

The Life Cycle of the Computer: A Study in the Materialities of Risk

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Abstract

The environmental effects of personal computers, from dangerous chemicals used in chip production to e-waste, have largely been ignored in pop culture, mainstream media, and much academic research. In order to take up these questions, this dissertation pursues a cultural study of the personal computer. The life cycle analysis (LCA) is a scientific method that calculates all the resources used in the life of a given object, from resource extraction, production, use, user, to disposal. As partial method for my study it brings an environmental accounting, as used in the sciences, and a structure to my cultural study, which approaches the computer as a cultural artifact. In order to more fully consider cultural aspects from daily personal negotiations to larger political questions, I extend the LCA with assemblage theory to consider the social and representational spaces associated with computers and the environment. What my primary sources have in common is that they represent moments of visibility of these problems. My research sources include documents from news media, policy papers, art practice, management discourse, corporate texts, and activist reports. The relative absence of these topics in academia, the news, and popular culture functions as the structuring absences of this project. A large part of my work has been to follow these fleeting moments in academic and mainstream sources. Because of the emphasis on the visual in our culture, my central problematic involves theorizing the visible, especially in relation to the visual, in risk culture in order to theorize how and why environmental risks remain outside to so many understandings of computers and the information age. I argue that to fully understand the environmental effects of technological culture we need to examine six interlocking factors: notions of materiality and immateriality; the geopolitics of toxicity and risk; the shift from industrial

to risk society; cybernetics and the environment; the relationship between visibility and
visuality; and risk culture.

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Introduction

Many thinkers see computers as the defining technology of the millenium. Behind this bold pronouncement lies the banal reality of internet shopping, online porn, email, and the extensive use of personal computers for work. The personal computer is both product and driver of larger societal shifts related to information society: technological innovations like the microprocessor and the internet; major economic reorganizations in manufacturing, education, and office work; and changes to our experiences of time and space, especially the growth of simultaneity, speed, and acceleration. The introduction of the personal computer is generally traced to the release of the IBM personal computer in 1981. This designation primarily refers to portable machines with data storage and computation capabilities and distinguishes them from their mainframe predecessors. IBM's aim was to have a computer on every desk, and this objective has been surpassed considering that many Canadians have a computer at home, work, and school (Matthews and Matthews 19). With corporate policies of obsolescence, consumers must buy new electronics with galling frequency in order to stay current. Most of us have a few old cell phones or computers stashed away in some drawer or closet. Each generation of personal computers is not only better, faster, cleaner, but also smaller, and smaller machines require more resources to produce them. Correlatively, these machines have increasingly shorter life spans.

With the production of computers - from resource extraction through mining to the manufacturing and assembly of components and their disposal - come major ecological impacts. At the heart of our technologized culture is a contradiction between consumer culture, which enhances our romance with electronic gadgets, and the

increasing devastation to our environments and health, often as a result of the daily processes of capitalist production. The day to day reality of our romance with these machines (at least in wealthier communities) is often defined by small frustrations and pent up rage related to the daily maintenance of life in the information age: checking online bank accounts, negotiating new quirks resulting from weekly coercive software and security upgrades, and overflowing inboxes in multiple email accounts with multiple and rotating passwords. These annoying negotiations are overlaid with the anxiety related to risk society: avoiding ingesting pesticide residue in our food, figuring out if we have radon in our homes, minimizing exposure to ionizing radiation from our cell phones, as we adjust to the "new normal" of extreme weather events. These affective states are increasingly negotiated or produced by our interactions with computers, which are central to larger socio-economic and political structures of the information age and to the crisis culture related to large-scale environmental problems. In order to theorize these growing contradictions I take apart the personal computer and do a cultural study of it by analyzing its life cycle from resource extraction to production, use and user, and disposal. In doing so, I attempt to bring the life cycle analysis into cultural studies, a strategy that has been pursued by very few scholars, with Du Gay et al's *Doing Cultural Studies* as a notable exception. I argue that the environmental risks associated with personal computers get taken up in particular and limited ways in visual culture so that they are often obscured, and rendered less visible and less comprehensible.

The materiality of computers and other microelectronics is repeatedly ignored and misrepresented in media and cultural studies. In his essay "Out with the Trash: On the Future of New Media," Jonathan Sterne points out that much of the research in media

studies on computers focuses on the internet, online communities, and their disembodied effects. He reminds us that not only does the user have a corporeal body but that the computer has a physical infrastructure including the “keyboard, mouse, monitor...computer...[some kind] of connection, routers, servers, T1 lines, backbones, switches...” and so on (Sterne 17). It is only by examining the materiality and perceived immateriality of the computer that we can begin to understand its environmental impact. Life cycle analyses are important tools with which to account for those processes and by-products historically framed as side effects or externalities. They offer an entry into an environmental accounting of the materiality of high tech for media and cultural studies scholars.

Scientists have begun to do life cycle analyses to calculate the environmental impact of a given product at each stage of its life: material extraction, material processing, manufacturing, use, and disposal (Matthews and Matthews 23-4). Eric Williams and his colleagues at the United Nations University in Tokyo do life cycle analyses of high tech devices and they estimate that 240 kilograms of fossil fuel, twenty-two kilograms of chemicals, and 1500 kilograms of water are required to make every desktop computer (E. Williams 67-8). The massive use of water is problematic because it puts pressure on already strained water resources in many communities and because it becomes waste water.

As Williams says,

the amount of materials used to manufacture a computer chip these days is hundreds, if not thousands of times greater than the quantity actually embodied in the chip. This makes the weight of the chip a misleading

indicator of the amount of materials used, and it means that people ... who have cited microelectronics as an example of radical ‘dematerialization’ have misunderstood the situation (qtd. in Grossman 62).

In fact, the ecological footprint of electronics becomes larger as devices get smaller. This is counter-intuitive as the miniaturization of electronics seems to imply that fewer resources are needed. Although fewer materials end up in the final product, more waste products, including water, are created in the production of smaller devices and machines. These misunderstandings about the amount of resources needed to produce hi-tech devices, the by-products created in production and the e-waste generated from these devices are endlessly repeated across scientific, mainstream, and academic literatures.

In this dissertation, I bring critical cultural theory and risk society theory into the life cycle analysis framework in order to theorize the risks associated with the personal computer. I take apart the personal computer, and in each chapter I explore the risk associated with a particular stage of the life cycle from resource extraction, production, use and user, to disposal. Tracking the actual minerals, metals and plastics that make up the components of my computer and the precise routes through the global trade in electronics is incredibly difficult, if not impossible, due to the rapid innovations in the materials used and secrecy of the industry. Moreover, this approach does not get at the larger political, structural, and discursive issues that extend ideas of the perceived immateriality of these machines and how this understanding contributes to ongoing environmental degradation. But the life cycle analysis functions as a reframing tool for cultural theorists so that we might interrogate not only how we have typically structured our conversations about media, as Sterne notes, but also how we might build a materialist

environmental approach to cultural studies. I argue that to theorize the current state of technological culture and our relationship to the environment from a cultural studies perspective we need to examine a set of interlocking factors: notions of materiality and immateriality; the geopolitics of toxicity and risk; the shift from industrial and risk society; cybernetics and the environment; and risk culture as it relates to the affect and aesthetics in our relations to machines.

The Interlocking Factors that Underlie this Study

Joost van Loon's work on risk and technological culture provides a useful framework through which to understand the ecological impacts of technological society because it deals with how environmental problems exceed the institutions in place to deal with them. This is especially useful for understanding complex technologies such as computers and explains how the production of hazards is legal and maintained by said institutions. Coined by Ulrich Beck, the term risk society describes the shift of balance in the promises of modernity where the unwanted consequences - such as nuclear, chemical, ecological, and biological threats - of any given thing begin to overtake the desired effects (Beck, *Ecological Enlightenment 2*). For example, given the positive and desired outcomes such as the efficiency and speed of work and communication afforded by personal computers, pollution and waste are generally considered side effects or externalities. What marks risk society is that threats such as pollution, the depletion of resources, and dangers to human and nonhuman health cannot be contained by those social institutions responsible for governance, production, and so on (Beck, *Ecological Enlightenment 2*).

In order to properly understand the materiality of the computer, we need to account for the sheer volume of machines that are produced and then trashed soon after. The need for frequent upgrading, and the subsequent trashing, of computers is often attributed to Moore's law, named after Intel's founder Gordon Moore, which states the capacity of semiconductors will double every eighteen months thus rendering the previous generation outdated. Being couched in the language of "law" gives these technological changes a weightiness and inevitability, but I would argue that the responsibility lies equally in the corporate policy of planned obsolescence that seeks to ensure growing profits. Sterne shows that in order to use one's computer the user is forced to stay up to date as peripherals, software, and hardware are not generally backwards compatible for any length of time (Sterne 24). A computer is usually only "new" for about six months, after which the monetary value of the machine drops significantly, although typically it still functions as intended (Sterne 24). In her essay, "Falling Apart: Electronics Salvaging and the Global Media Economy," Lisa Parks establishes that distinctions between "old" and "new" media technologies are directly linked to corporate policies of planned obsolescence. In other words, when studying "new" media technologies we must be alert to corporate agendas, which rarely invite discussions of the larger labour or ecological problems associated with a given product (Parks, "Falling Apart" 33). Although the personal computer can hardly be described as a new technology any more, constant software and hardware upgrades mean that a discourse of newness accompanies these machines. The technology sections in most of the newspapers I read regularly are barely distinguishable from advertising about the same products in their praise of the latest upgrades, applications, and so on.

Staying current with technologies, including personal computers, is presented by educators, politicians, activists, and others as necessary to the economic and social wellbeing of a community (Selwyn 342). The term digital divide is used to gauge computer and internet penetration into a given community or population. In the North American context, the term has been used by activists to make a case for providing computers to disadvantaged communities, especially to youth and schools in poor neighbourhoods. The term is losing its relevance in the North American context as computers increasingly become part of the infrastructures of education, communication, and business. Some researchers caution that the digital divide is increasingly defined in wealthier countries not by whether or not someone has a computer but by how current their computer and associated software are. Looking at penetration rates for personal computers, in 2014 a relatively small percentage of the global population has access to computers and the internet, most users are in rich countries and communities. The continent of Africa, for example, only has about 9.8% of total global internet users (internetlivestats.com). If we reframe the discussion to consider the environmental and health effects of personal computers a very different picture emerges. If a person or community is more likely to have access to a computer or internet, they are less likely to be exposed to the environmental burdens, specifically the toxic pollution associated with the production and disposal of electronics. The term digital divide works to conceal these effects because it frames our understanding of the computer only in terms of the perceived benefits for users. Mining practices, silicon chip production, and e-waste all have potentially devastating effects on ecosystems and worker health, and long after the production is gone these effects remain in the form of polluted groundwater, disease, and

other associated problems. If we are to properly understand the risks of personal computers, we need to reframe the terms of the discussion to consider the less visible geopolitics of toxicity and risk associated with these machines. The term digital divide is often a part of the apparatus that renders invisible the environmental risks associated with computers.

Ulrich Beck's risk society thesis traces the transition from industrial to risk society. Risk society is marked by the perception that the proliferation of "bads" is overtaking the production of "goods." Beck locates the shift in the postwar period, especially with the emergence of nuclear and petrochemical industries (Beck, *World Risk Society* 53; van Loon, *Risk* 29). In industrial society hazards and risks are known, but generally framed as side effects or externalities given the larger social benefits of industrial production and related processes. In risk society institutional attempts to contain side effects, including ecological devastation, result in the further production of hazards and risks. For example, government regulations that seek to limit contaminants in drinking water through maximum concentration acceptable (MAC) guidelines of pollutants, such as pesticides, also work to normalize this pollution, and thus allow for their production and use to continue. (These guidelines also do not typically take into account the interactions between various chemical pollutants.) Beck suggests that one of the major changes that comes with risk society is that all people are equally affected by hazards, leaking radiation from nuclear power plant will harm everyone in its proximity and elsewhere, for example. The environmental justice movement provides an important corrective to this misconception, as many authors and activists have convincingly demonstrated that poor people and people of colour are disproportionately on the

receiving end of the effects of pollution, global warming, and other environmental problems. Ursula Heise contrasts the underlying politics of risk society as attributing environmental problems to the failures of capitalism, as outlined in Beck's work, to those of environmental justice theorists who locate ecological destruction as symptomatic of the inequalities created by capitalism (Heise 149).

Most of the institutions that regulate and enforce environmental degradation occur at the national level and for this reason risk society is best understood as a world risk society. Corresponding directly to the geopolitics of toxicity and risk, much of the toxic production and disposal of computers happens in China, India, Ghana, Nigeria, and other poor countries with lower computer penetration rates, while design and software development is typically done in North America, Europe, and other wealthier communities with high rates of computer use and ownership (although this is changing; see Nakamura and others in on the outsourcing of coding to China). The European Union has some of the most stringent environmental laws in the world, which prohibit the use of toxic substances in electronics, and they also have some of the most advanced electronic reclamation facilities (Grossman 10-11).

The emergence of risk society in the postwar period corresponds to the introduction of the term information society, first used in the 1950s by Fritz Machlup to describe increasingly large segments of the US population working in knowledge industries, including education, communications, finance, and research. Katherine Hayles' research on cybernetics shows that as early as 1950 information became defined as an informational pattern and she argues that this definition has had profound impacts on how we understand materiality, immateriality, and information technologies (Hayles,

How We Became 1). She argues: "information lost its body" (Hayles, *How We Became* 2). Part of this belief is that human consciousness became equated with information patterns, contributing to the idea that human minds can rove cyberspace leaving their bodies behind, most famously exemplified in William Gibson's *Neuromancer*. It has also contributed to the idea that cyberspace and digital information are immaterial, despite their instantiation in a medium, namely microprocessors. The belief that human minds and information do not need a body, biological or machinic, makes it incredibly difficult to understand, let alone theorize and act on, the environments in which they exist.

The invention and widespread use of microprocessors starting in the 1970s marks a new stage of information society. Nigel Thrift argues that software has become infrastructural because it is embedded in so many of the daily technologies that shape daily life and practices, from coffee pots, to cell phones, shipping and delivery systems, accounting, banking, lights and so on. Computers are implicated in risk and information society in complex and interconnected ways. While other technologies such as cars are more polluting in use, personal computers are more environmentally harmful in production and disposal than in use. Technology plays an important role in risk society, giving us the tools to analyze risk even as they are a major contributor to environmental risk. Computers are incredibly environmentally hazardous and this is exacerbated by their ever-shrinking use phase, through which more machines are manufactured and then trashed sooner, putting enormous strain on natural resources. The use phase is also when associated applications are informational and therefore considered immaterial. And they are also crucial to the maintenance and production of daily life, including understanding and safeguarding against the very problems they help to create. Their ecological impacts

are far reaching just as they are also critical for communication, computation, and modeling, potentially to analyze those very problems caused by their production, use and disposal. Theorizing the relationship between the material and immaterial with respect to computers is critical to understanding the complex and contradictory ways that computers define information society, and contribute to the proliferation and management of risk.

The seemingly insurmountable contradictions at the heart of risk society are difficult, depressing, and can produce complicated reactions. The affect of risk society is reflected in an aesthetic and affective response characterized by a fluctuation between apathy, ambivalence, and anxiety. Risk society is marked by a sense of urgency that can be partly understood as reaction to information overload (van Loon, *Risk* 188). The reliance on technoscientific expertise, the very institutions that are responsible for but unable to contain the effects of risk, contributes to this overload and sense of immediate imperilment. Joost van Loon argues that this dynamic only adds to the proliferation of risk because it produces uncertainty and hasty decision-making (van Loon, *Risk* 4). I consider the discourse of risk from various locations in order to see how the presence and absence of environmental risk related to personal computers is created, transformed, and maintained.

Chapter Breakdown

Chapter 1. “Risk in the Computer Assemblage: Theoretical Framework and Methods”

In Chapter 1, I lay out the framework for theorizing the materiality of the personal computer. Together with the life cycle analysis, risk and assemblage theory are the organizing principles of this study and I theorize how they are driving a reconsideration of the literature of technology and the environment. Risk is by its nature virtual and I

examine how this plays out in visual culture and how risk is rendered visible and invisible in cultural networks. I finish with a discussion of the method for this project.

Chapter 2. “My Computer Disassembly: Theorizing the Material and the Visible”

In this chapter, I discuss the cottage disassembly of my old Mac iBook 3G. First, I locate its materiality as part of the production cycle. Then, I detail the materials that make up this machine. Finally, I theorize how we might understand this disassembly in terms of the relationship between the material, visual, and visible.

Chapter 3. “From Industrial to Risk Society: The Affect and Aesthetics of Mining the Computer”

Over half of the materials in the personal computer are metals and Canada is a world leader in mining. This chapter focuses on the mining of nickel in Sudbury. In terms of computers, nickel has been used in batteries, to connect layers of circuitry in microchips (although usually copper or aluminum is used), and is a waste product in semiconductor processing (Grossman 56 and 59). First, I use the example of nickel mining to consider the emergence of risk society out of industrial society in the Canadian context.

Understanding the shift from industrial to risk society allows for a detailed consideration of the mechanisms that enable the production, management, and proliferation of hazards and risks both domestically and internationally. Second, I look at how Edward Burtynsky deals with the themes of resource extraction, especially with regards to Sudbury, to argue that his work embodies the affect and aesthetics of risk culture, namely ambivalence and apathy.

Chapter 4. “Cybernetics and the Environment: Tracking Risk Through the Silicon Valley Immutable Mobile”

This chapter considers cybernetics and the environment through an examination of the emergence of the information age, with a focus on the birthplace of the computer, Silicon Valley, California, USA. Silicon Valley is produced in business networks as an economic model to be copied by other regions. The immutable mobile is a concept in science studies, which refers to a model that moves through a network unchanged. In this chapter, I consider how the Silicon Valley economic model can function as an immutable mobile. I argue that the circulation of this immutable mobile works to suppress the realities of ecological devastation and worker illness associated with the semiconductor industry so that the risk associated with the industry is framed only in terms business risk and rarely in terms of environmental risk. In the last section, I consider the limits of the Silicon Valley immutable mobile by examining the relationship between the counterculture movement in the US and the emergence of the information age with respect to environmental politics.

Chapter 5. “The Geopolitics of Toxicity and Waste: Cyber risk, E-waste, and the Digital Divide”

In this chapter, I argue that an expanded notion of the digital divide reveals a geopolitics of toxicity and risk whereby the penetration of the internet and computer use on a global scale is inversely correlated to the environmental risks associated with these technologies, especially with respect to e-waste. As in the previous chapter, I argue that anxiety about business risk and cyber risk dominate and conceal the environmental risks associated with the internet and computers. I chart how advance fee frauds, or 419s, coming out of Nigeria get reported in North American news as cyber fraud and how they can be related to the production of environmental risks and hazards. I consider how

coverage of Agbogbloshie, a dump in Ghana, is represented in the Canadian-made documentary *Ghana: Digital Dumping Ground* and the photographs of Pieter Hugo. Representations and understandings of risk mutate and shift in these texts and I argue that such images of e-waste ultimately function as a kind of risk containment strategy that conceals first world complicity in the production and disposal of e-waste.

Chapter 6. “Connecting individualization and environmentalism: What’s so personal about the personal computer?”

Personal computers became personal when IBM sought to differentiate them from their hulking mainframe ancestors. That computers are referred to as *personal* computers obscures the fact that they have become necessary to the fabric and functioning of what is now information society. As posited by Alan Liu and Ulrich Beck, with information and risk society comes individualization, or the orientation of risk and responsibility onto the individual. One area in which individualization is apparent is in the discourse of the computer user; software creators, service providers and other companies are continually striving for a “user friendly” interface. This discourse of user-friendliness constructs computer users as consumers in ways that disconnect us from the infrastructure of information society. Most markedly, environmental problems associated with computers in their production, use, and disposal are suppressed. In order to examine the implications for environmental discourse, in this chapter I compare how two very different users are constructed - the Mac user and the One Laptop per Child (OLPC) user.

Chapter 7. “Time, Space, and Waste: Bringing E-waste into Computer Time”

E-waste is one of fastest growing waste streams in North America. Joost van Loon argues that the risk society can be understood as the waste society. I argue that

whereas waste has historically been treated as a spatial problem, with a view towards containing waste in a geographical outside, it must also be understood through a temporal lens. As the policies of planned and perceived obsolescence accelerate the production and consumption of computers, more and more waste is created. The timescale of e-waste and other pollution must be framed in terms of the long term and, often unforeseen, effects of pollution through toxic chemicals released over time. First, I consider how recycling programs in Ontario have emerged and how they deal with the problem of e-waste. Second, I examine how waste is represented in e-waste art through the photographs of Chris Jordan, the WEEE Man project in England, and in the animated children's film WALL-E.

Chapter 8. "North American Risk Culture and the Turn towards China"

With recent political and economic reorganizations, China is simultaneously going through rapid industrialization and entering the information age. It has become a location of speculation and anxiety for North America, and has become a sort of repository for some of our anxieties about these processes. In this chapter, I return to Burzynsky's work to examine his China photographs alongside American Mike Daisey's monologue, *The Agony and Ecstasy of Steve Jobs*. Both their works have been hotly debated by critics, especially whether or not they are "political enough." In this chapter, I examine the works and their critical response to suggest that the work can be read as a part of the North American risk culture reaction to the organized irresponsibility of risk society.

1. Risk in the Computer Assemblage: Theoretical Framework and Methods

The personal computer as an object of study functions in two main registers in this project. Although I deal extensively with Apple because they exemplify many of the contradictions I am concerned with, this project is not a study of Mac but of the personal computer as a generic placeholder for all the PCs, computers, and laptops currently on the market. First, as an object, the computer - that hunk of metal and plastic on our desktop - is a box full of bits and components that have been put together and broken up again in a complicated pattern as they are shipped around the world. The life cycle analysis is useful for this aspect of the study. It allows for a materialist account of the resources used, the locations from which they are sourced, the methods of production, and the patterns of consumption. By bringing this analysis into cultural studies, we gain a more grounded view of the culture(s) of production and consumption. For example, a cultural studies' analysis might consider how computers are used in everyday life, and how this use relates to large social, corporate, and governmental power dynamics. Second, computers, and especially the internet, at least for a short part of their life cycle, are central to our mediascapes as spaces of representation, locations where social meanings are created, circulated, and transformed. This aspect of the computer is outside the scope of a life cycle analysis, but central to any cultural study, which enables a consideration of meaning and power as they relate to the computer as object of study.

In this chapter, I lay out the theoretical framework and method for this project. Risk and assemblage are the organizing principles of this dissertation and I begin by mapping out how risk might be theorized through assemblage theory. I move on to a

review of the literature on technology and the environment to argue that technology has been typically understood in much of this literature as created from or consuming nature, rather than as dependent on nature. Finally, I consider how risk is rendered visible and visual, especially in risk culture, a distinction I elaborate in a later section.

Risk in the Assemblage

The risk society thesis provides a critical framework through which to understand the environmental degradation produced as a result of the production, distribution, and disposal of the personal computer. Following Joost van Loon, I use assemblage theory to further develop Beck's concept of risk. Assemblage provides the theoretical structure through which to examine the risk produced as part of the life cycle of the personal computer. What the assemblage theory can do for our understanding of the personal computer is to complicate the life cycle analysis, which is a scientific and materialist accounting of the amount of resources needed to produce a particular product. Although assemblage theory lends itself to a materialist and environmentalist theorization of the personal computer, unlike the LCA an environmentalist politics is not necessarily inherent to it.

Writing about the assemblage Deleuze and Guattari state:

[T]he principle behind all technology is to demonstrate that a technical element remains abstract, entirely undetermined, as long as one does not relate it to an *assemblage* it presupposes. It is the machine that is primarily in relation to the technical element: not the technical machine, itself a collection of elements, but the social and collective machine, the machinic

assemblage that determines what is a technical element at a given movement, what is its usage, extension, comprehension, etc. (397-8).

Manuel De Landa extends and clarifies Deleuze and Guattari's notion of assemblage. As he explains, the assemblage can be described by relations of exteriority, rather than interiority (De Landa 10). Consider the example of an orchid. Described by relations of interiority we might consider an orchid on its own, but described by relations of exteriority that same orchid is impossible to understand without considering its relationship to the wasp that pollinates it (De Landa 10). In a relation of interiority a technological object is understood in isolation - a pen. Defined through assemblage theory, the same technological object is understood as a product of social, political, economic, and environmental relations. A machinic assemblage of the pen might include the hand, pen, paper, and intellectual and industrial linkages that reach through space and time to enable it, including plastics compounds and the food consumed by the writer.

The assemblage is a critical tool for understanding the computer as a cultural technology. According to Jody Berland:

...[a] cultural technology connects the various processes and practices that comprise culture: the materialities that produce it...; the geopolitical contexts within which such media emerge; the complex machineries of spatial dissemination through which their structures and materialities circulate and are put to use; the discourses and narratives through which such processes are made meaningful and familiar; the symbolic practices, disciplines, and forms of literacy and skill that arise in connection with them; the modes of political and corporate governmentality that define and

order these contexts; the responsive subjectivities acting within them; and the fissures and spaces in which oppositions or alternatives are inspired and imagined. (Berland *North of Empire* 12)

The personal computer as assemblage then includes not only mining, production, and disposal practices, but also those cultural notions of technology that shape and limit our interactions with nature and technology, including concepts and processes that produce and govern risk.

Considering the personal computer as an assemblage emphasizes it as part of a network of processes, relationships, ideas, and objects. It can reveal some of the environmental risks actualized by the personal computer and also how those processes and institutions work to contain and manage those risks. Understood through relations of interiority and exteriority, computers are complex because they are both nodes and systems in risk society. The interiority of a computer is more often described in terms of software, operating system, or data storage capabilities. If we consider interiority literally, it is difficult to find out precisely what is inside a computer, in terms of materials (as I discuss in the next chapter). In fact, computers tend not to be theorized in isolation (like the orchid as organism, or pen as technology). To some extent, the computer is already understood by its relations of exteriority, as a node in the worldwide web, connected to the cloud, or as a communications technology. However, critical relations of interiority and exteriority related to the environmental aspects of the computer are left out. Specifically, the materials and their toxicity contained within the computer and the environmental hazards and risks connected to the production and disposal of these machines. Assemblage, in combination with the LCA, enables a more

comprehensive theorization of how the environmental risks and hazards associated with the personal computer include, and are made riskier by, the hazards of mining, production, use, and disposal. Assemblage theory incorporates the material relations of exteriority.

The assemblage has been developed in science studies and offers critical insights into the relationship between technology and the environment. Bruno Latour uses the term “networks” in order to understand how categories that have been considered separate and discrete - such as science, culture, nature, and politics - are actually intrinsically connected, and how our false separation of these categories is partially responsible for many of our current environmental problems. Latour uses the concept of networks to map the interconnections between various actors (Latour 89). Actors are based on agency, or what they do, rather than identity, what or who they are. The result is that humans and nonhumans, for Latour at least, are equal in the network, understood by what they do and enabling a mapping of relations not limited by those conceptual dichotomies that are foundational to ways of thinking about nature and technology. In *We Have Never Been Modern*, Latour problematizes Western notions of nature and culture. He says that the separation between nature and culture upon which notions of modernity are predicated never truly existed. Rather, modernity has produced what he calls hybrids, things that cannot easily be classified as either culture or nature. Genetic engineering, the hole in the ozone layer, and so many contemporary problems trouble the dichotomy of nature and society (Latour 41). Genetically engineered corn, for example, cannot be properly classed as part of nature as it is equally the result of scientific research and procedures, and therefore usually categorized in the domain of the social.

Both Beck and Latour offer a critique that locates current environmental problems as immanent in the institutions, categories, and processes of modernity. Beck's risk society thesis offers a largely institutional critique of how environmental degradation is produced as part of the daily business of capitalism. It is particularly useful for theorizing environmental degradation that is produced as part of the everyday business of capitalism, as opposed to accidents, spills, or other environmental problems that are (supposedly) one time or unintentional occurrences. Hazards are the negative products produced through the processes of modernity, such as pollution, and risks are the calculations attached to them in order to rationalize them. Beck says:

The risks generated by industrial and large-scale technologies are the result of conscious decisions, decisions which, first, are taken in the context of private and/or state organizations for economic gain and to seize the corresponding opportunities and, second, are based on a calculation for which hazards represent the inevitable downside of progress. Hence these hazards associated with industrialization do not become a political issue because of their scale but because of a social feature: they do not assail us like a fate; rather we create them ourselves, they are a product of human hands and minds, of the link between technical knowledge and the economic utility calculus... these kinds of risks ... enter the world peacefully, they thrive in the centres of rationality, science, and wealth and enjoy the protection of those responsible for law and order. (Beck 25-6)

In other words, environmental risks are a result of a series of decisions made in the name of economic gain or social progress, in which hazards are a sort of necessary evil to be contained through a series of risk calculations.

In a positively Latourian statement, Beck explains that: “risk functions like an acid bath in which venerable classical distinctions are dissolved” (Beck *World at Risk* 187). Although this insight is not fully developed in his work, van Loon’s intervention traces Beck’s work on risk through assemblage theory to offer a crucial explanation of how risks behave in a network. In particular, van Loon notes that risks are virtual objects (van Loon 54). They are real, but not actual. Once they are actualized into a hazard, they cease to be risks at all. Assemblage theory offers a finer tool to understand how risk functions in the networks in which it circulates. Risks circulate in discursive practices and techniques, or the networks in which they are produced, translated, and proliferated (van Loon 54). Van Loon observes that both Latour’s and Donna Haraway’s work on technoscience draw attention to border problems, namely those conceptual limitations that stop us from grasping the connections or network spaces between humans, nonhumans, nature, and technology.

While Haraway is significantly influenced by Latour, she critiques actor network theory because it flattens relations, making it unable to take into account how power relations such as class domination, imperialism, and patriarchy are built into and out of practices of science and the creation of technology (Haraway, “The Promises of Monsters” 331). In “The Promises of Monsters: A Regenerative Politics for Inappropriate/d Others” Donna Haraway proposes to rethink nature as a relationship (network) or assemblage where not all the actors are human, but they also include the

organic and technological (297). This model moves away from a deadly view of the world where nature and humans are being gobbled up by the monstrous forces of technology driven by capitalism. Haraway's critique of Latour is crucial here because she brings the dimensions of power and history to the assemblage, which are critical to my understandings of the global inequities related to the production, use, and disposal of computers. Haraway uses the term assemblage to understand humans as material-semiotic actors in networks that include technological and non-humans. In other words, for Haraway the assemblage allows for a deeper understanding of the complex relations (including power relations) between humans and their objects, in and with the environment, understood as a network of humans, non-humans, technological objects, and more-than-human actors.

Like Haraway's work, this project is informed by feminist philosophies of technology and feminist approaches to environmental theory. A feminist approach allows for a method that questions the ways in which computers and the environment have typically been framed, both epistemologically and in terms of relations of power. Because technology has historically been theorized in the West as separate from and always acting on or out of nature, we tend not to think of it as dependent on nature, but only as destroying or consuming nature. This understanding underlies the current environmentally destructive practices of mining, production, and disposal and limits our thinking about how to imagine a way out of these problems.

Container Technologies and Visibility

In her essay, "Container Technologies," feminist philosopher Zoe Sofia suggests that by rethinking how foundational philosophers such as Heidegger and Mumford

understand technology we can begin to shift how technology is conceived, especially in relation to the environment. According to Martin Heidegger, technology's revealing action commands nature into a stockpile (or standing-reserve) in the service of human intent and needs, so that the earth becomes viewed as a source of extractable resources. Mining, for example, is literally the extraction of minerals from the earth. Heidegger says that in the logic of modern industrial technology a tract of land reveals itself as a location of coal, metals, or minerals (Heidegger, "The Question Concerning Technology" 256). Sofia shows that Heidegger does not fully consider how technology is produced. For example, in his discussion of the chalice, the tools and other materials in the shop of the smithy making the chalice are absent (Sofia, "Container Technologies" 197). Whether an object is made by an artisanal process (the chalice) or as part of industrial society (the computer), she argues, the processes of extraction, transportation, and supply are crucial to understanding that object (Sofia, "Container Technologies" 197). Sofia develops Heidegger's argument to take this point into account and make explicit its potential for theorizing the relationship between technology and the environment.

Sofia suggests that container technologies are in some ways aligned with nature in their re-sourcing and storage functions, although this characteristic may not necessarily be direct or obvious. What she means is that nature was historically treated as a source of an unlimited supply of resources. However, as she notes:

The specter of resourcelessness looms ever larger on the horizon as we reach the limits of the planet that had once been imagined as an infinite container of resources, now revealed as a finite resource itself. (Sofia, "Container Technologies" 181)

This insight builds on Heidegger's observation that technology commands the earth into a calculable resource. Sofia also demonstrates that an organism, such as a koala bear, cannot be understood as separate from its environment, eucalyptus trees for food and shelter; just as humans cannot exist without the earth and their technologies to sustain their existence (Sofia, "Container Technologies" 182, 198). Feminist theories of technology not only allow for a more nuanced understanding of power dynamics, but also a more comprehensive understanding of tool and container technologies, especially their interdependence with nature, culture, and the environment.

As Sofia notes, the computer can be located in the tradition of the work and influence of Heidegger, Mumford, and McLuhan in which technology is theorized as part of a lineage of tools that extend the limits of the human body, as it connects to the hammer, the spear, and even the car. Typically tools are understood as those things that reach out, to increase speed, motion, and extension. Sofia further develops these foundational understandings of technology in order to also understand its containment action. Container technologies such as jugs, urns, or sieves designed to hold, spill out, or act as filters are usually omitted from these discussions. Containers keep and preserve their contents over time and act as a technology of re-sourcing and storage (Sofia, "Container Technologies" 192). Following Sofia, and reconsidering containers as technology, a more comprehensive understanding of technology develops. Part of the action of container technologies is that they tend to elude our awareness, to be unnoticed and in the background (Sofia, "Container Technologies" 188). Often, the only time we become aware of containers is when they fail in some way: the glass breaks, spilling red wine all over the white rug; the underground chemical storage tank leaks, polluting the

groundwater of an entire community. When a given technology functions both as a container and as a tool, often the "tool" aspect is reinforced, while the "container" aspect is obscured. As containers, personal computers are essentially storage devices for data and yet they tend only to be conceived of as "flying vehicles" for "surfing the internet" (Sofia, "Container Technologies" 188). The expanded definition of the computer as both tool and container technology would also redefine the computer as container that stores and re-sources information. They tend only to be understood as data storage units when their hard drives fail and data is lost. In order for the computer to be used properly and safely by the user, he or she must also be kept safe from exposure to the materials, some toxic, contained by the computer chassis. The chassis literally hides the mined metals within for the safety of the user and to ensure the smooth running of the machine.

The concealing container aspect of the personal computer can be understood as, not necessarily a deliberate mystification on the part of the manufacturer or designer, but as one of those boundaries that the idea of the assemblage allows us to circumnavigate. To some extent, the very act of examining the computer as container works against the retreating or withdrawing tendencies of container technologies, and enables us to reconnect it to those processes of resource extraction, production, and disposal necessary to its construction. The revealing and concealing actions of technology force us to reconsider broader issues of both the visual and the material. Van Loon uses the term visualization to describe the Heidegger's insight into the revealing action of technology (van Loon 20). He notes that the visual has been dominant over the invisible in modernity. As Haraway and others have noted, technoscience is predicated on metaphors of vision that are not neutral or objective, but contextual and power laden (van Loon 91).

When considering environmental problems and risks, the invisibility of both environmental hazards (hidden toxins in drinking water) and risks (by their nature not visual) is important to understanding how they are dealt with by institutions, individuals, and others.

As a tool, the personal computer is an instrument for visualization, producing and connecting us to visual culture via the web and in other applications. We have to also understand how it fits into existing visualization technologies that make sense of, tell us stories about, and inform us about our place in the natural world. Strangely enough, as much as personal computers are central to producing and experiencing visual culture, they are less often - with obvious and important exceptions, such as Apple's brilliant design - considered as part of visual culture by cultural studies critics, even as they appear as fetishized and branded products in our visual landscape. If we also consider them as containers, we have a chance to really grasp their materiality, their design, the space they take up on the desk, their objecthood and materiality. When we can then see them as chunks of metal and plastic *and* as technologies of visualization, we can fully evaluate their environmental effects. In this way, understanding technology, especially visualization technologies, as both containers and tools renders them visible. We must begin to locate the personal computer not just within visual culture, but also in a broader context of the visible (more on that below). This project is structured around the *visibility* of environmental risk that includes texts that may not be visual per se, such as policy documents. I am not looking at how elements that are *visible* support, prop up, or create the *visual* object. Rather I examine their interactivity in order to theorize how the larger discourse is maintained.

The visible for me is not simply what we can see (with our eyes), but those moments, texts, or larger discussions that render something discernable and evident as part of the circuit of culture. E-waste, for example, became much more visible in Ontario with the introduction of the Waste Diversion Act (WDA) of 2002, which designated Waste Electric and Electronic Equipment (WEEE) as one of the four waste streams to be diverted from landfill. By contrast, e-waste can be understood as part of our visual culture through the photographs of Edward Burtynsky. Both the WDA and these photographs render e-waste visible, but only the photographs visualize it or bring it into the realm of what we can see. Because of the modern predilection for visualization, the visual often signals and converges with moments of visibility (Mirzoeff 6). My point here is that what is visible - what we are talking about, legislating, writing about, or otherwise occupied with in our cultural spaces - is often reinforced by the artifacts of visual culture, those things we see and look at. By extension, what is not brought into the realm of the visual and visible (which often overlap and coincide), what is kept hidden, invisible, or obscured, is as important as what is visible and visualized. In terms of risk, we don't "see" risk, *per se*, rather we experience risk as an affective state, we legislate risk, we mitigate risk, we report on risk. Risk is a slippery character and very much imbricated in the visual and the visible, material and immaterial. The role of the visual in risk society is often to make it comprehensible or visible in some way, whether it is to expose it, contain and manage it, or to narrate risk culture. Visual culture is then a crucial location through which to theorize risk society as part of the apparatus of visibility.

Technological Obsolescence and the Affect of Risk Culture

Scott Lash distinguishes between an emergent risk *culture* and risk *society*. He suggests that Beck and Giddens' theorizations of the risk society, in which the dominant social institutions are inadequate to contain the bads of modernity, overlook some of the daily, lived expressions of risk. For Lash the risk society can be characterized as institutional, determinate, rule-bound, and hierarchical, whereas risk culture can be understood as those reflexive, indeterminate, or disordering aspects, often related to the symbolic, aesthetic, and quotidian. Although not directly connected to this study, he uses the example of Robert Mapplethorpe's photographs to suggest that although the photos do not explicitly document the AIDS crisis, it is likely that many viewers made the connection since Mapplethorpe died from AIDS because the photographs both document and interpret the gay community in complex and difficult ways. While Lash understands the various institutionalized, social, and medical attempts to deal with HIV/AIDS as part of risk society, Mapplethorpe's photographs can be located in risk culture because they deal with the contradictory, affective, and symbolic aspects of HIV/AIDS, which I would argue include anxiety and ambivalence. Lash's understanding of risk culture resonates strongly with van Loon's observation that the affect of risk society tends to oscillate between apathy, ambivalence, and anxiety. Both Lash and van Loon identify those elements of risk society that escape an analysis focused too narrowly on institutions and institutional responses (Beck and Giddens). But both also leave culture cast too narrowly.

Culture is both over-determined and underdetermined in their accounts. Lash suggests that risk culture can be the location from which new social formations emerge to challenge, manage, and perhaps even save us from the institutional deadlock of risk

society (60-61). In so doing, he loses some of the nuance that his original distinction seeks to capture. Specifically, he seems to understand culture only, or mostly, as a place of resistance, and not also as a location of acceptance, ambivalence, negotiation, contradiction, as well as resistance and challenge, to the hegemony and social institutions of risk society. Van Loon does not connect affect to culture, but merely leaves it hanging as a sort of artifact of risk society. He does not define or engage with culture as a complex, daily, and lived part of society. They both gesture towards the fact that culture is ordinary, lived, and contradictory, but they do not fully develop the idea that culture is a site of struggle over meanings and attitudes.

Williams' structure of feeling provides a critical framework through which to further theorize risk culture. He says:

We are talking about characteristic elements of impulse, restraint, and tone; specifically affective elements of consciousness and relationships: not feeling against thought, but thought as felt and feeling as thought: practical consciousness of a present kind, in a living and interrelating continuity. (R. Williams, *Marxism and Literature* 132)

What is crucial in this account is that he understands culture to be constituted by both feeling and thought, produced by and through societal institutions, and suggesting a more nuanced appreciation of culture that captures some of the key elements of risk.

Alan Liu suggests that cool has become the cultural dominant of the information age. Coming out of the renegotiations of work and leisure, information workers adopt a cool stance (Liu 78). And Jonathan Sterne reminds us that computers are "designed to be trash," so that we are forced into a "radical monopoly of coercive participation" in which

we are forced to upgrade software, hardware, and peripherals (Sterne 19, 24). These are the dynamics that structure technological culture in risk society, producing a complex constellation of reactions from adoration, anxiety, and apathy to frustration, resentment, and rage. Theodor Adorno offers us an avenue through which to understand this cycle of feelings. In his study of music and popular culture, he describes the emotions of scorn and resentment of people trying to keep up with the latest recent music craze, which he terms the effect of "the obsolete modern" (Adorno 463). He explains a cycle of emotions as people try to deal with the rapidity of obsolescence of the latest hit, beginning with a generalized ambivalence that turns into fury and scorn directed at outdated idols and songs. By contrast, in technological culture obsolescence is related to computers and other ICTs, and so our reactions are produced by and directed at these machines. This cycle of emotions is reminiscent of the oscillation of reactions to risk, from apathy, anxiety, to ambivalence, suggested by van Loon. Bringing these insights together, we can start to map the structure of feeling related to risk culture.

Methods

Deleuze and Guattari's notion of assemblage provides a framework through which to navigate the two structuring methods from the humanities and sciences, the cultural study and the life cycle analysis. The assemblage allows me to bring together the insights of a cultural study that takes seriously the social and representational aspects of the scientific process of a life cycle analysis, which considers the environmental effects of a product. In particular, it allows me to negotiate the boundaries of these two disciplinary approaches. The life cycle analysis is a quantitative, science based method, intended to measure the amount of resources and energy used throughout the life of a

product. It offers a linear structure, which organizes my chapters, and I rely on the calculations of life cycle analysis scientists to understand the magnitude of resources used to make and run computers. In contrast, the authors of *Doing Cultural Studies* suggest that to engage in a 'cultural study' requires a consideration of five interlocking aspects in the circuit of culture: representation, identity, production, consumption, regulation (du Gay, Hall, Janes, Mackay, and Negus 4-5). Du Gay et al's study is unsurpassed, but I further ground the circuit of culture in materiality, which applies to all these aspects.

If the question that motivated this research was why are we not talking about computers and the environment, then as much as my object of study is the computer, it is also about an absence in the cultural discourse. My sites of analysis are the different parts of the life cycle: resource extraction, production, use, user, and disposal. Because China is the source of most computer production, much e-waste disposal, and has the largest number of citizens of any country who are online, it is also a site of analysis. Since my guiding question points to an absence, or series of absences, I was not able to choose my primary sources in advance. My central problematic was not to look at a specific body of films that dealt with computers and the environment, for example. Rather, my method was to research where, who, and how the question of computers and the environment is raised at each stage of the life cycle. The search for the presence of any reference to computers and the environment has meant that my primary sources are a scattered and eclectic mix from popular culture including popular magazines on photography and technology, children's films, documentaries, photographs, online art, reports from activist groups such as Greenpeace and Basel Action Network, non-fiction literature on business management, public relations material from computer and electronics companies and

manufacturers, municipal and provincial policy documents, a monologue, and my disassembled computer. I use the assemblage to emphasize the connections between various and variegated contexts and moments. In effect, this dissertation is structured around moments of visibility (and corresponding blind spots), the disconnected and invisible aspects related to the environmental effects of personal computers in the academic literature, in much of mainstream discourse, and in fleeting moments of visibility in pop culture, art, and news media. These are the structuring moments of (in)visibility that shape the project.

In order to understand how the culture of technology frames our relationship to nature and the environment, I investigate how this culture describes and manages the risks associated with the personal computer. To some extent, this has meant doing a sort of discursive triangulation to find out why and how this absence has been structured both in the academic literature and in my primary sources. In many cases what my primary sources have in common is that they are points of convergence in my search for answers to these questions. Rather than choosing a text or a series of texts and asking questions about them, my project is structured around moments of visibility and connection, chasing and tracking my object of study as it appears and disappears. I argue that in order to understand the environmental effects of computers we must consider their materiality, especially in resource extraction, production, and disposal, but computers typically become visible in mainstream discourse as e-waste, and often only in the works of documentary photographers, documentary filmmakers, and activist groups. The difference, then, is between seeing and noticing. We see computers everywhere: in banks, cafés, libraries, schools, offices, movies, newspapers, advertisements and jumbled on the

sidewalk. Because, as Nigel Thrift notes, they have become infrastructural, that is necessary to the daily business of life, they slide into the background of our notice most of the time. We do not notice them any more than we notice hydro poles or roads on an average day. We see them only as background technologies. That is we do not notice them at all. The role of the news media is often contradictory as we rely on journalists to research and inform us about risks and problems related to the environment. However, in risk society reporting on risk sometimes has the effect of circulating and re-producing risk, often with the effect of minimizing or distorting it in some way. This particular and often contradictory role of the news media is one of the most perplexing locations of risk discourse related to the personal computer.

As many cultural studies practitioners have noted, method in cultural studies is “profoundly pluralistic” (Johnson, Chambers, Raghuram, Tincknell 26). Much of my primary source material is part of our visual culture and my interest is in the visible, an important distinction for this project. For Nicholas Mirzoeff, visual culture:

is concerned with visual events in which information, meaning, or pleasure is sought by the consumer in an interface with visual technology. By visual technology I mean any form of apparatus to be looked at or to enhance natural vision, from oil painting to television and the internet. (Mirzoeff 3)

I take cues from Mirzoeff, Ella Shohat and Robert Stam, all of whom show that the visual is always connected to our other senses and must be understood in the "wider context to which it belongs" (Mirzoeff 6). To examine these visual texts, I employ a method that both offers close textual analysis and tracks the micro-discursive shifts they suggest.

Tracing what is visible means working my way through these presences to find their connections to the absences.

As an assemblage, or series of assemblages, the personal computer is revealed as a complex technological object. It allows for a materialist account of the processes of resource extraction, production, use, and disposal related to the personal computer. It also enables a cultural study of the machine, which for this project means understanding the computer as infrastructural, as a space of representation, and as a critical tool in producing, circulated, and proliferating risk. It is central to both risk society and risk culture.

2. My Computer Disassembly: Theorizing the Material and the Visible

This project is premised on the idea that we need to understand computers as material and so in this chapter I discuss the disassembly of an old computer. It marks the starting point of my project to bring the materiality of computers into cultural studies conversations.

When a computer is laid out in pieces, its materiality is foregrounded. I label its parts according to what they are made of and where they were manufactured. Taking apart my computer is a way to locate it in what Jussi Parikka calls the "new materialism." Parikka characterizes this type of analysis as theorizing the objects of media and how they are related to other materialities of labour, other objects, bodies, and networks (96). Parikka says:

this level of media analysis - and materiality ... starts to develop both an intensive look inside the machines... and the networks in which the machines are being compiled - and discarded. (97)

To study the materiality of an object is to locate it in the fleshy embodied world of humans, to consider its components and their composition, and to consider its multiple, converging, and structuring networks. It is an attempt to:

...approach media cultures through the various materials, components, long networks, and genealogies in which media technologies are being produced. (Parikka 97)

It foregrounds the materials and production and foreshadows the disposal processes related to the personal computer.

In this chapter, I do a rough sketch of the networks of production related to this machine by locating my amateur disassembly in the framework of existing research on electronics production and disposal, and how these processes are or are not visual and visible. At its heart, this chapter is about the contradictions inherent in consumer culture, especially related to electronics. It foregrounds the negotiations we made as individual consumers and users of these products. I use my laptop disassembly to examine how it signifies differently as it moves from the category of intact, working computer to garbagem, taken-apart computer. This chapter is an experiment in the relations of visibility and visibility; what can be revealed through literally cracking open the Apple brand by taking apart a laptop? Obviously, this micro experiment does nothing to effect the large-scale relations of production, use, or disposal of computers, and I offer it as an entry point into a larger discussion of the relations between visibility and materiality.

In an attempt to gain a better understanding of what is actually in my computer, I took apart my old white twelve inch Mac iBook 3G, an ancestor of the Mac PowerBook G4 (and which Apple now designates as “vintage”) that I currently use. Obviously not a precise or scientific endeavour, I offer this exercise as an entry into the complexities of the information technologies (IT) and electronics industries and the attendant difficulties in tracking materials and the sources of pollution and other environmental degradation associated with personal computers. In some ways it matters that I happen to have a Mac to take apart; not only are Macs (and Apple products) the most obsessively fetishized electronics products on the market, and have been since their inception, but Apple has also become the most notoriously secretive company in terms of sourcing components, materials and labour practices (Bilton). In response to my query about what materials are

in the Mac iBook 3G, Jennifer Gonsalves-Teixeira, from Apple Public Relations, responded: “I have done some digging and I am unable to provide you with a full list of materials contained within your iBook G3.” As part of the assemblage of the personal computer, the relations of exteriority mapped in this chapter are the networks of production, which include the toxic exposure of workers and ecosystems. As I discuss in the previous chapter, in general computers are understood as connected to and through networks (the internet, communications between individuals, businesses, and governments, access to information and data), or what might be described as relations of exteriority. This disassembly then begins with the actual and material interior of the computer in order to map a different set of exterior relations, ones that connect this consumer product to production workers and disassembly workers, activists and environmentalists, and their related ecosystems. The disassembly is a method to navigate the computer as artifact of visual culture, visible as a technology of connectivity and so on, and material artifact. I begin with a discussion of the computer as material artifact.

Computer Production

Computers are incredibly complex, fabricated from hundreds of materials and components and assembled and shipped globally. Elizabeth Grossman notes that textbooks and other books about computers and the industry almost never list the materials in a computer (Grossman 21). Tracking the materials, components, and geography of a single computer is exceedingly difficult because of these intricacies as well as the realities of production. The plans for semiconductors or circuit boards are proprietary and the materials contained within the computers change often due to shifting regulations, changes to the product, and market prices (Grossman 20). Not only are the

materials and processes of production difficult to pinpoint, their production is toxic. As Jim Hightower comments in the Foreword to *Challenging the Chip: Labour Rights and Environmental Justice in the Global Electronics Industry*:

Over the years I have repeatedly been whopper-jawed by the self-serving short-sightedness of the high-tech barons who have managed to inflict ... staggering amounts of pollution, worker health problems, and overall worker abuse... (Hightower ix)

The book documents the struggles and successes of electronics workers in the US, Mexico, Scotland, Malaysia, Taiwan, and China, many of whom have died from cancers and other illnesses related to toxic exposures in the workplace (Hightower xi).

Since the 1980s, and even more so in the 2000s, the Wintelist industry model has dominated the production of high tech electronics. This model is associated with the computer industry and describes the massive outsourcing and subcontracting of manufacturing, making production flexible, segmented, and horizontal. My 2001 iBook 3G was undoubtedly produced through such a process. Boy Lüthje identifies Sony, IBM, Apple and Microsoft as “product definition companies,” or flagship companies which control the design of new products and breakthrough technologies but which are not actually involved in manufacturing (Lüthje 22 and 27). Since the 1990s, these product definition corporations have outsourced production to contract manufacturers or subassembly firms. In employing these subcontractors, many of the recognized brands have been able to defer any knowledge of environmental damage or human rights violations related to the production of their machines, claiming they cannot be held accountable for the actions of their subcontractors.

Contract manufacturers, huge companies themselves, deliver services that include all aspects of systems manufacturing from the assembly and production of printed circuit boards, repair services, distribution, to components purchasing (Lüthje 23). This practice sped up with the recession in the early 2000s. Taiwanese contract manufacturers take advantage of low cost manufacturing in China. Chip production no longer happens in the Silicon Valley but is done more cheaply in Hong Kong, Singapore, the Philippines and Malaysia. Full-scale industrial parks in Malaysia, China, Mexico, and Hungary provide manufacturing and support for many of the contract manufacturers and other subcontracted companies (Lüthje 23-28). India and China, in particular, have become important locations of both IT production and disposal and are therefore also dealing with pollution and exposure to the many toxic chemicals and processes that accompany both. They woo foreign investment by promising cheap labour. The mobility of transnational corporations means that once workers have fought to win certain labour rights, including protection from exposure to dangerous substances, transnational corporations are able to relocate. This “race to the bottom” has meant that women in poor regions of the globe tend to become a major segment of the workforce, and subject to labour injustices including long hours, low wages, job precariousness, and unsafe working conditions due to exposure to toxic chemicals, repetitive stress injuries, and other chronic medical conditions and problems (Smith, Sonnenfeld, Pellow 9).

Computer Disassembly

None of these dynamics are revealed through the disassembly of my iBook 3G. However, it does offer a glimpse at the materials contained within. I suppose there is also a chance that I exposed myself to small amounts of toxic chemicals, such as brominated

fire retardants. The iBook 3G was introduced May 1, 2001 and discontinued a mere six months later on October 16, 2001 (everymac.com). I inherited mine from a family member and used it from about 2003 to 2006. Before opening the thing up to begin my disassembly project, I researched the materials and components and their manufacturers. I also consulted some of the many instructional videos posted on the internet that relate how to hack, enhance, take apart, and destroy various types of computers. In general, computers are made up of plastic, metal, and glass; a typical desktop computer has about thirty pounds of metal and fourteen pounds of plastic (Grossman 3, 7). My iBook weighs a little under five pounds (everymac.com). Finding out exactly what materials make up the components inside a computer is difficult given the level of competition and legendary secrecy of the computer industry, especially Apple (Bilton). In his analysis of computer recycling, Stefan Klatt notes that the absence of product data is a major impediment for electronics de-manufacturing (Klatt 221).

With respect to my iBook, Apple is the product definition company. It is responsible for the design of my iBook and its logo appears on the case. Getting inside my old iBook is more than simply locating the screws and unscrewing them. It also requires a special plastic Apple card, or a guitar pick, to gently pry apart the top and bottom halves of the bottom part of the laptop. These plastic shells are connected by parts that snap together. One of the major recommendations to make computers more recyclable is to discontinue the use of snap parts and to use more screws instead. Indeed, this part of the disassembly is the most difficult, frustrating, and time consuming. Undoubtedly, the use of snap-parts was introduced to speed up production. Sequence is important and before prying apart the shells, the keyboard, airport card, hard disk, and

battery had to be removed. It is also the stage of the disassembly when the design of the machine is literally breached.

According to its 10-K (a form required by American law and filed with the Securities and Exchange Commission in the US by all publicly traded companies), Apple has two main suppliers: Hon Hai, also known as Foxconn, and Quanta, both with headquarters in Taiwan (Apple 2010 10-K Report). It also relies on many other sole-source party vendors in the US, China, Germany, Ireland, Israel, Japan, South Korea, the Netherlands, the Philippines, Taiwan, Thailand and Singapore (Apple Inc., *LexisNexis*). Business reports show that in Apple financial statements the “raw materials” line is blank, whereas Hon Hai and Quanta list 92,027,102 (in 000s of Taiwanese dollars) and 37,460,644 (in 000s of Taiwanese dollars) respectively (Apple Inc. *LexisNexis*; Hon Hai Precision Industry Co., Ltd.; Quanta Computer Inc.). Apple does not buy any raw materials because it does not actually manufacture anything. Quanta has over 68 000 employees internationally and primarily manufactures notebook computers (Quanta Computer Inc.). Hon Hai is a huge international company with over 800 000 employees, twenty-five subsidiaries and over fifty associated companies (Hon Hai Precision Industry Co., Ltd.). Hon Hai manufactures computers, peripherals, connectors, casings, heatsinks, circuit boards, input/output connectors, keyboards, and mice (Hon Hai Precision Industry Co., Ltd.). Both companies also count Sony, Dell, and other major computer and electronics companies as customers.

Once inside my laptop, many of the components bear labels or stickers, either from production, inspection, or importation processes. Trying to decipher these labels, in different languages and created and affixed according to various national and

international safety and importation regulations, is complicated and confuses the already cluttered and contradictory landscape of Apple's environmental and labour record, as documented by Apple, Greenpeace, and other activist and academic research. Not only are there hundreds of components, but there are also literally hundreds of materials inside of my iBook. According to the labels, the physical production process is located mostly in China and Taiwan. What follows is a brief description of the components I was able to access. I draw extensively on Elizabeth Grossman's groundbreaking and thorough investigation of the high-tech industry in her book *High Tech Trash* to guess the compounds and the possible risks.¹ In the following disassembly, photographs of the process were taken by Angela Smith.

1) Top and Bottom cases:

The top and bottom cases are made of white polycarbonate (or possibly acrylonitrile butadiene styrene) (Agarwal and Wankhade 242). In electronics, this type of plastic typically contains brominated fire retardants (BFRs) and polybrominated diphenyl ethers (PBDEs) (Byster and Smith 206-7; Puckett 225). BFRs bio-accumulate and they have been found in breast milk, in rates that have been doubling every five years (E. Williams 52). In particular, they have been found in the blood and breast milk of electronics

¹ I used Grossman's book to guide my disassembly. For further information see: *Greening the Media* by Richard Maxwell and Toby Miller; *Challenging the Chip* edited by Ted Smith, David Sonnenfeld, and David Nagueib Pellow; Apple's *Supplier Responsibility Report*; *Computers and the Environment: Understanding and Managing their Impacts* edited by Rüdiger Kuehr and Eric Williams; the *Dirty Metals: Mining, Communities, and the Environment* Report by Earthworks and Oxfam America; the website *EveryMac.com*; the Basel Action Network video *Exporting Harm*; the report *The Other Side of Apple II: Pollution Spreads Through Apple's Supply Chain* by Friends of Nature, Institute of Public and Environmental Affairs, Green Beagle, Envirofriends, and Green Stone Environmental Action Network; and Greenpeace's *Guide to Greener Electronics*.

workers, and are linked to thyroid hormone disruption, neuro-developmental deficits, cancer, and reproductive problems (Grossman 7; E. Williams 52). In general, plastics make up about 19% of total electronics scrap, which is difficult to recover as a high quality material (Klatt 221). The bottom case also contains information for the consumer, including Apple's copyright, the model number, and the fact that it was assembled in Taiwan. The Canadian Industry Standard label designates it as ICES-003 Class B or interference causing equipment, meaning it is regulated as part of radio noise emissions from digital apparatuses. It also has an American Federal Communication Commission label and CE or Conformité Européenne label, a mandatory conformance mark on products in the European Economic area.

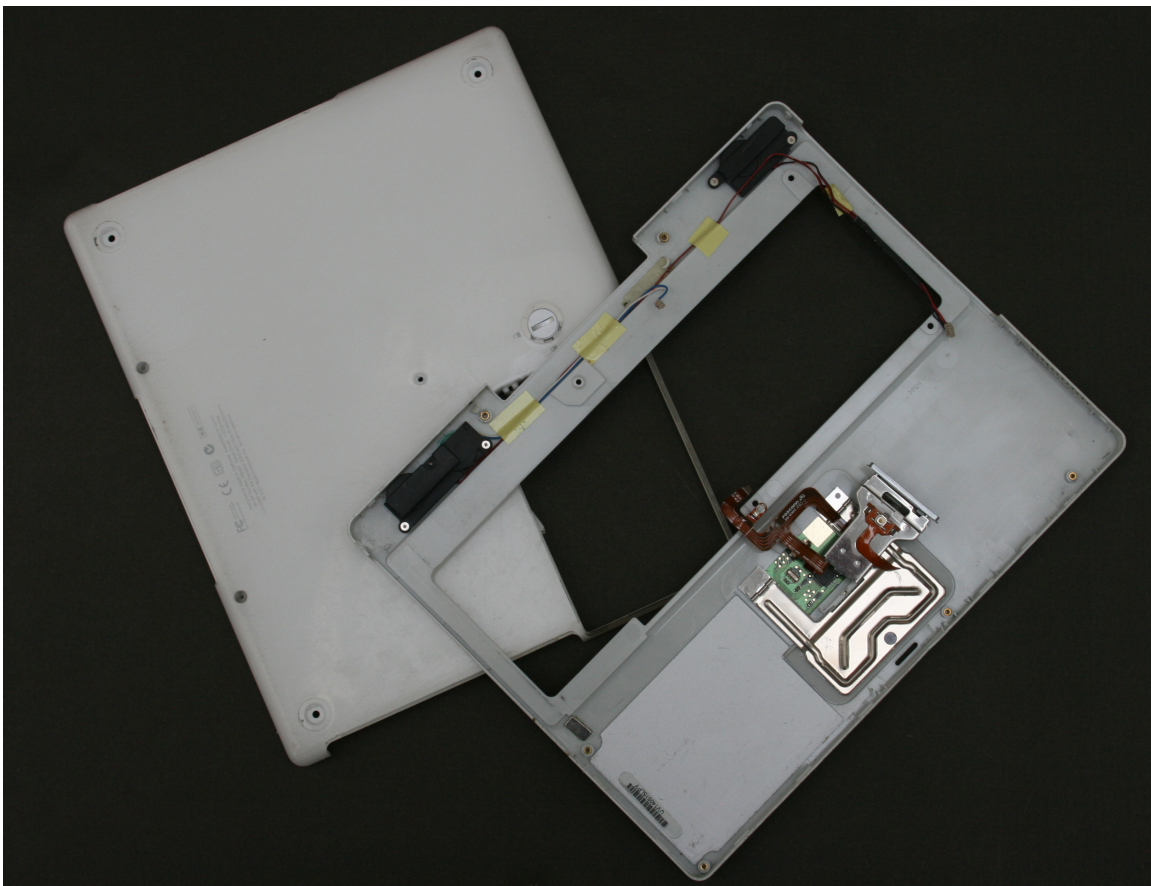


Fig. 1 Top and bottom cases, with track pad attached

2) Trackpad:

This is a complex component made of metal and plastic, plus a small circuit board that contains a Synotic chip ribbon cable, metal latch, and motherboard with a Foxconn label. In their examination of the sustainability of the commodity chain of Chinese electronics, Martin Eugster and his colleagues determined that integrated circuits, which are found in motherboards, make up half of the environmental impact in the manufacture of the personal computer (Eugster et al 19).

3) CPU Frame:

The frame is made of metal, which according to Grossman's research is likely aluminum (Grossman 18). Eugster and colleagues estimate that 20% of the total environmental impact in the production of computers is from the processing and use of metals (Euster et al 19).

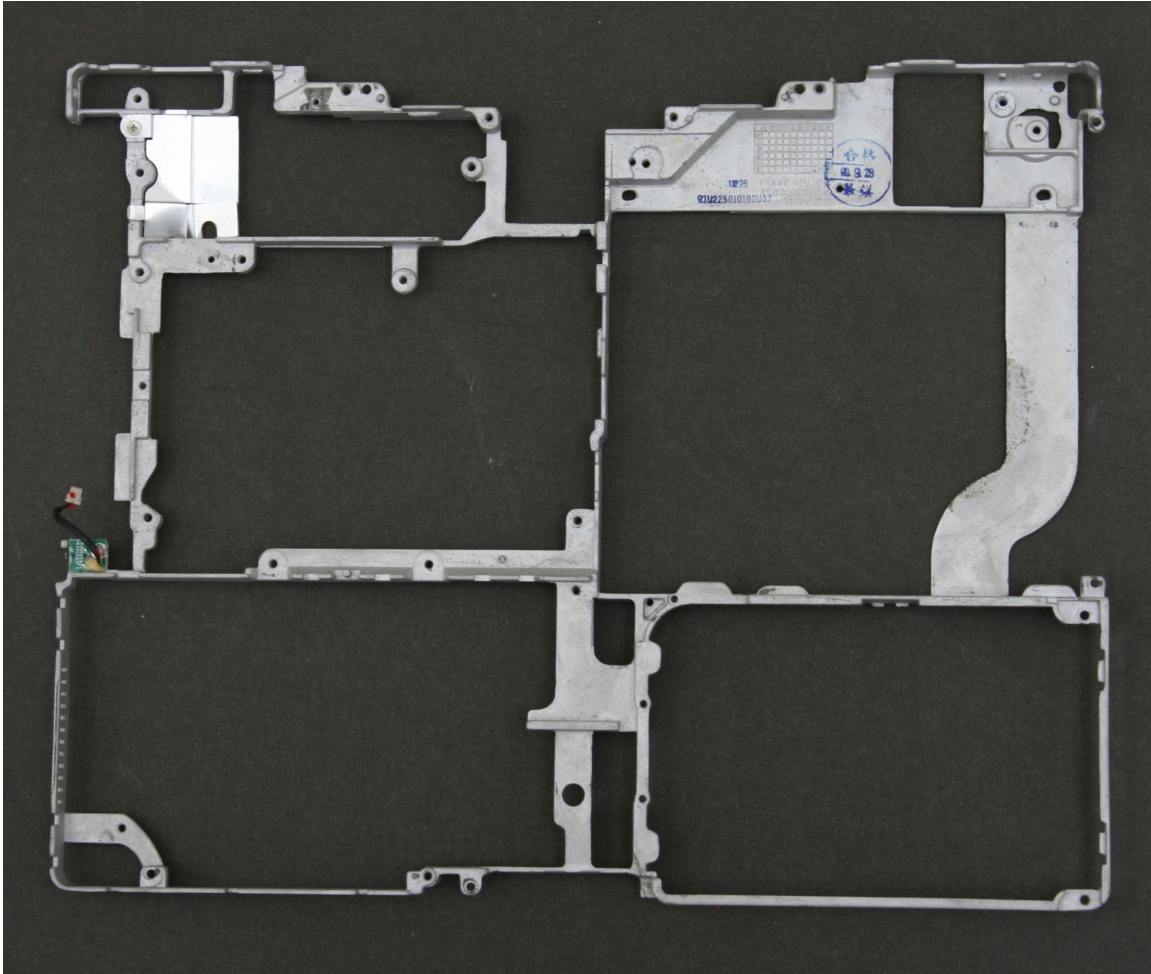


Fig. 2 CPU frame

4) Aluminum shielding:

There are four pieces of flexible aluminum shielding, as well as other metal structural pieces that are likely iron (Grossman 18). Metals are highly reclaimable through recycling and represent about 70% of the residual value of computers (Matthews and Matthews 35). Metal reclamation technologies are well developed and aluminum is in high demand in the recycling industry (E. Williams and Sasaki 185; Klatt 219).

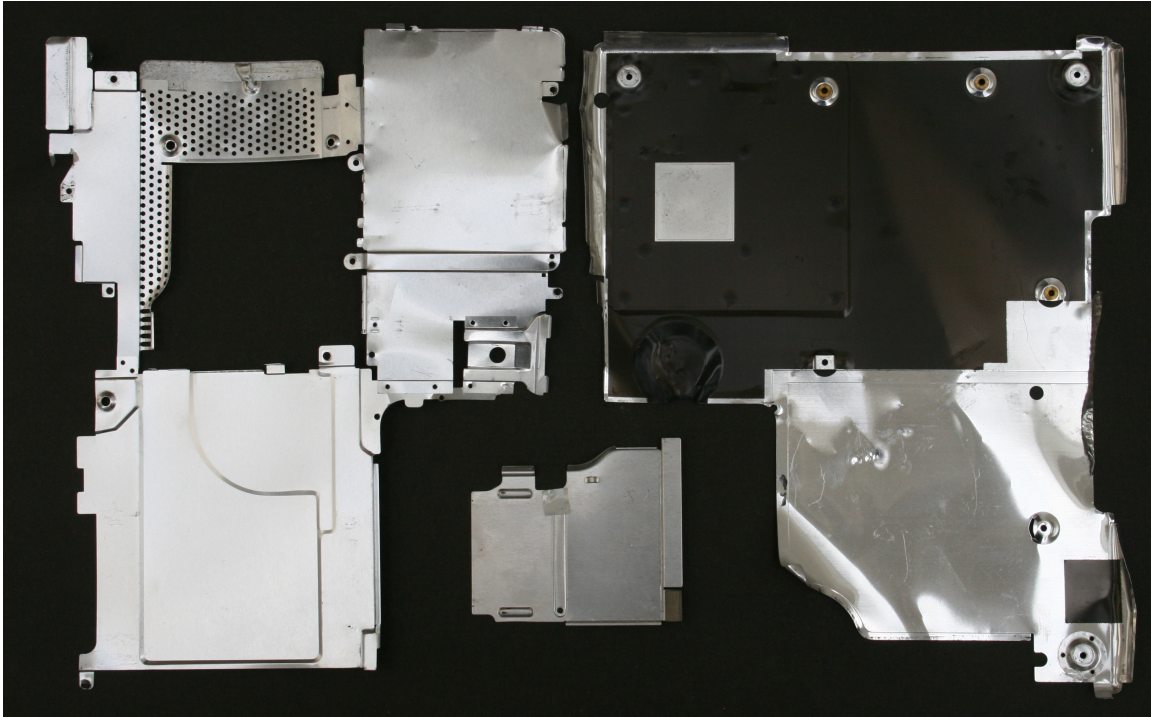


Fig. 3 Aluminum shielding

5) Screen:

The screen is enclosed with no obvious screws. Manufacturing liquid crystal display (LCD) screens like this one is more energy intensive than the older cathode ray tube (CRT) monitors (E. Williams 57). Researchers have found that 26 of the 588 compounds used in LCDs have acute toxic potential, although no tests have been done on their carcinogenic potential (E. Williams 58). LCDs also contain chromium, a dangerous heavy metal (Eugster et al 20). In general, the environmental impact of producing LCDs is very high because of the exploitation of natural resources (including gold in the integrated circuits), energy usage, and use of toxic materials (the production of poly methyl methacrylate sheets needed for the backlighting in LCD screens) (Eugster et al 20).



Fig. 4 Screen with connectors

6) Keyboard with ribbon cable:

The keyboard is also enclosed, although the plastic keys snap off. Research done by Eugster et al suggest that, comparatively speaking, keyboards in desktop (not laptop) models cause relatively little environmental harm because they use very little energy, resources, or toxic components (Eugster et al 19).

7) Battery:

I purchased the battery in 2003, which according to Greenpeace's *Guide to Greener Electronics* means it contains lithium but no mercury. Lithium was introduced as a safer alternative to nickel-cadmium batteries because these metals are very toxic, and experts recommend diverting them from the waste stream (Matthews and Matthews 26).

8) Airport wireless hub:

The airport wireless hub was made by an Apple subsidiary in Taiwan.



Fig. 5 Keyboard, airport, and battery

9) CD/DVD drive:

The drive is enclosed with a ribbon cable, has an Apple copyright and was made in Japan by Matsushita-Kotobuki Electronics Industries Ltd.



Fig. 6 CD/DVD drive

10) The motherboard:

The motherboard contains Apple and IBM sockets or CPUs, a Samsung chip and Broadcom chip. Researchers estimate that half the environmental impact in the production of motherboards is from integrated circuits, which are “the single most important source of negative environmental impact in the production of PCs” because of the amount of heat energy and waste produced in manufacturing (Eugster et al 19). According to life cycle analyses done by Eric Williams and colleagues, 1600 grams of fossil fuel and chemicals are needed to make one two gram microchip and the secondary material is 630 times mass of final product (Grossman 4). Semiconductors and circuit boards are typically made up of 30-50% metal, often copper, gold, silver, platinum, and

aluminum (Grossman 3; E. Williams and Sasaki 185). These metals are recyclable and good facilities exist. However, these metals are often "mined" by reclamation workers in poor communities (especially in China and Ghana) by "cooking" the board to release the metals, which also releases clouds of noxious gases from BFRs and PVC plastic (see the Basel Action Network film *Exporting Harm*). Printed circuit boards also contain brominated fire-retardants, lead, mercury, chromium, and cadmium, which are environmentally hazardous (E. Williams and Sasaki 185; Grossman 7).

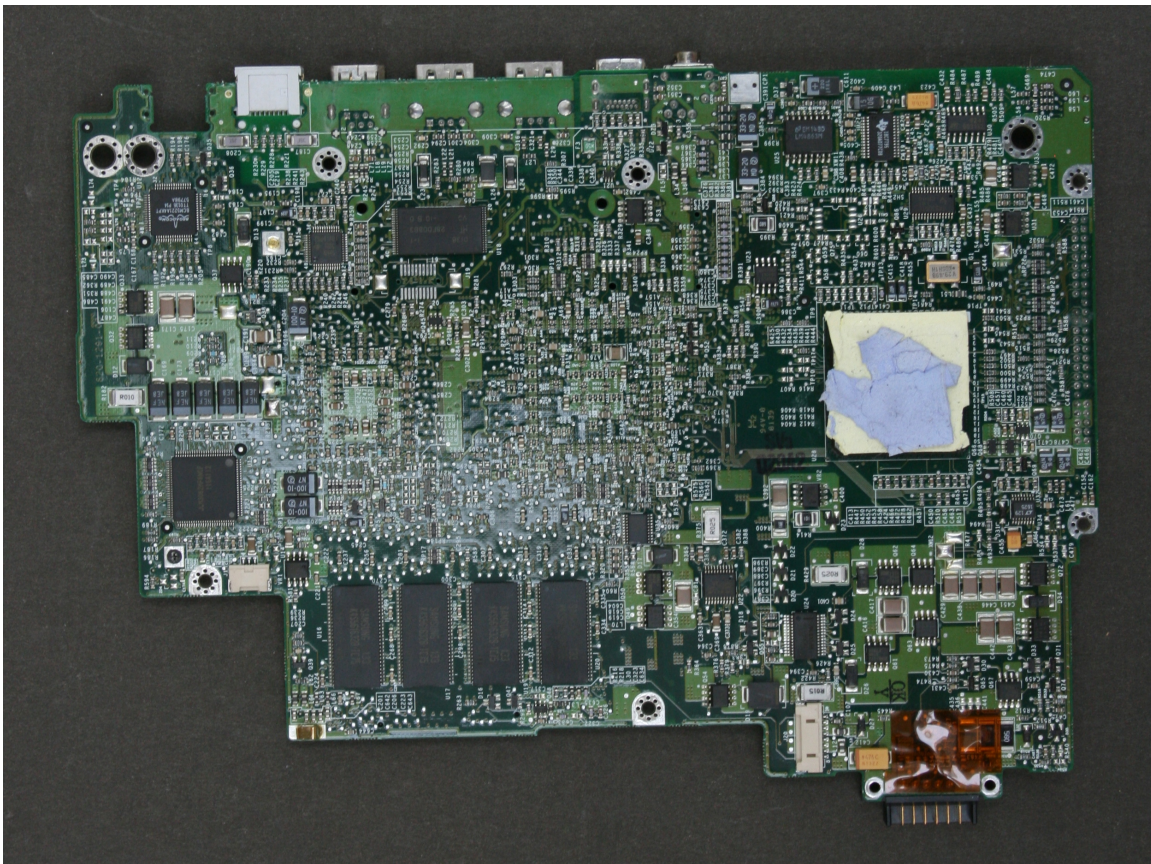


Fig. 7 Motherboard

11) Modem:

The modem also has Industry Canada and FCC stickers and was made by Microsystems Corporation, based in New York with locations globally (mostly Asia).

12) Hard disc:

The hard disc was made in Thailand by Fujitsu Korea.

13) Fan:

The fan is made of plastic and made in Taiwan by Sunon. Kevin Bridgen and David Santillo examined fans in a range of computers (including Apple's MacBook Pro, but not the Mac iBook 3G) and found small amounts of PBDE and bromine, both toxic substances, in all the fans they tested (Bridgen and Santillo 10).

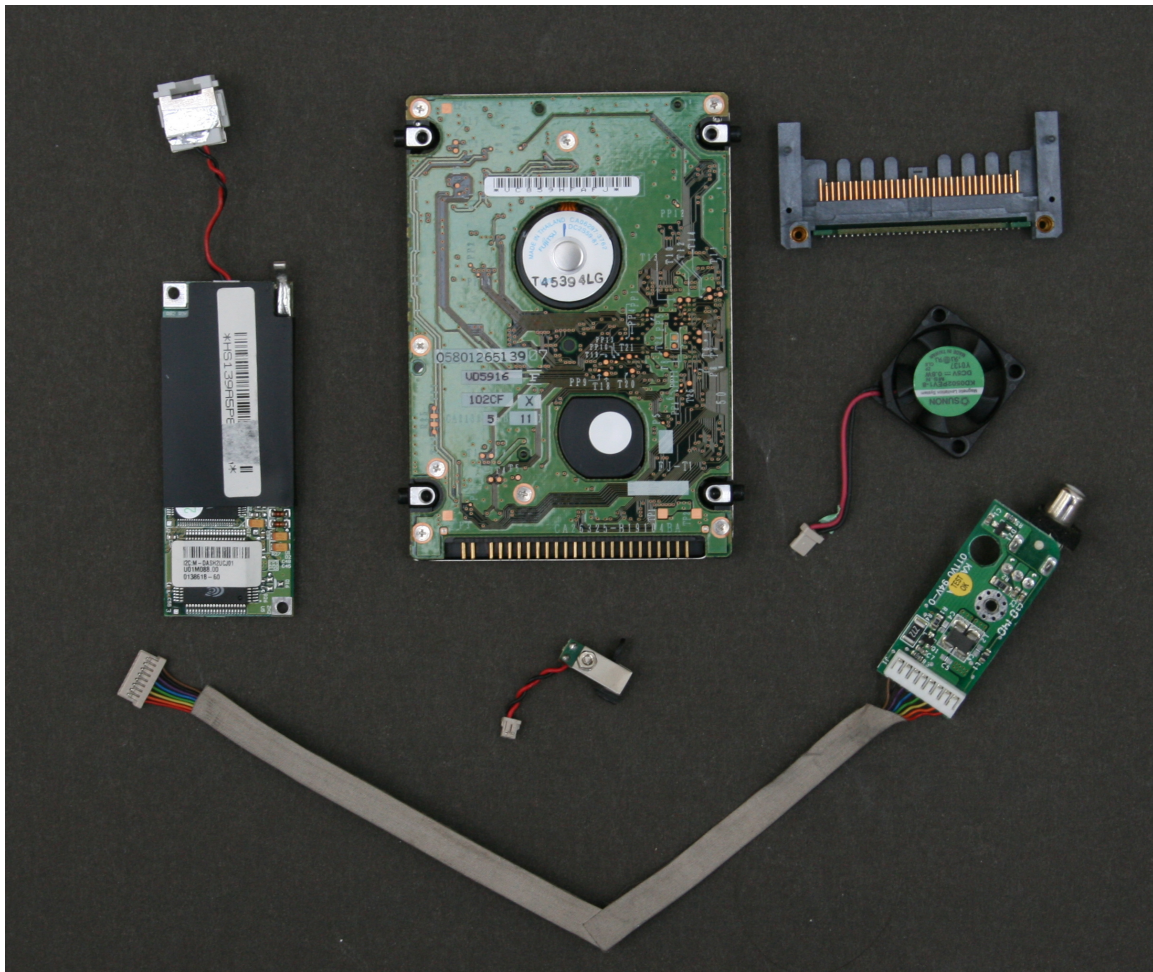


Fig. 8 Fan, hard disc, modem, and other parts

14) Other:

There are also lots of small plastic structural parts, a power supply cord entry, connectors made of screws, feet, springs, and tiny magnets. The power cord and other wires are likely insulated in PVC, which when burned releases persistent organic pollutants such as dioxins and furans (Grossman 7).

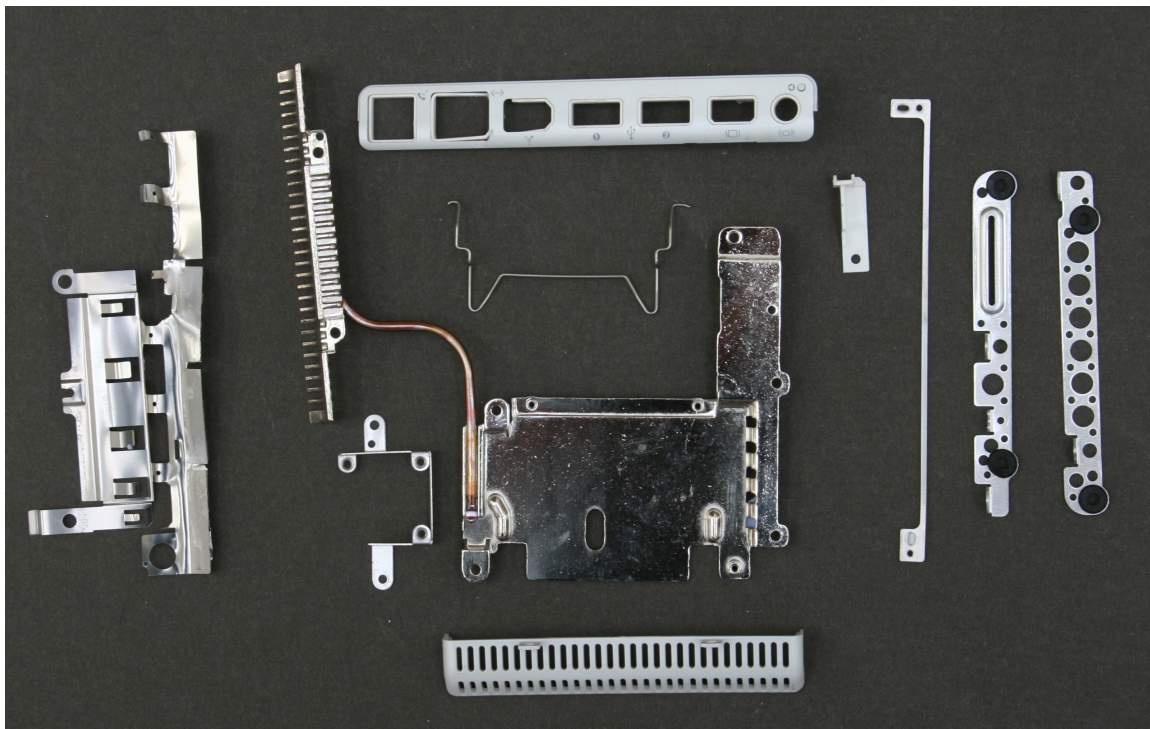


Fig. 9 Structural parts and connectors



Fig 10 screws, feet, springs, magnets, and other parts



Fig. 11 Power cord

Due to increasing pressure from consumers and activists, electronics firms typically have a “green” or environmental page on their websites. Because of this development, it is often easier to find out what materials are not in a computer than what are. Environmental campaigns often revolve around a particular dangerous substance (cadmium in batteries, for example) and companies will publicize the absence or removal of the offending material in their products. In 2006, Greenpeace began publishing a

“Guide to Greener Electronics” aimed at consumers, which rates large electronics companies in three categories: chemicals, e-waste, energy. In the 2010 Guide, Apple has a total score of 4.9/10. However, it scores relatively well in the chemicals section because they have eliminated PVC and BFRs from all their products. PVC is a persistent toxin (Grossman 189). Apple has also banned asbestos, cadmium, hexavalent chromium, lead, organic tin, polybrominated biphenyls (PBBs), PBDEs, polychlorinated biphenyls (PCBs), polychlorinated dibenzodioxins (PCDDs), polychlorinated naphthalenes (PCNs), polychlorinated terphenyls (PCTs), red phosphorous, and short chain chlorinated paraffins (SCCPs) (“Apple and the Environment”). However, because my iBook is so old in computer years I can only be certain that it was manufactured without the use of CFCs and that the battery does not contain nickel, lead, or cadmium (“Apple and the Environment”). Similarly, the computer I currently use, the PowerBook G4 (introduced January 31, 2005 and discontinued on October 19, 2005) was made without the use of CFCs and it uses the same type of battery (everymac.com).

In general, the reports about labour and environmental problems related to Apple are contradictory. In Apple’s 2001 *Supplier Responsibility Report*, they report thirty-six violations in the facilities they audited. A report, titled *The Other Side of Apple II*, by Chinese environmental groups who did onsite investigations of ten suppliers, found multiple environmental problems that were not addressed by Apple. The report says,

Apple has become a special case. Even when faced with specific allegations regarding its suppliers, the company refuses to provide answers and continues to state that “It is our long term policy not to disclose supplier information.” A large number of IT supplier violation records

have already been publicized; however, Apple chooses not to face such information and continues to use these companies as suppliers. This can only be seen as a deliberate refusal of responsibility. (Friends of Nature et al. 4)

Tracking environmental and labour problems related to suppliers is difficult, but establishing the flow and trade of raw materials becomes even thornier.²

Materiality, Visibility, and the Contradictions of Consumer Culture

It is almost impossible for the average user to learn exactly what materials are contained in their electronics, let alone to assess with any certainty the health or environmental risks posed by the production of their electronics or to that user. In fact, this amateur cottage disassembly might in some ways reinforce the very dynamics of mass production and chemical exposure that I am trying to reveal. I might be running the risk of further obscuring the stark economic, labour, and environmental costs of mass production. In addition, taking apart a Mac is a badge of pride amongst Apple geeks, and I might be misconstrued as an obsessive fan. I include it here, then, not as some badge of honour, but to foreground how little most of us actually know about the insides of our machines and how difficult, if not impossible, it is to find out... In general, average users are discouraged from taking things apart because we run the risk of hurting ourselves through inadvertent exposure to toxic chemicals or nullifying the warranty. I am left with a messy pile of e-waste, which takes up about four times as much room as the computer

² See the documentary *No Blood on My Mobile* for the difficulties in tracking sources of minerals used in electronics. Director Frank Piasecki Poulsen tries to find out if minerals used to make his Nokia cell phone are "blood minerals" (minerals mined in areas of conflict with documented human rights abuses). His journey takes him into mines in the Democratic Republic of Congo.

did when it was put together. I am loathe to take it to Toronto's e-waste depository because based on my research I remain unconvinced that it will not end up in landfill here or overseas in an unsafe reclamation site. In fact, when I recently moved, I brought it along in four large Tupperware containers, along with three other obsolete laptops.

In her theorization of container technologies, Sofia admonishes us to bring the processes of extraction, transportation, and supply into our understandings of technological objects (Sofia, "Container Technologies" 197). Breaking apart the computer is to literally reveal the innards, the mess of components and parts made from plastics and metals. It also makes the machine less visible as a computer, and perhaps more visible as a complex piece of consumer electronics, as evidenced by its guts full of plastics, wires, and motherboards. Although the components might not be easily identifiable to the average person in terms of what they are made of, whether it is aluminum or polycarbonate plastic, it draws our attention to the fact that these components are created through industrial processes of resource extraction, refinement, and especially production (but does little to actually reveal anything about the processes themselves). The disassembly renders the machine more visible in its bare materiality, by which I mean more obvious as an object created from natural resources and connected to ecosystems in which resource extraction, production, disposal and other related processes are happening. The disassembly makes the commanding action of technology, which is about commanding nature into a stockpile, a little more obvious or visible (Heidegger, "The Question Concerning Technology" 256). The toxicity of so many components remains invisible to the naked eye, but this exercise brings in the voices of labourers, activists, and environmentalists who are on the front lines of toxic exposure as a result of

the production and disposal of these machines. This chapter is an attempt to render my computer, and computers in general, more visible as material objects and connected to ecosystems around the world where they have significant, negative impacts.

In 2012, Apple was at the top of *Forbes'* list of the most powerful brands in the world (Badenhausen 1). Dismantling an Apple product is to literally crack the sleek design and accompanying mystique of one of their flawlessly designed products. As Dylan Williams points out this is connected to its design:

... Apple has been largely successful through early recognition that we live in a Visual Culture. That is, we live in a fast-forward world where consumers rarely have time to rationally deliberate over marginal performance differences and instead look for handy shortcuts to purchase decisions, particularly shortcuts like look and feel. What Apple succeeded in doing before its competitors is embracing this new visual culture: from developing the first icon driven software with the Macintosh through colourfully designed computer hardware with the iMac to beautifully minimalist and ergonomic MP3 players with iPod and easily navigable web music stores with iTunes. Few of these products were first to market and hardcore techies can point out a million product flaws... But society at large doesn't care. The kit looks great and works pretty much as well as anything else on the market. Apple has in effect introduced design, indeed fashion, as a principle source of competitive advantage in markets that have traditionally been functionally driven. ("Crit" 37-8)

The design, brand, and logo of Apple computers make them an iconic part of our visual landscape. The Apple brand does complex work when considered as part of the chassis, and as a container technology: it locates Apple in visual culture, and foregrounds it as a music playing, internet surfing, data storing, technology of communication. To some extent, cracking the shell of the laptop, which includes the iconic see-through bitten apple logo, breaks the concealing action of the chassis, which is also what makes the machine signify as a technology of visualization, data storage, and communication.

Admittedly, and in fact, importantly, with every passing month, the classic Apple design visible in the remnants of the old laptop seems less and less cutting edge because of the constant process of planned and perceived obsolescence that is the genius of Apple. Planned obsolescence describes the deliberate strategy by manufacturers to render their products unusable or undesirable so that consumers will buy a new one, increasing sales for that company (Slade 5). Every time the design is improved, it starts to feel as though the older version is outdated, unfashionable, and generally crappy (Slade 50). Design for style, or perceived obsolescence, is in the nexus between consumer and visual cultures. As part of visual culture, Apple computers connote particular meanings of coolness, efficiency, creativity, and techno-savviness, which make them special branded fashion accessories as well as everyday information and communications technologies. As a container technology, the Apple logo and design work to reveal certain relations of exteriority, namely connectivity and communication, and conceal others, namely the networks through which these toxic machines are produced and disposed. We tend not to see these technologies in their bare materiality, as created out of plastic, metal, glass and other resources or connected to their surrounding ecosystems. The relations of

materiality, visuality, and visibility are complex, and often the material is not necessarily the visible.

Taken together, these lessons from production and disassembly offer a more detailed account of the contractions that define technologized culture. I have to find a safe way to get rid of the bits and pieces that used to be my computer. And, as I will detail in Chapter 5, these negotiations are increasingly individualized and so my experience of dismantling the computer alone, with only the help of YouTube videos, reinforces this aspect of risk in technologized culture. Our incomplete understandings of the machines we use extensively everyday contribute to the "crisis culture" related to large-scale environmental problems. These problems not only seem insurmountable, but we are also left to negotiate them individually, with huge amounts of incomplete and contradictory information to guide us. Even with the addition of e-waste disposal collection by the City of Toronto, where I live, the local newspaper often reports on the failures and shortfalls of our collective garbage system and we are constantly interpellated as consumers to "properly dispose" of electronics and other recyclables.

3. From Industrial to Risk Society: The Affect and Aesthetics of Mining the Computer

Metals make up over half of the materials found in personal computers. Typically they include copper, aluminum, lead, gold, zinc, nickel, tin, silver, iron, barium, beryllium, cadmium, chromium, selenium, and gallium (Grossman 18). The mining and production of metals is a human activity with a long history, often linked to processes of industrialism, but routinely left out of more recent discussions of technology (and its production processes). As Elizabeth Grossman says:

Curious to know how these different metals, compounds, and other materials functioned within a piece of high-tech equipment, I consulted several well-known books about the computer industry and how computers work. Not one index yielded a single entry for any of the individual substances that enable this technology - further evidence of the curious disconnect between perceptions of high tech and the physical world. (Grossman 21)

To include mining in the production process of the computer is a reminder of the means through which high technology is made and allows for a more precise accounting of the raw materials and industrial processes needed to produce a computer. As Cedric Gregory, writing on the history of mining, states: “Without mineral production, [the citizens of industrialized countries’] smugly taken-for-granted comfort levels and ultramodern conveniences would have been impossible to attain” (Gregory 143). Having established that the research, production, distribution, consumption, and disposal of the personal computer is a complex and global affair, locating mining as part of this framework

demonstrates the intricacies of this international business and gives a start point from which to understand the materiality of the personal computer and those relationships between technology and the environment. Although Canada is not well known as a producer of high technology, Canadian companies have come to dominate the global mining industry and Canadians are major consumers of high tech products.

Mining, the extraction of raw ore from the earth to create metals for refinement and use, has become one of the most environmentally destructive industries in the world (Earthworks and Oxfam America 1). During the mining process, rubble, solid waste, tailings, and other toxic waste are produced, which pollute waterways, destroy vegetation, and harm wildlife and human health. These negative effects have typically been understood as side effects of industry, which can be properly managed for the overall benefit of companies, consumers and society at large. This arrangement, not unique to the mining industry, characterizes risk society. Risk society can be defined by the proliferation of bads, often defined as side effects, which begin to overtake the perceived goods as they exceed the processes and institutions in place to deal with them (Beck, *Ecological Enlightenment* 2). The development of the Canadian mining industry epitomizes the immanence of risk society in industrial society. At times, mining seems to be associated with an older industrial phase, the “bad old days” of mine collapses in Cape Breton or Virginia, for example. But as Gregory reminds us, mining remains a huge industry, necessary to producing the large amounts of metal in high tech, and other, products.

This chapter examines mining not only as crucial to the production of high technology, but also as producing some of the risks associated with the personal

computer. The assemblage of the Canadian mining industry reveals Canada's development as an industrial nation, our location in global risk society, and the emergence of risk culture. Returning to the relations of exteriority described by Manuel De Landa (in the previous chapter), the Canadian mining industry must be connected to other social institutions including the arts, which increasingly reflect the emergence and affect of risk culture.

Risk society, as theorized by Ulrich Beck and others, is primarily an institutional analysis. Scott Lash distinguishes it from risk culture. He says:

....the idea of risk society in Beck and in Giddens is institutionalist. Their positioning of risk is in a risk society that is institutionally structured. The 'risk society' is normatively ordered, vertically structured and individually based. Risk cultures in contradistinction are value-disordered, horizontally destructured and communally based. Could it be that inside the risk society a set of such risk cultures are emerging...? Is it possible that ... the predominant movement is from a risk society to a risk culture?" (Lash 50)

His point is that Beck tends to focus on institutions, such as government departments or the insurance industry, rather than on the lived experience of communities attempting to grapple with risk. Lash suggests that this emergent risk culture, which is grounded in daily life and culture, deals with the existential, symbolic, and aesthetics of risk society.

In the first half of the chapter, I examine the history of mining to theorize the shift from industrial to risk society in the context of the Canadian mining industry. I go into a great deal of detail in order to demonstrate the relationships between science and government, research and development in the development of risk society. In the second

half, I consider the affective and aesthetic aspects of risk culture related to resource extraction through the works of Edward Burtynsky. I argue that to fully conceptualize the risks associated with the personal computer, we must take seriously the extractive industries, their central importance to risk society, and how they are taken up in risk culture.

Mining and the Emergence of Risk Society in Canada

Harold Innis notes that Canada has historically had a staples economy, including a long history of mining activity. Before the arrival of European settlers and explorers and the formation of the Canadian state, First Nations peoples mined and traded gold, copper, silver, and turquoise (Cranstone 1). Mining activity is connected to Canada's colonial relations with England, France and the US. For Innis, a staples economy is not simply the production and export of natural resources, but is fundamentally tied to the development of geopolitical and economic margins and centres. This history stretches back to coal mining in Cape Breton, which dates from 1672 (Cranstone 1). Iron, gold, asbestos, lead, zinc and silver were extracted across the country during the 1800s. Since the 1900s, Canada has been a major producer of various metals including silver, gold, nickel, platinum, cobalt, copper, zinc, and iron (ibid 10-11). Prior to Confederation, colonial relations were dominated by the exportation of furs, timber, and other raw materials and importation of manufactured goods. Both France and England had “crown land” policies that stipulated that any metals found in their territories were the property of the monarchy. While French law commanded that both precious and base metals were property of the king, English law specified only the “royal” metals, silver, gold and copper as belonging to the crown (Nelles 3). Policy differed by region but, in general,

after Confederation, crown lands became property of the state, which allocated the right to extract resources to private companies while maintaining the notion that the Canadian public should reap some of the financial rewards associated with the industry (Nelles 31). In the post-World War II era, new mining technologies dramatically changed the exploration practices associated with locating mineral and ore deposits, leading to many important ore discoveries in Canada (Cranstone 7).

Canada's mining industry, as part of our staples-based economy, must be understood in relation to the production of industrial centres (Berland, "Space at the Margins" 295). Jody Berland argues:

The continuing differentiation of space that produces margins is both an originary foundation and a geopolitical result of the global division of labour, wherein some regions provide natural resources (or, more contemporaneously, technological resources such as telecommunications hardware and silicon chips) to other regions, which thereby reproduce their own advantages in wealth and power. (Berland, "Space at the Margins" 296)

Whereas Innis connects Canada's pulp and paper industry to the United States' newspaper monopoly, and Canada's subsequent economic and cultural marginalization, Berland emphasizes the crucial connections between all subsequent media technologies, including computers, their extractive industries, and the consequent social and cultural organizations.

According to Rosemary Donegan, who has curated many exhibitions on industrialism and Canadian art, Sudbury, Ontario has a "singular place in the Canadian

imagination” as a symbol of Canada as an industrial nation (Donegan, *Sudbury* 6). With over twenty million tons of nickel extracted or known to be extractable, Sudbury Ontario, dominated by Inco and Falconbridge, has been known internationally as a major nickel producer since the early twentieth century (Pearson and Pitblado 5). Nickel is one of the many metals found in a personal computer. It can be used for the magnetic recording layer in computer hard discs, for the electromagnetic shielding of computers, and for the nickel-cadmium batteries, often used in laptops (Cutler). Personal computers are incredibly complex and contain numerous metals, not to mention other materials. In this chapter I focus on nickel as representative of the complicated practices related to mining and resource extraction in the shift from industrial to risk society, routinely left out of discussions of personal computers.

One of the biggest problems associated with the mining industry, ecologically speaking, is the waste produced and the problem of how to contain its effects. Because of these connections and the fact that Sudbury was the location of a major environmental restoration project started in the 1970s, Sudbury is an important site through which to consider the environment, regulation, and the larger Canadian mining industry through the lens of risk society. Although nickel might be a somewhat arbitrary metal to represent the personal computer, it is critical to understanding the Canadian political, ecological, economic and technological landscape.

Both open pit and underground mines have been used in the Sudbury area. Open pit mining, which is increasingly the norm due to its lower production costs, produces eight to ten times more waste rubble than traditional underground mines (Earthworks and Oxfam America 4). The refinement process varies according to the type of metal but as

high quality deposits are used up, companies have begun to mine and to process lower grade ores. Demand for metals has gradually made it more economically worthwhile for companies to process these lower grade ores, which also produce more leftover rubble. Because only two to three percent of each rock mined in Sudbury has usable metal in it, the rest is waste, including the iron oxide that is too expensive to mine from that location (Donegan, *Sudbury* 6). By the 1950s, Sudbury was also renowned for the devastation of the surrounding area because of nickel mining, still visible in a 1987 satellite image (Gunn vii). By the early 1970s, this damage had resulted in 17 400 hectares of land with no vegetation, acidified and metal damaged soil, and major erosion on hills and slopes; another 72 100 hectares of semi-barren and blackened land with the growth of stunted birch and red maple; and 7000 acid damaged lakes (Lautenbach et al 109; Conroy and Kramer 3). That Apollo 16 and 17 astronauts visited the area in 1971 and 1972 to learn how to describe geological features only reinforced its popular appellation as a “moonscape” (Pearson and Pitblado 5).

Not meant as a precise history, the following section looks to Sudbury’s past in order to consider how nickel mining emerged there and to locate it in the shift from a staples economy to an industrial economy. In the Canadian context the development of nickel mining in Sudbury was crucial to its nation-building project as an industrializing nation. Examining the governmental regulations in place to manage the hazards of nickel mining demonstrates how risk society is actually inherent to processes of industrial modernization. Because pollution and environmental degradation are framed as tolerable side effects and acceptable risks, by legislating their limits government regulations not

only allow their existence, but also end up enabling their proliferation. In this way, risk society is inherent in processes of industrialization.

While blasting to create railcuts, nickel was discovered in the Sudbury area in the early 1880s (Gregory 80). In 1888, the first roast yard and smelter were built at Copper Cliff (Winterhalder 19). From the late 1880s until the 1920s, open roast beds were used as the first step in processing the ore. The crushed ore was piled on cordwood beds and set on fire for two or more months. This process heated the sulfide ore to oxidize the sulfide, releasing sulfur dioxide into the air (Winterhalder 19-21). Sulfur dioxide is a pollutant, now known to cause respiratory problems in humans, to contribute to acid rain, and to harm overall ecosystem health including plants, animals, and fish. At that time, the fumes were so dense that locals used rope to navigate between their houses and outhouses and would cover their vegetable gardens with burlap bags to protect them from damage during the worst emission days (N. Ross et al 31). The dispersion of smelter fumes across the region and the attempts to limit and control the resulting damage typify the negotiations of an emerging modern nation, what Beck refers to as the first modernity, which attempted to balance the competing interests of industry, economic growth, and public wellbeing (Beck, *World Risk Society* 2).

Risk is defined by the production and rationalization of hazards as predictable and regular occurrences (Beck, *World Risk Society* 51). Although the damaging effects of sulfur dioxide fumes were known by the turn of the century, early governmental response protected industry. In 1915, for example, legislation dictated that patents given to settlers of land included a clause exempting mining companies from smoke damage liability (Potvin and Negusanti 51). In 1921, complaints about damage to crops and vegetation

prompted the Damages by Sulfur Fumes Arbitration Act to be passed. This was replaced in 1924, and in 1925 a claims arbitrator was hired (Potvin and Negusanti 51). During this time, mining companies paid “smoke money” to area farmers whose crops were damaged by the fumes, and sold soil and fertilizer, used to neutralize the acidic effects of the fumes, to local residents at cost (N. Ross et al 31 and 37). By this time, Sudbury was one of the biggest global producers of nickel, an important contributor to the Canadian economy. The hazards of the industry were known and to some extent understood, as government and company policies illustrate. Because the hazards were produced lawfully, they were brought into and validated by those very procedures and regulations and this action worked to normalize the industry and its effects. As illustrated by the smoke money and agricultural subsidies, governance became a balancing act between the compensation and avoidance of hazards. Government regulations represent organized management of those hazards, largely in favour of mining companies, not the general public. This makes for an inherently unstable system that requires maintenance in order to preserve trust in government and industry. Since government institutions charged with public well being are constantly addressing those hazards, this action can also be said to create a sense of security or at least a sense that the issue is being attended to (Beck, *World Risk Society* 52).

With the fast pace of new technologies including plastics, the car, nuclear power, the invention of new chemical processes, and industrial culture, the potential destruction of the planet through those very decisions made by social institutions responsible for both industrial development and public safety became more obvious (Beck, *World Risk Society* 53). This became clear in Sudbury by the 1950s, as the area became as well

known for its barren landscape as for nickel production (Conroy and Kramer 3). In response, the government and industry handling of the destruction began to shift, and scientific research revealed the extent of the devastation and the limits of existing scientific knowledge. In the early 1940s, studies on the negative effects of sulfur on white pine and lichen, and by the 1950s lakes in the Sudbury area had noticeably lower fish populations (Winterhalder 24; Dixit et al 43). Although sulfur dioxide was blamed for damage, later studies showed that many factors interact to damage ecosystems, including the presence of nickel and copper metals, also released by smelter fumes. The sulfur in the soil has strong metal binding capabilities, further binding copper and nickel contaminants in the soil. These factors, combined with already low soil pH, cause aluminum to be released from clay minerals and so worsen the toxicity. These processes inhibit root growth and seedlings are more easily killed by frost or fire (Winterhalder 25-7). What became apparent, then, is that the causes of ecosystem damage were not fully comprehended by experts so that earlier attempts to mitigate damage were unable to take into account all the factors damaging ecosystem health. Additionally, the balancing act of attending to those hazards while supporting industry was made more difficult by the gaps in scientific knowledge. Although scientific knowledge and experimentation had been traditionally understood as taking place in the controlled conditions of a laboratory, as this example demonstrates, in another shift characteristic of risk society, that technoscience exceeds the confines of the laboratory, making the world at large the site of experimentation (Beck, *World Risk Society* 61). What was thought to be simply sulfur poisoning to plant and animal life was revealed as a complex set of interlocking and cascading effects started by the fumes.

By setting limits on acceptable levels of pollution, regulations end up enabling pollution to be created in the first place. The central contradiction of risk society is that the status quo established by institutionalized norms and regulations, or acceptable levels of pollution, also works to spread and proliferate those hazards it is trying to contain (Beck, *World Risk Society* 56). By the early 1970s, there was a shift in strategies used to confine the hazards of the mining industry. In 1970, sulfur dioxide emissions were 231 times higher than the allowable limit (N. Ross et al 38; Lautenbach et al 109). A control program meant to lessen emissions in the Sudbury area was put into place and in 1969 and 1970 the Government of Ontario laid the first control orders against mining companies in the Sudbury area (Potvin and Negusanti 52). As a result, in 1972 Inco built the Superstack, a 381 metre tall smokestack. What the Superstack did was to disperse pollution over a larger area, so that it became synonymous with acid rain during the 1980s, offering evidence that the bureaucratic strategies were spreading, not containing, the environmental hazards. The idea of cross border pollution also emerged in the 1972 United Nations Conference on the environment where Swedish delegates accused British industry emissions of polluting lakes in Sweden (N. Ross et al 40). Many factors may have contributed to the pressures on Sudbury to clean up, including the fact that it had become the largest source of acid rain emissions in North America. In fact, European environmental activists who sported t-shirts emblazoned with the message “No Sudbury” (N. Ross et al 40). Demands from local Sudburians and from environmental groups and changes in the global discourse on industry and environment may have been factors that compelled the shift in containment strategies by the government. In 1972, local emissions were down by 50 percent because of the Superstack and also because Inco’s Coniston and

Falconbridge's iron ore sintering plants were shut down (Potvin and Negusanti 52). In 1985, the Ontario government's Countdown Acid Rain program set legal limits for sulfur dioxide emissions to be achieved by 1994, and these limits were met by industry.

Evidence of these changing approaches to mining hazards can be found in the successful re-greening program that was launched in 1973 when the Regional Municipality of Sudbury began a restoration program with the goal of reestablishing the red and white pine forest (Lautenbach et al 109). As proof of policy changes, researchers from Laurentian University, once discouraged from examining local environmental problems, were included in the technical advisory committee along with members of industry, the local community, and government (Lautenbach et al 109; N. Ross et al 45). Research showed that grass and shrub cover were a necessary precondition to the growth of trees. Mining companies had already been sowing their tailings with metal and acid resistant plant cover in order to keep the dust from blowing over the barren landscape. Officials from the Ministry of Natural Resources approached the Regional Municipality of Sudbury about creating a coordinated effort between university researchers, residents, industry, and government was organized to research the problem (N. Ross et al 38). This group was eventually called the Vegetation Enhancement Technical Advisory Committee (VETAC) (N. Ross et al 48). The program involved a multi-step process beginning with the introduction of lime to balance soil pH levels, then the ground was fertilized and seeded. From 1978 to 1993, 3070 hectares of damaged land were treated (ibid 112). Although birch, poplar and willows spontaneously grew in the treated areas, coniferous trees had to be planted; in 1983 228,000 trees were planted (ibid 113). The program has gained international recognition, including the United Nations Local Government

Honours Award presented at the 1992 Earth Summit in Rio de Janeiro (ibid 119). Experts predict that with continued efforts, it will take about two hundred years to restore the ecosystem to health rather than the 2000 years it would have taken without intervention (N. Ross et al 96).

Although Sudbury is an inspiring example of ecological regeneration, and the project is studied and implemented by other regions facing similar problems, it has not necessarily affected larger mining practice, or even regulation, domestically or abroad. Rather it is better understood as part of the negotiation that defines risk society, through which tactics to manage risk ultimately regulate the production of hazards. The management of risks is an attempt to calculate things that are very difficult to quantify, especially when one considers the near impossibility of accounting for all the complex variables at play. These calculations fail because they ultimately become technical safety guidelines that normalize the creation of hazards (Beck, *World Risk Society* 56). Consider the following example. In Canada part of the federal Fisheries Act includes the Metal Mining Effluent Regulation (MMER). In 2002, the Liberal government introduced “Schedule 2,” an amendment in MMER that enables mining companies to dump toxic waste into lakes and rivers (Karunanathan 8). At that time, the Liberals reassured environmental groups that the loophole would only apply to lakes and rivers already polluted by mining waste. In 2006, the Conservative government authorized Vale Inco to use Sandy Pond in Newfoundland and Labrador, a twenty-eight hectare freshwater lake renowned for its prize winning trout, as a “tailing impound area” for its future nickel processing facility (Diebel). Through its watershed area, a complex of groundwater and tributaries, the pollution would create a plume all the way to Long Harbour, which would

likely destroy all living things in that water system (Diebel). Since then, five other bodies of water have been designated as mining dumpsites out of a list of twelve applications from mining companies (Council of Canadians). This shocking practice neatly reveals the impossibility of containment in terms of pollution, and, as the Council of Canadians demonstrates, it speaks to the absence of a National Water Policy in Canada in a time of a global fresh water crisis. But as Vale Inco asserts, they are in complete compliance with the law, which in fact protects them from being sued (Diebel). This situation also speaks, then, to the failure to manage the use of resources, as the very purpose of the Fisheries Act, “to conserve and protect fish habitat,” is completely undermined by its mobilization to do the exact opposite (Dieber). Here, the minutia of small technical risks actually legalizes large-scale environmental risk (Beck, *World Risk Society* 58). When risk and responsibility are connected in such a way, it becomes incredibly difficult, if not impossible, to assign responsibility in what Beck calls the “organized irresponsibility” of risk society (Beck, *World Risk Society* 6).

Organized irresponsibility certainly defines the operation of Canadian mining companies, which increasingly operate abroad, notably in Latin America but also in Africa and Asia. In fact, seventy-five percent of mining companies in the world are Canadian and they currently account for forty-three percent of global mining exploration (as of 2010) (Albin-Lackey; Popplewell). Beck considers globalization to be one of the unexpected consequences of industrial modernity and the operation of Canadian mining operations abroad is typical of the economic and organizational changes associated with globalization. The Canadian government, through agencies such as the Canadian Export Development Corporation (EDC), the Canadian International Development Agency

(CIDA), and Natural Resources Canada (Kuyek 208) funds these companies. According to Mining Watch Canada national director, Joan Kuyek, between the years 1995 to 2001, employment in the Canadian mining industry dropped by twenty percent and royalties paid by companies went down 45%, but government funding to that industry rose by fifty-eight percent (Kuyek 206). The government subsidizes Canadian mining companies even as the industry continues to be a major source of pollution and is not creating jobs in Canada. Increasingly, the trend has been for activist, non-governmental and civil groups to monitor the activities of these companies, making the control of information, especially through the media, a site of struggle (Kuyek 210). Mining companies such as Alcan, Barrick, and Placer Dome have begun to offer large donations to NGOs such as World Vision, CARE, and Canadian Hunger Foundation, in return for their public support (Kuyek 210). The erosion of regulation by the nation state in the face of multinational corporations and new free trade agreements represents a significant change in governance, and the intervention by international activist groups shows a major shift in risk containment strategies.

According to Joost van Loon, one of the characteristics of risks is their tendency to mutate and multiply. Considered in the global context, the mining sector is dominated by the proliferation of risks materialized in large-scale ecological damage and human rights violations. In 2009 the Prospectors and Developers Association of Canada (PDAC) commissioned the Canadian Centre for the Study of Resource Conflict to do a study, never released to the public, of the corporate conduct of Canadian extraction companies abroad. The report says that of 171 accusations of abuse against extraction companies, one third were against Canadian companies (Albin-Lackey; Hassanein, Lundholm,

Willis, and Young 15, 20). There are no regulations governing the conduct of Canadian mining companies operating overseas and many of the allegations are serious.³ Concern over these problems and allegations prompted Liberal Member of Parliament (MP) John McKay to introduce Bill C-300, a private member's bill meant to establish guidelines to monitor the activities of Canadian extractive industries operating outside of Canada.⁴ Debated on October 26, 2010, the bill was defeated on October 27, 2010 when the Liberal leader Michael Ignatieff and twelve other members of the liberal party were not present for the vote, essentially engineering the failure of the bill (Curry). For many critics, the bill did not go far enough as it would have initiated monitoring but not regulation (Albin-Lackey).

In 2004, an American investing group named Calvert Group, looking for socially responsible investment opportunities, was unable to find one mining company that met its criteria for corporate responsibility (Earthworks and Oxfam America 30). With these changes described above, especially in terms of industry and its regulation, the risks associated with the Canadian mining industry have multiplied and worsened. They are

³ For example, in 1995, the Canadian-owned Cambior gold mine in Omai, Guyana accidentally released 3 billion cubic liters of tailings containing cyanide into the Omai River. The runoff area between the River and the Atlantic Ocean, with a population of 23 000 people, was established as an "Environmental Disaster Zone" by the President of Guyana (Earthworks and Oxfam America 5). Copper Mesa, a Vancouver based company, has been accused of hiring paramilitary organizations to attack and intimidate the community of Junin, in Ecuador, that had been resisting mining operations since 2004 (Zorilla). One of the most heinous accusations was the gang rape of local women in Papua New Guinea by security guards at a Barrick Gold mine (Whittington).

⁴ Industry launched a massive lobbying effort to defeat the bill, and at the centre of the debate is the issue of corporate social responsibility (CSR). CSR is usually framed as voluntary measures to be taken by companies, but as Joan Kuyek says they cannot be understood as a replacement for enforceable regulation (Kuyek 212). The bill explicitly draws from recommendations in the 2007 Final Report of the Corporate Social Responsibilities Roundtables (Mining Watch).

not contained by the national government domestically or internationally and, rather than being limited, are actually being made legal and allowable by loosening of existing regulations. The environmental problems are not so much deregulated as brought into a logic of risk containment, an unstable, constantly changing, structure of organized irresponsibility not about public good so much as maximizing profit for big companies.

This brief consideration of the Canadian mining industry offers a litany of immense problems, especially when considered alongside the organized irresponsibility of those institutions charged with protecting the public good. In particular, the ineffectiveness and sheer perversity of new regulations being implemented is stupendous. It is difficult to imagine a rational course of action out of this situation let alone conceive of possibilities for change. Public discussion often degrades into polarized debates that pit industry and economic development against labour rights and environmental safety. The rationalization of hazards across history and geography is a defining characteristic of risk society. For van Loon, risk can produce a politics of urgency, a sense that immediate action is needed to get ahead of the tidal wave of ecological problems (van Loon, *Risk* 188). When faced by this apocalyptic urgency, these reactions often degrade into a vacillation between apathy, anxiety and ambivalence (van Loon, *Risk* 5, 23).

Mining, Edward Burtynsky's Work, and Risk Culture

Part of any social or historic moment includes larger collective, emotional, and affective responses, which in risk society can be complex, challenging, demoralizing, and overpowering (van Loon 188). The theory of risk society primarily deals with the institutional aspects of risk production, circulation, and containment, as described above in relation to the Canadian mining industry. As Raymond Williams tells us, the structure

of feeling is created by the economic, political, and institutional aspects of society, and gets taken up as cultural responses in art, literature, and the every day. The everyday of risk culture connects us to the larger institutions of risk society (Lash 53). Art practices often act as a barometer of mood, intellectual climate, and engage with conceptual and affective elements absent from, but often responding to and affecting, discussions of policy, governance, and industry.

Innis and Berland connect media, like the American newspaper empire, to the structures of natural resource extraction, such as the development of the Canadian pulp and paper industry. Similarly, the personal computer is inseparable from processes of resource extraction, which often remain excluded in media studies and mainstream discussions of technology. The photographs by Canadian Edward Burtynsky, which include Sudbury's nickel mines, represent a moment of visibility of resource extraction. In her conference paper “Toward an Environmental Materialism: Bodies, Waste, and the Industrial Sublime in Edward Burtynsky’s *Manufactured Landscapes*,” Sarah Jaquette Ray emphasizes that Burtynsky's photographs should be understood not simply as representations of the mining industry, but as reflections of those larger systems and processes crucial to the maintenance of technological culture. Her discussion resonates with Berland and Innis, both of whom reiterate the importance of connecting media to their extractive industries. I consider Burtynsky's photographs in the following section as an example of risk culture, which seeks to make sense of the affective aspects of risk society.

Edward Burtynsky’s career spans thirty years, during which time he has investigated human interventions on the landscape. His subjects have included railcuts,

mines, quarries, oil refineries, shipbreaking, transportation, motor culture, large scale manufacturing, electronics recycling, and more recently water. Considered as part of the assemblage of the personal computer, Burtynsky's photos make connections between the processes of mining and disposal, production and transportation, the usually hidden aspects in the life cycle of high tech. In his talk at Ryerson University's *Oil Symposium* in May 2011, Burtynsky compared the city to a circuit board, making further connections between the infrastructures of information circulation and those of transportation, urban consciousness and extractive industries. In keeping with the theme of this chapter, I will focus for the most part on those photographs dealing with resource extraction.

Shot on a large format viewfinder camera, part of the viewing experience of Burtynsky's photographs is their scale. Not only are they large prints, but their enormous subjects, whether shipbreaking, quarries, or mining, demonstrate the impact of industry on the land. As Burtynsky says of his impressions after gazing up at Toronto skyscrapers for the first time, "for things to be on this scale... there has to be something equally monumental in the landscape where we have taken all this material from" (Haworth-Booth 38). The photos draw the viewer in with their stunning landscapes, and often the viewer needs to spend a moment deciphering the image. As Paul Roth says of Burtynsky's technique: "[it] consistently provokes a crisis of vision... [that] attracts and repels the eye" (168). Burtynsky himself suggests that the scale and large format cause the photographic print to "oscillate" before the viewer sees the photo and is repelled by it (Burtynsky, "Interview on Stage").

Burtynsky's mining photographs of nickel tailings and abandoned mining shafts show the consequences to the land of the mining industry. Included in the *Manufactured*

Landscapes collection, Burtynsky took two series of photographs in the Sudbury area - one from 1983-5 of open pit mines and the other in 1996 of nickel tailings. The photo *Inco Cave-in Pit, Clean Hill Mines, Sudbury, Ontario* is of a mass of gray rock face around a cave-in, the foreground showing the lip edged with a human scale fence. *Inco Abandoned Mine Shaft, Clean Hill Mine, Sudbury, Ontario* is of another gray rock face above an eerie green pool of water, the rock face reflected in it. Empty of humans, these photographs show mines no longer in use, inviting the viewer to gaze at the neglected rough-hewn rock face. No longer productive as mining sites, the deserted mines are left after the ore has been extracted. Perhaps better known are the photos of active mining processes, including *Nickel Tailings #34* and *#35*, which show nickel tailings as vibrant orange streams across a blackened landscape. Once understood as mine waste, the photos are alarming. It appears that the fiery rivers have devastated the surrounding area, turning it into a blackened wasteland. All of these images capture the vast scale of industry and, with the possible exception of *Inco Cave-in Pit*, contrast bright seemingly artificial color against a drab background. In many ways it is their beauty and that moment of conflict or confusion that the viewer might experience trying to reconcile these usually contrary impulses that gives the photos their impact.

That moment of vacillation in the viewing process is described by many observers of Burtynsky's work. Roth says:

Sojourning witnesses to extraordinary scenes, we are present at critical moments, in hidden place, from impossible positions. Each is revealed in broad scope, and with abundant detail both familiar and unrecognizable.

The tone is bi-polar - intense and dispassionate; disoriented, yet strangely taciturn. (167)

Many of the photos capture contradictions between beauty and pollution, orderliness and neglect, complicity and helplessness. Photos of oil refineries in Oakville, Ontario and St. John, New Brunswick - *Oil Refineries* #2, 3 and 22, 23 - show hundreds of multi-tiered, shiny pipes, going in every direction, but reveal little about the process or pollution of oil refining except the complex and orderly design of the refinery itself. *Alberta Oil Sands* #7 and 9 are landscapes in muted colours, with the sky and clouds reflected in pools of water (lakes? tailings ponds? the oil sands?). Roads are barely visible, smokestacks dwarfed by the open expanse of land, but with huge tracks of it laid bare and exposed. With their quiet beauty, these are difficult photographs. Without the captions, deciphering their content would be difficult for anyone outside of the industry or not familiar with the area. And yet the captions simply label, giving no hint of the politically contentious nature of the project in Canada and internationally. (They were also taken well before the oil sands became such a huge and heated public debate in Canada and internationally). *Oil Fields* #28, taken in Cold Lake, Alberta has a shiny silver pipeline in the foreground, offset by the brilliant green of the grass underneath it. Behind it is the darker green of the forest. The colours and composition are beautiful. In all of these photographs there is an incongruity between composition and content. Somehow, the photos are not celebrations, but also not indictments of these polluting industries. As William Rees puts it:

Virtually every Burtynsky landscape is a masterpiece of ambiguity. Colour and composition seduce the senses while the scene repels the soul. Evoked

emotions of horror and rage compete with deeper surges of guilt and complicity in an unspeakable crime. (Rees 198)

In many of the photographs discussed above, scale creates distance, affective and actual, in relation to landscapes of human intervention. Richard Rhodes, editor of *Canadian Art*, in his interview with Burtynsky at the *Oil Symposium* at Ryerson University, observes that density functions as scale in many of Burtynsky's photographs. Part of the series of urban mines shot in Hamilton, Ontario, *Densified Tin Cans #2*, *Densified Oil Drums #4*, and *Densified Scrap Metals #3a* are all photos of metal to be recycled, compressed into large rectangular bales. They all have what Burtynsky describes as a "democratic distribution across the field" (Burtynsky, "Interview on Stage"). The result is a flat, almost depthless, image. The oscillating effect functions differently in these photographs. At first glance, the images are rusty, even planes, but longer viewing reveals spots of colour, blue or white oil drum lids and red and green tin can labels not yet corroded. The density pulls the eyes inwards to the details, overwhelming in much the same way that the vast scale does in the landscapes photos. In others, such as *Scrap Auto Engines #11* and *Telephones #21*, also taken in Hamilton, the eye is drawn to the recognizable details, such as a single, old phone, before being overcome by the sheer number of phones, hundreds jumbled together.

Some of his China photographs bring together the effects of flatness and scale. Images of the demolition of neighbourhoods, part of the Three Gorges Dam construction along the Yangtze River, show vast fields of dusty bricks, the rubble of destroyed buildings filling the entire frame. In *Feng Jie #4* and *#6*, in particular, the gray colour of the bricks provides the flatness, pulling the eye over the immensity to pick out the tiny

details, people, trucks, square stacks of bricks, bits of twisted rebar. In *Tanggu Port*, photographed in Tianjin, massive piles of coal ripple out into the horizon line. In the China pictures, the scale is simply gargantuan. The scale of ruin is overwhelming and impossible to ignore.

The photos of quarries are also remarkable because of their scale, made perceptible by the tiny figures of people and heavy machinery, but also because of the geometry of remarkably tidy linear cuts into the rock. *Carrara Marble Quarries* #24 and #25 are both shot from above, the trucks, human workers, and equipment rendering the huge scale of the quarry understandable, and providing the only colour in these photos; the marble is surprisingly light in colour, almost chalky. In his review of the book *Manufactured Landscapes*, Jonathan Bordo connects Carrara to Italian Renaissance art and histories of craft production (Bordo 89). For Bordo, their inclusion in the book in a section titled “Quarries,” situated between sections “Urban Mines” and “Mines and Tailings” is noteworthy. He describes the photos as “mournful” and contrasts them to the scenes of toxic industrial pollution in the other sections (Bordo 89). Bordo points not just to an oscillation in the viewing of an individual photo, but also to a sense of movement between photos. Bordo describes his viewing process:

The spectator is thrust into an ambiguous situation of pondering pictures of ecological devastation while beholding dazzling visual surfaces. (Bordo 91).

As with many other critics, Bordo grapples with the movement and ambiguity of these photographs, particularly with their potential environmental meanings.

Many critics of Burtynsky's work suggest that his photographs are ambivalent and politically ambiguous because they aestheticize ecological destruction. For Gerda Cammaer, the representation of ecological disaster in high art can only be described as taking a "neutral" stance, eclipsing the destructive dimension of those activities (Cammaer 123). Jennifer Baichwal, director of the documentary about Burtynsky entitled *Manufactured Landscapes*, says (in the DVD extras) that it is precisely this effect that drew her to the work, pointing out that many of the photographs could just as easily be displayed on the office walls of an environmental activist as a corporate CEO and vice versa. For many, Baichwal's film *Manufactured Landscapes* works to elicit a more ethical dimension than the photos viewed alone. The film is an artist portrait but many reviewers praise the film for its contextualization of the photographic subjects, those human workers, places, photographic and other labours that the film teases out of the photographs (Cammaer 126). The film follows Burtynsky as he photographs factories, rudimentary electronics reclamation sites, the Three Gorges Dam in China, and shipbreaking in Bangladesh. Among other things, the film gives perspective on the moment when the photograph is shot. One scene in the film shows Burtynsky up on a scaffolding above hundreds of Chinese workers posing, the moving image camera captures the orders shouted by managers, the shuffling and talking of the workers, and the surrounding factories. In other shots, the moving picture camera zooms in on tiny dots in some of the photographs and shows them to be people labouring in a factory, mine, or shipbreaking (Cammaer 126). In many cases, the film humanizes the photographic subject and draws attention to the workers.

Many critics point to where or how they viewed the photographs: collected into a book, in Baichwel's film, or in a gallery space. While these photos make colour and scale central to the viewing experience, it is unusual for the specificity of the viewing context to be so insistently discussed. Bordo's book review is a meditation of the significance of the photographic medium. He considers how the review essays in *Manufactured Landscapes* frame the images:

Burtynsky's photographs in this collection have been rendered "literary" in order to elevate the art value of the work by diminishing their cultural and political significance. The discourses clear the space for the Burtynsky spectacular to gain residence in institutions of art. Is the art gallery the most appropriate residence for this work? (Bordo 91-2)

Cammaer answers this question by suggesting that it is in fact their value as art objects, able to fetch high prices, rather than as social commentary, that make Burtynsky's photographs ethically troubling. For Cammaer, the context matters. As art object, the oscillation swings to heavily towards "beauty" or "awe" without contextualizing "questions of ethics" or the "awful" (Cammear 121). She says:

But more than Burtynsky's work [the film *Manufactured Landscapes*] is thoughtful and politically engaging. The film reminds us that we are all implicated in the cycle of industrial production and that these processes are reconfiguring our landscapes. The film offers the viewer the ability to go into time and space as only film can do, giving the viewers time to ponder on certain details, and taking them to the places and circumstances where the images were shot. This is not possible when seeing the photos, because

Burtynsky does not offer the details needed to do so. He also obscures the ethical issues by emphasizing the aesthetic qualities of his work when it is presented, and by seeking out beautifying effects when making it.

(Cammaer 128-9)

In their discussion, Ballamingie, Chen, Henry, and Nemiroff further complicate these questions by pointing to links to environmental groups on the artist's website and comments he made in his TED talk to suggest that the artist *is* in fact concerned with ecological devastation. Ballamingie concludes, "Indeed, his work can be viewed as art, documentary *and* activism – in large part, depending on the viewer (Ballamingie, Chen, Henry, and Nemiroff 89). In their wide-ranging discussion of Burtynsky's China photos, the authors point not just to medium but also to the context and social location of the viewer. Ultimately, I am inclined to agree with Baker who says: "Burtynsky's refusal to stand fast in any of these positions explains the improbable emotional authority of his work" (K. Baker 40). If the photos aimed to provoke a response of disgust or condemnation, their effects would be entirely different.

In their strangely ambiguous authority, Burtynsky's photographs capture the simultaneous and contradictory impulses inherent to risk society, exposing those landscapes that make technologized culture possible, even as we might oppose ecologically damaging practices. Baichwal says that: "we have to live with the uncomfortable ambiguity of our own role [in environmental problems] and also our inability to figure out a way to get out of it" (qtd in Bozak 71). But as Bordo says, they also "tap into and feed upon ecological anxiety and the premonition of disaster" (Bordo 92). These contradictory impulses resonate with van Loon's description of the politics of

urgency related to risk that move between apathy, anxiety, and ambivalence. The urgency of ecological disaster identified by both Bordo and Cammaer points to a sense of anxiety in the face of what often appear to be apathetic publics, irresponsible governments, and ambivalent multinationals. Van Loon suggests that anxiety often produces risk avoidance, so that anxiety can produce a withdrawal from risk (van Loon, *Risk* 5). On the other hand, apathy can be understood as a tactic of risk aversion, a turning away from or dislike of risk (van Loon, *Risk* 5). If we connect what might be understood as risk coping strategies to risk culture, as artifacts of reflexive-aesthetic judgment Burtynsky's photographs actively make connections between the institutions of risk society and the cultures of risk. With their almost clinical detachment, the photographs seem to evoke an affective response to risk, without necessarily functioning as risk aversion or containment strategies.

What I find compelling about Burtynsky's photos is that, taken together, they open up and encourage associations between the extraction of metals needed for production and the resulting processes of recycling and disposal, illustrating the colossal amounts of materials necessary for the creation and maintenance of our technologized world. In many ways, this dissertation shares certain thematic concerns with Burtynsky's body of work. Roth says,

The places Burtynsky takes us to are unfamiliar, obscure to our knowledge, but on some level they are no surprise. His images astonish largely because they give shape to our dread, to a suppressed realization of what our lifestyle has wrought. (Roth 169)

Connecting mining and resource extraction to our coveted technological objects, such as computers, is disturbing. As I discovered in my amateur disassembly (see Introduction), a precise and detailed inventory to source every component in the personal computer would have to include many other metals than nickel and include plastics, flame retardants and other materials including quartz, glass, and silica (Grossman 20). Burtynsky's photographs bring images of resource extraction and its ecological damage, which most of us outside of mining employees rarely see, into the spaces of the gallery or the internet image search.

The Canadian mining industry and its evolution epitomizes those contradictions at the heart of information society that the risk society thesis works to theorize. In particular, the ways in which the production of hazards has become institutionalized so that environmental problems, rather than being regulated and controlled by government, have exceeded those regulations and processes and attempts to maintain and contain these hazards result in the proliferation of risk. Burtynsky's photographs are central to the assemblage of the Canadian mining industry. His photographs speak to Canada's history as a staples economy and demonstrate that affect is equally part of the landscape, as they capture the anxiety, apathy, and ambiguity of risk culture.

Metals are ubiquitous, used in nearly every industry, not just high tech but including food production, housing, transportation, and medicine (Earthworks and Oxfam America 30). What the example of the mining industry shows is how risk society is immanent in modern industrialism. The production and refinement of metals has been essential to modern industrialism and central to the development of many nation states, including Canada. Oil and gas, motor culture, plastics, and transportation are connected

to the materiality of the computer, information society, and risk culture. Because metals are indispensable to the maintenance of life in our technologized world, an examination of the mining industry and its use in various products and services illustrates the contradictory impulses in the movement from modern industrialism to risk society and culture.

4. Tracking Risk Through the Silicon Valley Immutable Mobile

In the previous chapter I examine nickel mining in Sudbury as an example through which to consider the emergence of risk society out of industrial society in Canada. I argue that the works of artists, such as Edward Burtynsky, are critical to a fuller discussion of risk society, namely the affect and aesthetics of risk culture. This chapter is concerned with the stage after resource extraction in the life cycle of the personal computer: production. I turn to the birthplace of microprocessors, Silicon Valley, to theorize how ideas about risk circulate in discourses of computer production. The materiality of these machines and the externalities of their production are often suppressed by a dominant discourse that insists the only risk that matters in the production of computers is the risky investment deemed necessary to computer production. This chapter continues my investigation of the (in)visibility of the ecological damage.

Donna Haraway says:

Our best machines are made of sunshine; they are all light and clean because they are nothing but signals, electromagnetic waves, a section of a spectrum, and these machines are eminently portable, mobile – a matter of immense human pain in Detroit and Singapore. (Haraway, *Simians, Cyborgs, and Women* 153)

In this passage, Haraway is referencing both the material aspects of the manufacturing industry often obscured by discussions of the perceived immateriality of the machines associated with information society and the shift from industrial to risk society. The

global and mobile nature of capital sees plants closing in old American industrial centres such as Detroit and Silicon Valley while others open up in industrializing nations such as Singapore and China. Haraway points to how our notions about the immateriality of the technologies of global capitalism threaten to eclipse the enduring materiality of the global manufacturing processes and capitalism generally. The production of the personal computer is implicated in the processes of globalization whereby transnational corporations move factories, seeking lower labour costs and more lenient labour and environmental laws. Not only is the personal computer central to those changes associated with the information economy as an information and communications technology, but its manufacturing process is dispersed and global, part of the changes to capitalist production since the 1970s.

During the 1970s, companies in Santa Clara, California, which became known as Silicon Valley, began manufacturing microprocessors or chips. At that time, chips were promoted by industry leaders as a “clean industry,” largely because of the absence of emissions spewing smokestacks (Byster and Smith, "From Grassroots to Global" 111). A variety of acids, solvents, chlorinated and brominated substances, heavy metals and toxic gases are used to produce chips (Byster and Smith, "From Grassroots to Global" 113). Workers exposed to these chemicals show increased levels of cancer and there are higher numbers of birth defects in their children (Byster and Smith, "From Grassroots to Global" 112). In the early 1980s communities close to Santa Clara discovered that chemicals had leaked into the water supply and the *Silicon Valley Toxics Coalition* was formed in response (Byster and Smith, "From Grassroots to Global" 112). The group documented leaking underground storage tanks and exposed the ways in which communities of color

were located disproportionately closer to these polluting industries than white and more affluent communities. Since the 1980s, more and more high tech production is done in China, India and elsewhere, including Canada, while Silicon Valley has increasingly become the locus for software companies. There are important links between these countries and Silicon Valley, in the US. As with the mining industry, pollutants have typically been framed as side effects, a hazard knowingly produced by the chip industry. Chip production represents another area where the risks associated with the personal computer are actualized, but the emergence of chip production is also central to the emergence of the information age, which brings with it new social, political, and economic reorganizations.

Whereas Chapter 3 examines the assemblage of mining, this chapter looks at the assemblage of the microprocessor with a focus on its roots in Silicon Valley. In particular, I consider how it both facilitates and is made by shifts associated with the information age, especially its association with virtual capitalism and digital technologies. I argue that the Silicon Valley has become an economic model that circulates in business networks in such a way as to suppress the ecological devastation and worker illness associated with the semiconductor industry in that area. This chapter focuses on the perplexing and overlapping understandings of the virtual related to capitalism, risk, and computer technologies and how these definitions produce, reinforce, and buttress notions of computers as immaterial, clean, and ecologically neutral.

Locating the Virtual in the Information Age, Risk Society, and Capitalism

Information society and risk society both emphasize the immaterial and virtual, especially in terms of the emergence of computers and how they have entered the larger

social, political, and economic discourses. James Beniger locates the origins of the information age in the industrial revolution where the increased speed of production, communication, and transportation demanded coordination, distribution, organization, and rationalization of trains, goods, people, and mail (Beniger 8). Information processing and communications are critical to these processes. The term information society was first coined by Fritz Machlup in his 1962 book *The Production and Distribution of Knowledge in the United States*, in which he describes the increasing segments of the American workforce in industries including education, research and development, communications, media, information machines, finance, and real estate (Beniger 21). The information age entered a new phase with the invention of microprocessors in the early 1970s (Beniger 6). Microprocessors, then, are the medium of this latest phase of the information age as they are necessary to the network of software that increasingly facilitates coordination and distribution of people and goods.

Nigel Thrift writes about changes to capitalism since the 1960s, in what he terms the cultural circuit of capitalism to describe the unprecedented expansion of business schools, management consultants, and management gurus, and related media at that time (Thrift 3). He says:

it has made capitalism into a theoretical enterprise in which various essentially virtual notions (network, the knowledge economy, the new economy, community of practice) are able to take on flesh as, increasingly, the world is made in these notions' likeness through the power of consulting solutions - what Miller and others call the rise of 'virtualism.' (6)

This virtual turn is characterized by Thrift as a turn toward theory in the face of uncontrollable market conditions (76). He is cautious about using the term virtual and emphasizes that this reflexive turn in the daily business and practice of capitalism is always grounded in the material.

With the emergence of microprocessors, the position, storage, and flow of goods were, and are, increasingly hyper-coordinated. Taking hold in the 1960s, the nature of address - what will be where and when - shifted to a track and trace model, a development hastened by the later invention of the microprocessor and related technologies (Thrift 220). The track and trace model is brought about by technological innovations such as: the barcode; the .sis file, a network address system; the SIM card, or subscriber information module, used in cell phones to identify the subscriber to a network; the radio frequency identification (RFID) tag that can be read and tracked remotely (Thrift 220-22). Software has become pervasive and infrastructural, embedded in every aspect of life, organizing the movement of everything from elevators, to traffic lights, banking, and of course the coordination of the delivery and movement of goods (Thrift 158).

The rise of informational and virtual capitalism are connected to the emergence of information technologies, with which come some confusing and contradictory understandings of the virtual. Central to understandings of information, as Katherine Hayles reminds us, is that information itself has no body (Hayles 18). In the case of the computer industry, the materiality of production is further concealed by this idea that cyberspace and digital information are immaterial, decoupling them from silicon chip production and from the vast infrastructure of machines and components necessary to

keep that information available and flowing, as well as the environmental degradation as a result of these processes. Here, information is purely data to be communicated or translated in particular ways, a narrower definition than the one Machlup and Beniger deploy, and closer to how information is understood in terms of computers. Adding to the confusion, as Anne Friedberg documents, the term virtual is used differently in different discourses. The virtual came to be likened to digital technology in the 1990s. In reference to computers it often pertains to digital objects, while virtual memory can refer to random-access memory (RAM) (Friedberg 10). But as many other theorists have noted the virtual goes beyond cyberspace or virtual reality (see Friedberg 2006; Grosz 2005; Deleuze and Guattari 1988; Massumi 2002).

The changes related to the information age, particularly the development of chip production, relate to and can be traced through the emergence of risk society. When the chip industry emerged in the early 1970s it was generally more accepted in the wider culture that science had the potential to solve many problems, such as finding a cure for cancer and fixing the environment, but since the 1980s this belief has turned to skepticism (van Loon, *Risk* 83). This is partly due to the emergence of risk society, whereby risks, including bacteria, radiation, and others, once objects of and in the service of science have become actants that affect technoscientific practice (van Loon, *Risk* 56). What were once understood as objects of science affect the practices and outcomes of scientific practice in unexpected ways.

Risks can be understood as virtual objects (van Loon, *Risk* 58). According to van Loon:

the virtual object is not a hypothetical entity; it is real in the sense that it engenders reality; yet at the same time it is not ‘material’ in the empiricist-materialist metaphysical sense of directly observable matter. (van Loon, *Risk* 54)

Risks are virtual “for they would cease to be risks if they were more than a potential of becoming” (van Loon, *Risk* 63). In risk society, risk is a calculation of the nature, frequency, and production of hazards; risk is a hazard with a probability equation attached to it. As a result of this connection, risk is by its nature mediated; the measurement is always offset from the hazard. Risks only actualize as symptoms, or side effects, of that virtual object (van Loon, *Risk* 25). For example, one of the ways that the virtual object of environmental risk is actualized is by the polluted groundwater in Santa Clara. As soon as risk is actualized it ceases to be virtual, or a risk at all, and turns into its “side effects,” those toxic chemicals leaching into the ground water.

The turn towards the virtual is then fundamentally related to risk society. Risk society is characterized by a proliferation of virtual objects, including risks themselves. As expressions of the effects of the virtual, risks have a tendency to multiply, distort, and transform, often into new risks (Massumi 133; van Loon, *Risk* 31). The virtual can be understood as immaterial and real, but not actual, whereas the immaterial is that which has no body or physicality. Cyberspace and the internet are central to changes related to the latest iteration of information society. Understandings of cyberspace as virtual reinforce the idea that information has no body. However, cyberspace and the internet are instantiated in the medium of the computer, including hardware, computer chips, data farms, and the vast infrastructure required for the storage and communication of data.

Characterizing cyberspace as virtual obscures its materiality. There is a major contradiction in definitions of the virtual, which is immaterial and real, when applied to cyberspace, which is not immaterial at all since it has a medium. This confusion becomes critical when examining the emergence of the Silicon Valley model. Obviously, Silicon Valley is a real and actual location, but as I will discuss below its legendary status in business literature has also created a related virtual Silicon Valley, related to but separate from that originary place.

The business literature on Silicon Valley is the embodiment of those “virtual notions” that underlie Thrift’s understandings of virtual capitalism, but must also be connected to the understandings of the information age. An extensive popular and academic literature chronicles the development of the personal computer in the 1960s and 70s. Typically, it suggests that a few American geniuses and oddballs in Santa Clara, California spawned the so-called computer revolution. The story of Silicon Valley is celebrated as a model of economic development, in the face of changes to global capitalist production. This enduring idea, and its particular iteration in business literature can be understood as an immutable mobile. The concept of immutable mobiles in science studies generally refers to how a scientific concept, usually a chart, statistic, table, map or figure, gets created and circulated not just in scientific literature and practice but also in the larger systems, including media, government, business, and so on. Immutable mobiles are virtual objects that are created by networks, and circulate within networks unchanged. It is not Silicon Valley the place that is circulates in these networks, but the idea of Silicon Valley as the ideal business model. The immutable mobile offers a vehicle through which to track Silicon Valley as business model, especially since the 1980s.

What is remarkable about the Silicon Valley immutable mobile is its constancy as a touchstone of economic success in the business literature. It renders visible (reveals) the emerging economic logic of information society, namely the importance of specialized economic clusters fueled by "risky" investments, and simultaneously obscures (conceals) the economic and environmental degradation associated with the global chip and computer industries. This action or movement takes place as the Silicon Valley model is discussed, written about, and deployed in business literature, government policy, and elsewhere.

Examining Silicon Valley as an immutable mobile illuminates how it emerged and was promoted as a business and economic model to be emulated by other communities. As it circulates, the Silicon Valley immutable mobile consolidates as a tool for economic progress and prosperity and simultaneously conceals or obscures the environmental and health problems associated with chip production. Risks become understood, not as acceptable environmental hazards tolerated in the name of prosperity and jobs, but as business risk. Business risk and environmental risks are framed in fundamentally different ways. Most risks are defined by their transgression of borders. Environmental risks actualize as worker illnesses or ecosystem pollution; too much of the wrong chemicals in the wrong place disrupt the workings of immune systems and ecosystems. Whereas pollution as risk is about too much of something and in the wrong place, business risk is about not enough of something in a particular place. In business, risks are framed in terms of a lack of investment and innovation (van Loon 82). Business becomes risky when there is not enough capital or invention. As I will argue, environmental hazards are effectively taken out of the business equation (framed as

externalities), but of course they always return, as we see below. This dynamic is indispensable to understanding how the environmental risks from consumer objects, especially electronics, are disavowed in formulations of business risk.

Virtual Capitalism, Ecological Risks, and Silicon Valley

Journalist Don C. Hoefler characterized Santa Clara, California as “Silicon Valley” in the 1970s because of the emerging semiconductor industry at that time (Saxenian, *Regional Advantage* 178). Since the 1980s, a large number of magazines, popular literature, business books, newspaper and magazine articles on Silicon Valley’s computer industry have been published. It has become one of the stories that is told, retold, studied, theorized, and debated by economists, business leaders, and others. As part of this mythmaking, Silicon Valley has become an economic model to be emulated with little or no change, an idealized example of a regional cluster able to compete and flourish in the changing global marketplace. As Bob Metcalfe, founder of 3Com, says, Silicon Valley is “the only place on Earth not trying to figure out how to become Silicon Valley” (qtd. in Kaplan 25). In Canada, the Silicon Valley economic model has been applied to the technology sector in the Ottawa region, which has been dubbed and developed as Silicon North. In this example, and others globally, the Silicon Valley emerges as a model or immutable mobile, which is actualized in the business literature, Silicon Valley copycats, and in the routine business of the original Valley. This immutable mobile, has suppressed the other side of this industry, namely the health and ecological risks it produces. In the following section, I examine how the myth of Silicon Valley persists in ways that perpetuate the industry as clean, immaterial, and ecologically neutral.

Connected to and coming out of what Thrift terms virtual capitalism, the factors ascribed to Silicon Valley's economic success have been carefully studied and canonized in the dozens of books on Silicon Valley since the 1980s, which investigate and analyze not only the factors necessary for its development but also how to apply that success elsewhere.⁵ Thrift shows that as the so-called "new economy" began to emerge at that time, and with it came cultural shifts in terms of business management and the

⁵ These titles include: *Silicon Valley Fever: Growth of High-technology Culture* (1984) by Everett M. Rogers and Judith K. Larso; *The Big Score: The Billion-dollar Story of Silicon Valley* (1985) by Michael S. Malone; *Growing the Next Silicon Valley: A Guide for Successful Regional Planning* (1987) by Roger Miller and Marcel Côté; *Accidental Empires: How the Boys of Silicon Valley Make their Millions, Battle Foreign Competition, and Still Can't get a Date* (1992) by Robert X. Cringel; *Startup: a Silicon Valley Adventure* (1995) by Jerry Kaplan; *The Rise, Decline, and Renewal of Silicon Valley's High Technology Industry* (1997) by Dan M. Khanna; *Grassroots Leaders for a New Economy: How Civic Entrepreneurs are Building Prosperous Communities* (1997) by Douglas Henton, John Melville, and Kimberly Walesh; *Relentless Growth: How Silicon Valley Innovation Strategies Can Work in Your Business* (1998) by Christopher Meyer; *Inside the Tornado: Marketing Strategies from Silicon Valley's Cutting Edge* (1999) by Geoffrey A. Moore; *Microsoft Rising--and Other Tales of Silicon Valley* (1999) by Ted G. Lewis; *The Silicon Boys and Their Valley of Dreams* (1999) by David A. Kaplan; *The Silicon Valley Edge: A Habitat for Innovation and Entrepreneurship* (2000) edited by Chong-Moon Lee et al; *Understanding Silicon Valley: The Anatomy of an Entrepreneurial Region* (2000) edited by Martin Kenney; *From Silicon Valley to Singapore: Location and Competitive Advantage in the Hard Disk Drive Industry* (2000) by David G. McKendrick, Richard F. Doner, Stephan Haggard; *Cloning Silicon Valley: The Next Generation High-tech Hotspots* (2002) by David Rosenberg; *Smart Growth: Form and Consequences* (2002) edited by Terry S. Szold and Armando Carbonell; *Clusters of Creativity: Enduring Lessons on Innovation and Entrepreneurship from Silicon Valley and Europe's Silicon Fen* (2002) by Rob Koepp; *From the Ground Up: Building Silicon Valley* (2002) by Goodwin Steinberg; *Work in the New Economy: Flexible Labour Markets in Silicon Valley* (2002) by Chris Benner; *Silicon Valley Greats: Indians who Made a Difference to Technology and the World* (2003) by S.S. Kshatriy; *Fred Terman at Stanford: Building a Discipline, a University, and Silicon Valley* (2004) by C. Stewart Gillmor; *Building High-tech Clusters: Silicon Valley and Beyond* (2003) edited by Timothy Bresnahan and Alfonso Gambardella; *Making Silicon Valley: Innovation and the Growth of High Tech, 1930-1970* (2006) by Christophe Lécuyer; *Knowledge Management Systems Implementation: Lessons from the Silicon Valley* (2008) by Hind Benbya; *The Inside Story of China's High-tech Industry: Making Silicon Valley in Beijing* (2008) by Yu Zhou; *Secrets of Silicon Valley: What Everyone Else Can Learn from the Innovation Capital of the World* (2013) by Deborah Perry Piscione.

distribution of business knowledge to industry leaders (Thrift 114). Part of this virtual trend is what Thrift calls storytelling practices, marked by the large increase of business publications (Thrift 119). The literature on Silicon Valley is evidence of this trend, as is the booming consultancy industry which sprang up to advise other regions on how to replicate the success of Silicon Valley, California (Ghent Mallett 21). The Silicon Valley model is made up of the existing institutions and underlying factors in Santa Clara and how these allowed Santa Clara to become the Silicon Valley economic cluster.

Economist Michael Porter has capitalized on the need for consultants coming out of virtual capitalism and many governments and corporations have employed him as a management consultant on the “new economy.” Porter argues that in the global economy location generally matters less in terms of sourcing, production, and distribution. He says that economic clusters: “are geographic concentration of interconnected companies and institutions in a particular field” (Porter, “Clusters and the New Economics of Competition” 78). Examples of successful clusters include regions such as Silicon Valley in the US, the German chemical, Japanese electronic, and Danish food industries, which are able to compete internationally due to their high degree of specialization. These changing practices were not limited to business communities and, in the 1990s, governments, including Canada and Singapore, commissioned reports in order to remain competitive in what was perceived as a shifting global economy (Thrift 116). Porter’s work on the cluster model with its emphasis on remaining competitive during economic changes is not management theory per se. However, it is certainly targeted at academic, corporate, and governmental leaders and is often cited in the literature on Silicon Valley

(see for example: Kenney 2000; Lee, Miller, Gong Hancock, and Rowen 2000; Lécuyer 2006; McKendrick, Doner, and Haggard 2000; and Shavinina 2004).

Although they quibble about their relative importance, most writers agree on a few conditions that account for the success of Silicon Valley, California. One of the best known is AnnaLee Saxenian's 1996 study, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, which shows that preexisting conditions, including military spending and the proximity of Stanford University, facilitated the electronics production and market.⁶ Located in the area, Stanford University has contributed both innovative technology in its laboratories, and students who have gone on to form electronics and high tech companies (Gibbons 201). From World War II through to the Cold War, military research monies flowed into the area (Leslie 49). Stanford Research Institute (SRI) was built to carry out defense research and continues to be well funded by the military (Leslie 66). Fairchild Semiconductor, a pioneer in semiconductor production, was formed in 1956 by a group of frustrated engineers who left their original employer. Military contracts from the Air Force and NASA largely accounted for Fairchild's growth, with sales of \$130 million in 1963 (Saxenian, *Regional Advantage* 25). Defense funding remains important; Stanford continues to receive more defense funding than most other American universities (Leslie 66).

The presence of significant institutions including Stanford, and other research labs such as XEROX's PARC, make up a central part of the infrastructure, feeding well-trained engineers to high tech firms. Related experts and industry have sprung up in

⁶ That Norah Young interviewed AnnaLee Saxenian on the CBC show *Spark* in an episode titled "Building Creative Hubs and the Next Silicon Valley" that aired on February 1, 2012 demonstrates the study's enduring legacy.

response, including venture capitalists, lawyers, and marketing. According to Saxenian, it is not only the presence of these experts and institutions, but the fluid, mobile, and informal nature of social networks in the Silicon Valley that are key to its competitiveness (Saxenian, *Regional Advantage* 54). Scientists and engineers frequently change jobs, switching to other companies or starting their own companies according to their research interests or belief in a given innovation (Castells and Hall 18). Silicon Valley has a business practice characterized by informal networks that facilitate the sharing of financial resources, expertise, personnel, and knowledge (Henton 48). Communication between engineers and CEOs of competing companies is routine, and failure is an accepted part of the culture of Silicon Valley (Saxenian, *Regional Advantage* 55).

As Byster and Smith note, Silicon Valley serves as a “textbook model” or “blueprint” for other regions internationally who wish to emulate the economic successes of that region (Byster and Smith, "Electronics Production Life Cycle" 205). The Silicon Valley economic model has been translated and applied to hundreds of regions around the world, including: Silicon Fen in Cambridge, England; Silicon Alps in Austria; Silicon Wadi in Israel; Silicon Polder in the Netherlands; Silicon Beach in Vietnam; Silicon Island in Taiwan; India's Silicon Valley in Bangalore (Koepp 1-2; Lee, Miller, Hancock, and Rowen 2). Because of the ways that Silicon Valley has been studied, evaluated, and circulated it has emerged as a model or immutable mobile. It can be understood as an immutable mobile that has been produced by what Thrift calls the cultural circuit of capital, or virtual capitalism, in particular those management schools and gurus such as Michael Porter, who hold it up as a prime example of economic success. After Silicon

Valley recovered from the recession in the 1980s, when chip production began to be done more cheaply in Asia, the Silicon Valley immutable mobile was strengthened and produced even more vigorously by business and community leaders around the world. The Silicon Valley immutable mobile is directly connected to understandings of the shift towards virtual capitalism.

Ottawa's technology sector is but one example of a region that has employed the Silicon Valley model, and is evidence of its circulation and reproduction as an immutable mobile. With an eye to the original Silicon Valley, Ottawa's high tech industry has been dubbed, and developed as, Silicon North. Theorists have applied the Silicon Valley model to Silicon North, for example, to gauge and advance the success of the latter. In the early 1990s, the Business Council on National Issues and the Canadian government hired Porter to study Canadian competitiveness. The study culminated in the report "Canada at the Crossroads: the Reality of a New Competitive Environment," published in 1991. The report did not specifically deal with the Ottawa region technology industry. However it has inspired the small amount of Canadian literature on the subject (see Shavinina 2004). The thrust of the report is that Canada cannot remain competitive without making major changes to its economic strategies, namely moving away from a resource based industry. Citing other international success stories, the report suggest that clusters are important to a country's economic development and notes that "the creation of more dynamic industry clusters represents a major challenge facing the Canadian economy (Porter et al, *Canada at the Crossroads* 28-9). It also notes that the Canadian telecommunications industry is a strength on which it can be built (Porter et al, *Canada at the Crossroads* 71).

When the model is applied to Silicon Valley North, equivalent factors to Silicon Valley California are identified in the literature, namely existing academic and corporate structures. Northern Electric, which later became communications giant Nortel, started research and development facilities in the late 1950s (Ghent Mallett 22). Bell Northern Research and Microsystems, subsidiaries of Nortel, acted as anchor companies bringing jobs and research to the region starting in the 1960s (Ghent Mallett 25). Government research labs such as the National Research Centre (NRC), the Defence Research Establishment, and the Communications Research Lab were started in Ottawa in the 1950s. As with its Californian sibling, many companies owe their roots to these institutes. NRC spawned over 60 technology companies. In the 1990s, thirty percent of Canada's federal research and development funds went to the Ottawa region high tech industry (Ghent Mallett 22). The presences of Carleton and Ottawa universities have also provided research and engineering talent to local industry (Armit 220). One of the main differences between the Silicon siblings is that the US has more start up capital although since the 1990s, more venture capital has been available to Silicon North start ups (Ghent Mallett 26-7). Now that the Nortel campus has been shut down, pundits have proclaimed the end of Silicon Valley North (Ladurantaye). Silicon Valley North is one of the many regions to which the Silicon Valley business model has been applied and the literature pays close attention to those conditions deemed necessary to the original Silicon Valley. What remains to be seen is whether Silicon Valley North will make a recovery similar to the original Silicon Valley in the late 1980s and early 90s, when competition from Asian markets and the collapse of many businesses in Santa Clara threatened the region.

Immutable mobiles are virtual objects that remain unchanged as they circulate through particular networks, in this case the business, popular, and academic literature on Silicon Valley that informs business and political decisions in Silicon North and elsewhere (van Loon, *Risk* 51). As seen in the application of the Silicon Valley model to Silicon North, its movement through the network strengthens the existing networks through which they travel, namely the prevailing business attitudes expressed through corporate and governmental policies and practices (van Loon, *Risk* 51). Central to the Silicon Valley immutable mobile is that risk is solely discussed in terms of economics. For example, the findings of Saxenian's classic study illustrate that a risk-taking attitude, marked by flexibility in terms of jobs, finance, and corporate structure, has been key to the continued success of the Silicon Valley cluster, and its absence a factor in the demise of the Route 128 region, the high tech area around Boston, Massachusetts that was active from the 1960s to 1980s (Saxenian, *Regional Advantage* 38-9). The majority of high tech ventures fail and are financially risky by definition (Lee et al 9). The Silicon Valley "mindset" creates a job climate where past failures do not necessarily limit future employment (Saxenian, *Regional Advantage* 38-9; Lee et al 9). Additionally, changes to government regulation in the US have made risky investments more attractive (Rowen 189; Lee et al 9). In the Silicon Valley model, risk taking is a tenet of success in the high tech industry.

As immutable mobiles reveal and strengthen existing networks, they also work to conceal and repress other actants in the networks. In the case of the Silicon Valley immutable mobile, other hazards of high tech production, such as pollution, are ignored

and suppressed.⁷ The avalanche of publications lauding Silicon Valley as a model for economic success have all but drowned out the few dissenting voices.⁸ For decades the only text on the subject of the ecological damage resulting from chip production was the 1985 book, *The High Cost of High Tech: The Dark Side of the Chip*, in which Lenny Siegel and John Markoff evaluate the legacy of Silicon Valley. They warn:

Any community which hopes to share the benefits of electronics development must be prepared to pay the environmental or regulatory costs. Those communities which, desperate for jobs, relax their environmental standards, are making a terrible mistake. Not only are they risking environmental disaster, but they are unlikely to bring in additional investment. (Siegel and Markoff 174)

As the authors in the 2006 volume, *Challenging the Chip*, observe:

of the millions of words written over the past several decades about the electronics industry's incredible transformation of our world, far too few have addressed the downsides of this revolution. (Smith, Sonnenfeld Pellow 1)

And, “[h]igh-tech manufacturing has contaminated its workers, as well as the air, land, and water of communities wherever these firms are located...” (Smith, Sonnenfeld Pellow 1).

⁷ While one might cynically expect its absence in business literature these concerns are slowly entering the larger discourse. For example, separate from his work on clusters and the changing economy, Porter published an article in *Scientific American* where he argued that strict environmental protection fosters competitiveness (Porter, "America's Green Strategy" 168).

⁸ Castells and Hall's 1994 study is one of the few that deal with it, saying it is “one of the most striking examples of the contradictions between individual economic affluence and collective environmental deterioration” (Castells and Hall 25)

The Silicon Valley immutable mobile can be understood as one of the virtual objects produced in and by risk society that works to obscure other risks and their calculations, namely the toxic pollution and dangers to worker health (van Loon, *Risk* 53). Leaking underground tanks belonging to Fairchild Semiconductors were discovered in 1982, leading to testing of all major production sites. Most of them had major chemical leaks including IBM, and Hewlett-Packard (Siegel and Markoff 165). Tests found that trichloroethane (TCA) was present in the drinking water at rates 29 times above state regulations levels and that there were higher rates of miscarriages and birth defects in that area (Byster and Smith, "From Grassroots to Global" 112). Many workers also experienced "allergic" reactions to chemicals used in the chip manufacturing process, as well as higher rates of cancer than the general population (Hawes and Pellow 120). Community meetings in the early 1980s prompted the formation of the Silicon Valley Toxics Coalition, an activist organization, who had early successes in changing the laws governing hazardous materials and a community's right to know about their existence (Byster and Smith, "From Grassroots to Global" 112). Silicon Valley Toxics Coalition has since become an important international activist organization. Many people working in the so called "clean rooms" in semiconductor manufacturing plants have had their immune systems and health compromised because of exposure to dangerous chemicals including acids, solvents, chlorinated, and brominated substances, heavy metals, and toxic gases (Byster and Smith 113). These workers are doubly exposed to toxic substances through work and at home. In the US, Superfund sites describe land that the Environmental Protection Agency has designated as contaminated by hazardous waste that needs to be cleaned up. Silicon Valley has more Superfund sites than any other

region of comparable size in the US, attributed to high tech production facilities where unsafe levels of trichloroethylene (TCE), a solvent used in chip production and a carcinogen, has been found in the groundwater (Grossman 3 and 67). Similar problems are happening in chip production facilities globally including Taiwan, Mexico, and Scotland. As Dr. Joseph LaDou, an occupational health and safety specialist says, “what was once thought to be the first ‘clean’ industry is actually one of the most chemical-intensive industries ever conceived” (LaDou 33-4). As the Silicon Valley immutable mobile circulates, the associations from the original Silicon Valley, namely that computers are green and clean despite evidence to the contrary, have also circulated and been reproduced.

While electronics workers in Silicon Valley (and globally) waded through lawsuits and insurance claims in an attempt to restore health or just pay for treatment, the solution to the leaking chemicals was to install double walled containers in all new facilities, and to begin monitoring existing sites (Siegel and Markoff 167). In 2003, James Moore and Alida Hernandez, employees at IBM in Silicon Valley from the late 1970s to early 1990s, sued IBM for illegally exposing them to toxic chemicals causing cancer, non-Hodgkin’s lymphoma in Moore’s case and breast cancer in Hernandez’s case (Hawes and Pellow 121). The lawsuit includes two hundred cases that were filed against IBM for chemical poisoning in 2003. Amanda Hawes, the lawyer representing these cases, found that since 1969 the company kept a Corporate Mortality File, an exhaustive database that collects cause of death for all IBM employees. She says:

Once we were able to obtain the Corporate Mortality File through our discovery, I came to believe that IBM had it, but they have never wanted

to share or disseminate it because of the message it sends about the risks of working in the so-called clean industry. (Hawes in Hawes and Pellow 122)

Both Moore and Hernandez lost their trials (Hawes and Pellow 126). Hawes says of the case:

It's clear that our laws don't create any incentive for employers to be proactive about workplace hazards; they can be very confident that the 'worst that will happen' is a claim for workers' compensation, which has never, ever, been enough of a 'stick' to encourage precautionary steps to protect workers' health. (Hawes in Hawes and Pellow 127)

For IBM, and other such companies, workplace hazards represent business risks but the lasting effects are borne on the workers' bodies as well as the larger ecosystem.

Business and environmental risks are incommensurable, which points to the inadequacies of the insurance model when applied to labour and health hazards. As Beck shows, risk calculation, including insurance laws and practices, are about "making the incalculable calculable" (Beck, *World Risk Society* 52). As seen in the previous chapter, the systematic production of hazards by industry is put into an uneasy balance as, in the case of Silicon Valley, labour and environmental laws, as well as private health insurance claims, are revised through negotiations between workers, community groups, industry and government. Far from being solved, many of these hazards are exported as local labour and environmental regulations make the cost of doing business too risky. But more than that, the circulation of the Silicon Valley immutable mobile undermines these labour and environmental costs by understanding risk purely in terms of business, where risk is

framed by lack of investment and risky investment facilitates economic growth. Much of the risk is split across race, class, and gender lines so that chip workers bear the brunt of the health costs, exposed to toxic substances on the job, while business leaders profit. But the entire community is faced with the legacy of the Superfund sites and contaminated drinking water. As the Silicon Valley economic model is exported and implemented, reproducing those conditions necessary for economic growth, it also brings with it this repressed other, the production of environmental hazards. Understood within the logic of risk society, risks change and proliferate (van Loon, *Risk* 25). As risks transform, what at first seems like business risk becomes obvious as environmental risk.

Unlike other Silicon Valley copycats, regions that have attempted to reproduce the conditions of the original through the application of the immutable mobile, and who will surely inherit similar environmental problems, Silicon Valley California also has a counterculture connection peculiar to its location and the era in which it emerged. This marks a limit in the concept of the immutable mobile. Even as the Silicon Valley immutable mobile circulates and reinforces possibilities for economic success through this risky business model, while suppressing environmental risk, local culture grapples directly with these contradictions. As Deleuze and Guattari note, it is impossible to predict where the virtual will actualize and the counterculture connections to Silicon Valley are evidence of this aspect of the virtual as it relates to informational capitalism and risk society.

Counterculture, Virtuality, and Technology

Even as the business literature strives to explain and replicate the economy and innovations of that region, other theorists point to the impact of West coast counterculture

on the burgeoning industry, often connecting it to the environmental movement of the 1960s. Although largely absent from the Silicon Valley immutable mobile, this crucial connection works to strengthen the associations of chip production as nonpolluting and safe. The countercultural connection also marks the limits of the Silicon Valley immutable mobile. Van Loon says that although virtual objects, such as the Silicon Valley immutable mobile, circulate through networks, in this case the global business and management networks, to fully comprehend their behaviour we must locate them in the larger context. In the case of the Silicon Valley immutable mobile, we must consider the smaller and more local assemblage of the microprocessor, which includes the history and evolution of the counterculture movement in California.

In *What the Doormouse Said: How the Sixties Counterculture Shaped the Personal Computer Industry*, John Markoff details how American counterculture in the 1960s and 70s touched the Santa Clara Valley. In the early 1960s, the therapeutic uses of LSD were being tested. Guided LSD trips were being done at the *International Foundation for Advanced Study* in Menlo Park and several members of SRI took part including Hew Crane, Doug Engelbart and Bill English (Markoff 65). Unsurprisingly, given its military research, in the late 1960s SRI was also targeted by antiwar demonstrations (Markoff 171-2). Many young men avoided the Vietnam War draft by working on computer-related research, sometimes on defense-funded projects (Markoff 164-5). Fred Turner shows that Stewart Brand, the creator of the *Whole Earth Catalogue* was instrumental in bringing computer culture and counterculture together (Turner, *From Counterculture* 39).

In the next section, I will show how these communities overlap, but also how the technologically mediated image of the blue earth, taken by NASA astronauts and popularized by Brand and in *The Whole Earth Catalogue*, come together. These connections are largely absent from the Silicon Valley immutable mobile, but are crucial to the creation of the chip industry and to the maintenance of its reputation as environmentally neutral. Reading the counterculture and computer culture histories of Silicon Valley together demonstrates the evolution of the idea that computers and information technologies are environmentally beneficial. Furthermore, the risk taking behaviours of those in the emerging computer industry, including taking drugs and inventing information technologies, can be viewed as possible precursors to the risk taking attitudes necessary for business success in the Silicon Valley computer industry, especially with the emergence of informational capitalism.

Stewart Brand's own travels and relationships brought the communities together, as he journeyed between communes in rural California to operating the camera for Doug Englebart at an Augmentation Research Centre (ARC) (part of SRI) presentation. In 1972, he wrote an article for *Rolling Stone* magazine chronicling how "computer bums" at Stanford's Artificial Intelligence Lab had created an early computer game, Spacewar (Brand). Read widely by computer engineers, artists, and hippies alike, the *Whole Earth Catalogue's* eclectic structure and content allowed information about living off the land and Norbert Wiener's theories to share space on the same page (Turner, *From Counterculture to Cyberculture* 86). Information technology intrigued Stewart Brand and he saw immense potential in giving individuals the tools to access information (Kirk, "Appropriating Technology"). These communities shared the notion that technology can

make the world a better place, less wasteful of natural resources, with less polluting industries.

The conservationist movement dominated the environmental movement in the US until the 1960s when many environmentalists associated with the New Left reconsidered the role of technology and nature (Kirk, "Appropriating Technology"). According to Andrew Kirk, they rejuvenated the environmental movement and sparked research and discussion of sustainable energy production, recycling, waste management, and design, and he credits the *Whole Earth Catalogue* for putting these disparate ideas into the hands of budding environmentalists at that time (Kirk, "Appropriating Technology"). Kirk includes Apple founders Steve Jobs and Steve Wozniak, with their desire to create personal computers as part of these changes. Before that time, computers were massive machines, locked up in research facilities, and access was highly scheduled and restricted. Many young researchers and computer enthusiasts struggled to get time on the mainframes at odd hours, late at night. Large mainframe computers were seen as part of the bureaucratic, faceless, militaristic state apparatus. Given this context, the desire for a personal computer was a way to give the power and control of information technology to the average person. In particular, the New Left became intrigued by the idea of "appropriate technology" that was "cheap, simple, and ecologically safe" (Kirk, "Appropriating Technology"). Appropriate technology was originally conceived of as a way for industrializing nations to gain access to technologies that were appropriate to their climate, geography, and culture without inheriting the environmental and social problems that might come with those technologies (Kirk, "Appropriating Technology"). Part of the mandate of the appropriate technology movement was to take technology into

your own hands. Computer hobbyists, such as those involved in the Homebrew Club, which included members Steve Jobs and Steve Wozniak, among others, were doing just that. They would scrape, scabble, and beg for the parts they needed to build their machines.

Considering the counterculture histories of corporate leaders such as Apple, Intel, and Microsoft, Kirk concludes: “many of the radicals of yesterday have become the capitalist elite of today” (Kirk "Appropriating Technology"). Although computers, especially as they first emerged in enthusiast clubs, represented an avenue for decentralized and personalized access to information, they never really fit the definition of appropriate technology. While it may be impossible to avoid using components produced by large scale manufacturing process, from screws to other machine parts, even for small scale and appropriate technology, it is very difficult to separate early computer hobbyists and the machines they built from, not just exploitative and polluting production processes of semiconductors, but also from the military research contracts that allowed for their development. And while early enthusiasts may have been ignorant of those problems, their early machines are more accurately described as the products of enthusiastic hobbyists, some of whom had anti-establishment beliefs, than of appropriate technologists. Langdon Winner suggests that the proponents of the appropriate technology movement, as with others at that time, including some computer hobbyists, were increasingly pessimistic and distrustful of the reigning social institutions but felt overwhelmingly ineffective to change them (Winner, *The Whale* 69-70). But he notes that in the 1970s appropriate technology became less of a tool for social change, and with its display at consumer fairs and so on, it lost any edge of political change and became

framed as a consumer choice so that “appropriate technologists were unwilling to face squarely the facts of organized social and political power” (Winner, *The Whale* 80). He concludes that, ultimately, “Stewart Brand’s [Whole Earth Catalogue] consoled its readers with the idea that they were citizens of the planet earth and its global systems; hippie environmentalist spacemen in the tradition of Buckminster Fuller” (Winner, *The Whale* 65). Langdon Winner suggests that the American appropriate technology movement does not have a history in social struggle and does not make connections to larger political, as opposed to corporate technological structures. Then, in the turn from politics to consumerism, the logic of business, including business risk, is reinforced. The movement potentially contributes to the proliferation of virtual objects, in particular environmental risks.

Stewart Brand is both loved and reviled by environmentalists because of his unwavering passion and dedication to the environment as well as his support of biotechnology and nuclear power (see his book *Whole Earth Discipline* for his views on these topics). According to some sources, it was Stewart Brand who lobbied NASA to make available the image of the whole earth from space that became so iconic for the environmental movement. In 1976, his interview with Margaret Mead and Gregory Bateson was published in *Co-Evolution Quarterly* (Hayles 74). He also participated in MIT’s Media Lab think tank in 1988 (Betts 3). In 1985, he helped establish an electronic bulletin board in San Francisco called Whole Earth ‘Lectronic Link (WELL), a successor of the *Whole Earth Catalogue*. Founded in 1993, the technology and computer magazine *Wired* grew out of the *Whole Earth Review*, an offshoot of the original catalogue. And it is this peculiar twist that I turn to in the final section. Perhaps not surprising given this

lineage, *Wired* also tends to maintain connections between information technologies and their perceived environmental neutrality, if not benefits. In particular, it regularly reinforces the understanding of information as immaterial.

In fact the whole earth image appears on the July 1997 cover *Wired* Magazine, which displayed a cartoon planet earth image with a flower sticking out of its (his? her?) smiling cartoon mouth. The blue earth image popularized in the early 70s had become central to the Western environmental movement, popularized in buttons and posters, and celebrated in the first Earth Day in 1970 in the US. The image also appeared on the cover of *The Whole Earth Review*. In that same 1997 issue of *Wired*, in an article entitled “The Long Boom: A History of the Future, 1980-2020,” Peter Schwartz and Peter Leyden turn *Wired Magazine’s* predictably techno-utopic lens to the future and suggest that new technologies including personal computers, telecommunications, biotechnology, nanotechnology, and alternative energy have the potential to produce prosperity without any negative impact to the environment (Schwartz and Leyden). Their discussion of the colonization of Mars summarizes how the blue earth image is said to invigorate environmental consciousness:

As the global viewing audience stares at the image of a distant Earth, seen from a neighboring planet 35 million miles away, the point is made as never before: We are one world. All organisms crammed together on the globe are intricately interdependent. Plants, animals, humans need to find a way to live together on that tiny little place. (Schwartz and Leyden)

In their discussion of information technology they claim:

Infotech, which moves information electronically rather than physically, also makes much less impact on the natural world. Moving information across the United States through the relatively simple infotechnology of the fax, for example, proves to be seven times more energy efficient than sending it through Federal Express. Furthermore, these technologies are on an escalating track of constant refinement, with each new generation becoming more and more energy efficient, with lower and lower environmental impact. (Schwartz and Leyden)

Similarly, in a 1996 interview in *E-The Environmental Magazine*, Brand reiterates his enthusiasm for computers and his belief that information technologies are necessary for a future that is ecologically sound. In the interview, Brand repeats many of the (mis)understandings about information technologies, namely that they require less material. He says:

One of the homilies of the information age is that industry is more and more a matter of knowing than 'stuff.' Knowledge is much less environmentally damaging than stuff, and is very often environmentally enhancing. (Betts 2)

Later in the interview when asked about waste and planned obsolescence, he comments, "we're really not hard up for silicon." In this interview, Brand neatly encapsulates the notion, at the heart of the information revolution, that information has no body, and perpetuates the notion of the immateriality of information technologies. And, as I argued in the introduction, taken together these authors continue traditional understandings of technology that are limited by their exclusion of the production process in their

definition, an omission that has major consequences for evaluating the safety and sustainability of any technological object. And although computers and other information technologies are relatively ecologically neutral in their use phases, compared to the emissions producing car, for example, the processes necessary to produce silicon chips, not to mention other components, do not represent a clean or safe industry. The misunderstanding that technology produced in the information age does not require big emissions-heavy industrial production persists.⁹

The counterculture-computer connection is not simply historical. As Fred Turner shows in his article, “Burning Man at Google: A Cultural Infrastructure for New Media Production,” counterculture connections to the computer industry continue. Countless information technologists, including top executives at Google, participate in the annual Burning Man Festival in Black Rock, Nevada (Turner, “Burning Man at Google” 75-6). Burning Man now draws over 40 000 people in a massive, temporary, drug infused, community with large scale art installations, parties, talks and other events, culminating in the burning of a huge wooden man. Part of the Burning Man ethic is to “leave no trace” on the fragile desert ecosystem and hundreds of volunteers ensure that no trace of the festival is left after the majority of the participants leave.¹⁰ There is a fascinating point of overlap between the information industry of Silicon Valley and environmentalism. If the blue earth image is connected to environmental politics, then it is also connected to

⁹ This situation is starting to change as the barrage of news stories in 2010 to 2012 about workers illness and suicide at Foxconn plants in China illustrate. However, the myth of the immaterial and clean nature of ICTs persists.

¹⁰ Additionally, members of the community have issued an environmental statement (see

<http://www.burningman.com/environment/statement.html>).

software company logos including Foxfire, IBM's smart planet campaign, Google Earth, and even Facebook uses the image as notification icon.¹¹ I began this chapter tracking accumulations of meaning with respect to the terms virtual and immaterial in relation to information and risk society and I end this chapter with connections between the icons of information technologies and icons of environmentalism.

In relation to Silicon Valley, the connections between the counterculture and computer culture of the 1960s and 70s as well as the evolution of *Wired Magazine* out of the *Whole Earth Catalogue* have solidified the associations of information technologies as green industries. Certainly this connection must be understood in the context of risk society where risk calculations formulate the production of environmental hazards as side effects. The assemblage of the silicon chip demonstrates that the circulation of the Silicon Valley immutable mobile is bolstered by the countercultural links to the original Silicon Valley.

Publications such as *Wired* and environmentalists such as Stewart Brand can be seen as part of the legacy of not only Silicon Valley, but also of the risk-taking behaviours associated with the 1960s counterculture movement. This affiliation continues to reinforce notions that computers are environmentally friendly technologies by insisting on their immateriality and that digital information can exist without a medium. Of course, the circulation and storage of digital information depends not only on silicon chips but huge data farms and an ever-expanding infrastructure of cables, routers, and wireless hubs. These airy ideals can be grounded in the daily business of global manufacturing where the environmental and labour costs are becoming increasingly obvious and

¹¹ see Heise (2008) and Berland (2009) for discussions of the NASA blue planet image.

uncontainable. Ultimately environmental risks are uncontainable and will continue to proliferate as long as they remain suppressed by the terms of business risk. One of the ways environmental risks are beginning to affect the business world is in the insurance industry. Ulrich Beck makes connections between risk society and insurance, as a risk calculation that is becoming increasingly unstable with large-scale weather events, such as floods and drought, related to global warming and other environmental problems. Insurance calculations connect hazards to a probability calculation; they are essentially a type of risk calculation. Insurance companies are increasingly unable to insure due to environmental problems.¹² In terms of electronics production, how environmental problems will impact business remain to be seen. And although this practice is not sustainable in the long term, at this point, as I will discuss further in later chapters, they have been exported from Silicon Valley to places such as China. In this chapter, I situate the microprocessor as the medium of virtual capitalism. It is crucial to connect the so-called immaterial realms to physical bodies, cyberspace to the microprocessor, and virtual capitalism to the daily production and distribution of goods. In spite of its turn towards the virtual, we must recognize the environmental impacts of the capitalist production of information technologies.

¹² For example, Australian droughts linked to climate change have meant that since 1980 only 24% of crop failures are covered by insurance (National Agriculture and Climate Change Action Plan).

5. The Geopolitics of Toxicity and Waste: Cyber Risk, E-waste, and the Digital Divide

The last chapter focuses on the visibility of discourses regarding the production of personal computers, specifically microprocessors and Silicon Valley. This chapter turns to the part of the life cycle of the personal computer most often studied in Cultural Studies, the use phase. In particular, I am concerned with the term the digital divide and how it is used in discussions of the information age to construct an incomplete understanding of ICTs and their larger impacts on our global economy and ecology. This chapter also begins my examination of e-waste as, not only the most visible aspect of the ecological problems related to computers, but also its expression in visual culture. I continue my consideration of how dominant discourses tend to reframe environmental risk. I turn to news coverage of a documentary made by student filmmakers, in which they expose the illegal exportation of e-waste to Ghana and discover confidential documents from an American defence contractor on a discarded hard drive. I argue that this news coverage in Canada and the US, by focusing on cyber security, works in tandem with artifacts in our visual culture, namely the photographs of Pieter Hugo, to conceal the political and economic complicity of North Americans in the environmental degradation of poor regions of Africa.

The digital divide has been used to describe inequities in the distribution of personal computers, their associated applications, and desired outcomes; it refers to the divide between those who have access to the tools of the so-called information revolution, such as personal computers and the internet, and those who do not. The term digital divide was first used to describe lack of access to these technologies by poorer

nations as compared to richer countries. As Neil Selwyn shows, policy experts, activists and politicians quickly adopted the term to describe these inequities within a given nation. The governments of both Canada and the United States have begun collecting data on the use of the personal computer. Statistics Canada collects information on internet use and income spent on computer equipment and supplies. In the 2000 research paper *The Digital Divide in Canada*, George Sciadas reports that internet use had increased amongst Canadians with higher levels of education, those with children, and those living in urban areas, with usage also being higher among younger Canadians (Sciadas 2). In 2009, ninety-four percent of Canadians had broadband access, sixty-nine percent with high-speed access (Middleton, Veenhof, and Leith). In stark contrast to Canada, Africa has about 9.8% percent of all global internet users, who tend to be located in the Northern and Southern countries, especially in Egypt and South Africa (internetlvestats.com; Hilliard 19).

For Manuel Castells, the internet has become the defining technology of the information age, and as many others have also noted, it has become understood as the “motor” of the post-industrial global economy (Hand and Sandywell 198). Castells says:

Differential timing in access to the power of technology for people, countries, and regions is a critical source of inequality in our society. The switched off areas are culturally and spatially discontinuous; they are in the American inner cities or in the French *banlieues*, as much as in the shanty towns of Africa or in the deprived rural areas of China or India. (Castells, *Network Society* 33)

Access to information technologies is seen by academics, politicians, activists, and planners as crucial for the economic prosperity and overall success of a community and has been used to make a case for why disadvantaged communities need to be connected to these technologies. This chapter charts global patterns of computer use, especially the internet, and their associated risks.

Computer use is the part of the computer's life cycle that we typically write about in media and cultural studies, but in this chapter I argue that to fully appreciate its use we must equally consider its disuse as e-waste as a structuring absence. A preliminary mapping of the information economy uncovers a geography of risk related to the digital divide, so that the risks to which a given community is likely to be exposed correlate in several ways to their use of the personal computer. Communities who are not wired are more likely to be exposed to the "side effects" or externalities of technological culture, namely the pollution and health problems associated with its production and disposal, while of course communities who are wired are more susceptible to cyber risks, including viruses, fraud, and so on. The internet is not only the object of media coverage, it is central to these changes in the structure and form of the media assemblage, which includes the convergence of print, television, and radio news and entertainment on the internet, social media, and media workers, scientists and other experts, politicians, and viewers. The media is an important location from which to track how risks are produced, circulated and transformed, especially with respect to the myths about, and risks associated with, the internet. The media assemblage is a central apparatus both rendering visible and concealing the risks associated with e-waste.

In terms of media coverage, e-waste has become by far the most visible

environmental problem related to ICTs. Discarded computers, cell phones, printers, fax machines and other electronics are common sights at roadsides, local environment days, and in our news. Powerful and distressing images of unsafe e-waste reclamation practices in far off places such as China, India, Ghana, and Nigeria are beginning to mark our mediascapes. Equally, warnings to businesses and individual computer users to be alert to internet scams, viruses, fraud, and identity theft frequent the technology and business news. This chapter maps the digital divide alongside the two major risks associated with personal computers and the internet, cyber risk and environmental risk, and their representation in Canadian and American media. In particular, I consider how the media assemblage both conceals and makes these risks visible. The media assemblage in this chapter connects North American news coverage to documentary film and photography to establish how it not only represents risk, but also plays a “constitutive role” (van Loon, *Risk* 12). In other words, the media assemblage is a crucial institution in understanding environmental and cyber risk. As in the previous chapter, I consider how notions of business risk dominate and often emerge out of mutated environmental risk. I focus on how Nigeria and Ghana can be understood in terms of an expanded digital divide that includes both environmental risk and cyber risk. I argue that the visual representation of e-waste in Agbobbloshie, Ghana, through the documentary photographs of Pieter Hugo, in particular, becomes a sort of risk containment strategy, downplaying the role of wealthy nations in the production of e-waste. Paradoxically, although these works visualize e-waste workers in Agbobbloshie, they do not necessarily make visible the larger context that created the conditions of the Agbobbloshie e-waste dump.

Reframing the Digital Divide

In our increasingly networked and globalized culture, the circulation of images is a significant component of the mediascape. Although much academic work has focused on media and the environment in general, there has not been as much work on the specificity of the visual (Remillard 129). Visual culture scholars insist that images never simply document, rather they are productive in the creation of meaning. The visual has a particular organization, a visual economy that creates and circulates meaning alongside other aspects of the mediascape. In this chapter, I insert the visual into an expanded discussion of the digital divide that considers the visibility and distribution of risks related to computer technologies. As many authors have noted, images of nature are culturally mediated and draw on and exploit deeply held, and contested, notions of nature often characterized as beautiful and untouched. These types of representations have often been mobilized in defense of natural spaces, in order to protect them from industrial incursions or polluting activities (Remillard 128). By contrast, the images I examine below are portraits of workers in the Agbogbloshie dump in Ghana who disassemble electronics that arrive in shipping containers from overseas. As portraits, they are less obviously connected to the images of landscape, nature, or environmental protest that have been central subjects for study in environmental communication. Instead, they must be situated in the context of global economies of technology and waste and the circulation of often more difficult images. These photographs of workers, especially in their circulation in Canadian and American mediascapes, signify on multiple registers including colonial legacies of trade, aid in the form of obsolete technologies, and the impacts of both on daily living and working environments.

Theorists such as Neil Selwyn point to the limitations of the term digital divide as access and use of these technologies is in some places increasingly defined by level and type of access rather than a polarized notion of whether or not a user has access at all (Selwyn 344). In wealthier nations, the digital divide is increasingly about the quality of access to these technologies: speed of internet connection, up-to-date software, hardware, and peripherals, as well as current virus and firewall protections. In poorer regions, however, lack of access to technology continues to define the digital divide. The editors of the volume *Technicolour: Race, Technology, and Everyday Life* show that when the term digital divide has been deployed in the American context, people of colour are typified as victims struggling to keep up with technological changes (Nelson, Tu, and Hines 3). The term can be problematic because it oversimplifies, and has historically worked to stereotype certain groups, women and people of colour for example, as being left behind by technology. It also frames the terms of discussions about computers in particular and limited ways. First, when ICTs are only discussed in terms of access, dialogue is directed away from the advantages and disadvantages of the various technologies and services (Selwyn 349-350). Second, discourse on ICTs is confined to the perceived benefits of computer distribution and use and tends to exclude the so-called side effects including pollution and waste. The products of the information economy are equally the benefits of ICTs and the problems of e-waste and pollution. I use the term digital divide cautiously, alert to the inherent problems associated with it but embracing the possibilities such a troubled and contentious term might bring to a remapping of both the global use of computers and the global distribution of e-waste.

The continent of Africa continues to be framed within the terms of the digital divide as elsewhere as information and technology poor. Manuel Castells argues that with what he terms informational global capitalism there are simultaneous processes of economic development and underdevelopment, with the accompanying processes of inclusion and exclusion (Castells, *End of Millennium* 82). Sub-Saharan Africa is one of the poorest regions in the world, and its underdevelopment has corresponded with the rise of informational global capitalism. The multinational corporations who operate there generally export wealth generated from the large resource extraction industry, contributing to the area's impoverishment. The region has historically lacked the infrastructure needed to participate in these global economic changes, such as a stable source of electricity and telecommunications infrastructure, particularly phone lines (Castells, *End of Millennium* 92). The cost of electricity has been prohibitive for most people and there are few internet service providers (Robins and Hilliard viii). Most existing internet connections are in government agencies, universities, NGOs, private businesses, and industry offices (Robins and Hilliard viii). As Castells and others have pointed out, as much as half of the computer technology in the region was donated during the 1980s, usually through official development, UN and other development programs. This trend continues in the form privately run "donation programs" so that Africa has become a repository for old, often obsolete and non-functioning technology (Castells, *End of Millennium* 95).

Given that sub-Saharan Africa has so few computer and internet users and is framed as underdeveloped in terms of the information economy, the fact that Nigeria has become synonymous with email fraud is a fascinating and unusual example (Adogame

555). Cybercrime has become a major source of risk associated with computer and internet use through phishing, viruses, hacking, fraud, and identity theft. According to David S. Wall, the nature of cybercrimes are “informational, global, and networked” and as such are understood as directly impacting the daily business of the information economy (4). Within the context of the digital divide and in general, the issue of development is an overriding concern for Africa and Africans. North American media, however, routinely exoticize and sensationalize Africa in news coverage (Adogame 555). As a result, Nigerian advance fee schemes (schemes that ask targets to send money in order to access larger sums of money or rewards) have become one of the most visible aspects of Africa’s digital and online presence in our news streams.

Nigeria, 419s, and InformationWork

In 1997, the US Department of State created a report *Nigerian Advance Fee Fraud* linking mail fraud to organized crime in Nigeria. The report claims that the US received half of the three thousand letters sent out per week at that time (United States Department of State Bureau of International Narcotics and Law Enforcement Affairs). Named after the provision in the Nigerian Criminal Code, “419s” are advance fee scams, once undertaken through the post, now sent via email. Often from purported African royalty, the sender typically requests “deposits” or “advance fees” from the receiver in order to release vast amounts of money in frozen funds at an African or Nigerian bank, with the promise to share in it once released. The emails are usually personalized, addressing potential victims by name. Because hundreds of emails can be sent out with relative ease, if even a fraction of the recipients respond, the scammer stands to make money. Part of the charm of these emails is the characteristically clumsy wording and grammatical

mistakes that, according to Harvey Glickman, play on racist stereotypes about Africans being unintelligent, naïve, or ignorant to the world of business (Glickman 464). This belies the skill necessary to conduct these schemes. In their study of 419s, Bloemmaert and Omoyini conclude: “the people authoring these messages are street- wise in the world of the internet. They are fully competent users of the technology of globalized communication” (585). The authors of the letters typically use anonymous providers such as Hotmail or Yahoo. As Nigeria has become known as a centre of these scams, sometimes the scammers set up false servers in order to obscure their location so that the emails appear to be coming from elsewhere: a second hand clothing store in The Netherlands, for example (Blommaert and Omoniyi 585). Reports on the amount of money lost from these scams range from over \$100 million per year in the US to the same amount globally, with individuals losing from a few thousand to over a million dollars (Glickman 474).

In his article on these scams, Afe Adogame situates 419s in the context of Nigeria’s oil boom and its nationalist struggles in the 1960s. Oil wealth has largely gone to the country’s elite and been exported by foreign multinationals. By the late 1970s, coupled with harsh restructuring policies from the IMF, the resulting upheavals left the vast majority of Nigerians impoverished. Given these circumstances, some theorists interpret 419s as neo-colonial resistance, and strategies of taking back some of the wealth that has been stolen from Nigeria and its people (Adogame 556). In terms of the digital divide, 419s seem to defy the pattern of African countries being technology poor, the people untrained in the use of computers. In fact, the Basel Action Network report *The Digital Dump* finds that Nigeria is experiencing a boom in the number of internet users.

However, no legal jobs exist there to employ what are in fact skilled information workers (usually young people educated overseas who return to Nigeria and cannot find employment). This situation speaks to the economic divide that excludes Nigerians from participation in the legitimate information economy. These scams bring in a lot of capital to Nigeria, and in 2002 it was estimated that 419s might be the second largest industry in the country after oil (Glickman 476). In 2009, Nigeria was ranked third in the world as a locale of cybercrime (Chawki 6).

The oil industry has left a legacy of ecological devastation in the Niger Delta region of the country. There were over seven thousand oil spills in the region between 1970 and 2000, devastating drinking water, vegetation, fish stocks and the ecosystem at large (Vidal). Recently, Nigeria has also become a major destination of e-waste in the form of electronics donations from North America, Europe, and other wealthy nations (Puckett, Westervelt, Gutierrez, and Takamiya 11). Unlike other destinations, the Basel Action Network found that most of the machines sent to Nigeria were repaired and resold. However, the report speculated that the dangerous e-waste reclamation of valuable materials, as seen elsewhere in the region, may yet develop (Puckett, Westervelt, Gutierrez, and Takamiya 20). In other words, Nigeria is at risk for becoming another sizable location of dangerous and illegal e-waste reclamation, in a country that already has a legacy of oil spills that have largely been ignored by the global community and never been properly cleaned up, and where the perpetrators of these crimes, big companies such as Shell, BP, and others, have never been held accountable.¹³

¹³ This situation is changing, as a British court held Royal Dutch Shell responsible in 2009 for oil spills in Nigeria during the 1970s and 1980s.

These seemingly contradictory impulses whereby Nigeria is a major centre for cybercrime as well as a destination of e-waste (often in the form of “donations” and often repaired and resold) signify Nigeria’s exclusion from global capitalism. Afe Adogame is quite possibly the only theorist to directly connect cyber risk to environmental risk. In his research about 419s in Nigeria, he notes the term has come to mean any individual or organization that engages in seeming acts of theft, exploitation, or extortion (Adogame 563). Section 419 in the Nigerian Criminal Code deals with obtaining property through fraud or false pretences (Chawki 2; Glickman 461). Oil executives have been tied to allegations of corruption and fraud, including bribes. Adogame quotes Emmanuel Ogebe who says,

A situation where a US company pays money to a public official under the pretext that he is a private tax consultant sounds dangerously close to the definition of 419 under the law. (Ogebe qtd. in Adogame 564)

Ogebe is referring to corrupt US oil executives who pay off Nigerian officials. Adogame then continues to explicitly link the oil spills in the Niger delta to 419s, noting that internationally, little attention is paid to the environmental problems of Africa. In this example both cyber risk and the dumping of waste by rich countries in poor countries are understood as unethical, as Adogame stresses, there is also an economic “logic” at work whereby African countries bear the negative consequences of globalization including underdevelopment and pollution (Adogame 556). Increasingly, this pollution comes in the form of e-waste and can be correlated to a geography of risk that puts African countries at higher risk for being the repository of environmental hazards. Western media

coverage of Nigeria tends to be sensationalist, and much attention has been paid to 419s over the years, emphasizing cyber risk over environmental risk.

Joost van Loon tells us that: “risk society reorganizes inequalities on the basis of risk relations” (van Loon, *Risk* 31). As part of the changes associated with ICTs, the media have shifted to produce a rapid and global distribution of data, and those of us who are wired are likely connected at work, home, in public, private, and in transit. This, in turn, has impacted institutional organization and communication. It is the multiplication, mutation, and circulation of risk in the media that I am concerned with. Within the environmental movement news coverage of environmental issues is recognized as necessary in order to raise awareness and to provoke larger systemic changes to existing regulations and practices. News coverage of environmental problems often follows predictable patterns. Namely, news media are more likely to report on major catastrophes or events, such as Three Mile Island or Chernobyl (Allan, Adam and Carter 12). News coverage typically focuses on the event of the meltdown, and then drops off dramatically as the affected communities are left to deal with the subsequent illnesses and ecosystem devastation. This is problematic since many environmental problems tend not to be singular events but regular and cumulative problems, such as pollution or green house gas emissions. And this is certainly true of the environmental problems associated with computers and the internet, namely the pollution, health problems, and ecological degradation associated with e-waste and production. In risk society, the media assemblage plays a major part in the production and circulation of knowledge between various, and unequal, institutions and players including government and politicians, activists, scientists, universities, economists, and other experts (Allan, Adam and Carter

12). This is abundantly clear in the above examples in which not only do the concerns of rich countries and communities dominate news coverage, but the media assemblage is also a powerful force in defining and managing risks. As a result, cyber risk is surfacing as the most visible risk associated with the internet and the personal computer.

Agbogbloshie and the Visual Economy of E-waste

In contrast to Nigeria, the area of Agbogbloshie, Ghana has become a major repository for trashed and donated computers from rich countries, and as a result there is a major e-waste trade whereby e-waste is reclaimed by young workers looking for valuable metals. Prior to 2008, Agbogbloshie received scant attention in Western media.¹⁴ What follows is an account of how Agbogbloshie became visible through environmental reports, news, and art coverage. In 2008, Greenpeace International released a report titled *Poisoning the Poor: Electronic Waste in Ghana*, which reported that Ghana had become a major destination of e-waste and documented the contamination of the soil (Kuper and Hojsik 8). The report received negligible media attention in Canada and the US, although it was taken up in Britain and in Ghana (Wray; "Breeding Toxins"). In 2009, a group of University of British Columbia graduate students, supervised by Peter Klein, were tracking how "donations" of electronics from North America and Europe end up in Ghana, China, and India. The students' research culminated in the twenty minute documentary *Ghana: Digital Dumping Ground*, which first aired on the American television public access channel PBS on June 23, 2009. The film won an Emmy Award in 2010. In what follows, I analyze the documentary and its findings, and how those findings were taken up by English language news media in Canada and the US. In

¹⁴ One exception is National Geographic's 2008 story on Agbogbloshie.

particular, I demonstrate how the documentary makes visual and visible the story of e-waste in Ghana at the same time as the news media works to make visible only particular aspects of the story.

Ghana: Digital Dumping Ground is concerned with tracking the international trade in e-waste; it details the perilous working conditions of workers who recover precious metals from trashed electronics. The documentary begins in Ghana at the Agbogbloshie market and dump. There, young boys and men comb the dump for trashed electronics, burning wires and plastics to retrieve copper, iron, and other metals. The crew interview local journalist Mike Anane, honoured by the United Nations Laureate for his work on the environment, who is collecting labels from trashed computers in order to document the sources of the e-waste; they included a Philadelphia school board and the Environmental Protection Agency of the US, and other locations in North America, Europe, and New Zealand. He voices concerns about the effects of the toxic materials on the young workers' growing bodies and tells us that Agbogbloshie, one of the most polluted areas on Earth, was, a generation ago, wetland. As part of their research, the students bought hard drives in Tema, Ghana, and recovered the data from personal computers from families in New Zealand and the US. But what received the most media attention, as I will discuss below, especially in Canadian media, was defence contract information retrieved from a hard drive belonging to Northrop Grumman, a major US government contractor. The second half of the documentary follows e-waste to Guiyu, China, the largest e-waste dump in the world. In Guiyu and Hong Kong, the crew travel with Jim Puckett, the activist who broke the story of Guiyu in 2001, which resulted in the Basel Action Network documentary *Exporting Harm*. Finally, the documentary goes to

India, another major destination for e-waste, where both safer, high tech and unsafe, low tech e-waste facilities exist. The focus of the documentary is tracing the trade in e-waste from rich to poor countries; less than a quarter of the film deals with the theft of data from trashed hard drives. The film highlights the ecological contamination and resulting devastation to land, water, and human health.

In the days after the documentary was first aired, the major Canadian newspaper dailies reported the discoveries of the UBC students. Here are the headlines from June 23, 2009: the *Vancouver Sun* reported “UBC team uncovers sensitive defence records; In Ghana, journalism students buy hard drive originally used by a U.S. defence contractor” (Dalton Jr. A5); the *Toronto Star* said “Secret US data found on cast-off hard drive: UBC students probing global trade in e-waste uncover files in Ghana” (Fong); the *Victoria Times - Colonist* stated “U.S. secrets found on e-trash; UBC students’ research to air on Frontline”; and *The Province* pronounced “UBC class glean US security information; Journalism students buy old hard drives loaded with data” (Keating A7). On June 24, the *Globe and Mail* ran the headline “UBC journalism students find sensitive data in digital dumps; intact hard drives contained secret international security data and personal information, documentary says” (Colvin). And on June 25, *The Epoch Times* said “B.C. students find U.S. security data in Ghana dump” (Zhu). Finally, on July 3, the *Saskatoon Star Phoenix* noted “Right to privacy must be treated as a top priority” (“Right to Privacy”). All emphasize the potential security breach, but not one headline mentions the environmental aspects. All of the articles directly cite the film *Ghana: Digital Dumping Ground*; however the text of the articles emphasize the security risk associated with recycled hard drives. Although the global trade in e-waste might be

mentioned, only the *Vancouver Sun* refers to the legacy of ecological and health damage in Agbogbloshe or Guiyu. Dalton Jr. writes that e-waste “pollutes the environment and poisons scavengers seeking to extract metal” (Dalton Jr. A5). Many of the articles reference the fact that criminals buy the recycled hard drives for financial information and in the *Vancouver Province* Keating connects the practice to Nigerian organized crime. Astonishingly, the US media were largely silent on this matter, with a few short articles in Robert McMillan's column dealing with how to properly erase data on old hard drives and appearing in computer magazines such as *Computer World*, *IT World*, and *PC World*. In other words, like the news media, these industry magazines only took up the issue of security.

Because this case of media coverage is so small, it is possible not only to track the unfolding story in the news media, but also to chart the chronology of mutation of risk in the mediascape. What these examples further show is the role of the media assemblage in circulating risks, multiplying and distorting them, and often turning them into new or different risks (Massumi 133; van Loon, *Risk* 31). In the few years since, reports about Agbogbloshe have occasionally appeared in mainstream news reports in Canada and the US. When reporting on Agbogbloshe, Canadian news media generally report either on e-waste or on the security breach, but almost never on both. American news media, when they report at all, tend to focus on the e-waste in Agbogbloshe, but never mention the security breach. What is also missing from the news articles discussed above is the illegality of rich countries exporting hazardous waste to poorer countries, as per the Basel Ban. Rather, the articles, mostly from the Canadian media outlets, centre on the potential threat to US national security, and the risk of potential fraud, loss of privacy, and stolen

data including credit card numbers and social security numbers by individuals from rich nations whose hard drives are not properly erased before disposal. These examples from Ghana and Nigeria are not representative of the larger discussions and debates on the risks associated with personal computers and the internet. Rather, they are compelling because they demonstrate how the media assemblage makes visible cyber risk while obscuring and concealing environmental risk.

In these examples, the news reports shift the focus from e-waste to the potential for cybercrime, from environmental risk to cyber risk. The cascading devolution of environmental risks into economic risks, including the effects of hacking and phishing on organizations, the dangers of fraud and identity theft, and threats to individual and company banks accounts, works to reorient discussions away from persistent environmental problems. The devolution from environmental to security risk is particularly marked in news streams, but bolstered by persistent, lingering, and in some cases absent images of environmental risks related to e-waste. It is here, within the terms of the digital divide, among these tenuous connections between internet use, the trade in obsolete computers and the utter devastation of the lands and waters of poorer countries and communities, that we must expand our understandings of internet usage and its associated risks.

Risk containment strategies mean that environmental risks are unevenly distributed to disadvantaged communities who, very often, are also those who have less access to information technologies. The digital divide remains a productive term because it points to the economic logic at work in the distribution of technology and its associated risks. This reasoning was perhaps never so crassly put as by Larry Summers who said in

his tenure as chief economist of the World Bank, “underpopulated countries in Africa are vastly underpolluted” (qtd. in H. Rogers 201). The term digital divide often works to conceal the environmental aspects of information technologies. Although the digital divide continues to be used in relation to the penetration of information technologies and their perceived benefits, it has also begun to accumulate associations to e-waste, especially the illegal dumping in poor countries.

For example, an article in the June 2011 issue of the photography magazine PDN (Photo District News) called “Information Technology: The Digital Divide,” on Pieter Hugo’s work on the Agbogbloshie dump, that uses the term to refer to e-waste. While Hugo is attentive to some of the contradictions at work in the term the digital divide, the display of his photographs often work to both render visual, but conceal some of the dynamics. Hugo visited the region in 2009 and did a series of portraits of the workers. As noted above, the workers are mostly boys, teenagers, and young men who smash and burn the computers to get at the copper, aluminum, and other metals to resell. The portraits show the workers in the dump surrounded by fires, blackened landscape, and destroyed bits of technology. Hugo also photographed the girls and young women who often bring ice to put out the fires. As Conor Risch points out, many of the young people portrayed show elements of pride, inquisitiveness, frankness, and an element of accusation (Risch 196). Hugo says:

In all my work I try to find some sort of agency in the pictures. I want my desire to look requited, and the confrontation that I have toward the subject requited in a way. You are looking, but you’re also being looked

at, and by being looked at, your implicitness in this dynamic is being acknowledged. (Hugo qtd. in Risch 192)

Hugo seems to be acknowledging the dynamics of the gaze, especially between those from rich and poor countries. In 2010, Hugo returned, funded by the *New York Times Magazine*, and took more photos that show the overall landscape. These photos include the plastic shells of monitors used as stools by the workers, workers resting and eating, and impromptu shelters. They also show cows in and amongst the debris as livestock are taken through the dump from holding pens to their grazing grounds (Risch 196). The *New York Times Magazine* printed the works as a photo essay in 2010. Given that the photos have been exhibited for Western audiences, the reciprocal gaze of the workers prevents an easy reading. Taken together, the photos, Hugo's intentions, and the title of the article push some of the limitations of the term digital divide to include these scrap metal scavengers in the larger economic and spatial shifts associated with information technologies but usually left out of discussions of the digital divide.

Risch observes that Hugo's photos combine the post-apocalyptic with a pastoral element. For Hugo the landscape is "almost medieval... at the same time, you have the termination of the West's obsession with obsolescence and technology" (Hugo qtd. in Risch 190). He says these devices "end up on the other side of the planet, people burning them up to transmorph memories into pure commodities of copper and lead. It's a strange phenomenon" (Hugo qtd. in Risch 190). Here Hugo does not simply connect the data storage function of computers to e-waste, but he locates the intimate information people store on their computers in the form of photos, letters, bank documents, and so on in

political and economic realms, from Western consumer culture to the commodities market of dump scavengers.

These photographs were also displayed in Toronto as part of the 2011 *Contact Photography Festival* (see Figures 12 to 14 below). Not exhibited in a gallery, the catalogue describes their presentation:

As an installation situated within the urban surroundings of a parking lot, there is a heightened awareness of consumer culture and how the West has normalized its wasteful behaviours. (*Figure + Ground Program* 66-7)

The gravel parking lot at the busy intersection of Spadina and Front in downtown Toronto is surrounded by expensive and newly built condos. Often these billboards and panels advertise the very same high tech devices now shown on fire and in pieces in Ghana. The photos return our e-waste to us as part of a visual economy.



Fig. 12 Hugo Billboard 1



Fig. 13 Hugo Billboard 2



Fig. 14 Hugo Billboard 3

The situation in Agbogbloshie is not a singular event, as Chernobyl was, or a natural disaster or a particular armed conflict. It is a site of ecological disaster, produced through the global daily business of the information economy. These photographs are connected to images of disasters that parade across our screens and news streams, that

show us black bodies in the context of the latest crises, armed conflicts, famines, and so on in black and African nations. In her analysis of Hutu refugees, Liisa Malkki examines their visual representation and the circulation of these images. According to Malkki, these too familiar images of bodies of refugees often provoke horror and sadness. The people exist in terms of their “bare” or “mere” humanity, so that our shared humanity with these people becomes the only basis for connection (Malkki 387). The photos are evacuated of politics, history, or context. In fact, as Malkki notes, these photos often appear with little or no explanation. And this is certainly true of the outdoor exhibit in Toronto, where the panel explaining the exhibit was difficult to locate from the sidewalk. In the case of *New York Times Magazine*, the images were published only as a photo essay with a very short explanatory paragraph. As Malkki says, these visual conventions “seem to speed up the evaporation of history and narrativity” (Malkki 387). As Sherene Razack has noted, in such images the suffering of Africa is constructed as overwhelming, timeless and unchangeable: “those poor people over there” (Razack 23; Malkki 389). Although they are ostensibly part of a humanitarian impulse to document atrocities, when the photos return our e-waste to us as part of a visual economy, they work to push away the political and economic realities and our role within them. These images, then, function as a kind of risk containment strategy. Our e-waste is returned to us discursively, but established as “out there,” and by working to erase the context, it also obscures our complicity in its production. This movement works to disrupt the causal relationship between consumer culture in rich countries and e-waste dumping in poor countries. These images address the usual disconnect between planned obsolescence and e-waste but do not necessarily make the connections between ecological risk and cyber risk, let alone the global

economics of waste management. Although the photos allow us to see (visualize) e-waste, they do not necessarily make visible the inequities at work as part of the information economy.

The visual economy of e-waste is connected to the logic of the information economy. Manuel Castells has shown that in the information society, a geography of innovation has evolved so that particular locales such as Silicon Valley become dominant. These “valued” spatial clusters tend to develop strong economic, social, and political ties to other similar clusters through telecommunications, speedy transportation, and information technologies. Other spaces become devalued and isolated, broadening existing inequities so that Los Angeles, for example, can be home to extremely successful IT firms, while the poverty of already poor neighbourhoods is exacerbated because of, and by, their lack of access to those information technologies (Castells 29-31). As seen above, waste has become something to be managed from within capitalist society and increasingly it is disadvantaged populations who bear the brunt of containment strategies (J. Baker). And this is not just an issue of the global North and South.

Another disturbing trend is the use of prison labour in the US to do e-waste reclamation. Silicon Valley Toxics Coalition (SVTC) reports that companies such as HP have begun to create safe reclamation and recycling facilities in the US (Smith and Davis). The use of hammers and brooms, rather than the safer options of vacuums and specialized tools, and the spread of dust containing lead and other dangerous substances, have been reported by prisoners concerned with their labour conditions and health in letters to SVTC (Smith and Davis). When SVTC sent independent experts to examine these conditions, they compared them to those in one of the most notorious locations of

unsafe e-waste reclamation - Guiyu, China (Smith and Davis). We see that incarcerated e-waste workers may have more in common with e-waste workers halfway across the world in Ghana or China, than with reclamation workers at HP's electronics recycling facility. That e-waste reclamation by prisoners does not even enter our visual landscape is undoubtedly due to security and legal concerns by prison and other officials. However, American media do enter prisons for multiple reasons. For example, there has been a recent explosion of prison reality television shows such as *Beyond Scared Straight*, *Lockup*, and *Prison Diaries*. The use of prison labour for e-waste reclamation and its relative absence in our visual media is remarkable and must also be located as part of the visual economy of e-waste. In this case, the absence of images of disenfranchised American prisoners considered alongside the circulation of images from Agbogbloshie reinforces the function of those images as a containment strategy, obscuring the complicity of first world consumers and governments in the problem of e-waste. Responsibility is buried and concealed in the mediascape by this visual economy.

Ecological risk and cyber risk are not equal under the terms of the information society. The visual economy of e-waste both produces and obscures the geopolitics of toxicity and risk related to computers and the internet, and ultimately functions as risk containment. We need to consider risk containment strategies as operating both materially and discursively, and pay close attention to what does not appear in our media streams. The visual economy of e-waste, largely confined to occasional news coverage, documentary films and photographs, is connected to risk containment strategies that function to keep planned obsolescence, consumer culture, and waste management

separate. The geography of the information economy strongly reinforces the digital divide, especially in terms of risk exposure.

6. Connecting Individualization and Environmentalism to the Computer User: What's so Personal about the Personal Computer?

This chapter continues the discussion begun in the last chapter of the use phase of the personal computer, but I turn to the human user. I locate the user in the expanded understanding of technology as both container and tool, theorized by feminist philosopher Zoe Sofia. I demonstrate that discourses of user-friendliness, central to our understanding of computer use, tend to conceal the user as an embodied human connected to the physical infrastructures of information society. These discourses are implicated in the trend towards individualization in modernity, risk society, and information society. In order to examine the implications for environmental discourse, I examine the construction of two very different types of users - the “Mac user” and the “One Laptop per Child (OLPC) user.”

Personal computers became *personal* when IBM, and other manufacturers, sought to differentiate them from their hulking mainframe ancestors and to denote their use by an individual (with the 1981 release of their first personal computer). That computers are referred to as *personal* computers further obscures the fact that they have become necessary to the fabric and functioning of society, schools and business. This naming also coincides with the individualization inherent to modernity and risk society. Specifically, computers and the internet can be located in what Raymond Williams terms mobile privatization or that trend in modernity in which an increasingly mobile population consumes media in private individual family homes (R. Williams, *Television* 26). According to Ulrich Beck, the failure of the institutions of modernity to contain risks

means that individuals must negotiate the risks themselves (van Loon, *Risk* 32). The individualization inherent to modernity, risk society, and information society come together as we negotiate risks as individuals, and increasingly through the use computers and the internet. This negotiation requires access to large amounts of information, often created and distributed by those institutions and experts that downloaded the responsibility to consumers in the first place (van Loon, *Risk* 30).

In the framework of individualization related to risk society, Joost van Loon locates discourses of “conscious consumption” about GMO foods, waste and packaging, and diet (van Loon, *Risk* 30). In terms of computer use, conscious consumption or “greening” computer use as put forward by green bloggers and consumption experts includes reducing energy use, using a smaller monitor or screen, upgrading rather than purchasing a new machine, and buying components with less packaging (see greenlivingtips.com; paystolivegreen.com). Van Loon notes that this seeming freedom of choice to navigate risk alone, from conscious consumption to health and environmental risks, is in fact “forced upon us by default” (van Loon, *Risk* 32). He says:

In this sense it is emancipatory, even liberating, as the individual becomes more free to address his or her needs in the way he or she prefers. Moral obligations thus become restricted to those imposed by individuals themselves. This sense of individualization fits in with a liberal ideology of personal freedom and choice. (van Loon, *Risk* 32)

In information society, one area where individualization is apparent is in the discourse of the computer user; companies, software creators, service providers and others are continually striving for a “user friendly” interface. There is a vagueness about

the user in these discussions that can be connected to human-computer interface (HCI) discourse, which combines ergonomics and information design to optimize the interaction between human user and computer (Fuller, *Behind the Blip* 13). As Matthew Fuller observes, HCI is about creating efficiencies between computer and user, shrinking stimulus and reaction times, and manipulating graphics and interface so that the user can complete a given task simply, quickly, and easily (Fuller, *Behind the Blip* 13). He says:

[HCI] empowers users by modeling them, and in doing so effects their disappearance, their incorporation into its models... In its emphasis on perception, on narrowly applied psychology, it has split the user from any context. (Fuller, *Behind the Blip* 13-4)

While HCI disappears the user into models, other researchers who study computer users insist that context is critical to understanding said users.¹⁵ The disappearance of users into the model disembeds the user from the vast infrastructure necessary to support the user and knowledge work in general.

I argue that the internet, especially through the discourse of user-friendliness, creates a cultural atmosphere in which the computer user is primarily interpellated as a consumer. This effectively curtails the possibilities for an environmental discourse that goes beyond "greening" computer use, which is problematic considering the amount of resources necessary to the production of computers. First, I examine how the internet can be understood as a container technology. Then I locate the discourse of user-friendliness, the ultimate goal of any computer-user interface, as part of the corporatization of culture. In the next section, I consider how the branded Apple user is interpellated as a consumer

¹⁵ See Kittler (1999), Lally (2002), Hoffman (1999), Miller and Slater (2000), and Morley (2007) for discussions of human-machine interactions.

in Greenpeace's *Green My Apple* campaign. Finally, I examine how the One Laptop Per Child Project can be understood as part of a pattern of North-South projects, connected to the digital divide, in which student users are essentially targeted as consumers-in-training for first world products.

User-friendliness and the Corporatization of Culture

In previous chapters, I used the concept of assemblage to rethink how the computer as a technology is connected to mining, as well as other processes of resource extraction. I suggested that the concept of a machinic assemblage might enable us to understand writing as an assemblage that includes hand, pen, paper, intellectual and industrial linkages. In this chapter, I consider the human user-computer as assemblage.

Understanding the user-computer as an assemblage allows us to connect embodied human users to one another through networks such as the internet, production chains, and so on. As in previous chapters, this move grounds the human user and the computer in the material without losing the associated immaterial and virtual aspects.

Historically, as Jonathan Sterne shows, academic approaches to ICTs, including personal computers, have focused on those “disembodied” aspects such as chat rooms, internet use, and so on. Connecting embodied humans in the user-computer interface to the physical networks that enable their use reminds us of the materiality of both the human and computer in that interface. Nigel Thrift shows that computers and software are literally the infrastructure that shape our daily lives, turning on the morning coffee pot, as part of car and bus navigation systems, timing traffic lights, not to mention email, on time delivery systems, and cell phones. Thrift uses the term the technological unconscious to describe the taken for granted aspects of daily life which shape humans

and their environments, spawned in part by the vast network of software which orders it (Thrift 213). The technological unconscious is grounded in the body and as such makes connections between the material and immaterial through the computer user. Not part of the body, it is the embodied experience that (re)creates the daily environment of humans and their machines (Thrift 225).

The computer user is crucial to understanding the materiality of the information age, including the environments we live in and share with other living and non-living things. As Sofia, via Bateson, says, we cannot think of an organism outside of its environment because its survival depends on that very environment. Ultimately, the planet marks the limit boundary of the human container (Sofia, "Container Technologies" 181-3). The organic body is susceptible to and potentially in danger from substances contained in the computer, and also related to its production and disposal. Toxic substances related to electronics have been found in studies of household dust in Canada (Deathe, MacDonald, Amos 321). If the computer chassis protects us from the toxic materials within, then recentering the organic body shows the impossibility of containment, the connections between human and non-human organic bodies, and to underscore their shared susceptibility to toxicity. Of course, as I discuss in the previous chapter, people working and living in communities where electronics are produced or disposed of are often more at risk from elevated levels of toxic materials.

Considered as infrastructure it becomes more obvious that computers and software are supplied by and are part of utility grids, which in turn require materials and resources to run. Sofia reminds us,

unless we pay better attention to questions of containment and supply, we will misrecognize the technological character of the everyday metropolitan lifeworld, which is reliant on large utility grids ... (Sofia, "Container Technologies" 198)

These relations describe risk society where the constant access to the goods and services, a norm for many wealthy communities, is accompanied by the “[looming] specter of resourcelessness” (Sofia, "Container Technologies" 181). In terms of the user-computer assemblage, this assemblage includes the user, computer, and the networks of power supply, data centres, and other infrastructure needed to create and maintain the assemblage.

Once practices become embedded in everyday life, they become normalized and stabilized, as have practices associated with the computer from the technological unconscious to internet usage amongst many Canadians. In order for schools, businesses, or individuals to undertake their daily routines and activities they must have current computer hardware and software, not generally backwards compatible for any length of time, if at all. Jonathan Sterne refers to this dynamic as a “radical monopoly of coercive participation” (Sterne 24). For many computer users choosing whether or not to use or buy a personal computer given its negative environmental impacts is a false choice because it is necessary to and embedded in the routines of school, work, and recreation, as Thrift notes. The choices come in energy saving and buying practices; those practices of "conscious consumption" identified by van Loon.

Elizabeth Shove examines inconspicuous consumption practices in order to account for the vast amount of resources needed to heat and cool buildings, water usage

for cleaning, and other practices related to what she terms the twentieth century emphasis on comfort, cleanliness, and convenience (Shove 3). While buying and owning computers and related information technologies most certainly count as conspicuous consumption practices, word processing, surfing the internet, and other practices related to computer usage can be understood as inconspicuous consumption, as they do not tend to be framed as consumption practices, *per se*. This point has begun to enter discussions of computer use. In January 2009, the Times ran an article suggested that internet browsing creates more emissions than the aviation industry (Swaine). Their point was that data centres needed to conduct internet searches are incredibly energy intensive and this energy use is not counted in conventional studies of computer energy consumption. Shove's point is that both conspicuous and inconspicuous consumption practices should be included in environmental policies and practices that seek to reduce strain on natural resources. However, as she notes, many environmental groups and policies focus on the consumption of natural resources rather than consumption itself, the result is a focus on “green” consumerism or a “green way” of doing things (Shove 6).

Not only does Sofia's theory of technology enable an understanding of computers as connected to supply grids, but it also allows for a more complex understanding of how these machines might shape our thinking or behaviours, especially with respect to environmental action. For Sofia, container technologies encompass both the material and the immaterial. As a container, the computer protects the user from the toxic components inside their computer, albeit if only to show the impossibility of containment, as the above study of household dust demonstrates. Container technologies, such as the bowl or sieve, are correctives to traditional philosophies of technologies, which tend to focus on

technologies that extend, such as sticks or probes. Sofia connects container technologies to Doh Ihde's understanding of human-technology-world relationships, in which he categorizes technologies and technological relations into four categories. He categorizes a wide variety of technologies, what Sofia terms as container technologies, into the category of "background relations" or technologies that work as "a shelter, cocoon, or world," which include shoes, condoms, cinemas, houses, malls, boats, nuclear containment tanks, and virtual worlds. This category can also include a "cultural atmosphere" such as nuclear fear (Sofia, "Container Technologies" 187). In the case of the computer, the simulation of cyberspace, other software applications, and how the computer works to order our experience of the world can be located in this category of container. If we fully consider containment as active, then cyberspace, word processing, and other software applications used as part of the human-computer assemblage dynamically affect and form our cultural atmosphere in multiple ways (Sofia, "Container Technologies" 192). They both create a type of "world" or "cocoon" and a particular type of cultural atmosphere. In the next section, I argue that the discourse of user-friendliness is correlated to larger trends of individualization and central to creating a cultural atmosphere mediated by corporate interests and the corporatization of culture.

I begin with a consideration of the user-computer interface, with a focus on software. Software criticism is an emerging academic field that goes beyond HCI research to consider how software operates in the larger social, political, and community networks and to locate the individualized user in that larger context (Fuller, *Behind the Blip* 14). Matthew Fuller says:

software creates sensoriums, that each piece of software constructs ways of seeing, knowing and doing in the world that at once contain a model of that part of the world it ostensibly pertains to and that also shaped it every time it is used. (Fuller, *Behind the Blip* 19)

There are important connections between Sofia's notion of the internet shaping our cultural atmosphere and how Fuller theorizes software; both emphasize how these applications work to order human behaviour.

Alan Liu takes the idea that software shapes our behaviours a step further. In his study of knowledge work, Liu traces the evolution of the term “user friendly,” a concept central to HCI, ergonomics, software and the user-computer interface at large. He demonstrates that by the mid 1990s the term is no longer confined to design in IT firms but connotes in the larger social context (Liu 161-5). User friendly protocols invariably train the user to experiment in productive ways so that he or she learns to use the system or software (Liu 168). Although user friendly ostensibly means “ease of use” the term actually ends up referring to “ease of administration” whereby the “meta-management of corporate culture can now span across the boundaries of firms and social sectors to become the general form of contemporary culture” (Liu 169). The discourse of user-friendliness is ultimately connected to the information work and the corporatization of culture (Liu 172).

As many theorists have noted, information work has meant the erosion of boundaries between workplace and home, work and leisure. The internet, which Liu describes as the “user friendly face of information,” has become the dominant metaphor, if not vehicle, of information work (Liu 76). Liu says:

But the friendship of the Web, and everything it represents in the long history of work leading up to current knowledge work is strangely cold. It is from this coldness - remoteness, distantiation, impersonality - that *cool* emerges as the cultural dominant of our time. (Liu 76)

Cool has become the cultural face of information work; “forget this cubicle; just look at this cool web page” (Liu 78). Liu suggests that the cool stance of knowledge workers comes out of the renegotiations of work and leisure whereby work, especially information work, is posited as play. (The cool of the information age represents a distinct break from earlier iterations of cool attitudes in jazz, Dada, and so on.) Fuller and Liu’s understandings of software, knowledge work, and the user are related to the corporatization of culture in multiple ways: we literally connect and communicate through corporately constructed and mediated technologies; it is expressed as an attitude or affect of cool; and we are reinforced as individuals and consumers by those computer mediated interactions, communications, and labours. As a container technology, the internet is part of the apparatus contributing to and building the corporatization of culture, through user-friendly protocols and the emerging cultural affect of cool.

Mac Users and Branded Environmental Action

Apple Computers has arguably cornered the market on cool. Users of Macs are notoriously devoted and market research has shown that “Mac users tend to feel cool, trendy, and superior” (Firmin et al. 3). The immensely popular and award winning 2006 Mac versus PC television advertisements capitalize on these sentiments. In the ads PC and Mac are both played by white men; PC is typically dressed in a suit and is portrayed as stodgy and desperate while Mac is laid back, dressed in sneakers and jeans, and “more

cool and hip” (Benoit and Delbert 10). Since its inception Apple has been at the forefront of intuitive, user-friendly design. An important text about HCI, *The Art of Human-Computer Interface Design*, began as an interface training course at Apple (Laurel and Mountford xiii). There is no doubt that Apple and its products, from iMacs to iPods, have become entrenched in the culture of cool.

For Liu, the corporatization of culture has important ramifications for politics and he identifies cyberlibertarianism as the defining politics of the internet (Liu 240). The cyberlibertarian movement is descended from the counterculture technology community that later evolved into organizations such as the Electronic Frontier Foundation (EFF) and created magazines such as *Wired Magazine* (as discussed in Chapter 4). The movement is largely concerned with internet freedom defined by freedom from government and big business so that, as Liu says, “free speech online means the right of every individual to be an uninterrupted transmission source” (Liu 247). What is absent from the discourse is any notion of responsibility to community, nation, or other group (Liu 242). At the heart of cyberlibertarian discourse is the individual as entrepreneur and consumer, as opposed to the people, citizens and masses of other movements (Liu 246). It is one of radical individualism and needs to be distinguished from but also related to the individualization that Beck, van Loon, and others have identified as part of the changes that come with modernity and risk society. For Beck, individualization refers to the erosion of social structural systems. He says:

The closed state of national politics no longer exists. Society and the public realm are constituted out of conflictual spaces that are at once

individualized, transnationally open and defined in opposition to one another. (Beck *Individualization* 29)

Put in this context, cyberlibertarianism is symptomatic of the larger changes to the socio-political landscape. Relating to the user, not only is he shaped through software, politics, and structure but she is also strongly reinforced as an individual. That individualization happens on multiple levels as she is hailed as consumer, and, as we all are in risk society, increasingly and solely responsible for her own risk making decisions at work, leisure, and elsewhere.

Neither Liu nor Beck see the shift to the individual described above as necessarily signaling an absence of large-scale political movements or activism, rather they see it as part of the shifting political landscape. Liu contrasts cyberlibertarianism with four categories of cyber-politics: information technology and the environment including activist groups such as Silicon Valley Toxics Coalition; information technology and ergonomics in which the stress injuries of knowledge workers are taken up by organizations such as Coalition on New Office Technology; information technology and workplace privacy whereby employees criticize the monitoring by employers enabled by information technologies; and high-tech industries and labour organizations who point out that traditional blue collar union organizing continues as does the organization of “permatemp” white collar workers (Liu 267-70). Of particular relevance to this discussion is that Liu explicitly connects the environments of production and cubicle workers, toxic clean-room chemicals to stress injuries. In Liu’s analysis another dimension of the human user assemblage is revealed that goes beyond ergonomics, HCI, and studies on how the internet and IT technology are taken up. Akin to Fuller, the user is

not just theorized as material or by his cyber participation but as fully embedded in her thick context: she is connected to and through the infrastructure of software and the flow of toxic materials that come with and out of the maintenance and production of that infrastructure.

However, cool as the affect of user-friendliness is not only crucially tied to the corporatization of culture, but also works as part of the limited cultural atmosphere that shapes environmental discourse in particular and limited ways. In terms of environmental politics, Greenpeace has been a leader in using the media, including the internet to raise awareness of environmental issues. The organization has historically used a two prong strategy, doing public education and awareness campaigns through the mass media and launching political campaigns for international treaty making (Dale 3). In 2004, Greenpeace launched their campaign to reduce toxic materials in electronics and to reduce e-waste in general. As part of this campaign, Greenpeace began publishing their *Guide to Greener Electronics* in 2006 which ranks major electronics companies in three categories: chemicals, e-waste, energy. Although Dell and Lenovo made changes as a result of the campaign, Apple ignored the campaign. Greenpeace responded by launching their “Green my Apple” website directly targeting Apple through their notoriously loyal customer base:

Apple might tune out Greenpeace, but they would never tune out their customers. Apple’s famously loyal fan base was the one force on the planet that was guaranteed to get the attention of Apple CEO Steve Jobs. (“Green My Apple Bears Fruit”)

Greenpeace called on Mac users to become involved in a variety of ways from emailing Steve Jobs to creating spoof ads ("Green My Apple Bears Fruit").¹⁶ Ultimately, Steve Jobs and Apple Computers responded to the campaign and Apple has committed to producing its products with less toxic materials, although they still receive low marks in the "Guide," with a mark of 4.5/10 in the latest "Guide" they rank 6 out of sixteen companies measured (

Of particular interest to me is that Greenpeace targeted people as consumers and capitalized on the perception that Apple is cool:

Come on Steve, we'd expect that kind of reaction from fat corporate CEOs who dump polychlorinated biphenyls into rivers, not from a cool, potentially eco-friendly titan of the information age. ("iTox + iWaste")

The Greenpeace campaign capitalizes on the Mac user's self-perceptions in multiple ways, getting them to do the creative work of the campaign, as well as participating in the more typical letter-writing aspects of the campaign. The Mac user ultimately gets framed as cool and hip to environmental problems, using his or her creativity to make change.

Organizations such as Greenpeace are also limited with these types of campaigns. Although, the public can get behind "save the whales" campaigns, Greenpeace draws much of its financial support through donations from elites who are not always willing to go against business interests. The public gets drawn into campaigns such as Green My Apple as consumers of Apple products and the focus is on ways to green consumption

¹⁶ See Trebor Scholz's (editor) 2012 book, *Digital Labour: The Internet as Playground and Factory*, for larger discussions of digital labour as play and the erosion of boundaries between work and play in digital environments.

practices. We need to locate this branded user in the larger context set out by Liu and Beck. In this corporatized and individualized realm, environmental action reinforces consumer choice and greening practices, which ultimately do not even begin to address the larger problems of consumption. This gap becomes even more obvious when we begin to take into account policies of planned obsolescence whereby more and more computers are being produced, used, and trashed soon after. Branded environmental action, such as the Green My Apple campaign, bolsters the computer-user-as-consumer, and facilitates the corporatization of culture.

Creating New Markets through the OLPC User

Elizabeth Shove notes that many “greening” policies are highly problematic because they do not address consumption itself, let alone the inequities of consumption between North and South, including what would happen if demand is “allowed” to escalate to levels enjoyed by much of the North (Shove 5). Targeting poor children, largely in the global South, the One Laptop Per Child (OLPC) project aims to provide every child with a laptop. To consider the project in terms of the human user assemblage not only demonstrates that there is no typical user but also calls into question the efficacy and fairness of green consumption proposals. Although not obviously connected to consumption per se since the OLPC XO laptop is given to children for free, as I will demonstrate below, the project is connected to technology and aid projects that seek to create new markets in third world countries. The OLPC foundation was set up in 2005 as a non-profit organization to sell cheap rugged laptops in large quantities to the governments of poor countries, who would then distribute the laptops for free to children between the ages of six and twelve. According to the OLPC website, over two million

children in 42 countries, including Canada, have XO laptops. Manufactured by Quanta, one of Apple's major suppliers, XO laptops were originally priced at a hundred dollars but actually ended up costing closer to two hundred dollars (Ko 2).

Nicholas Negroponte, one of the backers and investors of Wired Magazine, spearheaded OLPC and the project can be understood as a continuation of his work at MIT's Media Lab. His regular column in *Wired Magazine* was the inspiration for his 1995 book *Being Digital*, in which he heralds the dawning of a new digital age that will bring untold freedom, progress, and equality to all humans. Langdon Winner identifies *Being Digital* as a prime example of a cyberlibertarian text:

linking ecstatic enthusiasm for electronically mediated ways of living with radical, right-wing ideas about the proper definition of freedom, social life, economics, and democracy. (Winner, "Technology Today" 998)

As discussed above cyberlibertarian discourse imagines users as individual netizens and consumers. Negroponte has been at the centre of discussions about the development and implementation of ICTs and OLPC literature reproduces familiar arguments.

The children targeted by the OLPC represent a particular type of user. Mark Foster, Vice-President of Engineering and Chief Architect of OLPC, says "...we're trying to build a machine that's appropriate for kids...it's totally targeted at kids." Made of green and white plastic, with a handle on top for carrying, a hand crank for power, and green antennas coming out of the top, the XO resembles a toy. According to Ya-Yin Ko, a number of assumptions about technology, development, and education underlie OLPC. As stated on their website, the OLPC mission says:

We aim to provide each child with a rugged, low-cost, low-power, connected laptop. To this end, we have designed hardware, content and software for collaborative, joyful, and self-empowered learning. With access to this type of tool, children are engaged in their own education, and learn, share, and create together. They become connected to each other, to the world and to a brighter future. (*One Laptop per Child*)

Unlike many other educational projects that aim to provide children and schools with laptops, OLPC promotes private use and ownership, giving the XO to individual children rather than to schools, for example (Warschauer and Ames 35). The assumption is that circumventing changes to curriculum and teacher training, will have faster, more direct, and positive effects on children and their learning (Warschauer and Ames 35). Studies of various OLPC projects reveal a more complex view.

From the perspective of educators, the project has received mixed reviews. Despite the relatively low price of the XO, equipping all children in an average sized school is equivalent to ten times the annual operating budget of schools in the world's poorest countries (Schwarz). Educators argue that low cost solutions to train teachers and build schools would be more effective (Warschauer and Ames 37). Indian officials were skeptical about the program and declined to participate. Calling the project "pedagogically suspect," they stated that they needed teachers and classrooms before laptops (qtd. in Ko 21). Critics of the program have suggested that the world's poorest children need access to clean water, food, healthcare, and teachers more than they need a computer. In terms of digital literacy, most studies find that in order for children to fully benefit from the project, infrastructure including access to electricity and, even more

importantly, teacher training are paramount (Warschauer and Ames; Pischetola 8). The project takes for granted that children need to be wired and connected in order to succeed (Ko 8). Though Negroponte and OLPC literature never explicitly use the term digital divide, ideas about children being left behind because of their lack of access to technology guide the project (Ko 78).¹⁷ In fact, distribution of the XO, especially without teacher support and training, tends to reinforce the digital divide, understood in the traditional sense. In particular, children from higher socioeconomic backgrounds typically have access to adults who can help them. Children with strong language and literacy skills often perform better in a non-structured environment, such as the one advocated by OLPC, while children who struggle with language or literacy tend to need more mentoring and one-on-one attention to succeed (Warschauer and Ames 44).

Although the design of the OLPC has been more favourably received than other aspects of the XO laptop, there have been important criticisms from industry. Particularly relevant for this discussion of the user-computer assemblage is that the user - poor children living in digitally underdeveloped communities - has been left out of product development, which is highly unusual for any computer technologies. In fact, lack of user testing is one of the biggest criticisms. User interface designer, Jakob Nielsen says, "It's always dangerous to release any product without the safeguard of user testing.... but it's outright reckless in a case like this" (qtd. in Hamm). One study shows that, on the hardware side, user testing could have prevented a number of problems in the XO1.0, including keyboard membrane and touchpad problems. Although these problems were

¹⁷ Vincent Mosco explicitly connects Negroponte's vision to the digital divide and quotes Negroponte as saying: "... twenty percent of the world consumes eighty percent of its resources..." (qtd. in Mosco 80).

solved in the XO 1.5, large numbers of the XO1.0 became unusable even in countries with supports in place to fix the laptops, such as Uruguay (Warschauer and Ames 41). In terms of software, the mesh networking feature that allows different XO users to link to one another is buggy and the security feature, BitFrost, reportedly accidentally locks users out (Warschauer and Ames 41). In terms of classroom use, a number of features limit teacher use of the laptop. SUGAR, the interface designed for the XO, is very different from existing Mac, Windows, and Linux models which most teachers are more familiar with and teachers require more training to use SUGAR. Additionally, no teacher interface exists so that teachers must work with each student on his or her laptop individually in order to view student work (Warschauer and Ames 42). These machines are supplied to poor users, targeted because they are disconnected from larger digital infrastructures, and demonstrates the assumptions that underlie computer use; namely that computers somehow function independently of power grids, help phone lines, repair shops, technicians, and other resources. Not testing these machines properly is irresponsible since once these machines stop working they are essentially relegated to e-waste, especially in remote communities with little access to some of the resources needed to repair or refurbish non-functioning machines. The point is not to question the right of poor children to have access to digital technologies; rather I aim to problematize the assumptions that underlie the OLPC project and their connections to Northern development and environmental discourses that continue North-South inequities and that focus on "greening" consumption.

In terms of environmental issues, critics of OLPC have voiced questions about the recyclability of the XO, not to mention the problem of disposing of all the machines

safely. But OLPC and Nicholas Negroponte stubbornly insist on the boundless possibilities of the XO. Of OLPC, Negroponte says:

This is probably the *only* hope—I don't want to place too much on OLPC, but if I really had to look at how to eliminate poverty, create, peace, and work on the environment, I can't think of a better way to do it. ("Nicholas Negroponte Interview")

Once again we hear echoes of the technological sublime in which human growth and harmony with the environment will be brought about through computer technology. The discourse of the technological sublime refers to the almost religious excitement that suggests technologies bring with them new possibilities for democracy or social improvement (Nye 38). *Being Digital* also repeats many of the misunderstandings about the materiality of technology. In his discussion of fiber optics cable Negroponte says "... if you want more, you just make more. It is, after all, just sand" (Negroponte 23). This comment is very similar to that made by Stewart Brand who said "we're really not hard up for silicon" (see Chapter 4; Betts 2). As discussed in Chapter Four, these comments radically misrepresent the resource intensive and polluting reality of computer production. OLPC defers these concerns saying that they cannot take on all problems at once ("One Environmentally Friendly Laptop per Child"). Given the geopolitics of toxicity and risk, discussed in the previous chapter, whereby the world's poor are increasingly dealing with the waste of the rich and are more likely to suffer the effects of global warming and pollution, it is clear that this situation is ongoing for many of the very communities that OLPC supplies and that they are being made to shoulder the technological risk.

Locating the XO user in the earlier discussion of cool, the OLPC can be seen as part of the corporatization of culture. Negroponte describes the OLPC approach:

So there is what I would call an iPod approach to what we've done. We haven't gone around and done ethnographic studies in Africa and asked anthropologists throughout South America and Asia to do it. In fact, we've said: "Let's make something like an iPod that is cool enough and good enough for kids around the world to really actually want it as they will an iPod and do that approach also to get the price down. ("Nicholas Negroponte at OLPC Analyst Meeting [Interviews]")

Not only does Negroponte make no mention of doing routine, industry standard user testing, but he also seems to suggest that ethnographers and anthropologists make better advisors for educational technologies than education experts. If we take seriously Alan Liu's proposition that cool is the face of information work, it is significant that in a discussion of a laptop designed to educate poor children that the word cool is deployed. Not only is coolness invoked, but also Apple, the coolest tech company around, is directly referenced.

FAIR, a non-profit group who distribute ICTs and train people in developing countries, offer this critique of OLPC:

For western organisations such as MIT, OLPC and their sub-contractors to benefit by transferring expensive and risky technology to the world's poorest countries, without any documented need for it, looks like exploitation to those of us who are really committed to global aid work. (qtd. in M. Schwartz)

Corporate profit is a key part of OLPC and FAIR explicitly connects OLPC to the financial gain of partners and organizers - who include AMD, Brightstar, eBay, Google, Marvell, News Corp, Nortel, Quanta, Red Hat, SES Astra, and others ("Mark J. Foster at Stanford"). Isabel Valdes posits that many aid projects related to technology have the end goal of converting poor people into consumers of first world products (Valdes 2007). Ya-Yin Ko concludes that OLPC is "in the service of marketing *a product* under the banner of philanthropy" (Ko 4). In other words, the OLPC project constructs the user not as a student but as a consumer in training.

Both OLPC and Greenpeace mobilize the user through the discourse of cool, which Liu explicitly links to the corporatization of culture in which the user is treated as a consumer rather than a student or citizen; it is part of the function of internet applications and other software to order the user as a consumer. In fact, bringing together Fuller's idea of the sensorium and Sofia's theory of the internet as a container it becomes clear that these technologies do not just contribute to, but also actively construct a corporately dominated cultural atmosphere. Or as Brian Massumi says, if personal computers are only associated with the simulation of cyberspace then much of what they actualize is lost (Massumi 137). This impoverished cultural atmosphere dominated by corporate interests can be understood as a type of containment, especially as related to environmental discussions and actions.

This understanding encourages a discussion of the environmental problems associated with the computer that is narrowly cast in terms of individual consumption, rather than on larger structural issues of production, consumption, and regulation. When we locate the user in terms of environmental thought and action, we end up in a conversation about how to "green" consumer use. Greening computer use is ultimately

about tweaking consumer habits, or in the case of OLPC priming students to become consumers, so that the larger issue of consumption and the global inequities of resource distribution are left out of our conversation altogether. Rather than asking how we can green our computer use, we need to start asking how our computer use is mediated by corporate entities and what the implications of those mediations are. If we follow Elizabeth Shove, the container and containment action of the internet and related technologies is connected to “greening” strategies that ultimately do not deal with the larger environmental issues. There is absolutely no discussion of the corporate policy of planned obsolescence, which is surely one of the most relevant aspects of computer consumption related to the environment as it directly contributes to the shrinking lifespan of computers and the growing mountains of e-waste globally. Connecting our computer use to those infrastructures identified by Thrift takes computer use out of the realm of the individual and locates our use of these technologies not simply as a personal choice based on environmental ethics or brand loyalty, but also as a series of corporate policies, including planned obsolescence, international trade agreements, national programs, and so on. Environmental education, actions, strategies, and policies must focus on those infrastructural aspects of information technologies if we are to make any lasting environmental changes.

7. Time, Space, and Waste: Bringing E-waste into Computer Time

As with Chapter Three, this chapter considers risk society alongside risk culture. I continue my examination of e-waste, but I look at how waste as risk pushes the limits of waste management practices in risk society. Locating e-waste in both the risk and information society theses brings into sharp contrast the speed of ICTs with the long-term toxicity of e-waste. It also further demonstrates the importance of connecting the visibility of ICTs in waste management discourse together with its appearance in risk culture because these interactions work to maintain a larger discourse of risk containment and aversion. As with Chapter Three I examine the affect and aesthetics of e-waste, turning to WEEE-Man, Chris Jordan's photos, and the film WALL-E in order to consider how these cultural artifacts work to contain and conceal the long-term timescale of waste-risk.

In December 2006, *Harper's Magazine* ran an article written by Matthew Power about the Payatas dump in Quezon City, in the Philippines. The dump became internationally known in 2000 when heavy rains caused a hundred-foot mountain of garbage to collapse, destroying a shanty neighbourhood and killing hundreds of people (Power). Hundreds more people work in the dump scavenging various objects. Electronics, including empty refillable printer cartridges, monitors, motherboards, circuit boards and Pentium chips are some of the most lucrative items. Workers make more money working the dump than farming in the countryside (Power). Power says:

Household and industrial trash has become for the world's poor a more viable source of sustenance than the agriculture and husbandry that has

supported civilization since the first cities sprang up in the Fertile Crescent (Power).

Waste management has historically been about containing waste in a geographical outside, but this outside is increasingly those poorer countries and communities who take on the burden of the garbage from the wealthy. Power's article also complicates definitions of waste as discarded and useless, drawing attention to the fact that garbage is increasingly about waste and squander; the careless, short-term use of products in consumer culture. This is especially the case with electronics, which are typically only used for months or years at a time. Waste electronic and electrical equipment (WEEE) is the “fastest growing waste stream in the industrialized world” (BAN qtd. in Deathe, MacDonald, Amos 321). In previous chapters, I have gestured to e-waste as the most visible form of environmental degradation associated with personal computers and other high tech devices. In particular, it makes manifest the gross inequities of global trade as well as the legacies of colonial and trade histories ossified and perpetuated through the World Bank and other global trade policies and through the political, economic, and social reorganizations associated with information society.

In this chapter, I examine the visibility of e-waste in two locations: e-waste made visible by the e-waste policy of the Ontario government, and e-waste art that visualizes e-waste. Examining these two sites demonstrates the relationship between risk society, which is characterized by institutionalized responses to risk, and risk culture, which is characterized by the aesthetic and affective responses to risk. In legislating e-waste, waste-risk is made visible in risk society as a social and political problem requiring legislation to manage and contain it. In visualizing e-waste, art also renders

waste-risk visible and works to connect first-world consumption to the accumulation of e-waste in rich countries.

Jody Baker tell us that waste is a spatial problem, one that has historically been solved through containment or disposal, the former characterized by barrels or chemical ponds and the latter by dumps at the edge of town (J. Baker). The dangers associated with waste are not new. Since the late nineteenth century waste was increasingly separated out of living spaces and cities because of the connections between waste and disease, including cholera and the plague (van Loon, *Risk* 106). The toxic chemicals necessary for industrial processes, whether used in production or produced as waste products, have also been relegated to the spaces outside of town and away from centres of human population. As the seepage and overflow of these sites have become banal occurrences, the temporary nature of these solutions has disrupted the tidy categorizations of waste management. The failure to contain garbage signals the failure of the logic and practices of waste management. The discourse of waste management dislocates the origins of that waste, namely production. As Heather Rogers says, “garbage reveals the market’s relation to nature; it teases out environmental politics hidden inside manufactured goods” (H. Rogers 231).

Understood through the lens of risk society, waste is a significant source of risk. With the acceleration of industrial culture and consumer culture, waste spaces have become increasingly scarce, and it has become obvious that the effects of toxic chemical exposure are poorly understood. As van Loon says:

The problem of low-level exposure is often exacerbated by the lengthy timescales of cause and effect, and by the latter’s often dispersed and

fragmented manifestation. Yet these same conditions made scientifically based risk assessments virtually impossible because cause and effect do not operate on the same linear timescale. The effects appear too dispersed, too contingent, too haphazard, to be all tracked back to a single cause.

(van Loon, *Risk* 107)

In other words, waste is not simply a spatial problem but one that must also be understood through a temporal lens.

Not only have we been left with a legacy of leaking, contaminated landfill and disposal sites but we are producing increasingly more waste with which future generations will have to contend. E-waste in particular is not simply a problem of disposal, rather it needs to be connected to production and consumption (Rogers 227-8). Jonathan Sterne shows that computers “are designed to be trash, to make room for future profits, additional hardware sales, and performance upgrades” (Sterne 19). A computer is usually only ‘new’ for about six months, after which the monetary value of the machine drops significantly, although typically it still functions as intended (Sterne 24). As a result of this policy of planned obsolescence, working computers are routinely trashed. Barbara Adam uses the term *timescape* in order to account for the multiple, contingent, and often incompatible timescales associated with modernity, nature, technology and the environment (Adam 56). Applied to the computer, the timescale of the computer is generally understood as one of speed and acceleration, but the timescale of e-waste must be framed in terms of the long term and often unpredictable outcomes of pollution associated with toxic chemicals released over time.

This chapter charts these timescapes in order to determine how computer time, especially the accelerated times of information society, run contrary to the long-term timescapes of toxicity. In the first section, I briefly examine the times of the computer, including notions of computers eradicating time and space. In the second section, I deal with Ontario e-waste policy as representative of the emergence of risk society. I consider how the evolution of the Blue Box program in Ontario makes waste-risk visible as a problem requiring governmental intervention. As with Chapter Three in which I explore the emergence and regulation of risk society through Sudbury's nickel industry, I go into detail about the history of the Blue Box program in Ontario to consider how waste-risk emerged as part of risk society. Not only has waste management often been left out of media and cultural studies, but the history of the Blue Box program also debunks the simple and comforting formula held by so many of us that says recycling is always “good for the environment.” The development of the Blue Box program also marks a moment when waste-risk becomes more visible to the average Ontario citizen who is asked to sort his or her garbage before hauling it to the curb for removal by the municipality. The third section considers how e-waste art makes risk visual and visible in risk culture. In this section, I examine the connections between American photographer Chris Jordan's works, the WEEE man project in the UK, and the animated children's film *WALL-E*. Ultimately, these works emphasize waste as a spatial issue, rendering the astonishing scale of waste produced by consumers both visual and visible. More than that I argue that these risk culture artifacts must be understood in relation to both information society and risk society in order to fully comprehend not just the corporatization of culture associated with information society, but also the incommensurable and incompatible multiple times

of the computer from use to e-waste. In keeping with the main argument of this chapter, all three sections deal with the visibility of the times of the computer in relation to risk, whether as a functioning machine or as garbage.

The Timescapes of the Computer

The time of the computer is generally described as acceleration, speed, and timelessness. According to Jeremy Rifkin, computer technology has changed how humans conceptualize time. Because computers operate in tiny sections of time too small to be discerned by human consciousness, in nanoseconds or a billionths of a second, we are now living in an era where time is organized at a speed that we literally cannot experience (Rifkin 15). By contrast, clock time is organized into hours and minutes and enables scheduling, the organization of future time in such a way as to maximize sequence, duration, tempo, and coordination. This approach can be seen in factories with the rise of industrialism (Rifkin 98). As many theorists have noted, the speed of communication afforded by the internet and other ICTs has meant that our experiences of distance and space are compressed: we can instantly communicate with someone in another time zone; capital can move across economies multiple times in the space of a few seconds; we speak and work in 'real time' (see Harvey 1989; Robins and Webster 1999; Castells 2000). For Manuel Castells:

Time is managed as a resource, not under the linear, chronological manner of mass production, but as a differential factor with reference to the temporality of other firms, networks, processes, or products. Only the networked form of organization and increasingly powerful and mobile information-processing machines are able to ensure the flexible

management of time as the new frontier of high-performance firms.

(Castells, *Network Society* 468)

With networked society, the changes to our perceptions and experiences of time enabled by ICTs can be described by timelessness and simultaneity (Castells, *Network Society* 491). There is an increase, not simply in the speed of information transmission, but also in the amount of information in circulation. As Joost van Loon puts it: “In the midst of the speed and irreversibility, ‘man’ is now rapidly losing the plot in managing information flows.” (van Loon, *Risk* 152). We are overwhelmed by the volume and speed of information in circulation and consequently unable to make sense of it. Although the volume and speed may not actively conceal environmental risk, these accelerated information flows must be connected to those apparatuses of containment that work to obscure e-waste, even if it is through sheer distraction or because it is hidden in a deluge of other information and data.

The times of the computer are related to risk in multiple and connected ways: ICTs are used to calculate risk; to manage risk; to circulate information about risk; to access information about risk by individuals, researchers, professionals, politicians, journalists, and others; and thus they are at the centre of risk proliferation in two important ways. First, they are part of the apparatus responsible for the speeding up of information streams, especially as it relates to a sense of loss of control. Second, as the policies of planned and perceived obsolescence accelerate the production and consumption of computers more and more waste, from the production of these machines and from their disposal, is created. We must include in considerations of the time of the computer not just speed, simultaneity, and acceleration but also those longer periods of

time needed for ecosystems to regenerate and pollution to be neutralized. For both Rifkin and Castells, computer time represents a further dissociation from social and biological time, including the cycles and rhythms of nature (Castells, *Network Society* 476; Rifkin 15). While dissociation may not be directly responsible for creating environmental risk, it can be connected to the processes that work to distract us from, and thereby obscure, environmental problems related to computers in information society.

As Barbara Adam tells us:

With electronic communication, distance lost its link with bodies moving across space. The near future was brought into the present. Once more, the colonial principle has been extended from space to time. While the compression of time, afforded by machine power, eliminated both immediate and near futures, other technologies created and subjugated the long-term, open future, pre-empting presents of countless successor generations of humans and other species. (57)

Adam includes nuclear power and synthetic chemicals in the category of technologies that, because of their long term toxicity or unknown effects, impact future generations. All computers contain some materials, such as plastics and heavy metals, that have long term or indeterminate effects on living systems. Van Loon says:

The excessive nature of waste returns to haunt the present as past-waste becomes present-toxicity. Suddenly almost all ecological risks could be rearticulated as pollution or waste-risks; indeed, one could argue that the world risk society is above all a world waste society. (van Loon, *Risk* 108)

The emergence of risk society out of industrial society is related to both the speed of information flows and the acceleration of the production of waste, and, in turn, to the production, circulation, and proliferation of risks. The emergence of risk society is also connected to the distractions of information society whereby information on environmental problems get lost in the floods of data we regularly access on the internet.

The Temporal Logic of Recycling

Canadians dispose of 5 million computers and monitors per year (Deathe, MacDonald, Amos 323). It is estimated that in 2003 140 000 tonnes of electronics ended up in Canadian landfill sites annually, dumping vast quantities of lead, cadmium, mercury, hexavalent chromium, and brominated flame-retardents (Environment Canada). These are all toxic materials that can leach into the groundwater and cause serious health problems in humans including damage to the kidneys, nervous system, DNA, bone structure, brain, allergic reactions, blood disorders and hormonal interference (Deathe, MacDonald, Amos 323). The United Nations Environment Program reports that 20-50 million tonnes of electronics are discarded every year and, of that, about seventy percent end up in poor nations (Grossman 6). This trade continues despite the Basel Ban, effective since 2008, which prohibits the export of hazardous waste from rich to poor nations (Basel Action Network). Up to eighty percent of recyclers in Canada take used electronics, pack them into shipping containers, and ship them overseas (Basel Action Network). In 2005, the Basel Action Network, the leading activist group that tracks e-waste globally, issued repeated warnings about companies that illegally export e-waste to poorer countries including China, Nigeria, Ghana, India, Pakistan, Bangladesh, Malaysia, the Philippines, Vietnam, eastern Europe, and some countries in the Middle East, in the

guise of donation programs (Grossman 189). It is impossible to verify how much e-waste is exported because Canadian statistics are not collected by Statistics Canada or Canada Border Services Agency (Carter-Whitney and Webb 5).

In Canada, although waste management is handled by three levels of government, it is largely regulated at the provincial level ("How Waste is Regulated"). Residential waste programs are carried out and funded by municipalities while commercial, industry, and other institutions must comply with provincial regulations ("How Waste is Regulated"; Carter-Whitney and Webb 4). The Waste Diversion Act of 2002 provides the legal framework for Waste Diversion Ontario, the non-crown corporation responsible for developing and implementing a variety of waste diversion programs (Waste Diversion Ontario). These shifting waste management policies and programs, especially the Blue Box program, are also connected to the emerging visibility of waste-risk as consumers and citizens change their disposal habits due to changes in those policies.

The Blue Box program is descended from negotiations between government, environmentalists, and the beverage industry to deal with the emergence of single use plastic pop bottles in the waste stream. During the 1970s, beverage containers were the fastest growing components of waste and by 1976 they were the largest category of municipal waste (H. Rogers 134). When single use disposables like pop bottles became the status quo, the waste beverage container problem was essentially shifted away from industry and onto government. Previously, a bottle-return system existed so that dealing with the bottle after the beverage was consumed was an internalized cost for the producer. The recycling of plastic disposable pop bottles marks a major change in waste management programs, a major concession to industry, and a failure to contain

environmental hazards. During the 1980s and 1990s, the Ontario government created many new waste diversion policies. Industry influence and lobbying played a crucial role in ensuring that the bottle-return system was never reinstated. In the early 1980s, beverage companies created the Recycling Support Council, an organization that offered to put forward monies to create a curbside recycling program for beverage containers. This was the start of the Blue Box program, which had expanded across the province by the early 1990s (Carter-Whitney and Webb 2). Most environmentalists contended that the deposit-return system was a better choice to reduce waste (Carter-Whitney and Webb 1). One of the major problems with the Blue Box program was that the cost to run the program was too high for many municipalities (Carter-Whitney and Webb 3). Waste-risk becomes visible to the larger public through the Blue Box program as citizens and consumers are trained to pay attention to their garbage by sorting it into waste and recyclable streams before taking it out for collection by their municipality. These negotiations between industry and government in which social institutions attempt to balance public health and well being with economic growth are typical of the emergence of risk society (Beck, *Ecological Enlightenment* 2). With disposable bottles, which are meant to be thrown out, the cost is externalized and the bottle enters the waste stream. Once in the waste stream, it definitively becomes an environmental problem and also the purview of the provincial and municipal governments.

In terms of risk management, recycling programs attempt to make waste profitable and to bring it back into the production cycle, what Sabelis and van Loon describe as “a sort bookkeeping model” which attempts to quantify the value of waste (van Loon and Sabelis 292). The conception of time as linear informs this position so that

waste produced in the present becomes a future source of profit (van Loon and Sabelis 297). Recycling works to manage the risk of waste, especially in terms of space, by bringing it back into the logic of the market. Adam says:

Technological products are premised on the Newtonian principles of decontextualization, isolation, fragmentation, reversible motion, abstract time and space, predictability, and objectivity, on maxims that stand opposed to organic principles such as embedded contextuality, networked connectedness, irreversible change and contingency. (Adam 41)

Assumptions about reversibility and linear time inform the recycling model of waste management because it assumes that all or most of the waste can be reclaimed.

Reversibility is an assumption that what can be made can also be unmade, with no danger of other negative consequences. And as I will discuss below, the recycling model of waste management does not necessarily take into consideration the pollution, toxicity, and health effects of the waste, regardless of its "recyclability."

Computers continue and exacerbate the waste-risk pressures on containment strategies represented by recycling programs, themselves attempts to alleviate strain on existing waste management strategies including landfills. With planned obsolescence, electronics are increasingly being treated by consumers, retailers, and producers as single use disposable products (like pop bottles), rather than expensive machines to be maintained and repaired over a longer period of time.¹⁸ In 2000, industry organizations signed a Memorandum of Understanding with the Ontario Ministry of the Environment,

¹⁸ This "disposability" is an ongoing struggle and negotiation for consumers and others, as the success of small independent iRepair stores attests. See Rob Walker's article "Replacement Therapy: Why Our Gadgets Can't Wear Out Fast Enough" in *The Atlantic* for a discussion of this negotiation by consumers.

and the Waste Diversion Organization was created (CIELAC Brief History 4). Under the Waste Diversion Act of 2002, the Minister of the Environment designated four waste stream programs: blue box waste; used tires; WEEE; and municipal hazardous or special waste including paint, batteries, needles, pharmaceuticals and other substances (*Waste Diversion Ontario*). The WDO is another instance of visibility with respect to e-waste in Ontario as the legislation requires businesses and consumers to change their electronics disposal habits. WEEE is one of the most complex items in the waste stream and offers even more challenges to waste management practices and policies than does the stubborn problem of single use PET bottles. The *Recycling Council of Ontario* estimates that seventy to ninety percent of the material in trashed computers is recyclable or reusable (Recycling Council of Ontario). Recycling e-waste is incredibly difficult due to the complexity and toxicity of these machines and it is primarily the precious metals - including copper, aluminum, lead, gold, zinc, nickel, tin, silver, iron, barium, beryllium, cadmium, chromium, selenium, and gallium - that are desirable. The resulting material that is recovered is generally low grade and requires further upgrading and refining (Deathe, MacDonald, Amos 323-4). Some plastic from high tech devices is recovered for recycling, although it is usually “downcycled” into a lower grade plastic not usually useable in another high tech device, so that cartridges and printers become plastic flowers, for example (Grossman 228). High tech facilities exist in Europe, notably in Sweden where companies like Rönnskär extract gold, copper, silver, nickel, and zinc from old electronics devices (Grossman 233).

The most successful attempts to reduce e-waste are to make the products more easily recyclable and to implement extended producer responsibility, which requires the

producer to pay for the disposal of their products or to have take-back programs. Groups such as the Basel Network are pushing for extended producer responsibility so that corporations such as Intel, HP and others will become responsible for taking back obsolete computers. Studies have shown that this encourages companies to update product design to facilitate recycling and refurbishing of personal computers (Tojo 273). Presently, the European Union has the most stringent rules. Since 2006 new electronic equipment in the EU cannot contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers (Deathe, MacDonald, Amos 325-6). These changes are necessary and signal important changes to waste management strategies that begin to shift the responsibility back to the producer. However, they do not address past waste or present and future production. In other words, they do not directly address the strain on natural resources with the production of increasing numbers of electronics, whether or not they are built from recycled materials. Nor do they deal with existing materials, going back to the 1950s, that have not been reclaimed or are sitting in landfill.

According to the Ontario WDA, WEEE includes any appliance that requires an electric current to operate, such as air conditioners, hair dryers, clocks, televisions, toasters, GPS units, fax machines, headphones, stereos, and so on. Most computer components are included in Schedule 2 Information Technology Equipment (*Waste Diversion Ontario*). The Ontario Electronic Stewardship, the umbrella organization that deals with WEEE with a mandate to reduce e-waste while increasing the recyclability of electronics, was incorporated and approved in the fall of 2007 (*Waste Diversion Ontario*). Mandated by the Minister of Environment, the Waste Electrical and Electronic

Equipment Program began in 2009 (*Waste Diversion Ontario*). In general, the WEEE plan for Ontario is to divert all municipal and commercial e-waste from landfill and to deal with the waste through environmentally sound methods. The costs are to be internalized through the identification of stewards who pay for the processing, storage, transportation, and recycling of e-waste (*Waste Diversion Ontario*). In their analysis of the program, the Canadian Institute for Law and Policy conclude that Ontario's WEEE program is not as stringent as Europe's RoHS and WEEE Directive, which seek to limit the use of toxic materials in EEE products. They also note that Ontario's WEEE program could provide further incentives to consumers and industry to participate in the program through tax credits.

Although improving the recyclability of computers and their components diverts some machines from landfill, as part of the process of waste management, recycling also typically fails to address the production of waste in terms of sheer volume. More than anything else, it inserts waste into the logic of capitalism, in an effort to make waste marketable (Sabelis and van Loon 294). For example, Noranda (now part of Xstrata), a Canadian mining company, has established facilities for extracting precious metals, such as the easily recyclable copper and gold, from old circuit boards (Grossman 218). The dependable flow of circuit boards, with small amounts of metal, alleviates some of the risk associated with the guesswork of locating viable veins of ore. As Deathe, McDonald, and Amos show, in order for e-waste to be profitable, recycling plants must have a regular flow of "raw materials," trashed computers components, and often the cost of extracting the usable materials is higher than the value of that final product (324). If, or when, recycling becomes economically feasible, it will drive the price of raw materials

down, thus increasing productivity, and, again, the production of waste. Producing more waste will strain waste management systems, regardless of the reuse or recuperation of materials. It also increases the amount of toxic materials in circulation, whether as by-products or unsafe components of a product.

The recycling model of waste management does not account for the waste products produced by the recycling process itself, and typically ignores those materials that are not recyclable and therefore results in higher concentration of toxic residues (Sabelis and van Loon 299). Recycling, as part of the waste management discourse, alleviates the pressure on landfill and existing waste management practices but, ultimately, does not address the roots of the problem, or the ecological hazards of those materials such as toxicity and biodegradability (*ibid*). Recycling, especially of plastics, functions as a risk containment strategy until these practices are located in a larger framework that regulates the production and flow of toxic materials. Recycling ultimately slows down and manages the flow of toxic materials without actually alleviating their long-term environmental effects or dealing with the build up of e-waste in landfills since the 1950s. Although recycling is crucial to any future waste management plans, at present it also must be understood as part of the risk containment strategies central to the maintenance of risk society that do not necessarily deal with the proliferation of risk. Municipal recycling and waste management programs, such as those laid out by the WDO, render e-waste visible to those businesses, citizens, and consumers who must negotiate new disposal practices. But this visibility is complicated by the noise of contradictory information that is part of information society, including the ways in which recycling is typically framed as a viable solution to our e-waste problem.

Risk Culture, Time, and E-waste Art

Cultural practices addressing risk have begun to make connections between production and consumption patterns. Whereas Ontario's waste policy makes waste-risk visible, e-waste art visualizes waste-risk and is an important site through which to understand the relations between risk society and risk culture. As discussed in Chapter One and as theorized by Scott Lash, risk culture can be understood as those cultural practices that respond to risk in terms of the affective and everyday, and especially in art practice. E-waste is highly visual, connected to images of circuits that have become part of the visual narrative of information society. E-waste has become the most visible and visual aspect of the environmental effects of personal computer, as seen in previous chapters in the photographs of Edward Burtynsky and Pieter Hugo, and in documentaries such as *Manufactured Landscapes* and *Ghana: Digital Divide*. In the next section, I turn to three examples that deal with waste-risk in the developed world (as opposed to its illegal exportation from rich to poor countries): American photographer Chris Jordan's works make connections between consumer culture and waste, including e-waste; WEEE Man is a giant sculpture in the United Kingdom made from e-waste created to raise awareness of the problem of e-waste in the European Union; and WALL-E is a 2008 animated American children's movie that shows future Earth inundated with waste, including e-waste. I locate these examples in the larger discussion of waste-risk to demonstrate how they visualize waste as a spatial rather than temporal issue.

Chris Jordan is an American photographer whose work has received much attention from environmentalists and green bloggers for its attention to consumerism, waste, and environmental destruction (Yes! Magazine; environmentalgraffiti.com;

inhabit.com; treehugger.com). His photos have been displayed internationally and published in many magazines and newspapers, including the *New York Times*, *PDN*, and *Mother Jones*. The following section will focus on the works collected in *Intolerable Beauty: Portraits of American Mass Consumption* (2003-2005), *Running the Numbers I: An American Self-Portrait* (2006 - current), and *Running the Numbers II: Portraits of Global Mass Culture*. Shot on an 8 by 10 camera, many of the works are then digitally manipulated, and displayed as very large prints, many as big as five to ten feet in length.

Some of Jordan's earlier photographs in *Intolerable Beauty*, especially those from a Seattle container yard of shipping containers and oil drums shot in 2003-4, are reminiscent of Edward Burtynsky's work.¹⁹ The remainder of the works in the series are digitally manipulated. They are difficult to comprehend from a distance, but a closer look reveals the composite nature of the image, made up of hundreds of tiny cell phones, cigarette butts, or circuit boards, for example. *Diodes, New Orleans 2005*, *E-waste, New Orleans 2005*, and *Circuit Boards #3, New Orleans* are all expansive and flat, described by one reviewer as "deceiv[ing] perception" (Fugami 38). What Fugami is referring to is that the viewer often needs to take a moment to decipher that the image is an amalgamation of many tiny objects. *Circuit Boards, Atlanta 2004* has a slick, oily texture, a black, flat plane disappearing off the edge of the photograph. As one reviewer describes it:

The photo seems to depict an aerial view of a metropolitan city, with its familiar grid pattern and raised square forms representing buildings neatly arranged over an expanse of land. (Fugami 38)

¹⁹ The comparisons have been unfavourable in some cases, see zekesgallery.blogspot.com.

Circuit Boards #2, New Orleans 2005 is a bumpy, green, circular pattern of circuit boards. Texture is a dominant quality in this series, often giving the impression of landscape. Described by another critic:

The image shifts between documentary evidence... and metaphor: a vortex evoking the endless flow of consumer detritus. (Gefter 20)

The overwhelming effect of these works is their scale, which evokes the scale of consumption, and they work to problematize consumption in relation to waste. The images represent the scale of consumption spatially, by literally filling the space of the image with hundreds of tiny copies of an object. They attempt to highlight the massive amount of products consumed by Americans and the waste they generate.

Running the Numbers I and II are a series of digitally created images that make statistics visual, a sort of sophisticated infographic, at once mesmerizing and gimmicky. As Eugene Rosa says the images have a “wow, gee whiz” quality to them (Rosa 328). Some, such as *Office Paper 2007* and *Plastic Bags 2007*, are similar to previous works, flat, homogeneous planes, but with statistics as subtitles; according to Jordan's website, *Plastic Bags 2007* “depicts 60,000 plastic bags, the number used in the US every five seconds.” Others, such as *Venus 2011* and *Gyre 2011*, less well received by critics, are inspired by famous works of art using a pointilist technique, each point a tiny photograph of a particular object.²⁰ The titles function as a commentary on the image and the larger issue of consumption in the US. I tend to agree with one critic who complained: “the tension between image and information collapses into pedestrian moralizing” (DeVuono

²⁰ In fact, on his website there are two versions of Seurat's *A Sunday Afternoon on La Grande Jatte*: *Cans Seurat* that “depicts 106,000 aluminum cans, the number used in the US every thirty seconds;” and *Caps Seurat* that “depicts 400,000 plastic bottle caps, equal to the average number of plastic bottles consumed in the United States every minute.

22). Others are better received by critics. For example, *Packing Peanuts*, which shows 166,000 packing peanuts, equal to the number of overnight packages shipped by air in the U.S. every hour, is all depth, a suspended cloud of foam bits. For Eugene Rosa, the success of these images is the message - its scale - and its political challenges. Using tiny images representationally, they function on the level of space and scale. DeVuono says:

There is a fitting synchronicity to how Jordan uses new information technologies to ferret out statistics formerly improbable to gather, and then combines that information with digital images, additional data coolly composed of numbers.

(DeVuono 22)

Their success is precisely the visual representation of statistics in space.

An aspect of risk society is the numerical representation of hazards, often through the use of statistics that represent risks as predictable events. (Beck, *World Risk Society* 50). The statistics Jordan uses in his work correspond to the waste-risk of consumption, comprised of predictable and daily events. Jordan captures the aesthetic impulse of risk culture to render the incalculable knowable through statistics, which he makes visually understandable. On his website, Jordan says:

Exploring around our country's shipping ports and industrial yards, where the accumulated detritus of our consumption is exposed to view like eroded layers in the Grand Canyon, I find evidence of a slow-motion apocalypse in progress.

For Beck, part of the action of statistics is that they work to make risks anonymous, which in turn make hazards difficult to trace, or to hold any party responsible. Returning to the timescape model, Jordan's photographs engage with both consumption and time,

namely the speed of high volume consumption. As with waste management discourse, Jordan's photographs deal with waste in terms of consumption, ignoring the amount and speed of production. Although these images flirt with the idea of planned obsolescence in the sense that they contextualize the scale of consumption temporally, they do not (and perhaps it is outside the scope of the project) engage with planned obsolescence as a corporate production policy. They suggest a collective responsibility, but seem to interpellate the consumer rather than any other group or collective.

The moment of reading Jordan's caption-as-title images is similar to reading an infographic (graphic visual representations of information) - the graphic design makes the data visually compelling. Infographics are akin to the cool renderings of information that Alan Liu theorizes, especially what he terms the "craving for form in information" (Liu 215). This comparison bears out when we return to some of the comments by critics above: Rosa's "wow, gee whiz" (perhaps not a very cool articulation about a cool image) and Duvuono's "data coolly composed of numbers." As discussed in Chapter Six, Alan Liu shows that cool is the "cultural dominant of our time," connecting it to the corporatization of culture. In their technologically rendered form and cool representation of statistics, Jordan's images draw on and reflect the corporately influenced data design of user-friendly corporate culture and bring together the coolness of information society with the hazards of risk society.

Although it also works on other registers, the WEEE Man statue also represents statistics visually, namely that he was created from the amount of electronics the average UK household goes through in a lifetime, including washing machines, vacuum cleaners, fridges, computer mice, and keyboards. One website says: "imagining the 60 million

WEEE Man (the population of the UK) helps us realize the scale of the growing problem...” WEEE Man is a seven metre tall, three ton sculpture commissioned by the Royal Society for the Arts and Canon Europe to promote recycling and raise awareness about the European Union’s WEEE initiative, which regulates producers, distributors, and exporters of EEE. The initiative shifts end-of-life costs associated with the collection, recycling, and treatment of EEE to the producer and requires sellers of EEE to provide free EEE return facilities. Created in 2005 by artist Paul Bonomini and displayed outside the London city hall, the sculpture is now housed in Cornwall, England at the Eden Project. An embodied representation of statistics related to disposal, the sculpture ultimately emphasizes waste as a spatial issue and makes visual the astonishing scale of waste produced by consumers.

My reaction to WEEE Man, as well as to Jordan’s images and so much other e-waste art in general, is strangely flat, affectless. My dominant response to WEEE Man is: “wow, cool.” For Liu, the affect connected to cool “is one that inhibits as much as it releases feeling” (Liu 235). He says: “cool is feeling that is muted by the technical. It is a technical feeling or feeling for the technical” (237). As with Jordan’s images, WEEE Man works to bring the affect, or lack thereof, of information society to risk culture. If, as discussed in Chapter Three, the affect of risk culture fluctuates between apathy and anxiety, then the affect of information society almost works as a safety valve or avoidance mechanism. Expressed in art as part of risk culture, these works make visible and visual waste-risk in such a way that they dampen or manage affective response.

However, WEEE Man also connotes on other levels. Paul Bonomini, the artist who designed WEEE Man, says:

I designed him to look like he's dragging himself out of landfill, coming back from the dead. He's there to remind us of this monster that we're creating when we dump these goods rather than recycle them. ("Giant Sculpture Made of E-waste")

WEEE Man certainly bears a familial resemblance to many human-machine hybrids, cyborgs, and monsters of the 1990s, especially the T-800 in *Terminator*. In many of these narratives, and with the Terminator franchise in particular, our future world is an apocalyptic place when technology taking over is an entertaining spectacle. Monsters have long been border creatures that provoke reactions of fear or uncertainty about the broaching of boundaries. Current monsters can be said to broach the boundaries between science and emotion, human, animal, technology, us and them (Berland). In her paper "On Hybrids," Jody Berland looks at how hybrids are making us more comfortable with monsters, suggesting that contemporary monsters tend to be hybrids and have a different function than monsters of the past. Certainly WEEE Man reads more as cool than scary. Berland says "One could say that while the monster conveyed the horror of the unnatural entity, the hybrid has almost completed the work of naturalizing the idea." Berland is interested in animal-human-technology hybrids, but I think we can count WEEE Man as a human-technology hybrid in this lineage too. The WEEE Man as a cool monster can be considered to be a part of making us comfortable, "naturalizing" in Berland's words, the breached boundaries of information society of life, work, play. Part of the coolness of these monsters is that they mute affective response.

Another non-threatening, even friendly, hybrid is the robot, WALL-E (Waste Allocation Load Lifter – Earth Class), in the 2008 animated children's movie *WALL-E*.

WALL-E is a still functioning robot who continues to compact garbage on a future earth long abandoned by humans. Meanwhile, humans are living in a recreational space liner, maintained by a complex computer system. *WALL-E* is one of the few popular films to make explicit connections between consumer culture, waste, and the environment. It imagines that waste from unchecked consumption has literally turned future Earth into one giant landfill site cluttered with humanity's detritus. Although unnamed as the US in the film, future Earth and future humanity, as in many American films, resemble current American culture. However, as Kelly Gates notes, there is a disconnect between the message of the film and the structural conditions of its production, distribution, and consumption given the vast amount of merchandise produced to promote the film, including cheap plastic toys, t-shirts, robots, and so on, most of which is destined for landfill soon after its purchase (58).

Beth Snyder Bulik, writing in *Advertising Age*, points to the likeness between EVE, the robot heroine in *WALL-E*, and the iconic design of the Apple line.²¹ EVE has the sleek white look that began with the iMac computer and has come to define Apple products. Pixar, the animation company that produced the film, was owned by Steve Jobs, Apple's CEO at that time. Jonathan Ive, the chief designer at Apple, was a consultant on the set of the film for a few days. Within the film itself, an iPod projects a film that WALL-E, the robot hero, watches and the Mac boot tone is used. Both Jobs and Ive receive "special thanks" in the film's credits (Bulik). While I am not insinuating a great marketing conspiracy, the interconnections between Apple, Pixar, and the *WALL-E* film point not

²¹ The heteronormative robot romance as depicted in the film can hardly be described as the "cyborg sex" of Donna Haraway's "Cyborg Manifesto:" "the lovely replicative baroque of ferns and invertebrates...such nice organic prophylactics against...heterosexism" (*Simians, Cyborgs, Women* 150).

just to sophisticated product placement but also to the contradictions at the root of information and risk society. The film capitalizes on anxiety about garbage and waste as a long-term problem, at the same time as the promotion machine directly contributes to that problem. WALL-E's close ties to Apple and Pixar make it really hard to take the environmental message seriously, especially given that Apple products are some of the worst on the market with respect to planned obsolescence and backwards compatibility.

WALL-E is a fascinating example of waste-risk because the film depicts a long term timescape without showing the environmental labour required to rehabilitate land and waters polluted by toxic materials. It also unquestionably accepts the concept of reversibility discussed above, whereby what can be made, or in this case destroyed through garbage, can be unmade, or in this case, fully rehabilitated. Going back to these incommensurable timescapes that Adam describes, computers are not only part of the acceleration associated with information society but they are also central to mass consumption and consumer society. Both WALL-E and WEEE Man make e-waste visible in easy ways in line with consumption of ICTs and the business of information society. Neither communicates the global context, the inequities between rich and poor, nor the business as usual toxic trade not policed in any way by rich or poor countries, let alone corporate policies of planned obsolescence. Cute WALL-E and cool WEEE Man can both be seen as friendly monsters of the information age.

The cool structure of feeling that Liu identifies as being a key component of information society comes out of a response to the friendliness of corporate culture and the larger corporatization of culture. Corporate timescapes of just in time delivery, obsession with present profit, and death dating (or planned obsolescence in which

products are designed to fail after a given period of time) are inadequate to deal with the actual timescapes of e-waste. Looking back to Ontario's waste management policies, it is clear that industry must be involved in any plan to deal with waste. However, it is also clear that the negotiations between industry and government have evolved in such a way that waste, including and especially e-waste, are neither maintained nor contained. Rather, our recycling programs only approach waste spatially, and are struggling with it as a spatial program. Bringing together risk society and risk culture, demonstrates the limits of our cultural imagination when it comes to garbage and waste.

Returning to Barbara Adam's timescape approach:

a timescape perspective conceives of the conflictual interpenetration of industrial and natural temporalities as an interactive and mutually constituting whole and stresses the fact that each in/action counts and is non-retractable. (Adam 56)

She stresses that this approach calls for a more cautious approach. Bringing a timescape approach to e-waste must include a plan to stem the ever-increasing flow of waste from planned obsolescence, to deal with the existing toxic garbage in landfills around the world, and a long-term strategy for the regeneration of spaces degraded by industrial and consumer waste. Part of this cautious approach must include a consideration of time in the long term, and this is becoming increasingly true if we think about the long-term impacts of toxicity and pollution. A more complex understanding of time and toxicity understands time as cyclical and the effects of toxic pollution as cumulative, possibly non-reversible, at least in the linear sense. These friendly monsters are buying time.

8. North American Risk Culture and the Turn towards China

Because China has become central to all aspects of the personal computer's life cycle, it is a fascinating location through which to examine moments of visibility related to the personal computer and its environmental effects. As with Chapter Five, this chapter considers the interactions of visual culture with the discourses of the information age and risk society. China is one of the leading producers of computer chips and components, has the largest number of internet users in the world, and Guiyu, China has the largest e-waste dump in the world (Grossman 185). In short, China provides the location for a material and discursive convergence of many of those risks discussed in previous chapters including cyber risk, business risk, environmental risk, and waste-risk.

China is arguably moving simultaneously towards an industrial society, as it undergoes rapid industrialization and urbanization, and into the information age, as much of its population is going online, which makes it a significant locale through which to consider risk society and culture. These changes mean that it is entering into the dynamics of risk society in which the gamble to balance the goods of industrial society, such as jobs and wealth, are weighed against the bads, pollution and the social upheavals related to massive social reorganizations. These societal shifts also correspond to an emerging risk culture. It is beyond the scope of this project to consider the emerging Chinese risk culture, but China has become incredibly visible in North America as an emerging political and economic player on the world stage, and also as a source of anxiety about its potential to overtake Western powers. In this chapter I discuss how

western risk culture is projected onto China in the works and related criticism of Edward Burtynsky and Mike Daisey.

Edward Burtynsky and Mike Daisey are North American artists whose work directly confront and render visible anxieties about China. Canadian photographer Burtynsky, whose work I discussed in Chapter Three, travelled to China between 2002 to 2005 to photograph factories, the Three Gorges Dam, and other sites. Director Jennifer Baichwal's film crew, who were shooting a documentary on his work entitled *Manufactured Landscapes*, filmed him during parts of these trips. Mike Daisey is an American monologist whose critically acclaimed show *The Agony and Ecstasy of Steve Jobs* chronicles his life-long obsession with Apple products alongside revelations of labour atrocities in Chinese factories that produce Apple products. He was featured on the National Public Radio (NPR) show *This American Life* (TAL) on January 6, 2012. When NPR researchers discovered that aspects of Daisey's show did not conform to journalistic standards of truth, they retracted the show. In an agonizing follow-up show on March 16, 2012, they asked Daisey to account for those aspects of his story that did not comply with those standards. Both Daisey and Burtynsky's work deal with China and its connection to North American technological culture. They document China's increasingly powerful status as a centre of manufacturing, and especially its growing economic and political clout, and the environmental and labour consequences of these developments. Burtynsky and Daisey are two of the only North American artists to go into Chinese electronics factories, to consider the environmental toll of electronics, and to bring them to a Western audience.

What is particularly relevant for this project is that putting Daisey and Burtynsky side-by-side reveals parallels in the critical reception of their work. Critics have questioned each artist's responsibility toward the subjects he is documenting and whether or not his work can produce an ethical response in the viewer. Critics of Burtynsky's work worry that his work is not political enough, that it erases the human subject, and that it does not carry enough of an environmental message. In contrast, Daisey's work is criticized because his attempts to prompt viewers of his show to take responsibility and to force the industry to take responsibility have been overshadowed by the TAL debacle. Taken together, Burtynsky and Daisey's China works demonstrate the negotiations, pleasures, and contradictions of North American risk culture. Beck says that organized irresponsibility:

... helps to explain how and why the institutions of risk society must unavoidably acknowledge the reality of catastrophe while simultaneously denying its existence, hiding its origins and precluding compensation or control. (Beck, *World Risk Society* 149)

In other words, organized irresponsibility refers to the dynamic of risk society in which we are all to blame but no one takes responsibility. China's rapid growth thrusts it into this dynamic.

In this chapter, I connect the production and documentation of risk culture by Burtynsky and Daisey to the organized irresponsibility of risk society. Projection is an anxiety response that externalizes blame or responsibility. China becomes a location of our disavowal of responsibility, the object of our anxiety produced through and by risk culture. Looking towards China, Daisey and Burtynsky capture some of our anxieties and

ambivalence not simply about China's development, but also about risk itself. In this way, China becomes part of *our* structure of feeling related to risk culture. In the mining chapter, I argued that Burtynsky's work fits into risk culture, largely because of its ambivalence, but his China photos are slightly different because they contain more human subjects and they have been called more documentary and less painterly in quality (see Bellamie et al). In *The Agony and Ecstasy of Steve Jobs* Daisey essentially rehearses his helplessness, ambivalence and contempt, common to so many of us in risk culture, relating to Apple and the forced upgrade. The subsequent disavowal of his work by the mainstream press marks another level of organized irresponsibility since this reaction works to nullify Daisey's attempts to provoke collective action. While Burtynsky's work raises questions about responsibility through discussions of complicity that characterize the anxiety produced by risk culture, Daisey rehearses the organized irresponsibility of risk culture. In this chapter, I argue that organized irresponsibility in risk culture produces contradictory affective responses, including a pleasure in the simultaneous acknowledgment, helplessness about, and disavowal of risk.

Burtynsky's China and North American Risk Culture

I focus on the most in-depth examinations of Burtynsky's China photographs: essays from the book *China: the Photographs of Edward Burtynsky*, including one by Mark Kingwell, Jennifer Baichwal's film *Manufactured Landscapes*, which I also discuss in Chapter 3, and a panel discussion at Carleton University, subsequently published in *Environments*. The interdisciplinary discussion at Carleton involved political economist Patricia Ballamie, visual sociologist and postcolonial scholar Xiaobei Chen, linguistic anthropologist Eric Henry, and art historian and curator Diana Nemiroff. The changes to

China's landscape, especially as it becomes "the factory to the world," have become a subject of intense discussion and speculation for the rest of the world. In the film

Manufactured Landscapes, Burtynsky describes his attraction to China:

When looking at China, I was looking at that place where all these materials coalesce ... they're coming in from all around the world. Iron ore, aluminum, wood, all these things that China has very little of and then these factories are ... where all these things get formed into products and then sent back out around the world.

The China photographs capture some of the West's fascination with and anxiety about China's recent technological and political emergence, including and especially as it relates to the affect and aesthetics of risk culture. As the Carleton panelists note:

Our responses to the photographs reveal at least as much about ourselves – our hopes and fears for our environment and our economies, for example – as they do about China. (Ballamingie, Chen, Henry and Nemiroff 92)

These comments suggest that for North Americans, China has become a sort of repository for our own affective responses related to risk culture, a location through which we can work out our anxieties about the social, economic, and environmental effects of industrialization and informationalization (although that projection can be conscious or unconscious).

Taken as a whole, Burtynsky's China photographs begin to historicize the industrialization of the West through China's industrialization, and at the same time historicize China's industrialization as well. Although China has become the manufacturer to the world, it is not just the scale of production of goods for the world that

is staggering; it is also the scale of construction that propels the changing Chinese landscape. Located on the Yangtze River, the Three Gorges Dam is the biggest hydroelectric dam in the world. Great destruction was necessary for the construction of the controversial project. As Burtynsky notes on his website, rich agricultural land, important archeological sites, 1600 factories, three major cities, 140 towns, and over 1300 villages were destroyed and then covered in water to facilitate the building of the dam. When the dam was first filled, it caused a noticeable tilt in the Earth's rotation. The dam provides the electricity needed for the growing manufacturing sector and the rapidly growing urban populations. Chen comments on the political complexities of balancing the goods and the bads in risk society: "the Dam ... seems to exemplify the complexity of pursuing environmental justice, the elusiveness of an uncomplicated and uncompromised good, and the political nature of choosing what to privilege" (80).

Or as Kingwell puts it: "The China photographs, labeled scenes of the next industrial revolution, actually reveal the latent truths of the first one, our past by way of the future" (Kingwell 18). The Three Gorges Dam photographs fit into the Burtynsky oeuvre because they document the vast scale of the dam. Many show the muted gray of the rubble from destroyed towns or of the newly built dam structures, highlighted by details in saturated colours: red and green construction cranes, emerald grass, or turquoise water. They are sort of flat and somber photos, with trucks, carts, workers and other people working to establish scale. The details pull the viewer's gaze into the photograph, past the uniform grayness, and into the staggering scale of destruction.

The Carleton panelists connect Three Gorges to the St. Lawrence Seaway and the International Hydro project in eastern Canada and the US that was finished in 1958,

and which displaced 6500 people. They draw parallels between the controversial aspects of both projects: apple orchards and burial grounds were flooded by the Seaway project; and orange orchards and archeological locations were submerged by the Three Gorges project (Bellamingie et al 79). They locate Three Gorges in relation to Canada's history of modernization. There is a tendency when discussing China to criticize it for having lax environmental and labour laws. In this lazy criticism is often an implicit comparison of China to Canada or other Western countries, in which China is found lacking. In fact, China is more than a parable of Canada's past modernization projects; it is also firmly entrenched in our current and future economic endeavours as our second largest trading partner (Bellamingie 77). As Bellamingie notes, five Canadian companies were involved in the building of the Three Gorges Dam and CIDA funded their feasibility study (Bellamingie et al 81). The Carleton panelists refuse simplistic moralizing or any disavowal of Canada's historic or current participation in environmentally and ethically dubious modernization projects.

For Ballamingie and Chen, Burtynsky's manufacturing photos bring up questions regarding the conditions of factory workers and the representation of Chinese workers in the photographs (77-8). For Chen there is a tension between stereotypical representations of Chinese workers as oppressed, "ant-like," and undifferentiated, aligned with a long tradition of misrepresentation of Chinese people in the West, and with reactions from some Chinese viewers of the photos who see economic opportunity and progress (78-9). Many critics feel that the film *Manufactured Landscapes* works to humanize and differentiate the people in the China photos. The film individualizes the workers through close-ups of the workers, revealing painted fingernails, earrings, and other personal

details. The filmic medium also demonstrates some of the realities of factory work unavailable to photographs, including the repetitive, rapid motion of testing spray nozzles and the absence of conversation. Although Burtynsky does not photograph a factory that manufactures high-tech electronics like computers, it is not difficult to imagine that industry when viewing the photographs of shoe, iron, and even the chicken-packaging plants. Since the 2010 Foxconn suicides and their high profile in the Western press, it is possible, even likely, that North Americans viewers seeing these photographs will now make the connection to these events.

Chen speculates on the reception by Western audiences:

Perhaps the more salient question is whether Western viewers treat these photographs as art or documentary? If their effects are those of documentary photography, then they ought to be critically assessed as such. More pointedly, if Western viewers rely on these images to understand China, what have they learned? Do these images help Westerners to understand the complicated and contingent negotiations of life chances in the myriad of tremendous social changes in China, or do they simply fill a Western viewer's field of vision with transfixed differences?" (Bellamie et al 90)

Chen seems to suggest that documentary photographs have a potentially pedagogic function and that their reception by Western audiences is an important indicator of their effects and efficacy as messages. Although I am not sure that the pedagogic measure of these photographs is their most salient aspect, they certainly render visual industrialization and its accompanying social and environmental risks. Furthermore, the

distinction between art and documentary suggests that these photographs do not, or cannot, perform as both, which is surely the precise function of documentary photographs. In Burtynsky's case, they create meaning through the documentation of particular landscapes not usually available to the larger public, Chinese, Canadian, art-going or otherwise. For Canadian audiences, they have the potential to visualize and make visible aspects of Canadian risk society through Chinese industrialization. Their display in Canadian venues, inclusion in *Manufactured Landscapes*, with accompanying reviews and debates in the mainstream press and elsewhere render risk visible.

The shift in aesthetics of the China photographs, that they have a less painterly, as noted in Chapter 3, and more photojournalistic quality than Burtynsky's other work, is cited as an important element in understanding their effects. Chen says:

Arguably, Burtynsky's photographs of China come across more as documentary than his other work. Burtynsky responds ambiguously as to whether his photography is primarily art or documentary aimed at provoking social change. He has asserted that his photography would have the greatest impact as exhibited fine art and not as printed documentary photographs. In most of his work, he usually provides no more than the date and place of a photograph in the caption – a hallmark of artistic photographs. At the same time, in his public lectures and on his website, his concern for the environment and sustainability is impossible to miss; he even gestures towards social justice issues such as wages. He also often provides a good amount of explicit social context for his photographs in lectures and on his website. His China

photographs, however, unlike other collections on his website, are the only ones to include accompanying background narratives. (Chen in Bellamingie et al 89)

Documentary photographs can produce an ethical response in the viewer and presumably to contribute to larger social change, but I am not sure that Burtynsky's photographs work only in this way. Although the panelists do not explicitly make this comment, the China photographs are less beautiful; they do not aestheticize or render toxic landscapes sublime in the same way as his earlier works. It was this function that disturbed earlier critics (see Cammaer and to some extent Bordo). Perhaps viewers are more comfortable with a less ambiguous visualization, although, as I argue in Chapter 3, it is this particular ambiguity that makes Burtynsky's works so powerful. In Chen's comments, there is an undercurrent of uncertainty about the reaction of viewers to Burtynsky's photos, concerning whether the viewer admits or acknowledges complicity in the conditions of Chinese factory workers, in the destruction of houses, or pollution of the environment. The deliberations by critics about the complicity and responsibility for Canada and Canadians underscores their importance as documents of risk culture, especially as locations through which the dynamics of organized irresponsibility are negotiated.

Canadian and Chinese viewers often read the manufacturing photos differently. According to the panelists, many Canadians point to the complicity of Canadians in the conditions of Chinese factory workers. Furthermore, as Bellamingie says: "Canadians enjoy a high material standard of living based in part on cheap imports that, one could argue, do not adequately reflect the negative social and environmental externalities associated with their production" (Bellamingie et al 77-8). The harsh working conditions

of the Chinese facilitate affordable consumer goods for Canadians. Canadian labour and environmental laws are irrelevant in China even as most of our consumer goods originate there. It raises questions about our responsibility to Chinese workers and the (im)possibility of our effective intervention in the organized irresponsibility of risk society.

Presumably in response to the scene in *Manufactured Landscapes*, in which Burtynsky instructs Chinese workers to line up for the photograph, one Chinese viewer says:

When the photographer demanded all the workers on the assembly lines to face the camera, when the photographer demanded a country elder to face the camera, the shy and puzzled looks of tens of thousands objectified objects [tell us that] China longs to be merged into the globalized world, longs to be recognized [as modern]. (Jin qtd. in Bellamie et al 79)

The Chinese viewer acknowledges the Western gaze constructing a particular visual artifact that renders the Chinese visible as other and the Chinese perspective in which manufacturing jobs are creating wealth for poor Chinese peasants. Postcolonial scholars note that the dynamic of projection constructs both the colonizer and the colonized (Branaman 143). While the China-Canada, or even the China-North America, dynamic is not strictly one of colonizer and colonized, it is structured by similar power imbalances. Chinese and Canadian viewers are positioned differently in this dynamic and this positioning informs their reading of Burtynsky's photographs. For Canadians, Burtynsky's China photographs become a place onto which they can project their

anxiety. Risk culture is largely defined by anxiety and Burtynsky's photographs seem to facilitate a projection of our anxiety about labour, industrialization, and the environment onto China.

In her discussion of the final scene in the film *Manufactured Landscapes*, Bozack pointedly says:

As patrons mill about contemplating the portraits, we are confronted with the film's most essential juxtaposition; here is the exclusive venue and privileged audience that receives Burtynsky's images of China and then interprets its impact on the globe's ecological health. By ending here Baichwal unequivocally identifies us, the audience, as participants in and benefactors of this insidious cycle of unsustainable development; not only do we consume China via its ubiquitous exports, but also through the very images that represent and thus 'manufacture' this country. (Bozack 71)

She refers to the dual processes of material and visual consumption at work, through which we are accomplices to environmental destruction. These are the dynamics that are at play in the critical reception of Burtynsky's works, even though Bozack, as with so many other critics, must depend on the film to articulate these tensions. Baichwal both facilitates and makes explicit a re-contextualization of Burtynsky's photos, especially as it pertains to questions of responsibility for Western viewers. The peculiarity of risk culture is the disavowal that viewing the images allows us. They offer us some simultaneous and contradictory pleasures: relieved acknowledgement and frustrated helplessness, but also rage or anger, and ultimately ambivalence. This anxiety about whether the photographs

are political enough belies some of the pleasure of viewing, especially of viewing art, which is informed to some extent by an expectation of ambiguity.

Mike Daisey and the Organized Irresponsibility of Risk Culture

By contrast, Mike Daisey as an artist is the target of accusations related to his complicity and lack of responsibility that can be characterized as part of the negotiations of organized irresponsibility in risk culture. I saw Daisey's monologue *The Agony and Ecstasy of Steve Jobs* at the New York Public Theatre on March 17, 2012. The piece chronicles Daisey's lifelong relationship to Apple products, his disillusionment with Steve Jobs and Apple, and his subsequent trip to China to investigate working conditions at Foxconn. It marks a moment of high visibility of the production process and worker health, although it does not explicitly question the larger environmental repercussions of these processes. What is unusual about this piece is that it unambiguously brings together the Mac user with the Foxconn worker to question consumer responsibility and the larger systems of production. The performance of the monologue *The Agony and Ecstasy of Steve Jobs*, its subsequent broadcast on the popular National Public Radio show *This American Life* (TAL), and the resulting retraction by TAL and media furor, which I discuss below, mark a moment of visibility in terms of the risks, especially to worker health, related to personal computers. The TAL debacle can be characterized by how various players, especially technology and theatre reporters, sought to lay blame or responsibility for Mike Daisey's lies and the implications for the realities of electronics production, consumer responsibility, artistic production, and journalism. The event points to the crisis of responsibility that plagues risk society.

The Agony and Ecstasy of Steve Jobs consists of two main story lines: the evolution of Apple under the direction of Steve Jobs and the labour issues at Apple's largest subcontractor Foxconn. Daisey positions himself at the centre of the narrative as a life long Apple fanboy who became uncomfortable and then outraged by the terrible labour conditions at Foxconn. The monologue is part exposé and part call to action for American electronics consumers, especially Apple users. He describes the moment of rupture when he found test photographs taken from inside a factory that produces iPhones:

...it's about the fact that someone bought an iPhone and when they got it, it wasn't blank—it had information on it from inside the factory. And in fact, in the camera roll, there were pictures on it. From inside the factory. They posted these pictures into the article, and I looked at these pictures, and they took my breath away.

(Daisey 16)

Although Daisey does not describe which photographs he saw, the photographs are likely those of a young woman who works at Foxconn who flashed a peace sign at a co-worker whose job it is to test the cameras on iPhones. These photos were not erased by the workers and were later published on the *Mac Rumours* website by the person who bought the phone in the UK. For Daisey, the photographs clearly connect him as an American consumer and iPhone user to the labourer at the Chinese electronics factory.

Daisey was interviewed by numerous news outlets about his research trip to China, on which the monologue is partly based. In January 2012, TAL devoted an entire episode to the monologue. TAL retracted the show after producers discovered that some of aspects of the show were not verifiable. *American Public Media* China correspondent Rob Schmitz tracked down Daisey's Chinese interpreter, Cathy Lee, and fact-checked

Daisey's monologue after hearing the NPR podcast because certain details seemed implausible, such as the guards at Foxconn carrying guns. Lee also said to Schmitz that she and Daisey met with fewer workers at the Foxconn gates and that some of the unionizing workers did not suffer from the injuries described in the monologue and podcast. In an excruciating follow-up TAL episode, host Ira Glass interviewed Daisey to find out why Daisey lied. Although all of the events Daisey narrates did not happen to him personally, all the facts regarding labour conditions at Foxconn are true, including the illegality of unions, worker health problems related to the use of N-Hexane, and long working hours. As one critic said: "he was creating a composite to better draw attention to his cause" (Abrahamian). A furious debate erupted over the Daisey debacle regarding journalist truth, fact checking, and the line between fiction and non-fiction in theatre. Meanwhile, Daisey has revised the monologue, cutting out the offending six minutes of "composite" storytelling and replacing them another twelve minutes of journalistically verifiable material. The new version was performed at the Woolly Mammoth Theatre in Washington in July and August 2012.

As I watched the blogosphere, news media, and other interested interlopers take on the debate surrounding the Daisey TAL episode, I couldn't help but notice the attempts to assign responsibility to various players, mostly to Daisey, but sometimes also to Apple or to electronics consumers. Because Daisey made the rounds of media outlets, penning an opinion piece for the New York Times and appearing on Bill Maher's show, he positioned himself as an expert on Apple and labour conditions in China. It is on this basis that most of the criticism against him is launched. The vitriolic blame projected onto Daisey disavows anxiety and especially any possibility of responsibility, either by

the accuser, consumers, Apple, or China. The task here is neither to defend nor to castigate Daisey, but to consider how this moment of visibility actualizes aspects of risk society and culture. Most, if not all, of the controversy surrounds the China material. What is particularly relevant for this project is that the Daisey controversy is a moment of visibility not only of electronics production, and its related hazards and risks, but also of the relationship between the Apple user as consumer and the history of Apple, especially the role of Steve Jobs.

Many defenders of Daisey point to the different standards for truth in journalism and theatre. Mallika Rao says:

The first-person exposé of FoxConn - the factory in Shenzhen, China where Apple (and many other) products are made in verifiably awful conditions - included fabrications about child employees, maimed limbs and guns, all of which Daisey didn't see but claimed to see and later said he may as well have seen because they're probably there, which should have made saying he saw them okay. Perhaps no entity was more convinced that what Daisey did was not okay than the media, where the crime of inventing details to make a story more persuasive is a career-ender. (Rao)

Although he seems to be gesturing to the news media, it is not clear to which elements Rao refers (television, bloggers, radio, or all media). In an article titled "Should Mike Daisey Get Credit for Being Accountable?," Erik Wemple says:

Those remarks and the list of fibs and whoppers that Daisey told "This American Life" and the American public have yielded a pretty consistent

reaction among critics. One says he's just a liar in search of excuses.

Another gives him the middle finger in print. Another says that Daisey has poisoned a bunch of careful reporting on the actual conditions in Chinese facilities that produce Apple products. (Wemple)

Adrien Chen writes, in the article "How I Was Duped By Mike Daisey's Lies,"

This is how Daisey perpetrated his con since "The Agony and the Ecstasy" premiered in early 2011: He took a vacation to China, hacked together a story out of some sensational lies then paraded them around like the world owed him a favor. While we were too busy wallowing in self-recrimination to check if what he said was true, he used his fake facts to leverage himself into the position of the world's most prominent Apple critic, appearing on MSNBC and "Real Time with Bill Maher," and writing an op-ed in the New York Times. In the process he debased anyone who actually cared about the true injustice of Apple's manufacturing process. Daisey's lies hurt labor organizations like SACOM [Students and Scholars Against Corporate Misbehavior] by giving their critics ammunition to ignore their real complaints. He cynically warped the stories of Chinese workers to promote his campaign, and trivialized the work of journalists who actually do real reporting on the issue. (Chen)

By contrast, Chrisk Klimek calls Daisey an "unreliable narrator" and yet says:

In my view, *The Agony and the Ecstasy of Steve Jobs* remains valuable not for the specific facts it imparts but for the way it makes us think, at least

for two hours and hopefully for much longer, about the human cost of the devices we carry with us. Daisey lied about what he saw and heard, but he didn't lie in portraying the circumstances within Foxconn as hellish.

(Klimek)

The role of *The Agony* and Daisey in helping or hindering the plight of Chinese electronics workers, and the extent of their dangerous working conditions, dominates much of the press.

Daisey is blamed for harming notions of journalistic truth and the work done by activist groups. It is difficult not to see another, not necessarily deliberate, outcome. As these attacks on Daisey, especially from those who worry his work could debase Chinese labour activism, continue, blame is displaced from consumers, concerned citizens, corporate players, or legislative bodies. And while his actions may be problematic, he certainly cannot be held responsible for the ills of an entire industry. This disavowal of responsibility by bloggers and news media effectively projects some of our collective anxiety about our responsibility to Chinese workers onto Daisey, while rendering less visible Apple's responsibilities to consumers locked into cycles of forced upgrades by planned obsolescence or to workers in its factories exposed to dangerous chemicals for the sake of efficiency.²² As the controversy blew through the American press, other details of the monologue were effectively swept under the rug.

²² For example, the now infamous n-hexane employed to clean iPhone screens is used because it dries more quickly than other cleaning chemicals, thus increasing the productivity of workers who can clean more screens in a given period of time. <http://www.theguardian.com/world/2010/may/07/chinese-workers-sickness-hexane-apple-iphone>

The Agony is as much a castigation of the electronics industry as it is of corporate America, consumer society, and the politics of information. At the end of *The Agony* performance, Daisey circulates two flyers with information on how to protest the problems with the electronics industry, from urging consumer boycott strategies to letter writing, even providing Apple CEO Tim Cook's email. While Daisey urges electronics users to take collective action, the media blames Daisey as an individual. In both cases the individual is the focus: the individual electronics consumer is urged to take part in collective consumer action and Daisey is targeted as an individual playwright. Any discussion of structural change, especially in terms of regulation, is deferred. Both risk society and the corporatization of culture are connected to trends of individualization where people are increasingly interpellated as individuals and consumers, as opposed to citizens or workers. More than anything else, we can locate Mike Daisey and the debacle around *The Agony* within the organized irresponsibility of risk society and culture. In his quest for documenting and assigning blame, and especially in his engagement with the news media machine, Daisey is identified as a risk to theatre, to news reporting, and to the cause of Chinese workers and labour in general. Little blame is assigned to Apple, Foxconn, or any governments or agencies responsible for regulating working conditions, trade agreements, or environmental regulations. The blame is projected onto Daisey and he becomes the location for that anxiety. Bringing together the organized irresponsibility of risk society and anxiety of risk culture, Daisey becomes the place onto which we displace that anxiety and disavow our responsibility. The anxiety of risk culture is defined by that mechanism of disavowal.

As we saw in Chapter 6, risk society and information society both entail a corporatization of culture and individualization. If we connect the documentary impulse in Daisey's work, which points to questions of responsibility, this responsibility, as seen in *The Agony* transcript and the media coverage of the Daisey debacle, culminates in individual responsibility and works to both open up and foreclose the possibility of assigning blame or taking responsibility. As Beck notes:

risk societies are characterized by the paradox of more and more environmental degradation - perceived and possible - coupled with an expansion of environmental law and regulation. Yet at the same time, no individual or institution seems to be held specifically accountable for anything. (Beck, *World Risk Society* 149).

Although *The Agony* focuses on labour problems, as we have seen in previous chapters, the labour conditions can never be separated from environmental hazards because of the toxic chemicals necessary to production. Furthermore, Daisey in his attempt to both take and lay responsibility ends up mired in, perhaps even producing, the organized irresponsibility of risk society in risk culture.

The religious metaphor is often used to describe Apple consumers. Daisey describes himself:

And of all the kinds of technology that I love in the world, I love the technology that comes from Apple the most. Because I am an Apple aficionado, I am an Apple partisan, I am an Apple fanboy, I am a worshipper in the cult of Mac. I have been to the House of Jobs, I have walked through the stations of his cross, I have knelt before his throne. And like so many of

you who may be members of this religion with me, you may know that it can be difficult, at times, to keep the faith. And I have strayed now and again.

Like many of you, I indulged in the Linux heresies. And in the late nineties, I did sleep with a Windows system or two...but who didn't, really? But for the most part, I have been faithful. And we speak tonight of the operating system as a religion and I submit to you, how could it be otherwise? Because in this age, when so much of our lives are mediated by technology, I say to you, if you control the metaphor through which people see the world, then you control the world itself. (Daisey 12)

In this passage, Daisey deftly connects the technological fetishism related to technology in general, and Apple products in particular, to larger structures of power including the corporatization of culture. Beck compares risk society to a Catholic confessing his or her sins:

However few sinners actually want to repent and instigate change. Most prefer for nothing to happen whilst complaining about that very fact, because then everything is possible. Profession of sins and identification with the risk society allow us simultaneously to enjoy both the bad good life and the threats to it. (Beck, *World Risk Society* 138)

Connecting Daisey's worship of Apple to Beck's "sinner" in risk society speaks to the negotiation of pleasures in risk culture. In many ways, this comparison describes the discussions of Burtynsky's work, the simultaneous difficulties and pleasures, affirmations and denials. Part of the pleasure rests in the acknowledgment of our responsibility, which amounts to little more than the gesture of viewing the work, in contributing to

environmental degradation and global inequalities by our participation in information society, while at the same time repudiating any real action. Surely, this negotiation speaks to our complicity in the organized irresponsibility of risk society.

Conclusion

As I began writing this conclusion, the power cord for my laptop, which had required a special twist in order to draw electricity in previous months, finally died. With a mere twenty minutes of battery life left, I backed up all my documents and switched off the computer. I quickly learned that Apple no longer manufactures the type of power cord with a round head required to power my machine. It now makes a “new and improved” power cord with a rectangular magnetic head that does not work with my laptop. After spending the last six years researching and writing on planned obsolescence, e-waste, and related topics, the irony is not lost on me. For a tense few hours it seemed that I would have to replace my computer because of a dead power cord in order to finish my dissertation. Luckily, the Chinese electronics market has filled this niche and I now have a fully functional knock-off power cord. This is one of the many ways in which Apple death-dates its peripherals forcing consumers to update fully functional devices. Luckily, I was able to delay the inevitable forced upgrade.

There is a particular constellation of emotions that seems to define such interactions with technology. Of course, there is the frustration and rage, but first is the dread in the pit of your stomach. The fear of losing, in this case, my entire dissertation, experienced in all caps and excessively punctuated [LOSING MY ENTIRE DISSERTATION!!!!]. For me, it also involved a slightly hysterical, typo-laden text to my partner, who is a television editor, much more tech savvy than I am, and the reason I own a Mac in the first place. In this particular instance, she was sitting with a director and could not be interrupted for, what turned out to be, a trivial and easily solved hardware

issue. I received a terse reply that ended with the directive: "back up everything now." I was left to navigate the technological and affective straits alone.

Raymond Williams tell us that our structures of feelings are fundamentally connected to larger political, economic, and social structures. My reaction to the power cord incident was typical of the rage and frustration experienced by so many of us in our technological interactions as part of risk culture. I began this dissertation by suggesting that materiality is a crucial avenue through which to understand the environmental aspects of computers. The materiality of technology and the environment is radically under theorized in cultural and media studies, but so too is risk culture, especially its connections to technological culture and the information age. Before moving on to a discussion of the particularities of risk culture, I begin this chapter with a discussion of the major themes of this dissertation, including notions of materiality and immateriality, the geopolitics of toxicity and risk, the shift from industrial and risk society, and cybernetics the environment.

The complicated relationship between the material, immaterial, visible, and visual affordances of the computer is at the heart of this dissertation. Computers have a massive ecological footprint because of the volume of resources they use throughout their life cycle. We need a lot of physical resources to make, power, and use computers. We also need resources to cope with e-waste, which is the fastest growing waste stream in the industrialized world, and which also contributes to our toxic and solid waste problems. Because of the processes associated with globalization many of these processes are so geographically disconnected - coltan mined in the Congo gets put into phones assembled in China sold to consumers in Canada and ending up in a dump in Hungary - that as users

we do not know anything about what is actually inside the computer. Probably because we are too busy worrying about security updates, remembering seventeen different passwords and login information, and relearning programs after forced software upgrades to pay attention to this dark side of computers. For many of us, the off-site nature of garbage and production buttresses the intellectual misunderstanding of computers and ICTs as immaterial.

The idea that computers and other ICTs are immaterial persists in multiple ways. As Katherine Hayles tells us, part of what contributes to notions of the immateriality of computers is that information is routinely understood as separate from its physical body, whether that body is a hard disc or a human body. Much of the work connected with the information age is performed by people working on computers, performing tasks such as coding, data processing, design and other work, and this is often referred to as immaterial labour, in spite of the embodied souls bent over computer keyboards in cafés and cubicles around the world. Finally, this thinking can be seen in naming conventions, such as the MacBook Air or cloud computing. As experienced by the user, cloud computing further distances us from where our data is stored without losing the convenience of immediate access. And yet data farms are massive facilities, often located in remote places such as Nevada or Norway. They are also energy hogs, requiring vast amounts of power and water to cool the facilities, and they contribute to carbon emissions. Cloud computing and data farming exacerbate these persistent misunderstandings about the immateriality and environmentally friendly nature of computers and ICTs. The trend towards cloud computing continues the radical divorce of the computer user from the daily production

and maintenance of the information economy, and the off-site nature of data storage and processing further aggravates the notion of computers and ICTs as immaterial.

Materiality and immateriality are fundamentally related when we are talking about computers. Zoe Sofia's theorization of container technologies helps to reconnect these issues. I see as crucial for this project Sofia's insistence that technology and the environment are connected, in terms of the resources they use and the ways in which they structure our needs. She observes that most thinkers from Heidegger to Mumford see technology as a tool for extending the human body. Cars or pencils, for example, lengthen human reach and enable extended travel or communication. When also understood as container technologies, which have storage or resourcing functions, these same technologies are framed differently; cars keep their contents safe from other people and from the elements, while pencils hold lead to write with later. Container technologies also have a concealing aspect, they tend to withdraw from our notice or actively conceal their contents. In the case of a computer, the chassis conceals the interior and removes it from our awareness as we use its virtual functions to write emails, connect to the internet, or use other software applications. The material, then, is not necessarily the visible. There is a convergence between the unremarked visibility of computers as container technologies and our understanding of these machines as immaterial. Strangely, taken together, the physical presence of these machines is not what we notice most about them; it is not their most visible aspect.

What we do notice about computers - their more visible aspect - is that they are technologies of visualization. They visualize data, creating meaning from information and thereby making it visible. Consequently we depend on computers to decipher,

deliver, and interpret information on everything from the environment to cultural meanings, from art and entertainment to science, health and ecology. We continue to use computers for composing, checking email, and reading documents, but since Web 2.0 and the explosion of social media, they are also an increasingly visual medium: as television streaming, BuzzFeed displaying, and cat video watching machines. They thus also significantly contribute to the production and circulation of visual culture. In these functions, they reveal and conceal, or render visible and less visible, different cultural understandings of everything, including technology and the environment, and depending on particular users' interests. Computers are then more visible in their function as a technology of visualization.

In Chapter 2, I argue that we must begin to see computers materially and locate this project within what Jussi Parikka terms the 'new materialism,' which considers objects as part of their structuring networks. I argue that this is a crucial step to understanding the environmental effects of these machines. As Allan Sekula reminds us, the speedy communications engendered by cyberspace, emails, phone calls, and faxes cannot overcome the actual space and time needed to move goods (Sekula 50). Even in the information economy, it takes a container ship eight days to cross the Atlantic Ocean and twelve days to cross the Pacific. Here too the container technology disappears from the sphere of the visible. The life cycle analysis, borrowed from the sciences, functions as antidote and method for this project. It brings into sharper focus those features often excluded from discussion of computers, especially their materiality. The strategy of examining the material aspects of the personal computer illuminates the environmental hazards related to their production, use, and disposal and acts as a corrective to the

tendency of media and cultural studies to focus on what Sterne calls the “disembodied” aspects of computers (Sterne 17; see Berland, *North of Empire* 289-90).

Mineral extraction, processing, and refinement are necessary prerequisites to the development of electronics and microprocessors. The Canadian mining industry epitomizes the emergence of risk society out of what Beck calls the first modernity as the state attempted to balance the public good, industry, and environment. As seen with nickel mining in Sudbury, these negotiations ultimately enabled the production of environmental hazards such as air pollution and acid rain. Although the degradation of the Sudbury area has largely been successfully remediated, the mining sector continues to be one of the most polluting industries in the world. Canada’s wealth is historically derived from a staples economy, and Canada’s emergence as an industrialized nation can be directly tied to its history of mining, and Canada now dominates the mining sector internationally. This expertise is now used in modernization projects around the world, funded by CIDA and other government agencies as seen in Canada's participation at Three Gorges Dam in China. Coming partly from this history of modernization, Canadians are now one of the most wired populations in the world, full participants in the information society. Considering nickel mining - nickel being one of the many possible metals in the computer - reminds us of the role that Canada and Canadian companies play not only in the production of computers, at the most basic level, but also in the production of their associated risks and hazards.

Information technologies are imbricated in both the production and circulation of environmental risk. E-waste arguably began in the 1950s with the disposal of early consumer electronics, such as radios. The development of the microprocessor in the early

1970s directly enabled two critical issues related to personal computers and risk. First, there is the environmental pollution related to the production of microprocessors, the myth of the “clean” industry versus the reality of leaking underground storage tanks, worker illness, and the global exportation of this industry and its related problems. There are also environmental hazards related to Moore’s law, the doubling of the capacity of microprocessors every eighteen months, and the diminishing size of electronics. These factors directly contribute to the gargantuan increase in the resources needed to create electronics and the waste products as a result of that production. The moment the microprocessor was first marketed to consumers, in combination with Moore’s law, the huge increase in consumer electronics and their decreasing life span, the risks related to e-waste exploded. It marks the increase in the rate of e-waste production. Globalization and the global production of environmental hazards, including and especially waste, are defining characteristics of the risk society as the institutions in place to manage these risks, often national regulations in the case of labour and environmental issues, are both overwhelmed by and inadequate to contain them.

Since I began this project the production process has become more visible, mostly in terms of labour problems and mostly in China, and especially in our news stream. In particular, the spate of worker suicides at Foxconn in 2010 made shockingly clear the difficult working conditions of those Chinese workers who make most of our electronics. In some ways, China offers a fascinating microcosm of the development of risk society as China simultaneously develops industrially and technologically, especially in terms of the internet and related ICTs. For the West, including Canada and the US, China becomes not only a source of risk as an economic and political competitor, but also, and perhaps

more insidiously, a repository of risk, as it imports vast quantities of trashed electronics and plastics for recycling. We project our anxiety onto China.

Second, the advent of microprocessors completely revolutionized information and communications technologies, ushering in the age of rapid information processing and transfer. The life cycle analysis overlaid with an assemblage approach allows for connections to be traced through those material networks of production, assembly, and disposal to those immaterial elements such as the surrounding discourses and the virtual as it relates both to cyberspace and risk. But more than that, and importantly for this project, it illustrates the relationship between hazards and risks. Risks are hazards attached to probability equations. Although risks are real, they are not material until they actualize, literally materialize, as a hazard, such as workers falling ill exposure to dangerous chemicals. As Joost van Loon argues, ICTs play a critical and central role in the production, circulation, and translation of risk associated with risk society. To a large extent the shift from industrial to risk society, especially as it pertains to the information economy, is characterized by a turn toward the virtual. As discussed in Chapter 4, information technologies are associated with the virtual in terms of memory and cyberspace. Risks are also virtual in that they are not yet actual. Together, these factors contribute to the turn towards the virtual. Information technologies like the computer are crucial to analyzing data related to environmental problems, but they are also part of the information proliferation machine related to research, policy, news, and art. The computer, and other ICTs, are central to the vast array of information that circulates and informs our understandings of nature, technology, ecology, risk, and the environment through the news, films, television, and art that communicate the environment.

Joost van Loon uses the term "telematic symbiosis" to describe how risks rapidly traverse many domains to create the "hyper-intensified multiplication of risks" (van Loon 157). Telematic symbiosis refers to the constellation of information-processing and media technologies that allow for the rapid ubiquitous dispersal and exchange of information (including text, images, and video) between corporations, citizens, governments, and other players across public and private spaces and over multiple screens (van Loon 152). In Chapter 4 we saw how definitions of risk evolved over time in Silicon Valley so that what could be understood as risk taking in terms of experimenting with technologies or playing around with drugs such as LSD helped to fuel the risk taking culture and behaviour associated with the emerging software industry, namely the necessity of high risk investments. The circulation of the Silicon Valley immutable mobile conceals the environmental risk associated with the production of microprocessors and the enduring pollution of the Silicon Valley aquifer. In Chapter 5, I discuss how cyber risk such as fraud dominates North American news coverage of environmental risk related to waste as Agbogbloshie enters the news media machine and rapidly changes to a story about the risk of fraud for individuals and businesses. Simultaneously, the West quietly feeds the dangerous and unregulated Chinese e-waste reclamation industry. In these examples, there is a sort of inverse digital divide. The more likely a person is to be wired - that is to have access to a computer and the internet - the less likely they are to be at risk from the more immediate effects of environmental risk in the form of worker illness and injury related to the production or disposal of electronics. Thus we see disenfranchised workers in Agbogbloshie, in American prisons, and in Guiyu, China who are less likely to be wired, but who are exposed to the toxic chemicals

released with the disassembly of computers while the educated, urban, and wealthy people around the globe are more likely to participate in the information economy and are more at risk of cyber-attack or fraud. The geopolitics of toxicity and risk refers to the unequal global distribution of these risks in information society.

In general, the environmental hazards related to computer use do not directly affect the user, but tend to actualize in terms of “externalities” such as emissions related to energy use, air quality, or the increasing toxicity of household dust; things that could harm us whether or not we actually use the computer. As I discuss in Chapter 6, the computer user, whether she is a Mac or OLPC user, is interpellated as a consumer. As computers and related ICTs become infrastructural, especially in wealthier communities, their use can be understood as what Elizabeth Shove terms inconspicuous consumption, an aspect of daily life related to comfort and convenience. As a result, environmental action related to computer use tends to focus on changing consumer behaviour and greening computer use, rather than larger structural changes related to production and disposal. Buying a more energy efficient computer is good, but does little to curb the vast resources needed to manufacture a new computer, nor does it affect its shortening lifespan or the inadequate disposal options for electronics. The individualized approach to environmentalism hides the fact that for many of us computers are compulsory to our education and work so that opting out of using a computer is not a real option. Additionally, information workers face additional risks associated with the information economy, including repetitive stress injuries, increased work hours enabled by mobile technologies, and the neoliberalization of labour. With the individualization of both information and risk, the computer user is asked to navigate these risks and hazards

alone. She becomes an information processor coping with information overload in the accelerated medium of the internet.

In Chapter 7, I compare the speed of garbage to the speed of the internet. Because of the internet, computers, and other ICTs, our experience of time is marked by timelessness and simultaneity. Because of the acceleration of computer production, use, and disposal resulting from planned obsolescence, there is a corresponding acceleration in the production of e-waste. The time needed to neutralize the toxic substances related to the production and disposal of computers is long term and it has become increasingly obvious that the timing of exposure to toxic substances affects the type and severity of resulting illnesses. Linear notions of time, especially understandings of reversibility, have limited our ability to fully comprehend and deal with the potent toxins in our environments and bodies. Risk society is then marked not only by the inability of our institutions to deal with the proliferation and circulation of environmental risks, but also by their acceleration. As Joost van Loon tells us, this overwhelming and rapidly shifting situation can lead to an affect of anxiety, apathy, and ambivalence.

The structure of feeling related to risk culture includes this affective cycle of anxiety, apathy, and ambivalence, but also scorn, frustration and rage. Some of these dynamics are at play in the works of Edward Burtynsky, Chris Jordan, and Pieter Hugo, whose work is discussed in Chapters 3, 5, 7 and 8. Their photographs mark moments of visibility of the hazards from personal computers. To some extent, the visibility of environmental problems is directly correlated to their visibility. Leaking underground storage tanks and high levels of TCE in a human body are not highly visible or visual and are correspondingly difficult to represent in visual culture. E-waste by contrast is visually

compelling and especially visible in locales such as Guiyu or Agbogbloshie, and even in our local environment days. (In Toronto, city councilors hold "environment days" when residents can get free compost and green bins and they can also drop off e-waste, batteries and other hazardous waste. In these moments, it is not uncommon to see huge bins full of e-waste). As part of risk culture, news coverage of environmental problems tends to focus on singular events such as the BP oil spill in the Gulf of Mexico rather than regular events such as the air pollution created by cars every day. In general, these events seem to provoke an initial anxiety until the story runs its course, after which they become routine and our reactions dull; we become more apathetic or ambivalent. Mike Daisey's monologue, *The Agony and Ecstasy of Steve Jobs* is not visual, but marks a moment of visibility of the labour process, and he also connects the cult of Mac to the production of Apple products. As I discuss in Chapter 8, Daisey rehearses many of the emotional responses in risk culture, especially as it relates to Apple, the forced upgrade, and obsolescence.

As I suggested in the introduction to this chapter, we need to spend more time thinking about our daily interactions with computers. Current risk culture is informed by the dynamics at play in risk society, the information economy, and technological culture. As much as this dissertation is about moments of visibility of environmental problems related to computers, it is also fundamentally connected to those moments of visibility that arise when our technologies do not work properly. We tend only to notice our machines when they are new or when they fail us in some way. I return now to the power cord incident in order to think through the implications of these dynamics for risk culture.

The power cord incident is another quotidian moment of visibility that reinforces the materiality of the machine. It reminds me that in order to function my computer requires larger networks. It needs electricity to power it, connecting it backwards through the wiring in my apartment, to the power lines on my street, the substation, the transmission lines, and the power generating station, not to mention the wireless hub, router, distribution system, and internet provider. It is one of those moments when the infrastructural aspects of these technologies, to paraphrase Nigel Thrift, become obvious. It also reminds me of a cartoon of various social media, bragging through text messages about how important they are. The punch line is when electricity joins the conversation to say: "Keep talking, b*tches." The humour is drawn from the fact that technological culture is so full of in-the-moment braggadocio that we lose sight of its dependence on elements of infrastructure such as electricity that have become basic in wealthy parts of the globe. The obsolete power cord is a reminder of that infrastructure.



Adorno was right (see Chapter 1). Part of modern obsolescence is scorn, which I felt for my crappy, out-of-date computer. And in the throes of the power cord incident I became infinitely more aware of the scorn that I felt from others in previous months - fellow Mac users at the local café, the store clerk at the computer store, my students who saw me struggling with an older computer. Never do our machines seem so material as when they malfunction or break. For most of us, our only real entry into their environmental aspects is when they are teetering on the edge of the category of junk. Once they become visible in this way, they are potential junk; a delicious moment when,

if you have backed up your files and have room on your credit card, you can buy the latest, the lightest, the fastest, and the best new computer your credit will allow. Part of what is so giddy about that moment is that you can let the scorn in.

Because my problem was simply fixed by a knock-off power cord, I spent some time with rage. Death dating means that the power cord can be expected to fail before the computer does and brings the expectation that this failure, along with dings on the case and other annoyances, might prompt the user to go and replace this most complicated, resource-laden machine. That day my rage was directed against the fact that a power cord, which is surely one of the simplest and older technological components of my computer, is death dated. It was really rage against Apple because they simply quit manufacturing this most basic and necessary of parts.

I also experienced rage at the inconvenience. I did not want to waste precious battery life, and luckily I was able to use my partner's desktop computer, which she uses for video editing at home, to google the closest computer store so I could locate its number online and call them to find out if they sold power cords that would work with my machine. I got on my bike and rode twenty minutes to the closest computer store specializing in Apple and related products. I was angry at Apple for this lost writing (experienced as LOST DISS WRITING TIME!!!!), never mind that I had probably lost at least an hour that morning to pointless and distracting internet surfing. Laptop computers and other ICTs are often framed as technologies of convenience: they enable fast and easy communication; the user can work from "any location"; phone books, reference books, and entire libraries are accessible with a few keystrokes. It's not convenient when they fail due to the death dating of their components.

Shove reminds us that technologies of convenience reshape our needs, and in the process our expectations and in some cases infrastructures shift too. For example, once American houses were built with air conditioning every subsequent owner or tenant of that house has no choice but to use the air conditioning because the house became simply unlivable in the hot months without it. She also makes the connection between first world consumption and third world underdevelopment. Framed as an environmental problem, this structured inequity means that as poor countries "catch up" to consumption levels in rich countries, they become blamed for creating environmental problems on a planet on which several eco-crises are in full swing. As more Chinese consumers buy cars, for instance, the air quality in big Chinese cities worsens and the emissions contribute to global warming. Now China is the target of anxiety about global warming which originates in the west.

In the case of computers and ICTs, the ways our needs and infrastructure are shaped have been documented in terms of work and communication. Expectations of availability for work have shifted. With date stamped emails, we can tell when a colleague or boss emails at midnight on Saturday. People can use their computers to work from anywhere, and they are always working. The expectation is that we are and need to be connected, and we expect that infrastructure to be there. In one stark, and possibly ironic example, after Hurricane Sandy, New Yorkers with no power combed the city looking for places to get free wifi and to charge their phones and communicate with friends and family. Very few studies have measured the environmental impacts of computers, but those that exist are telling. There have been estimates that browsing the internet causes more emissions per year than the aviation industry. This statistic is hotly

contested, but widely circulated in academic talks and in the mainstream press (Swaine).²³ What is clear is that computers and ICTs, as technologies of convenience, are reshaping our needs and infrastructures globally and unevenly.

My self-absorbed rage at the inconvenience associated with the power cord incident could very well be a tweet at #firstworldproblems, the description of which reads: "Your/my problem may be annoying, but there are much worse things happening in the world" (qtd. in Madrigal). However, as Teju Cole writes:

I don't like this expression "First World problems." It is false and it is condescending. Yes, Nigerians struggle with floods or infant mortality. But these same Nigerians also deal with mundane and seemingly luxurious hassles. Connectivity issues on your BlackBerry, cost of car repair, how to sync your iPad, what brand of noodles to buy: Third World problems. All the silly stuff of life doesn't disappear just because you're black and live in a poorer country. People in the richer nations need a more robust sense of the lives being lived in the darker nations. Here's a First World problem: the inability to see that others are as fully complex and as keen on technology and pleasure as you are. (Cole qtd. in Madrigal)

Cole neatly points to the realities of global connectivity within the dynamics of the geopolitics of toxicity and risk. It also points to the possibilities for a range of risk cultures. Risk culture in Lagos is not risk culture in Toronto.

²³ In his keynote speech at the Simon Fraser University Communications Department 40th Anniversary Conference, Richard Maxwell cited this statistic.

It is significant that my two examples, the twitter feed and the cartoon, are from technological culture. It is crucial to connect this frustration at obsolescence to the apathy of risk culture and to the larger structures of risk society, including and especially environmental problems. As artifacts of risk culture, the cartoon and the example from twitter both point to individualized reactions to collective frustrations. Like much online humour, they serve as temporary distractions, but also as a sort of release for some of that pent up anxiety and apathy symptomatic of risk culture: the simultaneous acknowledgement and disavowal of risk, and the organized irresponsibility of risk society. The rage at obsolescence acknowledges death dating and is thus a moment when we are forced to see the machine as potential garbage, and in its most tangibly physical state.

Risk culture is fundamentally about the negotiations of navigating hazards individually in the face of what Sofia calls the "specter of resourcelessness" (Sofia, "Container Technologies" 181). As Shove reminds us, small individual actions, especially green consumerism, are unlikely to create any meaningful or long lasting environmental change unless we grapple with the infrastructural components of our resource heavy daily technologies and the structured inequity of first world consumerism and third world underdevelopment, both of which are maintained by the organized irresponsibility of risk society. These are the institutional frameworks that produce the structures of feelings of risk culture.

Activists group and labour groups around the world, including Basel Action Network, Greenpeace, and Students and Scholars Against Corporate Misbehavior (SACOM), are directly confronting the organized irresponsibility of risk society. As

multinational corporations relocate to find cheaper labour, they also weasel their way out of labour and environmental laws they find restrictive or expensive. This is surely one of the major contributors to the organized irresponsibility of risk society as national regulations are circumvented and therefore rendered ineffective. Increasingly, it is activist groups and NGOs that are confronting these global environmental and labour inequities. Beck considers this politics from below to be one of the defining features of global risk society. Beck's risk society thesis offers one of the most compelling and convincing theorizations of technology and the environment. There is a way in which risk theory can seem depressing, even nihilistic, and yet that is not Beck's perspective. Rather, he sees risk society as immanent to modernity and the politics from below as one its defining, positive, even hopeful developments. The apathy, anxiety, or ambivalence found in risk culture should be read as symptoms, not of hopelessness, but of potential, of possibility, and as an avenue through which to diagnose the corporatization of culture that feeds the organized irresponsibility of risk society and ultimately inspires people to resist and change its direction.

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