

Constructing a Politics of Knowledge in the Age of the Internet

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ABSTRACT

The politics of knowledge in the age of the internet is concerned with many overlapping elements. From the reimagining of research in relation to the new infrastructures to the development of new technologies and their social, cultural, ontological, and epistemological implications, here the politics of knowledge centers around questions of information technology infrastructures in late capitalism, the control society, and reflexive modernization. As these social and political theories operate across academic disciplines and organizational systems, new formulations of knowledge production arise such as transdisciplinary research. Transdisciplinary research can be considered as a model for knowledge production that is still capable of recognizing the shared and processual nature of knowledge that operates contrarily to the objectified and commodified understanding of knowledge in late capitalism. Using critical analysis centered in considerations of reflexivity and the control society, I argue for the possibility of alternative cyberinfrastructures for the e-sciences and virtual learning environments as systems of cultural reproduction. These alternatives privilege constructions of science understood as creative, social, and processual following the findings of actor-network theory and the theories of Deleuze and Guattari. Finally, I argue that we are co-constructing a politics of knowledge within and through the infrastructures that we are building, and within these politics there is a conception of the practices of science and research that could be informed by a reconsideration of social theories of technology and our contemporary social and political theory in relation to the development of future technologies and future ways of understanding those technologies.

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I. Introduction

These published academic papers are united by several topics and a central thesis that reflect my research program as a scholar in Science and Technology Studies(STS) and Internet Studies. The main theme of these papers are the politics of knowledge production and the technologies of knowledge production. With this set of papers, I argue for a reflexive, inclusive model of knowledge production that resists the persistent enclosure of knowledge and research practices within a monocultural imagination of science and information technology. By encapsulation, I mean the processes related to capitalism and modernity through which information technology such as academic technologies and cyberinfrastructures begin to lock people and academic practices into understandings of knowledge as a commodity or minimally an object that could become a commodity instead of recognizing the processual, fluid, and distributed nature of knowledge. Against this enclosure, I argue that we need alternative models and modes of research that allow researchers to operate in parallel with the strictures of the technical and organizational systems of late capitalism and reflexive modernity, while resisting and clarifying those strictures (Castells, 2002; Boltanski et al., 2006; Beck, 1997).

The process of resisting, clarifying, and then reflexively reconstructing our environment is central to the projects of reflexive modernity and the philosophical project of the redescription of late capitalism is part of the way that we can understand the transformation of research and knowledge production as part of our

everyday lives. There is a necessary insider/outsider positionality to this form of critical project where we need to be mindful of the status of the conceptual personae involved in the construction of this situation (Deleuze & Guattari, 1996). In this dissertation following the work of Deleuze and Guattari, read through the literatures of Science and Technology Studies, Internet Studies, and other fields, I attempt to construct a series of alternatives that would resolve, or if not resolve at least resist, the problems of enclosure of knowledge and the construction of the control society in relation to research and knowledge production. In doing so, I also describe the possible subaltern discourses and positionalities in late capitalism and their relationships to the knowledge society in the internet age. By contextualizing the problems of enclosure and control societies within these frameworks, I was able to realize critical spaces for operation in cyberinfrastructures, virtual worlds, and learning environments.

The central thesis of this dissertation is that these information technologies and the institutions around them, are constructed through all previous and contemporary discourses systems whose conventions, social forms, norms, and institutions are related to them. That is to say prior forms of the everyday in the systems of discourses are our references for the development of new forms of the everyday. Our investment in forms of prior ages is as such re-inscribed onto current forms. And to some extent, our investment in forms and our nostalgias toward them circumscribes and directs our forms (Thévenot, 1984). Enmeshed as we are within our discourses and lifeworld, we translate our conventions, social forms, norms,

and institutions from one shared milieu into future designs and possibilities. In this case of this dissertation, I regard the translation and design of information technologies as a critical juncture for intervention into our discursive practices. This juncture of design, I argue, does account for their possibilities for translating our current forms to future forms as we reconstruct the limitations and modulations of those prior forms by importing them into new arenas. This approach follows the co-constitutive thesis of social reproduction, following Bourdieu, but applied to as well through technology using critical analysis (Bourdieu and Nice, 1987; Bourdieu, 1993).

In parallel to the co-constitutive thesis of social reproduction, I argue that we need to understand technologies relation to society as processual and systemic. Technologies must be regarded of as processes that arrange the systems of relations, systems of signs, and/or systems of discourses surrounding technics and techniques. As processes, these semiotic relations help to form the ontological, epistemological, and discursive practices that preoccupy the communities of people who integrate those technologies in their everyday lives and practices including the academics that study those technologies (Baudrillard, 1998; Baudrillard, 1981; Thévenot, 1984; Baudrillard, 1996; Baudrillard, 1975).

Related to the co-constructive thesis is the tie between technologies and the organization of the systems of production of knowledge related to them. Our academies and research organizations have taken up the work of coming to understand technologies. As they have organized these practices many reproduce prior models

of knowledge and its production that may not map well into information technologies. To that end, disciplinary, interdisciplinary and transdisciplinary endeavors have sprung forth dealing with virtual learning, internet studies, global studies, and many other areas. The dialectical relations between the disciplinarity of modernity and the anti-disciplinarity/interdisciplinarity of postmodernity have developed into a new dynamics of enclosure, of deterritorialization, and of reterritorialization. (Guattari & Vilar, 1992; Genosko, 2002). In studying the synthesis of fields of analysis from disciplines and anti-disciplines, I follow Felix Guattari by calling for a form of transdisciplinarity. While Guattari and Vilar's transdisciplinarity does not resolve any social issues that surround knowledge in general, it provides a conceptual frame to capture an alternative program for disciplinarity in the sociology of knowledge. Hence, transdisciplinarity provides the basis to consider future programs of knowledge development as well as how certain epistemological problems may be resolved in those futures.

One of the theoretical positions that informs my work and unites these essays is an understanding of the conventions, knowledges and infrastructures developed to manage them. The ways we legitimate or justify the design and use of our information technology based infrastructural systems must be built on a reflexive subjectivity modeled on distributed cognition and semiotics. I based my analysis upon readings of Baudrillard, Bourdieu, Latour, Law, Bowker, and Star's work on this topic (Bourdieu, 2004; Bowker, Timmermans, & Star, 1995; Star & Bowker, 1995; Law, 2008; Latour, 2005; Latour, 1988; Thévenot, 1984; Thévenot, 2001;

Thévenot, 2002; Boltanski & Thévenot, 2006; Jagd, 2004). I try to find the discourses of legitimation and justification that people use in the design of these infrastructural systems and then develop a critique of those systems based on their legitimation. In understanding questions of legitimation, my work is influenced by the work of Lyotard, Habermas, and Boltanski & Thévenot in relation to the ways of creating and sustaining systems of legitimation in contemporary society (Habermas, 1971; Lyotard, 1984; Boltanski & Thévenot, 2006; Habermas, 1975). Those authors recognize the modes of legitimation that we use, how legitimation operates in discourses, and how we might see those modes of legitimation as highlighting critical junctures that need to be analyzed. Though these authors all draw from different traditions, they are all in genre of what might be called critical theory. I follow in their traditions by attempting to understand the problem of legitimation and specifically the relation of that to conventions, knowledges and infrastructures. The construction of reflexivity that I use derives primarily from two sources; Bourdieu, on the one hand, and Beck, et. al.'s concept of reflexive modernization on the other hand (Beck, 1997; Bourdieu, 2004; Bourdieu & Wacquant, 1992; Beck et al., 1995). Beck's understanding of reflexivity operates at the systemic level, where reflexivity is a distributed social action in relation to the current form of modernity, so that we can build a new modernity. My work follows his by locating and developing the alternative discourses that ground alternative possibilities, and thus provide for our ability to recognize and resist the forms of modernity such as the society of control. Whereas Bourdieu's reflexivity is based on the individual subject,

the researcher and must be consciously aware of the outcomes intended and unintended that his or her researcher constructs. This reflexivity is like John Law's directing, asking us to recognize in his work on the messiness of social science (Law, 2004). Following Law and Guattari, I try to recognize the messiness of my work, while integrating that awareness into my construction of the otherness required for critique (Guattari, 2000; Guattari, 1995). I place this position on the subjective reflexivity of the researcher within an ecological frame, recognizing the process and systematicity of the research while trying to recognize myself within the network ecology of which I am a part, but also recognizing I am trying to develop a sense of separation in order to describe, resist, and critique it. I synthesize these theoretical positions into a working critical model that provides for a grounded normative position as a mode of critical analysis. In several of the papers, this concern for a critique of discourses related to conventions, knowledges, and infrastructures is identified with the question of paralogics. That is, the systems of discourse enveloping our arguments and logics that serve to legitimize and ground them within our society and culture (Kent, 1993; Lyotard, 1984). This interest in paralogics is similar to the concern for paratext in textual analysis and pragmatics in discourse analysis. It is a concern for the space, infrastructures, ecologies, and environments that give meaning to the text in case of a paratext, and similarly a concern with similar things and actions in cases of pragmatics. The focus upon what Lyotard calls "paralogy", which are the alternative systems of reasoning and their apparatus of legitimation, leads to my fascination with paralogics and paralogy.

1. Method

The central method in my work is a poststructural critical analysis. In this form of critical analysis, I try to align the empirical evidence to a theoretical framework in order to decipher signs of what Deleuze and Guattari call "lines of flight" (Deleuze & Guattari, 1988; Stivale, 2005). Lines of flight, which are processes of becoming, are operational trajectories representing processes of deterritorialization and re-territorialization through which power is framed and directed (Patton, 2000). To bring clarity to the power dynamics that am critically analyzing, I construct a position derived from subaltern discourses through which we can see an alternative assemblage with a line of flight that is different from the original. This second position that I employ is a minoritarian position in the field that I promote as an option amongst many possibilities, including the current dominant assemblage. Thus, I construct a form of ontological politics as the basis of critique (Mol, 1999). By considering the differences in the possible assemblages and their lines of flight, I am able to develop the position of critique of the dominant position, based on the minoritarian position. By choosing a position that is not dominant within hegemonic discourses, but is instead one of many possible subaltern or minority positions which resist and as such inform the hegemonic discourses, I point toward prior instances of ontological politics and the choices that were made to legitimize and justify the dominant position.

With this methodological approach, I analyze systems and modes of legitimation, justification, and truth-making within co-constitutive discursive fields (Fou-

cault, 1997; Boltanski & Thévenot, 2006; Foucault, 1979). I direct my analysis away from the juridico-discursive formations of power centered on the state, and position the analysis within the wide fields of a cultural, social or technological power, much like Foucault. Legitimation, justification, and truth making for information technology are bound within discourses of legitimation and justification, which I see as paralogics that subsume logic and enables interactive communication. Paralogics are not rule-bound, grammar-bound, nor logic bound--they are what imbricate the rule-boundedness, grammar-boundedness, and logic-boundedness that allow us to generate meanings and communicate them throughout our objects and practices as part of semiotics (Lyotard, 1984). In short, looking toward paralogics is much like looking toward paratexts. I try to look toward the structure, form, origination, and direction of the logics, just as the paratext can be used to identify the author, the media, structure, front matter that give meaning to that text and as it the reader know the general direction of the text. This approach allows us to look toward the qualities which ground the logics, the arguments, and the attempts to reconstruct things as part of the larger theoretical assemblages.

2. Structure of Dissertation

This dissertation compiles several papers related to my critical research program in STS and Internet Studies. There are several short papers, and several long papers, all of which have been published before. The structure of the dissertation and the ordering of chapters therefore are centered on the development, arrangement, and application of the themes and methods outlined above.

Chapter two deals primarily with reflexivity in e-science, and here I am attempting to to problematize one current conceptualization of e-science. This chapter was originally presented as part of a group of papers for ACM Siggroup. That collection dealt with alternative models and alternative communities developing out of the group uses of computing. This paper presents the idea of how reflexivity in relation to various models of power can be used as a way of understanding the relationships surrounding e-science in the entrepreneurial university. It also asks how these two new institutions--e-science and the entrepreneurial university--seem to accept an unreflexive model of technical and social progress, blinding them to future problems. This essay explores the conceptual frames of power in e-science and it introduces two thematic concepts of this dissertation: capital and control as relations within systems of bio-power. In exploring these concepts, I try to highlight the forms of social power that developers and designers of e-science are manifesting in the world.

Chapter three highlights some problems of knowledge production and research in general when approaching a field from Bourdieu's perspective. That is, when constructed as socio-technical systems, specifically in this case, the field of study is the internet. In thinking about the internet as a subject of research and a field for research, I argue that the field is likely to become fragmented and confused through the cross-purposes discussion amongst disciplinary and interdisciplinary perspectives. In part, I argue that this fragmentation do to the rapid changing nature of the internet and its social and cultural relations. One change that I point

out is the increasing transformation of the internet into infrastructure and toward appliances, which I argue pushes it down as a less popular topic of research in academia, limiting its understanding, and hindering its general understanding among the public. The public understanding of science and technology in this case is a driving concern that should enable us to resist the disciplinarity and maintain focus on the globality of the internet through transdisciplinarity.

In the fourth chapter, I develop a critical analysis into the political economy of the internet based on the case of virtual learning environments. Virtual learning environments, embedded now at many universities and related institutions, provide one example of the capacity of technological systems to carry ideological positions and to reintegrate those positions. In this chapter, I argue that the institutions and social structures currently arrayed around virtual learning environments are transformed by their application, which can allow for a reflexive recreation of such learning environments. As a critique based on informational power understood in terms of Castells' Hegelian 'Spirit of Informationalism', I show that information and informational power is fluid and social as opposed to being primarily ideological in the Hegelian sense. The elements surrounding informational power and information, like institutional social, cultural and educational powers, do have ideological elements based in capitalism. Hence these ideological tenets also are driving those institutions toward "business-based" models and ideas. In recognizing this capitalist integration of institutions, I argue that the production of knowledge found in some cultural and educational institutions is resistant toward this in-

tegration. And, it should be. That is to say, I argue against global capitalism in the production of knowledge, and I assert there is also a global communal sharing that needs to be recognized. This communalism enables points of resistance such as open source software, to resist the capitalization of knowledge and educational institutions.

In chapter five, I move back toward questions of social construction of technology to critique social construction of technology(SCOT) from perspectives found in the post-structuralism of Deleuze and Guattari and Isabelle Stengers(Bijker, Hughes, & Pinch, 1989; Stengers, 2000; Bijker & Pinch, 1989; Stengers, 1997; Guattari, 2000; Genosko, 2002; Guattari, 1984; Guattari, 1995). This argument recognizes the utility of the social construction of technology and the empirical program of relativism, but attempts to extend those positions by considering the possibilities of Guattari's "meta-modelization" and Stengers' "cosmopolitics". Taking these ideas as foundations for an ecological model, I push against the model of closure, questioning its merits as an analytical device, but accepting it as a narrative tool. I reject it on the basis that the design is rarely stable and is always in flux, just waiting a new push from a different community to move its development further. Consequently, I want to critique the stability model of SCOT and position the risky models of Stengers as an extension that encourages looking for places where closure might not be found, where that part of the model might fail. In seeing where closure might fail on one level, I add in meta-modelization as a methodology for considering new axiomatics and axiologies that can be transform

methodological considerations. Backing again toward a public understanding of science question, I use these two factors to argue that given the common sense and theoretical problems of closure in SCOT, we might want to look for cases that people understand that do not meet ideas of closure or even stability.

Chapter six returns to a case study, but instead of looking at the institutionalization of virtual learning environments, this chapter examines e-science and cyberinfrastructure as sites of discourse. I analyze how policy documents have defined those concepts, and construct a critique of cyberinfrastructure and e-science based on their construction in relation to the "control society" (Deleuze, 1990, 1992). In particular, how can resistance be based on an alternative conceptualization of science and scientific practice that those systems could embrace. I start with the argument that cyberinfrastructural policies are regarded as blackboxes, we put words and money in one side and get infrastructures on the other side. I then open the blackbox by mapping the ideological positions of the words we insert in relation to the models of science that we have available. I tease out the discursive tensions in the policy statements regarding cyberinfrastructure and argue that claims of necessity will drive the implementation of cyberinfrastructure through those tensions. Specifically, how do those tensions play against what we know about science and knowledge production? I argue that this technical infrastructure will then be used to capture modes of knowledge production. These trends institutionalize the modes of production within infrastructural capacities, controlling them and normalizing them to fit expectations of knowledge production that do not

map onto the expectations of everyone involved in the enterprise.

I suggest following Deleuze and Guattari's conception of "royal" versus "nomadic" science, that there is a strong tendency to royalize science and to make it fit expectations of normality (Stengers, 2000; Deleuze & Guattari, 1988; Welchman, 1999; Patton, 2000). Indeed, we can see cyberinfrastructure and e-science as one method of controlling the population to enforce that normality. Following the enforcement of normality as a system for the control society, I posit the alterity of the creative scientist or hacker as a way of understanding how this sort of system impinges on the possibilities of researchers to discover and develop new knowledges. I then argue that there might be the possibility for a different, open, more social, less individualistic and less non-modulated/controlled environment in which to pursue research. We can build a less encoded and more open system that would allow people to 'play' with the technology. In short, I argue that we need a information technology tied to Deleuze and Guattari's nomadological science, and not one built on the more royal models of control of users that we currently are developing.

In chapter seven, I take up the idea of transdisciplinarity in relation to virtual worlds and the problems of institutionalizing the study of virtual worlds in academic disciplines. In this study, I argue, building from my prior research on transdisciplinarity that we frequently confront incommensurable perspectives on a global topic. That is, when we research a large enough topic from one perspective, eventually we will confront another perspective on the same topic that cannot be

translated into our topic through our own or the other perspective's methods. In other words, sometimes interdisciplinarity cannot be accomplished. With that contradiction in hand, I argue that there needs to be a meta-perspective constructed amongst the disciplinary work, that can translate from either discipline into the shared understandings others hold. Here, I problematize the territorialization and boundary work found in disciplinary practice and attempt to argue that there is a space to stop constructing boundaries and to start an inclusive transdisciplinary dialogue.

The goal of this research is to bring into consideration more insights from material semiotics as part of my analytical framework. Specifically, I use semiotics to argue that there is a meaning-laden construct when we refer to the virtual and virtuality, but that that it is not a stable sign in any sense. It is more of a series of relations that are being co-constructed by different groups existing in various cultures that import different meanings to the concept. It is through those relations and our understanding of them that we develop the disciplinary and interdisciplinary perspectives. As such I would argue we also create analytical or critical traditions.

Following an analysis of co-constructed systems of relations as disciplines and traditions, I move into the problem of transdisciplinarity, namely, how we can use it to realign the systems of relations to cast light on the transversal relations that allow for transdisciplinary dialogues. Finally, contrary to an agenda of exclusion and differentiation of perspectives that generates disciplinary perspectives, I posit

that we might promote an agenda of inclusion. Through this model of inclusion, we can rebuild our understanding of virtuality into a meaningful cross-disciplinary shared understanding, perhaps rising to the level of transdisciplinary understanding.

Finally, I end with chapter eight. This chapter is a response to a paper by Dylan Wittkower that centers on a construction of the revolutionary possibilities of openness in software and cultural production. My response is a meta-critique, which follows from the previous theoretical constructions, but integrates more strongly the construction of knowledge production produced above. Here I argue that, "Knowledge is a distributed process communicated amongst subjects in relation to their understandings of the world," (Hunsinger, 2008). It is a process that is shared, so it really cannot be objectified and commodified in ways that are required by late capitalism. This is not to say that something is not made into a product, objectified and sold, but that knowledge cannot be. Following that, we can see that Creative Commons and the variety of other quasi-proprietizing constructs that are meant to allow revolutionary activity. "Cultural environmentalism" is what law professor James Boyle calls these systems we put in place to maintain culture and cultural institutions within a framework of laws paralleling the application of legal frameworks in environmentalism(Boyle, 2007). For Professors Boyle and Wittkower, cultural environmentalism is a good way to construct a resistance to property based theories of knowledge. However, I argue that cultural environmentalism is just yet another form of neoliberalism. To resist proprietizing tendencies, we

need to work on creating alternative understandings of knowledge that map more closely on the way we experience knowledge.

Building on the argument about the nature of knowledge, I extend the analysis to understand new forms of cyberinfrastructure as physical manifestations of cultural conventions and norms. I argue against Wittkower that the norms we are constructing in computers and cyberinfrastructures are not revolutionary at all, but merely the same sort of conventions that we produce in late capitalism in relation to artifacts. That is we produce ownership relations, relations of domination and relations of control. Similarly, I deny Wittkower's construction of communality as the basis of these revolutionary ideas in favor of demonstrating that late capitalism and the consumer culture upon which cultural environmentalism is predicated are tied very strongly to individualism and corporatism by their reconstruction of the community around individuals. These arguments show how we can look at the optimism of open source as a ruse that hides the actual operations of software production and related open source movements within society.

In the end, Chapter eight concludes by advancing Baudrillard's semiology against Wittkower's Marxism. That is to say, we need to understand that cultural and knowledge production is founded less within capitalism, though it can be, but it can also be founded in communities and those communities can also be bound up in other cultural milieu. We have to consider the possibilities of alternative modernities, which might actually provide for the revolutionary endeavors that Wittkower presents. However, as I argue, his Marxism is still very much caught up

within the hegemonic construction of modernity through cultural environmentalism as neoliberal discourse.

These papers, while constituting a whole, are also significant as individual contributions. Several of the papers have been cited in dissertations and other scholarly publications many times. They are making an impact on a variety of fields from internet studies, to computer science, to various fields where colleagues are trying to understand the issues of transdisciplinarity, social construction of technology, virtual learning, and knowledge production. While the newer papers have not been cited as much, over time they will likely get scholarly attention. As a corpus, they relate to central themes and enable researchers to build future research upon them.

3. Contributions

Each of these papers makes contributions to a field that might be described as the politics of knowledge, and more specifically the politics of university-based knowledge production. They examine the technologies of knowledge production, the organization of knowledge production, and transformation of knowledge production in the internet age. In doing so, they present a unified body of work that makes several contributions to the theoretical development and description of technologies, alternative models of technologies, and organization of knowledge production in relation of those technologies.

These papers also can be regarded as contributions to several fields in science and technology studies, social theory, academic technologies, and internet

studies. The primary contribution that these studies make to science and technology studies are in the extension and development of social theories of technology. Specifically, I built on SCOT, actor-network theory, as well as the economic sociology of Laurent Thévenot and Luc Boltanski--read as sociology of critique and post-structuralism--to contribute to the semiological understanding of technology in society (Thévenot, 1984; Thévenot, 2001; Thévenot, 2002; Boltanski & Thévenot, 2006; Law, 2008; Law, 2007). While my work is related to John Law's understanding of actor-network theory as material semiotics, I construct my understanding of objects and infrastructures as more fluid and interpretable. My material semiotics of objects and infrastructures is different because I understand technologies within discursive systems as participating in semiosis. This system of discourse with its plurality of possibilities provides spaces of relations that allow for critique, whereas Law's material semiotics are placed much more in relation to agents than discourses. I also differ in that I focus on the development of the virtual and conventional in relation to those discourses, so I am looking at how our assemblages, their lines of flight, and our everyday practices co-construct our discourses and thus our material semiotic position. In exploring a more discourse oriented material semiotics, I attempt to provide grounded empirical interpretations of the materiality, allowing them to be recontextualized within our virtual worlds and our everyday conventions.

I would also argue that I make significant contributions to developing the critical theory of infrastructure studies with my critiques of e-science and cyberin-

frastructures. I develop the idea that there can be alternative models of cyberinfrastructures with purposes that support more pluralistic forms of knowledge production that escape from the current designs, which I argue are based on control and commodification of knowledge. Because we can understand the social trajectory of the control society within the current models, we should pursue alternative models.

Similarly, building upon critical theory and STS, I contribute to the development of theories of knowledge production in relation to disciplinarity and theories of transdisciplinarity. By combining the problems of disciplinary versus transdisciplinary knowledge production with problems of the control society in information technology research, I help to develop an understanding of how we use a variety of discursive justification systems across many arenas to similar effects. Thus My insight that the control society is pervasive in knowledge production.

Finally, I contribute to strengthening the thesis of co-constitution of society and technology in relation to technologies and systems of knowledge production. I argue in each one of these chapters that our reflexive relationship to technologies is part of the system of knowledge production, and its organization of our systems of knowledge production. We can see this through the conceptual relations and semiotic relations that these two sets of relations intertwine in our systems of knowledge production and this generates our sociology of knowledge in late capitalism.

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II. Reflexivity in E-science: Virtual Communities and Research Institutions

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1. Abstract

The social and policy aspects of e-science are becoming more important as the social and technical infrastructure for it progresses. This essay presents the idea that we should pursue a reflexive perspective in its development, keeping in mind that e-science has the capacity to radically restructure current power relations in research institutions. However, it probably will not cause radical change, as much as exacerbate the already difficult situations that the virtual communities of researchers face in the entrepreneurial university.

Categories and Subject Descriptors

J.2 Physical Sciences and Engineering

J.3 Life and Medical Sciences

J.4 Social and Behavioral Sciences

K.4.1 Public Policy Issues

General Terms

Human Factors, Management, Theory

Keywords

E-science, Virtual Community, Reflexivity, Policy, Ethics

2. Introduction

E-science is at once application of massive networking and computing power to problems in the scientific communities and the cyberinfrastructural systems, both social and technical that come about through the application the technical infrastructure. In short, e-science resolves to be computationally intensive science and its requirements. E-science also conceptually addresses social concerns surrounding the necessity of collaboration in performing computationally intensive science. Virtual laboratories built on e-science technologies, such as the GRID, have the possibility of becoming virtual communities of researchers. E-science is pursued in many disciplinary and transdisciplinary endeavors. Perhaps the most common idea of E-science beyond enabling collaboration is in simulation and modeling, which is performed as e-social-science in the social sciences, and similarly applied many other disciplines where computation can provide insights. Power in these scientific virtual communities parallels power elsewhere online and offline. The implementation and integration of computing and networks into our everyday lives has been the work of both individuals and society as a whole through a myriad of institutions, in which power already existed. Since its inception, the foundations of internet have been enmeshed in scientific and engineering practices. However, it is only recently that e-science has differentiated itself from the normal use of the internet in science. In this period of differentiation, we are faced with contradictions between new possibilities and old institutions, and power

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relationships between them are developing anew.

3. Power and Reflexivity

The structures of power in scientific virtual communities should not be thought of as only located in those communities, but it is distributed through the ecological systems in which they participate, both online and off. It flows through both the discursive and non-discursive systems in which they exist. This includes directly and indirectly the research and development enterprises in which they participate. In short, the fields of power in which virtual communities exist are plural and exist both online and off [1][2]. They are fields of power and as such fields of struggle [3]. These fields are constituted by our acts as researchers, producers of knowledge, and producers of tools. "Every scientific act, like every practice, is the product of the encounter between two histories, a history embodied, incorporated in the form of dispositions, and a history objectified in the very structure of the field and in the technical objects (instruments), writings, etc," [3]. As researchers we have to be explicitly aware not just of our effects on these communities as *en loci* researcher, but also outside of that role, when we are applying the knowledge gained in order to further our own projects. We have the power to structure these power dynamics, to transform the discourse, and at a very fundamental level, transform the world we are researching. In the emerging arena of e-science, these relationships are developing now, as individuals, research teams, and indeed even nation-states are entering the arena of e-science, and establishing themselves as reflexive points of negotiation, in the fields of power. Establishing e-science as

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points of reflexive practice will be a necessity for understanding the power of e-science and the virtual scientific communities surrounding it. Science in general and e-science acts within a social world, and it has clear effects beyond the allocation of knowledge, labor, and other resources. Being reflexive means that we realize that when we speak as researchers--when we are speaking to development of knowledge, "...every word that can be uttered about scientific practice can be turned back on the person that uttered it, " [3]. The mirror of reflexivity allows us to place our work in the larger context and understand that it is dependent on that context [3]. The mirror is not perfect, it does not return a true image, it distorts and changes the reflection, and our actions have effects in that reflection as well. Reflexivity also aids our understanding of our positionality in the virtual scientific communities forming the backbone of e-science. Through reflexive research practices, we realize that our practices justify our research as much as its outcomes, especially when the context of those outcomes is increasingly questioned on ideological or financial grounds. It is not surprising that computer networks and eventually the internet arose from the institutional frameworks and power structures of governments, universities, and corporations such as engineering firms. Those institutional frameworks share a common modern narrative that values knowledge and innovation, and within that narrative framework, institutions developed that concentrate, control and commoditize those values. The concentration of resources both capital and intellectual found in those institutions after the World War II cen-

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tered them as a system of innovation and provided them with enough institutional momentum to be able to take the risks necessary to pursue innovation. Within those institutions and their relevant narratives, power existed, and while we can clearly find power as Weberian bureaucratic dominance, there is also discursive power, disciplinary power, and the generalized pastoral power that flows through society as a whole [4][5][6]. These institutions are what situate e-science in context, much as the history of the internet has a strong relationship to those institutions. Narratives such as merit, equality, hierarchy, all structure people's understandings of those institutions and their imagination of the possibilities those institutions provide.

4. Cyberpower and Discursive Power

When we talk about power in the scientific virtual communities of e-science, we are talking about both the power found in the everyday life of researchers and the powers found explicitly online. Online power flows through these communities, through these systems, and operates on individuals and societies. It is not simply liberating or dominating, it changes the very belief systems in which we live everyday [7][8]. The social imaginary from which people construct their understanding of power also instructs the way we build things, such as preferring one sort of ordering over another, and when we build software for virtual groups, frequently our imagination of the situation is not universally shared. For e-science, researchers and proponents are imagining a diverse set of systems and infrastructures

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that are intended to empower the research community:

We envision the creation of thousands of overlapping field and project specific laboratories or grid communities, customized at the application layer but extensively sharing common cyberinfrastructure. The cyberinfrastructure should include grids of computational centers, some with computing power second to none; comprehensive libraries of digital objects including programs and literature; multidisciplinary, well-curated federated collections of scientific data; thousands of on-line instruments and vast sensor arrays; convenient software toolkits for resource discovery, modeling, and interactive visualization; and the ability to collaborate with physically distributed teams of people using all of these capabilities. This vision requires enduring institutions with highly competent professionals to create and procure robust software, leading-edge hardware, specialized instruments, knowledge management facilities, and appropriate training. [9]

In fact this vision for e-science in the United States is clearly embedded in the social imaginaries and narratives in which higher education, engineering groups, and science in general rely up to legitimize their both their existence and their ability to pursue independent research. The requirement of the development of a complex cyberinfrastructure for e-science that requires teams of 'highly competent professionals' to be able to work seems very much to be in the current operational mode of large-scale science, such as found at CERN or major laboratories [10][11]. The sole difference is that instead of bringing people together in one location to collaborate, this e-science architecture is predicated on virtual communities of scientists coming together over through technologies. This will bring about power dynamics. One analyses of power in the online environment provided by Tim Jordan gives us a tripartite division of power through which we can think about how these virtual communities might operate.

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Cyberpower is the form of power that structures culture and politics in cyberspace and on the Internet. It consists of three interrelated regions: the individual, the social, and the imaginary. Cyberpower of the individual consists of avatars, virtual hierarchies, and informational space and results in cyberpolitics. Power here appears as the possession of individuals. Cyberpower of the social is structured by the technopower spiral and the informational space of flows and results in the virtual elite. Power here appears as forms of domination. Cyberpower of the imaginary consists of the utopia and dystopia that make up the virtual imaginary. Power here appears as the constituent of social order. All three regions are needed to map cyberpower in total and no region is dominant over any other. [12]

Given Jordan's construction of cyberpower as tripartite division portrays an idealization of the idea of power in three contexts, none of which actually map strongly into the everyday lives of the people working in e-science in a real way, but only in a way that is either abstracted or impractical. As designers and developers of technology, we have to wonder how it can be applied to us, and wonder more appropriately to the users of technologies, outside of that abstraction. Here, I turn to Foucault's notion of biopower, the power of the management of populations, and it provides a sense of the real power that software development, and the design of virtual community software has in users lives and research.

Power is not something that is acquired, seized, or shared, something that one holds on to or allows to slip away; power is exercised from innumerable points, in the interplay of non-egalitarian and mobile relations ... Power comes from below; that is, there is no binary and all encompassing opposition between rulers and ruled at the root of power relations, and serving as a general matrix--no such duality extending from the top down and reacting on more and more limited groups to the very depths of the social body. [13]

Power as such exist in users and developers, but not in one over the other,

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but in a complex interplay of give and take that is often found in social relations. It is not oppositional, but it is there, and we have to be aware of our effects in that sphere. When we construct our tools and perform our research, we change the social field and in changing the social field, we enter into a relation with those in that field. By recognizing that relationship, we take responsibility toward the future of that relationship and in that, we reify the relationship through research. So, what kind of power is found in e-science, when they refer to empowerment? It is clearly a performative power, the power to create something:

The base technologies underlying cyberinfrastructure are the integrated electro-optical components of computation, storage, and communication that continue to advance in raw capacity at exponential rates. Above the cyberinfrastructure layer are software programs, services, instruments, data, information, knowledge, and social practices applicable to specific projects, disciplines, and communities of practice. Between these two layers is the cyberinfrastructure layer of enabling hardware, algorithms, software, communications, institutions, and personnel. This layer should provide an effective and efficient platform for the empowerment of specific communities of researchers to innovate and eventually revolutionize what they do, how they do it, and who participates. [9]

However, it is also a social power, but not necessarily the one found in Jordan. This power is closer to the bio-power found in Foucault. The power exists as diffused between the layers, and it exists to empower with the capacity to innovate. Innovation does not arise in a vacuum nor is it simply a matter of technological enablement [14]. It arises in an institutional context of enablement, but e-science is already arising in innovative institutions. We are talking about the ability to do more, to manage more, to control more, and all of this is done through the internet

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and information technology.

5. The Context of Capital in E-science

In the age of e-science, in which the technical infrastructure that 'big' science requires is based on immense informational resources, information and the ability to control it becomes the basis for power, similar to Foucault's bio-power, but objectified through the concepts of information and capital. Informational power is a power of control, control of distribution, and control of origination. It is a power of establishing borders, territories, and limiting access. Informational power is the key to understanding what will be a successful scientific virtual community in the future. As e-science maps the practices of the disciplinary systems of science, we can understand that the systems of control found in those disciplines will pervade e-science, but with greater emphasis on the control of information. Science is predicated on assumptions of normality, and when the normal becomes fast, too informationally productive, and generates enormous surpluses of capacity, like a bomb, the excessive power; the excessive information explodes [15][16][17]. In e-science, the condition of excess is predicated on the fact that terascale capacities are growing the world over. This informational explosion breaks the boundaries, overwhelms the territory, and forces humans to develop new tactics for management, for governance. One clear boundary or norm that has been broken in recent years is that of disinterestedness, [15]. The ability of a researcher to separate the science from his or her personal goals or future profits is sustained by the researchers norms and social imaginaries. In the context of the entrepreneurial university, re-

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searchers have known of this issue for some time [18]. The instrumental nature of science in service of profit and property is becoming the defining projects of many researchers' careers, and access to e-science resources and the requirements of co-operation at a distance and virtual community that these resources will likely exacerbate the problem:

A more elaborate and nuanced account of the current situation in academic science would emphasize the respects in which norms of professional behaviour and institutional policies are in flux. It is uncertain that the traditionally prevalent disposition in favour of scientific co-operation will be able to withstand the pressures from the newly ascendant spirit of 'academic entrepreneurship.' Similarly, at the institutional level it is far from obvious that commitment to the collective goal of 'the pursuit of knowledge' will continue to guide the policies embraced by a majority of leading research universities. In many places it already has ceased to prevail in the face of the instrumental emphasis placed by public funding agencies upon the wealth-creation function of knowledge, and the growing legitimisation of the pursuit by researchers of personal wealth through ownership of intellectual property. Quite obviously, these are important issues not only for the scientific communities involved, but also for society. Moreover, they are issues whose ultimate outcome can be powerfully shaped by the effects of myriad, seemingly small decisions about the technological and institutional infrastructures of e-Science. [19]

This is the problem of modern science. It is not simply information overload, but it is a condition of being overwhelmed by information and power, pluralized through narratives and imaginations of both wealth and knowledge. Because we have built an informational infrastructure based on speed and power, we are faced with trying to develop new policies to manage the realization of national investment in science versus personal profit from science. E-science will not resolve this issue, but the competition for resources fits the general trend of university and na-

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tional investment to provide private research outcomes. When we lose clarity about the norms and goals of scientific virtual communities, we open the door to issues of individuality and complex relationships within those communities that are not easily resolvable in terms of technology access or technology governance. Paul David notes of e-science :

It is evident that the complex collaborative undertakings in view here – those that are meant to be enabled, indeed, empowered by e-Science facilities and services – cannot be supposed to arise and function automatically as ‘perfect teams’ expressing some primitive cooperative impulse among the human actors. Quite the contrary: the collaborators will need to find solutions for non-technological issues of resource allocation and governance that involve conflicts arising from the divergent interests of the individuals and organizations involved.[19]

In the competition for personal gain, either capital or reputational, the teams ultimately have problems managing their interests in relation to one another. The collaborative nature of e-science could continue to fuel the question of ownership of outcomes. It brings into question the central marxist question, who owns the output of the system when the workers do not own the machines of production? Currently these issues are resolved by contract, but those contracts insufficiently account for the complete fields of relations involved, such as the research team and society. There seems to be no end in sight for the progressive development of this infrastructural problem, and reflexively the increased production of information multiplied on information only complicates the already unclear situation of profit and property for the future of e-science. With terabit/sec speeds already in place, informational capacity is likely already beyond the limits of human understanding

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in any real sense, and we are beginning to see how this informational capacity in science manifests itself as a tool of transformation or weapon of destruction of the institutions built on fordism and post-fordist understandings of information as productive tool. This confuses the question of allocation of resources immensely. If the relationship between research productivity and capital investment is not sustainable, then the excess informational capacity cannot be used. In that case, we end up with a situation in which computational capacity, network bandwidth, and related items could fall into a mode of cost recovery to justify their existence, which then limits capacity to those teams which can pay for access or otherwise justify their expenditures to get access. Thus control of the informational tools becomes a matter of capital, and this could have negative effects.

6. Conclusion

The structures of power in scientific virtual communities are problematized by their continuing enmeshment into the institutional structures of late capitalism, such as the entrepreneurial university, the engineering firm, and the information systems that they inhabit. Power flows through these discursive and non-discursive systems, both as informational power, but also as social power. The research and development enterprises in which these communities exist have elements that seem to question the foundational assumptions necessary for the success of these communities. These institutions are what situate e-science in context. Norms and Narratives such as disinterestedness, merit, equality, and hierarchy structure people's understandings of those institutions and their imagination of the possibilities those

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institutions provide. As researchers, we have a responsibility to be aware, not just of our research, but also of its contexts. The scientific milieu has norms and narratives that structure its relationships internally and externally. When we are applying the knowledge gained in order to further our own projects, we have the power to structure these power dynamics, to transform the discourse, and to make choices in the way we practice our relationship to the world. For e-science, as researchers begin to build the infrastructure to manage their research, they need to be aware of their social power, but also their informational power, because they are powers to change the world.

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III. Toward a Transdisciplinary Internet Research

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1. Abstract

Given the expanse of the Internet as a topic for research, the need for transdisciplinary research becomes evident. This paper introduces and expands on the problems of Internet research and how some of those can be resolved by pursuing transdisciplinary research. Issues introduced are the fragmentation of understanding, the disunity of research, and the public reception of that research.

Keywords Internet research, public understanding of science, transdisciplinarity

Internet research as a field is somewhat indefinable. The subject of research is so extensive and ever-changing that we have generalized the referent "Internet" to encompass nearly every perspective in relation to the technology. The field is rapidly changing and could become incomprehensible as a whole to both its academic and public audience. The contestation and divergence of the axiomatic and conceptual foundations of Internet research fragment our understanding, and a nascent disciplinarity, either imported from existing disciplines or developing around the topic itself, will quickly reproduce traditional problems of translation and interpretation among fields of knowledge. By recognizing these ongoing problems in the development and structuring of disciplines in relation to bodies of knowledge, we can see we need an inspired solution for it, the development and implementation of transdisciplinary Internet research.

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Internet research is slowly building a body of knowledge that is pertinent to many disciplines. Likewise, many disciplines strive to say something about the Internet and to map an understanding of the Internet into their discipline. Disciplines have borders and display a "recognizable continuity" (Becher, 1989, p. 21). The disciplines enclose and defend a territory of knowledge, some of which is heavily contested among the disciplines. This territoriality also leaves gaps and unclaimed spaces. In the contested territories, interdisciplinary possibilities arise and encapsulate certain issues and topics that cannot be captured by the disciplines alone. These disciplinary and interdisciplinary spaces are important specialties for Internet research, and their perspective in regard to the Internet is beginning to be recognized by larger audiences.

Disciplinary and interdisciplinary research map well onto some aspects of Internet research, but they are not the only options. There has been a movement toward transdisciplinary research in fields such as information sciences, policy studies, geological sciences, and even disciplines like biology in the last 30 years. Transdisciplinary research attempts to approach the object of study beyond and across disciplinary and interdisciplinary perspectives. The challenge for us is to think of research as a field that comprises several independent disciplines and interdisciplinary endeavors that can be combined into a whole, transdisciplinary field (Dickens, 2003, p. 97). A transdisciplinary field is one defined by the globality of its object of study, combined with the complex, emergent, and changing nature of that object (Genosko, 2002, p. 26). The very nature of the Internet as an object of

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study is its incomprehensibility as a whole from disciplinary or interdisciplinary perspectives.

By building into each research endeavor an integration with transdisciplinary discursive and axiological systems, we increase the possibility of dialogue and mutual exchange. Realizing that no single perspective will capture the territory, we need to develop and integrate inclusive models that can bring understanding to the greater whole (Genosko, 2002, p. 25). This project of translation among disciplinary and interdisciplinary perspectives is already occurring in Internet research in many of the journals and colloquia, and it will continue and become more vigorous should we actively encourage its development.

As Internet research has expanded, disciplinary and interdisciplinary forms have become more institutionalized as subdisciplines and specialties, as centers, departments, and sections in universities and research institutes. Without concerted effort, transdisciplinary efforts will be minor sidelines instead of major practices. Transdisciplinary research breaks the heavily normalized disciplinary boundaries, hierarchies, and stratifications normally found in academic knowledge production. This research creates a *locus communis* or commonplace that develops into a common set of understandings across the fields in transdisciplinary pursuits. This knowledge production should over time create a core body of knowledge that will define what we know about the Internet. Without a stable core that provides for integration, knowledge will fragment (ISSC, 2003, p. 3).

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Internet research could end up being fragmentary, and to some extent unintelligible as it progresses. This means we should consider what the core of Internet research will become and how it will make sense not just to researchers and experts, but also to a broader audience. Recontextualizing for multiple disciplines our research and mixing the axiological systems of our research to make sense of and bring understanding and interpretation to the complexities involved in researching the Internet, we progress from disciplinary and interdisciplinary understandings toward a transdisciplinary understanding.

The body of knowledge constituted by Internet research will continually refresh in light of the field as a whole, creating transdisciplinary knowledge as it will inform both expert and lay researchers alike. For laypersons, heavily disciplined or even interdisciplinary knowledge can be hard to interpret, and harder to utilize in any meaningful way. Transdisciplinary knowledge, because it has been recontextualized for the broader audience of multiple disciplines, is more accessible and interpretable. This interpretability and transdisciplinarity will allow Internet research to retain its relevance to a broader audience, and with that encourage a sustaining public interest and possibly the future growth of the field.

Public reception and relevance are becoming important issues to consider in Internet research because the technology is slowly disappearing from the public view. The desktop computer is rapidly devolving toward an everyday appliance like a refrigerator, and few people specifically study refrigerators anymore. This is

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not to say the refrigerator is not important to everyday life or individual research agendas, but it is to say that refrigerators, like all appliances, are usually understood as part of a system of objects, technical system, or similar theoretical assemblage. These theoretical assemblages are particularized to certain disciplinary discourses, which define and limit the understanding of the objects of enquiry. These discourses impart a salience to particular facets of the object's understanding. Each facet emphasizes certain issues that fit into their homogeneous subject matter and seemingly forgets others (Briggs, 1977, p. 2211). This "facetization" of understanding is the fate of the common appliance in the disciplines. Each discipline develops and polishes its facets without full cognizance of the greater transdisciplinary whole. Between the perspective-oriented aspects of disciplinary research, and the disciplinary tendency to homogenize, systematize, and normalize, appliances become ordinary, everyday, and dismissed as part of the disciplinary discourse. They are forgotten as objects of study and within the individual disciplines because they become hidden in the abstracted, systemic understandings of the disciplinary perspectives and theoretical assemblages describing them (ISSC, 2003, p. 3).

While disciplinarity is a threat to the Internet research in some respects, it is not the only issue. The fast rate of change has become an issue for Internet research. Parts of Internet technology, such as Wide Area Information System (WAIS), are already forgotten as research topics. As researchers become more specialized and technologies differentiate, some topics will become popular and others less. Beyond the worries of disciplinarity, we need to be careful not to lose the ref-

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erent of the Internet to specialization, commodification, and technological development, if we are to maintain a field of Internet studies and retain its relevancy to our audiences.

As the Internet and telephony combine in the form of cellular phones and Internet telephony, certain parts of the Internet become less visible. The networks are already very much invisible to the every day user. As topics of research become less publicly visible, they become less relevant to the audience, and in the end may even lose their definition. This can have tragic consequences for our growing body of knowledge. Internet research could become a subset telecom research, digital studies, or something else, and when it takes on the identity of the other, it will surely lose some of its current richness.

At what point, though, are we no longer studying or researching the Internet? And if we are not, then what are we studying: interfaces, computers, network effects, or something else? If the topics of study that comprise Internet research are in fact independent disciplinary endeavors in themselves, then where is the place for Internet research? The place for it is in the broader discussion, the bringing together the various and sundry disciplines and interdisciplines into a place where they talk to each other. It is a place for realizing that we need a common ground on which to build an audience, and an understanding. In short, we need transdisciplinary research. Transdisciplinarity resolves the problem by establishing the commonality in "unconnected or partially interacting disciplines,"

From: 2005. Hunsinger, Jeremy. "Towards a Transdisciplinary Understanding of Internet Research". Information Society. 21(4) (Briggs, 1977, p. 2211). The transdisciplinarity can create the topic of study; it can realize its objects and the continuance because it develops the axioms, understandings, and discourses that construct relevancy both inside and outside of academia.

With this short introduction to transdisciplinarity, it is my hope that I have introduced a real possibility for the future of Internet research. I have introduced several issues that transdisciplinarity helps to solve. But we need to be circumspect as researchers so that our research reaches beyond our disciplinary and interdisciplinary communities to the broad audience that our research addresses, including those that are determining the nature of the Internet and its future. We can with effort recontextualize our research and pursue transdisciplinary research in order to allow the broader audience to better understand the complex, global, and ever-changing nature of the Internet as a whole and as such continue doing the work we enjoy for years to come.

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IV. The Political Economy of the Internet: Contesting Capitalism, the Spirit of Informationalism, and Virtual Learning Environments

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In Neal Stephenson's *Diamond Age* the world is transformed by a series of events surrounding the creation of a virtual learning environment in the form of a book, *The Young Lady's Illustrated Primer*. It is a story of power, liberation, social division, and transformation. It is a fable of information technology and virtual learning environments in which the dustpan world of Stephenson's novel is overcome. The social structures that create the virtual learning environment are transformed by its creation, creating a population that were critically aware of their situation and what they can do to change it. Similarly, virtual learning environments are transforming learning and thus transforming the world and our understanding of it. Inherently these environments, like all technological environments, contain systemic, ideological biases, and assumptions. We need to be critically aware of these environments, their biases and assumptions and the world that creates, endorses, and in the end supports them, so that we have the ability to understand our responsibilities toward not merely their usage, but their creation, and what is built into them, the biases, values, and ideological positions.

For virtual learning, it is clear that human interests and social structures are

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politicized and embedded in the relationships of power found in the era of informational capitalism. The power is merely embedded not only in the social world, but also in our technics, our institutions, and our ecology. Informational capitalism has transformed the world and made it a more interesting and problematic place to live. In its moment, informational capitalism has transformed the landscape of education, brought about the advent of the virtual learning environments, a new contestation surfaces involving the manifold roles of information and knowledge, their centralization and distribution through society. In attempting to come to grips with these issues for virtual learning environments, I confront the spirit of informationalism as conceived by Manuel Castells. I question the explicit ideas for it in the context of online education as network enterprises.

"The spirit of informationalism" is the culture of "creative destruction" accelerated to the speed of the opto-electronic circuits that process its signals, Schumpeter meets Weber in the Cyberspace of the Network Enterprise". (Castells, 2000: 215)

Castells sees the recreation of the digital world through the Schumpeterian idea of creative destruction, this is a conception of innovation and labor, where an old set of institutions is destroyed and a new one is created to take its place. But I argue, the old set of institutions, the old forms, and clearly the old powers, are implicit in the new network enterprises; they are not destroyed as much as they are recreated in the informational arena. Through this continue recreation of old forms into new combined with the ongoing capitalist enterprise, there becomes new cen-

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tralizations of information, new places that hold power, and want to retain power.

Informational capitalism requires us to accept the perspective that information transforms the central systems of our economy, and with that has ripple effect to everything that depends on those systems. To understand one of those ripples, virtual learning environments, we have to understand what information is in the context of learning and learning's goal—knowledge.

1. Information and Knowledge

Our everyday life is enmeshed in information. From its physical manifestation in computer-aided design of toasters and cars to its purely digital form constituting the monetary flows of capitalism, internet broadcasted lectures, and the textual flows of email, information is ubiquitous. These digital goods constitute a significant part of our economic, social, and political milieu. "Digital goods—by which I mean things we produce, such as this book in its original form, that can be reduced to 1's and 0's—are materially different from other goods, mainly in that they are material-less and have economic lives of their own" (Mckenzie, 2003: 2). The 1s and 0s fill our everyday existence, constructing and signaling everything from traffic signals to art. These fundamental reductions seem to have lives of their own because they are informational signaling systems that control parts of our lives and occasionally interact in unexpected ways. Information's core conception is that it contains meaning. Meaning is constructed and reconstructed through interaction. Humans and machines interact with it and are left changed. That infor-

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mation can impart change is very important to it as a concept, because it explains its importance for our economy and society and as such why control of information is transforming our lives and institutions. Information causes change, and the ability to control that change is a significant power in our everyday lives. The moments of informational capitalism are inscribed in these digital goods and the implications for this are not dissimilar to the effects of prior revolutions in material culture on everyday life and as such learning.

In the context of learning, information is not synonymous with knowledge as Lively indicates, "Information is knowledge in any form" (Lively, 1996). Contrarily, one type of information is encoded knowledge, knowledge abstracted and removed from the subject and encoded into any of a myriad of forms. Other types of information may encode the values, norms, ideologies, and other meaningful abstract systems, which may be embedded in knowledge, but may also be externalized in other meaningful parts of our ecology. Knowledge though, when it is encoded, is transformed into information. The encoding process varies, and with it, the usefulness of the information it produces varies. Digitalization, for instance, transforms knowledge into zeros and ones, making it, giving it some use in digital technologies, such as computers or the internet. "Digitalization shifts human agency and structure to a register of informational bits from one of manufactured matter" (Luke, 1995). Digitalization transforms knowledge from its analogue whole to its digitalized parts, fragmenting it, and allowing less meaningful parts to

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be forgotten altogether. It creates an informational representation of the analogue, abstracted at a definable level, losing richness and completeness for the sake of control, ubiquity, and efficiency, shifting the registers of subjectivity with it. While digitalization is conceivably a manual activity, it usually requires an immense amount of human labor, machinics, and informatics to enable its functional use in society. This labor is in part of our subjectivity that we are embedding through the labor process into the digital object. Combining the embedded labor with the embedded knowledge the digital, informationalized object contains the moment of informationalization to a form of alienation of subjectivity. This alienation of subjectivity has been seen in the industrial age as a normalized function of production. However, in digitalization, the informationalized object no longer is objectified as physical artifacts, books, papers, etc., but it is informational, which entails that with the proper tools, we can make infinite copies and distribute them without cost. This mode of production and distribution transforms the value structure of the artifact transforms the value structure surrounding our subjectivity, and with that transforms the structures surrounding knowledge, devaluing and to some extent delegitimizing them (Lyotard, 1984).

Similarly to books and traditional instructional materials, information forms and requires an infrastructure. The infrastructure contains implicit and explicit biases about labor, subjectivity, and power, just like the infrastructures of material culture. The infrastructures themselves also encode norms, traditions, and modes of

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use, distribution, and production. "While design intentions can be evaded or subverted, as most hacking practices indicate, the infrastructures raised in cyberspace also begin to conventionalize how and why they are used by most of their clients (Luke, 1995). This conventionalization is normalization. As new digital tools are created, they recreate the environments that their creators use to create them, thus the cultural systems embedded in these tools are not only distributed as product by consumed by their creators.

This creates contested spaces of cultural production that parallels and constitutes the mode of production of the digital artifacts. There is a "hacker" space, that many think countervenes but in most places eventually sublimates itself into informational capitalism (Castells, 2002; Himmanen, 2001). The subversion found in hackers and their alternative mode of production, which seems to be a subaltern, is actually a substructure of the hegemony. The creative practice of coding in informational capitalism is always integrated into the larger whole.

The codification of knowledge and the architecting of its infrastructures is clearly an immense, ongoing project that is encapsulating both the past and seeks to encapsulate the future. The institutions pursuing this encapsulation and their corresponding norms and traditions surrounding information are just as important as the information itself. This might be why some metaphors and ideas carry well in the provision of information; the library, the encyclopedia, and the journal have their metaphorical relation in digital space. It might also be why builders of infor-

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mational spaces structure them similarly to their own experiences in the classroom or elsewhere. They want to pass on their traditions, real or imagined, in this digital environment. The old physical form is made new in digital form to conventionalize and normalize the way people use the information provided by technocrats and through their infotechnics.

The information itself, to be used, must be interpreted either by a human or machine. These interpreters are nodes that make the knowledge available. Once available, information tends to flow either as knowledge amongst humans or socio-technical networks like the internet to reach another node of translation. These networks are the central institutional structures of the information society, and the manifold ways that they order and structure our world is still being understood. These networks can be understood to operate on many levels, from the interpersonal network, to the global information superhighway, to the massive networks of economies, monetary exchange, and capital flows. They can be seen along the whole spectrum of analysis, from the atomic like digital subjectivity to the molar like integrated world informational capitalism (Guattari, 2000). With these networks we have interactions and interchanges, and transformations at all levels, they are always in flux, and so, along with the information they contain, must be interpreted, and must be converted into knowledge through interpretation. These networks require human and machinic capacity to operate, and in that requirement they require certain knowledges and ideas to be inculcated into future generations

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of the network and the culture surrounding it, until such a point as it becomes apparent that they do not apply and then we have a change, paradigm shift, or minor revolution (Fleck, 1981; Kuhn, 1996; Lakatos, 1980).

Castells believes the transformation from the industrial age to the information age is revolutionary. In that revolution, there is another relationship between information and knowledge that is transformed by thinking about information. "What we think, and how we think, become expressed in goods, services, material and intellectual output, be it food shelter, transportation and communication systems computers, missiles, health, education, or images" (Castells, 31). If the goods, services, and productive outputs structure the way we think then information itself structures the way we think. What we believe about information, such as "information wants to be free", structures our worldview. Our knowledge about information may be true or not, but in either case; it structures our relationship to information. If we believe the learning environment to be a marketable good in all cases, then institutions and tools will reflect that belief and with that, you have changed the premises of education and educational institutions toward a market mentality and in that transformed the future.

2. Informational Space and Informational Power

While there are many forms of power operating on many levels of analysis in informational capitalism, informational power is one of the defining forms of power within the spaces it inhabits. Lefebvre indicates this in his conclusion of *The*

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Production of Space:

Historical formations flow into worldwide space much like rivers debouching into the ocean: some spread out into a swampy delta, while others suggest the turbulence of a great estuary. Some, in democratic fashion, rely on the force of inertia to insure their survival; others look to power and violence (of strategic—and hence military and political— kind).

(Lefebvre, 1991: 417)

Power flows through and inhabits space through the social presences of human beings and the technologies they create and use in that space. Power is a subjective and universal part of human experience. It is embedded in language, and operates as much through discursive formations as through physical force. For the first time in history, the human mind is a direct productive force, not just a decisive element of the production system (Castells, 2000: 31). There is a very real aspect of all forms of power, and it can be analyzed in a variety of ways. With the recognition of information all around us, the recognition of power operating in and through information, as much as through any other interaction or artifact, becomes manifest. Much like the physical power of arms and armies, informational power is about spaces or territories, and what is allowed to pass through those spaces.

Comprehending the nature of this power perhaps can be aided by Foucault's description:

Power is not something that is acquired, seized, or shared, something that one holds on to or allows to slip away; power is exercised from innumerable points, in the interplay of non-egalitarian and mobile relations . . . Power comes from below; that is, there is no binary and all encompassing opposition between rulers and ruled at the root of pow-

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er relations, and serving as a general matrix—no such duality extending from the top down and reacting on more and more limited groups to the very depths of the social body.

(Foucault, 1978)

In short, power is not purely the dominating power of armies, but it also exists as dispersed and pastoral. It is a power of control, but it is not limited to the manipulation of base emotion, like fear based in inequities in the means of production and their control, it is habituated and constructed into the very subjectivity of the individual and populace, through the establishment of norms, traditions, and similar systems. This power governs populations as much as any other, and it is through its operations that the governance of the internet and a political economy of the internet are made possible.

The spaces of power though need not be real spaces, though real spaces have much the same characteristics. The construction of virtual spaces whether perceived or imagined also holds and sustains power:

Software and networks do more than structure and present information; they also generate and sustain spaces, or hyperreal estates, which need to be rethought and reenacted as spatial domains with their own unique properties of accessibility/inaccessibility, boundedness/unboundedness, underdevelopment/overdevelopment, security/insecurity, publicity/ privacy, openness/enclosure or commodification/collectivization for the cybersubjectivities now beginning to inhabit them in groupware, thoughtware, mediaware formations as digital beings.

(Luke, 1995)

Hyperreal, virtual spaces construct another area of informational power as Luke indicates. Functionally, they operate as real loci of power for users and cre-

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ators, like any space does. It has the power of the territory and the power of flows that occur in it. Capillary power flows through these spaces as distributed interests are pursued, contesting the very structure and presentation of the information involved. These virtual territories are places of recruitment and enclosure (Latour, 1988, 1993; Callon, 1998). The imagination of the virtual learning environment is commonly an imagination of a virtual space, like a virtual library, a virtual classroom, or a virtual lecture hall. It is the imagination of a simulation of a classroom, frequently lacking the other secondary systems supporting the existence of classrooms, and in that partial simulation it amplifies all of the structures of power that we can identify with classrooms.

Is there anything more than simulation and power in these environments? There must be because they are informational, they possess the perpetually reconstructed artifactuality of the digital artifact, which can be created and manipulated in real time according to programmers or others wishes. This is part of informational power, the power of immediate control via infotechnics. In short, these virtual territories are spaces that are controlled by infotechnics that are built by programmers and designers. This array of infotechnics and communities establishes a defensible territory, a community of knowledge, and practice that provides the productive capacity for the future development of informational spaces.

This community is at the core of any notion of informational power because its members control the means of production and reflexively structures the mode of

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production. They are sub-political in that the decisions they make are directly political, but our outside of the public sphere. "Sub-politics, then, means shaping society from below. Viewed from above, this results in the loss of implementation power, the shrinkage and minimization of politics," (Beck, 1995, 23). The state, the social apparatus as a whole, becomes less powerful because the sub-political exists within it, and transforms it. The meta-politics involved in sub-politics is where the politics of the information age plays out. It is a politics without choice, determining what will be within or outside of political decision-making depending on many variables, but driven by economic concerns. Even though many state and institutional policies exist as official political apparatus, they do not change the institutions as a whole. Information producers and users are altering the rules of virtual learning environments and transforming the very environment in which they operate. They are providing an external system, a different set form of governance, with a different form of power, a sub-political power of transformation and depoliticization, that may be liberating for certain economic interests, but even if not liberating is encapsulating to the greater population because they are the ones that learn the values, norms, and rules built into the information systems.

3. Informational Power and the Paralogics of Control

There is a question of governance and economy in the sense that people and machines control information and inversely, according to Norbert Wiener, information can control people and machines in a variety of ways (Wiener, 1965).

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Through the creation of informational goods, people create value, and then they have the choice of what to do with this valuable object, and when they make those choices, they are in fact governing the relationships surrounding this informational good. So we can think of informational power about the control or management of informational goods in a given territory. A political understanding of the contestation of informational power provides us with an understanding of the informational power as a power of control, a power of territories, a power of flows, and a power of institutions and artifacts/objects. Informational power is thus a power of space, both real and virtual, where issues of who owns, who governs, and in the end, who controls information are contested.

This definition of information power helps us to understand what is at stake in the digital world. The technical assemblage of information surrounding learning in later modernity and the power and culture constituting it already are surrounded with monumental institutions for their production and distribution. One of those institutions is a school, which is usually part of a large system of nodes and networks governing the production and distribution of education. The materiality of education stored in schools, libraries, and increasingly in virtual learning environments, clearly must contain valuable information if their management is so costly in comparison to their production.

Inherently, the architecture surrounding informational artifacts varies significantly along several spectrums. The difference between the book as it sits on a

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students' desk and the book as it exists on someone's computer for future reading on their Personal Digital Assistant is the difference between the physicalized information and information in its digital form, letters and words versus bits and bytes. From physical artifact to digital artifact is one spectrum of analysis, but there are others. Value is another significant area of analysis. When virtual learning environments become points of translation, and points of negotiation, where they become partial subjects or actants, and thus possess power, they become valuable (Latour, 1993). In that they hold value, and come to embody values, they become political spaces and spaces of governance.

These quasi-objects need not be like any artifact that we currently know (Latour, 1993). Ted Nelson for instance frequently argues that in fact these informational artifacts should not be limited by physical form or the metaphor thereof, but should be as open as the human mind allows (Nelson, 1987). However, we are burdened by familiarity and tradition, though there are processes of detraditionalization certainly removing some of our boundaries, norms, and expectations over time, leaving us with new forms for digital artifacts which will have to some extent, new ways of expressing informational value (Lash, 2002; Luke, 1989). Nelson's *Computer Lib/Dream Machines* clearly realizes the concretization of traditions and tried to break the paradigmatic structures implicit in the page and book. But as we can learn from his efforts, fighting the behemoth of traditionalized capitalist institutions may not in the end bring you to the desired result.

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It is clear that informational artifacts seemingly possess the qualities Nelson identified, it is also clear that most information systems are not built to handle empowered, fluxing, compound, actants, such as mutable hypertexts, wikis, or related interactive digital media. Those are aberrations of the normal institutions and call for new institutions to be imagined. Because of their fluxing nature, and the number of people using them at any point in time, some digital objects can take on a life of their own and be very hard to control and archive.

Most archived media reproduces media in earlier forms, media that is fixed, and closed. The reasons for this are varied, but control and encapsulation of the artifacts should not be dismissed as one of the possible motivations.

These quasi-objects take on significance in our culture whether we want them to or not because they have value (Latour, 1993). With the social construction of value, we always have the social construction of means to control its value. Overtime we develop norms, laws, rights, and similar social technologies to manage these things and their effects. Copyrights, patents, Digital Rights Management, even computer operating systems are being built to control and manage what people do with information that they may have created, transformed, or otherwise interacted with to create value. Even when people want to make their materials publicly accessible, they might face impediments based on the systems of control, which are built into our socio-political economic system. These paralogics of control: the laws, norms, and instruments are part of informational power because it is

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centered on the access and use of information, the control of information, and the limitations put upon that by a variety of institutions.

Informational power then is not unlike any other power; it involves the creation of artifacts, their transmission, and their control. It involves subjects, their construction, and their control through norms, traditions, laws, and other means. Informational power then is a social power as much as it is technical. It is not just a power based in contestation, but it is a power of enculturation, transformation, and everything that implies. This is why informational power as the control of information, its distribution, and its access is a core issue in the informational capitalism.

4. Business Models as Cultural Models for Virtual Learning

There is a tension widely described between normal, shared, cultural production and its capitalization. The tension exists between some content producers and content commodifiers (Lessig, 2001). The tension centers on the concept of ownership, and as such control of information. For our purposes, this is a question of provision, and in capitalist structures collection of payment, but provision is the central question. We have a problem because for a few hundred years there were commodities that were heavily imbued with value through their initial production, and then imbued with other values through their reproduction (Benjamin, 1985). The transformation from individual and guild craft production to industrial production changed the value structure of production. Likewise, when the costs of replication of the digital object become infinitesimally close to zero, commodity struc-

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tures change, and this changes business and culture.

The normal, communal sharing of knowledge in science and education is somewhat contrary to the privatization accompanying commodification (Merton, 1942). We can see the transformation of knowledge production and provision toward a commodification model in current events. Systems and forms of knowledge are rapidly changing, as knowledge becomes more business centered than science centered. With businesses such as Blackboard moving into teaching, Pearson's digital publishing providing digital only materials too classrooms, and the rise of for profit universities providing online content, the traditional forms of knowledge that science and human development requires are moving from the public to the private sphere. This extensive privatization and rapid transformation of education make knowledge provision an increasingly costly service, one that states and nations are slowly vacating. Instead of knowledge provision being of a shared cost between colleagues, educational institutions, teachers, and students, it is a matter of massive contracts between capitalist institutions and occasionally other forms. This service model drives further privatization of public knowledge in a strange circularity, where the privatization of knowledge encourages the further privatization of knowledge, and packages of related knowledge are sold together. By packaging private knowledge with public knowledge, the ownership of the knowledge in the public domain becomes unclear, and if they are bundled in certain ways, such as in a database in the United States, the public knowledge then becomes private knowl-

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edge. This vicious circle is happening throughout the educational enterprise, and with the market ballooning to tens of billions of dollars in the next decade, it is hard to see where it might stop.

The institutional apparatus that allows this privatization and commodification of knowledge manifests in our everyday life. They are justified in part by a claim that the production of a digital artifact within a proprietary system under license gives the proprietor some property rights toward the artifact, whether or not, it can be directly shown to be derived from their product or not. However, ownership of these tools is a key strategy for the informational world.

Productivity and competitiveness in information production are based on the generation of knowledge and information processing. Knowledge generation and technological are key tools for competing between firms, organizations of all kinds, and, ultimately countries.

(Castells, 2000: 124)

We have to be careful when, like Castells, we assign the outcomes of production and processing to the firm, organization, and country, because it need not be so. When we think about it this way though, we automatically put information, no matter what its intent, into the realm of profit and capital. This move imports significant ideological commitments about ownership and control that do not hold for all digital artifacts.

We have a choice between the open models of shared knowledge versus a closed model of owned, proprietary knowledge. However, it is not really a binary

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opposition, but a spectrum of virtue and vice. Some knowledge will be owned and some will be shared. It will become an asset not just of individuals and corporations, but also of nations and part of national security and trade policy. We see this today already with certain computers being classified as weapons in the U.S. to prevent them from being used by certain nations to decode transmissions. These instruments of control are being used as weapons against loss of "intellectual property". "This is an age in which ownership of ideas — copyright — can create international trade crises and lead publishing houses to fight the electronic revolution with all their might" (Chodorow, 2001: 5). The technologies developed to handle this will then determine the future of knowledge, if we design computers with implicit Digital Rights Management for music and movies, and people habituate themselves in their contexts, then those habits over time will likely territorialize other habits, practices, and assumptions in their everyday life.

In the end, as Lessig indicates in *The Future of Ideas*, we have choices. One choice we can make is to have a system of control that allows for all to define their own roles instead of having them being defined for us. The default choice seems to assume the current system of centralization of systems into corporations, and information provision in pursuit of economic incentives will rule the day. If we look virtual learning environments, it seems as if many of their chief promoters have made the choice similarly to Castells' spirit of informationalism. They assume the rampant progress of informational capitalism, and frame the situation in that con-

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text instead of framing it in terms such as social or public goods.

Traditionally, models based on public goods are put forth as the motivation for education, such as sharing of knowledge, providing for the education of the public, or similar social goals. While there need not be tensions between the commercial interest and the public good, in this case the tension is clear, especially if the commercial interests impedes the public good as it might if the commercial spirit of informationalism holds forth. If our knowledge is embedded within payment structures that require our schools to submit to and in the end participate fully in the realm of privatized, commoditized knowledge, then what are we teaching about public goods, and how do we legitimize the functions of government in that respect? The crisis of legitimation surrounding public goods is clear. If learners do not participate in the public sphere in schools, where will they participate in it? As our educational institutions are detraditionalized from their roots in information and knowledge as public goods, toward the privatization of knowledge, the students are learning the values of privatization, corporations, and similar interests, which certainly have private, not public interests at their core.

The forms and values that educational institutions take force real understandings of the way they work and should world onto their users, from the student, to the instructor, to the woman off the street. "Users and Doers may become the same" (Castells, 2000: 31). The development of this multiplicity and its transition into a fully fledged digital knowledge space will take on aspects of the tradi-

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tional forms as much as they will become something new. However, the traditional role of educational institutions is more significant. Like early churches, educational institutions seed a territory with specific forms of knowledge and structures of control. It is a pastoral knowledge closely related to the pastoral power of feudalistic institutions. In libraries and universities, knowledge is housed not only in books, but in the buildings, structures, traditions, and people themselves. They combine as the institutions to provide a portal to the forms of knowledge that has become their role to provide such as books, newspapers, movies, and music, and in that are a place of power.

They are not merely local nodes in the network of information though. They are global networks and the nodes are global too, though they are local to some users. Chodorow states "Librarians and collections are now serving an increasingly global public and serving it globally" (Chodorow, 2001: 11). This is clearly true for libraries and educational institutions, but the global public that they serve should not be mistaken for a utopian universalization of access to education and information. In becoming networked enterprises, these institutions take the dispositions that information and its owner's put on access and use. They cannot give access to information without overcoming social, economic, and technological barriers embedded in information technology. This means that the traditional public institutions may no longer serve for the public at large, but will only serve in formational public, which implicitly has a different demographic than the universal

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public, much as the televisual public is a different demographic than newspaper reading publics (Baudrillard, 1983).

Different publics consume and thus require different information, and that perpetuates the differentiation of the public into individual consumers and the eventual collapse of the public sphere. In a recent issue of *Educause Review*, Cass Sunstein warns higher education of the problems of the individualized market in higher education (Sunstein, 2002). The argument, which parallels one in his book *Republic.com*, is that one of the aspects of learning in our current environment is the exposure to and tolerance of the ideas of others. He sees this tolerance and the trust of the good of plural views collapsing under the weight of individualized filters and the ignorance of others. This collapse of the public into not merely publics and counterpublics, but to a non-public is one of the risks of moving from the universal public with a unified public sphere. The death of the public sphere and the collapse of the social are not new theoretical constructs. They are historically issues involved with the growth of a legitimation crisis in late capitalism (Habermas, 1975). This legitimation crisis is tied intrinsically to educational institutions as public goods and the rise of the information society according to Lyotard (1984). Between Sunstein, Habermas, and Lyotard, there is reason to view that as the publics collapse and are transformed, there are spaces of power where informational institutions are aiding in the devolvement of the universal public into the informational, filtered, individual consumer. This structural change transforms the cul-

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tural models of information that business models use and lessens the resistance toward the commoditization of public goods.

The idea that educational institutions will benefit from the new efficiencies of virtual learning is clear in the public rhetoric, but we have to wonder about how the system will end up and who will benefit from that and why. In fact, if we look at the transition to the informational mode of production that will be required, we quickly see there are other issues at stake. When we move from industrial production to informational production, the infrastructure required is different. No longer do you need factories, presses, and large institutions maintaining them. "The production of services and other informational commodities (legal contracts, product promotions, movie showings, scientific papers, etc.), however, can be conducted almost entirely on the Net through shareware packages or on-line services" (Luke, 1995). The one benefit of the fordist, factory-based production had was that it provided for a new arena for collectivity, for people to work together in a common goal, and learn to be effective in organizing themselves toward that goal, which then translates into political effects that sought new power for the workers and producers of these objects, both the creative class, technocrats, and the capitalists.

But the diverse interests of these competing classes and their technocratic constructs have implications for society much like fordism transformed and unified subjects into classes, post-fordism, and late capitalism, ruled by technocratic

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producers and systems breaks the collectivities and transforms the public sphere,

which traditionally contains the learning environments as Beck indicates:

Technocracy ends with the alternatives which break open the technoeconomic process and polarize it. These alternatives become fundamental and detailed, professional and profitable, found careers, open markets and perhaps even global markets. They divide up the power bloc of the economy in this way and thereby make possible and enforce new conflicts and constellations between and inside the institutions, parties, interest groups and public spheres of all types, and as far and as soon as this occurs, the image of the indifferent self-referentiality of social system shatters. (Beck, 1995: 48)

As the economy is divided and transformed by information, the new constellations of technocrats in institutions gain power, and subvert some of the institutions interests to their own, and with that the imagination, the norms, and traditions embodied in that institution loses the self-referential possibility of identity and the collectivity and its politics fails. Likewise, with online education and distributed, online production, you no longer require the physical location, the factory or its functional equivalent, that produces this politicized collectivity.

In fact, informationalized production deterritorializes production, distributing power, and control across many individuals and institutions that do not seem to have the same political effect. This is paralleled in the decentralization of users, and their individualization in education that Sunstein describes as possible in virtual learning environments. Unlike most educational institutions, where you might meet, socialize, and coproduce knowledge and power, virtual learning environments like Blackboard have few communal facilities that allow the normal interac-

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tion of the anonymous and social public. They focus on the user and the service, this transforms the potentialities of production from communal and shared to one of limited potentialities where one person and one screen with their own digitized experience, individualized and customized to limit. With digital rights management regimes in place, these functions will be reterritorialized and recentralized, to be controlled by different interests.

It can be imagined to be otherwise of course.

In the fluid world of the electron, the body of scholarship in a field may become a continuous stream, the later work modifying the older, and all of it available to the reader in a single database or a series of linked databases. In such a world, scholarship would progress in a perennial electronic conference or bulletin board. Contributions and debates would occur on the Internet and be continuous. The browser would become the catalog to the collection of knowledge. (Chodorow, 2001: 7)

Chodorow envisions an information intensive interactive communal system, perhaps one like Wikipedia. However, wikipedia is a communal, open project and not a closed learning environment. It is an encyclopedia of sorts as claimed by its presentation at wikipedia.org (Wikipedia.org, 2004). But it is still distributed, and in some ways heavily contested instead of a collective domain. It is an encyclopedia of negotiated knowledge, not of universal agreement, and is still mediated through the internet, its controls, and interfaces. Similarly, the social constructivist, open source learning system developed at Curtin University of Technology called Moodle might be a point of resistance against the corporatization of education and

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the privatization of knowledge found in informational capitalism. However, both Moodle and Wikipedia are late arrivals to informational capitalism, and both are facing increasing problems with the capital requirements of information provision, such as funding of bandwidth, providing easy access, and openness in the face of the barrage of the normalized culture of commodification.

The processes involved in virtual learning are always involved in the creation and distribution of informational power, the control over information, in all its dimensions. The strategies and tools available to them are the ones that are built into the institutions in which they exist, such as ownership, rights management, software production, etc. These tools and strategies are being vested into knowledge spaces in a variety of ways, and are producing systems that have significantly different social effects than their predecessors and namesakes.

5. Conclusions

Manuel Castells in *The Rise of the Network Society* argues that there is a spirit of informationalism that provides an ethical foundation of the network enterprise (Castells, 2000: 214). This parallels Weber's argument in *The Protestant Ethic and the Spirit of Capitalism*, in which the normative framework of Protestant Christianity is put forth as the core driving force and the ethical justification of capitalism and capital accumulation.

Inarguably, Castells is talking about a business network, but the education is more and more becoming a form of networked enterprise, and more often than not

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is a business venture of itself in these the days of academic capitalism. "These business networks that form the new network enterprise are built on technological tools and attempt to compete globally and resist to some extent the idea of the state," (Castells, 2000: 212). They are very much transnational institutions or if not stand a high likelihood of becoming one. But they are the same sort of institutions we find in our everyday lives, the old forms, and the old powers, are inherent in the Castells network enterprises; they are not destroyed as much as they are recreated in the informational arena.

We should not forget that these transnational institutions are technologically enabled. This is what allows them to reach their audiences and investors equally well and convince them of their relative merit in comparison the wide array of competing services. This as Castells notes, is part of their historical development, they arose with these tools and moved into the informational arena by strategically implementing information services within their organizations. These arose in specific historical context though.

The informational, global, economy is organized around command and control centers able to coordinate, innovate, and manage the intertwined activities of networks of firms. Advanced services, including finance, insurance, real estate, consulting, legal services, advertising, design, marketing, public relations, security, information gathering, and management of information systems, but also R&D and scientific innovation, are at the core of economic processes, be it manufacturing, agriculture, energy, or services of different kinds. They can all be reduced to knowledge generation and information flows. Thus, advanced telecommunication systems could make possible their scattered location around the globe. (Castells, 2002: 410)

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The context is the firm and the service sector business for Castells that is the locus of the information network and control. However, as we have seen, it need not be so. The publicly funded school provides a counter example, a public good, that while like a firm was occasionally provided for by states, and non-business groups. As a category for reference and ground for traditional expectations, educational culture provides an alternative to the grounding of the spirit of informationalism, while always being immersed in its contexts.

Information systems are scattered in one context, the geographic, but concentrated in another, the informational. Relatedly informational power is concentrated where information combines with institutions, both new and old. This concentration is aided by the social development of new technologies strategically supporting the goals of the social groups that consume them. The combinations of possible institutions and information technology are nearly endless. It is clear that many groups strategically seek some goal in relation to informational power, either concentration or diffusion of it. Many things will happen, some people will win, and some people will lose. Will our world be like Stephenson's socially fragmented, informational dystopia, or will there be a revolution or a point of balance where we can balance the tendencies of informational capitalism with the provision of public goods such education and knowledge? Depending on what happens in the near future, either the spirit of informationalism will align with Castells' conception or not, and this has implications for the future of virtual learning

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V. Broadening Possibilities by Expanding the Theoretical Richness of the Social Construction of Technology

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1. Abstract

There is a possibility to expand the theoretical understandings behind the social construction of technology (SCOT). By reconfiguring the processes of modelization involved in SCOT, meta-modelization will admit the subpolitics involved in SCOT and expand the cosmopolitical and ecological awareness involved in our model-making activities. This essay contests the politics of SCOT in order to increase its theoretical richness and acceptability to broader audiences.

Keywords: Social Construction of Technology (SCOT); Poststructuralism; subpolitics; cosmopolitics

Paradigmatically Social Construction of Technology (SCOT) is useful for modeling technology and society. It models and describes the society–technology relationship and as such provides explanations for how certain technologies develop. Technology, as a set of social and artifactual practices, rarely ends with the systemic relationships usually described in SCOT. The socially constructed technological system is constantly in flux, changing the relationships, and transforming itself and its ecology until it can hardly be captured in analysis. In a socially constructed technological reality, these transformations have far broader implications than the technology itself. They can and do change the lifeworld itself and as such change the platform in which the analysis occurs.

The canonical example of the bicycle shows the SCOT analysis modeling

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the paths toward the closure of a problem and stabilization of the artifact, a model extended from the Empirical Program of Relativism, where the idea is less focused on a stable point than on how science arrives at a point of consensus (Pinch and Bijker 1987). In the bicycle example, the authors describe the progress of bicycle technology toward a single design, resolving several problems represented by fixed groups with interpretable interests. Whether as a whole the bicycle ever was a unified design is still an open question, even today there still are significant variations in bicycle design and the parties interested in its development are manifold, fluid, and contentious. As the design arose from the interests of various social groups, we might also consider whether those groups comprised a more complex, fluid, and mutable population with changing interests, or whether they were more fixed as they seem to be in abstracted model. While concretizing and simplifying these abstracted social interests and social relations into fixed relations may have benefits on one level in SCOT, such as ease of description, and construction of neutrality. But the simplification covers, and perhaps hides, the very complex and fluid social realities that always exist. This sort of problem has been plaguing social construction since its inception (Bijker et al. 1987). Fundamentally, it seems to be a problem involved with a lack of data or the need for simplification of that data, but it is also a problem involving the richness of understanding and of representing the case in the world.

In noting the possible complexity and flux in the bicycle example, I attempt-

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ed to question how the concrete, systemic relationships that the understandings of the social construction of technology provide are not necessarily the complete picture. One reason for this eclipse of totality is that these fixed understandings can miss the boundaries and constraints of social construction and more specifically how the conceptualization of these models and their constraints reflexively construct people's subjectivities, not only in relation to the technologies, but in relation to the rest of their conceptual system. Time and space are transformed by speed, but not only speed in the technical sense, but also in terms of the conceptual sense, which brings in new issues of immediacy transforming amongst other things our various responses related to fun and harm (Virilio 1986, 1995). This transformation is a transformation of our experience of our mental, social, and environmental ecologies (Guattari 2001). It indeterministically transforms our relationship to the everyday world by our interaction with technology itself, the models we map onto it, and theories we have about it. When we understand the importance of speed, not merely as an implication of techniques, but as part of our subjective world, we can see it less as an independently measured variable that can be fixed in time and space, then as a relative system requiring movement, not of just of things, but of norms, constraints, gravity and gravitas (Virilio 1986; Deleuze and Guattari 1987). This transformative positionality becomes embodied and enculturated, it is practiced and through that practice becomes reflexive, which gives us, as theoretically informed researchers, an understanding of what is eclipsed when we practice

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the social construction of technology.

Theoretically informed research based in the social construction of technology can account for those ecological changes more effectively by being reflexive. Through the reflexive application of its theories, SCOT may begin to clarify and transgress its norms and boundaries. Through reflexive transgression, it is possible to see the axiomization of SCOT structures and limits of the theory and practice of research. It is from that theoretical stance, that I propose the enrichment of SCOTs models. With a richer set of models, we can then begin account for the fluid, complex world that SCOTs conceptualizations concretize and SCOTs abstractions model. Perhaps this expansion of the theoretical richness of SCOT may provide further insights into some of its foundational principles.

Below I will introduce two theoretical tools that might be fruitful areas to incorporate into SCOT, by expanding its understanding of itself and its norms, boundaries, and concepts. The first is the "risky" analysis of Isabelle Stengers work in science studies (Stengers 1997). She identifies a specific form of risk-based politics that operates in science. A politics centered on the willingness to break norms and recreates worldviews, making and breaking more than the scientist's reputation, but also the system of theory in which he or she works. This analysis can be used to surface the sub-politics of SCOT, which are seemingly centered in the depoliticized, yet contested axioms, norms and limits of SCOT that structure people's actions and force limited choices or limited perspectives in their research and

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thinking (Beck et al. 1995). By realizing these subpolitics are always present, we can create a critical space that will allow us to play with and contest those norms bringing in new ontological, ethical and aesthetic concerns, and foster innovative transdisciplinary approaches as exemplified in Stengers' work. The importance of these concerns becomes clear when we start to question the normative, political, or aesthetic purpose axioms of SCOT, such as the principle of neutrality serves. If you only ask, "what scientific purpose it serves?", then you are not seeing the principles sub-political nature, and certainly won't be able to understand the cosmopolitical questions central to "risky" analysis, and must accept it as a face-value axiom grounded by sciences heavily traditionalized relation to aesthetics, politics, ethics, and religion (Stengers 1997; Latour 1999). Without understanding its subpolitics, or cosmopolitics, we are prevented from being truly reflexive, because we cannot grasp our positionalities in relation to our theory or its "object" and we will not be unable to adapt the social construction of technology to the increasing complexities and fluxing systems of our world, where these normative, political, aesthetic, and ontological ideas are becoming contestable as part of our everyday ecologies.

The second possibility is to invite more work at the meta-systemic level, as exemplified in the late work of Felix Guattari (Guattari, 1995, 2001; Genosko 2002). Guattari attempts to provide a system of meta-modelization. Meta-modelization is capable of handling the issues involved in global technological regimes

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by introducing a complicated set of changing ontological categories that can be accounted for in our research. Meta-modelization is a meta-methodology, in that it attempts to "map theoretically and empirically the transitions, transformations, and effects of complex objects, which because they constantly undergo changes based on imbalances between their elements, must be capable of modification in their turn" (Genosko 2002, p. 27). Being able to map our theory between and amongst changing understandings of its objects has value, it makes us able to think clearly about the social and technological changes that occur before, during, and after our research occurs. Meta-modelization gives us a platform for analysis that is consistent with change but does not fix society and technology purely into static and temporal frames or purely into objective and subjective frames. Guattari provides other frames, his four functors in his meta-model operate as containers for anti-essentialized categories, where the definitive structures of his frames map across the changing aesthetic, ontological, and political landscapes. However, meta-modelization also provides a new space for creativity and critique, a new way of "mapping" our interests and concerns onto the world, and a new way of creating new maps for this. If we can think of the social construction of technology as a set of theories, and these theories have models and axioms, then meta-modelization gives us one place to reconsider them, and to build relationships amongst these theories, their models, and their axioms. Meta-modelization requires an ecological perspective on the systems of society and technology. It generates insights into understanding not

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just SCOT and its evidence, but also the effects of SCOT as an operational theory in our mental and social ecology (Guattari 2001). This could provide the basis for a richer, more coherent, and rigorous model for SCOT to build upon, and with that, we could explain our ideas to a broader, transdisciplinary audience.

To summarize, my argument is for a more theoretically rich, extensive, ecological consideration of social construction of technology, moving away from less complicated models into ones that admit more emphasis on the changes in the world that surrounds humanity's relationships to technology. While I have provided a few possible directions to go, they are not the only possible directions, and there are many ways of combining ontological, political, aesthetic, and ethical categories into the social construction of technology.

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VI. Toward Nomadological Cyberinfrastructures

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1. Abstract:

This chapter critically analyzes the cyberinfrastructure and e-science policy discourse in the knowledge society. As a work in critical infrastructure studies, I argue that the tendency of cyberinfrastructure and e-science to reify certain misunderstandings of science and knowledge as social and cultural processes misaligns the policy outputs with the policy practices. From this understanding, I argue that we need to consider the development of a nomadological cyberinfrastructure.

Keywords: Discourse, Critical Policy Analysis, Cyberinfrastructure, E-science

2. Introduction

E-science and its seemingly required cyberinfrastructure appeared as centralizing concepts of policy discourse and eventually became part of policy goals in the late 1990's and early 2000's. These new infrastructures will be the basis for the internet for years to come. U.S. science policy has emphasized the term 'cyberinfrastructure' and recentered significant funding around it with the development of the Office of Cyberinfrastructure in the United States' National Science Foundation and the addition of cyberinfrastructure to the European Union's Seventh Framework Programme. This recentering of policy in relation to a new terminological construction, created new possibilities for transforming our information infrastructure and thus our developing knowledge society. Our cyberinfrastructure is the in-

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frastructure of our future knowledge society, as well as the infrastructure of e-
science.

However, our cyberinfrastructure policies are an infrastructural blackbox, much like the telecommunications policy was in the 1990 (Mansell, 1990). A blackbox is a metaphor which means to create borders that limit the interpretation of what goes on internally. That is to say, data and information enter one side of the blackbox, and on the other side of the blackbox we receive the outputs of the internal mechanisms. Cyberinfrastructure policies blackbox an immense amount of intellectual territory replete with ideologies, including areas of collaboration, areas of data mining, areas of archiving, and areas of the advancement of knowledge. In keeping the operations of these areas underdefined and underdetermined, the policies keep them out of view until practices are normalized and conventionalized. Thus, these policies aid to reconfigure scientific communities that use these cyberinfrastructures to develop norms, conventions, and principles that will then reconfigure the next generation of information systems along ideologically influenced trajectories.

In this paper, I want to resist the tendency found in the policy documents of cyberinfrastructure and e-science policy's discursive positionality that objectifies science and its projects as products and outcomes. This objectification transforms science, its communities, and its outcomes into something that is more efficient, more informational, more controlled, and less human. Science in the end is a com-

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munity and communicational process of ordering the world that occurs through the negotiations of humans, their epistemic communities, and the technics they develop to interrogate their worlds in order to map them. Science is not a product. Scientists are not the factory workers or data processors of the new knowledge society.(Chompalov et al., 2002). Science is a social process, much like all knowledge production. Science is not a thing or an object as it often described in popular discourse, as much as it is a multiplicity that is perpetually coming to be (Deleuze, 1995).

Science policy, of which cyberinfrastructure policy is a part, similarly is a combination of concepts and practices melded and operating as an entangled whole in popular and other policy discourse. With sufficient investigation, elements of the processes of science may be disentangled and presented in simplified relations within the science policy. Yet the extraction and simplification of the elements from science discourse into science policy discourse rarely does justice to the science as practiced by the myriad of scientists.

As a multiplicity, our understanding of science parallels our understanding of the state in that it is the combination of many bodies and subjectivities coming to be over time. In that unification of bodies distributed across temporal and spatial relations, science is a communicational process of capital accumulation and thus the production of subjectivities. The multiplicities of science and the state as communicative systems are intertwined through capital, but the two have no precursors

From: 2009. Hunsinger, Jeremy. Toward nomadological cyberinfrastructures. in Handbook of Internet Research. Edited by Jeremy Hunsinger, Lisbeth Klastrup, and Matthew Allen. Springer in each other (Deleuze & Guattari, 1988). Science does not come from the state, nor does the state derive from science, both are human processes related to our faculties that are tied implicitly to our ecological field's permanent history(DeLanda, 2000). Science and the state never began and they'll never end—their origin stories are fictive and inseparable from their rhetorics. Yet we continually rewrite their histories in relation to each other over time and space and through policy discourses. Currently, both sets of histories are inscribed through reference to other ideological multiplicities that play parts in all conceptualizations of modernity: informationalism and capitalism.

By mapping cyberinfrastructure and e-science policies as locations of a relational re-construction of their relations to capitalism and informationalism, we can uncover trajectories hidden within the blackbox and through that learn more about the creation of the new sets of multiplicities and subjectivities that are developing. In opening this blackbox, I hope to contribute to a new possibility or minimally a renewed reflexivity for cyberinfrastructure policy and hopefully e-science, one that allows for the resistances and mobilities necessary for the creativity and communication central to science(Hunsinger, 2005).

3. Discursive tensions and constructions in cyberinfrastructure policy

Tracing the conceptual tensions of cyberinfrastructure through a series of exemplar definitions will allow us to more fully understand its discursive relations -- as discursive relations are inherently social and thus political -- it is important to

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tease out the meanings and connections where we can; given that we are working in a discursive arena where entangled meanings are plural. The tracings of concepts keys us into their deeper implications and indications of the concept's history.

Concepts have a history, which may include their history as components of other concepts and their relations to particular problems. Concepts are always created in relations to specific problems: 'A concept lacks meaning to the extent that it is not connected to other concepts and is not linked to a problem that it resolves or helps to resolve' (Deleuze and Guattari: 79). The history of concepts therefore includes the variations they undergo in their migrations from one problem to another. (Patton, 2000: 13)

Conceptually, cyberinfrastructure has already begun its migrations across the fields of policy. Cyberinfrastructure, while not essentially contested, does vary conceptually (Gallie, 1956; Connolly, 1993). Cyberinfrastructure as a term, like e-science, does have a particular history and a component structure. The problem that the creation of the term is meant to solve is one of making clear the constructions of the necessities for statist policy to create a parallel meaning between physical infrastructures such as roads or sewage treatment plants and information technologies in order to legitimize the continued and extensive state investment. Cyberinfrastructure through this discursive parallel makes a claim to be something that is necessary and necessarily in that it exists less than in the form that it will become. Existence as such is more important than the structuring forms that it will take (Bourdieu, 2005).

Policy discourse is situated in national environments, and cyberinfrastructure policy is similar. It is primarily found in United States science and technology poli-

From: 2009. Hunsinger, Jeremy. Toward nomadological cyberinfrastructures. in Handbook of Internet Research. Edited by Jeremy Hunsinger, Lisbeth Klastrup, and Matthew Allen. Springer cy. This situatedness of the policy allows for somewhat invariate representations of the concepts through the primary policy documents. The majority of research on cyberinfrastructure defines it in relation to the Atkin's report, also known as "Revolutionizing Science and Engineering Through Cyberinfrastructure". The conceptualization provided on the base level is:

The newer term cyberinfrastructure refers to infrastructure based upon distributed computer, information and communication technology. If infrastructure is required for an industrial economy, then we could say that cyberinfrastructure is required for a knowledge economy.

(Atkins and Et. al., 2003: 84)

From this description, cyberinfrastructure is required for the knowledge economy, much as infrastructure: roads, sewers, canals, water supply are required for the industrial economy. These systems that became infrastructures developed their necessity after their existence. Cyberinfrastructure claims it will become a necessity once it exists. What kind of infrastructure is this? Dooley, et. al. describes it as a set of technology resources:

The term cyberinfrastructure, coined by an "NSF Blue Ribbon Panel", refers to software and hardware which enable scientists to exploit cutting edge technology resources, including compute and data servers, visualization devices, instruments and networks, for advancing research in science and engineering.

(Dooley et al., 2006: 195)

These are resources that can be used and reused, much like water lines and electrical grids, but centered on enabling scientists to do advanced research in science and engineering. To get more specific than that we can turn to Finholt, who describes parts of the actual networks and systems in specific as

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Cyberinfrastructure can be thought of as the combined environment formed from high bandwidth networks (e.g., Internet2's Abilene network in the U.S.), high performance computing (e.g., the distributed teraflop computer project), and open-source and standards-based "middleware" (e.g., the computational Grid, as realized through the Globus security, resource discovery, and data transport toolkits – for details see www.globus.org). (Finholt, 2003: 17)

The specificity of cyberinfrastructure policy in practice becomes, as we can observe, a policy of infotechnics (the technics of informationalization) and their development. Globus makes the middleware toolkits and shares them and these toolkits when run on Abilene or other research networks become cyberinfrastructure. This does not seem to be extraordinarily innovative or conducive to science as process. Contrarily, it seems to be about developing the current informational infrastructure for science until it possesses immense capacities, such as petascale computing.

The embeddedness of cyberinfrastructure within the knowledge economy is obvious. What is not clear is what the knowledge economy actually entails about what knowledge is. One of the problems with the knowledge economy is that it assumes that knowledge becomes a product of the economy (Unesco, 2005: 47). While there is a long tradition of seeing knowledge as a product, as an end, as a goal to be attained, those who actually pursue knowledge know that this product is never attained, and worse once a level of knowledge is gained, it must be actively maintained or it will quickly fade (Ricoeur, 2004; Augé, 2004). The product model

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of knowledge then is a fiction within the discourses of capital, and more recently a fiction within the discourses of information.

The way that we imagine and portray knowledge within our discourses needs to consider the way that a human comes to be knowledgeable. The interactions amongst people and with the world that we experience and learn from are what generate our knowledges. The way that we describe that knowledge is extremely important for the knowledge economy, to understand pure knowledge, that which exists in our brain, as someone else's property is to enter into a new axiomization of the human mind, one that looks disturbingly non-human. When we frame knowledge as a product, it becomes what it principally cannot be, which is property. Knowledge, once framed as an object, can be commoditized, but we cannot own it, just as we cannot own the contents of anyone else's mind. We might make claims against the other persons mind, but we cannot determine the disposition or contents of that mind. Knowledge in the knowledge economy has to then be about the flow of knowledge, the expression of knowledge, and the commoditization of expressed knowledge.

In parallel to Dooley, Et. Al, Atkins, Et. Al. describes the technologies of cyberinfrastructure. "The base technologies underlying cyberinfrastructure are the integrated electro-optical components of computation, storage, and communication that continue to advance in raw capacity at exponential rates," (Atkins and Et. Al., 2003:5). He describes these technologies as exponential accelerants of the knowl-

From: 2009. Hunsinger, Jeremy. Toward nomadological cyberinfrastructures. in Handbook of Internet Research. Edited by Jeremy Hunsinger, Lisbeth Klastrup, and Matthew Allen. Springer edge economy. However, knowledge, unlike information, is a human capacity.

Human capacities take time and communication to develop. Capacities take time to realize the reality of the beliefs at hand and their relations to the ecologies in which we exist. It takes time to understand and interpret the data that we have. Indeed, most of the data that we have from science will likely never be interpreted (Bowler, 2005). The 'raw materials' of empirical evidence for knowledge creation will, as such, stay raw, much like the huge databases of consumer information, physics simulation, and other data fields stay raw for years until people actually interpret and understand the relationships in the data. Faster, in terms of knowledge, is not better or more efficient. Faster only means that there is more production information. Cyberinfrastructure policy is not producing knowledge as much as it re/produces itself and produces raw information. The overproduction of information generally slows the production of knowledge because information overload limits the human capacity for interpretation. This is starting to sound very much like the issues of infrastructural production in the early industrial age, where humans were the limiting factor in what could be produced with their manual labor, now we will limit what can be produced because of our mental labor. Labor is, in the end, what determines the output of production, though infrastructure can have effects that multiply labor immensely.

Cyberinfrastructure proposes to build the technics to cope with its own overproduction of information. However, information is not knowledge and making

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the transition from one to another is no small feat for humankind. For Atkins, cyberinfrastructure has a second purpose, it performs the boundary work between technical systems and scientific cultures. Cyberinfrastructure is the "enabling layer" between scientific technics and scientific practice.

Above the cyberinfrastructure layer are software programs, services, instruments, data, information, knowledge, and social practices applicable to specific projects, disciplines, and communities of practice. Between these two layers is the cyberinfrastructure layer of enabling hardware, algorithms, software, communications, institutions, and personnel. This layer should provide an effective and efficient platform for the empowerment of specific communities of researchers to innovate and eventually revolutionize what they do, how they do it, and who participates. (Atkins and Et. al., 2003: 5)

Throughout the report, the values of science as process and knowledge as process are overwritten with the values of capitalism, science as production, knowledge as object. The boundary work of cyberinfrastructure is supposed to be "effective and efficient" at "empowerment of specific communities of researchers." The reality is that what the report actually suggest is that in parallel to the technics of boundaries, we need to set up a new laborer that develops the systems that perform the boundary work. These new professionals will likely not be either technicians nor scientists, but a hybrid. This practice of cross-training and para-professionalization of scientific practices is usually part of the apprenticeship to scientific careers, but as science gets inscribed with informatic and communicational practices, the pressures of expertise sharpen the divide to create the new forms of workers that are envisaged. This hybrid technician will almost certainly become part of the service economy of science, much as lab technicians in medical labs have be-

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come part of the service industry to medicine. Cyberinfrastructure, by creating a new class of worker, is creating a new form of service science to work with the new form of infrastructure.

The Atkins report indicates that there will be more participation in science through cyberinfrastructure. Cyberinfrastructure, while definably a great project for the knowledge society tends to understand itself in relation to objects instead of in relation to society. It admits the discourses of society into its world and portrays them through capitalistic understandings of the world. There is a tension between the conception of knowledge and science as processual, constructive, creative acts of minds and bodies and science and knowledge as objectified product in the world of consumptions. This tension is fundamentally about the way capitalism constructs the relations of ontology and epistemology in the world. In particular, modern capitalism, and its derivations in postmodernity, attempt to rewrite process as object, this is one of the axioms of capitalism (Patton, 2000). Capitalism recodes all other social and human functions as capitalist functions.

4. Royalizing science: Controlling science through cyberinfrastructure in the knowledge society

The knowledge society as realized through informationalism and capitalism is transforming the sciences by requiring new skills, creating new classes of scientific workers, and providing new ways to monitor, control, and modulate the processes of science. Part of this transformation is the new formation of the state in the age of information, as alluded to above. The state is becoming information-

From: 2009. Hunsinger, Jeremy. Toward nomadological cyberinfrastructures. in Handbook of Internet Research. Edited by Jeremy Hunsinger, Lisbeth Klastrup, and Matthew Allen. Springer al, and humans are moving through modulations in relation to the codes they possess (Deleuze, 1990: 178-179, 1992). The transformation from a disciplinary society of confinement and encapsulation, to a control of movement and constant modulation transforms with it the technics of biopolitics and policy. Cyberinfrastructure policy is part of a new control system for science. The policy, while allowing distributed interaction of scientists, data, and systems to manipulate that data actually centralizes and brings new forms of control to scientific practices by creating new powers that can mediate their actions and interactions.

Science for Deleuze and Guattari falls into a spectrum of conceptualization from royal science to nomad science. While both nomad science and royal science exist within the state, the only science which is usually supported by the state through its institutional support such as policy and capital is the royal form. The two different forms of science differ in their fundamental approach to the world as Deleuze and Guattari note:

What we have, rather, are two formally different conceptions of science, and, ontologically, a single field of interaction in which royal science continually appropriates the contents of vague or nomad science while nomad science continually cuts the contents of royal science loose. (Deleuze and Guattari, 1988: 367)

The two forms of science stand in complementary relationship, each feeding the other with new knowledges and innovations. This relationship could be thought of to be the core and periphery of sciences, where royal science is the core. That reading would be typical in the sociology of science, but it would not be the

From: 2009. Hunsinger, Jeremy. Toward nomadological cyberinfrastructures. in Handbook of Internet Research. Edited by Jeremy Hunsinger, Lisbeth Klastrup, and Matthew Allen. Springer reading intended. The two systems are intertwined in a way where the core and periphery as social structure makes little sense. Instead, we should think of the institutions that privilege the knowledge of each form. Royal science, objectifying and measuring, is the preferred science of the state where it is viewed as definitive, meticulous and usually true or at least truth seeking. It is the science of knowing what is there, what exists, and knowing it completely. Nomad science though is the science of what is becoming, what will be, what is being created. Nomad science is the creative and innovative side of science, the science that moves beyond mapping, measuring, discovering, and labeling the truths of the world toward innovation of those requisite truths and developing/discovering new and alternative truths.

The construction of truths that the two sides of science deal with are fundamentally different. Nomad science constructs truth from movement, whereas royal science constructs truth from placement. For nomad science, the truth is that the subject is becoming something, for royal science, the subject is something. Cyberinfrastructure and its policy are slowly migrating from a dispersed, nomadic science to its more royal version and in that transition, as we can see with the discussion of the new class of technicians, above, certain promotions and demotions occur:

Whenever this primacy is taken for granted, nomad science is portrayed as a prescientific or parascientific or subscientific agency. And most important, it becomes impossible to understand the relations between science and technology, science and practices, because nomad science is not simple technology or practice, but a scientific field in

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which the problem of these relations is brought out and resolved in an entirely different way that from the point of view of royal science.(Deleuze and Guattari, 1988: 367)

The diminution of nomad science is clear when we talk about the nature of science in the field or applied science, in applying science, nomad science attempts to solve real problems in the world instead of mapping the world as it is. To do that, it must reach out of its institutions, joining the communities and their local understandings to construct and understand the problem that they need to resolve. It is not just applied science, the very way that you engage and model the world in nomad science is different when compared to royal science:

It is instructive to contrast two models of science, after the manner of Plato in the Timmaeus. One could be called *Compars* and the other *Dispars*. The compars is the legal or legalist model employed by royal science. The search for laws consists in extracting constants, even if those constants are only relations between variables(equations). An invariable form for variables, a variable matter of the invariant: such is the foundation of the hylomorphic schema. But for the dispars as an element of nomad science the relevant distinction is material-forces rather than matter-form. here, it is not exactly a question of extracting constants from variables but of placing themselves in a state of continuous variation. If there are still equations, they are adequations, inequations, differential equations irreducible to the algebraic form and inseparable form a sensible intuition of variation. (Deleuze and Guattari, 1988: 369)

So for nomad science, as compared to royal science, the scientist, and the institution must change, must move, and then note the approximations that this causes in the world. It is change that is noted and change that becomes something new. It is change in the end that becomes our knowledge of the world, because it arises from our manipulations. This is not to say that royal science does not manipulate

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the world, but in manipulating the world, royal science holds the human, social, political, epistemic, aesthetic, and ethical world as a constant and manipulates something in the world. It does not admit that the very action in the world is changing the parameters of the human world and moving in relation to that which it is studying. By holding the human world and subjectivity constant in royal science, Deleuze and Guattari claim we are attempting to reproduce the world, and in a way we are:

A distinction must be made between two types of science, or scientific procedures: one consists in “reproducing,” the other in “following.” The first involves reproduction, iteration and reiteration; the other, involving itineration, is the some of the itinerant, ambulant sciences. Itineration is too readily reduced to a modality of technology, or the application and verification of science. (Deleuze and Guattari, 1988: 372)

However, on the other side, when we follow another science, we are standing on their shoulders so that we can see farther; we do not have the same vision as they do; we do not reproduce their vision; we need to construct our own. In royal science, by removing the human subjects and transforming them into at best a series of variables, we are construing them as fixed objects in the world, unchanging in time, or if changing in time, changing at fixed and known intervals. This is contrary to the modulation and fluxing of the itinerant science, where through following, and not reproducing, we are attempting to map the changes of the world in relation to the people moving through it. This becomes important when we are talking about cyberinfrastructure because as we have described cyberinfrastructure as participating in a knowledge society, one of the tasks that cyberinfrastructure at-

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tempts to do is to capture the reproduced data without admitting the existence of the data that arises from following. Cyberinfrastructure rarely admits the human aspect as a subject in the system of science, and because of that, cyberinfrastructure tends to be oriented toward royal science. If we do not capture the subjective side of science, the side that Latour and Woolgar capture in their book *Laboratory Life* (1986), then we have not captured the process of science, and have only constructed yet another objectified science. This objectified science might be the product of science, but it is not science, as it misses the human-centered processes of the scientists themselves. We will not have captured the nomadological side of science and thus, we will have missed many of the important facts that feed into the processes of successful science and innovation.

The state prefers royal science as the state abhors change, innovation, and creation outside of its normal frameworks. The state prefers to encapsulate the nomadological science and only recognize it in relation to the institutions that it creates, such as cyberinfrastructure. Cresswell argues that the innovation that the state wants, the creativity that it wants is construed as a conduit, one with clear bounds.

The state, on the other hand, is the metaphorical enemy of the nomad, attempting to take the tactile space and enclose and bound it. It is not that the State opposes mobility but that it wishes to control flows -- to make them run through conduits. It wasn't to create fixed and well-directed paths for movement to flow through. Deleuze and Guattari use the nomad as a metaphor for the undisciplined -- rioting, revolution, guerrilla warfare -- for all the forces that resist the fortress of State discipline. (Cresswell, 1997: 364)

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That is the disciplinary state in action. The disciplinary state attempts to confine and direct human action. In doing that, it creates a system that forces nomadological science to become royal science and in doing that it pushes some scientists in the royal science out into new conduits seeking spaces of free action and thinking. The interaction of royal science with nomad science always liberates some royal sciences. Nomad science in its iterations is always moving and testing boundaries, and some of those boundaries become interesting to royal science, but when we participate in the becoming that is part of the untested boundary we must become mobile ourselves, we must become nomadological. If cyberinfrastructure extends and replaces the informational spheres of science, the assumptions of information and control become more limiting, and the boundary systems of the control-based knowledge society will fix in place, or worse encode the boundaries of knowledge into the infrastructure systems, thus requiring scientists to become technicians in order to rewrite the system to create new knowledge.

The interactions then of the state as disciplinary society moving into a knowledge society predicated on control need to recognize the scientific process more completely in the systems that it supports. Just as the state has undergone a system of informationalization, science has undergone the same transformation, and the same systems, the same control-based infotechnics undergird the construction of the knowledge economy's infrastructure. When we write science policy for cyberinfrastructure then we have to be aware of the nature of the infotechnics to all

From: 2009. Hunsinger, Jeremy. Toward nomadological cyberinfrastructures. in Handbook of Internet Research. Edited by Jeremy Hunsinger, Lisbeth Klastrup, and Matthew Allen. Springer kinds of science. As Stengers writes below, the nomadological science will not disappear within cyberinfrastructure. Nomad science might become the hacker inside the machine. Nomadological motivations might be to free the knowledge processes from the informational system (Deleuze, 1990, 1992). We should not ignore the ambitions of the practitioners, as they could end up being the newest articulation of the processes of innovation.

Royal Science does not make the "ambulant" or "nomad" sciences that preceded it disappear. The latter do not link science and power together, they do not destine science to an autonomous development, because they were in solidarity with the terrain of exploration, because their practices were distributed according to the problems provoked by a singularized material, without having the power to assess the difference between what, from singularities, refers to "matter itself" and what refers to the convictions and ambitions of practitioners (belonging henceforth to the second world). Royal Science "mobilizes" the ambulant process. (Stengers, 2000: 155-156)

The relationship between nomad science and royal science enables and mobilizes royal science and allows it to become nomad science. Our science, as a process, is ambulant. The attempts to fix it in place in the disciplinary knowledge society as a royal science will only create new forms of resistance and creation. These forms of resistance and creation will not easily be reterritorialized by royal science. They will lose their recognition and become subversion as Welchman indicates:

It is not only the absence of formal tools that has inhibited nomad science. There is, according to Deleuze and Guattari, a political pact between the State (as rigidly stratified agent of order) and what they call Royal science (characterized by an exclusive emphasis on formalisation) which has made nomad science an eternally minor activity.

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Correlatively, rhizomatics is essentially subversive, a perpetual undermining of cognitive and political authority. (Welchman, 1999: 626)

As I have alluded above, there is a political pact through policy, institutions, and related statist tools to privilege royal science. The state and science have a strong relationship both as multiplicities that share many overlapping concepts and assemblages, but they also have an alliance to suppress certain kinds of creativity, to limit certain kinds of innovation and to structure the scientific process and the knowledge process as capitalist products. These processes becoming objects provide an ontological reality that maps back into the measurable, objectified world of royal science. In excluding the subjective side of science, the coming to be of the scientific fact, cyberinfrastructure policy has created two significant problems above. It has created a new control revolution in science, where informationalized science can and thus likely will be funneled through large, state funded, informational regimes. The second is that these new cyberinfrastructural regimes, while requiring a new class of scientist-technicians, have created a new class for creative resistance. Once the knowledge of how the machines are supposed to operate in the world then the knowledge of how to subvert the machines exists in the world. Following that, the knowledge processes will exist in our shared subjective experiences and our reflexive relation to the perspectival appreciations of control dramatically changes our subjectivities day to day, week to week, and year to year. By constituting a new cyberinfrastructure, we have in fact supported cybercreatives, who will likely be labeled cybersubversives by the statist regimes. This process

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5. Conclusion: Toward a nomadological cyberinfrastructure

In this paper, I have unpacked several blackboxes and discursive territories that relate to cyberinfrastructural policy in the United States. I have shown that not all that glitters is gold and that there are significant concerns for following our current path. However, I have not argued that we should not follow this path. Contrarily, I think we should, but in following the path we need to responsibly construct systems that resist the control-oriented interests in the knowledge society, resist the negative aspects of informationalization and capitalism. We need to build a somewhat different cyberinfrastructure. This cyberinfrastructure does not need to be user centered, which would be the response of royal science. Cyberinfrastructure needs to be centered on social interaction and creativity. We need, beyond a cyberinfrastructure of royal science, a cyberinfrastructure that complements it, we need a nomadological cyberinfrastructure, much like the current version of the internet. We need a system that does not fix and encode meanings, but we need a system that allows people to play with these meanings, to observe how the processes of knowledge and creativity in our sciences occur above and beyond the factual constructions of science.

This system needs to have the qualities of being open, social, and mutable. It cannot be hidden or blackboxed like most infrastructure. Hiding the infrastruc-

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ture will not protect it. Hiding it will not lessen the chance for it to be subverted; what will lessen that chance is if you remove the challenges of subversions, where each subversion becomes a legitimate project. When Virginia Tech built System X, I went to a meeting about research computing at Virginia Tech, I sat behind three older gentleman who spent the whole presentation talking back and forth about how they would manage the scheduling and cost recovery on the supercomputer, that was the royal science approach to supercomputing. The nomad approach would have been to give away the resource and develop a community that innovates and creates then eventually self-manages it for the benefit of all, building up maximum creative usage, not building walls to prevent usage. Open, social, and mutable infrastructure, customizable on the fly and hackable on the fly will enable innovation and the scientific process. Especially if when properly built that you can monitor and engage the whole social sphere around the cyberinfrastructural resources, not merely the scientific machinations that occur through the infrastructure, but the social machinations with their multiple lines of flight and subjectivities (Masakazu, 1997).

This open and mutable infrastructure does not map onto the state or royal science. Both institutions can use this type of system for their own ends, open design for creativity should not be the core of the possible questions, but what they cannot do is control the system, remove the meaning from the information or create products where there may be none. Because of the lack of 'productivity' of the

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'creative' system, I fear that we will probably not witness the birth of a cyberinfrastructure for nomads, and that the public infrastructures now in place will likely move farther into the private sphere, where they can be profit centers and premium networks spaces much like highways and telecommunication systems have become (Graham and Marvin, 2001:291).

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VII. The virtual and virtuality: Toward dialogues of transdisciplinarity

Jeremy Hunsinger

In confronting the issues surrounding virtuality and its study in the future, we need to think about the plurality of perspectives and communities that support them. In pursuing this line of thought, we must confront the contradictions found in our knowledge and understanding of the virtual. These contradictions can be resolved by considering the possibility of radical otherness found in virtuality and its implications for our future knowledge, for a basis of dialogue about transdisciplinarity, and for the inclusion of the whole plurality of perspectives available in specific contexts. The argument continues through three phases. The first is a consideration of two incommensurable perspectives on virtuality. With that contradiction in hand, I propose a more general position that takes a metaunderstanding of those two perspectives. From this understanding, an analysis of the possibility of the development as a discipline is problematized in relation to the boundary work and territorialization of the field. Finally, the resolution to the constitution of boundary work is presented as creating an inclusive transdisciplinary dialogue, which will help us create and sustain a legitimate research program of virtuality studies.

1. A question of perspective

The nature of the virtual is teeming with plural meanings. The meanings we choose to use as the basis of our interpretations of virtuality have deep implications

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for our current work and future collaboratory potential. When approaching the virtual, scholars from diverse disciplines have found that conceptually “the virtual” wrestled with the profound challenges to their ideological or disciplinary constraints that the concept presents. However, in many of the abstract areas of the disciplines, one could argue that there is nothing other than the virtual; theoretical mathematics or metalogic, for instance, which examines questions of the virtual almost exclusively. However, the virtual is no longer limited to those theoretical disciplines. As the technical realm has opened up a new arena of the virtual in recent years, the whole of the human disciplines (arts, psychology, sociology, business, etc.) have engaged virtualities as areas of exploration. The nature of the virtual has become more pluralist, and that shift has created a space for new dialogues about the meaning and inclusion of virtuality. The meanings we choose to use as the basis for our interpretations have deep implications for our current and future collaborative work.

The virtual should be understood as those sets of things which have no referent in the real world, yet are virtualized through the projection of identities, institutions, ecologies, and their relations in a world that is mediated, such as through a computer game or other embodiments of a world without referent. Virtuality, then, must be mediated by something such as our minds, or digital or analog systems, because while we might usually think of computer games as one paradigmatic sense of virtuality, the plural realities of textual fictions are as much virtualities as

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are games or logical abstractions. The virtual is less the expression of the virtuality on the page or on the screen as the distribution of that reality through the memories and actions of its participants. The virtual is the combined and active imaginations and memories through which we engage mediated environments; it is a shared, but plural, projection. As we become more aware of the expansion of the virtual, the actualization of the virtual through the practices of our everyday lives, our economies, and our politics is restructuring research programs and academic centers, as we can see from the emergent interest in social simulation, e-science/e-social science, and digital humanities.

We might consider the following two perspectives of the virtual to exemplify the expanding and fragmented nature of virtuality studies. These perspectives derive from two very different disciplinary perspectives. The key differences in the two perspectives center on their understanding of the relationships between what exists and virtual objects. The first perspective, which we might think of as the synchronic perspective, constructs an understanding of virtual objects as ones that have no referent in the real world; they have no relationships that reach into the real. Building through the structures of reference, this perspective constructs an understanding of the inherent difference between the real and the virtual on the basis of a relation among sets of signs existing in a fixed and static field without temporal relations. This perspective assumes the virtual are immanent and floating signifiers that, while sensible as constructions outside of space/time, cannot be real

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(Van Fraassen, 1980). Thus the virtual is not real because it lacks either an empirical or positive relation to the world at a certain time. This analytical construction of the virtual assigns relationships in a system of meaning where there can only be one resolved set of conceptual perspectives relating to empirical observations at any point in time, without relations to either the past or future states of that object. In this model, one must think that something either is or is not virtual, and if it is virtual, it cannot be real.

An alternative to the synchronic analysis is the diachronic perspective. It is derived from the Bergsonian and Deleuzian traditions (though certainly the one that I provide is at best a derivation of pragmatic and process philosophies, but also grounded in a materialism). This perspective of the virtual, centers on artifacts and their mediations as related through time, but here the relations are processual and pragmatic, grounded in an open system of concepts. The concepts are defined not by their boundaries or opposites, but by the fluctuating constructions of relations that constitute the knowledges and understandings in those traditions. The virtual in this system of signs operates as a series of relations that are virtualized and constantly in flux; they have become virtual through any number of human, mechanical, or informational processes. These virtualities are real in that they exist as some relation to the world as constituted by our mental processes and material forms. This differs from the first perspective, which requires a fixed relationship at any given time, whereas the construction of the virtual in the second perspective relies

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on the flow of time to establish the relationship. However, as virtual objects are not actual as compared to potential in a Deleuzian ontology, and are fluxing and transitioning across a myriad of cyborg interpretants, the virtual is perpetually coming into being through those interpretants. The virtual exists as things and as signs to be perceived, and through their perception they are interpreted and understood in relation to other signs.

In the second perspective, the virtual, and virtuality in general, is not actual, in that the actual is what is not fluxing and changing except to become stable. For Deleuze, in *A Thousand Plateaus*, the actual is the system of strata. It is the aggregation and concretion of stable systems that can be modeled in a fixed and linear fashion (Bonta and Protevi, 2004). By contrast with the nature of the actual, for instance, a rock, which will tend toward finding a resting place in a gravitational field, the virtual is different. The virtual rock need not have the defined relations of a rock in the world. It need not react to gravitational fields, nor need it occupy a virtual space. However, there comes a time when, in attempting to grasp the relations through which we come to understand what it might mean for the virtual rock to be understood as a rock, that we might no longer have, in most people's interpretations, a rock at all.

Insofar as the virtual rock is both becoming rock and non-rock concurrently within the context of a plurality of human experiences of rockness, the virtual rock

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has no direct relation to a rock beyond mediation and conceptualization. The changing nature of the virtual is key to understanding the difference between the synchronic (i.e., same-time) perspective as opposed to the diachronic (i.e., changing through time) perspective on virtuality. In the synchronic and fixed analysis of the virtual, we deal with systems composed in time, but where that composition has ended, and where we are left with a construction of the virtual "as is." In the first perspective on the virtual, relations are fixed and uncontested in the imaginations of their interpretants. The processes are not ongoing, but are frozen in their states so that they are no longer becoming what they may be. In that they are frozen, the virtual rock "just is" a rock in the analysis. It may be other things too within the framework of rockness, such as part of a building, a weapon, and/or the gallstone of dragon. However, the synchronic mode of virtual has implications for our capacity to understand its nature as it fails to recognize the changing relationships of virtuality through time.

The importance of understanding the problems caused by having plural and divergent understandings of the virtual and virtuality cannot be stressed enough. The two perspectives of the virtual influence the research that is performed on virtuality topics, and if the virtual world becomes the domain of any fixed theory or perspective, elements of the possible knowledge of the virtual will be lost. The Enlightenment ideal of the unification of knowledge into hierarchical categories governed by divergent theoretical and empirical assumptions, which converge into the

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grand schema, is a process of editing out the parts of the knowledge that do not fit the scheme. Thus, when we consider the alternate perspectives on the virtual, we have to consider the implicit normative systems of knowledge and the edits they require. For the first perspective of the virtual, we must by necessity edit out the relations of time of the second, while the relations of time of the second erase the fixed meanings of the former. Thus, one perspective does not become the other, though they may over time provide points of translation between them.

2. Understanding the signs

Consider that we might merely think of virtuality as a system of signs, very real signs, but signs that do not map onto reality. In society, both reality and virtuality operate as systems of signs, complementing each other, each bulwarking the understanding of the other. This occurs where real things have references in the virtual, and some virtual things have reference to a real thing, but no virtuality or virtual world has a direct reference to reality or the real world. The signs interoperate and in some cases can be interpolated across virtual worlds and real worlds. Signs in the virtual world are less fixed on their objects and more fixed in the interpretative communities through which they operate. Given the plurality of systems and communities within those systems, we need to take care when constructing our interpretations of these perspectives.

The interoperation and interpolation of signs between the virtual and the real depend on human experiences. The virtual need not rely on those experiences,

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however; it can become a whole new set of experiences. The experience of information outside of textual, televisual, or other fixed forms that constitute the realm of the “normal” in our cultural milieu generally begins at the edges of metaphors grounded in that milieu. It is not hard to understand the avatar becoming virtual dragon or unicorn as much as it is hard to understand it becoming the virtual circle or square such as in the novel *flatland*. The virtual as reflected in fictional worlds provides some access to the radical otherness of the circle, but the access is limited by our own anthropomorphism of the circle. However, the capacity to understand elements of being a circle is present in our sign systems, whereas more alien experiences are possible. It is in those alienations that a creative construction of concepts, which are fundamentally innovative in breaking the structures and norms of the system of signs, occurs. It is in this breaking, in this transgression, where there is a virtuality that is neither actual, nor actualizable. In science fiction and fantasy texts, for example, there have already been humans becoming dragons, unicorns, and circles, and even alien beings, but those transformations have been enclosed in narratives and textualities that are normalized in our lives. This is to say that there is a virtual that is not fantasy, but that is real, and until experienced and interpreted, is misunderstood. This radical other of the virtual constitutes one liminality of the boundary of virtual experiences. It is a point that allows us to see how our understanding works in virtual worlds, because we have to imagine a new self to even begin to comprehend that which has no referent, no interoperation, and no interpo-

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lation with our current everyday life and cultural milieu.

That the real and virtual usually have a relationship does not mean that we can ever fully know or grasp a virtuality in our minds either individually or collectively, or from one subjective perspective or distributed perspectives. Our capacity to understand the normal in our cultural milieu is unquestioned, but the virtual provides things outside of these norms. As academics and informed readers, we may be able to come to terms with virtuality as a topic of study, as a series of relationships within the academy and society, and more precisely as a set of quickly formed differences, which may be overcome. However, describing and documenting the relations of virtuality to our everyday lives will take a plurality of knowledge practices, and thus a plurality of perspectives, disciplines, and methods. This intertwinement of the virtual and the real creates a messy arena for study, in which we can pursue a variety of modes of research.

3. Could there be “virtuality studies”?

Is there a field that studies virtuality? One way that we identify fields of study is to identify the questions that they address. To some extent, as alluded to above, all fields deal with virtuality. Those fields that study the causes of human action and the nature of human thoughts clearly are studying virtuality as well as reality. Thus, the full breadth of human life is open to question through the rubric of virtuality studies. Most centrally, the virtual has become implied as a cause of human action and in that those that study the virtual have extensions into a myriad

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of fields. Virtual constructs like *will* and *intent* pervade our theory and explanations. In other fields, other virtual constructs are pervasive and map through their concepts and explanations.

The explosion of virtualities across all fields lends itself to the construction of expert knowledge and expert terminologies that could become incomprehensible as a whole both to its academic and public audience. The unsystematic growth of virtualities has eventually yielded contestation and divergence of the axiomatic and conceptual foundations of virtuality, as we have seen between the philosophical and the media studies perspectives above. This dissensus about the nature and import of the virtual fragments our understanding, and the plurality of nascent disciplines, either imported from existing disciplines or developing around the topic itself, will quickly reproduce traditional problems of translation and interpretation among fields of knowledge. By recognizing these ongoing problems in the development and structuring of disciplines in relation to bodies of knowledge, we can see that we need an opening of dialogue about the virtual across these disciplines. This dialogue is necessary to preserve the plurality of knowledge and trajectories for research, to resist the narrowing of the expansive understanding of the virtual, and to sustain the continued interest in virtual worlds.

Virtuality studies is pertinent in many disciplines, which translate some understanding of the virtual into their own work. Disciplines have borders and dis-

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play a “recognizable continuity” (Becher, 1989, p. 21). Disciplines have boundary workers who seek to encapsulate and defend a territory of knowledge, some of which is heavily contested among the disciplines. This boundary work often is important in demarcating science from non-science and determining who receives the related benefits of belonging within the territory (Gieryn, 1983). The construction and contestation of territory in relation to benefits and public goods also leave gaps and unclaimed spaces where those goods will not propagate. It is in these less contested territories that interdisciplinary possibilities arise and encapsulate certain issues and topics that are often ignored by the disciplines.

We can see these contestations happening, for instance, in the pluralization of methods and techniques becoming literacies in domains of knowledge. As it has become more difficult to comprehend our everyday life due to the contestation of boundaries and its implications, knowledge has become territorialized as domains of literacy, as domains requiring specific or expert knowledge. We no longer have a sense of being singularly literate, instead we now must possess media literacy, informational literacy, and library literacy, to name a few. Instead of encouraging people to learn how to be generally capable and critical subjects, we now have boundaries that say they can be information literate, but not media literate, or generally literate. The division of the literacies indicates a fundamental misunderstanding of thought in context. Human beings have a capacity for thought, which is singular and applied to contexts, but the division of expertise based on contesta-

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tions of disciplines and territories implies that not only is our capacity for thought pluralized, it can be divided anew for each technical system and their requisite technicities (Dodge and Kitchin, 2005). Each new literacy maps a set of conceptualizations and productive functions that may be tied to a technical system, but the new literacies are centered on those technical systems, their technicities, and knowledge. Technicities, such as those in virtual worlds, do not create new mental capacities, though they might habituate old ones in new ways. However, it is likely that we will soon see the case where people will not be literate in the virtual, even when they use the virtual everyday in one sense, whether in virtual worlds or not, as literacy is becoming abstracted from the world of everyday social life and contexts (Schroeder, 2001).

The division, abstraction, and territorialization of the world as part of the process of creating and defending knowledge domains leads us to the position where the pluralities of meanings, which were once possible to understand as a whole within our everyday lives, have become impossible to understand outside of the contexts of expertise (Beck, 1992; Beck, Giddens, and Lash, 1995). The development of knowledge within related fields, where the knowledge does not refer to itself or refer to a process of the construction of subjects, is one sign of the development of disciplines. If understanding the virtual becomes a matter of having people who are literate, then we can be assured that there is a field on virtuality studies, and, more importantly, we can be assured that most people who have studied

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and will study the virtual will not be part of virtuality studies. In short, the disciplinary of virtuality, I argue, is not yet formed, but if it does form, it will become more than a discipline, it will become a literacy. In becoming a literacy, the study of virtuality will have to relate to literate people, creating new formalisms, and, through those formalizations, creating new norms for the knowledge of the virtual that will further divide research in the field.

4. A move toward transdisciplinarity

The extensive and open spaces currently inhabited by interdisciplinary studies are important new specialties for the constitution of virtuality studies, because they point to a territory constituted by transversals – those trajectories that cut across and pass through territories and constitutes new wholes, new transdisciplinary areas. There has been a movement toward transdisciplinary research in a variety of fields in the last 30 years. Transdisciplinary research attempts to approach the object of study beyond and across disciplinary and interdisciplinary perspectives. Transdisciplinary research is composed of several independent disciplines, which can be combined into a whole, transdisciplinary field (Dickens, 2003, p. 97). A transdisciplinary field is one defined by the globality of its object of study, combined with the complex, emergent, and changing nature of that object (Genosko, 2002, p. 26). This globality represents a larger whole that can be approached from many perspectives because it cannot be understood completely from any given perspective. As we have seen above, virtuality as an object of study is incomprehen-

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ble as a whole from disciplinary or interdisciplinary perspectives, as it does not yet have its own literacy. Realizing that no single perspective will capture the territories entailed by virtuality, we need to develop and integrate inclusive models that can bring understanding to the greater whole without destroying its parts (Genosko, 2002, p. 25). We need to engage in a process of metamodelization; that is, we need to examine and rebuild our models to account for more than disciplinary perspectives. One way to do that is to intervene in the formative disciplinary discourses through dialogue. By engaging our perspectival models with the enveloping discursive strategies of dialogue, the models that we use become transparent. We discover the fissures and breaks of our models, their points of operation, and application, and thus also where they fail to capture knowledges across disciplines. Discussing models at a meta level, and engaging in metamodelization through transdisciplinary dialogue, enables a broader, more applicable mode 2 research model (Gibbons et al., 1994; Nowotny, Scott, and Gibbons, 2001). We need to build a dialogue among scholars of the virtual that enables them to share their conceptualizations and research, not merely on the everyday level of research practices, but a dialogue that includes discussion of the axiomatic and axiological bases of their research. Such a dialogue would be the foundation of a new transdisciplinary research agenda. Granted, virtuality studies is not the only arena where these dialogues might enable research, but in virtuality studies it might prevent future confusions and allow us to construct a sense of agreement that is currently

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absent.

Inclusivity toward the groups of interested peoples seeking knowledge about virtuality and society is central to the transdisciplinary agenda of creating dialogues in research and development. Once the boundary work is overcome, most fields can be reimagined as transdisciplinary fields. To begin the process of reimagination toward transdisciplinarity, the creation of new discourses must occur, and we must begin to use them to translate among all disciplines with interests in virtuality studies in a way that allows for the general understanding of conceptual and empirical fields. The constitution of these new discourses will borrow heavily from the disciplinary field from which they are constituted. However, these discourses will by necessity have to innovate both linguistically and conceptually in order to map between disciplinary domains or traditions (MacIntyre, 1989).

Translation is not merely the importation of language and concepts; it is the constitution of the meaning of the other that is becoming a part of the whole. Through translation, we not only map concepts and languages, but we map and reconstitute the foundations of cultures and institutions. Translation does not only find the commensurable areas of cultures and communities; it must recognize where the communities and cultures are incommensurate. Translators must find the meanings the cultures and communities do not or cannot share (*ibid.*). Translation is not merely "samesaying," but it is mapping the plural territories, including their

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differences and parts, in the contexts of everyday lives, cultures, and communities (ibid.). The study of virtuality needs to move beyond the samesaying of translation surrounding the idea of the “the virtual” and “virtuality” to become a field in which the plurality of perspectives is inclusive toward the possible knowledges to be found. Translation, in virtuality studies, must create a new discourse that over time will participate in the wholes and not merely in the parts. This translated discourse will, over time, become part of the reconstituted whole, which is renewed in response to their presence.

For translation among fields to occur, the dialogues creating the transdisciplinary discourses of virtuality studies need to embrace an agenda of inclusion, so that the number of cross-community interpreters is maximized, allowing for many possible translations in many directions. Plurality of translation is the only means of providing for the plurality of interpretations and thus providing access to the meaning among groups, such as disciplines, that do not hold the same axioms or axiologies. The necessity of plurality and maximization of plurality seems counterintuitive if one accepts the unity of knowledges, but in exploring virtual worlds, one cannot help but realize the plurality of knowledges present. Inclusion of this plurality in the case of translation is by necessity tied to correct performance of translation, a plurality of perspectives brings the robustness necessary to make the interpretation possible. Cross-community, and thus cross-cultural translation, can overcome boundary work and the implicit problems of translation noted in Macin-

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tyre's work on translating among traditions (ibid.). The necessary communicative abstraction of translation forms the basis for transdisciplinary research, but once in place the translation through discourse can provide a common language for constructing a public understanding of research. This discourse becomes the home for new axiological systems, new points of agreement about the nature of the transdisciplinary field. This understanding of transdisciplinary research is fundamentally different from interdisciplinary approaches. Were we to engage in interdisciplinary research, we would engage in systematic appropriation and interpretation of the various disciplinary toolboxes involved into one or more frameworks of understanding that we already possess, whereas in transdisciplinary research we are attempting to construct the new framework through the sharing of research practices, axiomatic understandings, and axiological systems. Interdisciplinary research requires modes of translation as much as transdisciplinary work, but interdisciplinary research is fundamentally different, and that difference is where you also find the difference between samesaying and translation. In other words, interdisciplinary research is a mode of research that borrows techniques and speaks them into a whole, it tries to fill gaps in disciplinary research by redescribing the other disciplinary tools into the project, which is samesaying. Transdisciplinary research cuts across research at a foundational level, which requires not that one disciplinary practice be translated into another discipline such as interdisciplinary research, but that any discipline that participates translates into a mutually understood model or

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set of models composed of sets of axioms and axiologies informing our research practices. Interdisciplinary research is based on samesaying, whereas transdisciplinary is based on translation.

The agenda of inclusion makes necessary a study of virtuality that is constituted by disciplinary plurality. We need to train researchers in more than one discipline. We need to have cross-disciplinarity and thus cross-community-trained researchers to perform the act of translation among and for their respective communities. It is not enough to have interdisciplinarily trained researchers to translate methods and knowledge. We have to translate the wholes, not the parts of the disciplines.

As the virtual has expanded throughout everyday life in the last few years, disciplinary and interdisciplinary forms of research focusing on it have become more institutionalized as subdisciplines and specialties. Centers, departments, and sections in universities and research institutes focused on virtual worlds, game studies, medical simulation, business virtualities, and other topics have been created across the United States and around the world. Without collaborative effort toward a dialogue, these various research trajectories will become minor sidelines instead of major practices. For instance, is it already becoming difficult for the digital humanities to address the e-social sciences in a dialogue? Transdisciplinary practices break the normalized disciplinary boundaries, hierarchies, and stratifications

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normally found in academic knowledge production, by necessity and practice, not by a utopian proposition. Starting the dialogue is possible, but it requires us to move toward people doing similar work in other disciplines and to ask questions about foundations. Transdisciplinary research dialogues are not asking how individual researchers relate to each other, but how they relate to something larger, such as the virtual. The humanities, the sciences, and the special sciences discuss virtuality to some degree, but are we not at a loss about what exactly each group is saying? The agenda of inclusion and the dialogue of transdisciplinarity can help resolve these novel institutionalizations by reconstituting the basis of the institutions and the discourses themselves. In reconstituting these institutions and discourses, we need to be prepared for different institutional forms to arise, different research practices to occur, and different knowledges to be promulgated. Perhaps the transdisciplinary study of the virtual will no longer require the actual research institution in its current form because the communities that constitute the virtual world may be different from those in the real world.

The study of the virtual is becoming fragmentary, and increasingly unintelligible across disciplines and to the general public, as it progresses down narrow disciplinary paths. For laypersons, heavily disciplined or even interdisciplinary expert knowledges can be hard to interpret, and harder to use in any meaningful way. Transdisciplinary knowledge, because it has been recontextualized for the broader audience of multiple disciplines, is more accessible and interpretable due to the

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need to translate among disciplines. This interpretability and transdisciplinarity will allow the study of the virtual to retain its relevance to a broader audience, encouraging public interest and future growth of the field in ways other than the awesome media spectacles that have previously generated public interest in the virtual. In resisting disciplinarity, we should consider what the centers of our understandings and research about virtuality could become, and how virtuality studies makes sense not just to researchers and experts, but also to a broader audience. Every researcher has a research agenda, a set of questions, problems, and/or issues that they are working toward resolving in some manner. Those resolutions have trajectories and transversal relations that exist within some contexts, some knowledges, and some normative systems. Those contexts, knowledges, and normative systems contain inferences about what is possible, what virtuality studies could become. Recontextualizing our research to make sense of and bring understanding and interpretation to the possibilities and complexities involved in developing an understanding of virtuality can help us progress from disciplinary and interdisciplinary understandings toward a transdisciplinary understanding.

Public reception, relevance, and thus legitimacy are becoming important issues to consider in all research because they are the foundation for the capitalization of research; research and the aims of knowledge production are slowly disappearing from the public view, being replaced by controlled innovation and knowledge management. In an age where search engines can find the top results

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for any informational topic, it is harder and harder for the public to find the researcher behind yesterday's news of virtual worlds. The desktop computer is already disappearing into ubiquity and becoming an everyday appliance. This is not to say the household and business appliances are not important to our everyday life, our economies, our politics, or our individual research agendas. However, frequently these appliances are understood as part of a system of objects, technical systems, or similar theoretical assemblages that become particularized to certain disciplinary discourses; because of that they embrace disciplinary perspectives that highlight certain issues and seemingly forget others. This disciplinary back burner is the fate of the common appliance in the disciplines; it becomes ordinary, everyday, and thus systematized and normalized until it is forgotten as a separate object of study, though it frequently is and should be periodically be reprised and reintegrated into the growing body of knowledge (ISSC, 2003, p. 3; Herring, 2004, p. 33). We need to be careful not to lose virtuality studies to an embodiment in appliances and infrastructures lost to specialization, commodification, and technological development, or we will lose our topics of study. We need to preempt the disappearance of our topics of study into the everyday by increasing the relevance to researchers and the public they nominally serve. Virtuality studies' relevance and legitimacy varies with its capacity to communicate its findings and their relative importance to its audiences.

As virtual experiences and virtual worlds become part of everyday life, they

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will become less visible. The networks and infrastructures through which they operate are already very much invisible to the everyday user. As topics of research become less publicly visible, they become less relevant to the audience, and in the end they may even lose their perspectives. This may have tragic consequences for our growing body of knowledge and research practices.

The possibilities of having different research in virtual worlds highlight the directions we can pursue in a transdisciplinary manner. We do not have to use surveys when we have a history of the users' complete actions in a world. Their actions in virtual worlds, much like their actions in the real worlds, reveal as much as the surveys could reveal. Studies in virtual worlds do not have the same limits as studies in real life; this is clear whether the real limits are generated from the newly mutable physical world, the mutable social world, the alternative constitutions of subjectivity, or otherwise. While there is a tendency to map our current practices into the virtual environment, we need to be careful that we are not forcibly importing our reality to that environment in ways that harm the environment or its users. People already import a myriad of discursive frames into virtual worlds, but we do not need to reify those frames by pursuing the constitution of those frames through their parallel research practices, thus constituting the virtual world to be increasingly parallel to the real world. Perhaps there is, as indicated earlier in this chapter, a chance to see a radical other through reconstituting our research programs. What would it be like, for instance, to be a participant-observer in a world where the ac-

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tors are constituted as nonunified gusts of air, broken apart and performing actions across great distances? In other words, what if the virtual world was nonindividualist, nonbodily, and/or nontextually oriented. If there is a world that is fundamentally different from our current modes of thought, can we find ways of researching it that does not reconstitute it within our frame of reference without destroying it or radically reconstituting it to fit our models. I cannot imagine that the paradigmatic model of participant-observer would work without our westernized assumptions of subjectivity. Interpretation in virtual environments becomes problematic when we no longer can assume that the environment is a neutral object, much like we cannot assume that in the built environment. Similarly, one can imagine creating a survey of the humans behind the screen, but is that really accurately capturing the same being as is represented on the screen? On one level it may be, but we can imagine an interface where an ecology would be manifested by the cooperation of hundreds, if not millions, of people all contributing merely a part of a whole, which might bring into question just who is representing what about whom. We could also imagine an interface that interacted in nondeterministic ways, perhaps representing the subject in ways that limit the inferences we can make about other users. The openness offered by the virtual not mapping into the actual is a significant problem for traditional methods that may not map onto the assumptions, both epistemological and ontological, of our research models.

These epistemological and ontological assumptions are the axiological bases

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of research; they are claims about the world being measured and our interactions in it. They are as much claims about our own participation and our interpretations in the virtual world. They are bounded in disciplinary and interdisciplinary discourses, founded in traditions of research and understanding. Much like MacIntyre (1989), who argues that moral traditions are grounded in a practical rationality that was generated and still exists in a culturally specific historic trajectory of knowledge that in part explains and determines its possibilities, so are research traditions grounded and bounded in traditions. The functions of legitimizing our research depend on those traditions and their discourses and dialogues for their capacities to convey meaning to others. The virtual is not limited to the same epistemological or ontological systems that legitimize current social and physical research, as those epistemological and ontological systems need not be built into the code of the virtual environment. There may be, for instance, no individual research subjects in a world where avatars are constituted in a plurality of contributions from users. In lacking these shared epistemological and ontological assumptions, we have a new set questions that involve translation, that deal with research moving from the understandings of the possible in the virtual to the real in traditional research and the capacity of making comparisons between the two. If the assumptions of our research tools are no longer certifiably grounded in some manner, then the claims that we are capable of making about the virtual might falter. The different origins of this lack of legitimacy of research constitute yet one more reason to open dia-

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logues with other disciplines and to transition our thinking toward transdisciplinary research in virtual worlds, toward a larger dialogue about our research.

5. Conclusion and implications

Virtuality and society constitute a body of knowledge, a growing set of practices, and a set of divergent meanings that embody a place for realizing a common or perhaps an uncommon ground on which to build an audience and an understanding. In coming to terms with the divergent meanings of the virtual, the problems of public understanding and legitimacy of studying the virtual, and the question of a new disciplinarity of virtuality studies, we have come to terms with the questions of pluralities and territorialization in new fields of research. We cannot forgo the questions and possibilities raised in this chapter without admitting an unwillingness to confront thoughts about the future of our understandings of the virtual.

I have argued that, to study the virtual, we need a transdisciplinary agenda. This agenda should be based in an agenda of inclusion and dialogue with an eye toward the future. Transdisciplinarity resolves the problem by establishing the commonality in “unconnected or partially interacting disciplines” (Briggs, 1977, p. 2211). Commonality is what transdisciplinarity pursues, though it pursues that across disciplines through dialogue and model building. Transdisciplinary virtuality studies can create the topic of study, it can realize its objects and the continuance because it develops the axioms, understandings, and discourses that construct relevancy both inside and outside of academia. This way we can create and trans-

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late our findings to our colleagues and the public, providing legitimacy to our research and providing for its future. We need to be circumspect as researchers so that our research reaches out not only to our own disciplinary and interdisciplinary communities, but also to the broader audiences. We can with effort recontextualize our research and pursue transdisciplinary research to allow a broader audience to better understand the complex, global, and ever-changing nature of the virtual as a whole and as such continue doing the work we enjoy for years to come.

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VIII. Knowledge and Cultural Production in the Context of Contemporary Capitalism: A Response to Wittkower

Jeremy Hunsinger

1. Introduction

My critique of Wittkower's position on revolution industries is a metalevel critique based in the understanding of human subjectivity in relation to our knowledge and culture. In parallel, it is a critique of the reification of the capitalist model of intellectual property found in the revolutionary ideology surrounding open source software, Creative Commons, and related open knowledge projects. The critique is based in the core idea that knowledge and the knowledge society as founded in an appropriate understanding of knowledge and culture cannot be objectified into commodity relations. The basis of this critique is the understanding that knowledge and culture are processes that manifest themselves in human activities instead of understood as things or objects. When we think about knowledge in terms of knowledge societies, reflexive modernization and late capitalism, we should not think of it as something that is objectively alienated from ourselves, but as a series of processes that are distributed and communicated intersubjectively to establish shared meaning about the world.

Knowledge is a distributed process communicated amongst subjects in rela-

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tion to their understandings of the world. This understanding is the basis of the knowledge society, the basis of the service economy of late capitalism, and the innovations in communication arts and practices of the internet age. This understanding of knowledge and culture is also the foundation for understanding knowledge production and cultural production. It is not the commoditized object that contains the knowledge or culture; it is only in the mixing of the commoditized object with subjects that the subjects share in knowledge. In the processes of distributed cognition, which imply communication and relatedly negotiations with consent and dissent, the processes become knowledge. The knowledge society is not a society of knowledge objects but a society of people, and it is in the people that I find hope.

The conceptual relations that ground the relationships between labor, capital, culture, and knowledge in Wittkower's construction of revolutionary industry do not map onto the actual relations of cultural and knowledge production. By constructing the objective relations as he does, Wittkower's Marxist conceptual roots are based on the same roots as liberalism; in that shared foundation, he provides for the operationalization of precisely the modes of enclosure and colonialization of knowledge and culture that are found in neoliberalism. Given his understanding of the relationship between objects, values, and knowledge and the mediations of capital and culture, the revolutionary elements cannot be liberators, but will be leading the enclosure of our potential in neoliberal corporatization. This corporatization, objectification, and enclosure of knowledge and culture, I argue, is the basis for the

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growing shared alienation, whereas Wittkower ties that alienation to labor and goods. Contrarily, should Wittkower escape his model of the subject and the relations of knowledge and value, then move toward the model that I have elaborated, the liberation of knowledge and culture implicit in humanism is again possible.

The metacritique of Wittkower's cultural environmentalism requires the construction of the knowledge society based in distributed cognition, but it derives also from the phenomenological sense that someone else cannot objectify, commodify, or 'own' what is in our minds; corporations cannot own the processes in our minds which are our knowledges and values. Those knowledges and values are not alienable, but are subjectively experienced as ours through their communication. If we give up knowledges and values to objective relations, then we give them up to capitalist relations and when we will have given up our claims to our own minds, they will be owned to someone else.

2. Informational Cultures and Cyberinfrastructures

Cyberinfrastructures are the systems and structures that provide the basis for information-based development (Atkins and al. 2003; Unsworth and al. 2006). The internet, with its routers, fiber-optic cables, the computers with their processors, memory, monitors, and keyboards, and the systems that make them all function are what we mean when we say cyberinfrastructure. Most things that are labeled cyberinfrastructure exist on the internet between the user's terminals; such as terabyte and petabyte computing clusters, high speed research networks, and huge data

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repositories. Cyberinfrastructure conceptually covers all the infrastructures necessary for the information age. Cyberinfrastructure is the means of production of informational objects and the base of our informational culture. As an economic base, it has a central ideological function that defines relations in our informational culture. That function is based on certain central social and technical assumptions about identity, the capacity to act based on identity, and the modulation of that capacity (Deleuze 1990, 1992).

Those assumptions are the basis for the control society, for reflexive modernity, and for our consumer society (Deleuze 1992; Beck 1992; Beck, Giddens, and Lash 1995; Baudrillard, 1998). These three descriptions of society all participate in contemporary capitalism; they share fundamental assumptions of capitalism such as: the distribution of goods and risks, the assumptions of control of production and relatedly control of populations required by capitalist modes of production. In relation to those assumptions, we create the signs, codes, rules, norms, and laws that govern our relations to the objects of our life (Thévenot 1984, 2001). These assumptions of capitalism have moved beyond their myths of origination and have become institutions of our political economy. These mythogenetic institutions are of legitimation, reflexively reconstructed based on our current social forms into places where they need not exist, following trajectories based on pasts that are frequently fictionalized in order to provide the apparatus to justify their current juridico-discursive regimes (Foucault 1990). People tend to use past patterns to make

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sense of new patterns; in those heuristics, they make novel techniques look and operate nostalgically as metaphors of a misremembered time. These ill-formed conventions and organizational principles, drawn from an obscure and fabricated past, inform our future. The banality of the institutions of the society of control is founded in our everyday lives and the reproduction of culture, organization, and meaning of our intersubjective domain.

There is not a new colonialism of informational capital as Wittkower argues, but instead we have the obverse of the extension of our current conventions and their meanings. Our organizations always look like colonialism in the obverse because they are all extensions of our past conventions as reterritorizations. Colonialism, like imperialism, and capitalism as extensions, become translations of everyday conventions. They are seemingly dominating and transforming those conventions into a new intersubjective domain where they may be unwanted. These conventions may resonate with people's memories and respective narratives, especially in respect to differential power and knowledge. We can see this firstly in the organization of the protocols of the internet, which clearly reflect the borrowing and translating of bureaucracy and related necessities of dis/organized capitalism (Offe 1985; Davis 2003; Gershenfeld, Krikorian, and Cohen 2004). Similarly, the way we organize informational capital, such as intellectual property, is conventional (Lessig 1999). Intellectual property is intertwined with cyberinfrastructure is not a revolutionary construct but conservative one, as it borrows conventions and tradi-

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tions from physical property and rewrites them as an apparatus which provides its justification. Intellectual property as part of informational culture is a new normal based in the practices of the banalities of everyday life. This new normal is part of the problem that Wittkower misses as it is based on the assumptions objectification of knowledge and culture found in his account and the neoliberal account. We will always have colonialization of knowledge and culture as long as knowledge and culture are commodities instead of processes.

3. Individuation Contra Peer Production

Other norms come into play as one looks at how communal production and distributed cognition is undermined in our informational culture. One norm of computing, and by necessity a norm of cyberinfrastructure, is centered in reflexive modernity; this norm waylays the construction of Wittkower's new communal production. The cultural norm of individualism is central to modernity and its self critique. Individuation as the process and individualism as the norm are pervasive in computing which co-produces the cultural norm of individualism in capitalism (Beck et al. 1995; Beck-Gernsheim and Beck 2002; Lyotard 1984). After the period the initial systems of computing where time-sharing was managed by people and bureaucracy, individuation and bureaucratic control of users has been built into computers and cyberinfrastructures (Salus [1994] 1995; Ceruzzi 2003). One standard tool for the management of the computing population that arose early was the idea of the computer user, which was given capacities in the computer system,

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and could belong to groups, which would also be a medium to transmit, restrict, and modulate user capacity. Users and groups are systems of control, ordering, and governance of users through categorization and incapacitation.

The metaphorical 'universal machine' of modern computing is not predicated on freedom, but limitation, control, and the modulation of user behavior. Every function of the computer or computing environment does not necessarily serve to empower users. From the interface to the processor to the networks, there are systemic structures of control and individuation. The individual is designed into contemporary computing at a basic level of interaction. All interaction is mediated on an individual level and at best this action only surpasses individualization in custom designed interfaces for some games. However, most experience of computing is an individual at an individuated screen working on an individuated keyboard. As the computer progresses toward commodity device via mobile computing vectors, individuation is following along. Escaping the construction of one's computer identity is less and less possible as participating in the consumer society is becoming participating in the information society.

Cyberinfrastructure is based on individualist and consumer-based understandings of its users. These understandings are apparent in the manifest affordances of the technologies as they are designed. From the technics of screen, keyboard and chair that construct our body in relation hardware, to the individual log-

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in, personalized interface, and private password that construct our identity in relation to software, to the credit cards, electronic signatures, IP and MAC addresses that enable the Trusted Computing(TM) required for establishing our consumer habits on the internet, computers are constructed on the assumptions of users as individual consumers participating in a consumer society.

The cyberinfrastructures of science and the cyberinfrastructures of consumption are both cyberinfrastructures of knowledge production and cultural production. Seemingly the construction of cyberinfrastructures in the realm of sciences and technology would not necessarily feed into the cyberinfrastructures of consumption in a modern world, but in reflexive modernity the border between the knowledge society and the consumer society is arbitrarily enforced by boundary workers in all disciplinary arenas and undermined by their actions in our everyday lives. This is not to say that knowing and consuming have become the same, but to say that in many of our everyday capitalist conventions; consuming is a metonym for knowing. As the distinction exists but the usage collapses, the meaning of the terms become ambiguously related and in that relation there is evidence of the new modes of valuation of capital.

This relationship between the labor of consumption, knowledge production, and cultural production is found in works on produsage and consummativity, but more generally, the relationship is centered around capital and its valuation

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(Baudrillard 1998; Dant 1999; Bruns 2006; Bruns 2007). Capital in the form of objects, capital in the form of knowledge and capital in the form of culture have become equivocated in terms of valuation, which in turn relates back to the construction and valuation of cyberinfrastructures. For the cyberinfrastructure of knowledge relies on the same conventions and norms as the cyberinfrastructure of consumption and the labor of knowledge consumption ends up similar to the labor of consumer consumption, especially in the realms of fandom and celebrity cultures (Jenkins 2006). The cyberinfrastructures, which could seemingly be separated, are one cyberinfrastructure, and the legal systems surrounding them, such as copyright and trademark, do not differentiate in any substantive manner.

The problem once again is one of objectification of knowledge which must occur for knowledge to act as a commodity to be consumed. In cyberinfrastructures, documents with information in them become property of individual users; these documents are inaccessible to others unless they are shared via special or novel technologies. The metaphor of ownership of information has transformed our understanding of knowledge in relation to consumption, and in that transformation we can locate the central issue of the value of knowledge production and consumption, that of the objectification of knowledge and the denial of its intersubjective, processual nature.

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4. The Affordances of Open Source as a Differential Mode of Production

Open source and peer production do not escape the affordances of the technologies they use; they do not escape the norms of cyberinfrastructure. They still rely on the same affordances and we construct the same conventions as other software either through interface abstractions and universalizations, such as the world wide web's Amazon One Click purchasing, or our almost universal tool-bar based word processing as found in both Microsoft Word and almost all open source word processors. These conventions of the interface form practices of everyday life and become a de facto politics with a technological deterministic antipolitics in the Bourdieuan field constructed from popular discourses of technology. The deterministic antipolitics center on the encoding of the idea that the systems are built or designed with affordances for the users that are supposed to direct and limit the possibilities for use. The politics exists in the building of the interfaces, the chance for change and the chance for revolutionary difference. However, the politics are limited by norms which are frequently based in research which constructs, quite similarly to the computer, the human as an individual without distributed cognition or intersubjective domains. The research forms the justification for the design of the interface, and it reflects the norms of the interfaces that people have learned to find effective. We have the dialectic of convention and its justification occurring in this continual reproduction of the perfections of the interface of the universal ma-

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chine as machine of control. The politics of norm breaking/norm creation confronts the antipolitics of social reproduction and research; generating the next generation of sameness and difference in a manner that maps very closely onto the generation of consumer branding in the process of constructing and deconstructing markets. The affordances of the interfaces rarely, if ever, provide for any revolutionary mode of production, contrarily, radical changes in interfaces seem to generate from the antipolitics of a nonparadigmatic computer system, such as the Apple Iphone, the OLPC, and the Violet Nabaztag. The affordances of open source and peer production are, as such, vehicles of cultural reproduction more than vehicles of revolution.

The everyday lives of computer programmers associated with peer produced projects are rarely in any way revolutionary, though there are the occasional exceptions. Instead, the mode of production that they exist in is less one where they have escaped their mode of production in capitalism, but instead one in which their leisure time, their hobbies have come to participate completely in the same modes of production as their work lives. So long as they have access to the technical infrastructure to produce their code and distribute it, the mode of production is not revolutionary, but merely expansive. It is the reterritorialization of their leisure time by their labor and related interests.

So the differences of open source and peer production tend to produce more

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of the same in normal relation to the extensive division of the marketplaces in which it participates; it produces normal goods that compete in capitalist relations. The differential mode of production of a normal set of practices of an open source programmer produces multiple outcomes that not only reproduce software, but reproduce its interfaces, reproduces its norms, and reproduces its sociology of knowledge. The differential aspect occurs when the software confronts different users with different knowledge bases, thus spinning out different sets of codes and conventions by user and group. Open source software and peer production, while seemingly novel, are not novel at all, they are conventions, codes, and systems of reproduction structured on prior conventions, codes, and norms. The multiple outputs of content creation and software production are still realized in the realm of capital and consumption where the idea of 'free as in beer' is a metaphor necessary to hide the multiple forms of capital required for production (Weber [1996] 2004; Torvalds and Diamond 2002).

5. Alienation in Relation to the Mode of Production

The mode of production of capitalism centers on the reproduction of capitalism and its problems in relation to modernity and its reflexive critique. The mode of production then is that which reflexively reconstructs the relations, forces, and means of production in ways that emphasizes the problems and risks of modernity. As argued above, cyberinfrastructure emphasizes the risks of individuation and its relation to the production of subjectivities. In reflexive modernity, the civil social

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order recreates our risks and problems into rational, manufacturable and accountable systems (Beck et al. 1995:10). Fundamentally, this is the demand for control, and this demand for control in the face of uncertainty, risk and shared problems is the basis for alienation from both our shared collectivity and our labors (Beck et al. 1995:10). The alienation of our labor is at best metaphorical and at worst metonymical for the alienation based control and its generalization. The alienation that one feels by participating in capitalism is not an alienation of what we have produced, but an alienation based in what we can produce in a system of instrumental rationality and individual accountability.

The alienation felt in reflexivity modernity is an alienation based in the desire for autonomy, the desire to tell our own stories, and more importantly the ideological structures that say that individually, each person must be the center of his or her own narrative. This biographical production of subjectivity found in reflexive modernization feeds into the capitalist mode of production through management practices, such as taylorist time studies, self reports and individual annual reviews. These documentary practices narrativize our lives to others, objectifying it as goods operating in the political economy. That we tell our stories as individual and center ourselves there, even when presented with the co-production of software, the peer production of the internet. The problem that we feel, the problem that generates this sense of alienation, is not the feeling of labor lost, but of collectivity lost. Our alienation is not that we have lost ourselves in the production of the

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commodity object, but that in the production of the commodity object we have lost each other. We have to describe it in terms of individualized production, in terms of our individual contributions, our individualized narratives.

6. Corporatization against Collectives: the Leviathans of Contemporary Capitalism

This inability to construct an identity other than the individual is seen clearly in the reconstruction of this individual identity through corporatization of collectives such as has been seen in science and research (Newson 1998; Cannella and Miller 2008). In that corporatization has occurred in universities and research institutes worldwide, it should not be surprising that it exists in peer production and open source communities. The re-creation of the many people working in concert as a collective into the body of the corporation is the creation of the leviathans of contemporary capital (Hobbes 1994). In uniting the many into the one, the corporation creates a common good that is separate from the individuals, but to which the individual can contribute. We can see the creation of many leviathans of contemporary capitalism recreated in the open source boom and the web 2.0 boom. From the Mozilla corporation, to Apache Corporation, to Facebook, flickr, and Twitter, the necessity to build the new whole that is the leviathan is found in the realization that the new whole can be worth more than any reasonable construction of the labor or any real construction of the ideas involved. That the leviathan is greater than any valuation of its parts indicates the break of valuation in capitalism. The hyperbolic valuation in both booms relates to the way the leviathans of contemporary

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capitalism work. They work through the alienation of collectivity in favor of the one and in re-embedding the stories of the many into the one they recreate possibilities of valuation untied to the individualized projects.

This lack of tie of the individualized corporation to the individualized people is a key move in capitalism as it introduces the possibility and virtuality of mediation. The leviathan as mediation between the many and the one is important because it allows the construction of the new identity, the telling of new stories, and the rebranding of the whole. This new whole is distanced from the people who form it, becoming its own entity, its own firm, and operates separately from the interests of the people involved in it.

This mediation of interests in peer production and open source operates through the original collectives or later through their leviathans. It is through the leviathan that we come to terms with the recreation of consumer of open source and peer-produced materials. Without the leviathan, the collective rarely if ever has the capital nor the political direction to construct first the audience then the consumer of its production. It is the integration of the new participant in capitalism, the creation of the corporation, that we generate the market and with that market we generate a whole secondary set of relations and conventions to the objects we produce (Amin 1995; Baudrillard 1998; Castells 2002). This set of relations and conventions relates to the construction of the parties that are outside of the corpora-

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tion. That is to say, the construction of the clients, the audience, and in the end the consumer of the corporate provided goods as 'other'. It is in this creation of this second set of relations and conventions that identify the producer/consumer and thus insider/outsider dynamic that generates a sense of alienation of the people who are within/without respectively to each other as individuals. The user of YouTube and the contributor to YouTube exist in a different relation than the original mixed collective of mashup producers distributed around the internet before YouTube. The nature of the social and conventional differences is the core of the issue of ownership in peer production and open source software. The idea with either open source or peer production is that anyone could be on either side of the production/consumer dialectic. In that 'realization', we are not changing the organization, interests, or needs of the leviathans of contemporary capitalism, nor are we creating a new class of prosumers, or a new revolutionary mode of production, what we are creating is a new way for capital to accumulate in corporations.

Like Hobbes' leviathans of the state accumulating and representing power and capital, the leviathan of contemporary capitalism is the creation of a new identity, a new center for accumulation of capital, codes, conventions, and mediations, and in the creation of the new identity, you create and represent a set of interests. In that the collective that creates the leviathan, such as creators of mashups, have different interests than the leviathan, YouTube/Google, then there will be disinterest and dissent. These are also easily found on the internet with innumerable

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posts about the problems of YouTube, such as intellectual property claims, hate speech claims, and sexual content issues. There are even sites created to show you those things that YouTube has taken down, and then websites that represent what cannot even be shown on YouTube. The proliferation of data points railing against uniform identity can be found for all peer production and distribution systems. We need not look far in open source production either. The persistent problem of the forking of projects is an obvious example, that is when one set of programmers produce a code branch that becomes independent of the original branch and starts a new project following a different path; thus duplicating the work of others and dividing the audience. These divergences from the corporation as the unity of representation of the project are significant in that they highlight the pluralization of identities in relation to individual narratives, as in each of these cases the technological systems are built to recognize and promote the individual and their stories above the needs, real or perceived of any construction of the collective.

We need to be wary of explanations of binarity in describing the operations of capital, as in each case the leviathans of contemporary capitalism do not ally as a whole in operation against any subset of users necessarily. On the occasion that they create new, larger wholes, such as the MPAA, RIAA, or the BSA we have to realize that the interests of the new whole are not really the interests of those it seeks to represent, this is clear from the numerous releases of open music and statements against these corporations by their own constituents. This indicates that

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while we do have an age of leviathans that represent themselves as sovereign people serving communities of producers and users, we also have a proliferation of dissent from those leviathans. However, we should not assume that open source software or peer production operates outside or differently within the corporation, as the operations of the dominant paradigm and its conventions tend to control the long march through the institutions. It is that long march through institutions that tempers and recreates the conventions and practices as amenable to current modes of production, taking the radical potentiality of the collectives and processing it back into individuated production.

This accretion of capital in corporations is made possible by the construction and conventionalization of intellectual property rights. Those in turn are based on a misconception of knowledge and culture as commoditized objects. The capital accreted in corporation is valuable, but it is not valuable necessary to individuals as persons as much as systems for reproductions of the valuation of capital and the extension of value in that reproduction. The value of the leviathan is not in its corporate body, but in that body's symbolic regime, the institutions and institutionalizations it creates, and its projection into the future. If we can manage to promote an understanding of knowledge that contradicts the justificatory apparatus for intellectual property, we can undermine the legitimation of the institutions.

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7. Conclusion: Rethinking Value and Informational Cultures

In our current informational culture, Marxist (and likely other) interpretations require adaptation because as our plural cultural and economic systems change, the modes of analysis for those systems must adapt to the extent that the analysis needs to continue to map onto the practices and economics of the peoples. No singular perspective seems to be able to map onto all times and all places in any universal sense. Marxist analyses of the current informational culture and the related political economy frequently try to be universal and in doing so they lose the facts of our world in the face of the world that was the basis of Marx's analysis. Specifically, a Marxist cultural economics centered on labor-value as Wittkower uses no longer seems to capture or even apply in our informational culture. It has been surpassed by Baudrillardian economies of signs and desires as emphasized in his analysis of the consumer society in which we live (Baudrillard 1998). Value in our informational culture has become a free floating code of signs and conventions, less based on any reflection of the objects or labor than in the conventions surrounding the objects, and the consummativities of those objects. When confronted with the consumer society in our informational cultures, a reprisal of labor theories of value fails to capture the complexities of value found in the consumer society. Labor, as such, has failed to become abstracted from value and instead has become the metonym of value, but that metonymical relation exists in a field of near infinite transposition with other concepts that are also the metonym of value, such as

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desire, symbolic meaning, and humor. Each possible transposition indicates a possible alternative meaning with its interpretation and in that the mode of valuation is increasingly disjointed from the mode of labor. This disunion of reference through metonymical relations indicates over time that the labor theory of value is not really an operating system of value, but at best one set of tenuous relations between a laborer and an object of desire. The labor theory of value is a system of objectification of value that fails to operate in a world of subjective interpretation of values.

In all cases of value, we are confronted with questions of modernity, questions surrounding the purity of the concepts, questions around the relationship between simplicity and clarity, questions of humanisms and antihumanisms, and ultimately questions of the nature of knowledge. In our questions of modernity, we are confronted once again with the choice of modernities and within the modernity we choose, the form of informational culture which rests on its assumptions. Should we choose a modernity based on the isolated cartesian models of knowledge that objectify and construct knowledge as external to us, or should we follow Montaigne and recognize that knowledge is a process, a reflective process of constructing the world within us to relate to the world outside (Toulmin 1992)? It is in this recognition of modernity, and its internal self-critiques, that there is the space to return to Montaigne's construction of knowledge, and through that construction we can resist the objectification of knowledge in relation to the objectification of

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value.

These choices, like the analytical perspectives that devolve from them, inform our understanding of the questions, concepts, axiologies and axioms that we use. The problem that I am pointing to is not one of Marxist analysis, but one of the acceptance of certain terms of Marxist analysis and what those terms cover in modernity. The meaning of those terms are bound up in an ongoing process of disensual resistance to modernity. To say 'labor', is not merely to name a process, but a people, and beyond a people, it names a nearly infinite linguistic process of negotiation in everyday life that constructs and legitimizes relations in society. In using the labor theory of value, we are invoking a construction of reality that legitimizes and delegitimizes elements of people's experiences, their everyday lives, and in that we need to insure that we construct their everyday lives in relation to the reality we are constructing in our analysis, lest we pass the negative implications of our perspectives into reality (reifying problems without providing solutions).

As such our perspectives play their part in reflecting how we consider knowledge production and relatedly cultural production. By constructing this critique of the informational culture in modernity a consistent awareness of being one of many competing alternative understanding of reality pervades the text. It is not merely our construction of the theories we use which informs people, but also the competing viewpoints which are part of the mode of production of knowledge and

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are part of the conditions of knowledge production in our society. Realizing the plurality of perspectives and their relation to models of knowledge production in the informational culture, our perspective must account for the plurality of normativities constructed within them. Critical and reflexive analysis, as such, must move beyond dismissing the relative goods of one account over another and recognize why that account has become the legitimate or illegitimate choice for those people using it.

In this meta-critique of Wittkower, I have attempted to show that there are several issues with his account of revolutionary industries. I have avoided his reconstruction of the problem of copyright to center on the reasons why copyright and the current legal framework is not the core of the problem. Instead, I identify the core of the problem as a cultural issue of modernity and capitalism. We have a problem of objectification of value, knowledge, and culture, which allows for their commodification. I have identified places where given current practices and computer systems, the revolution that Wittkower suggests may happen, will not happen.

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FastCapitalism is happy to confirm that Jeremy Hunsinger has the copyright on his paper:

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and can use it as a chapter in his dissertation.

best,
ben

From: jeremy hunsinger [jhuns@vt.edu]
Sent: Wednesday, May 27, 2009 1:22 PM
To: Agger, Ben
Subject: Permission to use letter/email

Hi Ben,

I need a permission to use letter/email for the chapter:
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Given that I retain the copyright according to FastCapitalism, could you just write something above this to this account.

I'm going to staple this response as the final chapter of the dissertation so i can graduate this summer and go on to pursue other things.

The letter/email should say something like:

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Jeremy hunsinger
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