Ill Communication
Transmissive Control and the Decline of the Open Internet

Dissertation Proposal

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Introduction

"The world is now like a continually sounding tribal drum, where everybody gets the message all the time" – Marshall McLuhan

As the Internet engulfs more media and mutates its communications, McLuhan's (1964 [1994]) vision of a *global village* intensifies in relevance. The open, decentralized, and digital communications network has risen to become a dominant medium across the world. Its messages pulse and reverberate to manifest an expansive network that distributes a common high-speed tempo to its users. Unlike broadcast media, Internet access is relatively open, and the network comprises many different hubs and clusters. It also differs from conventional communication systems because its capacities depend on fluid digital code. The Internet hosts, as a result, the collision of political visions, alters the circulation of cultures, and sparks ruptures of production, such as free software and user-generated content. This diversity emerges and intersects through its expression in the common time and space of the Internet.

Yet, the tempo of the Internet, kept by the transmission of its bits called packets, now quickens and slows according to a common conductor. The tempo changes because the duration[1] of a packet transmission now falls under the purposeful direction of networking software, whereas it once derived from how fast the wire conducted its electrical signal. Though packets have always involved differences in duration, software now attempts to systemically control their duration. Bell Internet exemplifies these changes when it purposely began slowing down peer-to-peer traffic, while at the same time promoting its own digital mall to sell ringtones, movies, and music (Kapica, 2008). Without blocking content, Bell prioritized their

[1] The usage of *duration* derives from Henri-Louis Bergson who used it to characterize the temporal nature of existence and to compare in kind between processes (See Ansell-Pearson, 2002; Bergson, 1950 [1910]; Deleuze, 1988 [1966]). The usage is not a strict application of Bergson because he remains occupied with human consciousness, and this application concerns technical packets.

services, while slowing unprofitable peer-to-peer traffic[2]. The times of transmissions, in other words, has become tiered and managed due to control by software. Discussions of the changes in transmission time usually invoke computer science, and network engineering literatures. These literatures do not address the same concerns as communication studies that seek to reveal its diagram of power; however, diagrammatics[3] from communication studies do not adequately address time (See Leong, Mitew, Celletti, & Pearson, 2009). Thus, an analytic must be developed that addresses how developments in networking software change the time of transmissions and alters the diagram of power relations in networks.

Considering the ramifications of a changing Internet time involves a study of power relations on the Internet. Power should be "considered as a productive network that runs through the whole social body, much more than as a negative instance whose function is repression"(Foucault, 2000, p. 120). The constitution of a productive network involves certain diagrams or abstract machines, such as discipline or biopolitics (see Rose, 1999). The diagrams harnesses constituent power (*potentia*) into a particular assemblage or network (*Potestas*) (Negri, 1991) because it is "a transmission or distribution of particular features" (Deleuze, 1988 [1986], p. 73). The diagram characterizes an assemblage because it is the pattern repeat again and again. Its distribution of features defines the flows and affects of any assemblage, including a communication network.

The change in Internet time requires an appropriate diagrammatics; one increasingly based on control. Prior applications of a disciplinary diagram, known as a

[2] Many ISPs perceive file sharing and piracy as a threat to their emerging on-demand services. Speaking at the 2010 Canadian Telecom Summit, David Purdy, Vice-President of TV/Video Product Management for Rogers Communications admitted, "there is some benefit in managing our networks just in terms of cutting down p2p traffic." Traffic shaping, in other words, cuts down on competition from piracy.

[3] Diagrammatics refers to "a particular analytical method" that "generates meaning in the process of *continuously* redefining itself" (Elmer, 2004, pp. 23-24).

digital enclosure (Andrejevic, 2002; Bettig, 1997; Dyer-Witheford, 2002), describe the logics as the establishment of checkpoints on the information highway. The approach has proven problematic given the increasingly open, de-centered nature of the Internet. With the advent of web2.0, the centrifugal forces online intensify and the diagram shifts from the conscribed spatial movements of enclosures in favour of the fluid moments of control. As Rogers writes, research must "move beyond the dominant treatment of the Web as a set of discrete sites, which are blocked or accessible" toward the web "as an information-circulation space" (Rogers, 2009, p. 229). Control offers a more appropriate theoretical approach to the power relations of circulation because it emphasizes the capacity to observe and intervene in an open communication system. The concept arose in the work of Nobert Weiner on *cybernetics* – a name that gives indication of the operation of control. "Its name signifies the art of pilot or steersman," he writes before adding "that the word 'governor' in a machine is simply the latinized Greek word for a steersman"(Wiener, 1950, p. 9). The governor is the unit in a machine regulating its operation. Control, in digital communication networks, is a centralized governor mechanism transmits and regulates circulation (Massumi, 2002b). Yet, the contemporary intensification of control over time requires a specific diagrammatics.

The dissertation introduces a diagram of control, known as transmissive control. It affects forces of power through the constitution of the time of expressions as part of a collective assemblage of enunciation in the words of Deleuze & Guattari (1987 [1980]). It operates through software to manipulate the temporality of a transmission during its expression. Transmissive control software *produces and assigns temporalities to transmissions utilizing algorithms for data profiling and networking*. Two types of algorithms express temporalities based on how they allocate pasts and futures to constitute a present (Deleuze, 1994 [1968]). The past comes from machine-readable profiles derived from monitoring techniques within networks to build models or simulations of its traffic, its risks, and its costs (Elmer, 2004). The future, on the other hand, remains a desired network form (Latham, 2005) that algorithms work toward by "increasing the probability of a desired outcome rather than its absolute determination" (Samarajiva, 1996, p. 129). Network traffic experiences specific durations depending on how the software relates a message to a profile and how the software manages a profile to fit a specific logic of networking. The process creates tiers of durations that possess specific temporalities that can be distinguished by their speed, quantification of time (i.e. clock time), allocations of time (i.e. windows of time), synchronization, and frequency. Investigating the introduction and operation of transmissive control explicates the changes in the relation between time and power.

Objectives

The Internet as an object of study offers an illustrative context and cases to explore the facets of transmissive control.[4] Transmissive control elucidates the diagram of the assemblage of software, hardware, computers, humans, networks, institutions, and discourses comprising the Internet. The dissertation first situates the transmissive control and the Internet by asking: (1) How does transmissive control contribute to theories of Internet control? (2) How does transmissive control assist in characterizing the contemporary Internet and its expression of time? How has the expression of Internet time changed? The dissertation then develops a theory of

[4] Transmissive control operates on both wired and wireless networks; however, the nature of wireless radio modulations muddles the specific intentionality of control. The dissertation, in response, will focus on wired Internet communications. Further, since most backbone and mid-level infrastructure is fixed wired networks, the study of wired networks remains the best example of transmissive control. Future studies could apply transmissive control to discuss its particular implications to wireless transmission.

control through the following questions: (3) How does networking software control the expression of time? What technologies enact this control? (4) What are the limits of this control? How do dissidents elude[5] this control? (5) How do democratic movements mediate control? How do the social sciences contribute to the representation of control? The dissertation aims to answers these questions through a literature review of studies of Internet control, a periodization of its emergence on the Internet, and three cases related to its operation, elusion, and representation.

Answers to these questions will contribute to three major streams: communication theory, the emerging field of software studies (see Fuller, 2008), and the political economy of communication systems. The concept of transmissive control adds to theorization of the link between communication and control. Second, the investigation of software to control, to elude control, and to publicize control contributes to software studies by researching networking software. Finally, the operation, the surrounding antagonism, and the attempt for democratic representation of transmissive control interrogates the political economy of the Internet. In particular, the attempt to publicize transmissive control engages with the forefront of the media reform movement and its attempts to engage the public in a call for more democratic communication systems[6]. The dissertation, in sum, will add theoretically, methodologically, and politically to communication studies.

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[5] The word 'elude' comes from the English translation of a conversation between Antonio Negri and Gilles Deleuze in the French journal Future Antérieur. The interview appears in English in the book Negotiations translated by Martin Joughin. He translates the original French passage "Il faut un détournement de la parole. Créer a toujours été autre chose que communiquer. L'important, ce sera peut-être de créer des vacuoles de non-communication, des interrupteurs, pour échapper au contrôle." as "We've got to hijack speech. Creating has always been something dif-ferent from communicating. The key thing may be to create vacuoles of noncommunication, circuit breakers, so we can elude control". Joughin translates the French verb *échapper* as *elude*. It might also be translated as 'to escape', 'to dodge', or 'to run away'. For the original French interview, see http://multitudes.samizdat.net/Le-devenir-revolutionnaire-et-les. Thanks to Ganaele Langlois for help with this translation.

[6] In Canada, see the work of the Open Media organization and its Save Our Net campaign at http://www.openmedia.ca/.

Working Hypothesis

The utility of the concept transmissive control appears once it has been situated in the history of the Internet. The emergence of transmissive control depends on a fragmentation of network time from a consensus over a common high-speed network to a network of tiered times. Twenty years ago, the popularized Internet ushered in an *instant world* of high-speed communication. A consensus brought together governments, engineers, hackers, techno-utopians, libertarians, and telecommunication firms to create the 'network of networks.' Today, this shared vision of a common high-speed Internet has been fragmented into conflicting expressions of network time. Unprofitable peer-to-peer communications acquire a slow speed with time to waste, where value-added services operate instantly with no time to lose. At the same time, hackers and pirates have taken issue with deployments of transmissive control and have attempted to elude its dominion – in effect, expressing their own fleeting network time. The context of the decline of a consensus over an open high-speed network and the rise of a fragmented network time leads to a concrete study of the operation of network time explored in the three case studies.

The first case interrogates the transmissive control software sold by firms, such as Cisco Systems and Juniper networks. These firms sell ready-to-install equipment to network owners. Products range from deep packet inspection and deep flow inspection servers to policy management servers. The options and features of this equipment provide the case to study the operation of transmissive control. The case investigates the profiling and networking algorithms (Galloway, 2006; Goffey, 2008) embedded on this equipment. Specifically, the case studies how profiling and programming algorithms express tiers of durations for packets. They operate through pasts based on profiles of prior network traffic and futures envision an idea process of internetworking online. Its effects include traffic shaping, throttling, bandwidth caps, and value-added services.

The power of transmissive control can also be understood at its limits – the moments where it lacks dominion. Computer piracy offers a paradigmatic case of elusion of this control since it has been deployed to route out illegal file sharing. Pirates, with their belief that information wants to be free, have manifested a strong antagonism toward the usage of transmissive control. The Pirate Bay then provides the second case. The influential piracy website based in Sweden has been a leader in the politicization of Internet issues, included digital copyright and file sharing. In response to new laws in Sweden to protect intellectual property, they launched a service known as iPredator to help home users elude transmissive control software. Its involvement marks one of the first concerted efforts to thwart transmissive control. The case will investigate their iPredator service to explain how it modulates traffic to elude computer profiling.

The struggle between control and pirates does not provide a solution; in fact, the means to politically judge transmissive control must be found. Harold Innis (1951) once made a 'plea for time' – an escape from time to reflect on the essential values. A same response might also be appropriate for the Internet. How might citizens overcome the instantaneous effects of transmissive control and actually reflect upon it? Finding a political time involves a translation of transmissive control from its instant operation into a memory capable of representing its effects to the public. The third case, thus, investigates projects, especially software projects, that represent transmissive control to the public.

The whole dissertation, in sum, expands transmissive control through the following outline. The fragmentation of the consensus about a single high-speed Internet enables the emergence of transmissive control. Opening the black box of software to discover their algorithms and networking processes reveals the operation of transmissive control. Yet, it has a finite capacity to adapt to its inputs. The Pirate Bay demonstrates how political actions entail the modulation of communication to interfere with transmissive control. Despite the resistances of The Pirate Bay, their actions lack the mechanisms to address the control democratically. The final case, then, involves how it to bring transmissive control into the public light. These components explicate a theory of transmissive control.

Theoretical Perspectives

The dissertation grounds itself in theories of communication as *expression* (Lazzarato, 2003; Massumi, 2002a, 2002b). Expression refers to a central concept in the work of Deleuze and Guattari that they distinguish from the convention semiotic system of content. '*Variables of content*' refer to "proportions in the intermingling or aggregation of bodies, where '*variables of expression*' refer the "factors internal to enunciation" (Deleuze & Guattari, 1987 [1980], p. 88). The study of communication as expression entails the study of enunciation. Studying expression focuses on the conditions internal to the way the world comes to be, not their semantic content. "The subject," Massumi writes, "does not express the system. It is an expression of the system" (Massumi, 2002a, p. xvi) or as Lazzarato (2003) writes, "images, signs and statements do not represent something, but rather create possible worlds". Expression enunciates the processes of becoming or the ontogenesis of society. The constitutive logic of expression in any assemblage is part abstract machine or diagram

– its immanent logic (Deleuze, 1988 [1986]). Deleuze and Guattari refer to the expressive components of any assemblage as the *collective assemblage of enunciation* (Deleuze & Guattari, 1987 [1980], p. 88). This particular assemblage offers the primary means to question expressive modes of power found in communication systems.

Packet transmission is the collective assemblage of enunciation of the Internet. All modalities – their processes, mutations, syntheses, and repetitions – must flow through the Internet's common assemblages of expression. Transmission, then, unites the co-existing and overlapping modalities of the Internet, including forms of labour (Mosco, 1996), deliberative dialogue (Poster, 2001), and ideology (Dean, 2002). While the content changes, the forms of transmission remain the same. All content travels in the same way: the Internet encodes information as packets that computers send in bursts across networks. Emphasizing expression cuts straight to the power of the enunciation without conflating or overlooking its content.

Transmissive control is the emerging diagram of power in the collective assemblage of enunciation of the Internet. It operates by forming, shaping, and mediating any message at the level of expression, not content. Expression *transforms* communication and its effects – a point Latour makes explicit. "Information as something that will be carried through space and time, without deformation, is a complete myth," he argues (Lovink, 2002, p. 155). Expression online functions as flows of packets. How expressions transmit flows of managed packets routed across the many networks of the Internet transforms its communicative effects. Transformations assign "objective materiality as well as socially constructed constraints" (Wise, 1997, p. 58) that express or constitute collective assemblages as part of the message.

Transmissive control manifests in the profiling and programming algorithms that intervene at the moment of expression. Massumi emphasizes the effect of control at a the moment of expression where he writes, "control involves the assimilation of powers of existence, at the moment of their emergence (their phased passing), into a classificatory schema determining normative orbits around which procedural parameters for negotiation and advocacy are set" (Massumi, 1998, p. 57). The terms Massumi uses clearly align with the terms of transmissive control: profiling utilizing classificatory schema and networking logics have normative orbits that pull communication toward its goals. One could leverage the concept to explain how ISPs have utilized transmissive control to permeate communication with economic rationality, expressing the time to speak or to create online in tiered service plans and high-speed clients, or as wastes of time in marginalized modalities of communication.

Methods and Sources

The method employs a combination of experimental software studies to augment its critical approach. Where software studies (Chun, 2005; Fuller, 2008; Mackenzie, 2006) have questioned the politics of software running on computers and web servers, the approach has yet to empirically study networking software. Research thusly draws on software studies, but it develops new methods to understand how packet transmission enacts transmissive control. The overarching perspective focus on how software processes packets and the three cases use specific methods to study its operation, its elusion, and its representation.

The first study will investigate the software enacting transmissive control. It seeks to explore the operation of transmissive control software. The study will use the GNS3 network simulator to virtualize a computer network. The GNS3 application allows for the creation of a network topology where transmissive control technologies then can be installed. The application simulates these technologies using virtualizations of same software running on the popular Juniper Networks and Cisco Systems[7]. The study will configure a network and install virtualizations of transmissive control software to study their processes profiling and networking. Analysis would also document the configurability of these processes.

The second study will utilize packet analysis (Sanders, 2007) to explain how the Pirate Bay's iPredator software eludes transmissive control. The case provides an opportunity to interrogate the limits of transmissive control technologies. A series of tests using the Wireshark packet analysis software will render how BitTorrent packets move across the Internet – how they can be seen, how they trigger traffic shaping software by ISPs, and how they evade such software. The perspective will emphasize how packets trigger and elude forms of network control.

The final study will be the most experimental. The project seeks to find ways to represent transmissive control to the public. It will first review how groups have publicized transmissive control and how media reform groups have approached the issue. For example, Vuze, a popular BitTorrent client, surveyed its users to assemble a list of the traffic management practices of a number of ISPs[8]. Second, the study proposes to make recommendations on how a means to publically monitor transmissive control could be implemented in Canada. These recommendations will arise form experiments with a number of Internet measurement tools.[9] If possible, the project will support the deployment of tools based on its recommendations. The final study, then, actively seeks to engage the research project with the public debates over network neutrality, traffic management, and public broadband.

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[7] The study will develop its method from the introduction to the application, see: http://downloads.sourceforge.net/gns-3/GNS3-0.5-tutorial.pdf?download/.
[8]For the results, see: http://wiki.vuze.com/w/Bad_ISPs/.
[9] For more details, see: http://www.measurementlab.net/.

Relationship to existing literature or professional practice

A number of disciplines have responded to traffic management software. Three disciplines in particular have touched upon these issues: the concept of the digital enclosure from the political economy of communications, the question of network neutrality from the legal and economic streams of Internet governance, and the problem of Internet censorship and surveillance for International Relations. While each of these streams contributes to the knowledge, this section demonstrates how a theory of transmissive control rectifies the gaps in the theoretical, political, and methodological facets of these literatures.

First, advanced traffic management software has its most sophisticated theoretical treatment in the concept of the digital enclosure from the political economy of communication (Andrejevic, 2002; Bettig, 1997; Dyer-Witheford, 2002). The digital enclosure refers to how copyright holders, Internet Service Providers, and software firms fund the development of digital locks and exclusionary technologies to prevent unauthorized usage of digital networks (Dyer-Witheford, 2002, pp. 132-135), and channels users into streams that deliver profiled advertising, produce cybernetic commodities based on a user's web usage, and consolidate web traffic into commercial web portals (Dahlberg, 2005, pp. 163-172). The digital enclosure, in effect, entrenches "economic and political interests" through "the systematic incorporation of technological choices in absence of consumer choices" (Elmer, 2004, p. 26). Transmissive control might act as a digital enclosure because it guides information into regulated tiers and zones; however, the theory of enclosure struggles to describe this control because of its binary logic of open and closed.

Problematically, the digital enclosure duplicates a binary of open/closed to critique the commercialization of the Internet. The binary, at its worst, threatens to reduce the complex ramifications of advance traffic management software into a question of good (open) and bad (closed). Further, the spatial metaphor of enclosure describes the problem as a fixed and static system. Software does not operate as a structure, but as a process. Communication does not exist permanently outside the influence of control, but temporally. The case of the Pirate Bay illustrates how resistance involves a race. Pirates race to find the virtual limits of control as quickly as control technologies modulate their operation to encompass resistances. While the broader political economy of the digital enclosure remains useful, transmissive control adds a more precise account of the struggle online that avoids the confines of a simple concept of open and closed, and the limits of space and structure.

Second, the Internet governance literature debates the optimal institutions and principles to regulate the Internet (Benkler, 2006; Braman, 2003 ; Mansell & Silverstone, 1996; Moll & Shade, 2008). The capacity of advanced traffic management software to tier content has provoked a debate over the virtue of a network neutrality principle (Crawford, 2007; Lemley & Lessig, 2000; Longford, 2007; McTaggart, 2006; Sandvig, 2007; Wu & Yoo, 2007), one that mandates the equal treatment of communication online in order to protect the Internet as a public medium and to prevent carriers from discriminating traffic for commercial gain. Problematically, software has too often been assigned an objective role in the network neutrality controversy that ignores the politics of code. Ignorance arises, in part from, the many, seemingly objective definitions of code circulated by different factions in the controversy. Factions justify their attitude toward the network neutrality principle through politicized interpretations of software (Longford, 2007, pp. 36-37), so a more nuanced understanding of software is required.

Finally, censorship and privacy researchers in International Relations have considered advanced traffic management software, such as Deep Packet Inspection (DPI). The literature questions how authoritarian regimes deploy control technologies to censor the Internet (Deibert, Palfrey, Rohozinski, & Zittrain, 2008, 2010). The field has attracted many emerging scholars (Bendrath, 2009; Parsons, 2008; Paterson, 2009). Unlike the other prior two fields, the international relations approach has given in-depth consideration to the functionality of advanced traffic management software and the conditions of its emergence. The approach adopts a statist approach to question how national governments and other political actors adapt this software, and its technical and discursive 'openness' of the Internet to its local context. They document, in other words, "how states are seeking to establish national borders on cyberspace" (Deibert & Rohozinski, 2010, p. 4). However, their emphasis on authoritarian regimes, while vital research, differs from the nuanced neoliberalisation of the Internet in liberal democracies. This type of control deliberately avoids techniques of censorship to perpetuate a sense of openness. Thus, the cases drawn from the deployment of advanced traffic management software in liberal democracies differ from deployments in authoritarian regimes and thereby make a contribution in their own right.

To address these gaps in the literature, the dissertation brings the tradition of control in communication studies into the discussion of advanced traffic management software. Mass communication studies have always held an interest in the relation to communication and social control (Barney, 2000; Braman, 2003; Jowett, Jarvie, & Fuller, 1996; Mulgan, 1991). Research often proposed communication systems as a means to engineer an ideal society. The American pragmatists exemplify this perspective of communication systems. Walter Lippmann (1997 [1922]) argued the media must control the ’pictures people have in their heads’ to guarantee a functional democracy. Communicative control, in his words, manufactured consent. John Dewey (1954 [1927]), on the other hand, focused on how media experiments could transform a mass society into a great community. He wrote at the end of The Public and its Problems, “we lie, as Emerson said, in the lap on an immense intelligence. But that intelligence is dormant and its intelligence broken, inarticulate and faint until it possesses the local community as its medium” (p. 219). Experiments in communications, he believed, could mobilize the ’immense intelligence’ of the public. However, both authors only speculated on the actual infrastructure of a communication system

Cybernetics and information theory forged a greater bond between communication engineering and social engineering (Shannon & Weaver, 1949; Wiener, 1961 [1948]). Wiener (1950) argued that computer-assisted communication allows for a system of management, responding to constant feedback and re-adjusting. Wiener’s description of cybernetics begins demarcating control as an active and constant influence. He frequently used the metaphor of a gunner tracking a moving target. Control was not only a method of tracking, but also the capacity to pull the trigger at any given time. Cybernetics, in short, framed control as observation and action. Cybernetics spread into all disciplines, including political science where Karl Deutsch (1966) linked cybernetic with governance, proposing cybernetic systems of governance. Stafford Beer (1974, 1975), a researcher in management cybernetics worked the Allende government in Chile to develop a communication system, known as Cybersym, to manage a planned economy. Cybernetics, in short, ushered in the engineering of communication systems to the realm of politics.

Control did not acquire a critical dimension until well after the explosive growth of cybernetics, even though Wiener, for instance, worried about the use of cybernetics for military purposes (Conway & Siegelman, 2005). James Beniger (1986) offered the first critical appraisal of what-he-called the control revolution. His book offered both a theory and history of control. Beniger advocated control studies as a *teleonomic* epistemology. Teleonomics describes society as the interactions between interconnected programs or logics. Studies of control, thus, focus on the invisible teleonomics of the programs that mediate the circulation of social actors. His history argued that control arose out of a response to the limitations of traditional techniques of management in the early 1900s. His argument includes analogue mechanisms of control, such as Frederich Taylor's scientific study of time to improve extraction of labour power. His approach and theorization of control continues to resonate as a seminal study of the history of control technologies; however, his long history of control downplays the specific nature of control in digital systems. How then do digital networks exert control?

Darin Barney contributed a major study of the nature of control in networks through a mix of "classic philosophy (Aristotle), phenomenology (Heidegger), Marxism, and (Leo) Straussian-inspired cultural criticism (George Grant)" (Latham, 2002, p. 108). His version of control involves the capacity of networks to "enframe the world as a standing-reserve of bits because they demand that human practices be converted into bits in order to be mediated and included in the institutional life of society" (Barney, 2000, pp. 230-231). The approach provides a compelling critique to the hyperbola of networks as the savior for democracy; however, the logic of enframing and technology produces a totalizing logic that "renders its practitioners powerless in the face of the enemy, whom it endows with fantastic properties"

(Latour, 1993 [1991], p. 125). Barney simplifies the operation of software and multiplicity of control that he reduces to a singular essence of network. As a result, his version of control underestimates its dynamics and its elusions. His approach begs for a more nuanced conceptualization of control.

Gilles Deleuze (1992, 1995) offers a version of control more in tune with advanced traffic management software. His study of control extends the Foucaultian research on power into the contemporary age. He situates control as an adjunct to disciplinary societies. Where discipline *fits* individuals into social molds, control fluidly intervenes in social expression. Control, then, does not discipline or mold, but mediates the expressivity of social actors, such as humans, information, or computers. Massumi connects control with a *transitive mode of power* that transmits events. The conditions of transit – "what effects it lets pass, according to what criteria, at what rate, and to what effect" (p. 85) – adapt to the inputs dynamically, where discipline operates through fixed molds. The factory, for the example, not only disciplines the worker through intense surveillance and social conditioning to optimize their labour output, but also controls the workers through modulating performance bonuses that adapt to the variable inputs of labour and ensure maximal productivity.

Control also places a strong emphasis on time. The factory also illustrates how control can be characterized by how its modulations change over time, i.e. how wages differ from quarter to quarter (See Lazzarato, 2006). The temporality of control remains well suited for instant and changing operation of digital systems. As Deleuze writes, control "could just as easily be reject on *a given day or between certain hours*; what counts *is not the barrier*, but the *computer that tracks each person's position*" [emphasis added] (Deleuze, 1992, p. 7). Control accepts or rejects on a temporal basis based on how computers track movement. Since Deleuze specifically mentions computers as the machine of control societies[10], an emerging literature expands on Deleuze's gestures of the importance of digital systems to control societies (Bratich, 2006; Chun, 2006; Jones, 2000; Mulgan, 1991; Rose, 1999).

The protocol remains the canonical diagram of digital control; however, its limitations mark the beginnings of the dissertation's intersection with the literature on digital control. Galloway (2004), drawing upon the work of Foucault and Deleuze, introduced the concept to describe how control operates in decentralized computer networks, such as the Internet. Protocols "are all the conventional rules and standards that govern relationships within networks" (Galloway & Thacker, 2004, p. 8). While Galloway does not limit the scope of protocological power to the Internet, he clearly has the TCP/IP protocol in mind when he introduces the concept. Problematically, the protocol tends to a frame power as the product of static and homogeneous pacts written by computer programmers. Increasingly, users express themselves online through web platforms and peer-to-peer networks (Langlois, McKelvey, Elmer, & Werbin, 2009). My prior work on web2.0 explored the concept of the platform to understand these new structures of expression online and to understand how power operated in their assemblages of software, protocols, databases, and users (McKelvey, 2008).

Transmissive control further pushes beyond the assumptions of the protocological control by investigating software as a more involved control within

[10] Deleuze, in Postscript on Control Societies, writes, "types of machines are easily matched with each type of society - not that machines are determining, but because they express those social forms capable of generating them and using them. The old societies of sovereignty made use of simple machines-levers, pulleys, clocks; but the recent disciplinary societies equipped themselves with machines involving energy, with the passive danger of entropy and the active danger of sabotage; the societies of control operate with machines of a third type, computers, whose passive danger is jamming and whose active one is piracy and the introduction of viruses" (1992, p.6). Computers, he suggests, express a social form of control.

expression. Control becomes a moving target, rather than a static agreement networking decentralized nodes.

The study of transmissive control originates with a few different theories of Internet control. Latham (2005) introduced the concept of *network relations* to explain "the basic logics whereby computer networks would form and then connect or not connect (and the consequences of such formation and connection)" (p. 149). They provide the networking logics encoded as algorithms on the Internet's routers and switches. Algorithms "do things and their syntax embodies a command structure to enable this to happen" (Goffey, 2008, p. 17); however, as Beginer points out, programs depend on inputs. The unpredictability of input means that "the consequences of one's program cannot be entirely understood in advance" (Chun, 2008, p. 228). Elmer (2004) introduces *profiling* to explain how algorithms attempt to normalize input. Computers collect personal information to create machine-readable *profiles* that inform its decisions and its simulations. Elmer states that computer profiling "oscillates between seemingly rewarding participation and punishing attempts to elect not to divulge personal information" (p. 6) to create information systems that "place individual wants into larger, rationalized, and easily diagnosable profiles" (p. 23). Profiling not only applies to personal information, but ISPs depend on traffic profiles to manage bandwidth and identify threats. The theorization of *transmissive control* relies on network relations and profiling to explicate the techniques for the assignment of temporalities. This definition of control closely aligns with an emerging trend in the study of the algorithms as processes of control (D. Beer, 2009; Galloway, 2006; Graham, 2005; Lash, 2007).

Proposed Chapter Outline

The dissertation will be divided into six chapters. Each chapter explores one facet of a theory of transmissive control. Specifically, the chapters aim to study its emergence, operation, resistance, and democratic governance. The six chapters are:

Chapter 1. An Introduction to Transmissive Control

Chapter 2. The Decline of the Open Consensus

Chapter 3. Pandemonium: Intelligent Machines & Transmissive Control

Chapter 4. Gleaming the Cube: The Pirate Bay & iPredator

Chapter 5. The Difference Engine: How to Make Traffic Public

Chapter 6. Conclusion: Theorizing Transmissive Control

The first chapter will provide an introduction to the study of transmissive control. The chapter will situate the study in the literature of communication and control. A preliminary definition of transmissive control will propel the dissertation through its following chapters. Each chapter contributes to one facet of transmissive control.

The second chapter will investigate two periods of the Internet's evolution as a means to study the changes in Internet time due to the advent of transmissive control. The first period is characterized by a shared belief in the value of an open, high-speed Internet as a medium of open communication and free expression. The consensus brought together free software programmers, hackers, the venture capitalists of Wired Magazine, the new Right, the techno-utopians of the Whole Earth Catalog, governments, engineers, and traditional telecommunication firms forged in an era of common carriage (Abbate, 1999; Barbrook & Cameron, 2001; Crawford, 2007; Kelty, 2008; Mansell, 2002; Turner, 2006). The consensus allowed the formulation of a particular standard of *open communication* – one that differed from other internetworking logics, such as the OSI model and FidoNet (Latham, 2005; Murphy, 2002; Russell, 2006). The OSI model, for example, focused on monetizing the transmission of information. This consensus of openness forged the interconnection of networks through the common Internet protocol suite (TCP/IP) (Abbate, 1999, 2010; DeNardis, 2009; Mattelart, 2000).

The second period is the recent problematization of the past high-speed Internet by governments, network owners, engineers, and intellectual property holders. The end of the second chapter then will outline the decline of the consensus and the rise of transmissive control. Open and high-speed communication has increasingly been problematized in Canada as a threat to security and prosperity that requires better network management. Telecommunication firms, for instance, have questioned the efficiency of an open network and have begun implementing technical measures (traffic shaping, bandwidth caps, and value-added services). Their efforts have met resistance from computer pirates and hackers who have clung to a vision of a single high-speed network and worked to thwart this process. This conflict has fragmented time online.

Transmissive control software has gained consensus as the solution to the problematization of the Internet. The third chapter explores the operation of transmissive control software that exacerbates the fragmenting of Internet time. While deep packet inspection has attracted the most attention, the technology is only part of a larger suite of transmissive control technologies (Finnie, 2009). New networking software contain sophisticated algorithms for deep packet inspection, deep flow inspection, and policy management. These algorithms extend the perspective and program of network management to create tiers of information delivery; creating specific durations for kinds of Internet communication (Graham, 2005). These technologies have been quietly installed into defense networks and commercial ISPs, often with the promise to prevent congestion and to ensure quality of service. The technologies, in short, restructure the Internet and actualize transmissive control. A history of the development of these technologies and an investigation of how they work provides empirical evidence on the operation of transmissive control.

To these threats and so many others, Internet hackers, pirates, and rogues have reckless flaunted authority. An anonymous manifesto circulated by the Swedish anti-copyright group, The Pirate Bay, declares,

> *The machine, which operates under the radar frequency is unhindered.... It leaves no one unmoved and mangles everything in its path. Technically superior and physically independent it's constantly transforming, mutating and reappearing in new guises and under new codenames. With a stranglehold on its opponents it's completely untouched and even more – incomprehensible*[11].

Their description portrays themselves as a fluid, shape-shifting machine; one always ahead of their opponents network management. Strange swarms of humans and machines come together to fight off attempts to control the unwanted aspects of open communication. They regard network management software as a threat to their ability to communication openly and they deploy their own software to thwart better management. The fourth chapter uses the case of the Pirate Bay and their tactics to discuss the virtualities of transmissive control – how the group eludes the allocation of temporalities by confusing the profiling and programming of its algorithms. Specifically, the chapter will investigate their iPredator Virtual Private Network that encrypts its users' packets. The Pirate Bay created the software and its infrastructure to help users elude transmissive control. Their iPredator is part of a larger campaign to

[11] See, http://thepiratebay.org/torrent/4741944/powr.broccoli-kopimi

push the limits of transmissive control to protect open communication. Their struggles constantly change directions, tactics, and channels to stay ahead of the routines of the traffic management. The Pirate Bay, in other words, deliberately modulates its communication to interfere with transmissive control. Their *political* struggle then involves a modulating elusion. Control responds by again modulating its profiling and program to capture these new modalities generated by the Pirate Bay, but how quickly can it adapt? The lag leaves a time for elusion. The case of the Pirate Bay illustrates the cat and mouse game between transmissive control and its elusion, but it does not fully address its political ramifications. A solid discussion of their technologies maps the virtualities of transmissive control and its potential for elusion.

The Pirate Bay charts the fringes of a growing media reform movement: a trend of questioning the deployment of network traffic management, and advocating a renewal of the democratic accountability of the media. A common challenge is bringing technologies into the public light. The fifth chapter will question how to respond to transmissive control democratically. How can the processes of network software be publicly represented, debated, and governed? Media reform movements have made some steps to this end. Much of the controversy surrounding traffic management, in fact, results from public research projects. Comcast's interference with BitTorrent traffic came to light only after hackers analyzed their packets and discovered the invisible hands – of software routers and markets – interfering with their traffic. The social sciences have a vital role to play in the theorization and popularization of methods to represent the opaque technical workings of transmissive control. These public research projects develop instruments to represent packet shaping and traffic management to the public to allow decisions about its relation to the common good. For example, The First Nation ISP, K-Net, uses traffic shaping to prioritize its community video-conferencing based on its limited bandwidth. A decision based on the perceived common good of videoconferencing for the region (McIver Jr., 2010, pp. 157-159; McKelvey & O'Donnell, 2009). The study of methods for public representation of transmissive control explores the possibilities for its democratic mediation. The chapter seeks to propose processes to democratically respond to control, not suggest specific policies. The approach implies a firm belief in the democratic experiment – our need to compose a common world together (Callon, Lascoumes, & Barthe, 2009).

The concluding chapter elaborates the theoretical framework above by focusing on of the importance of transmissive control. Understanding it "maps not just its strengths, but it also its weaknesses. In plotting the nodes and link necessary to capital's flow, it also charts the points where those continuities can be ruptured" (Dyer-Witheford, 1999, p. 92). Network owners have already begun to exert social power utilizing transmissive control. Better network management practices "protect the network from spam, prevent denial-of-service attacks and virus attacks, and block access to child pornography sites," stated Ken Engelhart, spokesperson for Rogers Internet in the CRTC hearings on traffic management practices. The Internet must be protected from threats of spam, piracy, viruses, pornography, and hackers because of its importance to our daily lives. "Almost every aspect of *our way of life*," Engelhart adds, "has been transformed by the Internet." His words conflate network management and the public good – protecting the network protects our way of life. If the expression of our ways of life increasingly happens online (cf. Hayles, 1999), then our ways of life contain modalities of communication disruptive and productive to the network. The strategy positions network owners as arbiters of legitimate and illegitimate uses of an open communication network. Thus far, this position has enabled commercial ISPs to monetize Internet communication as part of their profit models and align public opinion to desire this monetization in the name of more efficient networks (CRTC2009). A theory of transmissive control offers a way to recognize the politics of traffic management software and to question the future of digital networks.

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