2006), Australia (Jungnickel, 2008) and Europe (Medosch, 2006). In addition, there have been studies of municipal wireless networks (Fuentes-Bautista & Inagaki, 2006; William Lehr, Sirbu, & Gillett, 2006; Powell & Shade, 2006; Sandvig, 2006; Sawada, Cossette, Wellar, & Kurt, 2006; Sirbu, Lehr, & Gillett, 2006; Strover & Mun, 2006; Tapia, Maitland, & Stone, 2006) as well as the role of urban interfaces for public engagement (Chang *et al.*, 2005). Overall, scholarship in this area tends to focus on the technical, economic or policy aspects of wireless networks rather than exploring media representations, technological affordances and uses of wireless networks as I will do in the pages that follow.

While there is some research on early Internet cafes and cybercafes, this research has not developed to include wireless hotspots. Recent studies have included analyses of user

behavior – in particular, videogame behavior -- at cafes in Toronto (Middleton, 2003; Powell, 2003), the embedding of local and global culture at cafes in London (Wakeford, 2003), cafes as innovative sites of access to information and communication technology in the United Kingdom (Liff & Laegran, 2003; Liff & Steward, 2003), the significance of place for mobile work (Brown & O'Hara, 2003), the relationship between the cybercafe and the community in Scotland (Stewart, 1999) and domestic and public uses of technology at cafes in the United Kingdom (Lee, 1999). More recently, there have been several studies about the use of wireless networks in cafes and public parks (Gupta, 2004; Hampton & Gupta, forthcoming; Hampton, Livio, & Trachtenberg, 2007). Gupta's research on cafes in Boston and Seattle was one of the first studies of WiFi use (2004; Hampton & Gupta, forthcoming).

Theoretical Framework

There are two sets of academic scholarship currently engaged in debate at the intersection between technologies, forms of organizing and the role of place. These are: first, organization studies and management (hereafter referred to as the 'managers') and, second, ubiquitous computing and related areas of computer science (the 'technologists'). My question – what happens when code meets place – is situated at the intersection of these two sets of fields. This intersection provides a fruitful opportunity for new research because of the way that each of these fields privilege certain perspectives while excluding others. It is at this intersection that the field of communications, conceived inter-disciplinarily, can make the strongest contribution to rethinking the questions posed in this study.

As a means of organizing the debate, I will adopt several concepts that have long interested scholars of communications and science and technology studies (STS): causality in technology-society relationships (technologically determined vs. socially constructed); the process of technology development (production vs. consumption); and the social consequences of technological change (revolution vs. evolution, utopia vs. dystopia) (Boczkowski & Lievrouw, 2007). For the purposes of this study, mobile and wireless technologies are situated within Boczkowski and Lievrouw's (2007, p. 10) definition of "media and information technologies," which refers to a "broad class of socio-technical systems that are studied in both STS and communications." In particular, the following four facets – historical scope, infrastructure, materiality, and the interplay between materiality and symbolic content and meaning – are most important (Boczkowski & Lievrouw, 2007).

The following discussion will illustrate the ways that these two sets of fields are complementary, each focusing on important aspects of this question, and illustrates the ways in which this study connects and builds upon these disparate fields. Each of these fields, though all relatively young as illustrated by their recent efforts to launch new journals and conferences, have long histories grounded in very different academic disciplines. Specifically, the 'managers' draw primarily on a social science tradition, while the 'technologists' draw on a distinct computer science tradition. While, for the most part, this study employs theories and key concepts from the social sciences, one of the strengths of communications, as envisioned by James Carey, the founder of the

interdisciplinary doctoral program in this field at Columbia University, is its ability to draw on concepts from the humanities and, in particular, cultural studies.

Carey's 'ritual view of communication' is employed as a key theoretical framework. Carey argues that most American studies of communication employ a 'transmission or transportation view of communication' and the 'effects' tradition that views communication "basically as a process of transmitting messages at a distance for the purpose of control," (1988, p. 15). In the last decade, since the mainstream adoption of the Internet, there has been an overwhelming emphasis on the ways in which communications transcends geographic constraints. Carey writes that such studies focus on "persuasion; attitude change; behavior modification; socialization through the transmission of information, influence or conditioning," (1988, p. 15).

In contrast to the 'transmission view', Carey advances a 'ritual view', which builds on earlier studies of communication by Harold Innis as well as concepts of culture advanced by Clifford Geertz, Raymond Williams and Stuart Hall. Innis (1951) theorized that all media could be identified as either *time-biased* or *space-biased.* Time-biased media such as oral tradition assert their control over the maintenance and preservation of ideas in time while space-biased media such as paper expand the reach of ideas in space for the purposes of control. For the purposes of this study, wireless networks can be understood both as space-biased and as time-biased media. This is because while wireless networks allow users to connect to the Internet, they are also located in bounded physical and digital spaces where users often gather.

Carey's 'ritual view' elaborates on Innis' theorizing about time-biased media, asserting the following: first, "communications is first of all a set of practices, conventions, and forms"; second, communication is a process through which shared culture is created, modified, and transformed"; and, third, communication should be "directed not toward the extension of messages in space but in the maintenance of society in time," and on the "sacred ceremony that draws persons together in fellowship and commonality," (1988, p. 18). By adopting the 'ritual view' as the key theoretical framework, this paper seeks to understand the practices and cultures of community wireless organizations and users of WiFi hotspots and the way in which they maintain associations in time.

In addition to the ritual view of communications, actor-network theory (Latour, 2005) is employed as a theoretical framework. Actor-network theory allows human and technological agents to be seen as having equal status in a network. Actor-network theory is well-suited for a study of mobile and wireless technologies in light of future ubiquitous computing scenarios, which imagine a world of networked people and objects (Weiser, 1991). Another advantage of using actor-network theory as a framework is its emphasis on 'following the user' in order to uncover relevant practices, technologies and places. Rather than predefining the research sites for the study, actor-network theory allows these sites to emerge from interviews with informants. For this project, all interviews were conducted on-site at WiFi hotspots selected by the informants. Taken together, these locations – scattered throughout Manhattan and Brooklyn – represent a network of WiFi hotspots inhabited by the people and technologies described in this study. By conducting

interviews at these sites, it is possible to gain a deeper understanding of the everyday lives of informants as well as to observe and confirm the activities and interactions that they describe in the interviews. For example, while interviewing Adam[2], a middle-aged freelance writer from Brooklyn who is described in more detail in Chapter 6, he commented that there were about seven other people who worked at the same Starbucks where he had worked for the past five years. He said that the regulars often interacted informally and provided social support for one another. He also mentioned that his wife and children knew that Starbucks was his office. During the interview, one of the other regulars, Lex, also a freelance writer, came over and said, "How is your work going today?" Adam's wife and children also stopped by to say hello. After a few minutes, Adam said, "OK, see you later. Daddy's working now."

Key Concepts

In order to understand the emerging socio-technical arrangements that are occurring when code meets place, it is vital to introduce concepts related to the social construction of technology (Bijker, Hughes, & Pinch, 1987), sociality and locality. All of these issues represent significant debates between 'managers,' who emphasize social aspects, and 'technologists,' who privilege technological aspects. More recently, both of these have attempted to incorporate both the social as well as the technological. However, neither is well-suited to address the spatial aspects of this problem.

Technologies: Socially Constructed/Technologically Determined

[2] The names of all informants have been changed to pseudonyms in order to protect their privacy and anonymity. In addition, the exact locations of specific WiFi hotspots is not revealed for the same reason.

The *social construction of technology* (Bijker *et al.*, 1987), developed in science and technology studies, has been applied in organization studies and techniques such as user-centered design have grown in popularity in ubiquitous computing. *Affordances* (J. J. Gibson, 1977; Norman, 1990), *infrastructure* (Star, 1999; Star & Bowker, 2002), *values* (Nissenbaum, 2001) and *disruptive technology* (Christensen, 1997) are additional concepts that will be helpful in describing wireless networks. First, affordances – possibilities and constraints -- are "the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used" (Norman, 1990, p. 9). By examining the affordances of wireless networks, we can begin to understand the potentiality enabled by the technologies, regardless of whether or not they are realized, as well as those that are discovered by users.

Second, rather than technology conceived as a 'black box,' the concept of infrastructure as "relational and ecological" (Star, 1999, p. 1) is useful in describing the wireless networks built and maintained by activists because it signifies the hidden political, economic and socio-cultural aspects of these networks. Star describes the following properties of infrastructure: embeddedness, transparency, reach or scope, learned as part of membership, linked to conventions of practice, embodies standards, built on an installed base, becomes visible upon breakdown, and fixed in modular increments. A related concept underscoring several of these properties is that of the invisibility of infrastructure, in that it becomes taken for granted and thereby disappears into the background unless it breaks down (Star, 1999). This is true particularly in the case of wireless networks because they are literally invisible. Thus, as Boczkowski and

Lievrouw suggest "particular artifacts should be conceptually situated within a broader landscape of related, and often unnoticed or invisible, material things, such as filing cabinets, magnetic tape and optical disks, telephone poles, library shelves, or wireless bandwidth" (2007, p. 11). Using this definition, wireless networks can be situated against a landscape of material objects including routers, laptops and antennas, which can be observed.

Third, the concept of values is important for understanding the way in which community wireless organizations build on the affordances of wireless networks and embed a range of socio-cultural, economic and political values into the infrastructures that they design. Nissenbaum (2001) poses the following set of questions regarding the embodiment of values in the design of technologies: What is the locus of control? Are the values transparent or opaque? Do they support a balanced, democratic exchange of information? Do they discriminate against users? Do they enhance or diminish trust? In order to apply these questions to the analysis of wireless networks, it is necessary to expand and reframe these questions: Who controls wireless networks and who uses them? What are the values of the companies and organizations that provide wireless networks? How are these values communicated to users of the network? What are the policies about privacy and personally identifiable information? Are wireless networks centralized or decentralized? Are they open or closed? Do they use proprietary or open source software? Are they visible or invisible? Is access free or paid?

Finally, WiFi networks are disruptive technologies because they allow multiple people to share the same Internet connection without paying for additional monthly services from the telecommunications company (though doing so may violate their contract. WiFi networks dramatically bring down the cost of Internet access because they greatly remove the need to install cables and wireless underground and throughout buildings. WiFi networks are especially useful in rural settings and developing nations where there is a lack of wired infrastructure.

People: Users/Producers

Understandably, while the 'managers' typically operate at the macro-level, studying the adoption and use of technology by employees within and between firms in their natural settings, the 'technologists' operate at the micro-level, focus on the production of technology for individual users, often in laboratory settings and, more recently, in public spaces. This study connects these two approaches by adopting the concept of *lead users* as innovators and producers, and *user-driven innovation* (Von Hippel, 1978, 2005) by including both community wireless organizations as well as a wider group of users of WiFi hotspots.

There are several concepts that are valuable in understanding the communication, interactions and practices of individuals in this study. First, Suchman's concept of *situated action* describes "actions taken in the context of particular, concrete circumstances" (Suchman, 1987). This view of action contradicts the rational Western model of purposeful action as determined by plans and introduces the resources and

constraints of physical and social circumstances. Thus, action is neither predetermined or random. In particular, four aspects of action are relevant to the analysis of human-machine communication: 1.) mutual intelligibility is the product of in situ, collaborative work; 2.) communicative practices are sensitive to particular participants in particular interactions; 3.) face-to-face communication helps detect and remedy misunderstandings; and, 4.) human communication is embedded in a background of experiences and circumstances (Suchman, 1987). Thus, Suchman understands communication not as a "symbolic process that happens to go on in real-world settings, but a real-world activity in which we make use of language to delineate the collective relevance of our shared environment," (Suchman, 1987).

Casual conversations and informal interactions, often referred to as 'water-cooler' conversations, are known to build trust, create social support and promote innovation and collaboration in traditional office settings. Research on the impact of electronic communication on informal interaction finds that informal communication within an organization typically declines as the use of e-mail increases (Sarbaugh-Thompson & Feldman, 1998). Social networks allow access to private information, diverse skills and power. Trust, diversity and brokers (or weak ties) are necessary to build powerful networks based on shared activities such as playing on a sport team, volunteering for a community organizations and serving on a non-profit board (Granovetter, 1973; Uzzi & Dunlap, 2005). Boundary-crossing and organizing diversity are elements that allow new media firms to remain innovative (Girard & Stark, 2002).

Places: Firms/Laboratories

Instead of studying what happens within the physical limits of firms or laboratories, this study is about places identified by community wireless activists and WiFi users. These include public parks, cafes and libraries, which might be referred to as *third places* (Oldenburg, 1989). Third places are neutral sites between home and work where informal, voluntary and playful conversation takes place. Third places are sites of belonging and community and are vital for the functioning of urban social life. Oldenburg fears that these third places are rapidly disappearing in the United States (Oldenburg, 1989). The places identified in this study, which we might call mobile work places, exhibit some of the characteristics of third places with several significant differences. For WiFi users, rather than being a site between home and work, third places literally *become* workplaces and may no longer function as the third places in Oldenburg's definition. At the same time, groups of regulars feel a sense of belonging and community at mobile work places and this is further supported by informal interaction, social support, collaboration and innovation that occurs at these mobile work places. Castells has articulated the tension between the *space of flows* – global networks of technology flows – and the *space of places* – the urban spaces of everyday life (Castells, 1996). Rather than distinguishing between spaces of flows and spaces of place, mobile work places are both simultaneously for WiFi users – they are networked through the Internet to their jobs while at the same time surrounded by familiar regulars, baristas and passersby with whom they spend a large part of their day. The concept of *innovation spaces* captures the recent interest of firms in designing physical environments that foster innovation and creativity (Moultrie et al., 2007). This concept is relevant because third

places represent new venues for collaboration and innovation. Finally, the concept *mediaspaces* (Couldry & McCarthy, 2004) links communication technology with space.

Communication: Content/Conduit

For example, recent studies by the 'managers' concentrate on analyzing individual modes of communication (i.e. face-to-face, telephone, e-mail, instant messaging) and their role in coordinating interactions across space for the purposes of control, while the 'technologists' often think about multiple modes of communication simultaneously. This focus deemphasizes the importance of place, location and context. On the other hand, the 'technologists' have often included multiple modes of communication within spaces, and, thereby, reemphasize place, location and context. This focus on extending messages across space and within space tends to privilege the content of the messages exchanged rather than the act of exchanging them. While there have been few studies of the use of mobile and wireless technology and forms of organizing by the 'managers', the 'technologists' have conducted numerous such studies in recent years.

Forms of Organizing: Networked/Virtual/Ad-hoc/Community

Since the Industrial Revolution, hierarchical and bureaucratic forms of organizing have dominated until very recently. These forms employ rational, scientific, 'command and control' models, which typically view communication as a transmission of content and information with measurable effects. As a result, theories of communication as information-transfer, transactional-process or strategic-control have been used to explain the relationship between communication and forms of organizing. These theories

incorporate a deterministic role played by media, communications and information technology. More recently, theorists have begun to describe communication as a balance of creativity and constraint using a dialogue metaphor, which emphasizes equality, empathy and communion. In contrast to earlier theories, these theories emphasize the socially constructed aspects of media, communication and information technology.

In the current period, since the development and mainstream adoption of the Internet, much emphasis has been placed on network and virtual forms of organizing. These forms emphasize fluidity and adaptability, decentralization, a renegotiation of power relationships and the need to minimize constraints while maximizing possibilities. Network forms are also referred to as 'epistemic communities' in political science, 'communities of practice' in sociology, and 'knowledge networks' in management (Howard, 2002). The key characteristics of network forms are: the use of information technology to integrate across organizational functions; flexible, modular organizational structures that can be adapted; the use of information technology to coordinate geographically dispersed activities; team-based; flat hierarchies and horizontal coordination; and, use of intra- and interorganizational markets (Poole, 1999). Similarly, virtual forms of organizing are geographically distributed; electronically linked; functionally or culturally diverse; and laterally connected, which makes possible highly dynamic processes, contractual relationships, edgeless, permeable boundaries and reconfigurable structures (DeSanctis & Monge, 1999). The term "virtual" has been widely used to describe new forms of organizing work, which differ from traditional forms in the location of the workers, where and how the work is accomplished; and the

basis for relationships between workers and organizations and between organizations (Watson-Manheim, Chudoba, & Crowston, 2002). To date, there have been few studies on the relationship between mobile and wireless technologies and new forms of organizing with a few notable exceptions (Mazmanian, Orlikowski, & Yates, 2006; Rheingold, 2003). However, for the most part, these studies reinforce many of the assertions found in the literature on network and virtual forms of organizing.

Recent scholarship on the open source movement, music file-sharing, and WiFi-sharing (Benkler, 2006; Noam, 2005; O'Mahony, 2002) has documented the emergence of economic models based on peer production and community forms of organizing and sharing. These models coexist and compete with hierarchical, market and networked forms of organizing. I will argue that this form can be extended to include community wireless networks and the communications infrastructures that they build. Furthermore, I will illustrate the way in which the community form coexists with other forms of organizing among a significant and growing segment of the economy, which includes remote workers, telecommuters, and freelance and self-employed workers. Noam argues that community-based sharing arrangements that have been observed in information technology and telecommunications, including open source software, music file-sharing and the WiFi (wireless fidelity)-sharing, are vital for the creation of markets particularly in the early stages of innovation. Thus, economic models based on grassroots communities and the sharing of knowledge and resources should not be automatically dismissed by corporations, but rather, they should be embraced for their creativity, energy, interactivity and peer-ship (Noam, 2005).

Sustainability

Currently, mobile and wireless technologies are being viewed as having an important role in the sustainability of cities. This is because mobile phones and wireless technologies are quickly being adopted -- with over two billion mobile phone owners by 2008 – and the capabilities of technologies are merging. In addition, these technologies are increasingly relevant in urban locations since over half of the world's population will be living in cities by the year 2007. The largest of these cities, called "mega cities," with populations of over 25 million will face serious challenges in terms of their sustainability. These cities will only be able to become sustainable if they are able to build strong communities and civil society groups. In addition, in a number of these cities, young people – the demographic most familiar with mobile phones and wireless technologies -- will make up the majority of the population. Paul et al.'s *collaborative urbanism* and Perlman's principles of *urban sustainability* explain the necessity of re-imagining and re-designing cities with a focus on public participation and Kang and Cuff's envisioned "friction mall" is concerned with the social, legal and economic implications of new media and ubiquitous computing (Kang & Cuff, 2005; Noam, 2005; Paul, Shetty, & Krishnan, 2005; Perlman, 1999). Citing a problematic "urban pedagogy that regards the city only as a technological or physical artefact" in the case of Mumbai, India, Paul et al. advance a need for a "collaborative urbanism that treats the city as an extra-curricular space by which we can reconstruct existing institutional frameworks." By its very nature, collaborative urbanism, conceived as a response to a political regime of predatory development, tactical negotiation and blurry urbanism, demands the active participation of a wide variety of stakeholders in the design of the city's physical infrastructure. In this

way, we can envision ways in which artists and activists might contribute to the authentication of their cities through engagement in the processes of urban planning assuming that there were mechanisms to do so (Paul et al., 2005). Along with the concept of collaborative urbanism, it is useful to consider Perlman's six principles of urban sustainability as distilled from the Mega-Cities project, which are summarized as follows: the importance of urban sustainability for global sustainability, the importance of alleviating urban poverty, the need for strong civil society and grassroots initiatives, the need to transform "micro" solutions into "macro" impact by transforming public policy from the bottom-up, the need to form collaborative partnerships and link local initiatives with global ones through a transnational network of non-governmental organizations, and the need for social justice, political participation, economic vitality and ecological regeneration (Perlman, 1999).

Kang and Cuff's "friction mall" is a utopian vision of the way in which we might go about embedding the public sphere into future pervasive computing applications. The basic characteristics of the friction mall are open, decentralized, peer-to-peer interactions rather than centralized, hierarchical domination. For example, in the friction mall:

> a whole new range of sociopolitical intermediaries could help facilitate 'political shopping' by providing not only information about quality and price, but also about social, environmental, and justice consequences. Before ordering veal parmigiana, Paul McCartney might sing into one's ear about animal cruelty. Before buying on overpriced shirt at Abercrombie & Fitch, the National Asian Pacific American Legal Consortium might provide a reminder about the firm's sorry history with racial minorities. Choosing among three fungible gas stations at a nearby corner, one might rely on the Sierra Club's recommendations (Kang and Cuff, 130).

In this example of political shopping enabled by pervasive computing, Kang and Cuff explain how it might be possible to construct an "activist shopper," the importance of

which should not be overlooked. In addition to political shopping, Kang and Cuff state that pervasive computing applications that allow one to meet like-minded strangers with whom they may not necessarily interact could serve to strengthen the public sphere. Kang and Cuff introduce the following design principles, which embed elements of the public sphere into future pervasive computing infrastructures: the protection of privacy, transparency of surveillance mechanisms, open access to information, and the public exchange and sharing experiences (2005, pp. 130-143).

Change: Evolution/Revolution

Finally, while organization studies and management scholars have approached social and technological change as an *evolutionary* process (DeSanctis & Monge, 1999), the 'technologists' have tended to view change as a *revolutionary* process. Nelson argues that the process of change may be viewed as a *coevolution* (Nelson, 1991, 1995). While these broad generalizations about the 'managers', on the one hand, and the 'technologists', on the other hand, cannot account for all studies of the role of media, communications and information technology and new forms of organizing, they do provide useful frameworks for new theory-building. The following chart (Figure 1) provides a quick summary of the above discussion:

Management/Organization Studies	ComputerScience/Ubiquitous Computing[3]
Technologies	
Social Science Tradition	Computer Science Tradition
Social-bias	Technological-bias
Adoption and Use	Production
People	
Macro-focus	Micro-bias
Firm-centered (employees)	User-centered (individuals)
Single-modes of communication	Multiple-modes of communication
Places	
Natural setting	Laboratory setting
Space-bias (emphasis on geographic distribution)	Space-bias (emphasis on location, context)
Transmission-focus	Transmission-focus
Change	
Evolutionary	Revolutionary

Figure 1: Framing the Debate

However, the advantages as well as the limitations of each of these approaches, and the academic disciplines contained within them, make some theories more likely to emerge than others. It is only by combining the relevant aspects from these various approaches and designing a study that bridges these dualities (society/technology, firm/individual, macro/micro, single-mode/multiple-mode, evolutionary/revolutionary) that we can begin to build an appropriate theory of causality. Furthermore, by integrating key theoretical concepts from communications and science and technology studies (STS), it is possible to rethink this question and build a theory of causality that correctly accounts for the complexities involved.

Methodological Framework

The primary methodology for this dissertation is ethnography. My first experience with ethnography was in Summer 2003 when I spent two months in Tokyo, Japan as a visiting

[3] Ubiquitous computing is a field of computer science.

scholar at the International University of Japan's Center for Global Communications (GLOCOM), where I was hosted by Professor Motohiro Tsuchiya, with funding from the National Science Foundation and the Japanese Society for Promotion of Science. The offices were located in Roppongi and I lived nearby in Asahi Homes, an expensive apartment-hotel across the street. It was my first time in Japan as a social science researcher – rather than as an exchange student or businesswoman – and my first trip since 1998. I had lived in Japan for one year in 1993 – 1994 as an exchange student at Sophia University's now-defunct Ichigaya campus while an undergraduate studying Japanese and Asian Studies at Skidmore College. Following graduation, I had worked for two years at a Japanese company in New York and, thus, had been fortunate to have several subsequent trips to Japan over the years. Still, after five years, I was eager to see my host family (a family that I had lived with in Fujisawa), reconnect with friends and begin my research.

After taking Charles Tilly's Designs of Social Research course at Columbia, I decided that the only methodology that I could imagine using for my dissertation was ethnographic research. Not only is ethnographic research is best suited for the theoretical frameworks that I have chosen but it also results in the most interesting narrative accounts of everyday experience. In recent years, ethnographic research has become increasingly applied to the study of consumers and technologies, however, there is still difficulty in translated qualitative descriptions into business strategy because this can be a long and costly process. Thus, there is greater need to examine the everyday lives of people in order to uncover more authentic and critical view of the role of technology.

Earlier that Spring, at a conference at New York University, I met *Smart Mobs* author Howard Rheingold who recommended Mizuko Ito's ethnographic research on Japanese teens and mobile phone use. Within days of my arrival in Tokyo, Izumi Aizu, a GLOCOM affiliated researcher, introduced me to the "Friends of Howard" [Rheingold] including Ito at the First International Moblogging Conference, an event organized by author and interactive design expert Adam Greenfield. A week later, I traveled with Ito to the Docomo House research lab at Keio University's Shonan Fujisawa Campus to learn more about the group's research on Japanese teens.

For the next eight weeks, I conducted participant observation and ethnographic observation in Tokyo's trains, cafes and public spaces, documenting these observations in over 500 photos. I attempted to, and finally succeeded in getting my own NTT DoCoMo i-mode phone in order to gain a deeper understanding of the products, features and services available in Japan. I focused many of my observations on interactions at popular meeting places such as Roppongi Hills (a newly constructed shopping complex that had opened in April 2004), Harajuku and Shibuya Crossing.

One of the psychological barriers that I found in conducting ethnographic research while a visiting scholar at GLOCOM was that I felt incredibly guilty about not being in the office at my desk during regular office hours. On a typical day, I would work from home in the morning, got to the gym around noon, pick up lunch and go to the office between 2PM to 6PM. However, on the days that I planned to do fieldwork, I did not go to the office at all. Since none of the other GLOCOM researchers were ethnographers, I felt

that there was an understanding that being out of the office meant that one was not working unless one had appointments. It was difficult for me to learn that the more time I spent outside of the office, the more I would learn about the ways in which mobile phones were used by Japanese youth in public spaces. By then end of the summer, this realization was starting to sink in. In addition, to my ethnographic observations, I set up appointments and interviews with businesspeople working on designing and marketing mobile products and services and attended industry events.

This project employs a number of different strategies for data collection. The project uses a mixed methodology (Axinn & Pearce, 2006; Creswell, 2003; Norman, 1990; Tashakkori & Teddlie, 1998) to combine ethnography, participant-observation, comparative research, survey research and in-depth qualitative interviews. This project can be described as a 'network ethnography,' an emerging transdisciplinary method that makes use of a wide variety of network data – using new media including e-mail, websites, log data and social network analysis – in order to study communication in organizations (Howard, 2002). In addition, the project employs new research tools such as network analysis, log data analysis, spectrum analysis, geographic information systems, photography and video analysis where appropriate.

Ethnography, Participant Observation and Comparative Research

In order to answer questions about the role of community-based organizations in the technological development of hardware, software and applications for wireless networks,

I conducted five years of ethnography, participant observation and comparative research in four countries (Japan, Hungary, Germany and the United States).

In August 2002, while serving as technology columnist for *Gotham Gazette*, a non-profit news and policy web site in New York, I wrote my first article about wireless networks, focusing on the launch of the Bryant Park network (Forlano, 2002). Bryant Park has since become the home of one of the most heavily used free, public wireless networks in New York, if not in the world. As such, it was selected as the site of one of the three case studies in this project, and will be examined in more detail in Chapter 5.

In Summer 2003, I conducted exploratory research in Tokyo, Japan as a National Science Foundation East Asia Summer Institute Fellow at the Center for Global Communications. The following year, I traveled to Budapest, Hungary and Berlin, Germany where I spent two months conducting expert interviews and building relationships with local community wireless organizations. These opportunities allowed me to add a comparative international dimension to my research.

In September 2003, as a communications researcher, I launched a special interest group (SIG) on the socio-economic implications of mobile and wireless technology for NYCwireless[4], a non-profit community wireless organization in New York. The SIG, composed of artists, architects, policy wonks, engineers and social researchers, explored a number of pressing issues facing advocates of free, public wireless networks including

[4] See NYCwireless.net for more information.

advertising and signage, messaging and advocacy, and measurement and use. Preliminary work on the survey design employed in this project was conducted by SIG members in Summer 2004.

Building on my participation in NYCwireless as a researcher, in January 2005, I joined the organization's board of directors. In this role, I represented community wireless groups nationwide on the FCC's Consumer Advisory Committee[5] (CAC) for two years from March 2005 to November 2006. In addition, I participated in regular monthly board and general meetings, testified at New York City Council hearings conferences, and attended national and international summits focused on community wireless networks.

In addition, while I have been sharing my Internet connection wirelessly since November 2004, from May 2006 to May 2007, I used a router configured by NYCwireless that allowed me to track the usage of the wireless network, which allowed me to monitor my own use as well as the over thirty registered users of the network. This allowed me to develop a deeper understanding of the role of the network name, login page and wireless router. The network name or service set identifier (SSID), which enables one to connect to the network, was NYCwireless (see Figure 2 below).

[5] See http://www.fcc.gov/cgb/cac/ for more information.

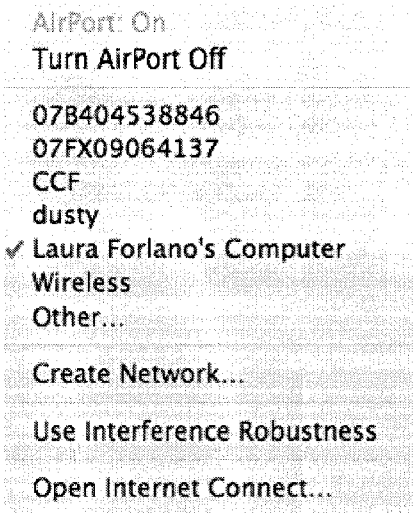

Figure 2: List of SSID's from PowerBook G4, March 2008.

The login (or splash) page was a NYCwireless SuperNode page, which allowed me to see the names of all online users (see Figure 3 below). The wireless router was an NYCwireless router (see Chapter 3).

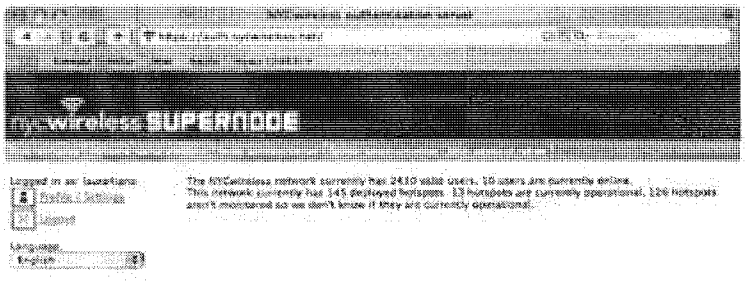

Figure 3: A NYCwireless SuperNode login page, March 2008.

Finally, in May 2006, I spent over 20 hours observing the wireless Internet users at a popular café on the Lower East Side between the hours of 11 a.m. and 9 p.m. The café was selected because it is popular with a wide variety of freelancers, students and artists in the neighborhood, where it has been located for over ten years. The activities of each

of the clientele in the café was noted, with specific attention paid to their use of mobile and wireless technologies and their interactions with others in the café. Participant observation was also conducted in that, on several occasions, I attempted to work from the café myself (unfortunately, without much success). The café is located in the heart of what was once New York's historic port-of-entry Jewish neighborhood, the Lower East Side, which is bounded by Houston Street, Canal Street and the Franklin Delano Roosevelt Drive on the East River[6]. This initial field study allowed me to identify patterns of use in order to inform the in-depth interview questions.

Survey

In order to answer questions about the way in which wireless networks are used -- by whom, where, for what purposes – and how these uses differ from earlier media, communication and information technologies, a survey on the use of wireless networks in cafes, parks, and other public spaces was developed. The 40-question online survey was conducted between October 2006 and April 2007, in New York, Montreal and Budapest. The survey was conducted with a small grant from Microsoft Research in partnership with local community wireless organizations: NYCwireless (New York), Île Sans Fil (Montreal) and the Hungarian Wireless Community (Budapest). Île Sans Fil translated the survey into French and conducted it bilingually in Montreal and the Hungarian Wireless Community (HuWiCo) translated the survey into Hungarian. These three cities were chosen to exploit the different architectures of their wireless networks, which have

[6] www.nycvisit.com Accessed on August 1, 2006.

been shaped by a number of factors including national telecommunications policy, economic incentives, climate, availability of public space, and local culture.

In New York, the surveys were publicized through fliers, on listservs, via e-mail announcements, and via the login or "splash" pages of the wireless networks of partner organizations. I handed out fliers at Bryant Park and several Starbucks locations in October and November 2006. At Bryant Park while handing out fliers, I was approached by a park security guard who informed me that I was not allowed to do research in the park. Upon learning that I had been in touch with the Bryant Park Restoration Association, I was allowed to continue promoting the survey in the park. However, this incident was significant in that it illustrates the park's status as a privately-managed public park. While handing out fliers, I often answered questions about the wireless network and fielded questions from international visitors in the park about a wide variety of topics. For example, a Taiwanese man asked me how to find an apartment in New York. A Georgian computer science student asked advice about getting into college in New York. And, a Turkish graduate student asked me to sit and talk with him about technology.

In New York, the Downtown Alliance, a Lower Manhattan business improvement district, placed a link to the survey on their website. The survey was included in New York City Council Member Gale Brewer's monthly e-mail announcement. In Montreal and Budapest, the survey was publicized only online. The survey was conducted using

SurveyMonkey[7], an online survey tool. The survey resulted in 1362 responses: New York (614), Montreal (370) and Budapest (378). The survey provided a valuable way of identifying informants for in-depth interviews.

The survey asks three types of questions about the use of the wireless Internet: general questions, technology and Internet access-related questions, content and activity[8] related questions and standard demographic questions[9] questions (see appendix for survey protocol). These questions were informed by a number of earlier surveys that have included questions about the use of mass media and the Internet such as the Pew Internet & American Life project and the General Social Survey. More specifically, the survey asks about the location of use, purpose and reason for use, frequency and length of use, types of technologies owned and used, access to the Internet, problems using the network, type of information and websites accessed, and kinds of activities pursued.

Results from the survey will provide descriptive statistics about how WiFi hotspots in public spaces are being used, by whom, where, and for what purposes. It should be noted that, in some cases, respondents were able to give multiple answers to the questions and, as a result, figures reported in the survey do not always add up to 100%. This will aid in the development of a typology of users of mobile and wireless technologies in public

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[7] See SurveyMonkey.com for more information.

[8] Questions on activities were adopted from the 2000 Pew Internet and American Life Project's Daily Tracking Survey (www.pewinternet.org) and by an earlier survey by Keith Hampton and Neeti Gupta developed in 2004.

[9] Questions on standard demographic variables were adopted from a February 2005 survey by Knowledge Networks (www.knowledgenetworks.com). Questions on occupation and industry were informed by the 2000 U.S. Census (www.census.gov) and New York City Economic Development Corporation (http://www.nycedc.com).

spaces. In addition, by comparing the survey results with earlier studies about the use of mass media and the Internet, one can understand how the use of WiFi hotspots is different from and similar to the wired Internet and earlier communication technologies. Furthermore, by comparing the survey results from New York, Montreal and Budapest, one can make recommendations about content and applications for mobile and wireless use across diverse markets and civic cultures.

Cases Studies and In-depth Interviews

In order to address questions on the social consequences of the integration of mobile and wireless technologies into people's everyday lives and the way in which wireless networks are sites of informal face-to-face interaction, social support, knowledge-sharing, collaboration, innovation and community formation, this study employs in-depth qualitative interviews centered around three case studies in New York, which were identified through insights from the ethnographic observations and survey results. Bryant Park, Starbucks, and the JetBlue Terminal at JFK were selected as the focus of detailed case studies. These three sites were chosen because they represent three different types of settings where WiFi hotspots are often deployed: cafes, parks and public spaces, and airport lounges.

Following is a short description of the three research sites. First, Bryant Park is a privately-managed public park in midtown Manhattan, which is located on Forty Second Street between Fifth and Sixth Avenues directly behind the New York Public Library. The Bryant Park wireless network was built by NYCwireless, a community wireless

organization, in partnership with the Bryant Park Restoration Corporation in 2002. The wireless network at Bryant Park is free to use. Second, Starbucks, an international coffee retailer, has 153 locations in the New York area (within a five mile radius) where a T-Mobile HotSpot is available.[10] The T-Mobile HotSpot requires customers to pay daily, monthly or annual membership fees in order to use the wireless network. Interviews were conducted in numerous Starbucks locations in Manhattan and Brooklyn. Third, JetBlue is a low-cost airline in the United States. While no interviews were conducted in the JetBlue Terminal at JFK, I asked informants that I interviewed in other locations about their experiences using the JetBlue wireless network. In addition, on several occasions, I conducted observations at the JetBlue Terminal at JFK. All three case studies were documented through a combination of ethnographic observation, in-depth interviews photography and spectrum analysis.

A total of 56 in-depth interviews – expert interviews as well as interviews with WiFi users -- were conducted between July 2003 and April 2007. Of the 613 survey respondents in New York, about 80 people were selected for interview. I selected these because I believed that, as heavier users of WiFi networks (having reported using the wireless network for two or more hours a day at a café, park or other public space) their experiences would be the most interesting to study. About 50 agreed to be interviewed. 29 interviews were conducted with users of WiFi hotspots; 27 interviews were conducted with experts including community wireless leaders, architects, consultants, technologists and researchers including those conducted in Tokyo, Budapest and Berlin. The

[10] See www.starbucks.com for more details. Accessed on June 20, 2007.

interviews with users of WiFi hotspots were one-hour, open-ended interviews, which were conducted at the locations in which the informant reported that they used the wireless Internet most frequently whenever possible. All interviews were documented with notes and recorded digitally. On several occasions, interviews were conducted by phone and recorded via Skype since the informants had moved to new cities since they took the survey. The interviews were not transcribed.

Of the 29 interviews with users of WiFi hotspots, the following breakdown emerged for the three types of research sites: cafes (19), parks and public spaces (8), and airport lounges (1). In addition, one interview was conducted with a neighbor who is using my WiFi hotspot. It is important to note that individuals often had used WiFi hotspots in a number of different locations including cafes, parks and airport lounges so the interviews often reflect their experiences at a number of sites. Among those interviewed, 24 were men and 5 were women. This sample does not accurately reflect the gender breakdown among WiFi users, however, men were more likely to respond to both the survey and interview request than women. This is, in part, due to the fact that I am a woman. Several survey respondents commented on my gender in the open-ended survey responses. While it is true that men were more likely to use WiFi in recent years, there is some evidence that the gender breakdown is now equal.

Interviews focused on informants that reported in response to the survey that they were full-time or part-time employees, self-employed or entrepreneurs. 14 of the informants are full-time employees; 13 are freelance, self-employed or entrepreneurs; and, two were

unemployed during the time that they reported using WiFi hotspots. Among full-time employees, one works remotely in finance for a DC-based firm and another works remotely in technology sales for a Silicon Valley-based firm. Among freelancers, one works remotely in public relations for a Boston-based firm. Informants worked in a range of occupations. One is a university professor, one is a photo-equipment repairman, one works in finance, one is a graphic illustrator, one works in hospitality, one is a lawyer, one works in media production, four work at non-profit organizations, one is a performer, two work in public relations, seven work in technology, one works in translation, two are Web-designers and three are writers. One of the unemployed informants is a homeless blogger.

New Research Tools

I have employed a number of new research tools in order to learn about community wireless networks and the uses of WiFi hotspots. These include network analysis, log data analysis, spectrum analysis, geographic information systems, photography and video analysis. I have used Issue Crawler[11], a network analysis software developed by GovCom.org in order to better understand the online links between the websites of community wireless groups (Rogers, 2006). Most community wireless groups around the world have an online presence in the form of a website. They link their sites to other community wireless groups as well as to useful websites about wireless networking, open source software and other resources. In order to better understand the relationships between community wireless groups, I used the Issue Crawler to create a visual network

[11] See GovCom.org or IssueCrawler.net for more information. Accessed on May 10, 2007.

analysis of the online links between groups that were listed on FreeNetworks.org. In order to do this, I made a list of the urls of the major community wireless groups. By analyzing in-links (links to a particular website) and out-links (links from a particular website), Issue Crawler draws a network map. Looking at the map, it is possible to understand the online relationships between the groups as well as determine the importance of individual groups in the network based on the number of links and position (or centrality) within the map as well as reveal unexpected websites, groups or organizations that may be important in the network. The Issue Crawler allowed me to understand the importance of the open source software community to community wireless groups.

Log data analysis of usage patterns on NYCwireless WiFi hotspots is used for comparison with the survey results. In January 2006, NYCwireless began deploying new access points, SuperNodes, which were designed and configured in order to capture usage patterns and generate statistics. The SuperNode uses open source WiFiDog captive portal software, developed by Île Sans Fil, the community wireless group in Montreal, in order to centrally manage a network of hotspots. The SuperNode requires that users sign-in to use the Internet. Signing in requires creating an account with NYCwireless with a valid e-mail address. Once a WiFi user has created an account, they can use any WiFi hotspot in the network with the same username and password. Community wireless groups are concerned with the privacy of personally identifiable information and do not collect information about their users aside from basic statistics about the number of users, times of use, amount of data transferred etc.

Spectrum analysis is used to collect, measure and analyze traffic data from wireless networks. Using a low-cost tool such as WiSpy, researchers can document the names of the wireless networks running in the area, decipher whether they are open or encrypted and determine the relative amount of traffic on each network. These features can be recorded and visualized in graphs. Spectrum analysis is particularly valuable to ethnographic researchers because it enables one to go beyond what is immediately observable and uncovers invisible uses of wireless networks. For example, since wireless signals penetrate through walls and other physical boundaries, it is not always easy to see who is using a wireless network. However, using spectrum analysis, it is possible to understand the amount of use that is taking place. This forces ethnographers to rethink their assumptions about the ways in which wireless networks are being used because they cannot rely only on their observations. Instead, they must account for potential uses that are taking place outside of physical boundaries that they can observe. Spectrum analysis allows researchers to understand usage patterns based on temporal, spatial, contextual and environmental factors. For the purposes of this project, spectrum analysis was conducted at four locations: two cafes (including Starbucks) and two parks (including Bryant Park). Maps and geographic information systems (GIS) were used to create maps of WiFi hotspots in New York as well as to map out the interview locations. Over 500 photographs were taken to document themes, activities and usage patterns that are described in this research.

Chapter 3: Anytime, Anywhere

In May 2007, I opened my mailbox to find a curious letter from Verizon. "Unlimited calling – that's anytime, anywhere," the letter announced. The phrase, 'anytime, anywhere' has become synonymous with the freedoms associated with the current era of mobile communication. It can be found everywhere from advertising slogans and newspaper articles to policy papers and business plans. The slogan—reflecting utopian, technologically determinist language drawn from computer science and related fields--has had a powerful impact in shaping the way in which debates about municipal wireless networks have been framed over the past three years. However, as I will illustrate in the following discussion, the language of 'anytime, anywhere,' which alludes to convenience and ubiquity, is of little use in describing the realities of municipal wireless networks, and, more importantly, it ignores the particular local characteristics of communities and the specific practices of users.

This chapter addresses debates around the social construction of technology by examining the media representations and technological affordances of wireless networks in an attempt to reframe current debates about community and municipal wireless networks. By viewing mobile and wireless technologies as socially constructed rather than as having technologically determined properties, it is possible to understand the political, economic and socio-cultural agendas at play in the representation and use of these technologies. These debates suffer from a technological determinism that has crippled their ability to envision alternative, and more innovative, solutions to address the challenges of building sustainable networks. Decisions about municipal wireless

networks, like many technological systems, are the domain of specialized groups of policymakers charged with cutting costs and improving economic development in their cities. Since it is often difficult to get citizens interested in technology policy decisions, policymakers often do not understand the needs of citizens. Thus, they resort to top-down policies that assume that 'if we build it, they will come' meaning that demand for a particular technology will increase once the infrastructure is in place. Unfortunately, this type of thinking has led to much fiscal waste. I argue that, rather than inviting – and even encouraging -- private companies to roll out one homogeneous business and network model nationwide, we must reframe debates around municipal wireless networks in line with local needs, uses and practices.

Background

In the past decade, a range of mobile and wireless technologies – hardware and devices, software and applications, equipment and networks -- have widely proliferated in both developed and developing countries. Mobile and wireless devices include mobile phones, personal digital assistants (PDAs), Blackberry's, laptops, routers and antennas. Currently, there are 2.8 billion mobile phones in use; 1.6 million are added daily ("A World of Connections," 2007). These devices communicate with one another through cellular networks and wireless networks operating on standards such as Bluetooth, infrared, radio frequency identification (RFID), near field communication (NFC), 802.11x (WiFi) and 802.16 (WiMax). Bluetooth is a wireless standard that allows short-range wireless communication between devices. Pedestrians and taxi drivers often use Bluetooth headsets, wireless receivers designed to fit neatly in your ear, which are linked

to cell phones carried in their pockets. While it may look strange to see people talking loudly to themselves without any sign of a mobile phone, this allows hands-free communication. These wireless standards are rapidly being embedded into people (RFID-implants in Japanese children), possessions (passports and driver's licenses), products (consumer electronics, clothing and packaged goods) and places (architecture and the built environment).

In 1985, the Federal Communications Commission designated a small slice of electromagnetic spectrum as unlicensed, meaning that no license was required to innovate hardware, software or applications using this spectrum. This spurned a wealth of inventions including microwave ovens, cordless telephones, baby monitors and garage door openers in addition to a wide variety of other consumer home electronics. In the late 1990's, the Institute of Electrical and Electronics Engineers (IEEE) standardized 802.11x or wireless fidelity (WiFi) networks, which use unlicensed spectrum. WiFi allows the capability of sharing a single broadband Internet connection with a group of users. As of May 2007, there were 143,429 WiFi hotspots in 134 countries[12].

There are several common models for the deployment of WiFi networks: decentralized hotspot networks, centralized hotspot network and mesh networks. In a decentralized hotspot network, every node – a wireless router capable of sharing an Internet connection -- is independent and not connected to any other node in the network. Each node has its own Internet connection and is hosted by an individual, business or community-

[12] See Jiwire.com for more information. Accessed on May 9, 2007.

organization. In a centralized hotspot network, every node is connected to a server that manages the network. Each node still has its own Internet connection but the server allows the node to be rebooted when necessary as well as hosting a login or splash page. In mesh networks, every node is connected to every other node regardless of whether or not they are connected to the Internet. A splash page is the first webpage that you see when you login to a wireless network. Splash pages are not necessary however, they are common at hotels, coffee shops and airports in order to regulate – and sometimes charge for -- the use of the wireless Internet.

Mesh networks, also known as ad-hoc networks, are decentralized, flexible, dynamic and resilient. In a mesh network, each node is connected to every other node indirectly through the nodes closest to it. While nodes need not be connected to the Internet in order to communicate with one another, if one of the computers in the network is connected to the Internet, all of the other computers will also be connected to the Internet. In practice, this means that people can communicate with others in the network wirelessly without relying on the networks of telecommunications or cable companies. Think of the citizens' band (CB) radio model but add e-mail, instant messaging (IM), voice-over-Internet Protocol (VoIP) and other applications. In a mesh network, every laptop can be a sender and receiver of digital information thereby enabling a bottom-up, people-powered Internet infrastructure. According to Reed's law, the more people participating in the network, the stronger the network will become. In the near future, it is likely that mobile and wireless devices will be equipped with mesh receivers, smart (or cognitive) radios and spread spectrum (or ultrawideband) technologies that will create ad-hoc

networks with the devices around them, determine which bands (or parts of these bands) of the electromagnetic spectrum are available for use in a particular geographic area and limit interference with other uses of spectrum. A new breed of mobile social networking applications such as Dodgeball and Socialight, mobile games, mobile content and information services, and mobile photo and blogging tools have emerged to enhance the ways in which mobile devices can be used. Some of these applications use global positioning systems (GPS) and geographic information systems (GIS) in order to provide location, context and mapping information.

Media Representations

By examining the media representations of technologies one can begin to understand how they are socially constructed. Earlier studies of electricity (Marvin, 1988) and cyberspace (Mosco, 2004) have illustrated that media representations of technology typically tend towards technological determinism, alluding to radically utopian visions of convenience, freedom and ubiquity or extremely dystopian scenarios of the future. Rarely do popular articles depict a balanced or objective view of the technologies in question because, overall, there is a lack of technical literacy regarding science and technology. Often, the language used to describe new technologies is adopted directly from engineers or scientists, those charged with innovating the technology, or industry experts, those who aim to profit from the technology. Specifically, with respect to mobile and wireless technology, the field of ubiquitous computing has been integral to the creation of visions, expectations and futures that resonate in the mainstream media. This is particularly true with respect to the linking of the phrase 'anytime, anywhere' to mobile and wireless

devices in order to connote desires of convenience, freedom and ubiquity. This slogan conveys the possibility of being liberated from specific times and places, thereby becoming ubiquitous, transcendent and godlike. It is God that traditionally is depicted as being everywhere at once and liberated from time. When in Japan in August 2003, one of the first articles that I downloaded onto my NTT DoCoMo i-mode phone was about an announcement by the National Institute for Japanese Language that proposed the phrase *jiku jizai* – Japanese for the state of being free form the confines of time and space – to replace the commonly used word *yubikitasu* which is adopted from the English word ubiquitous ("Scary Consequences of Ubiquitous Computing," 2003). According to the article, most Japanese do not understand the meaning of the English derived term. The new Japanese word, which incorporates the Chinese characters for time, space and freedom actually reveals an interesting contrast from the original Latin meaning. While historically ubiquitous has referred to the omnipresence of God, it currently implies that "the computer is just as omnipresent and ubiquitous as God."

Historically, the phrases 'anytime, anywhere' and 'anytime, anyplace' have been widely used in the mainstream media over the past several decades to refer to a variety of topics from fishing to free expression, perfume to politics, debates to disarmament inspections, and even terrorist bombings. Some of the earliest uses of the phrase can be found in the late-1970s and early 1980s. For example, in 1977, a satirical Christmas article claims that a boy could go fishing "anytime, anyplace, anywhere, anyhow, any day" despite being 2,000 miles from water (Shales, 1977). In 1978, an article about a political campaign quoted a Hawaiian candidate for governor, Ariyoshi, as saying, "he would debate Fasi

'anytime, anyplace,'" (Cannon, 1978). Another article about Beirut, cites an advertising campaign in an English-language weekly, which states, "Anytime, anyplace, an explosion can happen." (Friedman, 1983). This example refers to an ominous, even Satanic example of ubiquity and omnipresence. In 1986, an article about a security system quoted Governor Michael S. Dukakis, "It could be the ultimate deterrent against auto theft anytime, anywhere," (Dole, 1986).

The phrase is also the title of a popular Hadda Brooks jazz song and the tagline from a Martini advertisement. This seems to suggest that there is value in associating specific consumer products with notions of ubiquity and omnipresence. This may also allow marketers to target a broad demographic by claiming that their products can be enjoyed anywhere and, thus, by anyone. In fact, the phrase 'anytime, anyplace' and related concepts can be found in advertising from airlines to newspapers and dating services in addition to the common associations with mobile and wireless technology (see Figures 4-7 below).

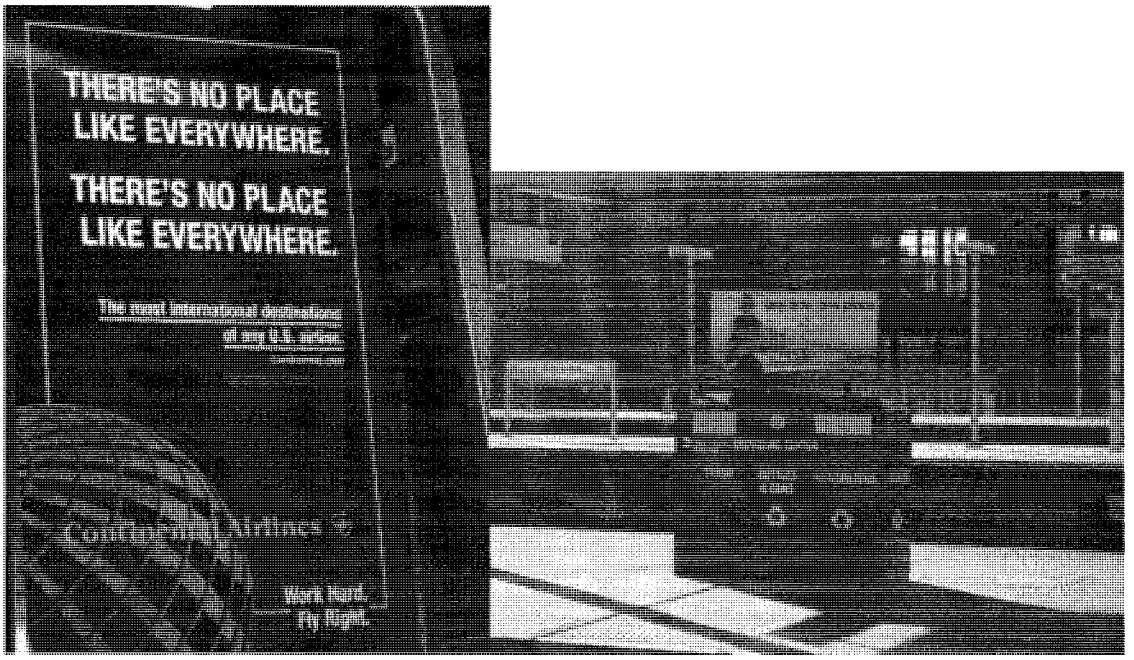

Figure 4-5: Continental Airlines Advertisement, New York, NY, 2007; New Haven Register Advertisement, New Haven, CT, 2007.

Figures 6-7: Lavalife Advertisement: "Click with singles anywhere, anytime on your mobile phone at mlavalife.com," New York, NY, 2007; Verizon Wireless Advertisement, New York, NY, 2007.

In recent years, the phrase 'anytime, anywhere' has been predominantly linked to the convenience, freedom and ubiquity of mobile and wireless technologies. Therefore, such language plays an important role in framing debates about these technologies by emphasizing mobility, globalization and the abstraction of physical space rather than the importance of local, bounded communities – including community wireless groups and the lived practices of users -- which will be described in more detail later in this paper. For example, a recent search of the general news in all major newspapers using Lexis Nexis resulted in over 1800 articles of which 690 referred to mobile or wireless technology (see Figure 8).

Search Term	Number of Articles
Anytime, anyplace	804
Anytime, anyplace AND mobile OR wireless (in heading or lead paragraph)	58
Anytime, anywhere	Over 1000
Anytime, anywhere AND mobile OR wireless (in heading or lead paragraph)	632

Figure 8: LexisNexis Search of General News in All Major Papers, May 31, 2007.

In the early 1990s, the phrase 'anytime, anywhere' began being used to describe the potential for mobility and portability. For example, in 1990, an industry expert forecasts, "We foresee a tiny communicator that everyone will carry around...the trend is toward portability. That means getting and sending calls anytime, any place," (Zeidenberg, 1990). Another company advertises, "the 'personal communicator' - a portable battery-operated device able to send or receive written or spoken messages at any time, from almost anywhere," for busy executives (Kehoe, 1992). In 1991, an industry analyst claimed, "We'll have computing anytime, anywhere," (Clark, 1991) AT&T's CEO at the

time stated that the company is, "letting people connect with each other in ways that satisfy their need virtually anytime anywhere," and government officials asserted, "The goal...is cellular telephone service "anytime, anyplace," (Fehr, 1994). Often, the language is used to describe customer wants, needs and the promises of a technological future. According to the CEO of AirTouch, a defunct U.S. wireless communications company that was formed in 1994, "They want nationwide, seamless service that enables them to (make and take calls) anytime, anyplace," (Wiseman & Kim, 1994). For example, "Even while they promote a wireless future, nearly every player agrees that fulfilling the vision of "anytime, anywhere" communication is a few years off," (Zitner, 1994).

In addition, the term is used to describe changing media consumption habits people are spending less time in traditional places such as 'at home' or 'at the office'. For example, in 2006, *The Guardian* writes, "The BBC must fundamentally change to meet the challenges of an age where people demand content 'anytime, anyplace, anywhere' on a variety of devices, not just TV or radio," (O. Gibson, 2006a). BBC director general Mark Thompson describes the emergence of "Martini media", referencing a popular drink advertisement with the "anytime, anyplace, anywhere" tagline (Rigby, 2000). Thompson asserts that, "We should aim to deliver public service content to our audiences in whatever media and on whatever device makes sense for them whether they're at home or on the move," (O. Gibson, 2006b). In 2001, Microsoft used the slogan 'anytime, anyplace, any device' in order to promote its "grand strategy for mediating our contact with every computer on earth," (Goldberg, 2001).

Finally, the phrase 'anytime, anywhere' has also been used to describe more advanced computing applications such as text-messaging, e-mail and business applications that are touted as enabling workers to be more productive. For example, an article about camera phones elaborates that they, "capture the precious and horrid times of our lives -- anytime, anyplace," (Johnson, 2004). Another article explains that wireless carriers, "sell customers buckets of minutes that can be used anytime, anyplace," (Solomon, 1999). The CEO of Motorola, Ed Zander, refers to a new era of convergence that is occurring, "on the road in the form of hand-held gadgets that can connect anytime, any place," (Fost, 2007). Greg Wilfahrt, the co-founder of SMS.ac, an online text-messaging company, states, "Is there ever a drawback to having anytime, anyplace connectivity," (Finan, 2005). Another article says that people, "prefer text messages because they can read them and respond anytime, anywhere, and quietly, without disturbing anyone," (Knapp, 2007). An article on smart phones claims, "access to e-mail anytime anyplace seems to go without saying," (Fitzgerald, 2004) and another argues that, "productivity is about when and how work is done, not where. Employees can be productive anywhere at anytime," (Knook, 2007).

Finally, this language has infected debates around municipal wireless networks finding its way into articles, requests for proposals and government brochures. For example, Suffolk County Executive Steve Levy says of a county-wide wireless project, "People could connect to the Internet anytime, any place," (Lambert, 2006). The city of Houston's wireless network is promoted with a red, glossy brochure that promises connectivity

'anytime, anywhere'. With respect to municipal wireless networks, the language is particularly problematic because it lures citizens with promises that are unlikely to be met and, if delivered, are probably significantly more costly than anticipated. Due to the properties of wireless technology, it is unlikely that cities will be fully-covered by the network's signal and, furthermore, may not penetrate many residential or corporate buildings without incurring significant costs for repeaters and the like. Thus, discussion about municipal wireless networks suffer from a lack of public understanding about the properties of wireless technology.

Affordances of Wireless Networks

The concepts of affordances (J. J. Gibson, 1977; Norman, 1990), infrastructure (Star, 1999; Star & Bowker, 2002) and values (Nissenbaum, 2001) are useful in building a more nuanced understanding of mobile and wireless technologies, in particular, WiFi networks. The most obvious affordance of a WiFi network is its ability to provide connectivity to the Internet. A typical WiFi network currently reaches between 300 to 1000 feet with some variation depending on the type of equipment and the way in which its software is configured and set up. Because its signal reaches a relatively small, bounded geographic area, people must be situated within close range of the network in order to get online. Thus, it is often common to observe people clustered within range of wireless networks whether they are at a café, in a park or public space or merely standing on the street trying to get a signal.

However, it should be noted that a WiFi network does not map onto existing physical or architectural boundaries. Instead, it reconfigures them in a number of ways by permeating walls, bleeding into public spaces and breaking down some traditional notions of privacy and property while re-enforcing others. For example, an interview with an architect revealed that the availability of mobile and wireless technology significantly changed the ways in which their clients wanted to use the spaces that were being designed for them. When asked where the office was likely to be, clients responded that they might like to work next to the fireplace. Or, they might like to move from room to room while they were working. This contrasted with the architect's preconceived notions about the use of the rooms that they were designing. In another interview, wireless-networking experts from Edinburgh remarked that hotel staff were puzzled when guests called in requesting to stay in specific rooms of their hotel. When asked, guests replied that reception of the recently installed free wireless network in the bar downstairs was stronger in those rooms. While there is currently no way to tell how prevalent this practice is, one might assume from our current experience with mobile phones that people often cluster in places where wireless signal strength is the strongest.

This reconfiguration of space is also reflected in the organizational culture of information technology companies such as Cisco and IBM, which have embraced more flexible employment models for their full-time employees. According to a conversation with a Cisco wireless sales employee, works starts "when he decides that it starts." He is not encouraged to go to the office and, instead, works primarily from home. This example illustrates emerging work practices that are enabled by portable computers and the

Internet. When he does go to the office he is free to choose whichever office he pleases, even that held by senior management, since there are no assigned desk-spaces for the majority of staff. In this way, the laptop computer and mobile devices themselves become the office. Furthermore, while the Cisco employee works on project teams, they are ad-hoc teams, meaning that they can be dynamically reconfigured as needed. For example, IBM employees are allowed to work anywhere that IBM has an office according to a recruiting seminar by IBM held at the Columbia Business School in 2006. One IBMer reports to have spent most of his summers working from Budapest, Hungary. Since technology companies often lead in the experimentation and use of communications technology, one might assume that such practices may soon become common in other industries as well.

However, according to Eric Rabe, a spokesman for DSL provider Verizon Communications Inc., "Most people if they are going to do serious work aren't looking to be sitting in a park...They want to be at a desk where they have their papers or business records," (Jesdanun, 2007). This illustrates that a lack of comprehension about the ways in which current socio-economic trends such as the growth of freelancers, self-employed, remote workers are supported by mobile and wireless technologies such as mobile phones, laptops and WiFi hotspots. Rather than choosing to be surrounded by "papers and business records," people are choosing to, and enjoying, working from alternative places such as cafes, parks and other public spaces. While some people that I interviewed acknowledge that this was only a temporary arrangement, others could not imagine working anywhere else. However, one self-employed lawyer eventually decided

to get an office when his orange folders began to take up the whole living room of his West Village apartment. Still, on afternoons when his maid was cleaning his apartment or when his wife, a seamstress with a home-office, needed additional space, he enjoyed working in Washington Square Park while his dog played outside. Despite these illustrations of emerging work cultures supported by WiFi networks, Verizon's own WiFi project, which placed hotspots on New York City phone booths, was a short-lived failure. The company announced that they would outfit 2000 phone booths with WiFi hotspots that would be free to use for Verizon DSL customers. Then, about six months later, they cut the project down to 500 phone booths. Finally, they canceled the project citing lack of demand and, soon after, announced a competing wireless service, EVDO, which uses cellular networks to connect laptops to the Internet. However, there might be other reasons for the project's failure such as the lack of available seating or the absence of visible outdoor advertising. Or, perhaps it was merely a ploy to lure more DSL customers a perceived added value.

It is difficult to observe the affordances of invisible networks. Take this example. On a rainy day in June 2006, I went to City Hall Park to observe the use of the wireless network. City Hall Park is a small park in downtown Manhattan surrounded by office buildings, including City Hall itself. Understandably, there was almost no one in the park let alone with a soggy laptop computer on their lap. That is, except for myself. I looked around and concluded that it was probably a very bad day to do research on the wireless network. However, upon conducting an analysis of the spectrum being used on the network, I found it buzzing with activity (see Figure 9).

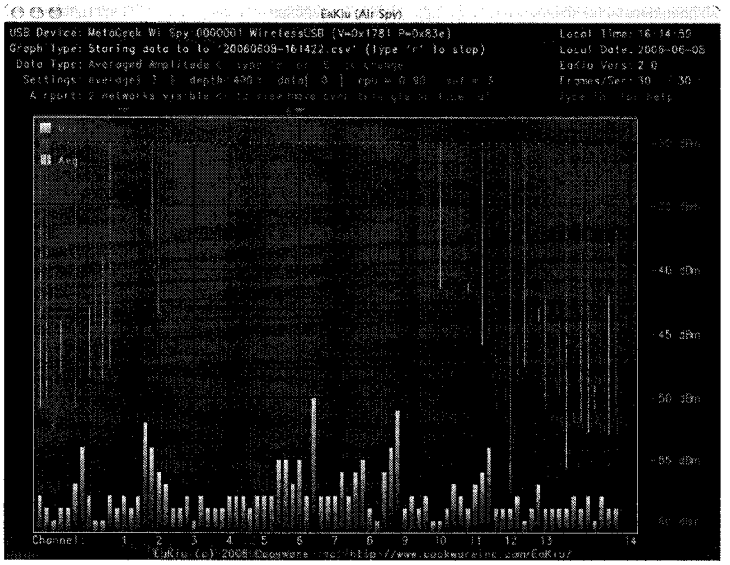

Figure 9: Spectrum Analysis of City Hall Park, June 2006, New York, NY.

In fact, to my surprise, there was more traffic on the network than I had ever observed before. The area underneath the red line in Figure 9 represents the total amount of traffic on the network. The small green triangle at the top of the chart indicates that this is a spectrum analysis of the open wireless network at City Hall Park (SSID: cornercast). My hypothesis for this activity is two-fold. First, it is possible that the network was being accessed by people, invisible to me, who were located in the buildings surrounding the park. Second, there was a college graduation ceremony taking place and it is possible that the videographer was uploading live video of the ceremony to the Internet. Thus, due to this affordance of wireless networks, I concluded that my ethnographic observation would be further bolstered by the use of technical data including log data and spectrum analysis.

Star's concept of infrastructure as "relational and ecological" refutes the language of 'anytime, anywhere' because mobile and wireless technologies must take on different meanings depending on their users. Like many communications technologies historically, wireless technologies are socially constructed in the mainstream media as technologies of convenience, freedom and mobility. While these descriptions serve to sell these technologies, or at least an image of them, they do not accurately reflect the needs and desires of users. Instead, these technologies must be evaluated on a case-by-case basis depending on the user and environment in which these technologies are being used. For example, in my interviews, I have uncovered many users who repeatedly use the same wireless network on an almost daily basis for as many as twelve hours a day. For these users, specific times and specific locations matter more to them than the promises of mobility. Furthermore, I have encountered users that share connectivity, such as sharing a paid wireless Internet account, thereby challenging the commonly-held business assumptions and reducing profitability for the providers. These uses contradict the telecommunications industry's drive for ubiquitous, always-on connectivity because by sharing a wireless account with a friend or colleague they are merely 'sometimes on'. Similarly, others may work regularly at a café where others go to get online but deliberately not connect to the Internet because they want to be offline (Hampton & Gupta, forthcoming). It is these nuances that are often not accounted for in media representations.

Infrastructure often becomes visible only upon breakdown (Daniel Beunza & Stark, 2003, 2004; D. Beunza & Stark, 2005; Kelly & Stark, 2002; Star & Strauss, 1999). Wireless technology both conforms to this logic as well as counters it. Wireless technology is perhaps more invisible than most infrastructures. Unlike other infrastructures such as electricity, water and basic telecommunications, which are marked by switches, faucets, and wires, there are few signals that wireless networks exist at all. Often, wireless networks are not marked, announced or advertised. It is often possible to find out that a network exists with a laptop computer that has a built-in receiver that lists the names of the nearby networks. The secure socket identification name (SSID) is sometimes the only indication that the network exists; sometimes the SSID is not 'broadcast' or announced to the public so only certain users know that it is there. When a wireless network is expected to be available but is not working, the amount of informal interaction among users increases as people share their frustrations with one another.

Yet, there are also a number of ways in which wireless networks, and their affordances, become visible to those who use them. Most obviously, the clustering of people hovering over their computing devices in public spaces signals that they may in fact be online. In addition, based on my experience sharing my own wireless network for the past four years, I have learned that the rapid blinking of green lights on my router -- when I am not online -- indicates that other people are using my network. Thus, these lights function to make visible the availability of a shared resource, unlicensed wireless spectrum, which can be used to allow many people to access the Internet at one time. Furthermore, the NYCwireless 'splash page,' a web page that loads when one opens a browser and

prompts a user to login, displays a list of the users that are currently online and those recently online. The 'splash page' also functions to make visible the presence of a physical community sharing a resource. Finally, my wireless router (see Figure 10 below), a clear plastic lunchbox with a star constellation motif, designed and built by NYCwireless board member Rob Kelley, makes wireless networking technology more visible to me. Through the plastic shell, I can see the router's circuit board and blinking lights, thereby literally transforming 'black box' technology into a designed object.

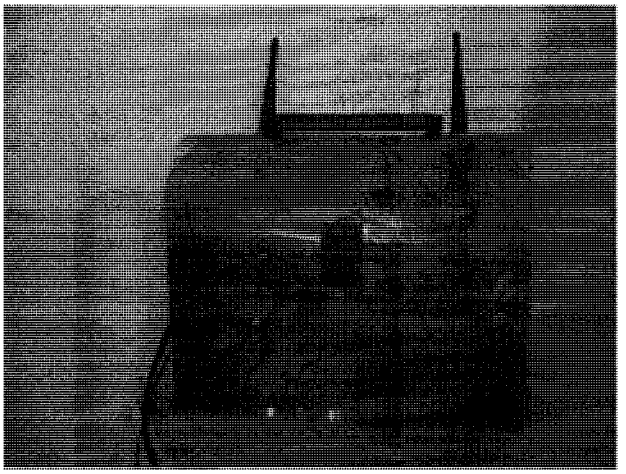

Figure 10: Wireless Router Designed and Built by Rob Kelley, NYCwireless, 2006.

The following examples describe the affordances of WiFi networks in order to explain some of the ways in which they enable as well as constrain behavior. For example, WiFi networks can be open or closed, free or for a fee, municipal or community-based. Rather than merely technological choices, these decisions represent a wide range of political, economic and socio-cultural values as we will see in later chapters.

Wireless networks can be open and, therefore, free to join and use without a password, or closed, "locked-down" or encrypted and, thereby, off-limits. As such, wireless networks are important in defining the boundaries of digital spaces, which are increasingly overlaid onto the physical spaces in which we spend our everyday lives. With regard to the openness and closure of networks, both software and hardware play a role in the social, political and economic regulation of the ways in which these networks can be used.

The security community – and, in particular, security experts quoted in the mainstream media – have played a key role in persuading people to close-off their networks in the name of preventing illegal or undesirable activities such as pornography or file-sharing. For example, in early 2000, when technologists were first experimenting with wireless networks, the majority of networks were open. Many of these networks had generic SSIDs such as linksys or Netgear, the names of the most widely used routers. However, in the post-9/11 environment, security concerns as well as the strength of the telecommunications lobbies in Washington, DC have significantly shaped the ways in which software and hardware have developed.

For example, several years ago, I attempted to use Microsoft XP's setup tool in order to install my wireless network. As an intermediary step, I was asked to choose a password. If I did not choose one, I was informed, the tool would select one for me. Of course, it is likely that a technologist keen on leaving their wireless network open would be able to circumvent the limitations imposed by such tools. However, for most users, as a result of

worries over security and the embedded politics of their software, in recent years, the majority of networks have become increasingly closed.

The majority of people are hesitant to pay a fee to use wireless networks. However, there is still much confusion over the legal and economic aspects of wireless networking. For example, is using a free wireless network stealing? Could it be considered illegal to use a free, open network? There have been few legal cases to provide clarity on this issue however, in some cases, it was decided that using a wireless network without authorization (meaning connecting to an open network) was illegal and akin to trespassing. Despite this, since connecting to networks is what most computers do as their default setting, it seems unlikely that merely the act of opening one's laptop or turning on one's iPhone could be declared illegal in itself.

Most people, in the United States at least, feel more entitled to use something that they have paid for. However, there is significant price discrimination in the market for wireless networking. This problem is particularly noticeable in hotels where prices range from completely free at the low-end hotels, to $25 USD per day of connectivity at the higher end and luxury hotels. For example, in June 2006, I checked into a budget business hotel in Dresden, Germany where the International Communication Association conference was being held that year. In order to log into the wireless network, I was required to enter a mobile phone number. To my surprise, I found that when I logged in with a US mobile phone number, I was charged 2 Euros more per day than when I logged in with a German mobile phone number. There was no particular rational for this price

difference – they were not billing the wireless access to your mobile phone bill, the mobile phone number was required only as a unique identification number -- and, unlike price discrimination in physical space i.e. charging more for an Apple PowerBook in Europe than in the United States, digital price discrimination occurs within the same space.

Diary of an Open Hotspot

While I have had an open hotspot since November 2004 when I got my first Netgear router, in May 2006, I began sharing WiFi using an NYCwireless WiFiDog SuperNode. Over the course of the year, it was gratifying to come home to flickering green lights, indicating that My Little WiFi was in use. Upon logging into the NYCwireless splash page, I could see a list of users who were online. While merely user names, the list gave me a strange sense of the geographic community surrounding my apartment. I began to know when certain users would be online, and when they would be offline. However, I did not have any way to communicate directly with users of my network since, to date, few wireless networks are equipped with communication tools such as e-mail, instant messaging or social networking applications. Austin's Less Networks is one community wireless network that has more advanced communication tools. Over the course of the year, My Little WiFi became one of the most heavily used hotspots in the NYCwireless network. At a conference at Columbia in Spring 2007, I began my talk by saying that I shared my home wireless network with over 35 people in my building. During the closing keynote, one of Verizon's top officials publicly scolded me for leaving my network open, and therefore prone to nefarious uses and security risks. He also accused

me of reselling my Internet access, which is not the case. This example illustrates the disruptive and political nature of shared WiFi access.

By May 2007, however, the network became nearly unusable, especially at certain times of day. The large number of users, the amount of bandwidth being used and problems with the NYCwireless servers (causing the splash page to load very slowly) made the user experience very frustrating. I got a complaint from one of my neighbors. Regrettably, I took My Little WiFi down until further notice. The solution was to limit the amount of bandwidth that I shared thereby saving a sufficient portion for my own uses that could be accessed with a password. This could be done by using an additional router or programming a single router. Thus, the network would move from completely open to semi-open. As of March 2008, My Little WiFi had not yet gone back online.

Conclusion

Over the past year, in 2007, municipal wireless networks have struggled to identify appropriate business models, failed to create workable private-public partnerships and, as a result, a number of high-profile projects have been cancelled. As this chapter illustrates, there is a disjuncture between the ways in which mobile and wireless technologies are represented in the mass media, their affordances and the ways in which they are used. Both representations and uses make up the social construction of these technologies. I argue that there is a need to reframe debates around municipal wireless, which are currently plagued by overly technologically deterministic language referring to ubiquitous, anytime, anywhere connectivity.

Such language is misleading for policymakers, businesspeople and citizens because it envisions a top-down network infrastructure that may be cost-prohibitive and possibly even unnecessary. For example, a municipal wireless network is unlikely to cover every residential building without significant expense deploying equipment to repeat the signal inside these buildings. Furthermore, the materials from which buildings are made could interfere with the reception. However, upon hearing that their city will have a ubiquitous municipal wireless network, citizens may have an incorrect perception of the network's coverage. Finally, this language assumes that place is irrelevant and homogeneous i.e. one place is just the same as any other place, and therefore ignores social needs and usage patterns. The empirical data presented above illustrates a myriad of reasons why people choose specific locations where they can access wireless networks. For example, one person likes Bryant Park because the chairs are comfortable, another because they can bring their kids along while they work.

By reframing debates around municipal wireless networks in lines with user needs and behavior, it might be possible to envision different business models, partnerships and policies for these networks. Municipalities have been eager to adopt the same models of other cities such as Philadelphia, San Francisco, Boston and Chicago. Instead, cities should consider their unique advantages, needs and cultures before embarking on projects to build municipal wireless networks. This might allow cities to plan network infrastructures that may not be ubiquitous but that focus on meaningful sites of everyday life rather than merely 'anytime, anywhere' connectivity. For example, a city might

focus on public parks, churches, schools, cafes and other locations where people tend to congregate. However, it should be noted that these locations will vary substantially from city to city depending on political, economic, socio-cultural, environmental and architectural factors. A better understanding of the cities potential users would allow the city to design networks, applications and services that could be tailored to the users needs. This bottom-up strategy might allow cities to avoid the current difficulties surrounding municipal wireless networks. In fact, in San Francisco, Meraki, a wireless networking company, is already implementing a bottom-up network built on users needs and demand.

In summary, making space for alternative business models, partnerships and policies requires the development of new conceptual frameworks. The current language of ubiquity and anytime, anywhere access is derived from computer science and related technical disciplines. Designing networks for people requires concepts that describe human behavior. While ubiquity and anytime, anywhere access may describe the technological promises, people's needs and uses are located in specific places of meaning, culture and community.

Chapter 4: Activist Infrastructures

Beginning in the late 1990s, early adopters of mobile and wireless technologies founded wireless user groups (WUGs), free networks groups (freenets) and community wireless networks (CWNs), and began experimenting with, developing software for, and building wireless networks in their cities. CWNs are volunteer-driven groups, organized around specific geographic communities – usually cities and towns including rural communities and Indian reservations -- that innovate, build and educate citizens about free, public wireless communications infrastructure. Many of the individuals involved in community wireless networks emerged from the Free Libre / Open Source Software (FLOSS) movement. Some of them developed an interest in the potential of WiFi sharing and community wireless when they found that they could not get high-speed Internet access in their own homes (Bar et al., 2005; Hampton & Gupta, forthcoming; Jungnickel, 2008; Longford, 2005; Medosch, 2006; Meinrath, 2005; Powell & Shade, 2006; Sandvig, 2004; Townsend, 2005). A key component of CWNs around the world is the role of individual volunteers who 'host' free, open wireless networks from their apartments and homes for the use of their neighbors, visitors or passersby. The networks typically reach within a short range of the wireless network (typically 300 to 1000 feet), however, some networks have found ways to reach across significant distances. There is even an annual competition to determine the longest wireless links. These networks are able to grow organically in a decentralized manner with the addition of each new node. This chapter describes the role of CWNs as lead users of WiFi and related technical artifacts including hardware (routers, antennas, solar-powered panels, laptops, WiFi-enabled cell phones and PDAs), software (both open source and proprietary software for captive portals, network

management and spectrum mapping) and applications (emerging social network tools that can be accessed on WiFi splash pages). As the following discussion will show, CWNs are motivated by diverse values, ideals and goals, which range from lowering the cost of Internet access and shifting the locus of control over communications infrastructure to community-based initiatives to the thrill of being the first to innovate an open source software to manage WiFi networks. The political nature of their work is evidenced by their efforts to influence pubic policy on a wide range of issues including network neutrality, media ownership, digital inclusion, spectrum management and municipal wireless policy; their participation in activism and protests related to issues such as privacy; and, their ongoing discussions of these issues on listservs, web sites and at face-to-face meetings and summits.

Today, there are thousands of WUGs, freenets and CWNS worldwide in cities including Seattle, New York, Champaign-Urbana, San Francisco, San Diego, Portland, Austin and Boston in the United States, and, internationally in Montreal and Toronto, Canada; London, United Kingdom; Berlin, Germany; Paris, Budapest, Hungary; Tallinn, Estonia; Belgrade, Serbia; Johannesburg, South Africa; and Canberra, Australia.[13] The identities and activities of CWNs are linked with global causes while at the same time situated in their local communities. CWNs -- composed of activists, entrepreneurs, hackers, researchers and artists – are active in advocating for a number of issues and ideas including network neutrality, digital inclusion and unlicensed spectrum. While, as alluded to in the previous chapter, wireless networks are largely invisible information layers that

[13] See FreeNetworks.org for a more comprehensive list. Accessed on May 3, 2007.

blanket towns, cities and spaces thereby going unnoticed, the CWNs are engaged in activism and organizing around specific values, beliefs and principles. This illustrates the social construction of these networks, through their innovators and users (these are often one and the same in the case of CWNs) as explicitly political, economic and socio-cultural.

Despite similarities in the beliefs and values of community wireless networks, these groups vary considerably in size, membership and activities from country-to-country based on political, economic, legal and socio-cultural factors. For example, while one community wireless organization cultivates the growth of networks in New York's parks and public spaces, another reaches across the Berlin rooftops, and those in Montreal and Budapest center on cafés. In addition, while groups in Seattle, Champaign-Urbana, Montreal and Berlin excel at the development and distribution of open source software, other groups such as the one in New York are more active in policy advocacy, outreach and education. This chapter will introduce and document the work of community wireless networks, focusing on two of these networks in detail: NYCwireless in New York and Freifunk in Berlin. I argue that community wireless networks are examples of a community form of organizing that is deeply embedded in locality, in part, due to some of the affordances of wireless networks that were discussed in the previous chapter.

While it is not possible to aggregate total usage of these networks globally, a recent study of mobile and wireless use in the United States shows that 41% of adults have logged onto the Internet while on the go from a laptop or handheld device. According to the

study, "62% of adults are part of a wireless, mobile population that participates in digital activities away from home or work," (Horrigan, 2008). There are equal numbers of men and women accessing the Internet wirelessly and 71% of these have broadband at home (Horrigan, 2008). Descriptive statistics of WiFi users will be presented in Chapter 5. It is important to not that, while these statistics describe WiFi users overall, they may not accurately reflect the users of CWNs. This is because CWN members are still, largely, young, male technologists. In fact, in some cities such as Berlin, while the networks technically open for anyone to use, it is unlikely that a passerby unfamiliar with the CWN would actually use them. This is because it is necessary to download special software on one's computer in order to use the network. CWNs also suffer from a lack or visible outdoor signage, which can make them difficult to find. However, many WiFi users are able to find open networks easily just by opening their laptops.

Beginning 2004, there were a number of significant efforts to bring community wireless groups together face-to-face, as well as to link them with other media activists. These are: the National Community Wireless Networking Summit (August 2004, Champaign-Urbana, IL), the National Community Wireless Networking Summit (March 2006, St. Charles, MO), the International Summit for Community Wireless Networks (May 2007, Columbia, MD) and the International Summit for Community Wireless Networks (planned for May 2008, Washington, DC). These events, which attract about 150 participants, allow CWN members – the majority of whom are young, male technologists – to engage in informal interaction, knowledge-sharing, collaboration and innovation. The location of the most recent events in and around Washington, DC suggests the desire

for CWNs to more deeply engage with public policy as well as to attract policymakers to the Summit.

The first National Community Wireless Networking Summit, and subsequent Summits, have been organized into three discussion tracks: policy, technology and organizing. According to the Summit's web site, the policy issues faced by community wireless leaders participating in the Summit in 2004 were: the cable and DSL duopoly, which was lobbying at the time to make municipal wireless networking illegal and succeeded in passing legislation in thirteen states; the failure of Congress and the FCC to make provisions for more unlicensed wireless spectrum; the lack of technical knowledge among elected representatives, which results in ignoring issues such as network neutrality, digital inclusion and the international competitiveness of the country's Internet infrastructure in terms of speed and cost.[14] This focus on pressing public policy issues illustrates the explicitly political nature of the work of CWNs.

A related meeting, the Cooperative Measurement and Modeling of Open Networked Systems (COMMONS) Project, brought CWNs and independent ISPs together in December 2006 and again in May 2007 to collaborate to discuss the possibility of building "a cooperative national backbone to connect select community and municipal networks to each other, and to the global Internet."[15] The project was formed in response to several problems including a financial crisis in the Internet infrastructure provider industry, a data acquisition crisis in that researchers often have difficulty obtaining access

[14] For more information, see the Summit web site at: http://www.cuwin.net/2007summit/2007background.
[15] See http://www.caida.org/projects/commons/. Accessed on November 23, 2007.

to Internet traffic data, and the difficulty of finding a robust business model in community and municipal networks.[16]

Following a breakout group discussion at the May 2007 Summit in Columbia, MD, the following month, a team of seven community wireless activists from around the world including representatives from NYCwireless (including myself), FunkFeuer (Vienna, Austria), CUWiN (Champaign Urbana) and Seattle Wireless formed the Open Source Wireless Coalition, a global partnership dedicated to the development of open source wireless technologies, in order to "to work with interested municipalities to develop and deploy open source wireless technologies" in response to a request for information from Open Air Boston, a private, non-profit corporation created to provide affordable wireless internet access in Boston. In four short days, the team created a nineteen-page response document using Google Docs to facilitate the collaborative writing process. While, as typical with community wireless activists, the team was primarily composted of young, male technologists, I found that I was able to contribute to the project as a social scientist.

More recently, another outcome of the May 2007 Summit, the International Association for Community Wireless Networks was formed in September 2007. According to the organization's bylaws, the purpose of the organization, of which I am a member of the board of directors, is to: 1.) encourage the development of CWNs; 2.) act as a public clearinghouse for information regarding regulatory and legislative activities affecting the design, implementation, and use of wireless networks; and, 3.) provide a forum for public meetings concerning the application of wireless technologies (Meinrath, 2007).

[16] See http://www.caida.org/projects/commons/. Accessed on November 30, 2007.

Internationally, there have been at least six events since 2002. These were: BerLon Wireless Culture Workshop (October 2002, Berlin, Germany), Freifunk Summer Convention (July 2003, Berlin, Germany), Fresh Air Free Networks (September 2004, Djursland, Denmark), the World Summit for Free Information Infrastructures (October 2005, London, England), the Airjaldi Summit (November 2006, Dharamsala, India), the World Summit for Free Information Infrastructures (May 2007, Barcelona, Spain) and the World Summit for Free Information Infrastructures (planned for 2008, Ghana). At the Fresh Air Free Networks event, I entered the high school gymnasium in rural Denmark and found it neatly lined with rows of tables on which community wireless activists had set up their laptops, routers and antennas. While a live band performed on the stage, most of them stared into their computer screens hacking away at wireless networking protocols or Skyping their families back home. Since the event was coordinated with a wireless for economic development road-show, it attracted a number of activists from Latin America, Africa and Asia. In addition, there was a small but active group of women, of which I was one, who held a meeting as part of the event.

The World Summit for Free Information Infrastructures in London in 2005 brought together participants from the community wireless, open source and open mapping communities (groups working on open source geographic information systems). This expansion of the Summit to include a broader range of participants from related technical and non-technical areas supports the overlapping interests, values and goals of these communities. CWNs are able to cross the boundaries of their own community of practice

in order to learn from related communities, experiment with open source and mapping technologies, and innovate in collaboration with other groups. The location of the international Summits that take place outside of the United States illustrates the ad-hoc, bottom-up form of organizing employed by CWNs. CWNs use listservs, wikis and websites to identify an appropriate person or organization that is interested in and capable of hosting a Summit in their country. This allows for flexibility and diversity in the nature and location of Summits.

The Rise of Municipal Wireless Networks

Several years later, after the early experiments by community wireless networks, municipal governments became interested in the possibility of deploying municipal wireless networks in order to increase economic development by lowering the cost of Internet access for poor communities and small businesses. Cities including Philadelphia, San Francisco, Boston, Minneapolis, and Austin have announced plans to build municipal wireless networks. In 2004, Philadelphia became the first large city to announce plans to build a municipal wireless network hoping that it would bring jobs and economic development to its underserved communities. A public policy debate ensued, and in November 2004, Verizon succeeded in passing state legislation in Pennsylvania that prevented municipal governments from providing broadband services. While Philadelphia was allowed to continue with their project, a total of 15 states have passed anti-municipal broadband laws in recent years. This legislation requires that cities give

telecommunication and cable companies the right to refuse plans to build municipal wireless networks[17].

Since 2004 over 350 cities – including Boston, Chicago and San Francisco, Los Angeles, Houston and Austin -- have deployed, planned or are seriously considering building municipal wireless networks including regional/citywide networks, hotzones and public safety networks (Vos, 2007). There are several common ownership models for municipal wireless networks: privately-owned networks, public-private partnerships, publicly-owned and community-owned networks. Most municipal wireless networks such as those in Philadelphia, San Francisco and Chicago have been conceived as privately-owned networks in which Earthlink or another Internet service provider builds and owns the telecommunications infrastructure. While the city is a partner, they do not share a burden of the costs. However, several smaller cities have designed public-private partnerships or publicly-owned networks. One example is St. Cloud, Florida. More recently, in 2007, many of the municipal wireless projects mentioned above have been unable to identify a business model and have been cancelled or discontinued. For example, in San Francisco, Earthlink failed to reach an agreement with the city because it wanted the city to become lead users of the network and agree to buy a portion of the network's bandwidth to insure that the company would be able to make a profit.

The current situation is, in part, due to the fact that these projects make a number of assumptions about the payoffs of municipal wireless networks without the benefit of

[17] See http://www.freepress.net/communityinternet/=states for more information. Accessed on May 9, 2007.

research on the communication practices of users. To date, there is little such research. In addition, wireless technology is often discussed as one of many ways to access the high-speed (broadband) Internet i.e. cable, digital subscriber line (DSL), fiber etc. Thus, there has been little analysis of the ways in which the use of the wireless Internet via WiFi may differ from that of the wireline Internet. In order to understand the potential user patterns that will be observed with respect to emerging technologies such as ultrabroadband (data transmission rates over 1 gigabit per second), it is necessary to disaggregate research about the various ways of connecting to the Internet.

Currently, researchers have identified a number of urgent problems with respect to the Internet. Specifically, these are: a financial crisis in the Internet infrastructure, a data acquisition crisis (specifically, researchers cannot access the information they need to solve these problems since it is owned by private companies), and the failure of community and municipal wireless networks to identify a sustainable business model[18]. In order to respond to these problems and develop appropriate solutions, researchers are desperately in need of Internet traffic data. However, the majority of this data is owned by corporate telecommunications and Internet service providers (ISPs). Furthermore, these corporate entities do not want to retain the data, other than for their own internal purposes, due to the Communications Assistance for Law Enforcement Act (CALEA), legislation that would require them to turn it over to lawmakers if subpoenaed. Thus, researchers are not able to obtain the data that they need in order to innovate potential solutions. One proposal is to use statistical reporting of log data from wireless networks, which are, for the most part, set up on an ad-hoc basis rather than by telecommunications

[18] See CAIDA (Cooperative Association for Internet Data Analysis) for more information (http://www.caida.org/funding/commons/wkshp_prop_0612.xml).

providers themselves, in order to better understand Internet traffic data. Log data when combined with quantitative surveys and qualitative in-depth interviews may reveal usage patterns that are integral to solving the problems facing the future of the Internet.

Mapping Community Wireless Networks

As indicated briefly above, over the past few years, there have been a number of efforts to connect CWNs worldwide for the purposes of informal interaction, policy-advocacy, knowledge-sharing, collaboration and innovation. These efforts include electronic links such as websites, listservs and audio-conferences as well as face-to-face meetings such as conferences, workshops and week-long camping events. One way to better understand the relationship of CWNs worldwide is through social network analysis. The following diagram illustrates the relationships between the websites of CWNs – understood as incoming and outgoing links -- that are listed on Freenetworks.org.

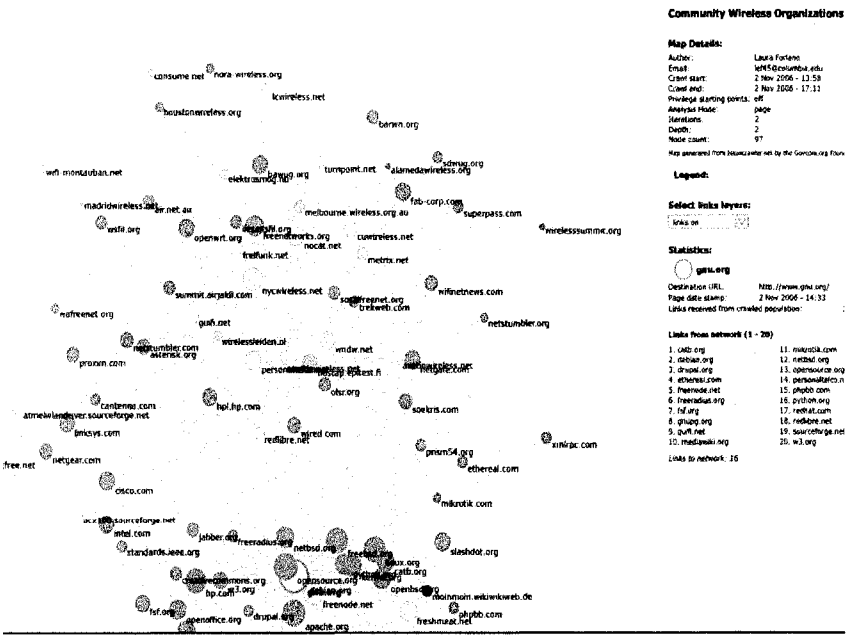

Figure 11: Social Network Analysis of Community Wireless Networks, IssueCrawler, November 2006.

In the diagram, yellow indicates a .net (the majority of CWNs), red indicates a .com, gray indicates a .org, and other colors indicate specific country domains. Larger circles imply a greater number of incoming and outgoing links while smaller circles illustrate a smaller number. More central nodes are of increased importance to the network while less central nodes are of less importance to the network.

After running the analysis, three distinct clusters emerged: community wireless networks, open source software and private sector intermediaries. This is important to note because only the urls of CWNs from Freenetworks.org were included in the analysis. Thus, the emergence of non-CWNs and private sector actors is significant. In particular, the diagram illustrates the relationship of CWNs to the open source software community. This makes sense since CWNs are highly interested in using, designing and sharing open source software. In fact, many CWN leaders are open source programmers and a number of CWNs emerged from the open source community.

Among community wireless organizations Seattle Wireless, NYCwireless, CUWiN (Champaign-Urbana Community Wireless Network), Freifunk (Berlin) and Île Sans Fil (Montreal) emerged as some of the most central and most important networks; again, as understood by the number of incoming and outgoing links. Interestingly, the majority of these groups are innovators of open source software, which has been adopted and deployed by other groups. Thus, it can be argued that open source software has an important role in mediating the relationships between CWNs worldwide.

Visualizing Invisible Networks

CWNs have been important lead users and innovators of wireless networking hardware and software that adopted, modified and deployed by other CWNs around the world (Sandvig, 2004). Currently, CWNs around the world are participating in the on-going development of the technological infrastructure in their communities by innovating and implementing open source mesh networking protocols. The two largest such projects are those built by the Champaign-Urbana Community Wireless Network (CUWiN) and Freifunk. CWNs are becoming important sources of user-driven innovation (Von Hippel, 1978), the value of which has been widely documented in a number of disciplines. CUWin, founded in 2000, grew from three mesh network nodes in 2002 to 50 nodes in January 2005. As described above with reference to the "ad hoc" network for emergency communications, the network allows individual nodes to communicate with each other regardless of whether or not they are connected to the Internet. As described by Sandvig et al.:

> CUWin and some other community wireless groups are not attempting to implement the same systems as those run by traditional telecommunications companies that have let them down: instead they are attempting to build a new kind of system – a wireless dynamic mesh network – in a configuration that is unlikely to be produced by industrial research and development (Sandvig, Young, & Meinrath, 2004).

In addition, the design of the dynamic mesh network is closely related to CUWin's goals as is illustrated by the following:

> As a loosely organized group, CUWin wanted a network that anyone could join or leave at any time. CUWin wanted the ability to efficiently share bandwidth from a small number of sources of backhaul (Internet connectivity) in order to reduce costs. Members wanted high-speed connections across town so that they could create an alternative to traditional Internet service, phone service, television service and, and analog AM/FM radio (e.g., using Voice over Internet Protocol and multimedia streaming) (Sandvig et al., 2004).

However, in order to achieve these goals, CUWin engineers need to be able to understand and manipulate the software on WiFi devices. Unfortunately, the manufacturer's of such devices have not provided adequate documentation to thereby presenting a significant bottle-neck to user-driving innovation in this area (Sandvig et al., 2004).

CWNs have also been pioneers in developing and using interfaces such as real-time maps to monitor the status and location of WiFi hotspots. This allows users to reconceptualize cities and spaces as zones of connectivity as well as those of disconnection. The mere use of the term WiFi hotspot to describe specific physical spaces emphasizes the digital rather than the social or spatial aspects of a particular site.

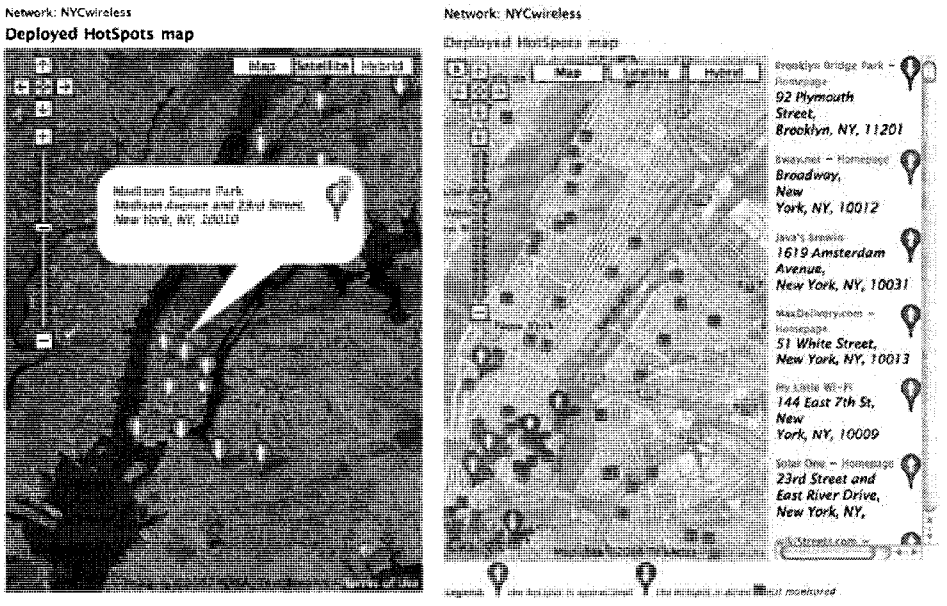

Figure 12-13: NYCwireless Satellite Network Map Showing Madison Square Park, November 2007; NYCwireless Network Map, July 2006.

The maps above from the NYCwireless network in New York illustrate the way in which specific hotspots are represented, visualized spatially and linked to one another as CWN members despite being sponsored and supported by different partner organizations such as parks conservancies and business development districts. In this way, CWNs form new relationships and associations between the establishments and spaces that they connect. However, these linkages are not merely within neighborhoods, cities or regions because some CWNs have a national and international presence. Austin Wireless, run by Less Networks, is one network whose presence extends beyond its home city.

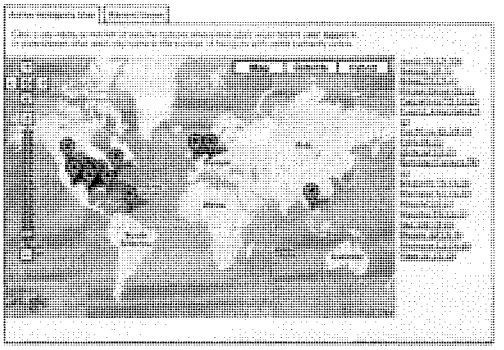

Figure 14: Less Networks Active Hotspot Map, November 2007.

CWNs are currently deploying social software applications in order to facilitate communication, social networking and community-building among the users of their networks. For example, the Less Networks "Shout Map" allows network users to make public comments for other network users. The "Recent Users" tab displays the profiles of other people who have used hotspots provided by Less Networks. And, the "Community" tab lists the most recently used hotspot, the profile of a featured user, the total network statistics and the total online users and their locations.

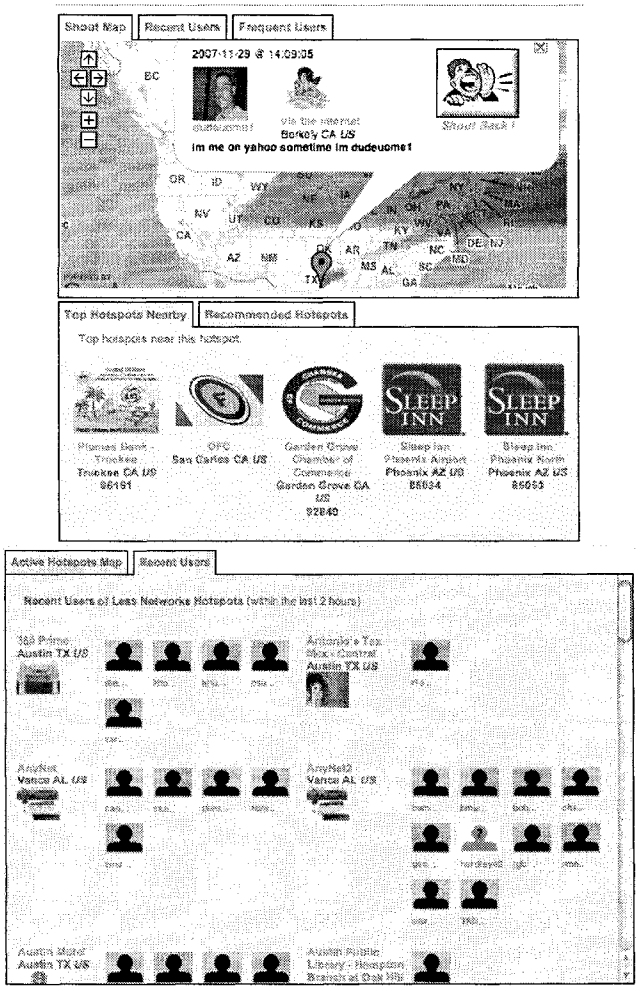

Figure 15: Less Networks Shout Map, Recent Users and Community Page, November 2007.

This discussion illustrates the importance of CWNs as lead users and innovators of hardware, software and applications.

Reconfiguring New York

NYCwireless, a group of volunteers dedicated to building free, public wireless Internet hotspots in parks and public spaces, has been building free, public wireless networks in parks and public spaces in partnership with city parks organizations, business improvement districts and local non-profit organizations since 2001. Specifically, NYCwireless has built hotspots at Bryant Park (in partnership with the Bryant Park

Restoration Corporation) and eight locations in Lower Manhattan including City Hall Park, the South Street Seaport, the World Financial Center Winter Garden, and the 60 Wall Street Atrium (in partnership with the Downtown Alliance, a business improvement district). NYCwireless has also worked with Community Access, a non-profit organization that provides affordable housing for people with psychiatric disabilities, to build wireless networks in three residential buildings in Manhattan, Brooklyn and the Bronx. In 2006, NYCwireless built wireless networks in Stuyvesant Cove Park (in partnership with Solar One, an environmental non-profit organization), Brooklyn Bridge Park (in partnership with the DUMBO business improvement district) and Madison Square Park (in partnership with the 34th St. Alliance). NYCwireless has conducted a number of public outreach events including Wireless Park Lab Days (September 2003), New York Live (August 2004), Spectropolis (October 2004), Manchester Live (November 2005), Berlin Live (November 2006). New York Live connected New York and Budapest for five days for five hours a day via videoconference, Manchester Live connected New York and Manchester for a one-hour city hall meeting and Berlin Live connected New York and Berlin for a simultaneous community wireless meeting between NYCwireless in New York and Freifunk in Berlin. A future event is planned in 2008 to connect New York and Shanghai.

In the summer of 2002, while working in Washington, DC on a summer technology policy fellowship, I first read about NYCwireless in the *New York Times*. "Bryan Park is Manhattan's newest Internet café," I wrote in an August 2002 article, "New York City Goes Wireless," for *Gotham Gazette*, a non-profit news and policy website in New York.

At the time, there were 70 wireless "hotspots" according to the NodeDB.com The Wireless Database Project. The majority of these were in Manhattan since, at the time, broadband had a relatively low penetration rate. It is necessary to have a broadband connection in order to share the Internet wirelessly. In 2008, New York is still struggling to connect underserved and low-income communities to the high-speed Internet as evidenced by a series of public hearings held by the Broadband Advisory Committee, which was formed in 2007.

Bryant Park, built in partnership with the Bryant Park Corporation (BPC), a not-for-profit, private management company that was established to revitalize the park in 1988, was one of NYCwireless' first major wireless projects. Bryant Park, originally designated as public property in 1686 by New York's colonial governor Thomas Dongan when the land was still wilderness, had faced decline in the 1970s and reopened in 1991. According to BPC, the park is the largest effort in the nation to use private resources – including management and funding – to a public park.[19] Over the past fifteen years, Bryant Park has been transformed into a vibrant public space that is home to a number of privately-sponsored events and activities including movies, music, classes and even a skating rink in the winter. There is also a restaurant and bar, the Bryant Park Grill, which attracts people to the park and is a well-known hang out during the summer.

The installation of the free wireless network, which was sponsored by Intel during the first two years, was part of BPC's strategy to reinvent the park. At the time, for a installation cost of $10,000 and $1,000 per month in ongoing charges for a T1 line, it was

[19] Source: Bryantpark.com Accessed on August 20, 2007.

estimated that the network could support 500 users writing e-mails and accessing the Internet. Anthony Townsend, an urban planner and co-founder of NYCwireless, said "Unwiring our cities will be as important as electrification was at the end of the 19th century...Cities that provide this amenity will thrive. Others will just get left behind."

One year later, in August 2003, I met Anthony Townsend at the Smart Mobile Workshop held in an auditorium at Roppongi Hills, a brand new residential and retail development in the heart of Tokyo, where he and Howard Rheingold had been invited to speak. Rheingold was promoting the Japanese version of *Smart Mobs*, which had been translated by the International University of Japan's Center for Global Communications (GLOCOM), the research center in Tokyo, Japan that was hosting the workshop. I had spent the summer at GLOCOM researching the use of mobile phones among Japanese teens on a grant from the National Science Foundation and the Japan Society for the Promotion of Science.

In his keynote address, Rheingold explained the ways in which networked media enable new forms of cooperation and organization, which he called "smart mobs". In particular he described the way in which always on, mobile and pervasive media – mobile phones, RFID tags, wireless sensors – make it possible to coordinate collective action in physical, face-to-face worlds in the same way in which the Internet has allowed coordination in the virtual, online world. Rheingold gave examples of "cooperation technologies" including Napster, Linux, SETI@home, distributed computing, WiFi, blogging and eBay. Flash mobs, a form of ad-hoc organizing, began in Tokyo according to Rheingold. While such

forms of organizing are in their nascent stages, examples of political protests coordinated via mobile phone in Seattle, Manila, Madrid, Seoul, and New York have illustrated their potential for communication, collaboration and organization irrespective of their political impact.

Townsend's remarks focused on NYCwireless, the organization that he had co-founded with Terry Schmidt to build public wireless infrastructure, educate the public about WiFi technology, advocate for telecommunications deregulation and provide emergency communications for New York following 9/11 and the Blackout of 2003, which had occurred only weeks prior to his visit to Japan. He introduced the group's philosophy of open wireless networks, which was fostered by hosting public meetings, building free hotspots and providing a forum for online discussion about WiFi networking. One of the group's goals, according to Townsend, was to claim a wireless domain in public spaces as something that would be free to end-users.

In order to further this goal, in 2001, NYCwireless built its first experimental park network in Washington Square Park. However, after three months, New York University shut down the network for unknown reasons. Next, a second experimental park network was built in Tompkins Square Park with support from a local record shop. However, when the record store that hosted the wireless equipment on its roof moved in the summer of 2005, the network was taken down. The group's next two major projects were the Bryant Park network, which was said to have 200 users per day by 2003, and the Lower Manhattan Wireless Network, a network of eight hotspots in the financial district,

built by Emenity, a for-profit spin off of NYCwireless, in partnership with the Alliance for Downtown New York. Similarly, Emenity built the Union Square network, which was sponsored by *Wired.* In total, by 2003, New York had over 150 volunteer nodes that were owned and managed by individuals according to NodeDB. Since WiFi was still a relatively new technology at that time, the large majority of these nodes were hosted by early adopting broadband subscribers in Manhattan.

Decentralized, volunteer-hosted networks are by definition unstable because there is no central mechanism for control. As a result, in 2006, NYCwireless began using WiFiDog,[20] a wireless captive portal that was developed by Île Sans Fil, a community wireless organization in Montreal, Canada. WiFiDog runs on OpenWRT, an open-source software for the Linksys WRT54G router and several other platforms that was developed by Freifunk, a community wireless organization in Berlin, in conjunction with C-base, a technical cooperative in Berlin. WiFiDog allows the real-time monitoring of nodes, the customization of splash pages and the creation of statistical reports on network usage. Currently, the portal or splash pages on these networks are beginning to be used for location-based content including news, discussion, events listings and advertising. Using WiFiDog, NYCwireless is able to move from a completely decentralized network to one where there is more centralized control and monitoring.

Townsend concluded that free WiFi was becoming more and more common, in part due to the efforts of groups like NYCwireless, stating that business districts and hotels were

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[20] More information on WiFiDog can be found at http://WifiDog.org, http://OpenWrt.org and http://LinksysInfo.org.

providing wireless Internet access. In addition, at the time, Verizon was extending free wireless access from its phone booths to anyone with their Internet service. However, this service was first scaled back and then cancelled stating "lack of demand". Shortly after, Verizon launched their EVDO cellular wireless service. Thus, the company had a clear profit incentive to eliminate their free wireless hotspots.

In 2003, according to Townsend, there were dozens of similar groups in Europe and North America according to Freenetworks.org. However, there was still a need for a global umbrella organization that could give voice to wireless communities, advocate for more open spectrum, educate the public, demonstrate successful uses of wireless technologies and provide a hub for research and development of wireless technology. At the time, Townsend saw a future of mesh networking communities, where users would become the telecommunication infrastructure for each other. This would be possible in cities where urban density would help to achieve a critical mass of people and technology. Finally, Townsend stressed the importance of social and community applications that were being designed by artists and technologists, many of whom were active NYCwireless members.

Later that week, at the invitation of Izumi Aizu, an Internet researcher affiliated with GLOCOM, Rheingold, Townsend and I traveled with a group of about 20 others including Joi Ito, an Internet pioneer and venture capitalist, from Tokyo to Kyushu, the third largest and southernmost island of Japan's four main islands, to attend the HyperNetwork Society conference in Oita and visited a small fishing village without

Internet access. On the flight back to Tokyo, Townsend and I discussed the possibility of founding a NYCwireless special interest group (SIG) to focus on the socio-economic aspects of WiFi use.

Upon returning to New York in September 2003, I volunteered at an NYCwireless event, manning a table at Wireless Park Lab Days, "a two-day event that celebrated the availability of open wireless (Wi-Fi) networks in Lower Manhattan and explored their implications for art, community, and shared space" co-sponsored by the Downtown Alliance, in City Hall Park (Spiegel, 2003). At the event, I explained wireless technology to passersby and informed them about the efforts of NYCwireless.

According to NYCwireless, the "wireless community movement" is described as "a group of volunteers who work with local organizations to construct a network of computers to share Internet access over radio connections," (Spiegel, 2003). In addition, their efforts allow, "public spaces [to] become equipped with community-owned and open wireless hotspots," and prompt thinking about how a wireless network, "affects the physical space and how urban Wi-Fi users may influence the notions of cyberspace when it becomes grounded in a specific location," (Spiegel, 2003).

Alongside the table, five artists and technologists working with wireless technologies displayed their projects, which explored the relationship between wireless connectivity and public space, challenging "the notion that wireless networks are about web surfing and email communication only," (Spiegel, 2003). The projects included: Mark Argo and

Ahmi Wolf's Bass Station,[21] which transforms a boom box into an open wireless node to allow the sharing of digital files; Yury Gitman's MagicBike,[22] a mobile WiFi hotspot that links wireless infrastructure with bicycle culture; Yury Gitman and Carlos J. Gomez de Llarena's NodeRunner,[23] an urban game produced in conjunction with new media art gallery Eyebeam and NYCwireless, that challenges two teams to log into and photograph as many wireless nodes as they can; Ricardo Miranda Zuñiga's Public Broadcast Cart,[24] a shopping cart that allows passersby to produce their own audiocast; and, Dana Spiegel's Virtual People Watching,[25] which visualizes the activities of WiFi users in an online forum allowing others to see what websites they have been accessing.

After discussing the idea for the SIG with other NYCwireless members at the Wireless Park Lab Days event and getting approval from the board of NYCwireless, I launched the SIG in late-September 2003. The purpose of the group, which became known as the Social Impact SIG, was to:

> focus on the unique social changes resulting from the growing adoption of wireless technology in New York. These include changes to social norms, interpersonal networks and the use of public spaces. The group will focus on the social impact of WiFi hot spots (privately-owned and community-based) and park projects in conjunction with the growing proliferation of cell phones. This is especially important due to the potential for future convergence in wireless technology services and devices. It is vital that the social impact of wireless technology be discussed, brainstormed and researched at the earliest stages of the proliferation of these technologies. Such thinking can inform the next generation of technology design, new business ventures and policy planning in this area.

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[21] For more details, see http://www.bass-station.net.
[22] For more details, see http://www.magicbike.net.
[23] For more details, see http://www.noderunner.com.
[24] For more details, see http://www.ambriente.com/wifi/.
[25] For more details, see http://www.sociableDESIGN.com/nycwchat.

In the months that followed, the SIG -- composed of artists, architects, policy wonks, engineers and social researchers -- explored a number of pressing issues facing advocates of free, public wireless networks including advertising and signage, messaging and advocacy, and measurement and use.

In summer 2004, while participating in the Oxford Internet Institute's Summer Doctoral Program, a two week seminar in Oxford, England, I helped to plan "New York Live", a public video-conference between New York and Budapest that ran for five hours a day for nearly a week in August 2004. The project was a collaboration between Krisztián Zana, Balázs Takács and Mathieu Borysevicz, run by Vizual Works Contemporary Art Association in Budapest, and sponsored in New York by Harvestworks (http://www.harvestworks.org/), NYCwireless, Uncommon Projects (http://www.uncommonprojects.com/), and OPENAIR, a bar in the East Village that hosted regular Share events, bringing music enthusiasts together to share their tunes over the free wireless network. The project allowed concertgoers at one of Europe's largest music and arts events—the Sziget Festival--to see, hear and interact in real-time with passersby in New York's East Village. The purpose of the project was to deconstruct the image of American popular culture as an icon (or idea) thereby circumventing mainstream media images and allowing people to communicate and interact on their own terms.

Over the course of the week-long project, many of the interactions seemed merely to convince participants in New York and their counterparts in Budapest that they were

actually connected face-to-face across time and space to participants in another country. Thus, "What time is it over there?" and "Where are you?" were often repeated questions between participants. But, there were also a number of exciting interactions between participants. For example, several New Yorkers stopped by to perform music or dance live over the video-conference for their audience in Budapest. Also of interest was a heartfelt two-hour reunion between a Hungarian woman living in New York and her brother in Budapest, whom she had not seen face-to-face for four years. As a follow up to the New York Live event, in November 2005, NYCwireless ran a one-hour live public videoconference between Tompkins Square Park in New York and Manchester Park in the United Kingdom. The videoconference helped the local community understand the potential uses of wireless technology and provided the local government with the support they needed to move forward with the project.

In October 2004, NYCwireless partnered with the Lower Manhattan Cultural Council and the Downtown Alliance to host Spectropolis, an event that "celebrated the availability of open wireless (Wi-Fi) networks in Lower Manhattan and explored their implications for art, community, and shared space."[26] The event was designed to make WiFi more visible and accessible to the general public. This description of NYCwireless serves to illustrate the ways in which CWNs, as lead users of WiFi technology, experiment with and innovate hardware, software and applications that embody their socio-economic and political values as well as conduct public outreach in order to raise awareness and spread their values throughout the community. These values include the belief that WiFi should

[26] Additional details about Spectropolis can be found at http://www.spectropolis.info or http://www.wirelesscommunity.info/spectropolis/

be cheap or free to end-users in public space, the understanding that electromagnetic spectrum is a resource that can be shared and the commitment to connecting underserved communities to the Internet. This narrative about NYCwireless illustrates that CWNs are more than merely technical assistance providers in their communities; in short, they are politically motivated activists participating in an emergent social movement. WiFi sharing suggests an alternate economic model based on cooperation rather than individualism. While WiFi sharing is legal, it may violate a business contract with an Internet service provider. Still, there is much misunderstanding when it comes to the question of whether or not WiFi sharing can be considered stealing and this question has not been sufficiently tested in the courts. It is possible to make the argument that WiFi sharing is a political act of civil disobedience because it sometimes ignores private contracts, which are enforced by government. As advocates for what might be considered a political act, CWNs are activists engaged in the building of communications infrastructure.

Authenticating Berlin

In early October 2004, I arrived in Berlin to spend a month on a grant from the American Council of Germany researching the activities of Freifunk, meaning 'free radio' in German, which is a community wireless network in Germany. On my first day, I had a breakfast meeting with Juergen Neumann, the founder of Freifunk whom I'd met at the Fresh Air / Free Networks Summit in Djursland, and his collaborator Ingo Rau. The two ran their own new media company, Ergomedia. Over coffee, Ingo explained to me the early efforts of Freifunk as well as important details of the German telecommunications

landscape. Later that day, I arrived at JewelBox, an artist studio and collaborative workspace in Freidrichshain, where Alex Toland, an artist, Ulf Kypke, a system administrator and the founder of the WlanHain, the wireless local area network in Freidrichshain, and members of the Chaos Computer Club worked.

Freifunk was formed shortly after Juergen Neumann, a technologist and entrepreneur since 1990, moved to Friedrichshain, a neighborhood in the eastern part of Berlin in 2002. There was no broadband access in the neighborhood because Deutsches Telekom had taken out the old, copper cables and installed fiber optic cables instead. However, they didn't offer DSL over fiber to end-consumers at the time and it took a number of years for people in the eastern part of Germany to get broadband. At the time, Neumann was living in a housing cooperative with 35 people who all shared a single ISDN connection for Internet access. After some research, Neumann found an Internet service provider about a kilometer away from his apartment building that would provide symmetric Internet access by wireless local area network (LAN).[27] According to Neumann:

> I bought routers and antennas and built two wireless LANs on top of our roof. One was to connect the house and it's 35 inhabitants to the provider, the other one was connected to an omni-antenna to spread the signal in a radius of about 500 meters, so that other people in the neighbourhood would also be able to connect to a cheap and fast Internet connection.[28]

Shortly thereafter, in October 2002, Neumann attended the BerLon Wireless Culture Workshop,[29] where he met people from community wireless groups including London's Consume.net and Denmark's Wire.less.dk who he continued to stay in touch with at other

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[27] E-mail correspondence with Juergen Neumann, February 9, 2007.
[28] E-mail correspondence with Juergen Neumann, February 9, 2007.
[29] For more details, see http://informal.org.uk/people/julian/publications/the_wireless_event/#berlon.

regional events including the Copenhagen Interpolation[30] and the Freifunk.net Summer Convention in 2003. He realized that these groups were confronting similar problems – the lack of cheap broadband – for a wide variety of different reasons, and that wireless was one part of the solution. At the workshop, Neumann met a number of other Berliners who had a similar idea; many of them were involved in the C-Base,[31] a computer-culture project in Berlin. In the following weeks, Neumann and others including software developers Sven-Ola Tücke (the inventor of the Freifunk firmware), Elektra (the inventor of B.A.T.M.A.N.), Marek Lindner and Sven (aka c-ven) Wagner. This group formed an initial project, wavelan-berlin, which later became the OLSR Experiment.[32] They initiated regular meetings on Wednesdays, which continue to this day, in order to, "share visions and ideas about how to build wireless networks."[33]

The next step was to create a German-language campaign about wireless networking since the majority of the materials at the time were in English. Together with mindworxs,[34] a team of web developers, Neumann created Freifunk[35] in 2003. Since then, the group has been working to build mesh wireless networks. The group's first website went live in March 2003. According to Neumann, "Freifunk.net and our vision of free and user-owned wireless networks is very well known all over Germany and in

[30] For more details, see http://www.metamute.org/en/The-Copenhagen-Interpolation.
[31] For more details, see http://c-base.org.
[32] For more details, see http://www.olsrexperiment.de.
[33] E-mail correspondence with Juergen Neumann, February 9, 2007.
[34] For more details, see https://www.mindworxs.org.
[35] For more details, see https://www.freifunk.net.

many other parts of the world today."[36] For example, a group in South Africa is using Freifunk's free firmware[37] to build local wireless mesh networks.[38]

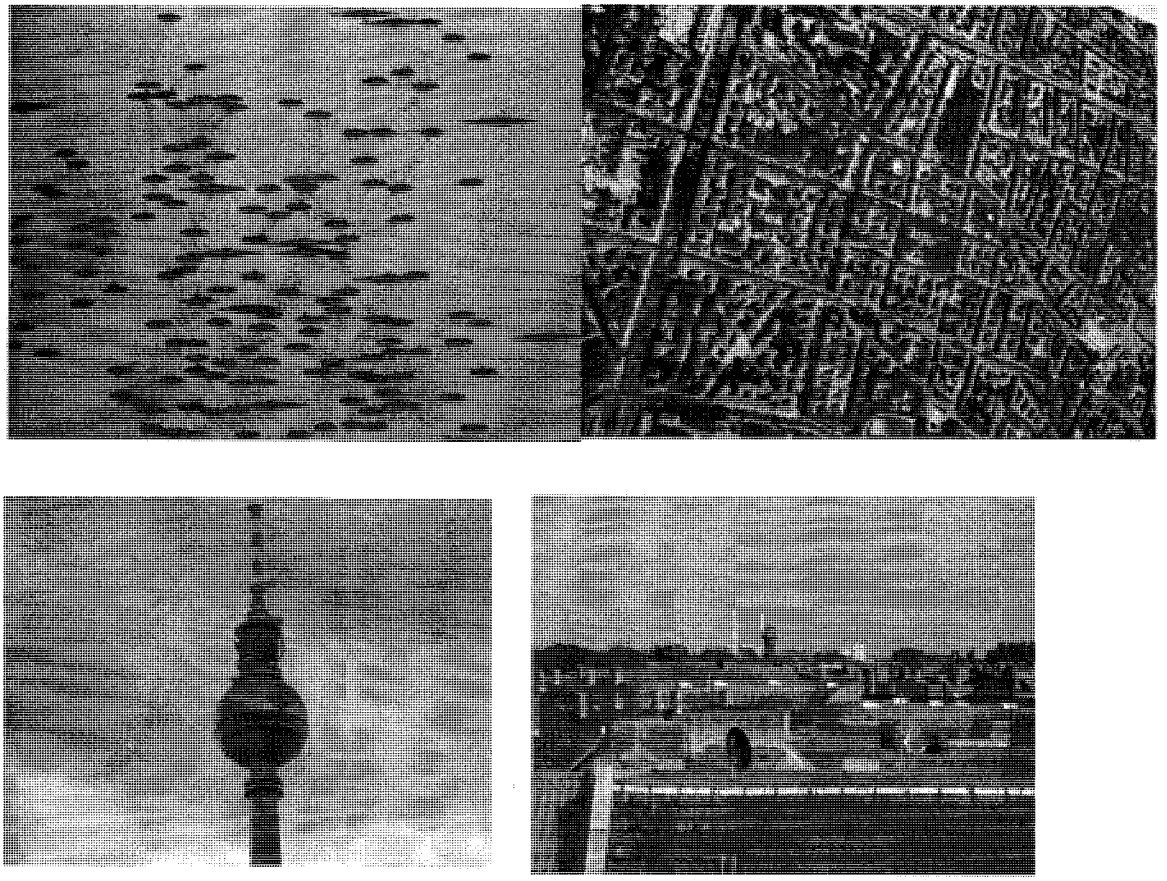

Figure 16: Technical-mapping, aerial view and rooftop view of Freifunk's Berlin Mesh Network, July 2006.

In order to become an active user of the Freifunk network, an individual must buy an access point and 'flash' it with the free, open source freifunk.firmware. The mesh network that is created by all active users is an intranet or open public local access network (OPLAN).[39] The network allows for the free – free as in no charge as well as in open -- exchange of data (including files, instant messages, e-mail, voice over Internet

[36] E-mail correspondence with Juergen Neumann, February 9, 2007.
[37] For more details, see http://freifunk.net/wiki/FreifunkFirmwareEnglish.
[38] For more details, see http://www.balancingact-africa.com/news/back/balancing-act_302.html.
[39] For more details, see http://www.oplan.org.

Protocol, etc.) within the network at speeds of up to 20 MB per second using the 802.11g standard.[40] This focus on building networks that are free to the end-user is similar across many CWNs around the world. While there is no question that there is a cost for bandwidth use, CWNs support an economic model based on cooperation and sharing rather than individualism.

The network is run under the terms of the Pico Peering Agreement (PPA).[41] The PPA is an attempt to connect CWNs and formalize their interactions by providing, "the minimum baseline template for a peering agreement between owners of individual network nodes" in which "Owners of network nodes assert their right of ownership by declaring their willingness to donate the free exchange of data across their networks." The PPA stipulates free transit (including an agreement not to interfere with data that passes through the network), open communication (including publishing information about the network under a free license), no guaranteed level of service, acceptable use, and local amendments.[42] The PPA illustrates that CWNs support a technical model that supports cooperation and sharing in contrast to corporate models. For example, the current debates over network neutrality argue whether or not corporations should be able to charge for differentiated speeds and types of data i.e. e-mails, voice traffic, music files and movie files or block access to certain web sites completely. While this might not be a pressing public policy issue given sufficient competition in the broadband market, the current duopoly of broadband provision has raised concern over what kinds of strategies

[40] E-mail correspondence with Juergen Neumann, February 9, 2007.
[41] For more details, see http://picopeer.net/PPA-en.html.
[42] See http://picopeer.net/PPA-en.html. Accessed on November 23, 2007.

corporations should be able to use to make a profit and the impact of these strategies on the Internet as a whole.

As the above description of Freifunk illustrates, access to the Internet is only one of the services provided by the network. As long as some of the node operators provide some of their unused bandwidth to the network, other users can connect to the network. In order to access the network, members must download the routing software OLSR to their laptop. OLSR detects the location of the nearest Internet gateway and announces it to the rest of the network. The network is able to grow organically because every new access point will automatically become part of the network and extend the reach of the network. Freifunk's expertise in managing a large network of this kind illustrates their role as lead users and innovators in mesh networking.

Similar to the technological aspects of the network, the Freifunk campaign is able to grow organically because local Freifunk initiatives are encouraged and supported. All website content including logos are published under a Creative Commons license in order to promote the distribution of the idea. As a result, Freifunk has expanded to include networks all over Germany, Switzerland and Austria. According to Neumann, Freifunk's Leipzig and Berlin networks are the biggest local, volunteer-run mesh networks in the world. He estimates that the network covers one tenth of Berlin, meaning that, theoretically, 350,000 people could connect to the network.[43] However, some degree of technological literacy is required to join the network due to the need to download the OLSR software in order to use the network and 'flash' the router with freifunk.firmware.

[43] E-mail correspondence with Juergen Neumann, February 9, 2007.

In summary, the Friefunk network is a decentralized, flexible and fast-growing not only as a "social initiative but also as a physical infrastructure," wrote Neumann.[44] Like NYCwireless, the Freifunk campaign combines both technical and political values, which underscores the role of CWNs as activists engaged in an emergent social movement.

To further describe, the people, activities and places that animate the above description of Freifunk, I return to my first night in Berlin when I visited the c-base "space station beneath Berlin." The c-base is a non-profit collaborative workspace, bar and event space for technologists, which functions as the research and development hub for Freifunk and WlanHain. The collaborative nature of the c-base illustrates participation in a form of organizing based on an alternate economic model of cooperation and sharing. The interior of the c-base or "c-base reconstruction project," which occupies the ground floor and basement of an apartment building on the bank of the Spree in Berlin's Mitte neighborhood, is modeled after a space station that has crashed on Earth and all of the activities that take place within it are considered to be part of the effort to rebuild the station according to the organization's mission. This is where I met Sven Wagner, a c-base manager and former theater set designer, and Corinna "Elektra" Aichele, a software developer who has made many key contributions to the development of open mesh wireless networking. Every Wednesday night, the c-base hosts a Freifunk waveLAN meeting. Newcomers are taught to build antennas out of Pringles cans. Others hack away silently on their laptops writing code, fixing bugs and plotting the installation of new networks.

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[44] E-mail correspondence with Juergen Neumann, February 9, 2007.

In early July 2007, the c-base faced eviction due to 30,000 Euros owed in back-rent. C-base member reached out to community wireless networks worldwide via listservs and personal e-mails. An alert, "All frequencies hailing!!! Berlin's c-base fighting for survival" was sent to the NYCwireless listserv from a c-base member named vortex who appealed community wireless activists around the world to help the c-base. "To my knowledge," he wrote:

> no other independent group in Europe has done more for research and inspiration into the field of open wireless networking. From promotion of German designed and acclaimed meshcubes, to promoting research and experimentation with wardriving, wireless mapping, wireless meshing, OLSR, and more recently a possible successor B.A.T.M.A.N. weekly events including wireless antenna building workshops have been held there regularly for years.[45]

He describes c-base members as a cross-disciplinary cooperation between 3-D artists, musicians, gamers, wireless networkers, hackers and caffeine freaks. Another e-mail from Wagner, explained the threat of the closure of "a vital part of Berlin's governmentally unfunded subculture" saying that the group had until the end of the month to come up with the outstanding rent.[46] He further described the c-base as, an important and fertile ground for ideas and projects, event location and space for open knowledge transfer," and "a home for creatives, utopians and space cadets." This description serves to illustrate the collaboration and innovation that takes place at the c-base among members who pay a modest monthly fee.

As a result of these appeals, the group was able to quickly raise 12,000 Euros of the needed funds and negotiated with their landlords in order to remain in their space. In six

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[45] E-mail from Vortex, July 3, 2007. Posted on NYCwireless listserv.
[46] E-mail from Sven Wagner, July 3, 2007. Posted on WSFII listserv.

short weeks, the group had raised 20,000 Euros and decided to reorganize the organization in order to prevent the dire financial situation from reoccurring in the future. The group's ability to raise a significant sum of money in a short period of time illustrates their skill in using listservs and the Internet to appeal to CWNs worldwide to support their work. NYCwireless contributed 100 Euros to the cause and several board members, myself included, donated their own personal funds. While I am the only board member to have actually visited the c-base or met many of the people described in this narrative, NYCwireless' contribution illustrates the supportive nature of CWNs as well as the respect for the c-base as a hub of innovation in wireless networking. "Be future compatible -- Reboot your universe now!," declares a letter from the organization's management urging new members to join and "support the continuity of a most unusual part of the Berlin sub-culture," and "gain an opportunity for creative exchange and access to trend-setting projects on-board your own space station."[47] In the end, their website proclaimed "space station crash cancelled: c-base reconstruction project continues!!"

In September 2007, I arrived in Berlin lugging an extra large 64-ounce jar of Skippy Creamy Peanut Butter as a gift for Toland and Kypke, with whom I was staying at their new 6th-floor walk-up apartment in Kreuzberg. From their office, you could see directly across the river to an open space next to the railroad tracks where they were collaborating on the development of a community project. Kypke was working on building the wireless network for the project. He was connecting the space to the mesh network through an antenna that was placed out his office window. "It was *exactly* 1 kilometer away," Kypke stated explaining that he was having problems with the connection. Yet,

[47] c-base Letter, August, 31, 2007. C-base.org Accessed on January 10, 2008.

since the equipment that he was using was proprietary, he couldn't access the code he needed in order to make an adjustment, and the company was not willing to share the details. This illustrates the role that CWNs play in trouble-shooting and experimenting with wireless networking hardware, software and applications. CWNs often confront and solve new problems, which pushes them to innovate their own hardware, software and applications. Later that day, I rented a bike and joined an opening party for the community project.

The following day, Saturday, September 22, 2007, Toland, Kypke and I abandoned our plans to go to Hamburg and decided to join an anti-surveillance protest that was beginning at the Brandenburg gate. Over 15,000 people from 55 civil society groups – including members of Freifunk, c-base, Chaos Computer Club and Network New Media – participated in what was the largest march for civil liberties and privacy protection since 1987, which was organized by the Data Retention Working Group ("Largest Anti-Surveillance Street Protest In Germany For 20 Years," 2007). The explicitly technical nature of the protest – apparent in t-shirts (such as Stasi 2.0), banners and puppets (the Giant Data-Octopus) -- was surprising as was the turnout from CWNs, some of whom came from Hamburg, Leipzig and elsewhere in Germany. Again, this illustrates the political nature of the work of CWNs. Perhaps somewhat ironically, the police came armed with surveillance gear including vehicles that were videotaping the march.

Afterwards, members from Freifunk Berlin and Freifunk Leipzig convened at the c-base for a party. This is where I first met Kloschi, a member of the Leipzig group, and

discussed the possibility of translating the WiFi survey into German. A small group of us mounted our bicycles and headed over to a bonfire party at the Wagenburg, one of Berlin's mobile squatter communities, where we were greeted, somewhat ominously by a pack of barking dogs. Mobile squatter communities and other collaborative housing arrangements, which are more common in Berlin than in the United States, are forms of organizing based on cooperation and sharing. Since several important members of Freifunk live in such communities, it makes sense that they introduce these values into the work of CWNs as well. The Wagenburg – a circle of aluminum trailors, one of which belongs to Elektra -- relies on solar-power and back up generators for electricity. For the party, the community had introduced a bar, outdoor kitchen, live band and *karaoke* machine. For three Euros, I ordered a heaping plate of vegetarian *spaetzle*, prepared according to a Schwabian recipe from Elektra's home state, and a bottle of Jever. At 11PM, the night in Berlin had just begun, and we biked to another party held in an abandoned bread factory, where we stayed until 4AM.

Conclusion

This chapter introduces and documents the existence of community wireless networks around the world. There is still much that we do not know about the ways in which these groups communicate, collaborate and innovate. However, I argue that community wireless networks are examples of networked, community, peer-produced forms of organizing that sit at the intersection of code and place. For these groups, whose identities are closely linked to the cities in which they work wireless technologies allow for the meaningful attachment to place. They are pioneers in the use of maps and social software applications for wireless networks. Maps are used to illustrate the real-time

status and locations of wireless networks, which allows users to view their cities differently based on the availability, or lack of wireless connectivity. Social software applications such as that developed by Less Networks in Austin, TX allow individuals to communicate with one another across multiple WiFi hotspot locations. Community wireless networks are part of an international cadre of activists that are concerned with access to information. While each group focuses on their local communities, their aggregated efforts are what allow them to see themselves as participants in larger political, economic, social and technological debates.

As lead users, community wireless networks are constantly experimenting with new organizational and technological models in their cities. Thus, they have developed expertise about possible models for organizations and technological infrastructure projects such as municipal wireless networks. This is because they apply ad-hoc, networked, community forms of organizing with a philosophy of organic, bottom-up and grassroots organizing that is rooted in their local communities.

Peer-to-peer networks are important because future communications infrastructures may, in fact, be networks of individuals carrying mobile and wireless devices that have the ability to send, receive and route communications throughout the network. For example, in Berlin's Freifunk network, each person hosting a wireless router or opening a laptop running the OLSR software becomes a node in the network. Similarly, in New York's NYCwireless network partner organizations including parks conservancies and business

development districts are linked through WiFiDog software, which centrally manages all of the hotspots in the network.

In addition, these networks are important in light of current proposals to link community wireless networks in the United States and around the world in order to form an alternative to the commercially-controlled Internet backbone. Over the past five years, CWNs have come together face-to-face at conferences and workshops to discuss technical, policy and organizational challenges. These initiatives have resulted in a number of recent developments including the formation of the Open Source Wireless Coalition and the International Association for Community Wireless Networks.

Chapter 5: Search and the City

In August 2004, on my second trip to Budapest – where I was to spend the next month on a grant from David Stark's Center on Organizational Innovation – I quickly learned about the efforts of the Hungarian Wireless Community (HuWiCo), a community wireless organization, and became a regular at Szóda, a colorfully-decorated, artsy wireless café-by-day and bar-by-night located near Central Synagogue, the world's second largest. My trip had gotten off to a rocky start -- complete with a ten-hour layover in London, a planeful of drunken soccer hooligans, and the wrong apartment key waiting for me upon my 2a.m. arrival – thus, I felt right at home when, less than fifteen hours after landing, within minutes of logging on at Szóda, I looked up to see a young Hungarian man with a flier about HuWiCo. However, it was 2004, and, clearly, cafes in Budapest were for smoking, drinking wine and socializing, not for staring, searching and surfing the Internet. It was pretty clear that I had violated a social norm by taking my laptop out for a six-hour date on a Friday night as I caught up on the e-mails that had collected during the span of my transatlantic flight while those around me unwound after a long week's work. Over the next four weeks, I spent countless hours at Szóda, visiting it almost daily in the late afternoons and evenings; I was one of the only patrons using the wireless network and, most certainly, the only woman.

The next time I visited Budapest, in July 2005, again, one of my first stops was Szóda. I had left my credit card in a Citibank machine in Berlin that morning and needed to notify them to cancel it. Sitting in the middle of the café, I attempted to use Skype to call the company over the wireless network. The sight of me talking into my USB-headset must

have been strange, attracting some stares from around the café, but you can imagine my surprise when the Citibank customer service representative's voice blared from the speakers of my laptop rather than through the headphones. In the end, after multiple tries, I called the company on my cell phone instead despite the cost. Despite this, by 2005, it now seemed commonplace to use the wireless Internet in the café, which was now operating a bicycle and scooter rental business on the side. On these and subsequent trips to Budapest, I fostered relationships with the members of HuWiCo, engaging them as partners on this survey of WiFi users in Budapest.

This chapter compares the results from a six-month survey of the use of WiFi hotspots in New York, Budapest and Montreal. It is hoped that further analysis of these survey results will contribute to a more acute understanding of the ways in which the user patterns of particular modes of Internet access may differ internationally. The major research questions addressed in this chapter are: 1) How is WiFi being used in public spaces, by whom, where, for what purposes? 2) How does this differ from earlier communication technologies, and, 3) How is the use of WiFi similar or different across cities internationally.

This chapter makes the following arguments based on the survey data: first, WiFi is an important factor in attracting people to specific locations; second, the use of WiFi highly localized in that it is often used to search for information relevant to one's geographic location; third, there are significant differences in the way that WiFi is used across a variety of locations including cafes, parks and other public spaces; fourth, at present,

WiFi users are, for the most part, young, male and highly educated displaying the characteristics of early adopters of technology; and, fifth, there is a convergence in the ways in which WiFi is used internationally in some respects, however there are also important differences in the reasons for these uses as well divergence in other respects.

The convergence that can be observed is both technological and socio-cultural. We are currently witnessing a period of convergence in the fields of media and information technology. For example, T-mobile has just launched "Hotspot at Home", a service that allows one to seamlessly roam between cellular and WiFi networks. On the other hand, while patterns of usage are often expected to vary based on political, economic, socio-cultural and, even, geographic and environmental factors, in some cases, convergence can be observed with respect to cross-cultural comparisons of the way in which technologies are used.

These findings may have an important impact in shaping current discussions municipal wireless networks by helping to identify content, applications and services that can be delivered over mobile and wireless networks. In addition, the answers to these questions are vital to inform a wide variety of legal and public policy issues related to information and communication technologies in addition to being important to the development of content and applications for mobile and wireless technologies. These include policies surrounding municipal wireless networks, spectrum, universal service, community media and network neutrality.

WiFi Use Survey

In February 2007, the Pew Internet & American Life Project reported that 34% of all Internet users have used a wireless connection and 27% have logged on from a place other than home or work (Horrigan, 2007). This question asks respondents whether they have ever used a wireless connection so there is no distinction between one-time users, infrequent users and regular users. The following sections will highlight the most important findings from the survey of WiFi hotspots conducted in New York, Montreal and Budapest between October 2006 and April 2007. According to the survey, respondents had used WiFi at Starbucks (34%), Bryant Park (33%), the New York Public Library (23%) and independently-owned cafés (21%) in the previous six months. In some cases, survey respondents were allowed to give multiple answers to the question, thus, statistics do not always add up to 100%. With the exception of Bryant Park, all of these locations represent multiple sites throughout the city. For example, Starbucks has 153 locations in the New York area (within a five mile radius) where a T-Mobile HotSpot is available.[48]

To learn more about Starbucks, on March 1, 2007, I contacted the company to schedule an interview at their Seattle-headquarters since I was going to be presenting the survey data at Microsoft Research in nearby Redmond. Unfortunately, in response I received a short note from Ryan J. in Customer Service stating, "Thanks for your interest in Starbucks Coffee Company. Unfortunately, due to the volume of student requests we receive, we're unable to grant interview or survey requests or provide information about

[48] See www.starbucks.com for more details. Accessed on June 20, 2007.

the company beyond what we make publicly available."[49] That same day, upon a repeated attempted to be introduced to someone in the company's market research department, I was told that I was, welcome to submit my research findings, but that in doing so I would need to sign a Disclosure and Release Agreement and that, "All ideas, suggestions or other information that is submitted will be viewed as the property of Starbucks, to use or dispose of as it wishes. For that reason, we recommend that you do not send prototypes, original artwork, or other valuable materials."[50]

Upon learning that I would not be able to interview anyone at Starbucks corporate headquarters, I attempted to befriend a Starbucks manager at a location in Brooklyn, N.Y. where I had interviewed several regular customers. Unfortunately, he refused to be interviewed, even confidentially, due to the company's strict media relations policies. In the end, I was able to interview Joseph Michelli, the author of *The Starbucks Experience* and a consultant who has worked closely with the company's senior management. According to him, Starbucks' corporate mission is to, "become the most desirable third place."[51] Along with that, they have a policy never to ask anyone to leave. As a result, they have a problem with WiFi users and homeless people. However, since their business in the United States is 80% take-out, it may not be a problem for their bottom-line; on the other hand, in Asia, their business is 80% sit-down (many people make reservations to sit and have coffee at Starbucks) so the impact of WiFi users might be different there.

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[49] E-mail from Ryan J., Customer Service, Starbucks Coffee Company. Received on March 1, 2007.
[50] E-mail from Ryan J., Customer Service, Starbucks Coffee Company. Received on March 1, 2007.
[51] Interview with Joseph Michelli conducted on March 19, 2007.

Continuing with the description of the sites identified in the WiFi survey, the New York Public Library has 69 locations with free WiFi access in the Bronx, Staten Island and Manhattan; Queens and Brooklyn operate their own library systems.[52] And, certainly, there are hundreds of cafés throughout the New York area that offer either free or paid WiFi access. Many, but certainly not all, independent cafes and selected corporate eateries such as Cosi and Panera Bread offer free WiFi. To access the Cosi network, you must create and login with a user name and password.

In May 2006, at a City Council hearing held by the Committee on Technology in Government, Bryant Park Restoration Corporation Executive Director Dan Biederman testified that their WiFi hotspots attracts 250 users per day. The Bryant Park Wireless Network, which was built in 2002, is one of the first, largest and most widely-used and well-known free, public wireless network in the world. The project was sponsored by Intel in its initial phase and is currently sponsored by Google. The organization invites New Yorkers to "Turn Bryant Park into your new office," according to its web site.

One of the main reasons for the popularity of Bryant Park's WiFi hotspots is that it is outside. Survey respondents said: "It is the best office in the world...I can have my feet in the grass and the world at my fingers," and "I love the park and being outdoors while still feeling like I am getting work done," and that the park allows them "To let the kids play outside while I work." Other popular sites visited by over 10% of respondents

[52] See www.nypl.org for more details. Accessed on June 20, 2007.

include: 60 Wall Street Atrium, Battery Park, City Hall Park, college campuses, JetBlue Terminal and Union Square Park.

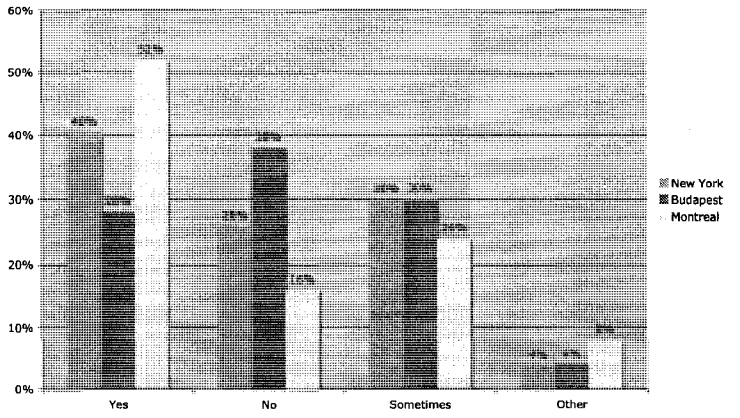
In Budapest, however, out of over thirty cafes and restaurants listed, respondents reported that they had used WiFi at Burger King (17%), Don Pepe (13%), McDonald's (11%), Szimpla Kert (16%) and Szóda (11%) with 58% of respondents listing additional locations where they had used WiFi. Don Pepe, Szimpla Kert and Szóda are cafes. I visited Szóda on an almost daily basis while in Budapest in September 2004 as decribed in the narrative above. While New York's WiFi hotspots are distributed between cafes, parks and other public spaces, Budapest's and Montreal's are primarily in cafes, restaurants or bars. The popularity of Burger King and McDonald's in Budapest is striking because only 5% of respondents in New York reported using WiFi at McDonald's at all. In Montreal, out of over twenty cafes listed, respondents reported that they had used WiFi at Second Cup (37%), Laïka (22%), Café l'Utopik (21%), Café Pi (19%), Starbucks (18%), Café Art Java 3030 (14%) and Santropol Café (11%). In addition, 61% of respondents named other locations where they used WiFi.

In New York, Starbucks (15%), Bryant Park (10%) and independently-owned cafés (12%) were the most frequently used hotspots. In Budapest, 16% of Hungarians listed McDonald's. Thus, in these two cities, large corporate establishments were the sites of the majority of WiFi usage respectively. However, in Montreal, 10% used WiFi most frequently at Laïka, 9% at Café Pi, 8% at Café l'Utopik and Starbucks, and 47% indicated that they most frequently used WiFi at another location. While I have not been able to

visit Laïka, one of the most popular cafés among WiFi users in Montreal, I was able to spend an afternoon at Café l'Utopik in October 2007. Café l'Utopik is a community-run, bohemian café on the second floor of a building in Montreal's gay neighborhood. It serves vegetarian food and is frequented by students and freelancers. This indicates a great diversity in locations where people use WiFi in Montreal. The remainder of the survey in all three locations was completed based on the respondent's most frequently used hotspot.

One of the most significant findings of the survey is that the availability of WiFi is an important factor in attracting people to the location where they most frequently use the wireless Internet. In New York, 40% of respondents indicated that WiFi is the reason that they went to the location and 30% said that WiFi is sometimes the reason that they went to the location; a smaller 26% indicated that WiFi is not the reason that they went to the location. However, in total, it is possible to argue that WiFi is a factor in attracting over 70% of the respondents to the location.

WiFi is Reason for Going



In addition, when choosing between two coffee shops of similar characteristics and quality, 75% respondents answered that they would choose one that provides WiFi access over one that doesn't; 20% say they might; and, 5% said that WiFi would not be a factor in their decision. In Budapest, the results were almost exactly the same, differing only by 1% whereas, in Montreal, 91% responded that they would choose the café that provides WiFi; 8% said they might and only 2% said they would not.

These findings have potential implications for economic development and supports the rationale that WiFi may enable commerce and productivity that would not have occurred otherwise. This is because, to the extent that WiFi draws people out of their homes and into cafes, parks and other public spaces, people may take additional trips on the subway, purchase food and beverages, or do retail shopping. For example, I typically spend far more money at New York businesses on the days that I leave the house than on those that I stay home. Taken as an aggregate, this spending on city businesses and services happens irrespective of the activities that people might be engaged in online while using the wireless network. In fact, in New York, since at least 2002 park organizations and

business development organizations have deployed WiFi hotspots in order to attract people to parks and public spaces. However, to date, there has not been any research to verify that their assumptions are correct. In addition, there are still significant differences between specific WiFi hotspots. While some, like Bryant Park, are incredibly successful; others do not attract nearly as many users. This seems to support the idea that there are multiple factors that draw people to specific WiFi hotspots. For example, one respondent that I interviewed, a full-time employee at a university club in mid-town, commutes 20 minutes each weekend in order to use the Bryant Park hotspot to work on his food and wine web site, from which he eventually hopes to earn a supplementary income. He likes Bryant Park because it is "comfortable" (in particular, he mentions the patented chairs that include a desk and cup-holder) and he is familiar with the area since he goes there after work.

Figure 17: New York City's Bryant Park and Patented Chair Design, New York, NY, August 2006.

His weekend trips represent additional subway journeys and potentially money spent on food and beverages or possibly even shopping while he is out and about. In addition, his website may soon generate additional taxable income. As such, it is possible to argue that the WiFi hotspot enables economic development that would not otherwise occur.

Similarly, in Budapest, 28% of respondents indicated that WiFi was a factor, 30% said that it was sometimes a factor and 38% said that it was not a factor. However, when taken together, it is possible to argue that WiFi is a factor in attracting the majority of respondents to the location in both New York and Budapest. In Montreal, 52% of respondents indicated that WiFi was the reason that they went to the location and 24% said that it was sometimes the reason; a total of 76%. Only 16% said that it was not the reason that they went to the location and 8% offered another reason.

According to the survey, the primary purpose for the use of WiFi is for both work and personal use (63%). A smaller number of respondents indicate that they use WiFi for personal use only (28%) and even fewer say that they use WiFi only for work (11%). It is often difficult to separate personal and work activities since laptops and the Internet have become embedded into everyday life. Thus, it makes sense that the majority of respondents use WiFi for both work and personal use. However, respondents who cannot access their personal e-mail at work or prefer to use their own computers for personal e-mail are among those who primarily use WiFi hotspots for personal use. This is an interesting reversal of traditional dichotomies about private and public behavior. Normally, it might be assumed that people conduct personal activities in private spaces such as homes or offices. However, in this case, people explicitly go to public spaces such as parks and cafés in order to do personal activities. This is also supported by my ethnographic observations at a café on the Lower East Side in May 2006. I found that, in part due to the crowded nature of the café space, people often went outside to make phone calls. While the indoor café space would be regarded as relatively more private as compared to city sidewalks and streets, people went into more public spaces in order to make their phone calls. In addition, since the café was often frequented by regular freelancers, it is possible that while the people inside the café were "familiar strangers", those on the street were completely anonymous and therefore provided a greater sense of privacy. Again, the results from Budapest mirror those in New York with the majority reporting that they use WiFi for work and personal use (57%), a smaller number reporting that they use WiFi only for personal reasons (29%), and the smallest group

saying that they use WiFi only for work (13%). In Montreal, 66% of respondents use WiFi for work and personal use, 19% use WiFi only for work, 15% use it only for personal reasons and 7% offer another reason.

In terms of the frequency, length of time and time of day, 42% of respondents reported that they use WiFi at the location weekly; 23% do so monthly; 15% do so daily; 11% only very rarely (less than once a year); 7% do so more than once a day; and, 3% do so annually. Thus, it can be said that the majority of respondents (57%) respondents use WiFi at the location at least once a week (by combining the daily and weekly percentages). In Budapest, 33% use WiFi weekly; 27% do so monthly; 22% do so very rarely; 11% do so more than once a day; 4% do so daily; and, 4% do so annually. In Montreal, 51% use WiFi weekly; 18% do so monthly; 16% do so daily; 8% do so more than once a day; 5% do so very rarely; and, 2% do so annually.

29% use WiFi for an hour; 27% do so for 30 minutes; 26% do so for two hours; 8% do so for 15 minutes or less; 6% do so for 4 hours; and, 5% do so for more than four hours. One respondent that I interviewed reported spending 12 hours per day at a Starbucks Café. While the majority of respondents use WiFi for between 30 minutes and two hours, it is not uncommon to find those who use WiFi for significantly more than four hours, in particular, among freelancers, remote workers, independent contractors and full-time information technology consultants. In Budapest, 32% use WiFi for 30 minutes; 25% do so for an hour; 22% do so for 15 minutes or less; 17% do so for 2 hours; 3% do so for more than four hours; and, 2% do so for four hours. In Montreal, 43% use WiFi

for 2 hours, 29% do so for 1 hour, 11% do so for 4 hours, 10% do so for 30 minutes, 6% do so for more than 4 hours, and 2% do so for fifteen minutes or less.

In New York, the peak hours for WiFi use are from noon to 3 p.m. (51%); followed by 3 p.m. to 6 p.m. (41%); 6 p.m. to 9 p.m. (29%); 9 a.m. to Noon (27%); 9 p.m. to Midnight (11%); and, lastly, 6 a.m. to 9 a.m. (7%). In Budapest, the peak hours for WiFi use are 3 p.m. to 6 p.m. (43%); noon to 3 p.m. (39%); 6 p.m. to 9 p.m. (35%); 9 a.m. to noon (25%); 9 p.m. to midnight (13%); and, 6 a.m. to 9 a.m. (6%). In Montreal, the peak hours for WiFi use are also 3 p.m. to 6 p.m. (46%); followed by 12 p.m. to 3 p.m. (42%) and 6 p.m. to 9 p.m. (42%); 9 a.m. to noon (25%); 9 p.m. to midnight (24%); and, 6 a.m. to 9 a.m. (5%). On the whole, the frequency, length of time and time of day of WiFi use does not differ significantly between New York and Budapest. However, the Montreal data presents some anomalies.

By combining survey data with statistical log data from the NYCwireless network, which currently monitors usage at 14 public hotspots, it is possible to generalize about trends regarding frequency of use and time of use. The following chart illustrates aggregate hourly network use on the NYCwireless network over the past year.

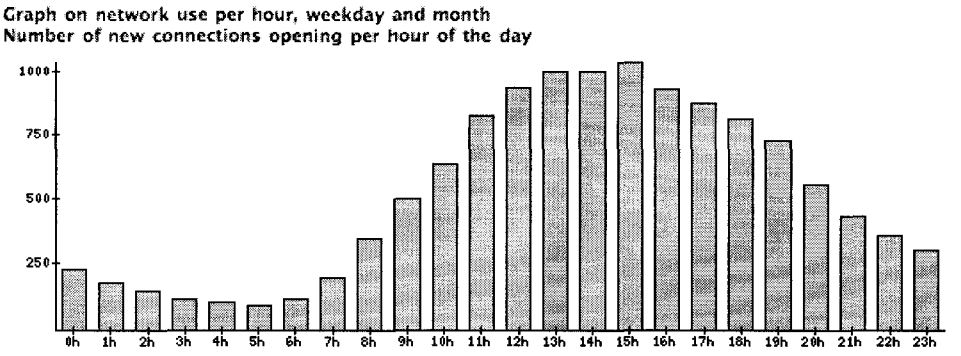


Figure 18: NYCwireless Hourly Network Usage, June 2007

Furthermore, the log data shows that usage peaks on Tuesdays with nearly 1500 aggregated individual user visits.

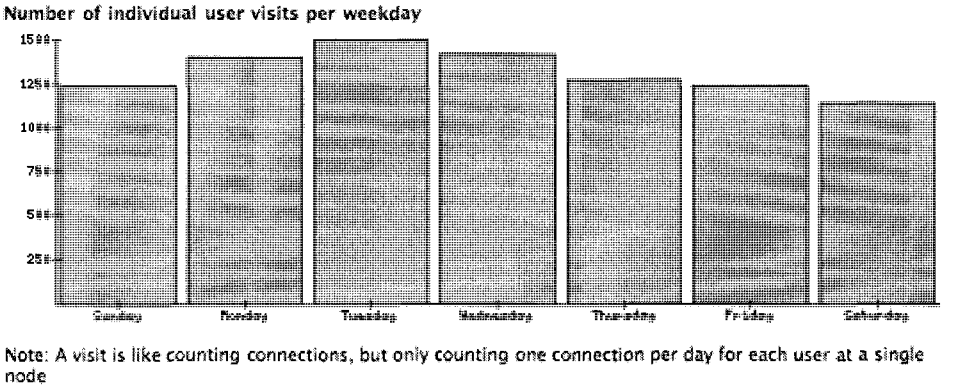


Figure 19: NYCwireless Daily Use, June 2007

Finally, the log data confirms that usage is relatively steady year round with a peak during the summer months. Data from June 2006 is significantly lower than for June 2007 due to the fact that several additional hotspots were installed last summer.

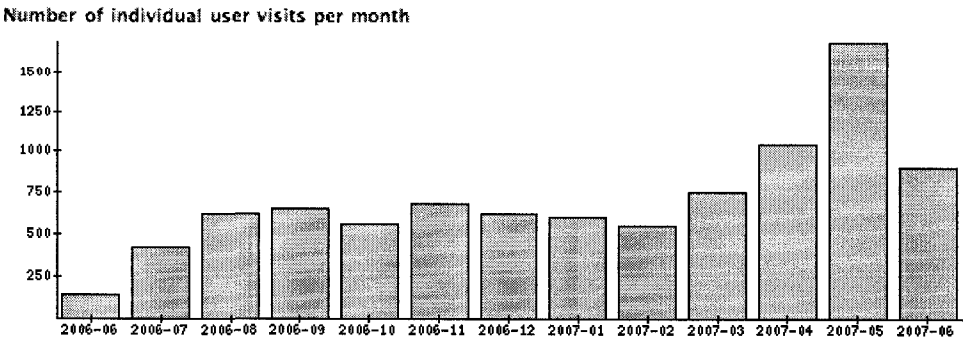
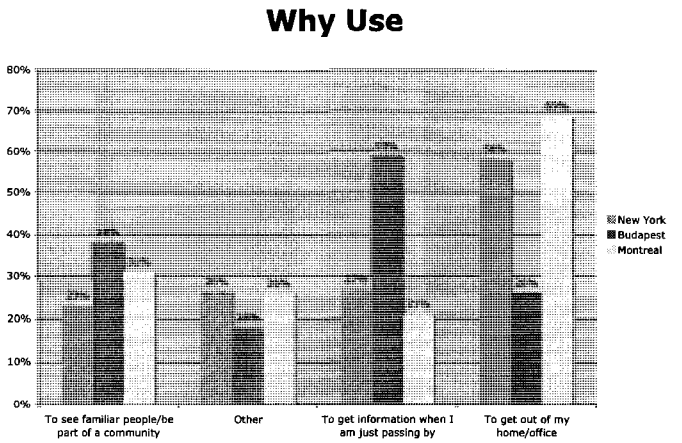


Figure 20: NYCwireless Monthly Use, June 2007

While the NYCwireless log data is based on only a small number of public WiFi hotspots that are currently being monitored with statistical reporting tools, future research may benefit substantially from a combination of log data, survey and qualitative research in order to make conclusions about user behavior.

When asked the reason that they used WiFi, 58% indicated that they wanted to get out of their home or office. 27% replied that they wanted to get information when they were passing by and 23% wanted to see familiar people or be part of a community.



These limited responses do not begin to account for the wide variety of reasons that respondents gave when prodded for more details about their rational for using WiFi. For example, some emphasized that it was convenient to where they lived or worked saying, "I live in Harlem and work at Wall Street. I don't want to carry my laptop all over the city." It is likely that this person was referring to using the Downtown Alliance hotspots, which include City Hall Park, the Wall Street Public Atrium and the Winter Garden at the World Financial Center though it is not possible to tell exactly since these responses were provided in open-ended survey questions. Others mentioned that a friend lived nearby or that it was a central location for client meetings. Finally, a few mentioned that they liked accessing it from their car. Again, it is not possible to know exactly when or where this person used WiFi in their car. However, I have often seen people sitting in parked cars near WiFi hotspots using their laptops. One place I saw this was in front of a bar called D.B.A. on 1st Avenue and 2nd Street. I have seen people standing outside of apartments using their laptops. My hypothesis is that they have found an open WiFi hotspot to use. There have been accounts in the mainstream press about the confusion over whether this

behavior is legal or whether it is akin to breaking and entering into a person's home. Others said that they used WiFi at home; some didn't have or couldn't afford Internet access at home. For example, one respondent said, "It's near where I am in the mornings and I can't get WiFi access at my house." Others wrote that they used it because it was free and/or easy to use, explaining, "It's free. I'm in Manhattan frequently and my home office is in Brooklyn. It's the only way for freelancers to stay in touch. I can't afford a Blackberry or Treo." Some were having problems with their regular Internet provider. Others were in-between meetings, traveling or waiting for something i.e. flight, train, laundry. For example, one wrote that they needed a place to work between two meetings, another wrote that before they got an EVDO card they "would use these hotspots to check email in between meetings when away from the office," another wrote that they used WiFi, "When I have time between work appointments (free time in schedule and not enough to go home)." Finally, some enjoyed the atmosphere/environment or liked the coffee and/or food at a particular location; and, finally, others wanted to relax or work while having breakfast or lunch.

Interestingly, in Budapest, the majority of respondents, 59% indicated that they used WiFi to get information when passing by; 38% used WiFi to see familiar people or be part of a community; 26% used WiFi to get out of their home or office; and, 18% gave other reasons. In Montreal, like New York, the majority of respondents, 69%, indicated that they used WiFi to get out of their home or office. 31% indicated that they used WiFi to see familiar people or be part of a community; 26% had another reason; and, the minority of respondents, 21%, indicated that they used WiFi to get information when

passing by. This question illustrates that, while usage patterns may be relatively consistent in all three cities, the rationale for using WiFi is very different, possibly for socio-cultural reasons.

With respect to free vs. paid WiFi access, in New York, respondents were highly likely to use WiFi at airports (74%), coffee shops (61%), hotels (79%), parks and public spaces (55%) and train stations (44%) if it were free. These locations may either be free or for a fee, however, the survey illustrates that people are more hesitant to use it if they have to pay for it. This finding is most useful in illustrating the different qualities of these spaces in terms of how conducive they are to WiFi use. While you do have to pay a fee to use WiFi at Starbucks, it is still one of the top four locations where people go online. One person commented, "For work I regularly travel between Baltimore and Boston. Starbucks is ubiquitous and consistent." Another hypothesis for the popularity of Starbucks despite people's unwillingness to pay is that people might share a T Mobile account. For example, Victor, a graphic illustrator, and Daniel, a writer, who will be discussed in more detail in Chapter 6 sit side-by-side at Starbucks and share a T Mobile account so, when one of them is online, the other is offline.

Survey respondents were much less likely to use WiFi at fast food restaurants (15%) and other restaurants (16%) even if it were free. The reverse is also true. Respondents were highly unlikely to use WiFi at these locations if they have to pay for it. Similarly, in Budapest, respondents were highly likely to use free WiFi in airports (56%), coffee shops (47%), hotels (71%) and libraries (54%) and less likely to use WiFi in bars (25%), fast

food restaurants (31%), parks or public spaces (39%), restaurants (18%) or train stations (39%). In Montreal, respondents were highly likely to use free WiFi in airports (57%), coffee shops (82%), hotels (73%) and libraries (80%) and less likely to use WiFi in bars (18%), fast food restaurants (31%), parks or public spaces (41%), restaurants (16%) or train stations (43%). Again, in both cities, the reverse is also true. People are extremely unwilling to pay for WiFi access.

In New York, 59% of respondents indicate that they would be willing to watch a short advertisement in exchange for free access; 14% said they would not; and, 27% say that they might. However, 48% of respondents answered that they would not be willing to pay a small service charge at a coffee shop, restaurant or bar; only 19% answered that they would; and, 33% say that they might. In Budapest, 58% of respondents indicated that they would be willing to watch a short advertisement in exchange for free access; 13% said they would not; and, 30% said that they might. Similarly, 38% of respondents would not be willing to pay a small service charge; 30% said that they would; and, 32% said that they might. In Montreal, only 39% of respondents were willing to watch a short advertisement in exchange for free access; 24% said they would not; and, 38% said that they might. 56% of respondents would not be willing to pay a small service charge; only 11% said that they would; and, 33% said that they might. In New York and Budapest, the data supports the advertising-sponsored hotspot model that is currently being tested in many locations and pursued by municipal wireless networks. However, WiFi users in Montreal seem more resistant to the idea.

Technology and Internet-related Questions

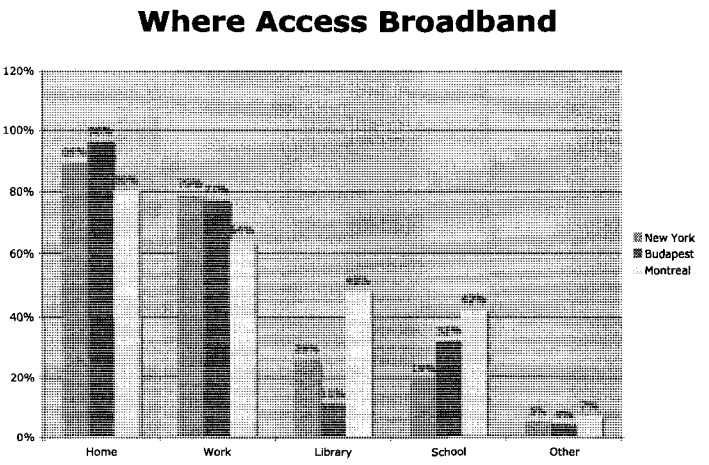
The following section gives an overview of responses to questions on hardware, applications and Internet access. Overall, answers to these questions seems to indicate that WiFi users are relatively early adopters with respect to a number of related technologies including laptops and broadband Internet access. For example, when asked what computer hardware respondents use to connect to WiFi, 96% used a laptop; 20% used a mobile phone; 19% used a personal digital assistant (PDA); 4% used a gaming device and 2% used another device. In Budapest, 87% used a laptop; 33% used a PDA; 22% used a mobile phone; 4% used another device; and, .5% used a gaming device. In Montreal, 99% used a laptop, 8% used a mobile phone, 7% used a PDA, 2% used another device, and 1% used a gaming device.

In New York, 97% owned a laptop; 90% owned a mobile phone; 79% owned a digital camera; 67% owned an iPod or MP3 player; 44% owned a PDA; 18% owned a gaming device; 5% had another device; and, 5% owned a pager. In Budapest, 91% owned a laptop; 94% owned a mobile phone; 53% owned an iPod or MP3 player; 43% owned a PDA; 28% owned a digital camera; 9% owned a gaming device; 3% owned another type of device; and, .8% owned a pager. In Montreal, 99% owned a laptop; 75% owned a mobile phone; 66% owned a digital camera; 60% owned an iPod or MP3 player; 12% owned a gaming device; 6% owned a pager; and, 4% owned another device.

In New York, when asked what Internet applications were used while connected to WiFi, 82% used web-based e-mail; 67% used an e-mail application; 66% used Microsoft

Office; 63% used instant messenger; 46% watched streaming audio/video clips; 23% used voice applications such as voice-over-internet protocol (VOIP); 22% used a virtual private network (VPN); 19% used remote desktop; and, 9% used another application. In Budapest, 72% used an e-mail application; 69% used instant messenger; 66% used web-based e-mail; 47% used VOIP; 42% used Microsoft Office; 32% watched streaming audio/video; 30% used a VPN; 28% used remote desktop; and, 14% used another application. In Montreal, 82% used Web-based e-mail; 66% used Microsoft Office; 64% used instant messenger; 60% used e-mail; 48% used streaming audio/video; 28% used a VPN; 19% used VOIP; 17% used another application; and, 14% used remote desktop.

WiFi is a complementary rather than a substitute good in all three cities. In New York, when asked where else respondents has access to the Internet, 95% had access at home and 89% had broadband at home; 81% had access at work and 79% had broadband at work; 31% had access at a library and 26% had broadband at a library; 23% had access at school and 19% had broadband at school; and, 5% had another location where they accessed the Internet and/or broadband. The Pew findings support this finding, reporting that in the United States 80% of wireless users have broadband connections at home (Horrigan, 2007).

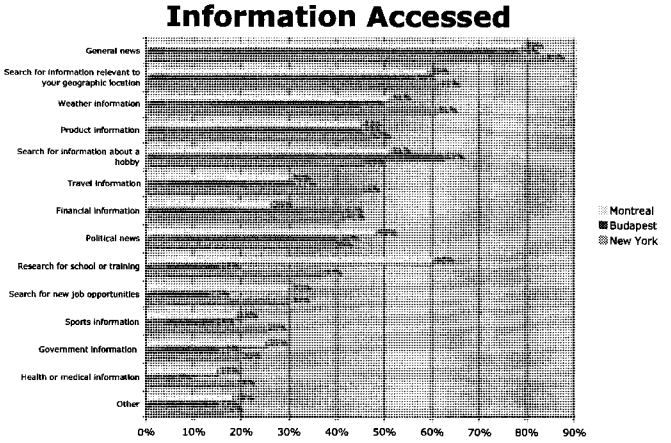


In Budapest, 96% had access to the Internet at home and all of them had broadband connections; 79% had Internet access at work, 77% had broadband; 36% had Internet access at school, 32% had broadband; 15% had Internet access at the library, 11% had broadband; and, 7% had access elsewhere, 4% had broadband. In Montreal, 87% had access to the Internet at home and 80% had broadband at home; 66% had access to the Internet at work and 64% had broadband at work; 47% had access to the Internet at school and 42% had broadband at school; 58% had access to the Internet at a library and 48% had broadband at the library; and, 7% had access to broadband somewhere else. The use of WiFi in cafes, parks and public spaces does not replace the need to subscribe to an Internet service from home. Among the respondents surveyed, perhaps ironically, WiFi users in Budapest were more likely to have broadband at home than those in New York. On the one hand, this is not surprising due to the low standing of the United States in terms of broadband penetration; on the other hand, it is possible, that the respondents in Budapest were more heavily skewed towards tech-savvy users. This will be explained in more detail in the demographic section of the survey results.

In New York, wireless users have encountered a number of problems using WiFi hotspots. Many (44%) are concerned about the privacy and security of data being transmitted over the wireless network. Others (43%) find the networks to be too slow. Many (22%) don't know that the networks exist due to lack of signage etc. In addition, some (16%) are concerned about the theft of computer hardware. Others (13%) have problems figuring out how to connect to the network. Viewing the computer screen in outdoor locations is also a problem for some (10%) users. Finally, respondents offer a number of other reasons why they have had problems using WiFi including the lack of power outlets, privacy and signage; other technical problems; weak or unreliable signals. 10% of respondents indicate that they have not had any problems using WiFi. In Budapest, 49% of respondent indicate that the network is too slow; 26% have trouble viewing their computer screen; 24% have not had any problems; 22% have concerns about privacy and security of data being transmitted; 21% have concerns about the theft of their computer hardware; similarly, 21% can't figure out how to connect to the network; 14% did not know about the availability of the network; and, 8% have another problem with the network. In Montreal, 33% indicate that the network is too slow; 33% have another problem with the network; 26% have concerns about the privacy and security of data; 25% can't figure out how to connect to the network; 20% have concerns about theft; 17% did not know about the availability of the network; and, 3% have trouble viewing their screen.

Content and Activity Related Questions

In New York, the top websites accessed via WiFi were Google (23%), Gmail (15%), Yahoo! (15%), Hotmail (5%), and the *New York Times* (5%); 26% accessed another website. In New York, respondents report that they access general news (83%), information relevant to their geographic location (61%), weather information (61%), product information (47%), information about hobbies (45%), travel information (45%), financial information (41%) and political news (39%); do research for school or training



(37%); search for new job opportunities (30%); access sports information (25%), government information (20%) and health or medical information (18%); and, other information (16%). With respect to searching for information relevant to geographic location, it is not possible to know exactly what kind of information was being accessed. However, I would hypothesize that people sometimes use WiFi to decide where to go and what to do including looking for restaurants, stores and other nearby activities.

In Budapest, 78% of respondents accessed general news; 62% accessed information about a hobby; 56% search for information relevant to their geographic location; 45% accessed weather information; 45% accessed product information; 41% accessed financial information; 40% accessed political news; 31% accessed travel information;

15% accessed government information; 15% accessed other information; 15% did research for school or training; 14% accessed sports information; 13% searched for new job opportunities; 6% accessed health or medical information. In Montreal, 79% of respondents accessed general news; 60% did research for school or training; 59% searched for information relevant to their geographic location; 51% searched for weather information; 51% searched for information about a hobby; 48% accessed political news; 45% accessed product information; 30% accessed travel information; 30% searched for new job opportunities; 26% accessed financial information; 25% accessed government information; 19% accessed sports information; 18% accessed other information; and, 15% accessed health or medical information.

In New York, the most common types of activities that wireless users engage in are sending or reading e-mail (91%), writing or word processing (59%) and going online for fun or to pass time (59%). They are also likely to send or receive instant messages (49%) and photos (36%), buy products (40%), access their work Intranet (35%), buy or make travel reservations (34%), and download and listen to music (33%) or watch video clips (29%). They are somewhat less likely to contribute content to a blog (21%) or other website (21%), send or receive music files (19%), do graphic or web design (15%), play online video games (7%), buy or sell stock online (7%), take part in a chat room (6%), or do something else (7%). Pew data supports these findings, concluding that wireless users are more likely to check e-mail and get news online than home broadband users and Internet users in general. Specifically, 72% of wireless users check e-mail on a typical day as compared to 63% of home broadband users and 54% of Internet all users. 46% get

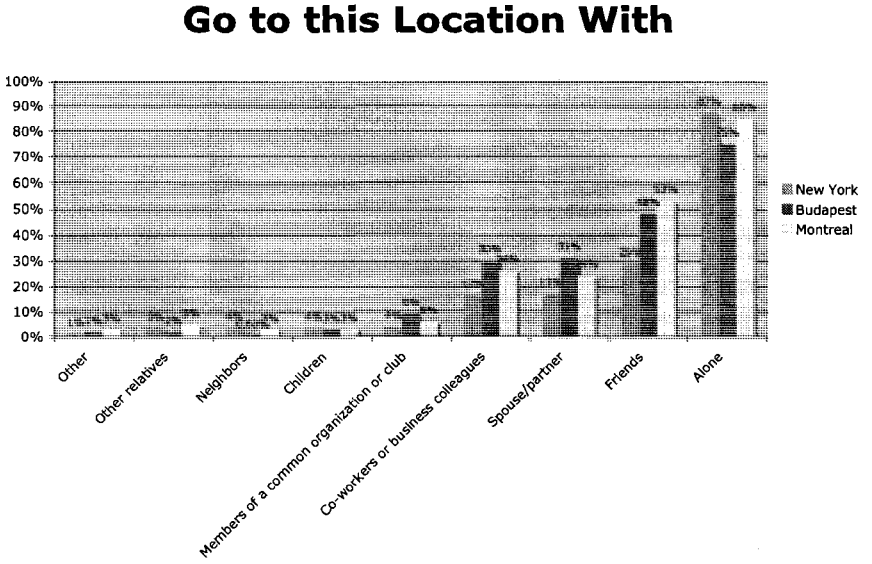
news online on a typical day as compared to 38% of home broadband users and 31% of all Internet users (Horrigan, 2007).

In Budapest, 88% of respondents use WiFi to send or read e-mail; 67% go online to for fun or to pass time; 53% send or receive instant messages; 40% access their work Intranet; 31% do writing or word processing; 30% download and listing to music; 28% download and watch video clips; 23% contribute content to websites other than blogs; 21% buy products; 20% buy or make travel reservations; 18% contribute content to a blog; 17% send or receive photos; 13% do graphic or web design; 9% play online video games; 9% send or receive music files; 7% take part in a chat room; 7% do something else; and, 3% buy or sell stock. In Montreal, 91% of respondents send or read e-mail; 62% do writing or word processing; 53% send or receive instant messages; 52% go online for fun or to pass time; 37% download and listen to music; 33% download and watch video clips; 33% send or receive photos; 31% buy a product; 28% access their work Intranet; 28% contribute content to a blog; 27% contribute content to a website (other than a blog); 20% do graphic or web design; 18% buy or make travel reservations; 17% send or receive music files; 12% play online video games; 11% take part in a chat room; 11% do something else; and, 4% buy or sell stock online.

In New York, in addition to using WiFi, wireless users make phone calls (66%), eat meals (65%), read (60%), watch people (56%), meet friends (49%), hold work meetings (15%), play video games (4%) or so something else (10%) at the location. In Budapest, in addition to using WiFi, 77% of wireless users eat meals; 66% meet friends; 64% make

phone calls; 37% watch people; 31% hold work meetings; 26% read; 9% do something else; and, 6% play video games. In Montreal, 72% of WiFi users eat meals; 69% read; 65% meet friends; 57% watch people; 39% make phone calls; 26% hold work meetings; 25% do something else; and, 2% play video games.

In New York, the majority of wireless users go to the location alone (87%). However, some go with friends (29%), others go with a spouse or partner (17%) or with a co-worker or business colleague (17%). It is not possible to know what accompanying friends, spouses or coworkers are doing, however, I have often seen dyads and triads of groups using their laptops together. Sometimes, there is only one laptop and both people are looking at its while other times, one person is on a laptop while the other is doing something else such as talking on their mobile phone. A small number go with children (4%), other relatives (3%), neighbors (4%), members of a common organization or club (4%) or with someone else (1%). In Budapest, 75% of WiFi users go to the location alone; 48% go with friends; 30% go with co-workers or business colleagues; 31% go with a spouse or partner; 9% go with members of a common organization or group; 3% go with their children; 2% go with other relatives; 2% go with others; and, .6% go with their neighbors. In Montreal, 85% go alone; 53% go with friends; 26% go with co-workers or business colleagues; 24% go with a spouse or partner; 6% go with member of a common organization or club; 5% go with other relatives; 3% go with their children; 3% go with neighbors; and, 3% go with others.



In order to better understand the reasons that people use the wireless Internet, respondents were asked to answer open-ended questions on *what they like about the wireless Internet.* In New York, freedom of movement to work in different places i.e. living room; mobility, portability and flexibility; and, the ability to work outdoors or remotely outside of the home and/or office were cited by nearly one third (29%) of respondents. For example, some write: "I can sit anywhere in my room or apartment or even outside…I don't have to sit at my desk," and "I depend on it. It makes working at home much more pleasant. When I've been on the road, I use open WiFi access points to keep in touch with friends and work."

Others explain: "the ability to work from somewhere that isn't my home/office," "the convenience of being able to get work done in a 'pastoral' setting" and "the location's beautiful…I can do work there instead of in the office or at home." Another group of respondents, 28% of the total, stress the convenience of the wireless Internet; in particular, the lack of wires, cables and cords. They write: "[There are] no wires! I'm a

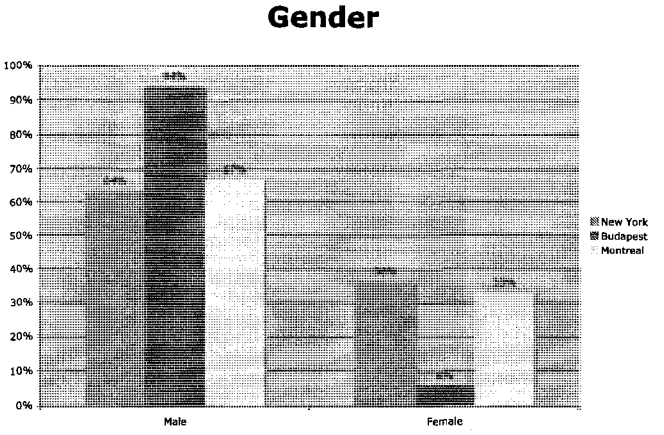
nervous type...like to change positions location a lot. Additionally, I work from home so leaving the house while still being productive is a plus," and "I can get onto the internet without having to plug into anything." 23% of respondents reference connectivity, the ease of access to information and the ease of use. For example, one respondent writes: "the ability to access the wealth of information on the Internet wherever I am. I can always find the answer to a question." 9% cite the widespread availability of the wireless Internet; 8% mention that it is (usually) free of charge; and, 5% say that it is fast.

Demographic Questions

Overall, the survey results show that wireless users are highly educated white males that are under 44 years of age. In New York, 41% of respondents were between 25-34; 25% were between 35-44; 15% were between 18-24; 13% were between 45-54; 5% were between 55-64; and, 1% were over 65. The findings are further supported by Pew data – a representative sample of the population – which showed that 49% of wireless users were between 30-49 in comparison to only 42% of all Internet users in this demographic; 30% were between 18-29 in comparison to only 19% of all Internet users in this demographic; 19% were between 50-64 while 29% of all Internet users were in this demographic; finally, only 3% were over 65 while 11% of all Internet users were in this demographic (Horrigan, 2007). Since the Pew study was conducted in the United States, it is a less relevant comparison for the Budapest and Montreal data. In Budapest, 45% of respondents were between 25-34; 34% were between 18-24; 16% were between 35-44; and, 5% were between 45-54. There were no respondents over 45. In Montreal, 48% of respondents were between 25-34; 24% were between 18-24; 17% were between 35-44;

1% were between 55-64; and, .3 were over 65. In all three cities, the majority of WiFi users were between 25-34. In both Montreal and Budapest, the second largest group of WiFi users were between 18-24 while the second largest group of WiFi users in New York was 35-44.

According to the survey, in New York, 64% of the respondents were male and 36% were female. In Budapest, 94% of all respondents were male and only 6% were female while, in Montreal, 67% of respondents were male and 33% were female. The significant difference between the Budapest results and that in New York and Montreal can be explained in part by the way in which the survey was promoted online. In Budapest, the survey link was included on the homepage of a technical publication, which is likely to have a largely male readership. It is expected that the gender breakdown of WiFi users in Budapest is more similar to that recorded in New York and Montreal. My findings are supported by Pew data in that there were more male than female WiFi users. Similarly, the Pew reported that 56% of wireless users were male and 44% were female. However, both my findings and Pew's findings contradicts data on Internet users in general. Women are more likely to use the Internet overall. Pew found that only 46% of all Internet users were male while 56% were female (Horrigan, 2007).



Preliminary analysis indicates that there are substantial differences between the way that men and women use WiFi hotspots. One hypothesis, based on literature about gender and public space, is that men and women have varied ways of spending time in public and semi-public spaces. In fact, while I was out distributing my surveys in Starbucks, Bryant Park and independently-owned cafés throughout the city, I found it much more difficult to find women working on laptops in public spaces. In addition, one person that I interviewed had a female friend that had been harassed at a WiFi hotspot in a café and, thus, discontinued their use of the hotspot. Finally, it is possible that my own gender was a factor in biasing the survey towards men in that men were more likely to respond to a survey being distributed by a woman. In fact, this hypothesis is substantiated by some of the feedback left by men in the survey itself.

In terms of the respondent's racial background, in New York, 62% of respondents were White, non-Hispanic; 15% were Asian; 7% were Hispanic; 5% were Black, non-Hispanic; 2% classified themselves as other, non-Hispanic; and, 9% did not answer this

question. My findings on White, non-Hispanic WiFi users are supported by Pew data, which indicates that 67% of wireless users are white as compared to 79% of all Internet users. However, my survey under-represents Blacks and Hispanics and over-represents Asians as compared to the Pew data, which finds that 12% of wireless users are Black as compared to only 7% of all Internet users; and 14% of wireless users are Hispanic as compared to only 8% of all Internet users (Horrigan, 2007). While both surveys confirm that the majority of wireless users are White, the Pew survey illustrates an interesting trend with respect to the wireless Internet: Blacks and Hispanics are *more likely* to use the wireless Internet than they are to use the Internet in general. One possible explanation for this is that the Pew survey does not distinguish specifically between WiFi or cellular access to the Internet. Instead, it asks whether devices such as laptops, PDAs and mobile phones have been used to connect to the wireless Internet. Blacks and Hispanics are more likely to have cell phones than to have laptops, PDAs or access to broadband. Thus, it is possible that the majority of these respondents are using their cell phones to connect to the Internet.

At the recommendation of the Hungarian Wireless Community (HuWiCo), the question on racial background was not asked on the Budapest survey. In Montreal, 72% of respondents were White, non-Hispanic; 15% preferred not to answer; 6% were form another, non-Hispanic background; 4% were Hispanic; 2% were Asian; and, 1% were Black, non-Hispanic.

Wireless users are a very highly educated demographic. When asked about their highest level of education completed, in New York, 43% of respondents have a bachelor's degree; 27% have a master's degree; 13% have some college but no degree; 5% have a professional degree; 5% have a doctorate degree; 4% have an associate's degree; 2% have graduated from high school with a diploma or equivalent (GED); 2% have some high school but no diploma; and, .2% have less than a high school education. These categories are mutually exclusive intervals. My findings are supported by Pew data, which shows that WiFi users are very highly educated, reporting that 42% have more than a college education as compared to 32% of all Internet users; 30% have some college as compared to 26% of all Internet users; 22% have graduated from high school as compared to 34% of all Internet users; 19% are currently students as compared to 12% of all Internet users; and, 6% have less than a high school education as compared to 8% of all Internet users (Horrigan, 2007).

In Budapest, 41% have graduated from high school; 30% have a bachelor's degree; 28% have some college (having attended a *foiskola*); and, only 1% have less than a high school education. The master's degree, professional degree and doctorate degree responses were omitted at the recommendation of HuWiCo. In Montreal, 43% of respondents had a bachelor's degree; 15% had a master's degree; 14% had some college but no degree; 13% had an associate's degree; 6% had a doctorate degree; 4% had a professional degree; 4% graduated from high school; and, 1% had some high school.

As expected based on their high levels of education, wireless users are relatively well paid. For the sake of ease of comparison to Pew data, I have condensed the income brackets into four categories. When asked their income, 33% of respondents reported making over $75K; 24% made less than $30K; 23% made over $50K; and, 21% made over $30K. Again, these are mutually exclusive intervals. It should be stated that because this question did not allow respondents to "opt-out" some respondents admitted to lying on this question in order to protect their privacy despite the fact that the survey results are anonymous and all responses are analyzed in aggregate as is customary according to ethical academic research guidelines. Despite this discrepancy, Pew reported that 34% of respondents made over $75K as opposed to only 20% of all Internet users; 18% made between $50-75K as opposed to only 13% of all Internet users; 14% made less than $30K in contrast to 23% of all Internet users; 13% made between $30-50K in contrast to 24% of all Internet users; and, 21% refused to answer in contrast to 20% of all Internet users (Horrigan, 2007). In Budapest, 28% of respondents made less than $3K[53][54]; 18% made between $6K and $12K; 16% made between $12K and $17K; 13% made between 17K and $29K; 12% made between $3K and $6K; 8% made between $29K and 58K; and, 5% made over $58K. In Montreal, 58% made less than $30K[55]; 19% made over $30K; 12% made over $50K; and, 11% made over $75K.

According to the survey, in New York, 57% of respondents are full-time employees; 16% are self-employed, freelance workers or independent contractors; 9% are full-time

[53] 1 USD = 173 Hungarian Forints (HUF), XE.com. Accessed on January 8, 2008.
[54] Results rounded to the nearest thousand USD.
[55] Results were not converted from Canadian Dollars (CAD) due to relative parity of CAD to USD. 1 USD = 1 CAD, XE.com. Accessed on January 8, 2008.

students; 5% are entrepreneurs, owners or partners in a small business, professional practice or farm; 4% are part-time employees; 4% are unemployed and looking for work; 1% are retired; 1% are homemakers; .4% are unemployed but not looking for work; .4% are disabled; and, 3% are not in any of these categories. In Budapest, 42% of respondents were full-time employees; 25% were self-employed, freelance workers or independent contractors; 23% were full-time students; 4% were part-time employees; 3% were not in any of these categories; 2% were unemployed and looking for work; .3% were unemployed and not looking for work; .3% were entrepreneurs; and, .3% were homemakers. In Montreal, 29% were full-time employees; 27% were full-time students; 22% were self-employed; 9% were part-time employees; 5% were entrepreneurs; 4% were in another category; 4% were unemployed and looking for work; 1% were homemakers; and, .6% were unemployed and not looking for work. While the majority of WiFi users in all three cities are full-time employees, a significant number – nearly a quarter – are self-employed, freelance workers or independent contractors and entrepreneurs. This is interesting because, in the United States, this represents an important and growing part of the workforce. In the current economic environment, it is more difficult to secure full-time employment than it had been in the past since large corporations and organizations are hesitant to want to take on the increased financial burden of paying healthcare and retirement benefits. People are also changing jobs much more frequently and staying at those jobs for shorter periods of time. It is likely that many people will have experienced being self-employed or working as a freelancer during the course of their careers.

Of those that are employed, in New York, 15% of respondents reported working in the media and entertainment industry; 13% are in finance and banking; 11% are in telecommunications and information technology; 11% are in the non-profit sector; 9% are in professional services (consulting, accounting, law); 8% are in education; 4% are in health and medical; 4% are in the government sector; 3% are in hospitality and travel; 2% are in insurance and real estate; 2% are in science and research; 2% are in manufacturing and industry; and 16% are in another industry. In Budapest, 41% of respondents were in telecommunications; 16% were in another category; 9% were in media; 8% were in education; 8% were in manufacturing; 5% were in science; 4% were in the government sector; 3% were in finance; 2% were in health; 2% were in hospitality; 2% were in professional services; 1% were in the non-profit sector; and, .3% were in insurance and real estate. In Montreal, 26% were in another category; 15% were in telecommunications; 14% were in media; 11% were in education; 9% were in professional services; 8% were in science; 4% were in health; 4% were in the non-profit sector; 3% were in hospitality; 2% were in finance; 2% were in the government sector; and, 2% were in manufacturing. In all three cities, media and telecommunications are two of the top three industries in which WiFi users are employed, which suggests that WiFi is more useful to people employed in these industries relative to other industries. My in-depth interviews confirm this finding since many of the people that I interviewed were employed as writers, graphic designers, web designers and technology consultants. This finding is particularly interesting in light of discussions about the creative class (Florida, 2002, 2005a, 2005b) and its importance to the overall economy because cities are attempting to create the conditions that will allow the creative class to thrive. WiFi

can be understood as part of the underlying infrastructure that supports the activities of the creative class.

Conclusion

This paper presents a comparative analysis of WiFi use in three cities – New York, Budapest and Montreal. Since there is limited information about WiFi users, this survey begins to describe the way WiFi is being used in public spaces in order to identify the similarities and differences in usage patterns internationally. In addition, by analyzing WiFi use discretely, rather than as a component of broadband Internet use, this paper advances the idea that different modes of Internet access allow for different uses of technology.

This paper has argued the following: first, WiFi is an important factor in attracting people to specific locations; second, the use of WiFi highly localized in that it is often used to search for information relevant to one's geographic location; third, there are significant differences in the way that WiFi is used across a variety of locations including cafes, parks and other public spaces; fourth, at present, WiFi users are, for the most part, young, male and highly educated displaying the characteristics of early adopters of technology; and, fifth, there is a convergence in the ways in which WiFi is used internationally in some respects, however there are also important differences in the reasons for these uses as well divergence in other respects.

As cities worldwide struggle with business models to support the building of municipal wireless networks and businesses attempt to identify content, services and application for mobile and wireless users, this paper provides an early look at the people, places and technologies driving the current phenomenon of WiFi use in cafes, parks and other public spaces. In the near future, the use of these technologies will become increasingly important as our cities and towns are blanketed with an invisible information layer comprised of radio frequency identification (RFID) tags, wireless sensors and communication networks. Thus, it is vital to better understand the complex uses of existing WiFi networks worldwide.

Chapter 6: Generation Mesh

Corporations, the military, government have moved from a hierarchical to networked organizational structures. In addition, many organizations have adopted a consulting-style project based structure rather than assigning work to separate business units. As a result, project teams have become smaller but the diversity of staff working on particular project teams has increased. This model has proved to be effective for innovation. The emergence of freelance work, as a new and growing category of employment, over the past ten years is of great interest because it coincides with the emergence of the Internet, portable computing and the widespread use of mobile and wireless technologies. This group has consciously chosen flexibility as a lifestyle over the securities of affiliated employment. Over the past ten years, the number of freelancers – independent contractors, self-employed and temporary workers, entrepreneurs – has increased and is now expected to make up 10-30% of the nation's workforce according to a Freelancers Union report, "The Rise of the Freelance Class." In New York, the media and technology industries including advertising, publishing, film and television, technology and the arts employ the large majority of freelancers. In addition, in general, freelancers are well-educated, earn over 20% more than the city's overall median income, and are entrepreneurial, creative and independent workers.

Mobile Work Places

The following section draws on a number of theoretical concepts that have been used to describe the nature of place, in order to develop a definition of mobile work places. Media representations of mobile work – in editorial coverage as well as advertising --

focus on freedom, convenience and 'anytime, anywhere' use of mobile and wireless technologies. In contrast to these images, which reinforce convenience, freedom and ubiquity, mobile work places are sites of inconvenience, constraint and specificity. By drawing on a number of concepts that have been used to describe the nature of place, we may begin to develop a definition of mobile work places. Suchman's concept of situated action, which describes "actions taken in the context of particular, concrete circumstances" (Suchman, 1987), the activities of mobile professionals can be analyzed with respect to the presence (or absence) of physical, technological and social factors. On the one hand, mobile work places are the 'third places' that Oldenburg believes are necessary for the functioning of urban social life, which he fears are rapidly disappearing (Oldenburg, 1989). However, on the other hand, mobile work places are distinct from third places because, rather than being a comfortable and causal place away from home or work, in practice *they are increasingly used as work places*. Castells has articulated the tension between the 'space of flows' – global networks of technology flows – and the 'space of places' – the urban spaces of everyday life (Castells, 1996). Mobile professionals are simultaneously participating in the 'space of flows' by virtue of their wireless connections to telecommunications and the Internet while, at the same time, cultivating the 'space of places' by forming indisputably local social networks as part of their everyday working life.

The concept of innovation spaces captures the recent interest of firms in designing physical environments that foster innovation and creativity (Moultrie et al., 2007). For example, Motorola invented the successful Razr phone by spinning off a separate project

team, locating them in a chic office in downtown Chicago (rather than at the corporate headquarters in the suburbs) and creating an environment where employees from different business units including marketing and engineering could interact closely. As the above narrative illustrates, mobile work places may be seen as innovation spaces for those that use them to stimulate their own productivity, expand their social networks, participate in site-specific work communities and collaborate on projects.

According to Stewart Brand, co-founder of the Global Business Network and founder of The Whole Earth Catalog, "the most productive people he knows have developed ways to work outside offices, not in them," (Schlosser, 2006). The sonic environment of a mobile work place is strikingly different from the stereotype of a typical white-collar office environment. For example, mobile professionals working in cafes are often surrounded by the loud screeching of the espresso machine as milk is foamed to perfection. While this could be seen as an inconvenience, many mobile workers report that sound is an important stimulant for their work. Those that are distracted or bothered by the ambient noises often use personal music devices such as iPods in order to block out the sounds.

For example, one informant, Adam, a middle-aged freelance writer from Brooklyn, elaborated that, while he rented an office space, he didn't like to work there. "It's too quiet," he said. Instead, he explained, "Starbucks IS my office." Since their founding in 1971, Starbucks has grown to over 12,000 stores worldwide, becoming the epitome of global brands. There are over 180 locations in the New York City area alone; 153 of which have wireless Internet access provided, for a fee, by T-mobile. Adam has been

working at a Starbucks for the past five years because he likes to be in a place where he can see people passing by engaged in their daily activities. "The challenge for office planners is to create flexible, stimulating spaces that are an attractive destination for employees who can choose when and where they work," (Bloemink, Hodge, Lupton, & MCQuaid, 2006). According to the design team at Herman Miller, "The kind of anonymity found in plain sight at Starbucks, the kind of variable stimulation found in libraries and public plazas—these are the new qualities to be fought for in work environments," (Bloemink et al., 2006). I interviewed one self-employed lawyer that finally had to get an office because his files had finally taken up most of his living room. But, for years he worked at home and out at WiFi hotspots. From my interviews, it was clear that for some people working in this way was a lifestyle and for others it was only a temporary phenomenon.

Another indication of the importance of sound is a CD, "Thriving Office," which is being marketed to telecommuters and small businesses. The CD, boasts two 39-mintute tracks – "Busy" and "Very Busy" – that replicate "the sounds people expect to hear form an established company" such as voices, phones and computers. The CD has received accolades from *The Wall Street Journal, Business Week* and National Public Radio as well as management gurus such as Tom Peters. Steelcase's WorkSpace Future Team said, "This background buzz keeps their energy up and mind in the game," and Herman Miller Corporation claimed, "Research has documented productivity gains of 38%, job satisfaction increases of 175% and stress reduction of 27%," ("Thriving Office," 2007).

Similarly, at mobile work places, people are *simulating the office environment* that they lack as a remote workers, telecommuter, freelancer or self-employed worker.

At the café that I studied, the soundscape was a mélange of Tom Waits being played over the café's speaker system and reggaeton[i] bleeding in from the street through the open door. While the area was once the home of the world's largest Jewish community[56], it is currently populated with designer boutiques stashed amidst the Spanish bodegas and bargain stores during the day. But, in the evening, it becomes one of New York's trendiest spots for nightlife including high-end restaurants, bars and music venues. The café – known as a "Boho café by day, low-key bar by night"[57] – is described as having a "café society".

The café offers free wireless Internet and, during peak hours (approximately from noon until 6p.m.), it is often difficult to find a table, which is testament to its popularity as a mobile work place. Overall, the clientele are diverse in terms of race, gender and age. The café's physical space is divided into several sections: a café, and a bar. The café has approximately eleven tables – six small round tables and one small square table that accommodate two people each, four large rectangular tables that accommodate two to three people each -- where people can plug in their laptops.[58]

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[56] Spanish dance music – a blend of dancehall and hip hop – that was developed in the mid-1990s in Puerto Rico, www.wikipedia.org Accessed August 1, 2006.

[57] www.citysearch.com Accessed on August 1, 2006.

[58] In Spring 2007, to the dismay of many longtime regulars, the owners of the café changed the layout, stopped serving food and limited the hours during which laptops and the wireless network could be used in order to cut costs and capitalize on their bar business. Finally, in Winter 2007, the café shut it's doors for good after the owner's moved out of New York and were unable to manage it.

The following section illustrates the way in which mobile work is tied to the transformation of the economy as a whole, the nature of public places themselves and *specific times and places* that are meaningful to individuals. Seeking to create an office-like-atmosphere – in contrast to the prospect of working at home in their pajamas -- pioneers have founded coworking groups and collaborative office spaces, such as the Village Quill, a writer's loft in TriBeCa, and formed Google Groups for coworking communities around the country. In fact, nextNY, a networking group for technology professionals in New York, holds "Café Slamming" events where members can work together at over a dozen different independent cafes around the city that offer free wireless Internet access. These mobile work places are intense sites of informal interaction, social support, collaboration and community.

Working for the Algorithm

Mobile work places support emergent occupations, practices and organizational structures that are evolving as the economy as a whole is transformed in the era of globalization and networked computing. Over the past ten years, the number of freelancers – independent contractors, self-employed and temporary workers, entrepreneurs – has increased and is now expected to make up 10-30% of the workforce in the United States. In New York, the media and technology industries including advertising, publishing, film and television, technology and the arts employ the large majority of freelancers. In addition, in general, freelancers are well-educated, earn over 20% more than the city's overall median income, and are entrepreneurial, creative and independent workers (Horowitz et al., 2005).

For example, Daniel, a freelancer and comedy writer from Boston, is currently employed as a search engine optimizer (SEO). SEOs are an example of a new occupation, which did not exist prior to the widespread adoption of the Internet. This illustrates the increased importance of Google and other search engines for navigating the Internet. Like many emergent occupations, the job of an SEO can easily be done on a project-basis and requires little face-to-face interaction with companies or clients. The task of an SEO is to create unique articles for Web-sites that have not yet launched in order to increase the ranking of the site on search engines such as Google. SEOs are given a list of keywords that must be used repeatedly in the articles. While the task of writing such articles sounds almost routine, it cannot be done by an automatic program because Google 'knows' the difference between original text and that which is, for example, copied from another website. The Google algorithm discriminates against sites that are merely copied and demotes them to sub-par status, known as 'grey-listing'. Instead, a writer must create unique text for the web-site despite that fact that it will never be read by anyone at all. As a result, the sites contain a mixture of fact and fiction, research and imagination. Thus, perhaps it should not be surprising that people working in such occupations seek out informal interaction, social support and community at mobile work places.

Making Work Public

Mobile work places are public or semi-public places. As such, they blur, and often reverse or contradict, traditional dichotomies such as employee and employer, work and

play, online and offline, public and private, presence and co-presence, individual and community, and local and global. For example, since a significant number of mobile professionals are freelancers, self-employed workers and entrepreneurs, the distinction between employee and employer is not well-defined.

Work and play are blurred through the heterogeneity of activities occurring simultaneously in mobile work places. For example, in the café that I studied, while many of the clientele were working on their laptops, others were talking with friends, making mobile telephone calls, eating, playing video games, drinking beer, reading or writing in their journals. In addition, the clientele often spent more than two hours in the café both working and socializing intermittently, and sharing beers with other patrons at the end of the workday. Those clientele that know each other, the 'regulars', often visit each other's tables throughout the day to take short breaks from their work.

Mobile work places are sites in which online and offline activities coexist. This includes the coexistence knowledge-work, service-work and unemployment. In the café that I studied, many mobile professionals work from the café in order to use the free wireless network. However, James, an academic, reported that he specifically comes to the café in order to be offline, specifically, to do his writing. James has access to the Internet at home where he is constantly bombarded with telephone calls and e-mails. Thus, for him, the café represents a haven where, while others are online around him, he can escape from the demands of communication. In addition, while many patrons enter the café armed with high-end laptops, iPods, PDAs and mobile phones, others do not have access

to these technologies. In particular, the café is home to a number of drifters including a number of alcoholics and a mentally-ill woman who busses tables in exchange for free coffee. The woman, who lives upstairs from the café, is assumed to be unemployed and spends long hours in the café passing the time. When patrons leave newspapers or coffee mugs on the table, she quickly folds the papers and returns them to a communal rack and clears away the dirty dishes.

Similarly, both Starbucks' comfortable third space and Apple's experiential shopping environment have become havens for a wide range of people including New York's homeless population. On a Thursday evening in November 2007 around 10:30PM, I went to the Apple Store on 5th Avenue and 59th St. in order to buy a red, rubber case for my new iPhone. Even at night, despite the relative quiet on the mid-town streets above, the store was teeming with customers. As I was checking out, my ever-inquisitive husband casually asked the sales representative if the store was always so busy. She responded that it was very busy 24 hours a day but that there was a lull around 4AM when only one-half of the store was filled with customers. However, she added, "The regulars," who she explained were mainly Caribbean, "often come in to call their families back home." She went on to say that in June, when the Apple iPhone was launched, many customers were using the phones to call Europe for free. Soon after, the company scaled back the free calling to include only the United States and several countries in Latin America and the Caribbean. Also, she explained, homeless people often came in to schedule job interviews. They would, she said, "stand and guard one of the phones all day until they were called back." My own observations confirmed the regular presence

of homeless people as I recalled an earlier trip to the Apple Store in Soho in September 2007 the day before I left for my most recent trip to Europe – I had been charged with bringing the latest device to inspire tech-envy, the Apple iPhone, to my collaborators in Budapest -- when I saw a seemingly mentally-ill man having a long conversation about a screenplay that he was writing. The premise, he explained, was that a group of people found themselves in a large bowl of cherries. "What do you think about that idea?" he said over and over, repeating his ingenious plot. As I slowly moved away, I realized how badly he smelled and it suddenly dawned on me that he was not your average-Apple customer.

Mobile work places also blur the boundaries between private and public in unique and interesting ways. While cafes are clearly private spaces in some ways, when compared to public parks for example, they are generally open to all and attract a wide range of patrons. Mobile workers often use technologies in order to signal their availability for interaction or conversation. For example, laptop screens are often used to indicate when someone is engaged in their work or open to being interrupted. Similarly, iPods and other portable music players are used to create bubbles of privacy in the midst of the public space of the café. The practice of using headphones in order to shield oneself from the ambient noise of the café or the music being broadcast over the café's loudspeakers is widespread among mobile professionals. In addition, while mobile phone calls were sometimes held in the café itself, it is far more common for patrons to leave the café and pace up and down the street while making mobile phone calls. This finding is interesting in that it reverses the commonly held notion that inside space is

private space while outside space is public space. In this case, mobile workers leave the public space of the café in search of a more private space on the street where they can carry on their personal or business conversations.

Finally, mobile work places are sites of temporal, spatial and project flexibility. While work in a traditional office white-collar environment typically begins at 9a.m., the hours of a mobile work place are not dictated by economic forces alone but rather by a mixture of social, cultural and personal norms. For example, the café that I studied was rarely crowded before noon when the first laptop-toting clientele would typically arrive. Before noon, the clientele mostly consisted of those who came to have coffee and read the newspaper in a relaxed environment. Similarly, after 8p.m., the lights dim, the music gets louder and the café is rendered into a bar environment. Mobile work places offer the possibility of spatial flexibility. Not only is it common for mobile workers move from place-to-place throughout the course of their day, the café's wireless network also allows them to move from table-to-table without sacrificing their connection to the Internet. For example, one regular mentioned that he would often work from one café in the afternoons and then move to another café in the evenings. This was partly for a change of scenery and party due to the fact that the first café became a bar in the evenings. In addition, during peak hours, people often began working at a table that was less desirable for its small size, cramped location or lack of proximity to electrical outlets. Thus, when a more desirable table opened up, it was common for that person to move to a more optimum location. Interestingly, people often seemed to prefer to share one of the larger, rectangular tables rather than working along at the small round tables. This is partly

because the large, rectangular tables offered more space and were slightly more conveniently located regarding plugging into electric outlets. Thus, rather than remaining in one location for the duration of the workday, it was common for clientele to table-hop until their ideal table was reached. Finally, it is assumed that mobile workers have some degree of control over the type of projects that they are working on and activities that they are participating in at any given time and place. Thus, it can be said that mobile work places offer possibilities for project flexibility in addition to their characteristic temporal and spatial flexibility.

Collaboration and Community

Casual conversations and informal interactions, often referred to as 'water-cooler' conversations are known to build trust, create social support and promote innovation and collaboration in traditional office settings. Since mobile professionals are often not physically present at a traditional office, research has focused on the impact of electronic communication on informal interaction finding that organizational communication typically declines as the use of e-mail increases (Sarbaugh-Thompson & Feldman, 1998). However, interestingly with respect to the case of mobile work places, there are ample opportunities for informal interaction. This is because, due to the relative flexibility of mobile work places, each interaction represents a negotiation for location, electricity, connectivity and security.

Laptop users needing to plug-in must often negotiate their way to a slot at the nearest power outlet, or, when seeking to connect, they might ask a neighbor the name of the

wireless network. For example, at Bryant Park in October 2006, I overheard one man with a laptop say to another, "What is the network SSID?" Finally, for those who spend long hours working at mobile work places, the security of their equipment and belongings is vital especially since they don't want to lose their valuable seat despite the need to get up to make a phone call, eat lunch or go to the bathroom. In order to maintain their location, while being granted some flexibility, they may turn to the nearest person to determine whether they are trustworthy. They may initiate the interaction by making a comment about the music and waiting to see how their neighbor answers. Based on their neighbor's reaction, they may decide whether or not to leave their laptop in the care of the stranger. In my observation at the Lower East Side café, to my surprise, people often left their laptops completely unattended for long periods of time –without asking a stranger to monitor it. In this example, the community plays a surveillance function in order to maintain a casual and relaxed but secure environment that makes others feel comfortable leaving their belongings unattended. However, one Starbucks in the Union Square area is known to have a serious problem with theft, thus, not all mobile work places exhibit the same sense of security.

Community surveillance also plays a part in enabling people to be productive in mobile work places, although in a much different way. For example, Jackson, a freelance translator in Brooklyn that works at Starbucks daily from about 4 p.m. to midnight, finds that being surrounded by people—despite the fact that he doesn't know them—makes him less likely to 'goof off' and read Grokster, a gossip blog about New York. Instead, he focuses on his work and feels that he is getting more accomplished.

Social networks allow access to private information, diverse skills and power. Trust, diversity and brokers (or weak ties) are necessary to build powerful networks based on shared activities such as playing on a sport team, volunteering for a community organizations and serving on a non-profit board (Granovetter, 1973; Uzzi & Dunlap, 2005). Mobile work places can be seen as hubs of information, skills and power, where everyone is a potential broker or weak tie. While informal interactions enable trust-building, the mutual recognition and the shared experience of working together day-after-day allows for these informal interactions to become valuable for the exchange of private information, learning from one-another and sharing access to new opportunities.

For example, on a particularly busy day in one of the world's busiest Starbucks, Victor, a self-employed 30-year old graphic illustrator, was queuing for his ideal seat. While waiting on line, he began talking to Richard, a freelance Web-designer and musician. Victor and Richard became friends and began working together on an almost daily basis. In the morning, the first person to arrive 'at work' would stake out space and notify the other by phone. If one Starbucks is too crowded, another coffee shop nearby is checked until an appropriate work place for the day is identified. Victor and Richard also met Daniel, the SEO in the narrative above, at Starbucks and work together with him everyday. Victor and Richard have collaborated on several Web-design projects together, a sign that they have built trusting relationships that enable them to access new employment opportunities. In addition, Richard mentions that working alongside Victor and Daniel allows him to relieve stress more easily rather than becoming frustrated and

giving up on his projects. Boundary-crossing and organizing diversity are elements that allow new media firms to remain innovative (Girard & Stark, 2002). Similarly, mobile work places allow the formation of social networks that bridge various clusters of knowledge. Rather than an isolated example, I found a number of mobile professionals that reported having developed social networks at mobile work places.

Anytime? Anywhere?

The following section illustrates the way in which rather than being sites of 'anytime, anywhere' connectivity, mobile work places are deliberately chosen for specific purposes. For example, Victor has three regular mobile work places: a pre-production place, a production place and a deadline place. While all three places are Starbucks coffee shops, they are each unique in their relationship to the physical environment and to his social network. During the pre-production phase of his projects, Victor requires books and materials that surround him at a Starbucks located within a Barnes & Nobles bookstore in order to research the history, settings and characters for the storyboards that he is illustrating. However, these Starbucks are often smaller and have very few electricity outlets.

During the production phase of his projects, Victor moves to another Starbucks nearby where he can plug in his laptop and light-box (needed for tracing and drawing). It is at that Starbucks where he spends most of his time. His drawings are often spread out on the table and he has a constant stream of friends and visitors who know that he works there regularly. Finally, when he is on deadline, Victor goes to a Starbucks in Korea-

town. He doesn't know anyone there and can work uninterrupted until he finishes his project.

Victor chooses each of these Starbucks, while seemingly identical to the average person, based on their unique physical, technological and social characteristics. While, for the most part, research on telecommuting and remote work assumes the elimination of commuting time in order to increase productivity and promote more sustainable transportation use (Gillespie & Richardson, 2000), Victor commutes 40 minutes to get to 'work' from his apartment in East New York (a poor neighborhood of Brooklyn). In addition, another informant, Jason, a remote technology salesperson for a Silicon Valley-based company, simulates his commute by taking a 30-minute walk to buy the newspaper or coffee on the days when he needs to be at home for private business phone calls before going to Starbucks for about four hours in the afternoon.

These examples illustrate the degree to which specific times and places are important to different people for varied reasons. As a regular patron of one Starbucks, Victor sometimes receives free coffee since he knows the Starbucks barista. He makes copies as the shop around the corner. He gets discounts on lunch nearby and likes to go out to dinner in the restaurants in the area after working from eight to twelve hours at the Starbucks. When asked why he commutes 40 minutes to get to work, he replies, "Everything is *here*." In fact, he got his first full-time job in the industry when an executive found him working on his drawings at 3 a.m. at a Ray's Pizza in the East Village.

To further elaborate on the ways in which mobile work places come to represent the unique social and digital ecologies, at the café that I studied, I identified approximately ten "regulars" who worked at or visited the café on a daily (or almost daily basis) for long periods of time from two to four hours, usually at the same times of day. The consistency in the people, times of day and length of time spent signals that these regulars have made working at the café a part of their routine. The regulars often call the staff by name, receive complimentary coffee refills and know other regulars at the café. Throughout the day, the regulars take frequent breaks from their activities and visit with other regulars. At the end of the day, while one might expect regulars to ceremonially pack up theirs things and head home, some people socialized with other regulars by having a beer together during the café's daily "happy hour". Other regulars pack up their laptops and move from the café on one side of the space to the bar area on the other side where they have drinks or dinner with friends. Clearly, for some, the café plays an integral role in their work and social lives. James even commented that while he would like to move to a new apartment, he does not want to be too far away from the café since he has not found another place like it from which to work.

Conclusion

This chapter illustrates the ways in which mobile work places, and their unique the social and digital ecologies, have become increasingly important in the lives of mobile professionals. Mobile work places support emergent occupations, such as search engine optimization, as well as occupations that have been transformed by information

technology, such as graphic illustration and translation. Mobile professionals choose public places such as cafes, parks and other public and semi-public places for a wide variety of reasons. For example, some explain the need to separate their work life from their home life. Others seek the constant stimulation that a public places provide or require the "surveillance" of others in order to be (or to feel) productive.

Drawing on Carey's ritual view of communications, actor-network theory and Suchman's concept of situated action, I analyzed the interactions between people, technologies and places negotiated by WiFi hotspots. I found that mobile work places blur, and often reverse or contradict, traditional dichotomies such as work and play, online and offline, public and private, presence and co-presence, individual and community, and local and global. For example, in my study, I found that people often went outside of the Lower East Side café, into very public places, to make private phone calls. In addition, in contrast to media representations of mobile work that focus on freedom, convenience and 'anytime, anywhere' use of mobile and wireless technologies, my year-long ethnographic study illustrates the ways in which WiFi hotspots enable local, face-to-face networks and communities.

I argue that mobile work places are important sites of informal interaction, social support and community. These factors are significant in promoting collaboration and innovation. As we shift from hierarchical forms of organizing to networked forms of organizing with the greater use of new media and information technology, it is vital to understand the ways in which mobile professionals rely on local, face-to-face communities encountered

at WiFi hotspots. Mobile professionals rely on the community to stimulate their own productivity, provide surveillance for their personal belongings and computers, decompress after a long day, exchange ideas and identify new projects for collaboration.

This research illustrates a shift towards community forms of organizing and peer-production, enabled by the complex interaction between emerging professions and WiFi technology as they are constituted in mobile work places. This study provides insight in order to inform scholars, managers, technologists, policymakers, architects and urban planners about emerging work practices. Mobile work practices are likely to increase in the near future due to current socio-economic trends including the increase of mobility as well as the growing number of freelance workers in addition to the declining price of mobile and wireless technology and recent interest by cities around the world in building municipal wireless networks.

Chapter 7: Codescapes

The central finding of this dissertation is that WiFi – a technology that, on the surface, seems to enable ubiquitous, 'anytime, anywhere' access to the Internet – has allowed for the emergence of a social format driven by the local innovation practices of lead users of WiFi. Lead users are believed to be important because they are adept at recognizing social needs and innovating ahead of the market (Von Hippel, 1978). More recent scholarship has indicated that innovation by lead users (or user entrepreneurs) is emergent and collective in contrast to earlier models of entrepreneurship (Tripsas & Shah, 2007). Specifically, lead users are often motivated to solve specific problems when there are no products or services on the market. Commercialization, when and if it does occur, happens much later in the process after lead users have shared their idea and received substantial feedback, both positive and negative, which has allowed them to improve their ideas. For example, in their study of the juvenile products industry, Tripsas and Shah describe new products for children created by parents who publicly use the products and receive feedback from other parents. It is only after the parents have been using the product that they might consider manufacturing and selling the project commercially. This differs from traditional notions of entrepreneurship because entrepreneurs typically survey the market for gaps and opportunities before deciding to innovate new products (Tripsas & Shah, 2007). However, discussions about lead users and entrepreneurship have not yet widely explored the role of place in collaboration and innovation. This chapter describes the local innovation practices and the role of place among lead users of WiFi.

This dissertation has explored two kinds of innovation by lead users of WiFi: first, the development of software, hardware and applications for the creation, management of WiFi networks by community wireless organizations (see Chapter 3); and, second, the emergence of forms of organizing that I call codescapes – which are enacted when social, spatial and technical factors come together – that are exemplified both by community wireless organizations as well as by a wider community of WiFi users including what are currently known as coworking groups (see Chapter 6). Despite the emphasis on enabling virtual, decentralized collaboration and innovation among large organizations, this empirical study of lead users of WiFi illustrates that both of types of innovation – the innovation of products, services and applications as well as the innovation of social formats are embedded in local, face-to-face interactions, which are necessary interpersonal communication channels for feedback. What follows is a discussion of the ways in which these codescapes function as feedback loops among community wireless organizations and coworking communities (or, more accurately, their early predecessors).

Chapter 3 describes the people, politics and pursuits of community wireless organizations, which are an important group of lead users of WiFi. Community wireless organizations have been active in experimenting with, building and designing WiFi software, hardware and applications since the late-1990s and early-2000, before many commercial providers entered the WiFi-market. Furthermore, the individuals that started community wireless organizations were motivated by their own socio-technical needs including the need for inexpensive access to broadband. To this day, in particular, after the widely proclaimed failure of many municipal wireless projects (though it remains to

be seen whether these projects will be able to identify workable business models and sufficient demand), community wireless organizations are still, and perhaps to an even greater extent, recognized as leaders in the creation of open source software, hardware and applications for wireless networking. For example, in New York, NYCwireless consistently gets weekly, and sometimes daily, requests for assistance in building wireless networks from individuals, communities, neighborhoods and government officials.

The following examples illustrate the local innovation practices among community wireless organizations, which have shaped software, hardware and applications for WiFi networks. First, while corporate messages about WiFi focus on ubiquity and 'anytime, anywhere' access, community wireless projects emphasize locality. This is important because community wireless organizations are located in specific cities around the world and their identities are explicitly linked to these cities. In fact, the majority of community wireless organizations include the name of their city in their organization name i.e. NYCwireless. One example of the attention to locality, as embedded in software developed by community wireless organizations is the development of WiFiDog by Île Sans Fil in Montreal. Specifically, WiFiDog is described as:

> The Wifidog project is an open-source embeddable captive portal solution. It uses the **physical limitations of WiFi** [emphasis mine] as an advantage to encourage **hyper-local** social interactions through **location-based** content and **location-based** services. Click here or here for examples of the **location-specific** splash pages which users are forced to see before they can access the web. Some of the content we show to users are **location-specific** images via Flickr. Users can send pictures to the portal pages of specific ISF hotspots by using the appropriate tag. Wifidog will grab them via Flickr's API and present them on the portal page to subsequent users. Another source of

> dynamic interactive locative content are any RSS feeds from either the owner or other **local** sources.[59]

While the emphasis on location-based services is commonplace in discussions about mobile content, applications and services, the acknowledgement of "using the physical limitations of WiFi as an advantage" is strong evidence for the role of place in innovation by lead users of WiFi. As evidence of its success, WiFiDog is used by over 30 communities and businesses in four continents. As lead users, different community wireless organizations have distinguished themselves by working on complementary open source software, hardware and applications.

Second, among community wireless organizations, it is common to hold regular, weekly or monthly, meetings in which members come together face-to-face in order to discuss, experiment with and build community wireless networks. Since it is impossible to build a wireless network without meeting face-to-face, locality is an importance affordance of WiFi in this case as well. Perhaps the best example of this practice is the C-base in Berlin, which holds weekly meetings for wireless enthusiasts. While, at first glance, these meetings do not seem particularly social – picture a collection of primarily male hackers sitting side-by-side in a circle with their laptops – these meetings allow for the exchange of information, knowledge and feedback about wireless networking, whether digitally or verbally.

Third, just as local meetings of community wireless groups are important for information-sharing, international face-to-face meetings are vital for integrating the open

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[59] See http://www.ilesansfil.org/tiki-index.php?page=Projets. Accessed on September 27, 2008.

source software projects developed by these groups around the world. As evidence for this claim, I cite the keynote address given by Aaron Kaplan, one of the founders of FunkFeuer, a community wireless group in Vienna, Austria, at the International Summit for Community Wireless Networking in Washington, DC in May 2008. Kaplan said that while thousands of people around the world had downloaded FunkFeuer's mesh networking software, it is very difficult to obtain feedback about how it is being used and what kinds of problems are occurring. The International Summit, is one opportunity for groups around the world to come together to share information, knowledge and feedback about wireless networking. For example, at this year's Summit, there was a dedicated room where technical developers from community wireless networks around the world could work together to combine their various open source projects.

Chapter 6 describes the people and work practices of a wider community of lead users of WiFi that work at cafes, parks and other public spaces. These mobile workers are also evidence of the local innovation practices enabled by codescapes. For example, when asked why he works at Starbucks, Victor, the graphic illustrator, points around the café at the other patrons and responds "Well, I'm designing for *them*, right?" This example shows that Victor is consciously placing himself amidst his audience for the purpose of better understanding the lives of the everyday people for whom he is designing. As such, Starbucks becomes a kind of incubator for his ideas and designs. Furthermore, he lays his illustrations out on the table and, in addition to attracting the attention of his friends and social network, he receives feedback about his designs from a wider audience of enthusiasts. Feedback, especially around tangible artifacts such as spreadsheets and

prototypes, is known to be an important component of the process of innovation (Schrage, 1999).

Let's take another example. On Tuesday, June 10, the coworking community "New Work City," founded by Tony Bacigalupo, announced a MeetUp event at Gramstand café on Avenue A and 13th St. in the East Village. Coworking can be defined as a gropuu of people that work side-by-side even though they do not work together in the traditional sense. Despite this, they have a mutual understanding of their value to each other in terms of social interaction, information-sharing, collaboration and innovation. Gramstand has free WiFi, which was set-up by NYCwireless. I arrived there at 10am for a meeting with Anthony Townsend about a potential project that we were working on. We looked around and saw a number of people working on their laptops in the dimly lit basement but saw little evidence of coworking upon first glance. Around noon, Anthony left just as Tony was arriving so I introduced them on the sidewalk. Tony and I went downstairs to talk and check out the scene. We started talking about coworking and, within a few minutes, a young Asian man who had overheard our conversation began talking to us, saying that he was there for the coworking MeetUp. He said that he was working on an open source educational platform for a start up company and that he was looking for a few programmers with specialized expertise. This illustrates the way in which third places such as cafes have begun to serve as hubs of talent, information and knowledge-sharing. However, without an explicit way to tell whether people were gathered there for coworking, and thereby expressly seeking to interact with co-present others, it was difficult to initiate links between people. Tony had devised a solution to

this problem: a sticker that would serve as a coworking emblem for people to display on their laptops. Much like other tangible artifacts such as spreadsheets, prototypes, illustrations or drawings, the sticker allowed unknown persons to engage with one another and demonstrate their participation in a community without violating the sometimes bizarre social norms of New Yorkers, which, for the most part, dictate that you do not start talking to people that you don't know in public; unless, of course, you are a tourist seeking directions. In addition to tangible artifacts, environmental factors can also trigger interactions. For example, while working on my laptop at a café in 2007, a middle-aged man commented to me about the music that was being played over the loudspeakers, saying that he didn't like it. A few minutes later, he asked me whether I would watch his computer while he went to the bathroom. The first interaction seemed to be more of a requirement in order to gauge whether or not I was trustworthy enough to watch his computer.

These examples illustrate the local innovation practices of mobile workers, who both collaborate with those around them on new projects as well as gathering feedback on their own work from a diverse group of co-present others. The nature of the work that they do – primarily in the media, technology and telecommunications fields – enables them to participate in, contribute to and shape codescapes, emergent forms of organizing that are created at the intersection of social, technical and spatial factors. As a new theoretical construct, codescapes must capture a variety of forms of organizing that are possible at the intersection of code and place. For example, digital networks may support, stabilize or contradict the regulation of social behavior by physical architecture.

The chart below briefly outlines some of the new socio-technical-spatial arrangements that are possible:

Physical Space	Digital Space	Social Space
same	**different**	**linked to co-present others**
same	different	unlinked to co-present others
same	**same**	**linked to co-present others**
same	same	unlinked to co-present others
different	**same**	**linked to ambient others**
different	different	unlinked to ambient others

Figure 21: Mapping Socio-Technical-Spatial Arrangements

In this model, there are a number of possible configurations. First, you can either share a physical space with co-present others or you can be separated by walls, floors or other architectural barriers. Second, you can either be connected to the same digital space – by this I mean a wireless network by the same SSID – or you can be connected to different digital spaces. While your access to communications capabilities such as the Internet, e-mail and instant messenger may seem to be identical, it is important to consider the fact that each digital space is a layer on top of the physical space that do not quite map onto one another since they are all coming from different locations and organizations with a different set of specifications, rules and politics i.e. encrypted vs. non-encrypted, paid vs. free etc. Finally, you might be socially linked to co-present others through face-to-face interactions or linked to ambient others through digital interactions. It is important to note that since we are talking about local innovation practices enabled by the physical limitations of WiFi, all of these configurations occur within relatively close range of once another geographically speaking. In this model, "place" occurs when people are linked in the social space regardless of their physical or digital configurations. These emergent forms of organizing – codescapes – that occur when code meets place emphasize the local innovation practices of lead users of WiFi.

Conclusion

You might recall that this narrative about the intersection of technologies, spaces and forms of organizing began on September 11, 2001. Now, seven years later in early 2008, the United States economy verges on the brink of a recession driven in part by the four-year war in Iraq as well as the recent sub-prime mortgage collapse and $700 billion government bailout of Wall Street (Crang & Thrift, 2000; Thrift, 2004). Corporate layoffs, mergers, outsourcing and bankruptcy have left many Americans without full-time employment. After two Bush administrations, the country is searching for a new political leader that can end the war and revive the economy. Over this same period, the Internet, mobile phones as well as other communications technologies have become steadfastly embedded in American life. In light of these larger socio-economic transformations, this dissertation seeks to understand the unique socio-technical arrangements that are emerging at this particularly fragile time in history.

While the first decade of the Internet can be characterized by its virtuality; that is, the migration of information, experiences and activities onto digital interfaces, networks and platforms. The next decade of the Internet will be characterized by materiality; or, rather, the integration of digital information into physical spaces. Currently, a palimpsest of digital information has blanketed our homes and offices, cities and towns as well as all of the places in between. The nation's borders have been outfitted with digital finger print scanners. Passports have been rigged with radio frequency identification (RFID) tags. The hordes of luxury apartment buildings announce security features such as video intercoms and keycard entry. Surveillance cameras are dutifully installed at intersections

to ticket speeders and tax peak commuters in city-centers. Once static billboards have been replaced by interactive digital interfaces. In a post-9/11 society, we have readily accepted and even welcomed these technologies into our everyday lives.

But, as society, we are unprepared to understand the implications of our rapid adoption of these technologies into our physical environments. At the broadest level, this dissertation examines the question of what happens when code meets place. Digital information, networks and interfaces may support, enhance, maintain, conflict with or contradict existing ways of shaping social behavior including social norms, laws, markets and physical architecture itself while at the same time being shaped by it. As we have seen in the earlier chapters of this narrative, the conversation between technology, place and forms of organizing is rife with unintended consequences, unexpected disruptions and challenges as well as with counterintuitive delights, surprises and discoveries.

Lessig's prescient book *Code* attempted to characterize the ways in which software might or might not play a role in regulating social behavior. For Lessig, code regulated behavior in a manner similar to physical architecture. More recently, scholars have attempted to clarify this characterization of code, saying that, while code may share some qualities of physical architecture, it is best discussed as its own category. However, neither of these positions is sufficient in tackling what happens when code meets place.

These issues cut across a wide range of academic disciplines – such as computer science and engineering, management and organizational behavior, communications and

sociology, science and technology studies, and architecture and urban planning -- and professional practitioners including policymakers, media, telecommunications and information technology executives as well as architects and urban planners. While scholars of management and organizational behavior have developed sophisticated theories about the role of technology and forms of organizing, scholars of computer science and emerging areas of research such as ubiquitous computing have analyzed the ways in which technology has been incorporated into physical place. However, neither of these fields is fully equipped to study all three of these categories: technologies, spaces and forms of organizing. By introducing theories from communications and science and technology studies and approaching this research as a network ethnography, it is possible to approach this topic anew, thereby reframing a number of central debates, which have historically shaped discussions of the media, communications and information technology.

In order to develop theoretical concepts well-suited to analyze the intersection between technologies, spaces and forms of organizing, this dissertation examines themes around social construction, sociality and locality, all of which represent major debates in the field of communications as well as between related academic disciplines. As its empirical case, this dissertation analyzes the people and places that constitute the landscape of the wireless Internet, in particular, WiFi and related wireless technologies. Mobile and wireless technologies are socially constructed in the mainstream media as anytime, anywhere technologies, yet their uses by community wireless activists, general users and freelance workers are deeply embedded in local cultures, meanings and environments.

This local nature of the use of mobile and wireless technologies is, in part, an affordance of the technology itself. For community wireless activists and freelancers, public WiFi hotspots are sites of informal interaction, social support, knowledge-sharing, collaboration and innovation. Finally, this case illustrates the ways in which networked, peer-to-peer, ad-hoc and community forms of organizing are rooted in local settings. This finding shifts the focus of scholarship about media, communications and information technology and forms of organizing to consider the role of place in contrast to the past decade of research on virtual organizations, collaboration and innovation.

Codescapes have important implications for business and organizations, design, public policy as well as for technology itself. For businesses, organizations and cities are grappling with significant change as hierarchical structures are reformulated and reshaped into more networked structures. The cases above are important for informing the future of work in light of discussions about the importance of the creative class. Freelancers and ad-hoc coworking groups are lead users in experimenting with emergent networked, ad-hoc and community forms of organization that are locally-based. By analyzing only what their remote workers are communicating about, businesses and organizations are missing out on the interactions, knowledge, collaboration and innovation that is occurring where their employees spend the majority of their days. Policymakers have reason to monitor these developments because the needs of these types of workers are very different than those in the past. In addition, all areas of government will undoubtedly be transformed by these changes.

Architects and urban planners are attempting to design residences, offices, public spaces and cities with emerging forms of organization in mind. Technologies often have multi-directional effects. While, by some estimates, commuting times are increasing, by others people are choosing to live and work closer to home. The trend of hybrid and multi-use spaces is a response to some of the issues raised in this study. For example, at a recent meeting with an architecture firm, I was asked how best to design an outdoor workspace for the purposes of informal interaction, collaboration and innovation. Another correspondence with an architect revealed the building of a multi-use copy shop, cafe and coworking space. The copy and printing industry is particularly interested in what happens when workers, traditional situated near large industrial copiers and printers, stop working in traditional offices and, instead, spend their days at places like Starbucks. This study cannot answer such questions precisely, however, it has opened up new territory for further research on topics that typically fall between the cracks of academic disciplines. Finally, technologists and technology policymakers can learn much from analyzing the needs and uses of lead users and early adopters of technology. While these uses may not always be representative of the population, they are often more telling for future innovations.

Appendix

New York WiFi Survey Results

Sample: n=614 adults 18 and older
Survey dates: October 1, 2006 – April 30, 2007
Conducted in partnership with NYCwireless and the Downtown Alliance
Note: All results are rounded to the nearest percent unless result is less than .5% in which case it is reported as is.

1. Where have you used the wireless Internet in the past six months? (Check all that apply.) **[N=612]**

	Response Percent	Response Total
60 Wall Street Atrium	10%	62
Battery Park	13%	78
Bowling Green Park	10%	58
Brooklyn Bridge Park	6%	36
Brooklyn Museum	3%	19
Bryant Park	33%	202
Central Park	8%	51
City Hall Park	13%	78
College Campus	13%	80
Corona Flushing Meadows	1%	5
Fulton Ferry Landing	1%	6
Independently-owned Café	21%	130
Jet Blue Terminal	13%	78
Madison Square Park	9%	54
McDonalds	5%	31
New York Public Library	23%	139
Orchard Beach	.3%	2
Panera Breads	5%	31
Pelham Bay Park	.3%	2
Prospect Park	2%	14
Rector Park	1%	4
Riverside Park	2%	11
South Street Seaport	9%	57
Starbucks Café	34%	206
Stone Street	3%	19
Stuyvesant Cove Park	2%	11
Tompkins Square Park	3%	21
Union Square Park	13%	80
Van Cortland Park	1%	5
Vietnam Veterans Plaza	3%	18
Wall Street Park	6%	37
Washington Square Park	8%	47

WFC Winter Garden	9%	54
Other (please specify)	22%	136

2. Where have you used the wireless Internet most frequently in the past six months? (Enter the name of one of the locations above.) **[N=611]**

	Response Percent	Response Total
60 Wall Street Atrium	4%	23
Apple Store	.3%	2
Battery Park	2%	12
Bowling Green Park	2%	9
Brooklyn Bridge Park	3%	15
Brooklyn Museum	2%	9
Bryant Park	10%	60
Central Park	2%	9
City Hall Park	3%	17
College Campus	6%	34
Independently-owned café	12%	70
JetBlue Terminal	2%	14
Madison Square Park	3%	15
McDonalds	.3%	2
New York Public Library	6%	35
Panera Breads	2%	11
Prospect Park	1%	3
Riverside Park	1%	4
South Street Seaport	3%	20
Starbucks Cafes	15%	93
Stone Street	1%	8
Tompkins Square Park	1%	5
Union Square Park	1%	7
Vietnam Veterans Plaza	1%	6
Wall Street Park	2%	12
Washington Square Park	1%	6
WFC Winter Garden	5%	31
Other	9%	53
Other (Home)	4%	27

3. For the remainder of this survey, please respond based on your answer to Question 2 above. Do you go to this location specifically because of the availability of the wireless Internet? **[N=612]**

	Response Percent	Response Total
Yes	40%	247
No	26%	158
Sometimes	30%	183
Other (please specify)	4%	24

4. What is the primary purpose for which you use the wireless Internet at this location? **[N=612]**

	Response Percent	Response Total
Work Use	11%	70
Personal Use	28%	170
Both Work and Personal Use	63%	383
Other (please specify)	2%	12

5. How often do you use the wireless Internet at this location? **[N=612]**

	Response Percent	Response Total
More than once a day	7%	44
Daily	15%	92
Weekly	42%	254
Monthly	23%	138
Annually	3%	16
Very rarely	11%	68

6. How long do you normally spend using the wireless Internet at this location? **[N=612]**

	Response Percent	Response Total
15 minutes or less	8%	50
30 minutes	27%	163
1 hour	29%	176
2 hours	26%	159
4 hours	6%	35
More than 4 hours	5%	29

7. At what time of day do you usually use the wireless Internet at this location? (Check all that apply.) [N=612]

	Response Percent	Response Total
6a.m. to 9 a.m.	7%	40
9 a.m. to Noon	27%	166
Noon to 3 p.m.	51%	310
3 p.m. to 6 p.m.	41%	252
6 p.m. to 9 p.m.	29%	177
9 p.m. to Midnight	11%	69

8. Why do you use the wireless Internet at this location? (Check all that apply.) **[N=612]**

	Response Percent	Response Total

To get out of my home/office	58%	356
To see familiar people/be part of a community	23%	140
To get information when I am just passing by	27%	164
Other (please specify)	26%	161

Other (responses)

Can access it from home	2%	9
Convenient to where I live and/or work	5%	32
Don't have/can't afford home Internet access	2%	10
Easy to use	1%	3
Free	1%	9
Having problems with regular Internet provider	1%	3
In between meetings	1%	4
Like the atmosphere/environment	1%	5
Like the coffee and/or food	1%	5
To access library resources	.3%	2
To be outside at the park	1%	4
To check e-mail or surf the Internet	1%	6
To check personal email or use personal computer that is not available at work	1%	4
To check street locations	.2%	1
To do work	1%	4
To get broadband Internet access	1%	7
To hold meetings	.3%	2
To relax	.2%	1
To see unfamiliar people	.2%	1
To work while having breakfast/lunch/resting	2%	11
Traveling	1%	7
Waiting for something i.e. flights, train, laundry	1%	7

9. How likely are you to use the wireless Internet at each of the following? (1 = unlikely, 3 = neither likely or unlikely, 5 = very likely) **[N=612]**

Free Access	**1**	**2**	**3**	**4**	**5**
Airport **[N=611]**	7% (44)	2% (11)	6% (38)	11% (67)	74% (451)

Bar **[N=612]**	52% (318)	13% (80)	14% (85)	7% (41)	14% (88)
Coffee Shop **[N=612]**	6% (35)	5% (30)	10% (64)	18% (112)	61% (371)
Fast Food Restaurant **[N=612]**	48% (294)	13% (82)	17% (105)	6% (39)	15% (92)
Hotel **[N=612]**	5% (32)	3% (18)	4% (26)	9% (55)	79% (481)
Library **[N=612]**	6% (37)	3% (17)	10% (62)	10% (63)	71% (433)
Park or Public Space **[N=612]**	6% (37)	4% (27)	14% (87)	21% (126)	55% (335)
Restaurant **[N=612]**	44% (268)	16% (96)	18% (113)	7% (40)	16% (95)
Train Station **[N=611]**	16% (98)	9% (56)	13% (81)	17% (106)	44% (270)

Paid Access	**1**	**2**	**3**	**4**	**5**
Airport **[N=610]**	61% (375)	13% (80)	15% (93)	5% (31)	5% (31)
Bar **[N=608]**	91% (553)	4% (23)	2% (15)	0% (3)	2% (14)
Coffee Shop **[N=608]**	59% (360)	16% (96)	16% (95)	5% (32)	4% (25)
Fast Food Restaurant **[N=608]**	88% (533)	5% (28)	4% (27)	1% (5)	2% (15)
Hotel **[N=608]**	41% (250)	11% (67)	21% (127)	14% (88)	12% (76)
Library **[N=608]**	70% (424)	12% (71)	11% (67)	3% (19)	4% (27)
Park or Public Space **[N=608]**	76% (461)	12% (72)	7% (44)	2% (13)	3% (18)
Restaurant **[N=608]**	86% (525)	6% (38)	4% (22)	1% (8)	2% (15)
Train Station **[N=609]**	67% (406)	13% (81)	13% (80)	3% (21)	3% (21)

10. What computer hardware do you use to connect to the wireless Internet? (Check all that apply.) **[N=603]**

	Response Percent	Response Total
Laptop	96%	577
Personal Digital Assistant (PDA)	19%	117
Mobile Phone	20%	122
Gaming Device	4%	25
Other (please specify)	2%	10

11. Which of the following technologies do you own? (Check all that apply.) **[N=203]**

	Response Percent	Response Total
Laptop	97%	587

Personal Digital Assistant (PDA)	44%	266
Mobile Phone	90%	542
Pager	5%	27
Gaming Device	18%	107
iPod or MP3 Player	67%	405
Digital Camera	79%	478
Other (please specify)	5%	32

12. What Internet applications do you use while connected to the wireless Internet? (Check all that apply.) **[N=603]**

	Response Percent	Response Total
Instant Messenger	63%	377
E-mail Application	67%	406
Web-based E-mail	82%	496
Voice Application (VOIP)	23%	136
Microsoft Office	66%	399
Remote Desktop	19%	117
Virtual Private Network (VPN)	22%	132
Streaming Audio/Video Clips	46%	275
Other (please specify)	9%	51

13. Where else do you have access to the Internet? (Check all that apply.) **[N=603]**

	Response Percent	Response Total
Home	95%	571
Work	81%	491
School	23%	140
Library	31%	187
Other (please specify)	5%	28

14. Where do you have access to the high-speed (broadband) Internet i.e. DSL or Cable? (Check all that apply.) **[N=603]**

	Response Percent	Response Total
Home	89%	538
Work	79%	476
School	19%	117
Library	26%	157
Other (please specify)	5%	30

15. Have you had any problems using the wireless Internet? (Check all that apply.) **[N=603]**

	Response Percent	Response Total
Can't figure out how to connect to the network		

	13%	78
Did not know about the availability of the network	22%	135
Speed of the network is too slow	43%	257
Trouble viewing computer screen	10%	61
Concerns about privacy and security of data being transmitted over wireless network	44%	268
Concerns about theft of computer hardware	16%	95
Other (please specify)	21%	129

Other (responses)		
Lack of power outlets	1%	5
Lack of privacy	.2%	1
Lack of signage	1%	4
Laptop weight/ergonomics	.2%	1
Location is not convenient	.2%	1
No problems	10%	57
Other technical problems	5%	29
Too slow	.4%	2
Weak/unreliable signals	4%	22

16. What websites do you access while you are using the wireless Internet at this location? **[N=485]**

	Response Percent	Response Total
AOL	3%	15
CNN	1%	7
Earthlink	1%	5
Gmail	15%	73
Google	23%	112
Hotmail	5%	24
MSN	2%	11
MySpace	1%	5
New York Times	5%	24
Other	26%	128
Yahoo! Mail	2%	10
Yahoo!	15%	71

17. What kinds of information do you access when using the wireless Internet at this location? (Check all that apply.) **[N=583]**

	Response Percent	Response Total
Financial information	41%	241
General news	83%	486
Government information	20%	114
Health or medical information	18%	107
Political news	39%	226
Product information	47%	272
Research for school or training	37%	214
Search for information about a hobby	45%	264
Search for information relevant to your geographic location	61%	356
Search for new job opportunities	30%	174
Sports information	25%	145
Travel information	45%	260
Weather information	61%	354
Other (please specify)	16%	92

18. What kind of activities do you do when using the wireless Internet at this location? (Check all that apply.) **[N=583]**

	Response Percent	Response Total
Accessing work Intranet	35%	206
Buy a product	40%	231
Buy or make a reservation for travel services	34%	198
Buy or sell stock online	7%	41
Contributing content to a blog	21%	124
Contributing content to a website (other than a blog)	21%	122
Downloading and listening to music	33%	192
Downloading and watching video clips	29%	171
Go online for fun or to pass time	59%	342
Graphic or web design	15%	88
Play online video games	7%	43
Send instant message	44%	259
Send or read e-mail	91%	528
Send or receive instant messages	49%	288
Send or receive music files	19%	111
Send or receive photos	36%	211
Take part in a chat room	7%	38
Writing or word processing	59%	345
Other (please specify)	7%	42

19. In addition to using the wireless Internet, what else do you usually do at these locations? (Check all that apply.) **[N=583]**

	Response Percent	Response Total
Eat meals	65%	380
Hold work meetings	15%	87
Make phone calls	66%	382
Meet friends	49%	284
Play video games	4%	21
Read	60%	348
Watch people	56%	325
Other (please specify)	10%	60

20. I usually go to this location with: **[N=583]**

	Response Percent	Response Total
Alone	87%	509
Co-workers or business colleagues	17%	96
Spouse/partner	17%	98
Children	4%	21
Other relatives	3%	19
Neighbors	4%	21
Members of a common organization or club	4%	22
Friends	29%	167
Other (please specify)	1%	8

21. Would you be willing to watch a short advertisement in exchange for free access to the wireless Internet at a café, park or other public space? **[N=583]**

	Response Percent	Response Total
Yes	59%	344
No	14%	79
Maybe	27%	160

22. Would you be willing to pay a small service charge at a coffee shop/restaurant/bar to support the availability of the wireless Internet? **[N=583]**

	Response Percent	Response Total
Yes	19%	108
No	48%	282
Maybe	33%	193

23. Given two coffee shops of similar characteristics and quality, would you choose the one that provides wireless Internet over the one that doesn't? **[N=583]**

	Response Percent	Response Total
Yes	75%	439
No	5%	30
Maybe	20%	114

24. What do you like about the wireless Internet? **[N=514]**

	Response Percent	Response Total
Availability/Ubiquity	9%	44
Connectivity; ease of access to information; ease of use	23%	118
Convenience (lack of wires/cables/cords, location)	28%	142
Fast	5%	25
Free of Charge	8%	41
Freedom of movement, the ability to work in different places i.e. the living room; mobility/portability/flexibility; Ability to work outdoors; outside of home/office/remotely;	29%	150

25. What do you dislike about the wireless Internet? **[N=506]**

26. Is there anything else that you would like to share about how you use the wireless Internet at this location? **[N=244]**

27. How did you learn about this survey? **[N=568]**

	Response Percent	Response Total
Downtown Alliance "Splash Page" or Website	35%	201
Bryant Park "Splash Page" or Website	.9%	5
WiFi Salon "Splash Page" or Website	1%	7
Other Wireless Network "Splash Page" or Website	1%	7
NYCwireless Listserv or Website	22%	127
Flier	3%	15
Word of Mouth	7%	40
Other (please specify)	29%	166

28. Where else would you like to see a free, public wireless Internet network available? **[N=387]**

29. Are you interested in participating in future studies and follow up interviews on the use of mobile and wireless technology? **[N=567]**

	Response Percent	Response Total
Yes	41%	231
No	26%	146
Maybe	34%	190

30. If you would like to be entered into the drawing for an iPod, iTunes or a $300 donation to charity, please enter your contact information below. **[N=510]**

	Response Percent	Response Total
Name	99%	503
Phone Number	89%	455
E-mail Address	100%	511

31. What is your age? **[N=538]**

	Response Percent	Response Total
18-24	15%	83
25-34	41%	221
35-44	25%	135
45-54	13%	70
55-64	5%	25
Over 65	1%	4

32. What is your gender? **[N=538]**

	Response Percent	Response Total
Male	64%	342
Female	36%	196

33. What is your racial background? **[N=538]**

	Response Percent	Response Total
White, non-Hispanic	62%	335
Black, non-Hispanic	5%	29
Other, non-Hispanic	2%	13
Hispanic	7%	36
Asian	15%	79
Prefer Not to Answer	9%	46

34. What is your highest level of education? **[N=538]**

	Response Percent	Response Total
Less than high school	.2%	1
Some high school, no diploma	2%	8
Graduated from high school, diploma or equivalent (GED)	2%	13
Some college, no degree	13%	68
Associate's degree	4%	21
Bachelor's degree	43%	229
Master's degree	27%	145
Professional degree	5%	28
Doctorate degree	5%	25

35. What is your annual income? **[N=538]**

	Response Percent	Response Total
Less than $5,000	10%	53
$5,000 to $7,499	1%	7
$7,500 to $9,999	1%	5
$10,000 to $12,499	2%	9
$12,500 to $14,999	2%	8
$15,000 to $19,999	1%	6
$20,000 to $24,999	3%	15
$25,000 to $29,999	4%	23
$30,000 to $34,999	4%	20
$35,000 to $39,999	6%	32
$40,000 to $49,999	11%	60
$50,000 to $59,999	11%	61
$60,000 to $74,999	12%	64
$75,000 to $84,999	5%	26
$85,000 to $99,999	6%	30
$100,000 to $124,999	10%	54
$125,000 to $149,999	4%	22
$150,000 to $174,999	4%	20
$175,000 or more	4%	23

36. What is your current employment status? **[N=538]**

	Response Percent	Response Total
Full-time Employee	57%	305
Part-time Employee	4%	23
Self-employed, Freelance Worker or Independent Contractor	16%	86
Entrepreneur or Owner/Partner in a Small Business, Professional Practice or Farm	5%	28
Full-time Student	9%	50

Unemployed -- looking for work	4%	20
Unemployed -- not looking for work	.4%	2
Retired	1%	3
Disabled	.4%	2
Homemaker	1%	3
Other (please specify)	3%	16

37. What is your occupation? **[N=537]**

38. In what industry or sector do you work? **[N=538]**

	Response Percent	Response Total
Education	8%	41
Finance and Banking	13%	69
Government Sector	4%	21
Health and Medical	4%	22
Hospitality and Travel	3%	15
Insurance and Real Estate	2%	13
Manufacturing and Industry	2%	9
Media and Entertainment	15%	82
Non-profit Sector	11%	59
Professional Services (consulting, accounting, law)	9%	50
Science and Research	2%	12
Telecommunications and Information Technology	11%	60
Other (please specify)	16%	85

39. In what city, state and country do you live? **[N=538]**

40. In what city, state and country do you work? **[N=538]**

Montreal WiFi Survey Results

Sample: n=370 adults 18 and older
Survey dates: December 14, 2006 – April 30, 2007
Conducted in partnership with Île Sans Fil
Note: All results are rounded to the nearest percent unless result is less than .5% in which case it is reported as is.

Survey Questions and Results

1. Where have you used the wireless Internet in the past six months? (Check all that apply.) **[N=369]**

	Response Percent	Response Total
Cafe Tribune	9%	32
Second Cup rue St-Denis	11%	41
Laïka	22%	81
Café l'Utopik	21%	76
Second Cup St-Laurent	12%	45
Cafétéria Collège Lasalle	1%	5
Second Cup Rue Marquette	6%	22
Resto-Pub 100 Génies	3%	10
Café Suprême	9%	32
Kafeïn	5%	18
Café Pi	19%	69
Santropol Café	11%	39
Café Art Java 3030	14%	50
Spin Café Buanderie conviviale	2%	6
Salon Alfred Dallaire - Salle B	4%	13
Zeke's Gallery	2%	8
Atomic Café	5%	20
Vices & Versa	4%	15
Palmyra Resto / Café	4%	14
Parc Émilie-Gamelin	2%	7
Other Second Cup locations	14%	51
Starbucks	18%	65
Pierre-Elliot Trudeau Airport	7%	25
Other	61%	225

2. Where have you used the wireless Internet most frequently in the past six months? (Enter the name of one of the locations above.) **[N=369]**

	Response Percent	Response Total
Cafe Tribune	2%	8

Second Cup rue St-Denis	2%	9
Laïka	10%	38
Café l'Utopik	8%	31
Second Cup St-Laurent	4%	15
Cafétéria Collège Lasalle	1%	4
Second Cup Rue Marquette	1%	4
Resto-Pub 100 Génies	2%	8
Café Suprême	2%	7
Kafeïn	2%	7
Café Pi	9%	34
Santropol Café	2%	6
Café Art Java 3030	4%	16
Spin Café Buanderie conviviale	1%	3
Salon Alfred Dallaire - Salle B	2%	8
Zeke's Gallery	1%	4
Atomic Café	4%	16
Vices & Versa	1%	4
Palmyra Resto / Café	2%	7
Parc Émilie-Gamelin	0.3%	1
Other Second Cup locations	4%	14
Starbucks	8%	31
Pierre-Elliot Trudeau Airport	2%	6
Other	47%	175

3. For the remainder of this survey, please respond based on your answer to Question 2 above. Do you go to this location specifically because of the availability of the wireless Internet? **[N=369]**

	Response Percent	Response Total
Yes	52%	193
No	16%	58
Sometimes	24%	89
Other (please specify)	8%	29

4. What is the primary purpose for which you use the wireless Internet at this location? **[N=369]**

	Response Percent	Response Total
Work Use	19%	69
Personal Use	15%	57
Both Work and Personal Use	66%	245
Other (please specify)	7%	26

5. How often do you use the wireless Internet at this location? **[N=612]**

	Response Percent	Response Total

More than once a day	8%	28
Daily	16%	60
Weekly	51%	189
Monthly	18%	67
Annually	2%	7
Very rarely	5%	18

6. How long do you normally spend using the wireless Internet at this location? **[N=369]**

	Response Percent	Response Total
15 minutes or less	2%	6
30 minutes	10%	35
1 hour	29%	108
2 hours	43%	158
4 hours	11%	39
More than 4 hours	6%	23

7. At what time of day do you usually use the wireless Internet at this location? (Check all that apply.) **[N=369]**

	Response Percent	Response Total
6a.m. to 9 a.m.	5%	20
9 a.m. to Noon	25%	91
Noon to 3 p.m.	42%	153
3 p.m. to 6 p.m.	46%	171
6 p.m. to 9 p.m.	42%	154
9 p.m. to Midnight	24%	87

8. Why do you use the wireless Internet at this location? (Check all that apply.) **[N=369]**

	Response Percent	Response Total
To get out of my home/office	69%	253
To see familiar people/be part of a community	31%	113
To get information when I am just passing by	21%	78
Other (please specify)	26%	94

9. How likely are you to use the wireless Internet at each of the following? (1 = unlikely, 3 = neither likely or unlikely, 5 = very likely) **[N=369]**

Free Access	1	2	3	4	5
Airport [N=369]	13% (49)	4% (15)	13% (47)	12% (46)	57% (212)
Bar [N=369]	37% (136)	15% (55)	22% (80)	8% (31)	18% (67)
Coffee Shop [N=369]	1% (5)	1% (3)	5% (18)	11% (41)	82% (302)
Fast Food Restaurant [N=369]	51% (189)	15% (54)	19% (69)	5% (18)	11% (39)
Hotel [N=369]	4% (14)	3% (11)	8% (29)	12% (44)	73% (271)
Library [N=369]	3% (10)	1% (4)	6% (21)	11% (39)	80% (295)
Park or Public Space [N=369]	10% (37)	8% (28)	24% (88)	17% (63)	41% (153)
Restaurant [N=369]	31% (115)	17% (64)	26% (96)	9% (34)	16% (60)
Train Station [N=369]	10% (38)	8% (31)	20% (74)	18% (66)	43% (160)

Paid Access	1	2	3	4	5
Airport [N=368]	69% (253)	12% (45)	14% (50)	3% (11)	2% (9)
Bar [N=368]	94% (346)	2% (7)	4% (13)	1% (2)	0% (0)
Coffee Shop [N=368]	68% (249)	13% (47)	16% (58)	2% (7)	2% (7)
Fast Food Restaurant [N=367]	93% (340)	4% (14)	3% (12)	0% (1)	0% (0)
Hotel [N=368]	47% (174)	13% (47)	26% (94)	11% (39)	4% (14)
Library [N=368]	76% (280)	8% (29)	11% (42)	4% (13)	1% (4)
Park or Public Space [N=368]	87% (320)	6% (23)	5% (20)	1% (4)	0% (1)
Restaurant [N=368]	88% (324)	5% (20)	5% (19)	1% (4)	0% (1)
Train Station [N=368]	67% (247)	12% (45)	15% (55)	3% (12)	2% (9)

10. What computer hardware do you use to connect to the wireless Internet? (Check all that apply.) **[N=357]**

	Response Percent	Response Total
Laptop	99%	355
Personal Digital Assistant (PDA)	7%	24
Mobile Phone	8%	30
Gaming Device	1%	2
Other (please specify)	2%	6

11. Which of the following technologies do you own? (Check all that apply.) **[N=357]**

	Response Percent	Response Total
Laptop	99%	354
Personal Digital Assistant (PDA)	19%	69
Mobile Phone	75%	268
Pager	6%	20
Gaming Device	12%	42
iPod or MP3 Player	60%	215
Digital Camera	66%	236
Other (please specify)	4%	13

12. What Internet applications do you use while connected to the wireless Internet? (Check all that apply.) **[N=357]**

	Response Percent	Response Total
Instant Messenger	64%	227
E-mail Application	60%	213
Web-based E-mail	82%	291
Voice Application (VOIP)	19%	69
Microsoft Office	66%	236
Remote Desktop	14%	50
Virtual Private Network (VPN)	28%	99
Streaming Audio/Video Clips	48%	171
Other (please specify)	17%	59

13. Where else do you have access to the Internet? (Check all that apply.) **[N=357]**

	Response Percent	Response Total
Home	87%	312
Work	66%	236
School	47%	166
Library	58%	206
Other (please specify)	7%	24

14. Where do you have access to the high-speed (broadband) Internet i.e. DSL or Cable? (Check all that apply.) **[N=357]**

	Response Percent	Response Total
Home	80%	284
Work	64%	230
School	42%	151
Library	48%	170
Other (please specify)	7%	26

15. Have you had any problems using the wireless Internet? (Check all that apply.) **[N=603]**

	Response Percent	Response Total
Can't figure out how to connect to the network	25%	88
Did not know about the availability of the network	17%	60
Speed of the network is too slow	33%	119
Trouble viewing computer screen	3%	12
Concerns about privacy and security of data being transmitted over wireless network	26%	92
Concerns about theft of computer hardware	20%	70
Other (please specify)	33%	118

16. What websites do you access while you are using the wireless Internet at this location? **[N=282]**

	Response Percent	Response Total

17. What kinds of information do you access when using the wireless Internet at this location? (Check all that apply.) **[N=335]**

	Response Percent	Response Total
Financial information	26%	88
General news	79%	265
Government information	25%	85
Health or medical information	15%	50
Political news	48%	161
Product information	45%	151
Research for school or training	60%	200
Search for information about a hobby	51%	170
Search for information relevant to your geographic location	59%	199
Search for new job opportunities	30%	99
Sports information	19%	65
Travel information	30%	101
Weather information	51%	170
Other (please specify)	18%	61

18. What kind of activities do you do when using the wireless Internet at this location? (Check all that apply.) **[N=335]**

	Response Percent	Response Total
Accessing work Intranet	28%	92
Buy a product	31%	104
Buy or make a reservation for travel services	18%	61
Buy or sell stock online	4%	14
Contributing content to a blog	28%	93
Contributing content to a website (other than a blog)	27%	91
Downloading and listening to music	37%	124
Downloading and watching video clips	33%	110
Go online for fun or to pass time	53%	178
Graphic or web design	20%	67
Play online video games	12%	39
Send instant message	48%	161
Send or read e-mail	91%	306
Send or receive instant messages	53%	177
Send or receive music files	17%	57
Send or receive photos	33%	112
Take part in a chat room	11%	37
Writing or word processing	62%	207
Other (please specify)	11%	37

19. In addition to using the wireless Internet, what else do you usually do at these locations? (Check all that apply.) **[N=335]**

	Response Percent	Response Total
Eat meals	72%	240
Hold work meetings	26%	87
Make phone calls	39%	132
Meet friends	65%	217
Play video games	2%	8
Read	69%	230
Watch people	57%	191
Other (please specify)	25%	85

20. I usually go to this location with: **[N=335]**

	Response Percent	Response Total
Alone	85%	285
Co-workers or business colleagues	26%	86
Spouse/partner	24%	81
Children	3%	11
Other relatives	5%	15

Neighbors	3%	10
Members of a common organization or club	6%	21
Friends	53%	177
Other (please specify)	3%	10

21. Would you be willing to watch a short advertisement in exchange for free access to the wireless Internet at a café, park or other public space? **[N=335]**

	Response Percent	Response Total
Yes	39%	129
No	24%	79
Maybe	38%	127

22. Would you be willing to pay a small service charge at a coffee shop/restaurant/bar to support the availability of the wireless Internet? **[N=335]**

	Response Percent	Response Total
Yes	11%	36
No	56%	188
Maybe	33%	111

23. Given two coffee shops of similar characteristics and quality, would you choose the one that provides wireless Internet over the one that doesn't? **[N=335]**

	Response Percent	Response Total
Yes	91%	304
No	2%	5
Maybe	8%	26

24. What do you like about the wireless Internet? **[N=318]**

25. What do you dislike about the wireless Internet? **[N=301]**

26. Is there anything else that you would like to share about how you use the wireless Internet at this location? **[N=174]**

27. How did you learn about this survey? **[N=334]**

	Response Percent	Response Total
"Splash Page" or Website	87%	291
Flier	1%	2
Word of Mouth	3%	10
Other (please specify)	9%	31

28. Where else would you like to see a free, public wireless Internet network available? **[N=238]**

29. Are you interested in participating in future studies and follow up interviews on the use of mobile and wireless technology? **[N=334]**

	Response Percent	Response Total
Yes	40%	134
No	28%	94
Maybe	32%	106

30. If you would like to be entered into the drawing for an iPod, iTunes or a $300 donation to charity, please enter your contact information below. **[N=306]**

	Response Percent	Response Total
Name	99%	304
Phone Number	93%	284
E-mail Address	98%	305

31. What is your age? **[N=317]**

	Response Percent	Response Total
18-24	24%	76
25-34	48%	151
35-44	17%	55
45-54	10%	31
55-64	1%	3
Over 65	0.3%	1

32. What is your gender? **[N=317]**

	Response Percent	Response Total
Male	67%	213
Female	33%	104

33. What is your racial background? **[N=317]**

	Response Percent	Response Total
White, non-Hispanic	72%	228
Black, non-Hispanic	1%	4
Other, non-Hispanic	6%	19
Hispanic	4%	12
Asian	2%	7
Prefer Not to Answer	15%	47

34. What is your highest level of education? **[N=317]**

	Response Percent	Response Total
Less than high school	0%	0
Some high school, no diploma	1%	3
Graduated from high school, diploma or equivalent (GED)	4%	13
Some college, no degree	14%	43
Associate's degree	13%	41
Bachelor's degree	43%	135
Master's degree	15%	48
Professional degree	4%	14
Doctorate degree	6%	20

35. What is your annual income? **[N=317]**

	Response Percent	Response Total
Less than $5,000	11%	36
$5,000 to $7,499	4%	13
$7,500 to $9,999	5%	16
$10,000 to $12,499	7%	22
$12,500 to $14,999	3%	9
$15,000 to $19,999	7%	23
$20,000 to $24,999	13%	40
$25,000 to $29,999	8%	25
$30,000 to $34,999	9%	31
$35,000 to $39,999	5%	17
$40,000 to $49,999	5%	15
$50,000 to $59,999	5%	16
$60,000 to $74,999	7%	21
$75,000 to $84,999	2%	7
$85,000 to $99,999	3%	8
$100,000 to $124,999	4%	12
$125,000 to $149,999	0.3%	1
$150,000 to $174,999	0.3%	1
$175,000 or more	1.3%	4

36. What is your current employment status? **[N=317]**

	Response Percent	Response Total
Full-time Employee	29%	91
Part-time Employee	9%	28
Self-employed, Freelance Worker or Independent Contractor	22%	68
Entrepreneur or Owner/Partner in a Small Business, Professional Practice or Farm	5%	17
Full-time Student	27%	84

Unemployed -- looking for work	4%	12
Unemployed -- not looking for work	.6%	2
Retired	0%	0
Disabled	0%	0
Homemaker	1%	4
Other (please specify)	4%	11

37. What is your occupation? **[N=316]**

38. In what industry or sector do you work? **[N=538]**

	Response Percent	Response Total
Education	11%	36
Finance and Banking	2%	7
Government Sector	2%	7
Health and Medical	4%	13
Hospitality and Travel	3%	9
Insurance and Real Estate	0%	0
Manufacturing and Industry	2%	7
Media and Entertainment	14%	45
Non-profit Sector	4%	14
Professional Services (consulting, accounting, law)	9%	27
Science and Research	8%	24
Telecommunications and Information Technology	15%	46
Other (please specify)	26%	82

39. In what city, state and country do you live? **[N=317]**

40. In what city, state and country do you work? **[N=317]**

Budapest WiFi Survey Results

Sample: n=378 adults 18 and older
Survey dates: April 1, 2007 – April 30, 2007
Conducted in partnership with the Hungarian Wireless Community (HuWiCo)
Note: All results are rounded to the nearest percent unless result is less than .5% in which case it is reported as is.

Survey Questions and Results

1. Where have you used the wireless Internet in the past six months? (Check all that apply.) **[N=376]**

	Response Percent	Response Total
A38 Állóhajó	9%	35
Abszint étterem és kávézó	3%	11
Anna kávéház	2%	7
Belga Sörözo	3%	11
Box Utca Étterem	3%	11
Buena Vista Kávéház	2%	9
Burger King (bármelyik)	17%	62
Café Eklektika	4%	15
Cafe Montecassino (régi Rolling Rock)	0%	0
Cafe Zaccos	2%	8
Cafe Zenit	3%	10
California Coffee Company	8%	30
Centrál Kávéház	6%	21
Champs Sport Pub	0.3%	1
Columbus Étterem Hajó	1%	3
Corinthia Aquincum Hotel	2%	6
Don Pepe (bármelyik)	13%	47
Függetlenségi park és McTels pizzeria	2%	9
Goa Café	1%	4
Godot Kávéház	3%	11
Kiadó Kocsma	3%	11
Manchester Dartspub	1%	4
McDonald's (bármelyik)	30%	111
Promenád kávézó	3%	12
Replika kávézó	1%	4
Sarok Sörbár Darts Club	1%	4
Siófok – Surfbeach	3%	10
Szimpla Kert	16%	61
Szóda kávézó & mulató	11%	43

Uránia India Kávézó	2%	9
Uránia Virtual NetCafe	3%	11
Vízisípálya – Dunaharaszti	1%	4
Zöld Pardon	7%	25
Other	58%	218

2. Where have you used the wireless Internet most frequently in the past six months? (Enter the name of one of the locations above.) **[N=377]**

	Response Percent	Response Total
A38 Állóhajó	2%	6
Burger King (bármelyik)	4%	16
California Coffee Company	4%	15
Don Pepe (bármelyik)	6%	21
McDonald's (bármelyik)	16%	62
Szimpla Kert	7%	26
Szóda kávézó & mulató	3%	11
Zöld Pardon	2%	6
Other	49%	186

3. For the remainder of this survey, please respond based on your answer to Question 2 above. Do you go to this location specifically because of the availability of the wireless Internet? **[N=375]**

	Response Percent	Response Total
Yes	28%	106
No	38%	144
Sometimes	30%	112
Other (please specify)	4%	13

4. What is the primary purpose for which you use the wireless Internet at this location? **[N=376]**

	Response Percent	Response Total
Work Use	13%	49
Personal Use	29%	110
Both Work and Personal Use	57%	216
Other (please specify)	6%	23

5. How often do you use the wireless Internet at this location? **[N=374]**

	Response Percent	Response Total
More than once a day	11%	40
Daily	4%	14
Weekly	33%	124
Monthly	27%	99

Annually	4%	16
Very rarely	22%	81

6. How long do you normally spend using the wireless Internet at this location? **[N=375]**

	Response Percent	Response Total
15 minutes or less	22%	84
30 minutes	32%	118
1 hour	25%	94
2 hours	17%	62
4 hours	2%	7
More than 4 hours	3%	10

7. At what time of day do you usually use the wireless Internet at this location? (Check all that apply.) **[N=374]**

	Response Percent	Response Total
6 a.m. to 9 a.m.	6%	21
9 a.m. to Noon	25%	92
Noon to 3 p.m.	39%	144
3 p.m. to 6 p.m.	43%	162
6 p.m. to 9 p.m.	35%	131
9 p.m. to Midnight	13%	49

8. Why do you use the wireless Internet at this location? (Check all that apply.) **[N=375]**

	Response Percent	Response Total
To get out of my home/office	26%	99
To see familiar people/be part of a community	38%	142
To get information when I am just passing by	59%	220
Other (please specify)	18%	68

9. How likely are you to use the wireless Internet at each of the following? (1 = unlikely, 3 = neither likely or unlikely, 5 = very likely) **[N=374]**

Free Access	**1**	**2**	**3**	**4**	**5**
Airport **[N=374]**	13% (49)	6% (24)	13% (48)	11% (43)	56% (210)
Bar **[N=374]**	29% (109)	15% (55)	21% (78)	10% (39)	25% (93)

Coffee Shop **[N=374]**	7% (26)	6% (24)	18% (66)	22% (84)	47% (174)
Fast Food Restaurant **[N=374]**	27% (102)	13% (50)	19% (72)	9% (34)	31% (116)
Hotel **[N=374]**	8% (30)	3% (10)	9% (32)	9% (35)	71% (267)
Library **[N=373]**	12% (45)	9% (32)	12% (45)	13% (48)	54% (203)
Park or Public Space **[N=374]**	13% (48)	9% (33)	22% (81)	18% (67)	39% (145)
Restaurant **[N=374]**	30% (114)	20% (73)	24% (88)	8% (31)	18% (68)
Train Station **[N=374]**	17% (65)	11% (43)	18% (67)	15% (55)	39% (144)

Paid Access	**1**	**2**	**3**	**4**	**5**
Airport **[N=373]**	73% (273)	12% (43)	12% (44)	2% (6)	2% (7)
Bar **[N=373]**	90% (336)	6% (22)	3% (10)	1% (2)	1% (3)
Coffee Shop **[N=373]**	74% (277)	13% (50)	9% (34)	2% (6)	2% (6)
Fast Food Restaurant **[N=373]**	83% (309)	9% (33)	6% (22)	1% (4)	1% (5)
Hotel **[N=373]**	53% (199)	12% (43)	22% (83)	8% (30)	5% (18)
Library **[N=373]**	75% (279)	10% (38)	9% (34)	4% (14)	2% (8)
Park or Public Space **[N=373]**	84% (315)	8% (30)	4% (15)	2% (6)	2% (7)
Restaurant **[N=373]**	88% (329)	6% (24)	4% (15)	1% (2)	1% (3)
Train Station **[N=373]**	77% (286)	12% (44)	8% (29)	2% (9)	1% (5)

10. What computer hardware do you use to connect to the wireless Internet? (Check all that apply.) **[N=368]**

	Response Percent	Response Total
Laptop	87%	320
Personal Digital Assistant (PDA)	33%	121
Mobile Phone	22%	81
Gaming Device	.5%	2
Other (please specify)	4%	15

11. Which of the following technologies do you own? (Check all that apply.) **[N=368]**

	Response Percent	Response Total
Laptop	91%	336
Personal Digital Assistant (PDA)	43%	157

Mobile Phone	94%	345
Pager	.8%	3
Gaming Device	9%	33
iPod or MP3 Player	53%	196
Digital Camera	28%	104
Other (please specify)	3%	11

12. What Internet applications do you use while connected to the wireless Internet? (Check all that apply.) **[N=368]**

	Response Percent	Response Total
Instant Messenger	69%	255
E-mail Application	72%	263
Web-based E-mail	66%	241
Voice Application (VOIP)	47%	173
Microsoft Office	42%	153
Remote Desktop	28%	103
Virtual Private Network (VPN)	30%	109
Streaming Audio/Video Clips	32%	116
Other (please specify)	14%	50

13. Where else do you have access to the Internet? (Check all that apply.) **[N=368]**

	Response Percent	Response Total
Home	96%	353
Work	79%	291
School	36%	132
Library	15%	55
Other (please specify)	7%	25

14. Where do you have access to the high-speed (broadband) Internet i.e. DSL or Cable? (Check all that apply.) **[N=368]**

	Response Percent	Response Total
Home	96%	352
Work	77%	284
School	32%	118
Library	11%	39
Other (please specify)	4%	15

15. Have you had any problems using the wireless Internet? (Check all that apply.) **[N=368]**

	Response Percent	Response Total
Can't figure out how to connect to the network	21%	76

Did not know about the availability of the network	14%	53
Speed of the network is too slow	49%	180
Trouble viewing computer screen	26%	94
Concerns about privacy and security of data being transmitted over wireless network	22%	81
Concerns about theft of computer hardware	21%	78
No problems	24%	88
Other (please specify)	8%	29

16. What websites do you access while you are using the wireless Internet at this location? **[N=275]**

	Response Percent	Response Total

17. What kinds of information do you access when using the wireless Internet at this location? (Check all that apply.) **[N=346]**

	Response Percent	Response Total
Financial information	41%	140
General news	78%	271
Government information	15%	51
Health or medical information	6%	22
Political news	40%	139
Product information	45%	154
Research for school or training	15%	53
Search for information about a hobby	62%	215
Search for information relevant to your geographic location	56%	194
Search for new job opportunities	13%	46
Sports information	14%	47
Travel information	31%	108
Weather information	45%	157
Other (please specify)	15%	53

18. What kind of activities do you do when using the wireless Internet at this location? (Check all that apply.) **[N=346]**

	Response Percent	Response Total

Accessing work Intranet	40%	139
Buy a product	21%	71
Buy or make a reservation for travel services	20%	70
Buy or sell stock online	3%	11
Contributing content to a blog	18%	61
Contributing content to a website (other than a blog)	23%	81
Downloading and listening to music	30%	105
Downloading and watching video clips	28%	96
Go online for fun or to pass time	67%	232
Graphic or web design	13%	45
Play online video games	9%	34
Send instant message	55%	190
Send or read e-mail	88%	306
Send or receive instant messages	53%	182
Send or receive music files	9%	30
Send or receive photos	17%	59
Take part in a chat room	7%	24
Writing or word processing	31%	107
Other (please specify)	7%	25

19. In addition to using the wireless Internet, what else do you usually do at these locations? (Check all that apply.) **[N=346]**

	Response Percent	Response Total
Eat meals	77%	267
Hold work meetings	31%	108
Make phone calls	64%	221
Meet friends	66%	230
Play video games	6%	22
Read	26%	89
Watch people	37%	129
Other (please specify)	9%	33

20. I usually go to this location with: **[N=346]**

	Response Percent	Response Total
Alone	75%	260
Co-workers or business colleagues	30%	105
Spouse/partner	31%	107
Children	3%	9
Other relatives	2%	7
Neighbors	.6%	2
Members of a common organization or club		

	9%	31
Friends	48%	165
Other (please specify)	2%	6

21. Would you be willing to watch a short advertisement in exchange for free access to the wireless Internet at a café, park or other public space? **[N=346]**

	Response Percent	Response Total
Yes	58%	200
No	13%	44
Maybe	30%	102

22. Would you be willing to pay a small service charge at a coffee shop/restaurant/bar to support the availability of the wireless Internet? **[N=346]**

	Response Percent	Response Total
Yes	30%	105
No	38%	131
Maybe	32%	110

23. Given two coffee shops of similar characteristics and quality, would you choose the one that provides wireless Internet over the one that doesn't? **[N=346]**

	Response Percent	Response Total
Yes	75%	260
No	4%	15
Maybe	21%	71

24. What do you like about the wireless Internet? **[N=283]**

25. What do you dislike about the wireless Internet? **[N=272]**

26. Is there anything else that you would like to share about how you use the wireless Internet at this location? **[N=160]**

27. How did you learn about this survey? **[N=337]**

	Response Percent	Response Total
"Splash Page" or Website	43%	146
HuWiCo Listserv	5%	17
HuWiCo Website	13%	45
Flier	.3%	1
Word of Mouth	2%	8
Other (please specify)	36%	120

28. Where else would you like to see a free, public wireless Internet network available? **[N=202]**

29. Are you interested in participating in future studies and follow up interviews on the use of mobile and wireless technology? **[N=337]**

	Response Percent	Response Total
Yes	34%	113
No	25%	85
Maybe	41%	139

30. If you would like to be entered into the drawing for an iPod, iTunes or a $300 donation to charity, please enter your contact information below. **[N=125]**

	Response Percent	Response Total
Name	92%	115
Phone Number	46%	58
E-mail Address	95%	119

31. What is your age? **[N=313]**

	Response Percent	Response Total
18-24	34%	106
25-34	45%	140
35-44	16%	51
45-54	5%	16
55-64	0%	0
Over 65	0%	0

32. What is your gender? **[N=313]**

	Response Percent	Response Total
Male	94%	293
Female	6%	20

33. What is your highest level of education? **[N=313]**

	Response Percent	Response Total
Less than high school	1%	3
Graduated from high school, diploma or equivalent (GED)	41%	127
Some College	28	89
Bachelor's degree	30%	94

34. What is your annual income? **[N=313]**

	Response Percent	Response Total
Less than $3K[6061]	28%	86
Between $3K and $6K	12%	36
Between $6K and $12K	18%	57
Between $12K and $17K	16%	51
Between $17K and $29K	13%	41
Between $29K and $58K	8%	26
More than $58K	5%	16

35. What is your current employment status? **[N=313]**

	Response Percent	Response Total
Full-time Employee	42%	130
Part-time Employee	4%	13
Self-employed, Freelance Worker or Independent Contractor	25%	79
Entrepreneur or Owner/Partner in a Small Business, Professional Practice or Farm	.3%	1
Full-time Student	23%	72
Unemployed -- looking for work	2%	6
Unemployed -- not looking for work	.3%	1
Retired	0%	0
Disabled	0%	0
Homemaker	.3%	1
Other (please specify)	3%	10

36. What is your occupation? **[N=313]**

37. In what industry or sector do you work? **[N=313]**

	Response Percent	Response Total
Education	8%	26
Finance and Banking	3%	8
Government Sector	4%	12
Health and Medical	2%	5
Hospitality and Travel	2%	5
Insurance and Real Estate	.3%	1
Manufacturing and Industry	8%	24
Media and Entertainment	9%	29
Non-profit Sector	1%	4
Professional Services (consulting, accounting, law)	2%	6
Science and Research	5%	15
Telecommunications and Information Technology		

[60] 1 USD = 173 Hungarian Forints (HUF), XE.com. Accessed on January 8, 2008.
[61] Results rounded to the nearest thousand USD.

	41%	127
Other (please specify)	16%	51

38. In what city, state and country do you live? **[N=313]**

39. In what city, state and country do you work? **[N=313]**

New York In-depth Interviews

Sample: n=29 adults 18 and older
Interview dates: October 1, 2006 – April 30, 2007
One-hour in-depth interviews conducted on-site at WiFi hotspots.

Occupation
Academic (1)
Equipment Repair (1)
Finance (1)
\Graphic Illustrator (1)
Hospitality (1)
Law (1)
Media Production (1)
Non-profit organization (4)
Performer (1)
Public Relations (2)
Technology (7)
Translation (1)
Web-design (2)
Writer (3)

Freelance/Self Employed (13)
Equipment Repair (1)
Graphic Illustrator (1)
Law (1)
Public Relations (2)
Technology (2)
Translator (1)
Web-design (2)
Writer (3)

Full-time (14)
Academic (1)
Finance (1)
Hospitality (1)
Media Production (1)
Non-profit organization (4)
Performer (1)
Technology (5)

Unemployed (2)

Expert Interviews

United States (January 2005-April 2007)
Douglas Fraser, Backnet (Edinburgh, Scotland)
Anthony Townsend (NYCwireless, New York, NY)
Ulf Kypke (wlanhain, Berlin, Germany)
Xavier Leonard (Heads on Fire, San Diego, California)
Chris Hillabrant, T-Mobile
Jennifer Siegal, Office of Mobile Design
John Horrigan, Pew Internet and American Life Project
Joseph Michelli, Author of "The Starbucks Experience"
Michael Lewis, Wireless Harlem
Matt Westervelt, Seattle Wireless

Japan (Summer 2003)
Robert Wagner and Andre Fischer, Product Visionaires (Siemens subsidiary)
Mizuko Ito, University of Southern California

Hungary (September 2004)
Jerzy Celichowski, Open Society Institute
Bodo Balazs, Budapest Technical University
Kristof Nyiri, Hungarian Academy of Philosophy
Mátyás Gáspár, UNDP
Vili, Josephus, Steve, Attila (Hungarian Wireless Community)
Krisztián Zana, Balázs Takács, Aniko Karath ("New York Live" Project)
Laszlo Karvalics, Technical University of Budapest
Zoltan Papai, Independent Consultant

Germany (October 2004)
Markus Beckedahl, Network New Media
Juergen Neumann, Freifunk and Ergomedia
Corinna "Elektra" Aichele and Cven Wagner, C-base
Miriam Struppek, Independent Artist and Urban Planner
Oliver Passek, Consultant, Green Party
Frank Steuer, Open Broadband Access Network
Holgar Weiss, Gate 5
Clemens Cap, Rostock University

Bibliography

A World of Connections. (2007, April 28). *The Economist.*

Anderson, B. (1983). *Imagined Communities: Reflections on the Origin and Spread of Nationalism.* New York, NY: Verso.

Axinn, W. G., & Pearce, L. D. (2006). *Mixed method data collection strategies.* Cambridge ; New York: Cambridge University Press.

Bar, F., & Galperin, H. (2004). Building the Wireless Internet Infrastructure: From Cordless Ethernet Archipelagos to Wireless Grids. *Communications and Strategies, 54*(2), 45-68.

Bar, F., & Galperin, H. (2006). Geeks, Cowboys, and Bureaucrats: Deploying Broadband, the Wireless Way. *The Southern African Journal of Information and Communication (SAJIC)*(6).

Bar, F., & Park, N. (2006). Municipal Wi-Fi networks: The Goals, Practices, and Policy Implications of the U. S. Case. *Communications & Stratégies*(61), 107-125.

Benkler, Y. (2006). *The Wealth of Networks: How Social Production Transforms Markets and Freedom*: Yale University Press New Haven, CT, USA.

Beunza, D., & Stark, D. (2003). The Organization of Responsiveness: Innovation and Recovery in the Trading Rooms of Lower Manhattan. *Socio-Economic Review, 1*(2), 135-164.

Beunza, D., & Stark, D. (2004). *A Desk on the 20th floor: Survival and Sense-making in a Trading Room.* New York: Russell Sage Foundationo. Document Number)

Beunza, D., & Stark, D. (2005). Resolving Identities: Successive Crises in a Trading Room after 9/11. *Wounded City: The Social Impact of 9/11, 1*, 293-320.

Bijker, W. E., Hughes, T. P., & Pinch, T. (1987). *The Social Construction of Technological Systems.* Cambridge, MA: The MIT Press.

Bloemink, B., Hodge, B., Lupton, E., & MCQuaid, M. (2006). *Design Life Now: National Design Triennial 2006.* New York: Smithsonian, Copper-Hewitt, National Design Museum.

Boczkowski, P. J., & Lievrouw, L. A. (2007). Bridging STS and Communication Studies: Scholarship on Media and Information Technologies. In E. J. Hackett, O. Amsterdamska, M. Lynch & J. Wajcman (Eds.), *New Handbook of Science and Technology Studies.* Cambridge, MA: MIT Press.

Brown, B., & O'Hara, K. (2003). Place as a Practical Concern of Mobile Workers. *Environment and Planning, A 35*(9), 1565-1587.

Cannon, L. (1978, September 24). Hawaiian Politics Has an Ethnic Cast; Japanese-American Domination Is Challenged in Violent Primary. *The Washington Post,*

Carey, J. W. (1988). *Communication As Culture: Essays on Media and Society.* New York: Unwin Hyman, Inc.

Castells, M. (1996). *The Rise of the Network Society.* Malden, MA: Blackwell Publishers.

Chang, M., Jungnickel, K., Orloff, C., & Shklovski, I. (2005). *Engaging the City: Public Interfaces as Civic Intermediary.* Paper presented at the CHI '05.

Christensen, C. M. (1997). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*: Harvard Business School Press.

Clark, D. (1991, April 22). Computing Without Wires: A new generation of portables will alter the way we compute. *The San Francisco Chronicle*,

Couldry, N., & McCarthy, A. (2004). *Mediaspace: Place, Scale and Culture in a Media Age*. London: Routledge.

Crang, M., & Thrift, N. J. (2000). *Thinking Space*: Routledge.

Creswell, D. J. W. (2003). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*: Sage.

de Sola Pool, I. (1977). *The Social Impact of the Telephone*. Cambridge, MA: The MIT Press.

DeSanctis, G., & Monge, P. (1999). Introduction to the Special Issue: Communication Processes for Virtual Organizations. *Organization Science, 10*(6), 693-703.

Dole, C. E. (1986, January 13). Electronic tracking system designed to help police curb car theft. *Christian Science Monitor*,

Eisenstein, E. (1968). Some Conjectures about the Impact of Printing on Western Society and Thought: A Preliminary Report. *Journal of Modern History, 40*.

Fehr, S. C. (1994, April 27). Voices From the Underground; Metro Expands Cellular Phone Service on Its Trains. *The Washington Post*,

Finan, K. (2005, June 12). Text messaging - the impersonal touch. *The Houston Chronicle*,

Fischer, C. S. (1992). *America Calling: A Social History of the Telephone to 1940*. . Berkeley, CA: University of California Press.

Fitzgerald, T. J. (2004, July 22). E-Mail in Your Hand, No Matter Where You Go. *The New York Times*,

Florida, R. L. (2002). *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life*. New York: Basic Books.

Florida, R. L. (2005a). *Cities and the Creative Class*. New York: Routledge.

Florida, R. L. (2005b). *The Flight of the Creative Class: The New Global Competition for Talent*. New York: HarperBusiness.

Forlano, L. (2002, August). New York City Goes Wireless. *Gotham Gazette*,

Forlano, L. (2006). Activist Infrastructures: The Role of Community Wireless Organizations in Authenticating the City. *Eastbound, 1*.

Fost, D. (2007, January 14). From shows, a new kind of technology emerges. *The Houston Chronicle*,

Friedman, T. L. (1983, July 17). Living with the Violence of Beirut. *The New York Times*,

Fuentes-Bautista, M., & Inagaki, N. (2006). Reconfiguring public Internet access in Austin, TX: Wi-Fi's promise and broadband divides. *Government Information Quarterly, 23*(3-4), 404-434.

Gibson, J. J. (1977). The theory of affordances. *Perceiving, acting and knowing: toward an ecological psychology*, 67–82.

Gibson, O. (2006a, June 27). Mobile phone users will be able to buy songs from radio: Main record labels sign up to 'killer' technology: Users to get free second copy for iPod-type players. *The Guardian*,

Gibson, O. (2006b, June 26). Smart media: Broadcasting: Anytime, anyplace, anywhere: It's going to be a tough wake-up call for any media corporation built to deliver

ready-made content to a passive audience, but the BBC has smelt the coffee. *The Guardian*,

Gillespie, A., & Richardson, R. (2000). Teleworking and the City: Myths of Workplace Transcendence and Travel Reduction. *Cities in the Telecommunications Age: The Fracturing of Geographies*, 228–245.

Gillett, S. E. (2006). Municipal Wireless Broadband: Hype or Harbinger? *Southern California Law Review, 79*, 561-594.

Girard, M., & Stark, D. (2002). Distributing Intelligence and Organizing Diversity in New Media Projects. *Environment and Planning A, 34*(11), 1927-1949.

Goldberg, A. (2001, September 13). Microsoft marches on The American software giant's global monopoly is

set to become even more powerful, says Andy Goldberg. *The Daily Telegraph*,

Granovetter, M. S. (1973). The Strength of Weak Ties. *The American Journal of Sociology, 78*(6), 1360-1380.

Grimmelmann, J. (2005). Regulation By Software. *Yale Law Journal, 114*, 1719-1758.

Gupta, N. (2004). *Grande WiFi: Understanding What WiFi Users are Doing in Coffee-Shops*. Massachusetts Institute of Technology, Cambridge.

Hampton, K. N., & Gupta, N. (forthcoming). Community and Social Interaction in the Wireless City: Wi-Fi use in Public and Semi-Public Spaces. *New Media & Society*.

Hampton, K. N., Livio, O., & Trachtenberg, C. (2007). Is WiFI use Compatible with Public Spaces? Wireless Internet Use, Sociability, and Social Networks.

Horowitz, S., Buchanan, S., Alexandris, M., Anteby, M., Rothman, N., Syman, S., et al. (2005). *The Rise of the Freelance Class: A New Constituency of Workers Building a Social Safety Net* New York: Freelancers Uniono. Document Number)

Horrigan, J. (2007). *Wireless Internet Access*. Washington, D.C.: Pew Internet & American Life Projecto. Document Number)

Horrigan, J. (2008). *Mobile Access to Data and Information*. Washington, DC: Pew Internet & American Life Projecto. Document Number)

Howard, P. (2002). Network ethnography and the hypermedia organization: new media, new organizations, new methods. *New Media & Society, 4*(4), 550.

Innis, H. (1951). *The Bias of Communication*. Toronto, Canada University of Toronto Press.

Ito, M. (2003). *Mobile Phones, Japanese Youth, and the Re-Placement of Social Contact. Front Stage - Back Stage: Mobile Communication and the Renegotiation of the Social Sphere*. from http://www.itofisher.com/PEOPLE/mito/ mobileyouth.pdf

Ito, M., Okabe, D., & Matsuda, M. (2005). *Personal, Portable, Pedestrian: Mobile Phones in Japanese Life*: MIT Press.

Jesdanun, A. (2007, May 21). Cities Struggle With Wireless Internet. *The Associated Press*,

Johnson, L. A. (2004, October 27). A Tough Call; Call Growing Use of Camera; Cell Phones Shows how New Technology can Bring Out; the Best and the Worst. *Pittsburgh Post-Gazette*,

Jungnickel, K. (2008). Making WiFi. Retrieved February 17, 2008, from http://www.studioincite.com/makingwifi/

Kang, J., & Cuff, D. (2005). Pervasive Computing: Embedding the Public Sphere. *Washington & Lee Law Review.*

Katz, J. E., & Aakhus, M. (Eds.). (2002). *Perpetual Contact: Mobile Communication, Private Talk, and Public Performance.* New York, NY: Cambridge University Press.

Kehoe, L. (1992, November 10). Latest gadgets jump the gun - Technically Speaking. *Financial Times,*

Kelly, J., & Stark, D. (2002). Crisis, Recovery, Innovation: Learning from 9/11. *Environment and Planning A, 34*(9), 1523-1533.

Knapp, L. (2007, March 31). Let Jott get your message across; Getting Started. *The Seattle Times,*

Knook, P. (2007, February 12). See mobility as a lifeline, not a chain *Financial Times,*

Lambert, B. (2006, April 28). Suffolk County Plans to Offer Free Wireless Internet Access. *The New York Times,*

Largest Anti-Surveillance Street Protest In Germany For 20 Years [Electronic. (2007). Version]. *EDRI-gram.* Retrieved January 10, 2008,

Latour, B. (2005). *Reassembling the Social: an introduction to actor-network-theory*: Oxford University Press.

Lee, S. (1999). Private Uses in Public Spaces. *New Media & Society, 1*(3), 331-350.

Lehr, W., Sirbu, M., & Gillett, S. (2004). *Municipal Wireless Broadband: Policy and Business Implications of Emerging Access Technologies.* Paper presented at the Competition in Networking: Wireless and Wireline.

Lehr, W., Sirbu, M., & Gillett, S. (2006). Wireless is changing the policy calculus for municipal broadband. *Government Information Quarterly, 23*(3-4), 435-453.

Lessig, L. (1999). *Code and Other Laws of Cyberspace.* New York: Basic Books.

Liff, S., & Laegran, A. S. (2003). Cybercafes: Debating the Meaning and Significance of Internet Access in a Cafe Environment. *New Media & Society, 5*(3), 307-312.

Liff, S., & Steward, F. (2003). Shaping E-access in the Cybercafe: Networks, Boundaries and Heterotopian Innovation. *New Media & Society, 5*(3), 313-334.

Longford, G. (2005). Community Networking and Civic Participation in Canada: A Background Paper (CRACIN Working Paper No. 2).

Marvin, C. (1988). *When Old Technologies Were New: Thinking about Electric Communication in the Late Nineteenth Century.* New York, NY: Oxford University Press.

Mazmanian, M., Orlikowski, W. J., & Yates, J. (2006). *CrackBerrys: Exploring the Social Implications of Ubiquitous Wireless Email Devices.* Paper presented at the European Group for Organizational Studies.

Medosch, A. (2006). On free wavelengths: wireless networks as techno-social models. from http://theoriebild.ung.at/view/Main/FreeWavelength

Meinrath, S. (2005). Community Wireless Networking and Open Spectrum Usage: A Research Agenda to Support Progressive Policy Reform of the Public Airwaves. *The Journal of Community Informatics, 1*(2), 174-179.

Meinrath, S. (2007). Bylaws. International Association for Community Wireless Networks

Middleton, C. (2003). Broadband Internet Usage Outside the Home: Insights from a Study of Toronto Internet Cafes. Ryerson University.

Mosco, V. (2004). *The Digital Sublime: Myth, Power, and Cyberspace*. Cambridge, MA: MIT Press.

Moultrie, J., Nilsson, M., Dissel, M., Haner, U.-E., Janssen, S., & Van Der Lugt, R. (2007). Innovation Spaces: Towards a Framework for Understanding the Role of the Physical Environment in Innovation. *Creativity and Innovation Management, 16*(1), pp. 53-65.

Nelson, R. R. (1991). Why Do Firms Differ, and How Does it Matter? *Strategic Management Journal, 12*, 61-74.

Nelson, R. R. (1995). Recent Evolutionary Theorizing About Economic Change. *Journal of Economic Literature, 33*(1), 48-90.

Nissenbaum, H. (2001). How computer systems embody values. *Computer, 34*(3), 120.

Noam, E. (2005). *The Commons as an Enabler of Commerce.* Paper presented at the conference on The Economics of the Commons: Organizing Private Transactions in Communications, Columbia Institute for Tele-Information, New York, NY.

Norman, D. A. (1990). *The Design of Everyday Things*. New York: Doubleday.

O'Mahony, S. C. (2002). *The Emergence of a New Commercial Actor: Community Managed Software Projects* Stanford University.

Oldenburg, R. (1989). *The Great Good Place: Cafés, Coffee Shops, Community Centers, Beauty Parlors, General Stores, Bars, Hangouts and how They Get You Through the Day*. New York: Paragon House.

Paul, A., Shetty, P., & Krishnan, S. (2005). The City as Extracurricular Space: Re-instituting Urban Pedagogy in South Asia. *Inter-Asia Cultural Studies, 6*(3).

Pedersen, P. E., & Ling, R. S. (2005). *Mobile Communications: re-negotiation of the social sphere*: Springer.

Perlman, J. E. (1999). *Urban Sustainability Principles: Lessons Learned from the Mega-Cities Project* o. Document Number)

Poole, M. S. (1999). Organizational Challenges for the New Forms. In G. DeSanctis & J. Fulk (Eds.), *Shaping Organizational Form: Communication, Connection, and Community* (pp. 453-471): Sage Publications.

Powell, A. (2003). Space, Place, Reality and Virtuality in Urban Internet Cafes. Unpublished Unpublished manuscript. Ryerson and York Universities.

Powell, A., & Shade, L. R. (2006). Going Wi-Fi in Canada: Municipal and community initiatives. *Government Information Quarterly, 23*(3-4), 381-403.

Putnam, R. D. (2000). *Bowling Alone: The Collapse and Revival of American Community*. New York, NY: Touchstone.

Rheingold, H. (2003). *Smart Mobs*. Cambridge, MA: Perseus Books Group.

Rigby, E. (2000, October 4). The debate hots up. *The Financial Times*,

Rogers, R. (2006). *Mapping Webspace with Issuecrawler*: GovCom.orgo. Document Number)

Sandvig, C. (2004). An Initial Assessment of Cooperative Action in Wi-Fi Networking. *Telecommunications Policy, 28*(7/8), 579-602.

Sandvig, C. (2006). Disorderly infrastructure and the role of government. *Government Information Quarterly, 23*(3-4), 503-506.

Sandvig, C., Young, D., & Meinrath, S. (2004). *Hidden Interfaces to "Ownerless" Networks.* Paper presented at the 32nd Conference on Communication, Information, and Internet Policy, Washington, DC.

Sarbaugh-Thompson, M., & Feldman, M. S. (1998). Electronic Mail and Organizational Communication: Does Saying" Hi" Really Matter? *Organization Science, 9*(6), 685-698.

Sawada, M., Cossette, D., Wellar, B., & Kurt, T. (2006). Analysis of the urban/rural broadband divide in Canada: Using GIS in planning terrestrial wireless deployment. *Government Information Quarterly, 23*(3-4), 454-479.

Scary Consequences of Ubiquitous Computing. (2003, August 9). *Asahi Shimbun,*

Schlosser, J. (2006, March 22). Cubicles: The Great Mistake. *Fortune.*

Schrage, M. (1999). *Serious Play: How the World's Best Companies Simulate to Innovate.* Cambridge: Harvard Business School Press.

Shales, T. (1977, December 25). The Best of All Possible Gifts; The Gift of Gifts. *The Washington Post,*

Sidel, P., & Mayhew, G. (2003). The Emergence of Context: A Survey of MobileNet User Behavior.

Sirbu, M., Lehr, W., & Gillett, S. (2006). Evolving wireless access technologies for municipal broadband. *Government Information Quarterly, 23*(3-4), 480-502.

Solomon, D. (1999, August 4). Talk Not Cheap on S.F. Cells; Phone rates among highest in nation. *The San Francisco Chronicle,*

Spiegel, D. (2003). Wireless Park Lab Days. New York: NYCwireless.

Star, S. L. (1999). The Ethnography of Infrastructure. *American Behavioral Scientist, 43*(3), 377.

Star, S. L., & Bowker, G. C. (2002). How to infrastructure. *Handbook of New Media-Social Shaping and Consequences of ICTs, SAGE Pub., London, UK,* 151-162.

Star, S. L., & Strauss, A. (1999). Layers of Silence, Arenas of Voice: The Ecology of Visible and Invisible Work. *Computer Supported Cooperative Work (CSCW), 8*(1), 9-30.

Stewart, J. (1999). Cafematics: The Cybercafe and the Community. University of Edinburgh.

Strover, S., & Mun, S.-H. (2006). Wireless broadband, communities, and the shape of things to come. *Government Information Quarterly, 23*(3-4), 348-358.

Suchman, L. (1987). *Plans and Situated Actions.* New York, NY: Cambridge University Press.

Tapia, A., Maitland, C., & Stone, M. (2006). Making IT work for municipalities: Building municipal wireless networks. *Government Information Quarterly, 23*(3-4), 359-380.

Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology : combining qualitative and quantitative approaches.* Thousand Oaks, Calif.: Sage.

Thrift, N. (2004). Movement-space: The changing domain of thinking resulting from the development of new kinds of spatial awareness. *Economy and Society, 33*(4), 582-604.

Thriving Office. (2007).

Townsend, A. M. (2005). *Wired/Unwired: The Urban Geography of Digital Networks.* Unpublished Unpublished doctoral dissertation, Massachusetts Institute of Technology, Boston.

Tripsas, M., & Shah, S. K. (2007). The Accidental Entrepreneur: The Emergent and Collective Process of User Entrepreneurship. *Harvard Business School Entrepreneurial Management Working Paper No. 04-054.*

Uzzi, B., & Dunlap, S. (2005). How to Build Your Network. *Harvard Business Review, 83*(12), 53-60.

Von Hippel, E. (1978). Users as Innovators. *Technology Review, 80*(3), 31-39.

Von Hippel, E. (2005). *Democratizing Innovation.* Cambridge: MIT Press.

Vos, E. (2007). March 2007 update of wireless cities and counties in the US [Electronic Version]. *MuniWireless.com.* Retrieved May 9, 2007, from http://www.muniwireless.com/article/articleview/5868/1/23

Wakeford, N. (2003). The Embedding of Local Culture in Global Communication: Independent Internet Cafes in London. *New Media & Society, 5*(3), 379-399.

Watson-Manheim, M. B., Chudoba, K. M., & Crowston, K. (2002). Discontinuities and continuities: A new way to understand virtual work. *Information, Technology and People, 15*(3), 191-209.

Weiser, M. (1991). The Computer for the Twenty-First Century. *Scientific American, 265*(3), 94-104.

Wellman, B., & Haythornthwaite, C. (2002). *The Internet in Everyday Life.* Malden, MA Blackwell Publishers Ltd. .

Werbin, K. C. (2006). Where is the 'Community' in Community Networking Initiatives? Stories From the 'Third Spaces' of Connecting Canadians (CRACIN Working Paper No. 11).

Wiseman, P., & Kim, J. (1994, July 26). A wireless alliance / Bigger is better in this gold rush. *USA TODAY,*

Wu, T. (2003). When Code Isn't Law. *Virginia Law Review, 89*(4), 679-751.

Zeidenberg, J. (1990, May 29). Ultra-portable phones gall diners, but trend seems relentless. *The Globe and Mail,*

Zitner, A. (1994, December 4). For sale: A new world of wireless; 'PCS' could offer a phone in every pocket, an antenna on every Coke machine. *The Boston Globe,*