THE LONDON SCHOOL
OF ECONOMICS AND
POLITICAL SCIENCE ■

LSE Research **Online**

Alison Powell

Metaphors, models and communicative spaces: designing local wireless infrastructure

Article (Submitted version)
(Pre-refereed)

Metaphors, Models and Communicative Spaces: Designing local wireless infrastructure

Alison Powell
Department of Media and Communications
London School of Economics
a.powell@lse.ac.uk

Abstract

Communications policies, like many other social policies, are founded on an ideal of democracy that frames increased access to and autonomy of communication infrastructure as aspects of democratic public spheres. Projects that aim at developing these capacities must grapple with the way such new media technologies are integrated into existing contexts or spaces, often using metaphors to frame their expectations. This paper analyzes how such metaphors are employed in the case of local wireless networking. Based on the nature of the metaphors employed, are local wireless networks – developed either top-down or bottom up – likely to produce more democratic communication spaces? Referring to empirical research on networks located in Montreal and Fredericton, Canada, the paper critiques the narrow approach to democratization of communication spaces inherent in networks of this type. This narrow focus is associated with metaphors used to describe a co-evolution of wireless technology and urban space. The paper identifies that the design processes that shape these networks could benefit from a more radical democratization associated with metaphors of recombination of space and technology. Such a shift in the framing and design of urban technology projects would have an impact on local wireless projects as well as many other projects aimed at democratizing communications or otherwise advancing social justice aims.

Keywords

Metaphors
Democratic communication spaces
Broadband networks
Community Networks
Participation

Introduction

Communications policies, and many other social policies are founded on an ideal of democracy that

frames greater communication as part of a more democratic public sphere. References to the public

sphere extend back to pragmatists Dewey (1963) and Lippmann (1925), but more recent investigations

have questioned the extent to which more democratic communications is aligned with more democratic

access to – and production of – communications infrastructure. These include alternative and

autonomous media such as local and community radio, as well as community networking projects

oriented towards providing access to and engagement with digital media and the Internet. These

democratic media projects often hold two parallel but connected aims: to engage civil society actors in

the production of communications media, and to advocate for expanded access to communications.

For community networks, in particular, these connected aims are also bound up in an articulation

between technical innovation and social progress, especially as they are made visible within urban

spaces (see Schuler, 1996 and Kavanaugh et al, 2001). Alternative structures for production,ownership,

and governance of communication infrastructures suggest potential reconfigurations of civic space as

well as opportunities for alternative social policies. This paper analyzes the connection between the

production of democratic communication spaces and the production of communication policies, by

exploring the metaphors used by the designers of community wireless networks. The production of

these local networks, which use wireless devices to provide alternative means of accessing the internet

can be read as an attempt to produce or reinvigorate mediated public spheres (see Powell, 2008), more

civic engagement (see Tapia and Ortiz, forthcoming) or, differently put, more democratic

communication spaces that are available to more people. Two urban wireless networks which use similar technology but have very different organizational structures, are analyzed in terms of the metaphors mobilized by their designers and promoters. These metaphors are records of attempts to frame the potential of the local wireless networks to create more democratic communications spaces. This process parallels other, more general, processes through which technology, especially information and communication technologies (ICTs) are framed as bestowing economic, social, or legal benefits (Nye, 2006). In essence, the different metaphors suggest different policy opportunities for establishing democratic communication spaces within cities. As Lakoff and Johnson (1980) make clear, metaphors are not merely figures of speech, they are fundamental means of forming the concepts that we use to order society. Sawhney (1996) claims that metaphors are exploratory hypotheses: the most salient capture the "liberty of action" where, as Cherry (1977) argues, "each technology offers freedom of movement along a certain dimension" (p. 295). In other words, metaphors act as ways to frame the new possibilities afforded by novel technologies and thus to define their desired social or economic impacts. The paper asks two questions: first, what understanding of democratic communications is implicit in the metaphors used by the designers and proponents of local wireless networks? Second, what do the limitations of these metaphors illustrate about the opportunities and constraints on participation in communication policy, and social policy in general?

Democratic Communication Spaces

Concerns about the democratization of communication and the potential of different types of spaces to contribute to greater democracy have contributed to efforts to involve more civil society actors in the production of and governance of communications systems. Normatively, these efforts connect with the ideal of a democratic public sphere in which communication is linked to participation and a protean

notion of democracy. Dahlgren (2001) writes that "the notion of the public sphere invites us to reflect upon relationships among media, communication and democracy" (p. 35). Efforts at reinvigorating what some theorists consider to be the democratic potential of communicative spaces have included alternative media (Couldry and Curran, 2003) that democratize mainstream content and mainstream production processes, as well as autonomous media that more radically destabilize the ownership and control structures of mainstream media and address broader social issues such as racism, sexism and difference. They have also included autonomous infrastructures, which more than these others have the opportunity to reconfigure organizational and social relationships along with policies and spaces (Langlois and Dubois, 2005). Indeed, Dahlgren notes that the public sphere integrates three interrelated elements: structural, spatial and communicative. What we think of as "public" thus includes the organization of our public engagement, the physical and architectural spaces we occupy, as well as the modes of communication in which we engage.

Theorists of the public sphere, including Habermas (1989) and Fraser (1992) describe how the opportunities to communicate, provided through media, technology or shared physical space are pivotal in the development of public engagement and political culture. Oldenberg (1996) makes a similar claim in his support of the "third spaces" of cities as sites for social interaction and exchange. Jacobs (1961; 2004) also argues that diverse types of urban meeting spaces are essential to building communities and strengthening public engagement. Concepts drawn from social geography provide a means of analyzing the relationship between spaces and technologies of communication. Graham and Marvin (2001) explore the transformations of public spheres in urban spaces, paying attention to how urban spaces provide physical and architectural records of attempts to alter social and economic experiences. These alterations include the process of gentrification of older industrial neighbourhoods (explored in detail by Solnit and Swartenberg, 2000) and the imbrication of ICTs such as RFID radio chips into transportation infrastructures and secured "premium" spaces (Graham and Marvin, 2001). In

each of these cases, the opportunity for the development of a public sphere is configured by the relationship between the different elements described above.

Graham (1998) categorizes spatial metaphors for technology based on "the uses to which they are put, and the power relations surrounding their development" (166): substitution and transcendence; coevolution; or recombination. He argues that most metaphors either assume that technology will substitute for or transcend urban space, although others focus on the coevolution of technology and urban space, or potential recombination of technology and space. Metaphors of substitution and transcendence, embedded in technological determinism, express fears that urban areas will lose their relevance and disappear, to be replaced or subsumed by ubiquitous internet connections. Graham writes: "most common here is the assumption that networks of large metropolitan cities will gradually emerge to be some technological anachronism, as propinquity, concentration, place-based relations and transportation flows are gradually substituted by some universalized, interactive, broadband communications medium (p. 168). In contrast, metaphors of co-evolution describe the parallel social production of geographical and electronic space. These metaphors focus on how new technologies diffuse into the older urban fabric, as well as how existing urban institutions are reinforced by technical systems. Metaphors of recombination link technology and social worlds, describing the relationships between bodies, machines, buildings, and other elements of urban life. These assemblies of space, place, and technologies support cities and configure the lives of individual citizens, for example, by controlling access to roads, public transportation, or the internet. Dodge and Kitchin (2005) argue that the combination between these coded elements and the spaces of cities creates complex assemblages that reconfigure relationships between individuals and city services. Wi-Fi networks are coded infrastructures, but they are also communication infrastructures. The decisions that their designers make about their architecture are expressed in the metaphors they choose to describe them. These metaphors establish how communicative space relates to geographic space, and are especially

significant as ways of thinking through the relationship between local wireless networks and other attempts to democratize communications or democratize urban space.

Initially, scholarship on local wireless networks focused on their local situatedness, suggesting that such networks might provide opportunities for more democratic communications by supporting local participation in building the network or more autonomous engagement with its potential as a new media. Yet the challenges experienced in creating these networks and engaging citizens hold lessons for scholars concerned with the impact of communication policies on social policies in general. After a brief introduction to how community wireless networks have been discussed by scholars and advocates, the following sections of this paper discuss the way that metaphors have been employed to highlight the potential transformations that wireless networks might make in democratic communication spaces. First, the metaphor of the commons is explored, and second, the paper introduces two case studies of relatively small-scale, Canadian wireless networks. Based on interviews and text documents collected during extensive fieldwork in both cities, the metaphoric arguments for the value of wireless networks in establishing more democratic communicative spaces are presented. These arguments are then discussed in light of the subsequent development and use of both networks. The results indicate that designers of local networks persistently frame the development of technology as a key force for establishing more democratic communicative spaces using metaphors that stress the co-evolution of technologies and urban spaces. Some of these co-evolution metaphors, more than others, suggest opportunities for social and organizational transformations. These opportunities are outlined for the specific case of community wireless networking, but they could also be applied to other social policy challenges that are addressed by technology development in urban space - such as sustainable transport, energy monitoring, or monitoring of air and water quality.

Scholarly perspectives on local wireless networks

Before 2005, most public Wi-Fi projects were local projects undertaken by small-scale organizations: neighbourhoods, community organizations, and municipal governments (Bar and Galpernin 2004a, 2004b, 2005). Beginning in 2006 and 2007 hundreds of cities and towns across North America began to invest in Wi-Fi projects (Tapia and Ortiz, 2006), many based on public-private partnerships. These included Google's proposal to cover San Francisco with Wi-Fi (Hudson, 2006) and Earthlink's partnerships with Philadelphia and other cities (Shaffer, 2009). Toronto constructed a high-speed wireless network in the financial district, initially in partnership with Toronto Hydro, but subsequently ownership has shifted to Cisco, and the Saskatchewan government sponsored a demonstration Wi-Fi network in Regina, Saskatoon and Prince Albert (Clement and Bryne Potter, 2008).

The non-profit development of Wi-Fi networks altered the policy calculus for the provision of local broadband (Gillett, 2006) by making internet access much less expensive and by expanding it over broad areas. In some cases, governance relationships were also altered established structures of governance and autonomy: for example, Fiser (2009) describes how First Nations in Northwestern Ontario used the construction of the communications network as a means of concentrating funding, expertise and governing autonomy. Scholars have since focused on the organizational, social and cultural aspects of community networks, categorizing organizational models for non-profit networks (Tapia et al, 2006) and examining their design, management (Ortiz and Tapia, 2008) and ownership (Middleton et al, 2007; Lehr et al, Gillett, 2006). Other work has critiqued references to the public good in the language of planning documents (Shaffer, 2007). As wireless networks in Europe have developed unique and sustainable organizational models, Josgrilberg (2009) has compared European and Brazilian networking models and Bona and Foglia's (forthcoming) edited collection includes descriptions of large-scale community-based networks in Greece, Catalonia and Denmark, reiterating

that open networks can be sustainable when they are developed in a culturally appropriate manner. From a Canadian perspective, Crow et al's (2010) edited volume has placed community wireless projects in context with policy, cultural and design issues associated with wireless.

Community-based networks, then, would seem more likely to inspire the development of democratic communication spaces based on broad participation and democratizing influence than municipal networks. Indeed, Ortiz (2008) reveals that municipal wireless networks describe their aims as being to bridge digital divides, even though few completed projects actually succeed in achieving these aims when assessed using quality of life indicators. This implies an incongruity between how networks are imagined or planned by their designers and their eventual social impacts. This paper addresses this incongruity by focusing on the nature of the metaphors used by the designers of both community and municipal networks.

Key metaphors: the commons

The metaphor of the commons emerged within early community wireless advocacy and suggested a parallel between the technical structure, governance model and social impact of wireless networks. Theorists and advocates including Priest (2004), Townsend (2005) and Meinrath (2005) leveraged the metaphor of the "wireless commons" to suggest Wi-Fi's capacity to reinvigorate a political commons. This metaphor leverages the possibilities offered by Wi-Fi mesh networks, suggesting a connection between the decentralized architecture used by some networks, and the commons model of politics and economics. A "wireless commons manifesto" circulated on the internet and signed by dozens of well-known community Wi-Fi advocates suggested that the availability of mesh networking technology would provoke a social revolution:

> Low-cost wireless networking equipment which can operate in unlicensed bands of the spectrum has started another revolution. Suddenly, ordinary people have the means to create a network independent of any physical constraint except distance. Wireless can travel through walls, across

property boundaries and through a community. Many communities have formed worldwide to help organize these networks. They are forming the basis for the removal of the traditional telecommunication networks as an intermediary in human communication. (Wireless Commons Manifesto, 2003)

The manifesto's language implies that the technical architecture of the mesh might be sufficient to inspire revolutionary global social and political changes by virtue of the fact that the networks are unencumbered by "any physical constraint except distance."   The manifesto suggests that the wireless commons will replace centrally-organized communications systems and perhaps inspire a renewed communicative public sphere (Habermas, 1989). Yet there are serious conceptual limitations to this vision. Herman (2010) notes that "the commons paradigm tends to assume in reductionist fashion that the correct technical and juridical disposition of people in relation to things will, *ipso facto*, yield a communicative relationship of communality where people anywhere can connect to each other everywhere based upon an ethical sharing of communicative resources" (p. 197). He further notes that "the commons as sphere of communication, the commons as a place of community, and the commons as a property relationship regarding technical resources become elided" (p. 197). One reason for this elision is the fact that certain types of wireless architecture, notably the wireless mesh, propagate wireless signals horizontally among nodes that act both as senders and receivers, and can become more robust and reliable when a greater proportion of these nodes are connected to the Internet.

In fact, not only the communicative resources but the technical architecture of many community wireless continue to be based on hierarchical sharing structures. In particular, the two networks discussed in this paper both employ Wi-Fi "hotspots" where wireless transmission is used to extend internet connectivity from one internet connection to several devices in the same area. This choice of configuration means that at hotspots, where many computers are using one internet connection, connectivity is not a common good. In fact, Wi-Fi hotspots produce rivalrous goods. Architecturally, they are much less radical than other types of wireless networks like "meshed" networks that are

designed to propagate horizontally with no central control. Hotspot networks instead act as miniature broadcasters. The metaphor, with all its potent significance, thus doesn't apply to the architecture. Does this mean that Wi-Fi hotspot networks are associated with more bounded and conventional communicative spaces, with more hierarchical governing structures? The following case studies look in detail at the metaphors employed by designers of Wi-Fi hotspot networks with different governing structures, focusing on how the metaphors imply a co-evolution between technological development and urban social space.

Methods

The case studies in this paper focus on two of the earliest public Wi-Fi networks in Canada and are based upon long-term qualitative study of both of these networks. The Fred-eZone network was a municipal government project built in the town of Fredericton, New Brunswick, a Canadian provincial capital with a population of 50,000 located approximately 800 km north of Boston in a relatively isolated area of Eastern Canada. The network was intended to leverage the city's existing fibre-optic network in order to help brand the city as a "Smart Community" (Gallant, 2006) but otherwise held no specific social goals. After an initial build-out, expansion of the network stopped in around 2006. The author began monitoring the development of the Fred-eZone in 2004, and in 2007 conducted a month-long fieldwork visit to the city that included in-depth interviews with designers of the network, workplace observation of the network designers as well as interviews with city and business leaders, a review of local media coverage of the project, and observation and informal interviews with users of the service.

The Île Sans Fil network, in contrast, was conceived, developed, and built by a group of volunteers in Montreal, Quebec, a city of 1 million people. The network grew out of the frustration of local residents with the lack of free Wi-Fi in bars and cafes. Volunteers hacked commercially available Wi-Fi routers

to create a centralized network and also to display unique login 'splash' pages at each hotspot location. They convinced bars and cafes to share their internet bandwidth, and recruited artists to contribute to location-specific art works to be hosted at each hotspot. The network grew steadily between 2004 and 2007, and in 2007 the volunteers began negotiating a partnership with the city of Montreal. Under the terms of this partnership the municipal government would require the volunteers to establish more hotspots in city-owned locations, in exchange for ongoing funding for a paid volunteer manager. The author conducted an ethnography of the group from 2004 to early 2007, which again included interviews with network developments and proponents, and the collection of written material from the group's website and the websites of its most influential members. Additional data collection occurred in 2009, consisting of a review of the project website and follow-up interviews with participants.

These cases provide contrasting examples of how wireless local networking was pursued. The Fred-eZone project was instituted by the government, while the Île Sans Fil project grew out of the interests of individual local residents, who founded a grassroots organization. Taken together they can be seen as opposing points on a spectrum of organizational forms for such projects. In addition, both projects chose relatively simple technical solutions for their projects – the "hotspot" broadcast of Wi-Fi connectivity – rather than more radical decentralized network architectures. In addition, designers of both projects used metaphors linked with the transformation of urban spaces to describe the expected significance of their networks.

In methodological terms, the combination of attention to how the designers expressed their views about the potential value of the networks as they were building them with a longer-term monitoring of their outcomes provides a means of tracking the connection between the visions of the designers and the realities of the network's construction and use. While the conflict between such visions and realities in both case studies is more fully explicated in Powell (2008b); a secondary analysis of interviews and

public discourse conducted for this paper allows the differences between the cases to be explored in terms of their metaphors. For this paper, material collected in field notes, interview transcripts and media files was re-coded and classified according to Graham's (1998) typology of spatial metaphors, revealing a consistency in the types of metaphors used by designers of both networks. Designers did not describe Wi-Fi networks as substituting for or transcending existing urban social spaces, nor necessarily establishing radical recombinations through which urban social spaces would become fundamentally altered by the logic of novel technologies. Instead, they expressed the likely impact of the networks as a type of co-evolution where social progress and technical progress would develop together. Similar types of metaphors appear in other contexts where technology development is connected with expectations of social progress. Exploring these metaphors provides a means of understanding both how local wireless networks come into being – at least from the perspective of their designers – as well as the limitations inherent in their contribution to democratic communications spaces.

Case Studies

Fred-eZone

The first of this paper's two case studies concerns the Fred-eZone network, designed and operated by the city of Fredericton as a means of highlighting the city's technology-friendly economic development strategies. The developers of the Fred-eZone described their goals for the network using metaphors to link the evolution of technology with the evolution of urban space. These are what Graham calls "co-evolution metaphors" and they link the development of a city with the development of technologies. In broader terms, such metaphors also underpin urban social policy choices such as "smart" city policies

and investments in ICTs. These policies presume that urban spaces – and economic development – will evolve and progress through a connection with new technology. They are an example of what Slack (1989) refers to as a persistent articulation between technology and progress.   The Fred-eZone designers established their network as part of an ongoing local government strategy for a "smart" or "connected" city. In 1999, the city created its own utility telecommunications company and built a substantial fibre network operated as a co-operative with other local partners, in an effort to help the city, located approximately 800 km from the nearest major metropolitan area, to remain competitive. The excess bandwidth from this network provisions the free WiFi network. The network's development was thus both pragmatic and symbolic: meant to exemplify a forward-looking technology-friendly government while simultaneously framing communication networks as public services that be managed and used in much the same way as other public services.

Both the fibre-optic network and the Wi-Fi network were designed by members of the city's information technology department, along with the director of the area's regional development organization, who had previously run an internet service provider. The designers of the Fred-eZone project defined WiFi as "intellectual infrastructure" and described it as essential for economic development. This framing of Wi-Fi clarifies the responsibility for developing Wi-Fi or other new technologies as resting with the local government, but it also limits the scope for technology projects to emerge or be altered by other actors.

The story of the Fred-eZone as told by the designers of the network is inflected with a sense of the city's self-sufficient culture and, particularly, the local government's priorities for stable economic development. The city's Chief Information Officer (CIO) describes how the city government pursued ownership of the fibre network despite the opposition of the incumbent telecommunications operators:

> We a few years ago were faced with the challenge of connecting different municipal sites

together . . . We approached [the incumbent operators] and said we would like to have access to fibre, would you rent it to us or sell it to us, but of course they didn't see it in their interests to do that. So what was the alternative? We said we want to use this stuff, we are going to have to build our own. (Maurice Gallant, Interview Feb 18, 2007)

This "building their own" included establishing a city-owned internet service provider and lobbying the national communications regulator for a license to act as a non-dominant telecommunications operator. The non dominant operator status required the incumbent operator to carry the municipal network's fibre on its utility poles. The fibre network was also designed as an open access network, so that any company was free to develop applications or services – though the access was limited to commercial offerings. This network was viewed as providing a community-owned challenge to the high prices of the incumbent operators:

We convinced [one of the incumbent operators] to allow us to use their poles to carry our fibre. Not without a little bit of discomfort, this was not something they wanted us to do. They tried to dissuade our councillors, our managers, that we shouldn't be doing this that this was unfairly competitive, that there was a commercial offering out there, that we should be using that. But we had done our research, we knew what the price points were, we knew what the price points could be . . . We announced that we were building a fibre network, does anyone else want on? . . .so anyway we got a number of folks to join that community network, and we really think of the city as one of the members of that community network. (Maurice Gallant, Interview Feb 18, 2007)

This narrative of community self-sufficiency provides the context for the public service metaphors that the Fred-eZone's designers use to describe their network. It also highlights the importance of the municipal government's top-down influence on the network's development and design.

The network's designers also referred to existing utilities - transportation, water service, and sidewalks – to describe the role they saw for Wi-Fi. One of the designers, who also heads the city's economic development organization, reflects:

Normally if you talk to someone about the definition of infrastructure it's going to be roads and streets, water and sewer. But cities are about a whole lot more than that now. They're about parks, cultural institutions. They are about the different levels of infrastructure. [City] Council sees this as intellectual infrastructure, something that will allow the people and the firms that live here to succeed and prosper here (Don Fitzgerald, Interview February 2, 2007)

Importantly, although these remarks take Wi-Fi to be part of an infrastructure, it is not specifically described as being public, suggesting that the communicative spaces that the bureaucrat designers envisioned were not necessarily participatory public spaces, but more like public services or public utilities. The same designer likened a Wi-Fi network to a sidewalk or other transportation infrastructure: "we have always maintained that it's the equivalent of the information super-sidewalk. We put the sidewalks up, we say walk up and down them, this is your transportation infrastructure. As long as you don't ride your bike or break any of the bylaws, we leave them alone. Same thing with the Fred-ezone"(Don Fitzgerald, Interview Feb 2, 2007). Another senior bureaucrat likened the Wi-Fi network to the city's water system. The sidewalk metaphor and comparison with the publicly provided water utility imply that the network is put in place for public benefit and to be controlled by the government, without investment in any specific applications or services. Fredericton's designers explained that they initially designed an interactive web forum for Wi-Fi users to comment on the provision of services or suggest new areas to cover, this feature was eventually discontinued.

The focus on providing an infrastructure without a historical pattern of government responsibility for the provision of utilities, which depends on broad provision of infrastructure but little innovation at the edges of those networks. Observers of municipal Wi-Fi network development note that the choice to conceive of Wi-Fi networks as utilities "re-runs" a cycle of infrastructure development that initially challenges but ultimately reinforces existing combinations of technology with city space (Sawhney, 2001; Sandvig, 2005). In particular, Sawhney argues that Wi-Fi networks initially formed islands of connectivity, but that slowly wireless provision of internet access will replace the existing telephone and wired internet infrastructure, taking much the same form. Sandvig observes that unique, locally-based socio-economic organizations like telephone co-ops served mainly to subsidize the creation of a broader telephone infrastructure. The focus of Fredericton's bureaucrats on defining their network as a

utility and an infrastructure is part of the rerun of this cycle. It conserves organizational and economic

frameworks similar to those that governed previous infrastructures. The result of this co-evolution of

technology and space are technologies and spaces that resemble those developed in the past.

Public utility metaphors for Wi-Fi networks are conservative and don't presume radical political

consequences of the technology's co-evolution with the city nor radical participation: such metaphors

do not, for example, conceive of Fredericton's Wi-Fi users as a mobile public (Sheller, 2002), or

explicitly conceive of the network in terms of a public sphere. Utility metaphors promise a

conservative type of co-evolution of urban space and technology, where technology is not disruptive

either of politics or governance. The communication spaces inspired by the Wi-Fi network are

democratic insofar as the network is democratically available and developed using tax revenue. No

explicit participation is sought from the public either in terms of how the network should work nor

even about whether it is necessary in the first place. In broader social policy terms, the nature of the

co-evolution between the city and technology as invoked by the Fred-eZone designers retains a

distinction between institutional decision-makers and the subjects of their decisions.

Marketing a coevolution of technology and urban space

The focus on local government's responsibility to direct the development of new technology and

integrate it into existing understandings of space was particularly evident in the way that Fredericton's

government referred to broadband development in their economic development literature. Like other

similar small cities, it suffers from high levels of out-migration that they address through local

investment and job growth. One senior university administrator described how communication

networks and computer technology became intrinsic to the region's identity:

> I still go to conferences and people come up to me and say "ah, you are so lucky you are from New Brunswick you must have all the latest technology" [The former government] was able to sell that vision to the people of new Brunswick that IT is important, that farming, fishing, forestry are not the future. Young people are not going to be growing up and living on farms. They are going to leave and go to Ottawa, as a high tech centre. He was able to sell that to the people of New Brunswick – I want my kid to go to university and get a really good job and it would be great if they could stay here – I want to see my grandkids! I don't want to have to go to Ottawa or Vancouver or San Jose or Ireland or wherever. And we can do this just as well as any of these other places (Greg Sprague, Interview February 21, 2007).

For this relatively isolated city, computer and network technology are entwined with economic development strategies that aim to reinforce its existing educational and academic investments – ideally making the city functionally equivalent to other (presumably more desirable) locations. Promoting local economic development is a matter of blending Wi-Fi technology into an overall development agenda.

The key role of the municipal government in designing the Fred-eZone and in employing metaphors that stress the role of the government in determining how technology and the city will co-evolve, undermines the potential of a Wi-Fi network to be embedded in a transformation of urban space or politics in Fredericton. Such recombination, should it occur in a city like Fredericton, would also necessarily involve a deeper involvement of the public in the development and use of the network, perhaps by leveraging ubiquitous connectivity into opportunities for civic engagement (Silverstone and Sujon, 2005). The metaphors that plan to govern Wi-Fi and broadband by describing them as being like other public utilities like the sidewalk reiterates that the designers of the Fred-eZone understand their network as being public – in the sense of a utility – and integrated into the long-term evolution of the city. Their top-down design of the network follows from this understanding, making the city government responsible for provisioning and managing Wi-Fi as it does sidewalks or water service. These metaphors imply that the Wi-Fi network would evolve like a public utility, and create communicative spaces that contributed to economic development. The next case study explores how

co-evolution metaphors were used by volunteers to evoke a far different future for public Wi-Fi, one in which technology, city space and politics might evolve in a more transformative way.

Île Sans Fil

The Île Sans Fil (wireless island) network was founded in Montreal by a group of university students in 2004. At the time the city had few publicly-accessible Wi-Fi access points. The students wanted to create a way of expanding free Wi-Fi connectivity in the restaurants and bars that they visited. They were also interested in the potential for Wi-Fi hotspots to share media content – art and community information – among people in a small area. The volunteers reconfigured commercially available Wi-Fi routers so that they would display a unique opening page at each hotspot, and established a centralized network architecture that allowed them to track users of the network. The group members then convinced local businesses to share their existing internet connections so as to provide Wi-Fi free of charge. In exchange, businesses received the reconfigured routers at cost, along with volunteer support to install the hardware and manage the network. Because the volunteers provided most of the support, the financial cost was low for the businesses who participated. At the same time, patrons received free Wi-Fi access and, each time they logged in, glimpses of local art presented on the login page. In early interviews, volunteers often lauded the network's potential to "create community" both by facilitating Wi-Fi sharing and by using the hotspots on the network to distribute local media content. They also described volunteer participation as being an essential aspect of the network's design and use, since volunteers could use the connectivity at existing Wi-Fi hotspots to develop new Wi-Fi software or applications.

This connectivity was linked with one of the key metaphors used by the designers and volunteers at Île

Sans Fil, namely the metaphor of the "third space." Many of the volunteers were inspired by

Oldenberg's (1989) evocation of the social benefit of spaces outside of work and home. The volunteers

invoked notions of democratic communication spaces both in terms of their own relationships with

other designers and developers, and in terms of their expectations of the users of the network – what I

have elsewhere (Powell, 2008a) conceptualized as the tension between "geek-publics" and

"community-publics". In comparison with Fredericton's network designers, Île Sans Fil's volunteer

members held more radical views about the potential for Wi-Fi networking to co-evolve with the city,

both in terms of providing internet connectivity in public places and as a means of creating a

community by engaging collective action. This collective action was described as disrupting not only

the existing provision of internet access in public places, but also a means of transforming social spaces

including the local media.

Wi-Fi hotspots as social media spaces

Early in the project, Île Sans Fil's designers talked about the potential for a network like ISF to

facilitate alternative communicative spaces, either by augmenting physical spaces by adding the

potential of socializing around and through Wi-Fi technology, or by facilitating citizen owned media

spaces. Over several years, volunteers repeated that one of the unofficial goals of their organization

was to "get people out of their basements" (Field Notes, 2005 and 2006; ISF mailing list October

2005). One volunteer explained his initial interest:

> I was looking for a place in Montreal to use my laptop, and I wanted to get out of my
> house. I had it for a while, actually since the beginning since I had a lot of problems with
> cabling at home. I wanted to get out of my house and see people and do something else.
> (Interview, LD[1], February 2, 2005).

---

1   While the government officials in Fredericton are identified by their full names, some of the Île Sans Fil volunteers are
    identified through anonymized initials, in keeping with research ethics procedures undertaken at the time of data
    collection.

The idea of Wi-Fi as facilitating public as opposed to private life was not limited to providing

opportunities for people to mitigate isolation and gain access to the internet in public spaces. Another

volunteer explained his perspective on the role of community Wi-Fi in creating a more engaged public:

> It has always been true but perhaps it is more true now that information in power. This is why I get bored when people say you are not a community group, or you are trying to connect less favoured areas. All you have to do to be a viable option is to exist, is to provide a viable option to the commercial providers. . . We want to give people the tools to do this local publishing thing, and the chance to get really good tools to publish this information, and if people can get the experience of publishing information themselves they will become aware of the way in which all these other pieces of information are published. (Interview, GB February 4, 2005)

The possibility of community media to critique mass media by demonstrating an alternative to it was a

key part of Île Sans Fil's vision and a central component to how the volunteer designers conceived of

the communication spaces they were building. The volunteers described how they thought Wi-Fi could

transform both city spaces and urban social relations. The metaphors reinforced the idea that

community Wi-Fi could mark a fundamental departure in established means of developing

communications infrastructures. This echoes the rhetorical connection between alternative network

structures and alternative social forms introduced by the Wi-Fi "manifesto" discussed above. For the

Île Sans Fil volunteers, discussions of the disruptive nature of Wi-Fi suggested that that technical

transformations would occur simultaneously with social and organizational transformations. One

volunteer explained his perspective on this disruptive quality:

> Wireless technology is itself a disruptive technology. Wired internet infrastructures are very centralized, very controlled by a few corporations. When I went to see ISF, I saw citizens coming together to build their own network, they were going to do it themselves, and they said, this will be ours, and it will serve our needs and not the needs of the majority shareholders of these corporations. (DD, interview February 15, 2005)

The same volunteer described a potential application of this decentralized community media: "it could

be very simple: in each neighbourhood, with each cafe we could go around and find one interesting

person . . . take a picture and help people get to know someone. It could be very interesting. Did you

know that your taxi driver was a brain surgeon in Iran before he had to flee . . .?" DD, interview February 15, 2005). As with the metaphors of the commons used in the manifesto, the metaphor of disruptive technology implies that changes in technology are accompanied by reconfigurations in power relations between cities and corporations, as well as the potential development of community media.

This focus on disruption of technology, management, and social relations suggests that Île Sans Fil's volunteers were planning for their network to create a recombination of city space and social space. Their plans for alternative media, volunteer activism, and "third spaces" seem to suggest an interest in transforming rather than recapitulating existing communication practices and social relations. In particular, volunteers refer to their actions as "hacking," referring to a set of cultural practices in which technical ingenuity is employed to alter material technologies - and sometimes social forms (Jordan, 2008; Coleman, 2004). One of the founders of Île Sans Fil described the ways in which citizen groups like his organization were engaged in a form of hacking that would transform the city by recombining it with more mobile, connected devices:

> We are hacking the built city. This statement is based on the idea that as wireless devices and services proliferate and ubiquitous computing becomes a reality, the physical environment (especially the built city) is rapidly becoming enhanced space or mixed-reality. The supposedly separate existences of off-line and on-line are intersecting and overlapping - most rapidly in cities . . . Where this get's (sic) exciting is that by citizens, artists and non-profit groups developing and adapting these technologies (portable devices, wireless connectivity, mobile- and location-based applications) and their model (who is supposed to use them and for what purpose) we are able to impact and change this enhanced space and through that have an actual impact on how the built city is experienced.(Lenczner 2005)

This hacking explicitly influences both social and technological spaces, since citizen participation is clearly an important part of the alternative recombination of technology and space that Île Sans Fil promises. However, other metaphors employed over the course of the project suggest that this hoped-for recombination was never actually achieved.

Lenczner's post continues by likening community Wi-Fi deployment to the building soccer fields.   He

concludes:

> With basically no money and only the intellectual and time resources of it's (sic)
> volunteers, ISF is trying to convert our 55 hotspots into great big soccer stadiums
> all around Montreal -hopefully complete with locker-rooms, art galleries,
> chalkboards, swingsets, libraries . . . It's a grand
> vision, and I don't know if we'll succeed, but I guess that's why we're all a part
> of this - because it's audacious and exciting and it's supposed to be beyond us.   (Lenczner
> 2005)

The choice of soccer fields as a metaphor evokes the interplay between community action and the

development of communicative spaces by suggesting that Wi-Fi networks could, like other community

projects, encourage skill sharing and self-organization. At the same time, the soccer field metaphor

refers to existing public services to make an argument for the utility of Wi-Fi networks which are

framed as being as useful and available as chalkboards, swing sets and libraries, a metaphorical turn

that is more focused on co-evolution than recombination.

Co-evolving like public parks?

The promise of recombination of social and city spaces is limited by the very metaphors that Île Sans

Fil have chosen. Likening their project to building a park echoes previous work that attempted to

develop an understanding of the Internet as being like a public park. Stewart *et al* (2004) argue that

truly public spaces are outside of commercial influence and are thus collectively produced: "the notion

of public goods is associated, since its origins, with the collective or public provision of both material

resources (such as roads, lighthouses, bridges, sewers, mail service) and non-material conditions (such

as national defense, a legal system, universal education, a domestic currency or collective health)" (p.

346), or what Berry (2008) explicates as part of the *res publica*, or public good. But are parks public

goods? In normative democratic theory, parks are examples of "small, bounded pieces of the public

realm" where local communities find the potential for the discussions and interactions that are the basis for democracy (Lofland, 1998). Ideally, they are spaces of relaxation and exchange, organized play and repose. Outside of the private realm of home and the commercial spaces of commerce, they might even be thought of as third spaces where close and looser ties combine to create better community. Yet parks are highly regulated spaces as well; Sennett (1976) describes their emergence as maintaining sociability between classes, but in a fleeting manner. The park's facilitation of social exchange takes place within relatively fixed conventional boundaries. Focusing on the park as a metaphor for community Wi-Fi spaces may undermine the framing of collective action by Wi-Fi hackers as part of a radical recombination of social practice and space. Indeed, recent research by Hampton, Livio and Sessions (2009) suggests that urban public spaces are not public realms for Wi-Fi users, who are often engaged in maintaining their own private set of contacts. Furthermore, Wi-Fi users do not respond as readily as other users of public space to outside influences or passersby. Parks are open to the public, but this does not necessarily make them democratic communication spaces.

The use of the park metaphor by Île Sans Fil's designers idealizes the role of technology in creating democratic communications spaces and highlights the persistence of metaphors of co-evolution. Following from their collective action as volunteers, Île Sans Fil's members expected to collectively produce communication spaces that would become part of the public realm – by mobilizing the other citizens using their networks. Their support for the development of alternative media using their hotspots, and their identification of their network building as a form of "hacking the city" are attempts at techno-social recombination, but their project was ultimately unsuccessful in developing alternative media or artistic content of local significance. Without this component, the project of setting up Wi-Fi hotspots was at best a technical goal with a unintended consequence of cutting costs for people who use the internet in certain establishments. In interviews, users of the Île Sans Fil network stated that they were most drawn to the fact that the Wi-Fi was free, rather than motivated to contribute to art and social

media. Furthermore, even as the volunteer group attempted to reconfigure telecommunications through collective action, its own organizational structure reinscribed in many ways the gender and class biases of conventional technology production (see Suchman, 2005). The vast majority of volunteers were young men, and despite attempts to institute consensus-based decision-making and non-hierarchical organizational structures, the volunteer group mimicked the structure and culture of a corporate technology design firm (Powell, 2007). Other public Wi-Fi projects with similar goals including the Austin wireless city project in Austin, Texas (Fuentes-Bautista and Inagaki, 2005), and the WirelessToronto project in Toronto, Canada (Cho, 2006) have experienced a similar narrowing of volunteer interests. Paradoxically, increasing involvement by local governments is perceived as a way to expand the influence of community Wi-Fi systems. An examination of the outcomes of the Île Sans Fil project reveals that this strategy further undermines some of the potential for radical recombination originally promised by the approach of "hacking the city."

Recombining Wi-Fi and Public Space

Assessment of the Île Sans Fil network in the years beyond its origintal inception reveal the persistence of co-evolution metaphors for technology integration. The Île Sans Fil network expanded to 150 hotspots in 2007. In the same year, the volunteer membership began negotiating a partnership with representatives from Montreal's municipal government. Members of the government described the partnership as a means of addressing its perceived failure to invest in municipal Wi-Fi. The partnership would include funding from the city for a professional manager to oversee the volunteers, as well as funding for further software development. In exchange, Île Sans Fil would commit to providing hotspots on city-owned property with splash pages describing city services and events.   This arrangement validated Île Sans Fil's bottom up approach to providing Wi-Fi, but also institutionalized

it: instead of being autonomously created and maintained techno-spaces, city-supported Wi-Fi hotspots now layer online versions of government information and images over government-owned space, substituting new delivery mechanisms for old. The autonomous communicative spaces created by the Île Sans Fil volunteers are thus replaced by civic spaces established by the city government. This may make the public spaces more like parks, in that they are explicitly governed by a public entity, but it may also reduce their influence as collective interventions for the creation of recombined third spaces. This process also shifts the role of the Wi-Fi network from being a demonstration of emergent civic engagement promising a recombination of city space and technology to being an extension of other city services – and a token acknowledgment by the city government of the actions of its citizens.

Autonomous action and collective participation from citizens without strong interventions by governments is a key part of radical recombinations of space, society, and technology. As the Fredericton case study illustrated, local governments can encourage new technologies to co-evolve with existing spaces in ways that reinforce existing assumptions about those spaces. Île Sans Fil's promise came from the volunteers' dedication to recombining Wi-Fi technologies and the spaces they visited in their cities, transforming them both in the process. This engaged volunteers with interests and expertise in a variety of fields, from art to engineering. However, as the project matured and the partnership with the municipal government was designed, volunteer roles were constrained to maintaining the technical functioning of the Wi-Fi network. Partly, this was a result of a narrowing of interest on the part of the volunteers, as more engineers and fewer artists and theorists volunteered for the project. The remaining volunteers were still interested in creating Wi-Fi enabled spaces but were less radical in their politics and in their approach. The recombinatory potential of autonomous Wi-Fi spaces linked to citizen-produced art and information was not fulfilled; instead a hybrid organizational solution - a public-community partnership - emerged that balanced the participation of volunteers with the oversight by the city. Similar public-community partnerships have been adopted by other Canadian

cities including Sherbrooke, Shawinigan, and Quebec City. These projects have explicitly involved volunteers in the process of creating the networks, while using bandwidth sponsored by municipal governments or corporate benefactors. These "hybrid-public" (Tapia, Powell & Ortiz, 2009) networks envision a co-evolution of technology and organizational structures, often involving not only the volunteer but the corporate sector. They can aptly be described by metaphors of public parks in that they are publicly owned, but may be funded by corporate donation or maintained by community volunteers. To mitigate against private control of public communicative spaces - be they parks or utilities - community participation is required, whether it creates radical recombinations of space and technology, or – as is more likely in the projects described here - contributes to more conventional metaphors of co-evolution.

Discussion

It would be easy to dismiss this paper's two case studies as failed opportunities for creating robust, alternative or autonomous communication infrastructures. But this would be to misunderstand the value of different communicative spaces. To return again to Dahlgren's (2001) argument about the value of democratic communication spaces, one of the more important aspects of a democratic communication space is its capacity to act separately from the market. Local wireless networks might then become valuable as ways of establishing economic self-sufficiency or even economic justice. In this sense the two cases here return mixed results. The Fred-eZone, framed as a pillar of economic development, suggests that a locally developed wireless network might provide positive economic effects. Yet due to the top-down nature of the network's development and the very limited scope for the use of the network, these economic effects are elusive. It is difficult to claim that a network primarily used by visitors to hotels and airports provides much economic justice to local businesses. Indeed,

interviews with technology sector businesses in Fredericton did not elicit any examples of businesses themselves using the Fred-eZone. Instead business owners referred to the existence of the network as an indication that the city government was supportive of the high-tech sector. A more democratic vision for developing economic justice based would have to involve business owners in envisioning themselves the potential role for a new technology, or the different relationships that a technology project might inspire between them and other stakeholders.

The Île Sans Fil network has had more success in contributing to economic justice by lowering the cost for small businesses of providing free Wi-Fi at their locations. In contrast to this (rather minimal) contribution to economic justice, the value of the network's contributions to social justice is quite bounded: the project empowered its volunteers, but failed to solicit broader and more sustained engagement from others.. Initially, the volunteer participation in creating Montreal's Wi-Fi network established communicative spaces in bars and restaurants through installing Wi-Fi routers as well as through the engagement of volunteers and their efforts at engaging content producers. By including local information and art on the login pages at each hotspot, the volunteers attempted to provide another opportunity for local engagement. Most fundamentally, the project's playful metaphors for Wi-Fi suggested that "third spaces" like parks could evolve along with Wi-Fi technology through light-hearted experimentation. Designers described Wi-Fi hotspots as contributing to community-based collective action aimed at developing park-like quasi-public spaces - by using Wi-Fi to display local information and art work. Much of the potential of these park-like spaces to become democratic communication spaces inspiring greater social inclusion was limited by the provision of Wi-Fi hotspots primarily to visitors who are already well-connected – the case in both Fredericton and Montreal. Various of Île Sans Fil's plans to expand the network to bridge the digital device or integrate into digital inclusion efforts have not been as successful as the expansion of hotspots supported by businesses, nor the hotspots still promised (as of September 2010) to be supported by the municipal government. In

essence, the Île Sans Fil project has created premium spaces of connectivity supported by either corporate or governmental notions of co-evolution, albeit ones supported by volunteers. The lessons from the limitations of these projects indicate the value of considering how efforts to engage citizens are framed, and hold lessons for other endeavours seeking to recombine city space and technology in more democratic ways.

More Democratic Communication Spaces?

Urban spaces manifest the outcomes of policy choices (particularly choices about the use of technologies). In both Fredericton and Montreal free wireless Internet access is available in public spaces, designed and managed by organizations other than telecommunications companies. But does this access, and the organization inspire more democratic communicative spaces?   In Fredericton, the coevolution of Wi-Fi technology and city space is framed using metaphors of public utilities. The city government developed the Wi-Fi network as a means of illustrating a broader municipal government policy. This implies that internet connectivity could operate like other utility services, "re-running" the infrastructure development cycle while using the language of innovation to tie investments in Wi-Fi to the city's economic development goals. The drawback of this approach is that it overlooks how Wi-Fi hotspots or wireless networks in general could support applications or services that could contribute to creating a broader public engagement with the city. Such more profound engagement would leverage the coevolution of space and technology to create more democratic communication spaces.

  In Montreal the activists imagined a community of users engaged and motivated by the opportunities for producing and consuming local content. This community was always imagined, but not in the Andersonian (1991) sense – the users did not imagine themselves to be engaging in the same sort of process as the volunteer network designers. As such, the project has gone some of the way towards

greater democratization of communication space and a more participatory engagement in urban space, but without the involvement of a greater range of stakeholders and with the increased influence of the city government, it is more likely to continue to connect with metaphors for co-evolution of city spaces, either private or governmental. In both case studies, the development of truly democratic communication spaces was limited by the small number of participants who claimed a stake in the process of co-evolution.

Conclusion

Local wireless networks are only one example of technological interventions in urban space that are envisioned as contributing to social progress – in this case, to the development of more democratic communication spaces. Some novel design approaches have the potential to leverage collective participation developing technology and conceiving of its use within the city. Such approaches are associated with all types of technology metaphors, including the more radical metaphors of recombination. Employing such approaches might be a way to mitigate some of the drawbacks of thinking about the relationship between technology and social change only in terms of co-evolution, and can be developed into policy alternatives that promote more inclusive and transformative development and application of new technologies. One of these design strategies is "co-design" (Bradwell and Marr, 2008) a public service design approach wherein users of services – for example, public transit or health care se - are explicitly involved in formal design activities. Especially when employed in the design of technologies for public services, these design approaches can garner benefit from involving a greater number of stakeholders and inspiring more radical service design. Such efforts might well, more than those described above, create ways of recombining city space and technologies. Co-design or participatory design (Clement and van den Besselaar, 1993) processes have been used to develop mobile energy monitors (Froelich et al, 2009), urban planning applications (Foth et al, 2009), and collaborative transport maps (Priedhosky et al, 2010). Such approaches broaden

participation and explore how social values can be embedded in design (Flanagan, Howe and Nissenbaum, 2008). Foth et al. (2008) identify participatory culture, Internet technology and real-time information as areas that can be developed to encourage urban dwellers to pursue sustainable lifestyles. Paulos et al. (2008) argue that relationships between citizens and cities can be reconfigured through 'Citizen Science' where citizen participation extends to identifying urban problems such as poor air or water quality and gathering data to address them. As interventions in social policy formation as much as technical development, such approaches increase the democratic potential of technical augmentations – or even recombinations – of urban space.

The development of more democratic communication spaces appears to be an unspoken goal of local wireless network development. Yet the opportunities to develop these more democratic spaces are limited by the design environment in which the projects are initially envisioned. A narrow set of stakeholders with an enthusiastic embrace of articulations between technology and social progress contributed to the development of numerous metaphors for local wireless networks that focused on the co-evolution between technology and urban space, even when more radical recombination was promised. Such assumptions of linear progress are enhanced by organizational structures that separate decision-making from use; participation from governance. A more radically democratic vision of urban social life as supported by technology or other shared resources might possibly be brought into being by increasing the participatory potential of the design process. Such an approach might allow local wireless networks like the ones described in this paper to fulfil their potential contribution to democratic communication spaces, and more broadly, for recombinations between technology and space to meaningfully engage stakeholders in addressing issues of economic, social and environmental justice.

References

Anderson, B. (1991). *Imagined Communities: Reflections on the origin and spread of nationalism.* London and New York: Verso.

Bona, Y., & Foglia, E. (2010). OpenWaves: Approaches to free wireless networks.   Retrieved August 26, 2010, from http://www.openwaves.ws/index.htm

Bar, F., & Galpernin, H. (2004a). *Wireless Internet Infrastructure: Alternative Models*. Los Angeles: Annenberg Research Network on International Communication, University of Southern California.

Bar, F., & Galpernin, H. (2004b). Building the wireless internet infrastructure: From cordless Ethernet archipelagos to Wireless Grids. *Communications and Strategies, 54*(2nd quarter), 45-67.

Bar, F., & Galpernin, H. (2005). *Geeks, Cowboys, and Bureaucrats: Deploying Broadband the Wireless Way.* Paper presented at the The Network Society and the Knowledge Economy in Context, Lisbon.

Bradwell, P., & Marr, S. (2008). *Making the Most of Collaboration: An international survey of public service co-design*. London: Demos

Cherry, C. (1977). The telephone system: Creator of mobility and social change. In I. de Sola Pool (Ed.), *The Social Impact of the Telephone* (pp. 112-126). Cambridge, MA: MIT Press.

Cho, H. (2006). *Explorations in Community and Civic Bandwidth: A Case Study in Community Wireless Networking.* Ryerson University and York University, Toronto.

Clement, A., & Bryne Potter, A. (2008). Internet Infrastruture for All! Time for Canadian municipalities to step up! In L. R. Shade & M. Moll (Eds.), *For Sale to the Highest Bidder: Telecom policy in Canada*. Ottawa: Canadian Centre for Policy Alternatives.

Couldry, N., & Curran, J. (Eds.). (2003). *Contesting Media Power: Alternative media in a networked world*. London: Rowan and Littlefield.

Cornes, R., & Sandler, T. (1996). *The Theory of Externalities*. New York: Cambridge University Press.

Crow, B., Longford, M., & Sawchuk, K. (Eds.). (2010). *The Wireless Spectrum: The politics, practices and poetics of mobile media*. Toronto: University of Toronto Press.

Dahlgren, P. (2001) "The Public Sphere and the Net: Structure, space and communication" in W.L. Bennet and R.M. Entman (eds.) *Mediated Politics: Communication in the future of democracy*. London: Routledge, pp. 33-50.

Dodge, M., & Kitchin, R. (2005). Code and the Transduction of Space. *Annals of the Association of American Geographers, 95*(1), 162-180.

Fiser, A. (2009). *The K-Net Broadband Governance Model: Historical Development and Institutional Framework.* University of Toronto, Toronto ON.

Flanagan, M. Howe, D.C. and Nissenbaum, H. (2008) Embodying Values in Technology: Theory and Practice, in J. van den Hoven and J. Weckert (eds.) Information Technology and Moral Philosophy, Cambridge University Press pp.322-353

Foth, M., Bajracharya, B., Brown, R., & Hearn, G. (2009). The Second Life of Urban Planning? Using Neogeography Tools for Community Engagement. *Journal of Location Based Services*, 3(2),
97-117.

Foth, M., Klaebe, H., & Hearn, G. (2008). The Role of New Media and Digital Narratives in Urban Planning and Community Development. *Body, Space & Technology*, 7(2)

Fraser, N. (1992). Rethinking the Public Sphere: A Contribution to the Critique of Actually Existing Democracy. In C. Calhoun (Ed.), *Habermas and the Public Sphere* (pp. 109-142). Cambridge, MA: MIT Press.

Froehlick, J., Dillahunt, T., Klasnja, P., Mankoff, J., Consolvo, S., Harrison, B. and J. A. Landay (2009) "UbiGreen: Investigating a Mobile Tool for Tracking and Supporting Green Transportation Habits, Computer-Human Interaction", Boston, 4-9 April.

Fuentes-Bautista, & 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.

Gallant, M. (2004). Fred E-Zone: Free Wi-Fi for Fredericton. Retrieved March 13, 2006, from

http://www.fred-ezone.ca/

Gillett, S. (2006). Municipal Wireless Broadband: Hype or Harbinger? *Southern California Law*

Review, 79, 561-594.

Gillett, S., Lehr, W., & Osorio, C. (2004). Local government broadband initiatives. *Telecommunication*

Policy, 28 (2004), 537-558.

Graham, S. (1998). The End of Geography or the Explosion of Place? Conceptualizing space, place,

and information technology. *Progress in Human Geography, 22*(2), 165-185.

Graham, S. (2004a). Beyond the Dazzling Light: From dreams of transcendence to the 'remediation' of

urban life. *New Media and Society, 6*(1), 16-25.

Graham, S. (2004b). *The Cybercities Reader*. London: Routledge.

Graham, S., & Marvin, S. (2001). *Splintering Urbanism: Networked Infrastructures, Technological*

Mobilities, and the Urban Condition. London and New York: Routledge.

Habermas, J. (1989). *Structural Transformations of the Public Sphere: An Inquiry into a Category of a*

Bourgeois Society (T. Burger & F. Lawrence, Trans.). Cambridge, MA: MIT Press.

Hampton, K., Livio, O., & Sessions, L. (2010). The Social Life of Wireless Urban Spaces:

Internet Use, Social Networks, and the Public Realm. *Journal of Communication*.

Herman, A. (2010). "The network we all dream of": Manifest dreams of connectivity and

communication or, social imaginaries of the wireless commons. In B. Crow, M. Longford & K.

Sawchuk (Eds.), *The Wireless Spectrum: The politics, practices and poetics of mobile media*

(pp. 187-198). Toronto: University of Toronto Press.

Hudson, H. (2006). *Lessons from the Left Coast: San Francisco's community wireless broadband*

initiative. Paper presented at the TPRC 2006: Research Conference on Communication,

Information, and Internet Policy, Arlington, VA.

Josgrilberg, F. (2008). *Muni-Wi: An exploratory comparative study of European and Brazilian municipal wireless networks*. São Paulo, Brazil: Fundação de Amparo à Pesquisa de São Paulo.

Kavanaugh, A., Cohill, C., & Patterson, S. (2002). *Community Networks: Lessons from Blacksburg, Virginia*.

Lakoff, G., & Johnson, M. (1980). *Metaphors We Live By (second edition).* Chicago: University of Chicago Press.

Langlois, A., & Dubois, F. (2005). *Autonomous Media: Activating resistance and dissent*. Montreal: Cumulus Press.

Lehr, W., Sirbu, M., & Gillett, S. (2006). Wireless is changing the policy calculus for municipal broadband. *Government Information Quarterly, 23*(3-4), 435-453.

Lenczner, M. (2005). Building Soccer Fields in Downtown Montreal.   URL: http://mtl3p.ilesansfil.org/blog/archives/2005/09/26/building_soccer_fields_in_downtown_montreal.html [August 26, 2010]

Lippman, W. (1925) *The Phantom Public*. New York: Harcourt Brace.

Lofland, L. (1998). *The Public Realm: Exploring the city's quintessential social territory*. New York: Aldine de Gruyter.

Mackenzie, A. (2005). Untangling the Unwired: Wi-Fi and the Cultural Inversion of Infrastructure. *Space and Culture, 8*(3), 269-285.

Meinrath, S. (2005). Wirelessing the World: The battle over (community) wireless networks In R. McChesney (Ed.), *The Future of the Media: Resistance and Reform in the 21st Century* (pp. 219-242). New York: Seven Stories Press.

Middleton, C. A., Longford, G., & Clement, A. (2006). *ICT Infrastructure as Public Infrastructure: Exploring the benefits of public wireless networks.* Paper presented at the TPRC 2006: Research Conference on Communication, Information, and Internet Policy, Arlington, VA.

Mosco, V. (2004). *The Digital Sublime: Myth, Power, and Cyberspace*. Cambridge, Mass.: 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*: SSRN URL: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=963814 [December 10, 2009]

Nye, D. (2006). *Technology Matters: Questions to live with*. Cambridge, Mass.

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.

Ortiz, J. A. (2008). *Great Expectations: Interpreting Mu-Fi's perceived impact on the digital divide.* Paper presented at the TPRC 2008: 36th Research Conference on Communication, Information, and Internet Policy, Arlington, VA.

Ortiz, Julio Angel & Tapia, Andrea H. (2008) "Keeping promises: Municipal communities struggle to fulfill promises to narrow the digital divide with municipal-community wireless network." *The Journal of Community Informatics: Special Issue on Wireless Networking for Communities, Citizens and the Public Interest.* Volume 4, Number 1.

Powell, A. (2008a). *Co-productions of technology, culture and policy in North Americas Community Wireless Networking movement.* Concordia University, Montreal.

Powell, A. (2008b). Wi-Fi Publics: Producing Community and Technology. *Information, Communication & Society, 11*(8), 1034-1056.

Priedhorsky, R., B. Jordan, and L. Terveen. "How a Personalized Geowiki Can Help Bicyclists Share Information More Effectively". Short paper. *Proceedings of the 2007 International Symposium on Wikis*. Montreal, Quebec. Association for Computing Machinery. URL: http://doi.acm.org/10.1145/1296951.1296962

Priest, J. (2004). The State of Wireless London.   URL:

http://informal.org.uk/people/julian/publications/the_state_of_wireless_london/

Sawhney, H. (1996). Information Superhighway: Metaphors as midwives. *Media, Culture & Society,*
   18(2), 291-314.

Sennett. (1976). *The Fall of Public Man*. New York: Norton and Company.

Shaffer, G. (2007). Frame-up: An analysis of arguments for and against municipal wireless initiatives.
   Public Works Management & Policy, 11(3), 204-216.

Shaffer, G. (2009). *Peering into the future: How WiFi signal sharing is impacting digital inclusion*
   efforts. Unpublished Doctoral dissertation, Temple University, Philadelphia.

Sheller, M. (2002). Mobile Publics: Beyond the network perspective. *Environment and Planning D:*
   Society and Space, 22, 39-52.

Schuler, D. (1996). *New community networks: Wired for change*. New York: Addison-Wesley.

Silverstone, R., & Sujon, Z. (2005). Urban Tapestries: Experimental Ethnography, Urban Space and
   Communication Technologies. *Media@LSE Electronic Working Paper*   URL:
   http://www.lse.ac.uk/collections/media@lse/mediaWorkingPapers/ewpNumber7.htm

Slack, J. D. (1989). Contextualizing Technology. In L. Grossberg, B. Dervin, B. O'Keefe & E. Wartella
   (Eds.), *Rethinking Communication, Vol 2:*

Solnit, R., & Swartenberg, S. (2000). *Hollow City: Gentrification and the Eviction of Urban Culture*.
   London: Verso Books.

Stewart, C. M., Gil-Egui, G., & Pileggi, M. S. (2004). The City Park as a Public Good Reference for
   Internet Policy Making. *Information, Communication, and Society, 7*(3), 337-363.

Tapia, A., Maitland, C., & Stone, M. (2006). Making IT work for municipalities: Building municipal
   wireless networks. *Government Information Quarterly, 23*(3-4), 359-380.

Tapia, A., & Ortiz, J. A. (2006). *Municipal Responses to State-Level Broadband Internet Policy*. Paper
   presented at the TPRC 2006: Research Conference on Communication, Information, and
   Internet Policy, Arlington, VA.

Tapia, A., Powell, A., & Ortiz J. A. (2009) Reforming Policy to Promote Local Broadband Networks. *Journal of Communication Inquiry*.

Thrift, N., & French, S. (2002). The automatic production of space. *Transactions of the Institute of British Geographers, NS27*, 309-335.

Townsend, A. (2005). *Wired/Unwired: The Urban Geography of Digital Networks.* Unpublished Doctoral dissertation, Massachusetts Institute of Technology, Boston, MA.

Wireless Commons. (2003). Manifesto: The Wireless Commons.   Retrieved March 15 [currently dead link], 2008