Chapter Two: Computerization movements – Re-mediating technology from the 1970s to the 2000s

Introduction: A History of Computerization and Community

Like electricity, the telegraph, telephones and televisions, computers and ICTs have been envisioned as potentially inspiring a more democratic society (Carey, 1989). This chapter critically examines these visions as they have unfolded over the past forty years through what Kling and Iacono (1991) call "computerization movements." In keeping with the overall focus in this thesis on the co-production of technologies and social forms, my interpretation of computerization movements focuses on ways that democratic imaginations of computer technology establish alternatives to the dominant institutional frameworks for computers – even while they contribute to them. At important historical moments, computers are associated with disruptive and oppositional political positions that promise social improvements through alternative applications of technology. However, at the same time computerization and the promotion of computers as a goal in itself supports the status quo of post-industrial, informational capitalism. In a dialectical process, the critical re-mediations of computer technology that are meant to be politically and socially progressive are integrated into institutional structures, some of which are not as progressive as originally envisioned.

This constructivist approach draws heavily on existing work in the history of computing. There are two broad traditions of constructivist computer histories: one concentrates on the shape of systems, connecting technological developments with social structures to describe how and why computer systems were materialized in particular forms (Abbate

1999; Ceruzzi 2003). These histories challenge more determinist accounts written by systems theorists that discuss advances in hardware or software without consideration of the social context (for example Goldberg 1988) and also challenge the technological determinism so often associated with computer histories. However, these more conventional computer histories contrast with a second genre of social histories concentrating on the personalities of computer developers and describing flamboyant iconoclasts and troubled geniuses. This history hinges on narratives that describe hackers building their own computers or looking for flaws in existing networks, creating software outside of institutional channels, and tales of activists creating community-based networks for socially innovative applications**.** This second type of history focuses on the visions and social or political goals of the people involved in these experiments, and it is also more likely to discuss these practices and goals in terms of community and to describe how these innovators make up different types of communities. Some examples of these histories include "hacker histories" describing the hacker cultures of the 1950s and 1960s by Levy (1984) and Markoff (2005), descriptions of the technical cultures of radio tinkerers in postwar America (Haring 2006), close histories of cybernetic researchers in California in the 1960s (Bardini 2000) and their relationships to members of the counterculture (Turner 2005). Also in this tradition is the cultural and social history of open source software developers from the 1990s onward as exemplified by Moody (2002).

One limitation of the first type of history is that it implies a kind of inevitability – the present computing context, with its small, powerful computers linked together in local

networks with connections to a global internet emerges as the obvious outcome of generations of discussions. Even if they are not necessarily deterministic, such stories lay out a rational landscape of ICT diffusion that focuses on how industries and practices develop (see Rogers 1995). In contrast, the second type of history can be too focused on goals, dreams, and visions associated with technology or on the personalities of the visionaries who are often men, especially when their goals are in opposition to the dominant understandings of computing – for example, in the development of community-based computer systems. Often, this focus on the individual genius reinforces masculinist conceits in computer development by celebrating the figure of the brilliant, solitary "lone hacker." In fact, in the past forty years, the transformation of computer technologies has been connected with transformations of organizational forms, including the increasing importance of ideals of community, which appear and reappear as symbolically important in discussions of technological change. Discussing a desirable form for "community" may be one way of evoking the myths of technological transcendence of existing space, time, history, and politics that Mosco (2004) claims underlie contemporary society.

In this chapter I use the concept of computerization movements to link together the two types of computer histories described above and capture some of the social, political and symbolic transformations that have taken place. I describe how computers and ICTs are envisioned as helping to achieve public interest goals, and what social and institutional changes result from the development of these visions. After introducing the concept of computerization movements as it might be understood from the perspective of new social

movements (Touraine 1977, 1988, 1992), I argue that computerization movements perpetuate a paradoxical dialectic between visions of computers as providing greater liberty, social justice, and economic transformation, and the maintenance of a potentially oppressive technical culture through existing economic and social institutions. I provide thematic examples drawn from computerization movements of the early 1970s onward, focusing on how these computerization movements mobilize visions of the democratic potential of computing, which may or may not be reflected in the institutional realities they help to shape. At some critical junctures, notably in the 1970s and at the current time, computerization movements contribute to broader social critiques that link technological changes, media regimes, and political shifts. I conclude by situating community wireless networking as a contemporary example of computerization movements, arguing that it creates its own critique of the existing ownership and institutionalization of communications infrastructure.

Computerization Movements

Kling and Iacono (1995; 1988) describe how intellectuals, professional associations, and civil society advocates helped to integrate computing into mass culture in the United States, arguing that "the spread of these technologies is not simply the byproduct of ambitious marketing departments in high-tech companies. The government, media, grass-roots organizations and coalitions of organizations all communicate favorable links between computerization and a transformed social order which help legitimate relatively high levels of computing investment for many potential adopters" (1995). In other words, visions of positive social transformation help to motivate increased investment in computing. Not surprisingly, Kling and Iacono note that actors in computerization

movements often use the rhetoric of technological utopianism to describe the social benefits that they believed computerization could produce. They reiterate that participants in computerization movements do not consider that they are engaged in marketing: they are instead participating in collective organizations and activities that may have social or political value; for example, early computer hobbyists created social networks and exchanged information to facilitate discussions about common passions.

While Kling and Iacono argue that computerization movements can be compared to other social movements such as labour movements, they are still critical of the technological utopianism of movements that aim primarily to introduce more machines in order to improve society. They conclude that even though the rhetoric of technological utopianism allows people without much experience with computers to sympathize with the goals of computerization movements, the movements themselves often pay little attention to the human cost or impact of computerization. Thus, computerization movements can often serve to advance the interests of elite groups, while justifying the continued existence of networked, technologized society.

I would argue that for the most technically expert members of society, who could also be considered as making up the technocracy – the group of technical experts placed in positions of power based on their knowledge and skills – computerization movements act as a legitimating force. Still, despite their legitimizing tendencies, computerization movements also provide the potential to radically re-envision technology. Kling and Iacono (1995) describe "counter-computerization movements" as mobilizations critical of

some of the outcomes of computerization: for example, the non-profit organization Computer Professionals for Social Responsibility, whose members include professional computer scientists in academia and industry, has lobbied against the use of computers in the service of the military-industrial complex. However, despite their critical stance, these attempts at re-visioning and restructuring technology are connected with the same activities that legitimate computer technology's high social profile. While Kling and Iacono argue that computerization movements are distinct from counter-computerization movements, I believe that the social critique that often develops as a result of computerization and the promotion of computers form part of the same process.

Computerization Movement Dialectics

Based on Kling and Iacono's conceptualizations, I argue that computerization movements present socially critical visions of computing that both criticize and legitimate the current social role of computing and information technology. In particular, the understanding of computerization movements can benefit from conceptual insights provided by Alain Touraine's New Social Movement theory.

New Social Movement Theory

Touraine (1977) presumes that industrial technology has created a rupture between post-industrial society and pre-industrial society. Drawing from this assumption, he claims that the social movements of post-industrial society focus not on control of labour, but instead on influence over the symbolic meanings circulating in society. His New Social Movement theory claims that contemporary social movements work in discontinuity with previous social movements. The theory argues that contemporary social movements

operate at the communicative level and in terms of the production of symbolic meaning, giving cultural orientations a social form (1988, p. 42). A central point of struggle in Touraine's new social movements is what he calls historicity – the set of ethical, cognitive, and economic structures that characterize a society at any point in its existence. New social movements challenge how these structures will be established and represented: in other words, they primarily debate who will define or influence the tenor of the times. Therefore, some of the struggles of new social movements concern ownership of data and the control of the production of symbolic goods.

New social movements have influence at the level of everyday lived society, rather than at the level of the state. Touraine (1988) distinguishes between what he calls diachronic and synchronic social changes. At the diachronic level, radical changes occur as eras end and others begin. At this level, the state's regulations can influence which types of changes occur, for example, favouring one type of economic system over another. New social movements operate instead at the synchronic level, where smaller and more symbolic changes alter social experience, including the experience of historicity. As Canel (2004) writes,

> Touraine's action theory attempts to rescue the subject from all forms of reductionism and seeks to achieve a balance between structure and actor. Post-industrial society, with new technology and increased reflexivity, gives rise to new conflicts and actors. His emphasis on the functioning of society (the synchronic dimension) and on normative contestation highlights the significance of the new movements. The emergence of new actors struggling over non-economic, non-political themes demonstrates the increased reflexivity of post-industrial society regarding the social construction of reality (2004, n.p.).

Touraine insists that the great struggle of post-industrial times is the struggle with historicity. Unfortunately, this insistence fails to describe how these symbolic struggles influence the broader structures formed diachronically by the state. Even though new social movements establish that symbolic aspects of the world are sites for struggle, Touraine's theories risk leaving social movements without any political dimension. He focuses on historicity at the exclusion of institutionalization, which may be a result of his focus on the discontinuities between post-industrial society and other phases of society. Despite this, his theories are usefully applicable to STS research. In particular, Touraine's concern for the synchronic sphere of life resonates with my interest in the co-production of symbolic, organizational, and material aspects of communication technology. Even more importantly, Touraine's identification of the control of data flows as one of the most important elements of post-industrial historicity anticipates computerization movements, where struggles over the shape and importance of computers are also struggles over who should have access to information and how it should be distributed. Empirical application of Touraine's ideas of new social movements to cases like computerization movements provides a conceptual framework that helps to explain why discussions of the social role of computers are important to contemporary society.

Applying New Social Movement Theory to Computerization Movements

Promoting computers and computing as a solution to social problems both supports and challenges the technological imperative that some scholars see as underlying assumptions about progress (Nye 2006; Slack and Wise 2005), as well as linking together the continuity and discontinuity perspectives on socio-technical change. In one way, the

enduring association between technology and progress challenges Touraine's (1988) insistence that postindustrial society is far different than industrial society. In another way, the focus on computers as emancipatory is essentially post-industrial, because it focuses the symbolic adoption of ideas about computerization. Computerization movements are partly struggles over how computers should fit into society, and whether and how they might make it more just and fair.

Still, computerization movements hint at one of the terrible paradoxes of contemporary society: on one hand they promise a rethinking of computing and a critique of dominant or oppressive representations of computers and technology, but on the other hand, they are part of a "technological society" oriented towards mechanization and consumption. Ellul (1964) argues that organizing society around technology creates a logic of technological dominance. Because they focus on developing and promoting computerization, computerization movements do little to undermine this logic.
I argue that criticism of and implicit support for a technological society are both present in computerization movements, together creating a dialectic that influences both progressive visions of computing and the sometimes more banal realities resulting from these visions. Assessing this tension within computerization movements allows us to see how discussions about the social impact of computers are essential for engaging with historicity: they are part of how the values of contemporary society are defined. More importantly, an historical summary of computerization movements can potentially indicate how the synchronic – affective, symbolic – elements of new social movements impact the diachronic – economic, political – elements of broader social change. This

chapter concentrates on the symbolic influence of computerization movements. Because computerization is itself part of the logic of capitalism, advocates for computerization are on one hand supporting the dominant economic and political system, while on the other hand they are providing alternatives to it by proposing critical symbolic and organizational contexts for computerization. This is especially true of the "grassroots" non-commercial, self-organized forms of many computerization movements that struggle to define the symbolic importance of computing.

Linking Constructivist Communication Studies and New Social Movements: Re-mediations

The concept of re-mediation helps to frame this symbolic importance. Lievrouw (2007) draws from Touraine to argue that new social movements centered on technology engage in a "re-mediation" of media content within the scope of their historicity. While Lievrouw argues that re-mediation of content and forms of media is separate from reconfiguration of technical systems themselves, I see computerization movements as re-mediating both communication systems and their content: they provide re-mediations of technology that resist the logic of capitalism by creating alternative understandings of or frameworks for computer and network technologies. Re-mediations take the logic of a technology as it is understood in one social context, and shift it to resonate with a new context. For example, while computers in the 1940s were associated with defense research, centralization, and expert planning, as Light (2003) and Turner (2006) point out, they were re-mediated by members of the 1960's counterculture as tools for individual freedom and decentralization. Computers have since been re-mediated numerous times in ways that highlight their association with visions of community,

freedom, and democracy. Eventually, the re-mediations themselves become less radical, sometimes developing into more permanent social, economic, or political institutions.

Lievrouw's concept of re-mediations is similar to Bolter and Grusin's (1999) understanding of how media forms are re-mediated: newer media forms like digital media absorb the logic of older forms like film or television. This re-mediation of aesthetic forms and functions is part of a broader logical of re-mediation that I argue includes social structures and organization. Computerization movements create new ways of envisioning computer technologies, establishing re-mediations that include new social contexts and institutional forms.

Computerization Movements Since the 1970s

The concept of re-mediations explains how computers and ICTs can repeatedly be envisioned as inspiring freedom and democracy while simultaneously becoming integrated into the very systems criticized for being undemocratic. I argue that computerization movements both support and criticize technocracy, creating a dialectic that has been repeated over the last forty years, sometimes contributing to social mobilizations at critical junctures in media and politics (McChesney, 2007). For example, in the 1970s, more easily accessible personal computers promised a challenge to the centralized mainframes of the day, and also connected with countercultural goals like providing community-based information and establishing small-scale communalistic societies. The critical juncture of the 1970s, where new computer technology challenged

the existing media and computing landscape, established computerization movements as part of an overall social critique, especially since computers promised alternatives to existing devices, organizations, and institutions. The potential for computers to inspire community or democratic participation emerged out of this critical juncture.

Later, the community computer networks of the 1980s provided services that were not always available elsewhere, or that were alternative to commercial services. However, by the 1990s, the success of the World Wide Web made some of these services less useful, and computerization movements focused the potential for networked computers to facilitate online "virtual" communities. A proposed "community" model for the internet was perceived as disrupting both consumer capitalism and the linkages between computers and the military-industrial complex. 1990s computerization movements promised to extend connectivity and the liberatory potential of computers to an even broader group of people: ideally, everyone. In many ways, this vision has influenced the West's current reality of ubiquitous, always-on computer networking. In the 2000s, computerization movements like community WiFi establish local organization as one of the contexts for computerization in the interests of community. Therefore, over the past forty years, the vision of "community computing" has inspired criticism of established computer structures through the development of alternative socio-technical forms, while at the same time influencing the development of computer technology and institutions. The following sections explore this dialectic by providing examples of computerization movements from the 1970s onwards.

Improving Office Work and Expanding Minds: Computing in the 1970s

Two opposing visions of computing emerged in the 1970s and early 1980s. In the business world, computing technology supported rationalized bureaucratic processes, while in the California counterculture epitomized by Stewart Brand and the 'new communalist' movement (described by Turner (2006)), computing was associated with the reversal of bureaucracies and the development of individual intellectual freedom. The tension between control and freedom is one aspect of the dialectic that underlies the promotion of computing, and has accompanied the commodification of computing and information technology.

Office Bureaucratization, Workplace Democratization

Kling and Iacono (1988) describe how computing systems have been associated with social improvements, in particular with greater autonomy and democracy of access to information, but also with an ease of use and streamlining of work. They describe the Office Automation movement that advocated computerizing offices as a way of making secretarial jobs easier, as portraying "social relations as cheerful, cooperative, relaxed, and efficient – better jobs in better environments" (p.233). The push for computerization, even in offices, was not coming from managers pursuing greater control, but also from advocates who imagined in computers the potential to make work – and life – easier. This meant that advocates for Office Automation, even as they acknowledged the potential for computers to promote 'deskilling' and increased work pressure (especially for women working in administrative positions), framed their promotion of computers around the idea that computerization could make office jobs easier. Still, the importance of control through computing systems was never very far from the discourse of institutional computerization movements.

The Counter-culture's Mind-expanding Machines

As computers in the 1970s became smaller and more powerful, voices besides those in industry began to represent the progressive social potential of different elements of computing, specifically the mind-expanding, personally-empowering and anti-bureaucratic potential of computing technology. Turner (2006) traces the connections between this strand of computerization advocacy and "systems-oriented ecological theory and cybernetics" (121). Influential members of the counterculture, especially Stewart Brand, became deeply involved in computerization research and advocacy from the 1970s onwards. Initially drawn together by research centres including Douglas Englebart's Augmentation Research Centre (ARC) at the Stanford Research Institute (SRI) as well as hobbyists associated with the loosely organized People's Computer Company and the Homebrew Computer club, computer researchers, hobbyists and advocates were inspired by the idea of computers as means of expanding individual intellectual capacity while encouraging "elements and emblems of a collaborative system designed to amplify . . . individual skills" (Turner, 2006 p.108). Englebart, in whose laboratory the first on-line, distributed computing system (the NLS) was developed in the late 1960's and early 1970's, advanced the idea of a 'co-evolution' of computer systems and their users. Based on experiments with the NLS, his vision rigorously involved "the coevolution of user and machine and the concomitant requirement that the user undergo the rigors of a learning process" (Bardini, 2000 p. 154). Englebart implied that through use of a computer system, an individual could become part of a system of collective intelligence. Ideally, a distributed, worldwide group of users would be drawn together through networked computers.

This idea resonated with the countercultural ideals of collective knowledge, mind expansion, and communal living and working. Stewart Brand's *Whole Earth Catalogue* and subsequent *CoEvolution Quarterly* magazine picked up these ideas and distributed them to a broad reading public that included back to the land advocates as well as counterculturalists and computer hackers. The Whole Earth Catalog and Brand's other work connected the discourses of what Turner (2006) calls "new communalism" an ethic associated with a return to rural, communal living, and which also associated this rural simplicity with the use of particular tools introduced to readers of Brand's *Catalog*, with the practices of computer experimentation and design like those that Englebart's team undertook. Turner describes how when SRI lab members moved to the newly founded research and development laboratories of Xerox PARC in Palo Alto in 1972, the Xerox PARC library was outfitted from the Whole Earth Truck Store, and also how PARC designers drew from layout elements in the Catalog in their design of new technologies. Later, Brand interviewed PARC engineers for an article in *Rolling Stone* magazine, at the time a countercultural magazine known as much for being anti-establishment as for its eclectic music criticism. In turn, the researchers and experts within PARC became advocates for the transformational potential of computing by building small-scale technologies for communication and collectivity. This constellation of Californian influences provided an imagination of the computer as a mind-expanding machine, linked into the expansion of consciousness. The key to the computer's mind-expanding potential – especially its potential for co-evolution – was that it, like the mind itself, could be modified[i].

This iteration of 1970s computerization movements contrasts directly with visions of the computer as a tool for control and bureaucratization. It presents the computer as one element in a project of radical emancipation through the encounter between human and machine. This computerization movement presents a new set of actors – not the para-professional organizations that Kling and Iacono describe, but instead loose networks of individuals with expert understandings of computers, who were not necessarily part of the counterculture, but in some ways allied with it. These people – hackers – had the skills to transform computers into mind-expanding machines that promoted and developed community.

Hackers

Hackers appear frequently in computer histories. Sometimes identified as computer hobbyists and sometimes as experts, hackers combine a deep understanding of computer languages with a playful problem-solving approach. The hacker's quasi-mythical cultural origins are as MIT computer science students of the 1950's and 1960s who reprogrammed mainframe computers for fun (Levy, 1984). The early hacker narratives describe late-night pranks, hackers sleeping in their offices, and other tales of devotion to machines. As a cultural category, hackers – with similar qualities to the WiFi geeks I introduce in the next chapter – suggest that modification of machines might be a way of engaging in the struggles of a computerized world. Levy's (1984) description of a 'hacker ethic' evokes some of the radical, oppositional character of hacker cultural identity. He argues that a hacker ethic includes the following values, that:

> 1) Access to computers – and anything that might teach you something about the way the world works – should be unlimited and total;
> 2) All information should be free;
> 3) Mistrust Authority – Promote Decentralization;

> 4) Hackers should be judged by their hacking, not bogus criteria such as degrees, age, race, or position;
> 5) You can create art and beauty on a computer;
> 6) Computers can change your life for the better. (p. 79)

The hacker personifies a connection between resistant ideals of computer systems design and resistant or oppositional social ideas. Hackers provide a counterpoint to associations between computing and the bureaucratic military-industrial complex. Their engagement with computers is intimate and playful; they break down established conventions. Revealing system weaknesses, sharing software, promoting "freedom" and playing with technology, hackers from the 1970s to the 2000s seem to promise a kind of resistance to the status quos of computing – a cheeky call-up of the parts of computerization movements that promised consumer electronics as solutions to social ills. Hackers assume computers can change lives for the better – and they attempt to do this by of routing around authority they perceive as bogus.

Turner describes how hacking connected the California counterculture with computerization movements. In the 1970s many "old guard" hackers who had learned computing on large centralized mainframes were working on ways to decentralize these systems and make computers more accessible. In California, this led to community-based computing initiatives, including the People's Computer Company, which published a playfully-decorated newsletter and opened a storefront where people could buy computer parts, and Resource One, a project that established public computing terminals around Berkeley. Resource One hosted the Community Memory project, a peer-to-peer community network that allowed Berkeley residents to post, share, and access local

information. Ken Colstad described the project in the People's Computer Company newsletter:

> Such a horizontal system would allow the public to take advantage of the huge and largely untapped reservoir of skills and resources that resides with the people . . . [it would] counteract the tendencies towards fragmentation and isolation so visible in today's society (cited in Turner, 2006 p. 115).

Resource One and the Community Memory project were developed by people who had been active in anti-war protests, and they act as a technological critiques of isolated, rationalized society and the military-industrial complex. The people who founded Resource One were computer experts who had learned how to hack at MIT. They were also, as Markoff (2007) argues, entwined into anti-war, anti-establishment counterculture. In 1970s California, hacking and computing became integrated into discourses and practices of community building. The dialectic negotiation between the computer as rationalizing tool and computer as mind-expanding democratic medium characterizes the process by which the culture of computer advocates influenced the design of computing tools, which then again became integrated into new visions of computing. In this way, the structural paradigm of the computer as an organizational tool synthesizes with the paradigm of the computer as a mind-expanding media for collective consciousness.

The connection between cognitive expansion and freedom of mind, communal living and democratic access to local information contributed to the framing of the social critiques offered by 1970s computerization movements. Yet this critical juncture, shaped as it was by the social unrest of the late 1960s, eventually passed, and personal computers instead became associated with the promise of neo-liberal capitalism. As the Apple Macintosh

personal computer emerged as a heavily marketed consumer product in 1984, these symbolic elements had combined to produce a new cultural structure or context, that of personalization, which would in turn engage dialectically with a new perspective on the computer (and, increasingly, the network) as a site for community development.

The 1980's – Democracy through Personalization, Freedom through Free Software, and Community through the Network

Personalization

Computer histories including the one presented by Ceruzzi (1999), frame the launch of the Apple Macintosh personal computer in the United States as the triumph of the "computer as a personal machine." These histories suggest that personalization is the end point of computer history. In 1984, an extraordinarily expensive commercial aired during the Superbowl portrayed the Apple computer as preventing society's descent into an Orwellian dystopia. This mass-media representation of technological utopianism evoked the personal, individual transformation that was to come as a result of new computing technology. The revolution was explicitly a consumer one as the Apple was a completely closed system: unlike earlier PC's that could be modified by their owners, there was no encouragement to open up the box and add, subtract, or modify components like hobbyists had done with the first personal computers.

In this context of personalization and commodification of computers, the association between personal computing and democracy persisted. Despite his earlier interest in communalism, in the 1980s Stewart Brand advocated that personalization of computers was a key part of their liberatory potential, and one that could be revealed with the help

of hackers. In 1984 he invited 150 hackers to a conference outside of San Francisco, with the goal of defining the social impact of hacking and developing a cohesive community of hackers. Turner argues that the conference represented an important moment of defining hackers (who otherwise played a variety of different social roles) as a cohesive community of cultural rebels who could liberate computing (and thus society) from the control of technocracy. However, this liberation was achieved partly through the process of personalization: Turner (2005) quotes Brand as saying that "in reorganizing the Information Age around the individual, via personal computers, the hackers may well have saved the American economy. High tech is now something that mass consumers do, rather than just have done to them" (p. 138). Therefore, by purchasing computers, mass consumers were reasserting their social influence.

Free Software

At the same time as black-boxed personal computers were being sold to a new generation of consumers, and personalization of computers was seen as a way to route around the control of centralized information systems, Richard Stallman and other former MIT hackers focused on opening up access to computer software, continuing the tradition of sharing source code that had been part of early hacking. Stallman was convinced that the MIT lab's culture of sharing was essential to developing good software, and thus promoting freedom. He founded the Free Software Foundation, dedicated to maintaining totally free and modifiable software. Stallman's libertarian political stance (which also became associated with free software in general) focused on personal freedom made possible through increased access to and control over source code. He developed an operating system called GNU (a recursive acronym for GNU's Not Unix) that was

completely free – not only free of charge, but built upon freely accessible source code. Stallman designed a special software license, the General Public License (GPL) to require that the source code of any modification to his freely available GNU operating system would also be free to consult and use. Moody writes, "Stallman created in the GNU GPL a kind of written constitution for the hacker world that enshrined assumptions about how their community should function" (2004, p. 27). This license codified in words and law the idea that software distribution might be connected to social values, for example, the values of freedom and democracy collectively held by the hacker community.

As computerization movement actors, hackers like Stallman defined software as a site where openness, freedom and sharing opposed enclosure, control, and individual ownership. Moody writes, "Stallman's work is significant not only because it engendered many of the key elements and pioneered many of the processes that made the success of what came to be the combined GNU/Linux operating system possible but because it provides an ethical backdrop against which the entire free software and open source story is unfolding" (p. 29). Free software established access to source code as a corollary to access to other means of production like printing. However, free software licenses guarantee the freedom of the software code, rather than the products derived from it. Free software thus creates individual freedom for software programmers. Throughout the 1980s business models developed that capitalized on this individual freedom. Free software's first licenses laid the groundwork for new forms of software production based on the re-use of common elements of source code. Called "open source" this method of

working depends on freely available source code but establishes ownership and profit models for the finished software products. What had begun as a radical claim that "information wants to be free" eventually facilitated a new business model for software development[ii]. The expansion of free software and open source modes of work expanded their influence partly through distributed computer networks, developed through the 1980s not only facilitated the hacker community's distributed work on computer code, but also captured the imagination of other computerization advocates.

Networking and Community

The individual PC, even when it is interpreted as a symbol of freedom to consume, has its limits. The possibility of building networks of computers transforms individual products into nodes in communication networks. The first computer networks were developed through the 1960s and 1970s and for the most part remained experimental and connected small groups of terminals linked to a central mainframe computer, but the ARPANET – built by researchers associated with the Advanced Research Projects Agency, a United States Department of Defense-funded research project – created a network that spanned the continental United States. The network was meant to facilitate shared use of computer resources, but researchers mostly used it to communicate using electronic mail. In the early 1980s, people who had worked on the packet-switching technology of the ARPANET created commercial packet-switching services that provided the possibility for people outside of ARPA-funded institutions to also use this form of communication. Abbate (1999) writes, "The ARPANET had publicized the benefits of computer networking in the early 1970s. Later in that decade, a number of individuals and organizations began to experiment with providing these benefits to computer users who

were excluded from the ARPA community and could not afford commercial network services. These grassroots networks, designed to be inexpensive, were usually run as cooperatives, with a minimum of central coordination. They were user-driven efforts" (p. 200). Some examples of these on-line services, as they were called, were newsgroups like USENET or non-ARPANET university links like CSNET and BITNET. The swift proliferation of these networks was eased along by the accessibility of small personal computers and local area networks that connected them.

As Abbate describes, one surprise in the development of the ARPANET was the role of the system's users in finding interesting and constructive applications. E-mail use grew along with computer networks: as other systems paralleled ARPANET, mail switching technologies made it possible to send e-mail to anyone with a connection to any computer network. The ability to communicate asynchronously with one of potentially millions of other people was a clear indication of the shift from computing systems to communication systems (Abbate, 1999 p.111) – or, away from the paradigm of the business organizer and towards the paradigm of the mind-expanding machine. This shift continued throughout the 1980s with the expansion and commercialization of online systems that had their roots in previous computerization movements. For example, Douglas Englebart's NLS was considered a curiosity when it was first presented in 1966, but eventually inspired the development in the mid-1980s of commercial bulletin board systems (BBS) that complemented the local and grassroots systems.

To cater to the increasing numbers of personal computer owners, commercial services like CompuServe and Prodigy charged subscribers monthly fees for access to these communication and information tools. Many of these produced what Rheingold (1993) called "virtual communities" where people "use words on screens to exchange pleasantries and argue, engage in intellectual discourse, conduct commerce, exchange knowledge . . .create a little high art and a lot of idle talk" (p. xvii).

Defining "Virtual Community"

Rheingold's main point of reference for his idea of virtual communities was the WELL, the "Whole Earth 'Lectronic Link" on-line system founded by Stewart Brand as a new home for the San Francisco counterculture. Regardless of the fact that the WELL's first participants already shared a local community and culture, the idea of "virtual communities" and "electronic frontiers" became, as Turner argues, "key frames through which Americans would seek to understand the nature of the emerging public Internet" (p. 142). The WELL's success stemmed not only from the fact that it served people who already shared a similar geographic location, but also because it provided ways for these people (many of whom had already explored new technologies and sites of exchange through the *Whole Earth Catalog* and *Co-evolution Quarterly* to create and exchange information that was worth paying for. The WELL, in essence, sold its community members to themselves, by creating an open structure to which people could add topics, posts, or responses. This model was adopted by other on-line services that developed around the same time.

On-line services like the WELL and the other community networks introduced North Americans to socializing using a keyboard, computer, and modem. In the context of what some advocates (especially Schuler 1996) perceived as a decline in "traditional community," online networks that could make access to information and communication more democratic were envisioned as pillars supporting a "new community" of deep, collective engagement and reinvigoration of local democracy. The WELL provides a strong example of how the notion of "grassroots" local engagement becomes connected with networked computer technology. These re-mediations of computer technology have drawn on the popularity of the personal computer, which had been the focus of computerization movements of the 1970s. They also established computer networks as networks of communication – and inspired the hope of creating community by expanding access to these networks.

The 1990s: Community or Commercial Networks?

In the 1990s, computers became framed as communication tools, amid rhetoric of an "information revolution" or "knowledge-based economy" that circulated visions of computers and networks as tools for democracy and liberation. In particular, this rhetoric accompanied the expansion of the internet from a primarily university-based network to a hyperlinked, multimedia platform for information, education, and commerce. The dialectic of the 1990s computerization movements contrasts the expansion of access to computer networks, especially the internet, with questions about whether this access fulfils community aims rather than becoming a commercial marketplace. Some of the literature pursuing this questioning includes Feenberg (1995), Shade (2002b; 1999), and a review by Feenberg and Barney (2004).

Feenberg and Bakardjieva (2004) identify two models for virtual or online community: the "consumption model" and the "community model." The opposition between these models describes the dialectic of 1990s computerization movements. The "consumption model" establishes the internet as a platform for consumption of goods and media, while the "community model" is anchored in hopes that the internet will support "relatively stable, long-term . . . associations" (p. 2). The "community model" draws from the experiences of people who participate in "virtual communities" like the WELL and other BBSs, as well as the developing local community networks. They argue that community building using new technologies can act as a 'democratic rationalization' that "challenges harmful consequences, undemocratic power structures, and barriers to communication rooted in technological design" (p. 16). They ask: "will the Internet become the ultimate entertainment and/or information medium, a seamless environment for business transactions of all kinds? Or will the Internet emerge as a community technology, enlarging human contact both globally and locally in accordance with the early visions and the subsequent practice of community building?" (2004 p. 24). These questions lay out the dialectic between the internet as mass medium and marketplace and the internet as platform for global and local community building.

This dialectic has motivated the development of studies in community networking. During the 1990s, concern about the impact of computer networks on community motivated theoretical and practical work following two interpretations and re-mediations of computing in the context of community: one a continued focus on virtual communities

as communities of interest replacing or transcending other types of community and the other the examination of how existing forms of community occupy the digital sphere – for example, the idea of reinforcing local communities by providing them with electronic tools (Stoecker 2005). Virtual communities were perceived as providing both new sites for democratic engagement in an age of transformed mobility, and as facilitating novel types of communication and work. The following two sections analyze these re-mediations before I move on to discuss networking in local communities.

Virtual communities and the Space of Flows

The re-mediations of computer networking in the 1990s engaged with the political potential of virtual communities not necessarily fixed in geographic space or place, inspiring theorists and practitioners to find a way of situating community and civic action in this new global context. Virtual communities promised a global reach of communities, linked through the web. This inspired Etzioni (2004) to envision that community and civic life would take place not in cities and towns and civic institutions, but in the "parallel universe" of cyberspace (Benedikt 1991) "layered on top of, within and between the fabric of traditional geographical space" (Batty, 1993 cited in Graham 1998). This drew out what Wellman and Gulia (1999) perceived as a "polemical" split between a perception that cyberspace would "re-enchant" community eroded by a loss of social capital and a perception that online community would destroy real community. The polemic was further embedded in a context of increasing globalization that was also facilitated by the expansion of the internet and networked technologies. Geographers like Harvey (1996) laid aside absolute definitions of the concepts of space and time,

describing instead how "multiple processes flow together to construct a single, consistent, coherent, though multi-faceted time-space system" (p. 260-261). This purported shift in the way that community and society are organized inspired Wellman's (2001) argument that networked communication and globalization mark the age of a "networked individualism" where social engagement becomes shallower, less grounded in place, and anchored in the individual. Proponents and theorists envisioned the network model as inspiring the development of different social imaginaries.

Castells (2001) assembles empirical evidence for the existence of a network society characterized by two kinds of social spaces: the space of flows that operates within the network, and the space of places. The space of flows is made up of small personal networks that feed into wider networks. However, even though the logic of flows and capital operate at a global level, people still live in places. Castells is unclear about whether or not valuable political engagement can take place within the space of places: he argues that power is located in the space of flows, so resistance should also be located there. He responds by proposing the concept of "networked resistance", which moves democratic engagement from a local to a global activity situated in the space of flows. This conceptualization of networked resistance is supported by empirical research on social movements and their use of information technology (for a review see Surman and Reilly 2003). It presents a clear example of how computer networks are re-mediated as potential sites of distributed, participatory democracy that extends farther than the democratization of personal computers by virtue of their commercial promotion.

Distributed Communication and Hacking

Free software hackers and open source developers also became better organized and active during the 1990s. In 1991, Linus Torvalds, a Finnish student, created the first version of a free software kernel, the core of a computer operating system. He announced this development to a newsgroup, calling it a project "for hackers, by a hacker" (cited in Moody, 2004 p. 46). Colleagues worldwide began contributing to the software, which combined with Stallman's GNU became a complete operating system, freely available. By the height of the dotcom boom in 1997 this operating system was competing with major software projects, with thousands of people contributing to its development. Hacking and free software still acted as a critique of centralization, control, and private ownership, but through the 1990s hackers and geeks benefited from the huge investment in new technology and internet companies, making large amounts of money from initial public offerings of software, as well as gaining cultural credibility (Hafner and Lyon 1998).

In 1990's academic literature, hackers were described as the probable inhabitants of the new social space envisioned as taking shape on the internet. In response to the dotcom boom's hyperbolic commercialization of the internet, theorists looked for evidence of non-commercialized, community activity on the network. Because hackers interfered with and reconfigured the network, hacking became imagined as a radical practice that demonstrated the potential of virtual community. Alternative media advocate Hakim Bey (1991), described hacking as creating "temporary autonomous zones" of radical unregulated action around the edges of the network while the Critical Art Ensemble's (1994) direct-action art projects used hacking as "electronic civil disobedience" against

sources of institutional command and control that could no longer be centrally located and targeted. Hackers, whether benign or disruptive, demonstrated that networked politics could include anarchy and resistance. Mosco (2004) describes how the hacker 'trickster' enlivens the positive potential of computer networking: "the hacker makes trouble for everyone, but this modern-day trickster has a powerful purpose: the realization of a mythic utopia locked up by our stagnating tendencies to freeze revolutionary technologies in the ice of outdated social patterns" (p. 48). Because hacking modifies the structures that underpin online space, it seems to propose the network as a space that can be modified and re-envisioned, much like the space of community. This remediation of networks as sites of struggle also reinforced visions of new virtual communities evolving on computer networks.

Politics, Publics, and the Network

Throughout the 1990s community networking projects developed and distributed networking tools to local communities. Some of these specifically engaged with the possibilities for creating a local space on a network. For example, the Amsterdam Digital City (DDS), active from 1994 to 1997 (Rustema 2001), tried to reproduce a city online as a way of developing interest in local city council elections. Scholars considered the DDS innovative because it allowed free access to its citizens to do anything they would do in a 'real' city: including meeting in bars and visiting the red light district. Similarly, Schuler (1996) describes how many community networks use navigation elements drawn from the geography of American small towns featuring the town square, post office, health centre, and school (Chapter 2, n.p.) Thousands of other cities and communities also

created online systems during the 1990s, sometimes giving them explicitly geographical or 'local' names like the Blacksburg Electronic Village (BEV) in Blacksburg, VA.

These community networks, or Free-Nets, usually provided some combination of local information, e-mail service, web hosting, and later internet service provision. They proliferated in the United States and Canada: Moll and Shade (2001) estimated that there were 35 networks in Canada in 1995-1996, with between 250,000 and 600,000 members. Many were founded or supported by people within universities, who had earlier access to computing and networking equipment. The BEV was founded as a partnership between Bell Atlantic, Virginia Technical University, and the town of Blacksburg, to act as a testing ground for online learning services. Ottawa's National Capital FreeNet (NCF) was founded by people associated with Carleton University, but run by volunteers as "a free, computer-based information-sharing network, linking the people and organizations of the region, providing useful information, and enabling an open exchange of ideas with the world" (Patrick 1997). Free-Nets provided an alternative vision of how computing should support community. Rather than situating community in the space of flows, their design and content augmented the local spaces of places. The BEV's success, for example, was framed in terms of how it created a local market for information services (Cohill and Kavanaugh 1997).

Many Free-Nets were founded before the widespread diffusion of Web-based graphical interfaces, and provided text-based information services organized into menus, similar to the Gopher menu-based search interface. These online services were accessible via

modem or public access terminal. Patrick described the NCF, for example, as providing "two types of services: access to an electronic network and content provided by the community and its members" (1997, p. 77), and found that most people using NCF in 1995 responded that they were only "slightly" or "not at all" motivated to contribute to their local community. Even though local information and communication with shared interest groups was rated as the third-most important service, this local communication channel disappeared from the FreeNet as graphically-based Web access became available. As Chapter One indicates, community networks emerged out of many different contexts in North America, and have had a lasting impact on how community and technology are connected.

As of 2005, the NCF had become a broadband service provider, using revenues from high-speed subscriptions to subsidize dial-up Internet access. The NCF is in many ways an exception: although some Free-Nets have become internet service providers, many have disappeared entirely, leaving a vacuum where local, community-based communication and information services had been provided. Through the FreeNets and community networks of the 1990s, internet access became available to a wider group of people. FreeNets also created a means to access local information and a venue for local discussions. While internet services provided some of the same kinds of applications, the local variation in how community networks were designed created more possibilities for democratic rationalization. As Feenberg and Bakardjieva write, "the various conditions of community we have identified can be found fulfilled in many of these experiments" (p. 23). However, one enduring impact of the FreeNets was the creation of networks of

researchers and advocates who continued to advocate for universal access to communication technologies especially the internet, within their own communities (Clement, Moll, and Shade 1998; Clement and Shade 2000; Gurstein 2003). These relationships between researchers, advocates, and developers of community networks have established working relationships and perspectives on public interest communication that continue to develop. As Chapter Six explores, the development of community WiFi has contributed to similar networks of activists, advocates and researchers.

As the global internet expanded through the 1990s, advocates focused less on the local impact of networking projects, possibly because of the unprecedented expansion of the internet and its commercial applications. Throughout the 1990s, the potential for networking to permit community development and democratic engagement in the "space of flows" encouraged re-mediations of computer technology that concentrated on the promise of online community. While this more distributed and network-supported vision of community has become highly commodified (Moll and Shade, 2004), I argue that it also establishes the conditions for 2000s computerization movements, which concentrate on re-establishing the importance of local community and real-life democratic engagement.

The 2000s: Mobility, Flexibility, and Computer-mediated Everyday Life

The 1990s re-mediations of computers and networks foregrounded the idea of democratic and community engagement online, in a sphere separate from that of the local community. They also included the transformation of free software's critique of

capitalism into the flexible labour and distributed production of open-source software development (Weber 2004). The increasingly global network was envisioned as providing an alternative to local spaces where some theorists felt democratic engagement was declining (Putnam 2000). As Web services began to replace the local online services of community networks, "virtual communities" joined geographic communities as sites for social and political engagement. For example, Bakardjieva and Smith (2001) found that participation in so-called "virtual communities" as a form of everyday collective practice permitted "immobile socialization" within the private sphere, establishing online communications sites for collective deliberation and action. This example of "being and acting together," along with the examples of networked politics, established global, mediated networking as a key context for personal computing going into the 2000s.

The assumption in the 2000s, in Western countries at least, is that computer networking should be pervasive, powerful, and extensive. Forlano (2008) argues that this assumption of "anytime, anywhere" networking and connectivity "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 totalizing of physical space rather than the importance of local, bounded communities" (n.p.). Ubiquity and pervasiveness are envisioned as the most valuable qualities of networking. This shifts the perceived link between community and technology. What was once called "online community" is now referred to as "social networking," (see boyd and Ellison 2007 for a summary) and communication tools like e-mail and social networking are now the internet's "killer

applications" (Middleton, 2003). Daily life for people in the West (and increasingly elsewhere) involves regular use of mediating technologies. Visions of democracy, community and ubiquity of access become ever more important as more of daily life can be mediated by technology, but these visions are also concerned with community ownership of communication technology, suggesting a renewed importance of more material concerns.

The Return of the Local, the Development of the Public

As Chapter One also discusses, the increased use of computers as communication and media platforms has had political impact. The "network society" no longer presents a flow of space and time apart from the spaces of everyday life, and consequently, the private rhythms of everyday life combine with the public exercise of democracy. This commingling of public and private demands different metaphors to describe it than the "online public sphere" (Calhoun 1998) or "networked democratic space" (Castells 1996) of 1990s computerization movements. This more nimble, mobile, and increasingly mediated experience of life creates new sites for democratic imaginations of computing, and new theorizations, such as Scheller's (2004) notion of public and private commingling.

Scheller argues that "taken-for-granted geographical understandings of public spheres as spaces and networks continue to limit the ways in which we might imagine the dynamics of public formation" (p. 39). She further argues that private and public spheres are increasingly commingled by mobile technologies. Instead of a public space or a

networked public, she proposes a viscous gel in which mobile communications technologies help people move in and out of contact with one another creating "flexible constellations of identities-on-the-move" (p. 49). Scheller's gel is not a consistent medium. Publics form in some places, for some periods of time, using some network resources, only to dissolve later. While Scheller's conceptualization explicitly theorizes mobility, her concept of the momentary "gelling" of publics helps to explain one of the key ways that 2000s computerization movements re-mediate technology. Concerns similar to those of previous generations of computerization remain, such as an interest in extending knowledge about and access to computers and information networks to a broad and diverse citizenry, and inspiring participation in democracy. Mobility and fluidity have shifted social as well as technical paradigms.

Community wireless networks (CWNs) play a part in changing expectations about how communication systems should be designed, and also change the way that publics are mobilized around and through these systems. CWNs mobilize local technical experts to apply their interest and expertise to developing non-commercial local broadband systems. As I explore in Chapter Three, this can inspire the gelling of a WiFi public engaged with the idea of developing community communications infrastructure. As software hacking becomes more common and more young programmers learn open-source software, community WiFi networks offer a way of building skills and contributing to "WiFi publics." These temporary publics re-envision and reconstruct connections between computer networks and local democracy by developing systems that are locally scaled, using organizational structures drawn from open-source software development.

The Expansion of Open-source Production

Like other computer hobbyists, WiFi geeks experiment with hardware and software that is simple and interoperable: all WiFi antennas and receivers use the data protocols and are built to a common standard. More importantly from the perspective of computerization movements, hackers experimenting with early WiFi modems discovered that the small processors inside them were running the Linux operating system developed by Linus Torvalds and the standard open-source operating systems. The accessibility of the operating system's source code made it possible (and challenging) to modify the modems. One of the important elements of the 2000s computerization movement context is the expansion and application of open source practices, not just within the computer hacking community but also within other areas of life. A generation of computer geeks learned programming by downloading and experimenting with free software, and through CWN projects, geeks frame hacking as a form of citizen engagement. In addition to using technical hacking to create WiFi communities, CWN geeks also contribute to extending the discourse and practice of hacking beyond the technical community. Chapters Three, Four and Six explore this in more detail.

Mobility and Flexibility

Community WiFi organizations have re-mediated WiFi, transforming it from an unstable new gadget to an infrastructure for connectivity. More generalized social shifts have accompanied this re-mediation: for example, Forlano (2008) notes that community-based WiFi has contributed to the development of a mobile public of freelance workers who use WiFi cafes in New York City as office spaces. NYCWireless, the local CWN, introduced free WiFi into some cafes and public spaces in New York City, which resonated with the increasingly flexible work practices of many freelancers and professionals, many of who

no longer work in conventional office spaces. As Forlano notes, WiFi hotspots develop their own communities and cultures that have as much to do with the other advantages of the location as with the availability of internet connectivity.

The disconnect between the media presentation of WiFi as a technology for ubiquity, and the situated local practices Forlano observes, suggests that one of the sites for CWN re-mediations of computer networking may be questions of local and global scale. CWN groups are resolutely local, attracting people with similar technical interests to face-to-face meetings. Yet they are also global and virtual, with practitioners around the world exchanging information online and at national and international meetings, with the goal of providing better WiFi connectivity to their local areas. The re-mediation of WiFi as a technology for local development rather than global connectivity fits into a broader context in which local information services like the ones that FreeNets provided were replaced with connections to the global Internet. At the current critical juncture, when conventional media is undergoing a crisis in ownership and credibility, the possibility of community-based media to develop through community-based WiFi projects is a key aspect of its politicization.

The expansion of open-source software development also contributes to this re-mediation, as greater numbers of geeks learn about software development, and participate in community WiFi projects. This aspect of the community WiFi movement is examined in the next chapter. Together, these elements impact the current visions of how computerization can be invoked in progressive social change. The contemporary context,

where the promise of ubiquitous connectivity is held out as an ideal and where hacking is again positioned as contributing to the public good, sets out opportunities to envision the progressive contributions of computing for local communities, but also creates opportunities to politicize community WiFi as part of broader goals for media reform.

Conclusion

From the 1970s to the 2000s, computerization movements have dialectically engaged with dominant imaginations of computing, putting forth alternatives to military-industrial computing and mass media at some critical junctures, but also legitimating the social role of computers and ICTs. Computerization movements can be thought of as similar to new social movements, because they frame computing in terms of its potential to transform democratic social life. On the other hand, forming a social movement primarily to advocate for advances in technology inspires a technocentrism that can reinforce technocratic control. The history of the visions and realities of computerization movements from the past forty years highlights what Lievrouw calls the "re-mediations" that computerization movements experience in different social contexts. The rest of the thesis focuses on the role of community WiFi networks in the current context of mobility, ubiquitous connectivity, and mutable publics.

CWNs are a contemporary form of computerization movement: they draw on elements of the computerization context that surrounds them, and re-mediate these elements by envisioning new forms and uses for WiFi networking technologies. The realities that

develop from these visions include local community WiFi networks and the promise of engagement of CWN actors – as communities and "gelling" publics – in democratic life. At the same time, like other computerization movements CWN projects play a role in institutionalizing computing technology. Experiments with WiFi establish technical standards and social frameworks that help the technology become established and accepted. Furthermore, CWN plays another kind of institutionalizing role, by changing expectations about how communication systems should be established, and by whom. This institutionalizing role may, at best, underline the importance of public or citizen involvement in telecommunications.

CWN critiques existing ICTs and media technologies by establishing alternatives to them. At the same time, these alternatives contribute to the development of new institutions. Hackers and geeks are involved in developing community WiFi, but so are bureaucrats, policy-makers, equipment manufacturers, and marketing agents – not to mention laptop computers, WiFi routers, and antennas. The history of the CWN movement establishes how these actors situate the connection between community and computer networks at a critical juncture in media and communications development and policy making, and how this contributes to the dialectic inherent in computerization movements between critique and institutionalization. The next chapter explores this dialectic, and the creation of WiFi communities and publics, in the case of Montreal's Île Sans Fil.

Bibliography

Abbate, Janet. 1999. *Inventing the internet*. Cambridge, MA: MIT Press.

Bakardjieva, Maria, and Richard Smith. 2001. The internet in everyday life: Computer networking from the standpoint of the domestic user. *New Media and Society* 3 (1): 67-83.

Bardini, Thierry. 2000. *Bootstrapping: Douglas Englebart, coevolution, and the origins of personal computing*. Palo Alto, CA: Stanford University Press.

Benedikt, Michael. 1991. *Cyberspace: First steps*. Cambridge, MA: MIT Press.

Bey, Hakim. 1991. *T.A.Z.: The temporary autonomous zone, ontological anarchy, poetic terrorism*. Brooklyn, NY: Autonomedia.

Bolter, Jay David, and Richard Grusin. 1999. *Remediation*. Cambridge, MA: MIT Press.

boyd, danah m., and Nicole B. Ellison. 2007. Social network sites: Definition, history, and scholarship. *Journal of Computer-mediated Communication* 13 (1). http://jcmc.indiana.edu/vol13/issue1/boyd.ellison.html.

Calhoun, Craig. 1998. Community without propinquity revisited: Communications technology and the transformation of the urban public sphere. *Sociological Inquiry* 68 (3): 372-397.

Canel, Eduardo. 2004. "Community power and grassroots technology". Government of Canada, http://www.idrc.ca/en/ev-54446-201-1-DO_TOPIC.html (accessed January 12 2008).

Castells, Manuel. 1996. *The rise of the network society*. Oxford: Blackwell.

———. 2001. *The internet galaxy: Reflections on the internet, business, and society*. Oxford: Oxford University Press.

Ceruzzi, Paul E. 2003. *A history of modern computing, 2nd edition*. Cambridge, MA: MIT Press.

Clement, A., M. Moll, and L. Shade. 1998. Debating universal access in the Canadian context: The role of public interest organizations. In *E-commerce and E-commons: Communications in the public interest*, edited by M. Moll and L. Shade, 23-48. Ottawa, ON: Canadian Centre for Policy Alternatives.

Clement, Andrew, and Leslie Regan Shade. 2000. The access rainbow: Conceptualizing universal access to the information/communications infrastructure. In *Community informatics: Enabling communities with information and communications techology*, 32-51. Hershey, PA: Idea Group Publishing.

Cohill, Andrew, and Andrea Kavanaugh. 1997. *Community networks: Lessons from Blacksburg, Virginia*. Boston: Artech House.

Critical Art Ensemble. 1994. "Electronic civil disobedience", http://www.criticalart.net/books/ecd/index.html (accessed January 25 2008).

Ellul. 1964. *The technological society*. New York: Alfred A. Knopf.

Etzioni, Amitai. 2004. On virtual, democratic communities. In *Community in the digital age: Philosophy and practice*, edited by A. Feenberg and D. Barney, 225-238. Toronto: Rowman & Littlefield.

Feenberg, Andrew. 1995. *Alternative modernity: The technical turn in philosophy and social theory*. Berkeley, CA: University of California Press.

Feenberg, Andrew, and Maria Bakardjieva. 2004. Consumers or citizens? The online community debate. In *Community in the digital age: Philosophy and practice*, edited by A. Feenberg and D. Barney, 1-30. Oxford: Rowman & Littlefield.

Feenberg, Andrew, and Darin Barney, eds. 2004. *Community in the digital age: Philosophy and practice*. Lanham, MD: Rowman & Littlefield.

Forlano, Laura. 2008. Anytime? Anywhere?: Reframing debates around community and municipal wireless networking. *Journal of Community Informatics* 14 (2).

Goldberg, Adele. 1988. *A history of personal workstations*. Palo Alto: Addison-Wesley.

Graham, Stephen. 1998. The end of geography or the explosion of place? Conceptualizing space, place, and information technology. *Progress in Human Geography* 22 (2): 165-185.

Gurstein, M. 2003. "Effective use: A community informatics strategy beyond the digital divide" *First Monday*, http://www.firstmonday.dk/issues/issue8_12/gurstein/ (accessed April 1 2008).

Hafner, Katie, and Matthew Lyon. 1998. *Where wizards stay up late: The origins of the internet*. New York: Touchstone.

Haring, Kristin. 2006. *Ham radio's technical culture*. Cambridge, Mass.: MIT Press.

Harvey, D. 1996. *Justice, nature, and the geography of difference*. Cambridge, MA: Blackwell.

Kling, Rob, and Suzanne Iacono. 1988. The mobilization of support for computerization: The role of computerization movements. *Social Problems* 35 (3): 226-243.

———. 1995. Computerization movements and the mobilization of support for computerization. In *Ecologies of knowledge*, edited by S. L. Star, 119-153. New York: SUNY Press.

Levy, Steven. 1984. *Hackers*. Garden City, New York: Doubleday.

Lievrouw, Leah. 2007. Theorizing alternative/oppositional new media: Exploring new social movement theory and the sociology of alain touraine. Paper presented at Society for Social Studies of Science, October 10-13, 2007 in Montreal, Quebec.

Light, Jennifer. 2003. *From warfare to welfare: Defense intellectuals and urban problems in cold war america*. Baltimore, MD: Johns Hopkins University Press.

Moll, Marita, and Leslie Regan Shade. 2001. Community networking in Canada: Do you believe in magic? In *E-commerce vs. E-commons*, edited by M. Moll and L. R. Shade, Ottawa: Canadian Centre for Policy Alternatives.

Moody, Glyn. 2002. *Rebel code: Inside Linux and the open source revolution*. New York: Basic Books.

Mosco, Vincent. 2004. *The digital sublime: Myth, power, and cyberspace*. Cambridge, Mass.: MIT Press.

Nye, David. 2006. *Technology matters: Questions to live with*. Cambridge, Mass.

Patrick, Andrew S. 1997. Media lessons from the National capital freenet. *Communications of the ACM* 40 (7): 74-80.

Putnam, Robert. 2000. *Bowling alone: The collapse and revival of american community*. New York: Simon and Schuster.

Rheingold, H. 1993. *The virtual community: Homesteading on the electronic frontier*. New York: Addison-Wesley.

Rogers, Everett. 1995. *The diffusion of innovations, fourth edition*. New York: Free Press.

Rustema, Reinder. 2001. *The rise and fall of DDS*. M.A. Thesis, Communication Science, University of Amsterdam.

Scheller, Mimi. 2004. 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.

Shade, Leslie Regan. 1999. Roughing it in the electronic bush: Community networking in Canada. *Canadian Journal of Communication* 24 (2): 179-198.

———. 2002b. *Gender and community in the social construction of the internet*. New York: Peter Lang.

Slack, Jennifer Daryl, and J. Macgregor Wise. 2005. *Culture + technology: A primer*. New York: Peter Lang.

Stoecker, Randy. 2005. Is community informatics good for communities? Questions confronting an emerging field. *Journal of Community Informatics* 1 (3): 13-26.

Surman, Mark., and Kelly Reilly. 2003. Appropriating the internet for social change: Towards the strategic use of networked technologies by transnational civil society organizations. New York: Social Science Research Council.http;//www.ssrc.org/programs/itic/.

Touraine, Alain. 1977. *The self-production of society*. Chicago and London: University of Chicago Press.

Turner, Fred. 2005. Where the counterculture met the new economy: The well and the origins of virtual community. *Technology and Culture* 46 (3): 485-512.

Weber, Steven. 2004. *The success of open source*. Cambridge, MA: Harvard University Press.

Wellman, Barry. 2001. Physical place and cyber place: The rise of personalized networks. *International Journal of Urban and Regional Research* 25 (2): 227-252.

Wellman, Barry, and M. Gulia. 1999. Net surfers don't ride alone: Virtual communities as community. In *Networks in the global village*, edited by B. Wellman, Boulder, CO: Westview Press.

---

[i] Modifying a computer required technical expertise, while expanding a mind might have involved drugs, laser light shows, or psychedelic music.

[ii] The open-source development process has had significant economic impacts impossible to discuss in detail here. Weber (2004) provides a review.