Echo-Chambers and Positive Feedback Loops:
The Complex Nature of Echoing Voices on the Internet

"Whenever you find yourself on the side of the majority, it's time to pause and reflect."
~ Mark Twain

Introduction

The Internet is a unique educational space that is currently being (re)defined by the emergence of blogs, online discussion forums and other socially open webspaces (e.g., wikis). A *blog* is a personal narrative or diary on the Internet where an author posts a message or initiates a dialogue, and an audience of readers may, in turn, respond with a commentary. Blogs cover an endless variety of topics and opinions that represent the diversity of the authors' interests and the readerships' responses. The *blogosphere,* or network of interlinked blog commentaries on the Internet, currently stands at over 95 million active blogs, and is dynamically changing with 18 updates per second (Technorati.com, 2007a). This online journaling activity is a global occurrence on the Internet with 175,000 new blogs created each day (or 2 new blogs actualized per second of every day), each of which are being updated by the minute, hour, day, or week.

The rapid emergence of a new generation of collaborative spaces on the Internet offers students and educators access to a plethora of 'global' conversations and online communities. In terms of blog posts by language, the current leader in the global blogosphere is Japanese with 37% of the overall blog discourse, followed by English at 33%, Chinese at 8%, and Italian at 3% (Technorati.com, 2007b). In conjunction with the more traditional textual representations of online discourses, these blogs are increasingly being embedded with audio, images and video posts.

Within such a large array of communicative possibilities, it might be assumed that the intellectual exchanges of the participants would be noticeably varied, and as a result a critical discourse would thrive in this diverse and emergent global (cyber)space. However, this may not be so and one must ask: *Are blogs and online discussion forums providing opportunities for critical discourse or are they, ironically, presenting significant challenges to intellectual diversity and critical thought due to a phenomenon known as the echo-chamber effect?*

The echo-chamber effect is a condition arising in an online community where participants find their own opinions constantly 'echoed' back to them, thus reinforcing a certain sense of truth that resonates with their individual belief systems. In terms of a consideration for

educational practice on the Internet, the inherent tension created by the echo-chamber effect is represented by notions of unity versus diversity in online communities and discourse.

This paper explores how participants within online collaborative spaces tend to act in very human ways: that is, they gravitate toward and are more comfortable communicating with people who share their ideas, conceptions of the "truth", cultures, and communication styles. Yet fundamental differences exist between face-to-face and virtual communications. Specifically, virtual communications often have fewer markers or visual cues by which to 'read' the implicit tests of authenticity; many of which are subconsciously present by one's exposure to "cultural microrhythms" (Condon, 1982). During an online dialogic exchange one might ask: To what extent do I really know that the person I am communicating with shares my thoughts, belief system, ideas, and values?

This "are you really who you seem to be" dilemma is a historical human concern, one that has led to the creation of folktales such as Little Red Riding Hood (Germany) and Lon Po Po (China) to warn our children not to fall victim to the deceit resident in the world (forest). At least some of the contemporary 'digital' wolves are less visible than those of children's stories, and while the human seduction to be fooled may take different forms, the digital medium has the potential to obscure the nature of this deception by the echo-chamber effect. Nevertheless, human beings are prone (in all areas of life) to be drawn to ideas that resonate with our own values and, thus, we gravitate to online opinions that constantly 'echo' our own ideas back to us. In reinforcing a certain sense of truth that resonates with our individual belief system, a mimetic phenomenon is actualized that metaphorically creates an echo-chamber on the Internet. My intent in this paper is to establish a general understanding of this phenomenon through a narrative inquiry (Clandinin & Connelly, 2000) and social network analysis (Marsden, 2005), while situating it in a discussion of the implications to teaching, learning and pedagogical practice.

Theoretical Context

This research activity is situated within a theoretical framework of social constructivism, which recognizes that social processes are instrumental to the building of intra and interpersonal knowledge (Davis, 2004; Vygotsky, 1978). It also draws upon an understanding of complexity theory (Sage, 2003) to assist in reading the self-organizing nature of the Internet as a complex adaptive system. While network theory (Latour, 2005; Watts, 2003; Barabási, 2002), a subset of

complexity theory, recognizes the significance of multiple 'agents' (e.g., organizations, humans, computers, objects and the environment) as contributors within a heterogeneous (social) network on the Internet.

Network theory opens possibilities for the exploration of the complex social attributes of human and non-human entities, and the implications of power relationships on intercultural exchanges enacted on the Internet, in order to, "find a way of talking about the social-and-the-technical all in one breath" (Law, 1991, p. 8). Complexity and Network theory read the condition of the echo-chamber effect as emergent to situations in which information or ideas are amplified through positive feedback loops inside an enclosed social space. A wide reading of the literature suggests that a content analysis documenting the emergent educational issues of self-reinforcing communities on the Internet (i.e., echo-chamber effect), nested in an understanding of positive feedback loops in the complex system of socially 'open' dialogic spaces online, is novel to educational research literature.

Rationale for the Study

In educational contexts, blogs and discussion forums are increasingly being turned to as a means by which students and teachers can access an authentic or 'global' discourse. The Media Awareness Network's (2005) *Young Canadians in a Wired World* research project indicates that, on an average weekday, 8-14 percent of elementary school students (Grade 4-6) and 17-19 percent of secondary school students (grades 9-11), engage in blogging or writing an online diary (p. 20). With this level of interest in elementary and secondary schools students' lives, educators at all levels will soon begin to consider weaving students' online dialogic experiences into their own pedagogic and professional practice. Research on the educational implications of blogging and other socially open webspaces is just beginning to appear in the research literature and is primarily concerned with the pedagogical use of blogs to enhance student writing or teacher reflections (Media Awareness Network, 2005), as opposed to the social implications of a mimetic echoing of opinions inside the blogosphere.

Research Questions

1. Are blogs and online collaborative spaces providing opportunities for critical discourse, or are they, ironically, presenting significant challenges to intellectual diversity and critical thought as participants engage only in the hermetically sealed dialogue that resonates with their unique viewpoints?

2. How can complexity thinking inform the emergence of a phenomenon of echoing voices within online collaborative spaces?

The data addressing these questions, as well as the implications of the findings, are discussed in this paper from a perspective that has an interest in intercultural collaborative inquiry on the Internet.

Research Method

The blogosphere (along with other emerging cyberspaces such as collaborative wikis and podcasting venues) provide very public locales where individuals recount, listen to, and comment on the storied nature of human existence. Narratives found in blogs often communicate how individuals 'read' the world, and in doing so share (and reconstruct) the events, topics, and people that are close to their consciousness. Bruner (1986) suggests these narratives are the means by which human beings organize their personal knowledge. Connelly and Clandinin (1990) declare that this personal knowledge is the basis for our actions and stories about the social world. In their discussion of 'narrative inquiry' as a research method, they claim that "humans are storytelling organisms who, individually and socially, lead storied lives. The study of narrative, therefore, is the study of the ways humans experience the world" (Connelly & Clandinin, 1990, p. 2).

To establish a general understanding of the echo-chamber effect on the Internet, and how this phenomenon might impact the many ways students and teachers experience the virtual world, a narrative inquiry was selected that draws on my own autobiographical writing as the data source (Clandinin & Connelly, 2000; Pinar, 1988; Grumet, 1988). As a site of study, the blogosphere was selected due to its rapid growth and potential impact on educational practice in the discipline of social studies. Narrative inquiry has been taken up in this study as a unique medium for data representation that helps explicate my conduct in an echo-chamber within the blogosphere. As Peshkin (1985) reminds us, "ideas are candidates for others to entertain, not necessarily as truth, let alone Truth, but as positions about the nature and meaning of a phenomenon that may fit their sensibility and shape their thinking about their own inquiries" (p. 280). As a method, narrative inquiry draws attention to the inter- and intra-subjective (Davis, 2004) experiences nested within one's interactions within socially open webspaces such as blogs.

As a means to account for the potentially more insidious implications of the echo-chamber effect, a limited online social network analysis (Marsden, 2005; Watts, 2004; Barabási, 2002) of Jeffrey Weise (a 16 year old male school shooter) was conducted in addition to my narrative inquiry. Online social network analysis is a relatively new research method that focuses on Computer-mediated communication (CMC), and patterns of relations among people and communities on the Internet. As Garton et al. (1997) suggest, "Social network analysts seek to describe networks of relations …tease out the prominent patterns in such networks, trace the flow of information (and other resources) through them, and discover what effects these relations and networks have on people and organizations". In general, when a computer network connects individuals, groups or organizations, they can become enmeshed within a set of social relationships (e.g., friendship, Internet work, information exchange). This is then deemed to be an online social network.

In this particular inquiry, the online dialogic patterns of Jeff Weise were mapped across several online discussion forums and blogs, into his final participation in the www.nazi.org discussion forum. This particular online social network analyses may be referred to as one concerned with an "*ego-centred*" (Wasserman & Faust, 1994, p. 53) perspective of network interactions where the focal person (ego) was Jeff Weise. The remnants of Weise's online activities are very publicly strewn across the digital landscape of the Internet, and his online social network presents a particularly disturbing insight into the implications of echoing voices within online discussion forums. No assumption is made in this paper that an entire coherent social network ever existed for Jeff Weise; however, given the limited scope of this study, some of the boundaries of Weise's social network began to emerge as data were collected. The last of which seems to be the 'www.nazi.org' discussion forum.

Research Limitations

  The objective of this research initiative was exploratory in nature and therefore best addressed qualitatively in a descriptive versus predictive manner. This research study provides insight into the social implications of the echo-chamber effect (i.e., positive feedback loops) on the Internet within two specific and deeply complex situations. It should be noted that the echo-chamber effect is an emergent online phenomenon and likely exists in varying degrees and at many different levels of group polarization, all of which are dependent on the size and history of an online community, and the self-reinforcing topological structure of hyperlinks within the different socially open webspaces. Although there are clear limitations to the scope of this work, it is hoped that this research provides an impetus for ongoing research into the emergent and complex nature of positive feedback loops online and the assumed implications of the echo-chamber phenomenon to educational praxis.

Narrative Inquiry: Echoing Voices and Political Blogging

Let me begin with a confession: unbeknownst to me, I was trapped in an echo-chamber during the 2004 United States presidential election and emerged from this narcissistic experience with an intangible sense of comfort from having only read and written that which resonated with my own belief system.

It began in the months leading up to the November 2004 election, while I was searching for information on the American public's overall sentiments toward the candidates - George W. Bush and John Kerry. I was reluctant to accept the North American television commentary or polling data due to my distrust of the expertly crafted media messages of the major news networks. This attitude is clearly representative of my nascent post-modern state, or what Blackburn (1994) would define as a "retreat to an aesthetic, ironic, detached, and playful attitude to one's own beliefs and to the march of events" (p. 295).

As I rejected the media messages of television, I subsequently found myself embracing a 'new media' space on the Internet where blogs were allowing individuals an opportunity to comment publicly on the political landscape of the U.S. election. I sensed that blogs would be a venue for a more authentic voice of the American public and would in turn embed me within the 'true' pulse of the electorate where I could interactively engage in the dialogue of an online community. This desire to use others as a method of knowledge acquisition is insightfully addressed by Karen Stephenson, when she suggests that "experience has long been considered the best teacher of knowledge. Since we cannot experience everything, other people's experiences, and hence other people, become the surrogate for knowledge. 'I store my knowledge in my friends' is an axiom for collecting knowledge through collecting people" (Stephenson, Internal Communication Focus, no. 36, undated).

Millions of other people were also turning to the Internet, and blogs specifically, for a more grassroots perspective on American politics. By March 2004, blogs had firmly established themselves as a popular venue for personal publishing. According to the Pew Internet & American Life research, "27% of Internet users say they read blogs...by the end of 2004, 32 million Americans were blog readers…at least some of the overall growth in blog readership is attributable to political blogs" (Rainie, 2005, p. 1). Worth noting is the early excitement surrounding the Howard Dean campaign and the political activism found on 'www.blogforamerica.com' where countless blog posting resulted in "115,632 handwritten

letters from (blogforamerica.com) supporters to eligible voters in the Iowa caucuses and New Hampshire primary" (Cornfield, 2005, p. 2).

One could find almost any political perspective within the blogosphere, and so I continually found myself returning to those blogs where I could easily (and comfortably) communicate with like-minded individuals. At times, the online discussions I experienced encompassed some minor disagreements; however, there appeared a tacit belief among users that this piece of (cyber)space entertained "like" sentiments only, and was not for the cavalier broadcasting of antithetical or hostile perspectives. Granted many participants in these blogs believed they were to be online spaces for political solidarity, much like the face to face gathering points of political pundits. If a new participant to a *Democratic blog* were to demonstrate any strong Republican (right-wing) views, a mob of voices would berate the outsider into submission, until eventually the individual was shunned and duly rejected by the virtual community. In essence, the ability to carry out a challenging conversation that had the potential to enlighten the forum to another perspective was being drowned out by a collective echo of disdain. As an educator, an awareness of the significant challenges to intellectual diversity and critical thinking within an online environment began to emerge in my consciousness.

Ideally, the divergent voices in our political discourse could have been embraced and celebrated. As Robins (1995) would suggest, "we must begin from the real world, which is the world in which virtual communities are now being imagined. And we must recognize that difference, asymmetry and conflict are constitutive features of that world" (p. 152). In an embodied (face to face) situation, where people are not overly familiar with one another and yet fundamentally disagree on an issue, the social rules of decorum often lead those involved to suppress their respective viewpoints so as not to offend the other party. However, within the blogosphere, due to the anonymity and fluidity of identity possible on the Internet, these nuances were frequently disregarded for a harsher (and more amplified) response to voices that descend from our own. I wonder; which of the social responses - face to face or virtual - is more ingenuous to articulating one's perspective(s)?

Although it was most interesting to be a participant in such an ostensibly 'enlightened' online community of thousands, the limitations to a critical dialogue within the multiverse of cyberspace became painfully apparent on the night of the Presidential election. As I watched

George W. Bush and the Republicans take a commanding lead in the election, I realized that I had indeed been trapped in an echo-chamber; a close-minded, white-walled space that continually bounced back my own sense of truth. In the end, it was through the myriad of interlinked opinions within the Democratic blogosphere by which I had reinforced my own (and others) misguided belief that a John Kerry presidency was inevitable. The essence of this experience is revealed in the ancient notion of mimesis, where many voices sing in harmony to a collective illusion.

Cass Sunstein, a distinguished University of Chicago Professor of Law and Political Science, expressed this concern about the polarizing effects the Internet might have on groups in his book *Republic.com*. He suggested, prior to the emergence of blogging's popularity, that the Internet has the potential to noticeably increase the opportunities for individuals to hear "echoes of their own voices and to wall themselves off from others" (Sunstein, 2001, p.49). When Sunstein (2001) conducted a random survey of sixty political websites, he found that only 15 percent had hyperlinks to sites with opposing perspectives on political issues; while 60 percent of the political websites linked directly to 'like-minded' sites.

This self-reinforcing topology of the political blogosphere then amplifies the ossifying tendencies of the echo-chamber effect and hermetically seals online spaces to other divergent perspectives. Barabasi (2002) supports this claim by suggesting that "the mechanisms behind social and political isolation on the Web are self-reinforcing: They alter the Web's topology as well, segregating the online universe" (p. 170). Such emerging phenomenon have the potential to blind educators and students to the ever-emerging cultural, linguistic and dialogic diversity online, in that they might only create, experience and navigate cyberspaces that reinforce their 'preferred' world view. To break from this condition, intentional pedagogic activities that bring students into contact with diverse perspectives (such as intercultural collaborative inquiries on the Internet), becomes a critical act in support of thoughtful educational practice(s) in a digitally interconnected era.

Online Social Network Analysis: Jeffrey Weise and a Nazi Echo-Chamber

An insidious and pathological case involving the echo-chamber effect on the Internet may be that of a sixteen year old mass murderer named Jeffrey Weise. This teenager was a member of the Chippewa American Indian Tribe of Red Lake, Minnesota, and a former student of Red Lake High School. On March 21, 2005, Weise murdered nine people, including his grandfather, a school security guard, a teacher, and several students at Red Lake High School before taking his own life.

Jeff Weise was an active participant in many different online communities and posted multiple messages under different pseudonyms. The digital remnants of these postings are strewn across the World Wide Web and offer an unusually high level of public insight into his virtually scribed thoughts and online activities. Of specific interest to this paper is the dialogue of an individual identifying himself as Jeff Weise from Red Lake, Minnesota, who used the screen name *Native Nazi* and *Todensengal* (German for Angel of Death) while publishing several comments during a five-month period between March and August 2004 on a Neo-Nazi discussion forum. This dialogic space, 'www.nazi.org', is run by the Libertarian National Socialist Green Party and promotes a Neo-Nazi philosophy through its online conversations and activities.

A peer of Jeffery Weise noted that he was an isolated student who had limited contact with others. "He was a goth," said Allan Mosay, 14. "He had no friends. He didn't communicate" (Haga et al., 2005). However, during an examination of his online conversations in the various discussion forums and blogs, he can be found to be surprisingly communicative and connected with others. For instance, at 'www.livejournal.com', Weise was linked to over 261 virtual 'friends'. It might be said that, in this regard, Weise was caught up in a virtuality where his identity was indeed fluid and his sense of self could float from one community to another on the Internet. Mark Poster (1990) describes the impact of (cyber)space on the subject's position as the body becoming disrupted, subverted and dispersed across different social spaces. In his essay *The Ecstasy of Communication*, Jean Baudrillard (1983) also speaks to this experience as "the end of interiority and intimacy, the overexposure and transparency of the world which traverses (the schizophrenic) without obstacles. He can no longer produce the limits of his own being, can no longer play nor stage himself, can no longer produce himself as a mirror. He is now only a pure screen, a switching center for all the networks of influence" (Baudrillard, 1983, p. 133).

Is it possible that Weise entered 'www.nazi.org' and, similar to my experiences in the political blogosphere, had his own belief system ossified through the *echo* of the online conversation? Excerpts of his dialogue, as retrieved from Google's Cache (2004), are republished below to provide a unique insight into Jeffery Weise's conversation and the subsequent echoing of his perspective throughout the online discourse:

Discussion Thread Title: Native American Nationalists?
Post by **Todesengel [Jeff Weise]** on **Mar 19th, 2004, 12:09am**
"My name is Jeff Weise, a Native American from the Red Lake 'Indian' reservation in Minnesota. I'm interested in joining the group, as I support your ideals and even though I am young, I still want to join. What is the age requirement (if any)?"

*Post by **BlueEyedDevil** on Mar 20th, 2004, 12:39am*
"There is none that I am aware of; we welcome all ages and all nationalities, regardless of your back-ground. Our main goal here is to educate and inform--in hopes of creating a better world for all of us. I welcome you, Jeff! What brings you to the forum?"

Post by **Todesengel [Jeff Weise]** on **Mar 19th, 2004, 1:15am**
"Thank you. What brings me to the forum? Well, I stumbled across the site in my study of the Third Reich as well as Nazism, amongst other things. I guess I've always carried a natural admiration for Hitler and his ideals, and his courage to take on larger nations. I also have a natural dis-like for communism…"

*Post by **BlueEyedDevil** on Mar 20th, 2004, 12:39am*
"I respect your open-mindedness; not everyone is so brave to think the way you do... I would like to see all Nationalists work together towards a common goal; there is much we can learn from one another."

*Post by **freenation** on Mar 25th, 2004, 5:01pm*
"There is a place for you, I hope you stick with us."

Post by **Todesengel [Jeff Weise]** on **Mar 25th, 2004, 8:27pm**
"Once I commit myself to something, I stay until the end..."

*Post by **binarymike** on Apr 8th, 2004, 2:43pm*
"We welcome you, brother. It will take many combined minds for us to unite, and forge something out of nothing!"

The personal situation of Jeffrey Weise, his socio-economic context, and the many other perturbations surrounding his life before the school shooting on March 21, 2005, – including this online dialogue and the echo-chamber effect – are deeply interconnected events. While one should not oversimplify the complex circumstances and dynamics that play into a tragedy such as the Red Lake shooting, it is important for the educational community at large to recognize that for young people, unmonitored and uniformed exposure to the Internet has the potential to draw them into potentially harmful psychological and physical activities.

In a document produced by the *Federal Bureau of Investigation,* six traits of student assailants are profiled, with one of them being that "the student regularly searches for web sites involving violence, weapons, and other disturbing subjects (p. 20); and access to computers and the Internet is unsupervised and unmonitored*"* (O' Toole, 2000, p. 23). In terms of the Red Lake shootings, contributing factors to this tragedy may indeed have been Weise's unmonitored computer access (note times of 'www.nazi.org' postings); however, it is also likely that a steady ossification of his immoral belief system was achieved by the echoing voices of an online hate group.

The Internet as a Complex System

How might complexity thinking inform the emergence of a phenomenon of echoing voices within online collaborative spaces? Waldrop (1994) defines a complex system as "a dynamic network of many agents (which may represent cells, species, individuals, firms, nations) acting in parallel, constantly acting and reacting to what the other agents are doing" (p. 5). While Davis et al. (2004) point to complex systems as phenomena that are:

> adaptive - that is, their dynamics are better described in terms of Darwinian evolution than Newtonian mechanics. Further, each involves a certain spontaneous self-organization, in which coherent collective activities or characters arise in the activities of individual agents. In brief, complexity is concerned with non-linear dynamics, emergence and self-organization. It might be defined as a formal attempt to explore how simple and sometimes non-purposive components in a system can self-organize, emerge or evolve into coherent, purposive and complex wholes…In more provocative terms - and revealing our own educational biases toward the science of complexity - such adaptive, self-organizing phenomena are *learning systems* (p. 2).

The Centre for the Study of Complex Systems (2007) at the University of Michigan describes a system as 'complex' if it is deemed to have a significant number of the following characteristics:

> **Agent-based:** The basic building blocks are the individual agents of the system.

> **Heterogeneous:** These agents differ in important characteristics.

> **Organization:** Agents are organized into groups or hierarchies. These organizations are often rather structured, and these structures influence how the underlying system evolves over time.

> **Dynamic:** The agents change over time. The dynamics that describe how the system changes over time are usually nonlinear, sometimes even chaotic. The system is rarely in any long run equilibrium.

> **Feedback:** These changes are often the result of feedback that the agents receive as a result of their activities.

> **Emergence:** The overlying concerns in these models are the macro-level behaviours that emerge from the assumptions about the actions and interactions of the individual agents.

The World Wide Web can be found to match many of the above noted characteristics, and as such could be identified in terms of a complex system. Of particular interest to how complexity thinking might inform the emergence of the echo-chamber effect on the Internet is the impact of 'feedback' on the agents and their activities within the complex system of the blogosphere. Within the feedback loops of a complex system, information circulates into the system, is modified, and then returns to influence the behaviour of the originator of the information or the initial condition. This feedback loop is either *positive,* in that it amplifies the information/ideas, or is *negative,* in that it dampens or challenges the information/idea flow.

Complexity science would then read the condition of the echo-chamber effect on the Internet as an emergent behaviour to situations in which information (or ideas) are amplified through "positive feedback loops" inside a blogging community. For instance, within a positive feedback loop in the blogosphere (i.e., the complex system), like-minded blog community 'agents' and their ideas are introduced to information or an idea that becomes amplified by repetition or exaggeration (i.e., positive feedback) to the point that a distorted "truth" emerges for that online community.

On the other hand, negative feedback loops in complex systems tend to dampen the mimetic effects of information flows, exaggerations or the repetition of ideas, and therefore lead to more stability in a complex system by regulating the polarization of 'agents/information/ideas' in any one particular direction. This is intuitive to a classroom collective that supports critical thinking and divergent opinions; one where new ideas and patterns of thought are generated when students challenge (and are challenged) to 'think outside of the box' - a negative feedback loop in pedagogic action. If amplifications continue to occur to a system in only one direction (i.e., echoing voices), and the agents therefore do not face any negative feedback (i.e., divergent information/ideas) that can challenge the system, then that system will become unstable and ultimately reach a breaking point or state of total collapse.

Positive and negative feedback loops are found across social, ecological, cultural and biological domains. Positive feedback loops can include phenomena such as global warming, real estate or stock market bubbles, and cancer cells; while negative feedback loops are manifest in the homeostasis of a healthy human body, price stability in a market economy or a classroom collective that supports an inquiry stance to learning.

To better understand the unique characteristics of the blogosphere (and the emergent behaviour of the system in terms of positive or negative feedback loops), the chart below compares the Centre for the Study of Complex System's (2007) models of complexity in ecology and the field of immunology, with my own conceptualization and understanding of the blogosphere.

Complex System Characteristics	Blogosphere	Ecology	Field of Immunology
Agent(s)	Individual blog authors, commentators & their ideas	Individual animals	Cellular material
Heterogeneity	Discourse interaction via text, audio, or video	Eating, nesting, breeding habits	Antigens, antibodies
Organization	Self-organizing topical discourse	Schools, herds, food chains	Cellular organization
Adaptation	Recursive & emergent adaptation	Hunting, mating, security	Immune response
Feedback	Positive feedback loops (self-reinforcing discourse) or negative feedback loops (dampening, challenging discourse)	Success or failure	Immune response
Dynamics	Spread of Ideas: Unity, diversity	Predator-prey interactions, competition	Infection spread
Emergent behaviour	Ideas, thoughts: Positive feedback loops (echo-chamber effect), negative feedback loops (divergent discourse)	Extinction, niches	(Un)healthy cells

Implications of the Research

The use of blogging and discussion forums as a means for student dialogue has the potential to impact teaching and learning in ways that we cannot clearly predict at this early stage of their organic development. As Marshall Mcluhan (1965) points out, to adopt a new technology without understanding the consequences is akin to "surgery carried out on the social body with complete disregard for antiseptics" (p. 62). Although it is early in the evolution of the Internet to provide clear recommendations for educators and fellow researchers (and trepidatious to provide supposed solutions to the many challenges posed by the dynamics of complex systems) some educationally pragmatic considerations are as follows.

Identity Formation and Issues of Privacy

In terms of media studies, students may engage in a form of identity formation when they participate dialogically in the blogosphere. The use of online narratives as a means of journaling creates some significant issues for privacy when young people begin to 'share' globally via blogs or discussion forums. Once student narratives are published online, they can be difficult to remove, as evidenced by Jeff Weise, the Red Lake School shooter, and his 'echoed' belief system within a Nazi discussion forum. Pedagogical practices that utilize the Internet as a medium to engage in the social construction of knowledge should place issues of safety, security and privacy at the forefront of the purposeful engagement. Educators need to be cognizant of how young people engage in presumably innocent aesthetic practices on the Internet and how easily they can become embedded in these activities.

Examining Notions of Diversity

In relation to an interest in curriculum, it will become increasingly necessary for educators and students to be more conscious of the *echo-chamber effect* while engaging educationally with the blogosphere or online discussion forums. In the new Alberta secondary social studies curriculum in particular, an emphasis is placed on "how diversity and differences are assets that enrich our lives. Students will have opportunities to value diversity, to recognize differences as positive attributes and to recognize the evolving nature of individual identities" (Alberta Education, 2005, p. 5).

Sunstein (2002) points to the need for chance events (teachable moments) surrounding discussions of diversity to be framed in our curricular activities when he says, "unanticipated

encounters involving topics and points of view that people have not sought out and perhaps find quite irritating, are central to education, democracy, and even to freedom itself" (p. 34). As Shor (1992) suggests, "Critical teachers are willing to take the risk of introducing topical themes because student conversation and thought often do not include important issues in society (p. 558); and the examination of such topics is a fundamental responsibility of the teacher who legitimately serves as a more informed adult guide" (p. 558 and 582). As caring pedagogues, and in support of respectful and trusting classroom environments, it is our duty to provide opportunities for students to critically reflect on notions of diversity through those chance encounters with topics and individuals that can enrich learning. Perhaps such reflection can be achieved while inquiring into the range of 'global' perspectives resident on the World Wide Web.

Individuality versus Community

From a pedagogical perspective, the potential limits to intellectual diversity in an online environment are a starting point for an inquiry into how certain virtual community structures can be responsible for valorizing the group's voice over that of an individual's. As Baudrillard (1983) suggests, "something has changed, and the Faustian, Promethian (perhaps Oedipal) period of production and consumption gives way to the "proteinic" era of networks, to the narcissistic and protean era of connections, contact, contiguity, feedback and generalized interface that goes with the universe of communication" (p. 127). Through an awareness of a potential tyranny of community (virtual and otherwise), students may also begin to triangulate and shape their own understandings outside of the tautology of group polarization.

Promoting Diversity within Complex Systems

If the Internet is to be used as a space of educational practice, perhaps unplanned encounters with opposing perspectives is essential to the amplifying effects of positive feedback loops (i.e., echo-chambers). Therefore, in terms of participatory pedagogic practices, it becomes important to have students prepared to introduce (and respectfully sustain) divergent perspectives in online communities that might not ordinarily be prone to divergent views. To keep a system 'complex', it must be defined by diversity (in its agents and its ideas) and must continually be challenged or it will become a 'non-complex system', where "the agents are usually few…in

number, they are often identical to each other and perfectly rational" (Centre for the Study of Complex Systems, 2007). Diversity is in fact a source of the system's intelligence, and defines its ability to keep 'learning'. Pedagogic activities such as intercultural collaborative inquiries on the Internet therefore become a new and interesting way to support critical thinking in cyberspace.

Considerations for Future Research

A specific question for further research consideration is:

- To what extent (if any) will the increasing personalization and semantic nature of the World Wide Web amplify the echo-chamber effect and create positive feedback loops online?

The Internet is currently known by the cultural meme of Web 2.0, which Musser & O'Reilly (2006) define as a "set of economic, social, and technology trends that collectively form the basis for the next generation of the Internet - a more mature distinctive medium characterized by user participation, openness, and network effects" (p.4). However, an even more revolutionary consideration for educational researchers will be the Internet's future transformation into an extremely personalized cyberspace where filtering technologies such as RSS Feeds (Really Simple Syndication), and semantic search engines (with self-reinforcing algorithms) refine and tailor the online user experience so that people will tend to read, visualize, and hear about dimensions of the world to which they have a specific affinity (Web 3.0?). In essence, the contemporary World Wide Web is rapidly moving to what Berners-Lee et al. (2001) have described as the "Semantic Web". Tim Berners-Lee (1999), the chief architect of the World Wide Web, originally articulated his vision for the semantic web as follows:

> I have a dream for the Web [in which computers] become capable of analyzing all the data on the Web – the content, links, and transactions between people and computers. A 'Semantic Web', which should make this possible, has yet to emerge, but when it does, the day-to-day mechanisms of trade, bureaucracy and our daily lives will be handled by machines talking to machines. The 'intelligent agents' people have touted for ages will finally materialize.

The resulting divisiveness of the technological 'perfection' of the already emerging semantic web will be profound as individuals are increasingly only 'fed' the exact variety of information (e.g., specific political views, topical book themes, local environmental conditions) and sources (e.g., individual blogs, mainstream media online, ethnically-oriented webspaces) to

which they digitally ascribe. In many ways this personalized digital state has already emerged through the highly accurate book recommendations from amazon.ca based on my purchasing habits, and with RSS-Really Simple Syndication that delivers (or 'feeds') information updates from select websites to a highly personalized web portal. This active screening (out) of content, facilitated by the emergent nature of the 'semantic web', is a state Nicholas Negroponte (Director of the Massachusetts Institute of Technology (MIT) Media Laboratory, and chairman of the global 'one laptop per child' initiative), has dubbed the "Daily Me" (Negroponte, 1995). As individuals (without difficulty) engage cyberspace with only that content that they want to see, hear and read about, then notions of diversity will be increasingly challenged, while freewill and personal choice will take on new (and obscured) meaning.

Conclusion

Individuals have always been able to seek out others who share our opinions, whilst ignoring perspectives that contradict our own. However, with the increasing personalization of the Internet, and access to an enormous assortment of socially-open online communities and conversations (e.g., 95+ million blogs), the potential exists for students (and teachers) to feed solely on their own sense of truth, and in doing so avoid tempering forces that challenge their own opinions. What then is the potential of the Internet, as a purposeful enhancement to pedagogical practice, if students only tend to seek information which echoes their own preconceived notions of the world? At the base of the findings in this paper is the echo chamber effect on the Internet that causes individuals to solidify their beliefs through 'positive feedback loops'. The extent to which the echo-chamber effect is occurring online in emerging socially open webspaces such as blogs continues to deserve more thoughtful study and attention, especially as it applies to educational research and activities involving the Internet.

Even in 1985, Neil Postman pointed to the challenges presented by echo-chambers in the foreword of his book *Amusing Ourselves to Death: Public Discourse in the Age of Showbusiness*: "Orwell feared those who would deprive us of information. Huxley feared those who would give us so much information that we would be reduced to passivity and egoism. Orwell feared that the truth would be concealed from us. Huxley feared the truth would be drowned in a sea of irrelevance" (Postman, 1985, Foreword). As thoughtful educators in an increasingly wired-world, it is essential that vigilance be paid to the many challenges the Internet

presents as a (cyber)space for open dialogue, and approach the use of this globally interconnected network with a critical eye on the emerging phenomenon of the echo-chamber effect.

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