IMMATERIAL CULTURE:
BEYOND DISAPPEARANCE
Consequences of advanced technologies on interior design

BY
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A Thesis
Submitted to the Faculty of Graduate Studies
In Partial Fulfillment of the Requirements for the Degree of

MASTER OF INTERIOR DESIGN

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THE UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES

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ACKNOWLEDGEMENTS

First, I thank my graduate advisor, Susan Close, who has been enthusiastic, supportive, dedicated and patient throughout this research endeavor. I would also like to thank the other Advisory committee members for their continued feedback and support: Dr. Shauna Mallory-Hill, Professor Christopher Budd and Professor Phillip Tebbett. And I would like to thank Professor Lynn Chalmers for her encouragement and interest.

I am also indebted to the three primary research participants – who were exceptionally generous with their time and ideas. I am grateful to William J. Mitchell for first triggering my interest in the topic – and for his enthusiasm and interest to be part of this research. Also, I would like to thank Francis Duffy. I thank Peter Anders, who has been exceptionally generous with both his time and research ideas. I am grateful to Peter for his enthusiasm and encouragement in my work.

I would also like to thank the very supportive individuals who worked along side of me at Gensler and Conant Architects. A special thank you to Dana Jenkins, Bruce Moore, Lois Palguta and Peter Conant. Also, I thank my colleagues at the Pratt Institute for Art & Design, in Brooklyn for their support – Myonggi Sul and Lee Stout. And a very special thank you to Professor Mark Karlen for his support and advisement.

Thank you to those of you who kept me inspired through friendship and conversation during this pursuit: Ben Checkwitch, David Koren, Niki Lederer, Jana Macalik, Lori Sutherland, Suzette Subance, Mary Sze and Corey Winters. Also, I would like to send a special thank you for the continued support and academic encouragement of Katherine Isaac and Karen Wilson Baptist. Also, I thank Rick Wood and Diane Hanks for their flexibility and support during this project.

Also, I am grateful for Ben & Jerry's Ice Cream makers of Vermont USA, for their contribution and dedication to producing Cherry Garcia frozen yogurt.

I would like to thank my family: the Brueckners, the Semkiws, the Roscoes and the Watkins for their continued support. And, none of this would have been possible without the dedicated support, encouragement and patience of Derek Brueckner. Thank you – I will be forever grateful.

I dedicate the work to my father Donald Watkins and grandmother Valerie Emelnichenko.

ABSTRACT

Culture has increasingly become defined through immaterial sources. Over the past fifteen years, electronic and digital technologies have delivered an ever-expanding immaterial culture to define western society. Digitized information, real -time communications and wireless technologies have all contributed to redefine the condition and status of physical space and materiality at the entry into the twenty-first century.

My study attempts to inform current and future interior design practice, process and education. Grounding the inquiry in theory, the approach strives for expanding the analysis towards the future implications of immaterial culture on design and architecture. The inquiry aims to review the dominant traits, conditions, challenges and opportunities presented by immaterial phenomena on interior design.

Advancing immaterial culture is not merely a condition of disappearance. And further, suggests to be a far more complex phenomena. William J. Mitchell, former Dean of the School of Architecture and current Academic Head of the Program in Media Arts and Sciences at Massachusetts Institute Technology [MIT] observes, "the interesting challenge is not just to replace atoms with bits, or presence with telepresence, but to learn…critically and thoughtfully to work out the subtle, complicated, problematic relationships of the material and the virtual" (1998, p. 214). The inquiry aims to develop a deeper understanding of this relationship, of the physical (material) space to that of virtual or digital (immaterial) space, as presented in the digital era. Through critical analysis, I consider the contentious underpinnings and suggested implications of this relationship upon the design of the interior environment.

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INTRODUCTION

Origin & Discovery:

In the spring of 2001, I was asked by a client to design their new office space. At the time, I was employed as a commercial interior designer in New York City working on a wide variety of similar project types. The program was over ambitious for the proposed piece of real estate. In the simplest terms, the client was requesting 'too much stuff' to be fit into 'too little of a space'. The scenario was not entirely uncommon; yet, as I will explain momentarily, the project proves to be unique.

Attempting to resolve the client's requests, I conducted several space planning, or test fit, studies. I recall schematically developing numerous permutations and combinations for the plan, frustrated at my inability to resolve the quandary. I stepped back and took a deep breath. I started to study the plan intensely. Carefully, my eyes traced over what appeared to be the problem area: the lease lines, the line representing the demising wall, partitions to the washrooms and the inner lining of the perimeter of the building along the window wall. I became acutely conscious of the inherent boundary line, the project periphery of the spatial setting, as the restricting feature. For the first time, I sincerely contemplated the inherent features of the imposed restrictions of an interior setting.

Anne Massey (2001), Professor of Design History at Southampton Institute reminds us that interior design "is concerned with all the elements of the interior spaces of the architectural shell" (p. 6). Through my analysis of the space plan, I was reminded that the material presence of this shell implied containment or limitation. I became aware that physical space, set within an interior setting, could only be stretched, pulled or rearranged so far before something had to give. This is not to suggest that an interior setting cannot be innovative or effective in design response within this physical spatial site. Rather, the medium of interior space would forever be destined, by definition, to be bound and defined physically through this restriction and containment.

Although the predicament was depressing, something profound happened during this analysis to give hope. I had recently completed a seminal architectural theory book *City of Bits* by William J. Mitchell (1995). In his book, Mitchell presents a highly relevant analysis of the impact of advanced technologies on the physical nature, presence and status of architectural and urban space in the digital era.[1] Suddenly, during the space-planning quandary, I noticed the ideas presented by Mitchell were visible and apparent, actively formulating and informing my analytical inquiry and design processes. I considered how his theories of spatial extension, space compression and the more attractive feature of dematerialization delivered through technology hinted at the opportunity to get me out of the unresolved predicament of the space plan. Could advanced technologies extend the boundary that only moments ago were pure limitation? What influence do these advanced technologies have on delivering new spatial conditions into the interior design project? It became apparent that I had to assemble a deeper understanding of the phenomena before finding any direct answers to these questions.

The ideas that emerged as a result of the correlation between Mitchell and my space-planning exercise unfortunately did not resolve the dilemma for my client. But the

[1] Digital era in this study refers to the time period of 1990 up to the date this was written. This date is widely contested, and is explored in more detail in Chapter 4 of this document.

merger triggered something more profound. It not only represents one of the rare moments where theory and daily practice collide unexpectedly before ones own eyes, it is also the origin point for this investigation. The merger planted the initial seeds of curiosity, intrigue and mystery that marked the beginning of the inquiry at hand.

The Research Inquiry:

The inquiry explores the complexities introduced by immaterial culture as evident in the digital era. The intention of the inquiry is to provide a deeper understanding of the foundations of immaterial culture, as rooted in the relationship between physical space and cyberspace.[2]

First, it is important to note the radical changes that have occurred in Western society over the last fifteen years. Advanced electronic and digital technologies have redefined several of our cultural, social, economic and political arenas. Mobile phones, real-time networks, wireless technologies and cyberspace have populated our environments and have altered how individuals socialize, communicate and work. The digital era has evolved much of what we do and how we do it. Architectural theorist Elizabeth Grosz (2001) attests "...the most striking transformation effected by these technologies is the change in our perception of materiality, space, and information, which is bound directly or indirectly to affect how we understand architecture, habitation, and the built environment" (p. 76).

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[2] The term cyberspace is used to define the spatial condition or experience attributed to, or as delivered by, advanced electronic and digital technologies. I provide a more extended discussion on terminology later in this chapter. The evolution of cyberspace is explored in Chapter 4.

As interior design is defined through physical space, it is indebted to material culture for its manifestation. The proposition of an emerging immaterial culture should be of concern to the profession. Questions arise such as: What constitutes an immaterial culture? How will it inform and influence the physical design of space? What are the future implications of it on interior design practice, process and education? The research study here intends to deliver a succinct and accessible understanding of the challenges and complexities imposed on interior design through an expanding immaterial culture.

Immaterial culture is not just a dematerialized event. It is important to stress that dematerialization is one of several spatial features of immateriality. The intention of this study is to provide an analysis of dematerialization, while expanding the exploration into the underpinnings that are inherent in the phenomena. There is not one spatial feature introduced by immaterial culture; rather, there is a highly complex web of interrelationships evolving as a result of immaterial culture. The intention of this study is to provide a deeper understanding of these interrelationships and construct a critical analysis of it's influence on interior design.

Through the five chapters, I attempt to provide an extensive yet detailed account of the new spatial phenomena emerging within immaterial culture. I have defined the dominant spatial features as (1) Dematerialization, (2) New Craft, (3) Spatial Typologies (4), Fracture and (5) The Bionic Generation. Although these topics are separated into chapters, they are not isolated conditions in terms of their role in immaterial culture. On the contrary, the conditions presented in the chapters are connected, reciprocal and frequently overlap.

In the first chapter, titled Dematerialization, I introduce the reader to the production and processes of dematerialization through an analysis of the status of everyday artifacts in Western society. Although complex in nature, dematerialization as a process remains relatively accessible and is presented in literal terms throughout this chapter. The inquiry considers the instigating factors contributing to dematerialization. To gain a deeper understanding of its evolution, I present a discussion of the history of information technology [IT]. The inquiry provides clear and succinct lineage of the repercussions of dematerialization upon the design of the interior environment.

Through the second chapter, titled New Craft, the inquiry shifts toward the deeper, more subversive and intricate nature of immaterial culture. I provide analysis of the complex structures of the relationship between physical space (material) and cyberspace (immaterial). The study exposes how these domains can inform and influence one another through the design process. The analysis expands upon architectural theories of cybrid design methodology, as introduced by Peter Anders (1999).

In Chapter Three, Spatial Typologies, I examine the evidence of how advanced technologies actively evolve design language. The inquiry is derived from a semiotic analysis and examines the radical changes occurring in spatial typologies of the digital era. I illustrate how the emergence of immaterial culture has significant repercussions for how individuals construct spatial meaning. Through a deeper analysis of evolving spatial typologies, I illustrate the new opportunities presented to interior design.

In the fourth chapter, entitled Fracture, I describe the historical attributes and theoretical underpinnings of a splintered spatial identity. The intention of this chapter is to gain a deeper understanding of the evolving features and status of the physical artifact, the individual and the spaces in-between as presented in the digital era. The evolving identities challenge interior designers to understand the condition in which they are working.

In the final chapter, I describe the emergence of a bionic generation. Here, the inquiry evaluates the evolving status of biological human bodies and the spaces they inhabit as reinvented through sophisticated technology. Focusing the investigation upon current innovations in holography, computer software, artificial intelligence, robotics, nanotechnology, smart architecture and biotechnology I illustrate how evolutions in technology are creating a bionic generation. I expand the discussion through a theoretical analysis of contemporary cyberspatial and architectural theory. Throughout the chapter, the study reveals the potential effects of a bionic generation on the future practice of interior design. To gain a deeper understanding of the influence and impact of a bionic generation, I evolve the analysis further through references of the hyperreal and hypermodern theory.

The inquiry aims to provide a broad and expansive analysis on the conditions of immaterial culture that prove to be most influential on the practice, process and profession of interior design.

Issues with terminology – I choose cyberspace

The digital era has delivered an abundance of irreconcilable terms. For this reason, it is important to provide a brief discussion here on the matter of terminology. One of the terms to describe the spatial realm introduced or delivered through advanced technologies is cyberspace. It is one of the most widely used terms to describe the spatial experience as offered in the digital era (Bertol, 1997). Yet, this term, like several other terms proves to be an evolving and unstable definition. As Architectural theorist Neil Spiller (2002) explains:

> Every writer's definition of cyberspace is different. The word connotes a world of infinite possibilities, but few could define what it is or what it means for everyone. For some cyberspace is where you are when you are on the telephone; for others, it is place that is no place; and for others still, it is the world of computer simulation...To provide a compact and definitive description of the phenomenon that is cyberspace is an impossible task. (p. 7)

Not only is this term evolving and unstable, it can also be replaced with other evolving terminology in the digital era. Inconsistency in the language is excessive and is a prominent feature in a review of the literature, language, architectural theory and media (Spiller, 2002). Terms such as virtual space, cyberspace and digital space have all proven to be interchangeable (Romero, 1998). Some (Romero, 1998) also refer to the same condition as information space and others (Li *et al.*, 2001) use terms such as electronic space. Researchers (Donath *et al.*, 2001) have also chosen to use the term digital environment. Most commonly, these terms have come to refer to same thing (Dictionaries, 2000c). Other popular definitions abandon the spatial reference altogether. Rather, attempting to aim for a non-loci experience, or state of 'being', terms such as digital realm (Leach 2002), virtual realms or virtual world (Mitchell 1995) have also become common.[3]

Although I choose to use the term cyberspace in this inquiry, all these terms are referring to the same phenomenon – a phenomena that is distinctly not held within a

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[3] The term virtual reality has fallen out of fashion more recently. The term has remained more restrictive to specifically define the immersive environments used with a head mounted set and data gloves to virtually 'enter into' a cyberspace environment. The term has lost its zeal, and has become widely contested for its oxymoronic features (Leach 2002).

physical realm. These terms refer to an immaterial experience delivered and supported through advanced electronic and digital technology. They have no physical location and do not hold the consequential features of resistance inherent in physical materials. They are not constructed out of physical matter, but instead are made or supported through bits and chips, the 1's and 0's of the binary language of information technology (Negroponte 1995; Wertheim 1998).

Again it is not my intention to defend the use of one term over another, or present extensive argumentation to evolve a definitive terminology. Rather, this inquiry intends to remain flexible and make reference to the varying terms found throughout the sources.

Research Questions:

The goal of my study is to gain a deeper understanding of immaterial culture.

1) What is immaterial culture?
2) What are the dominant traits and characteristics of an immaterial culture?
3) How does immateriality challenge, inform and influence interior design practice, education and process?
4) What are the potential consequences or implications of expanded immaterial culture?

METHODOLOGY

METHODOLOGY

Overview &Framework:

This research was never intended to find a specific answer to a specific question. Rather, the inquiry was developed to deliver a deeper understanding of complex and unpredictable phenomena. There is no specific hypothesis as inherent in the positivist approach to research methodology. As the outcomes are unknown at the onset of the study, an open-ended approach is best suited to support this uncertainty. For this reason, qualitative research methods have been used.

The approach of this methodology is complimented by what researchers Groat and Wang (2002) define as Interpretivism. For Groat and Wang, Interpretivism is derived from a phenomenological position and empowers the researcher to embrace a subjective interpretation of information to formulate a reading of unknown phenomena. Through this approach, my role as interpreter and researcher embraces and embeds my past experiences and knowledge of interior design practice, education and process.

Anthropologist Clifford Geertz explains that researchers use this approach in an attempt to assemble meaning or a thick description (as cited in Groat and Wang, 2002). The approach considers the value of analysis that extends beyond what appears to be the obvious or evident on the surface. It is used to construct a contextual underpinning of what is beyond the surface. The intention is to expose the foundation of the phenomena, as opposed to merely providing a description of it. Geertz (1973) describes this approach to analysis as to study artifacts and deliver an interpretation of them. It relies heavily upon the interpretive analysis of the researcher to contribute to the findings.

Using a combination of textual analysis, case studies and personal interviews, the study has evolved through multi-method qualitative research. For the textual analysis, I refer to several secondary sources. Research and theory derived from a variety of sources including peer-reviewed journals, books, magazines, conference proceedings and Internet sources.[4] Critical theory was used throughout the inquiry to expand the conceptual framework and formulate more links to interior design. Throughout the inquiry, I note that the body of research in interior design covering the issues of immateriality is thin. To gain a deeper understanding, I refer to analysis developed outside of the discipline of interior design. I have evolved much of the interpretive analysis through other spatially reliant design professions such architecture, industrial design and urban planning.

The textual analysis and theory is grounded in architectural theory, cybertheory and cultural analysis. To achieve a greater awareness of the features and conditions emerging in immaterial culture, I purse this study as a reflective designer. As cultural historian and theorist Edward Dimenberg (2002) claims, a reflective architect or urbanist is one who has "Become sensitive to cultural meanings not only in architecture but also

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[4] Sources in this study also embrace several popular magazines, webpages, film, television series and newspaper articles. As advanced technologies are evolving at such a rapid rate, it is increasingly valuable to compliment the academic research with daily and weekly periodicals and news reports on technology. Sources such as *Wired*, *The New York Times* and *BBC* on-line news have been used throughout the inquiry to capture some of the most recent conditions of technology. Using popular sources such as these, are evident in work of others inquiring about advanced technologies. For example, William J. Mitchell (1995, 1999) cites from sources, such as: *The Wall Street Journal, Wired, Newsweek, The Boston Globe* and *The New York Times*. Thomas Horan (2000) refers to *Forbes, Wired* and *Newsweek*. Also, in evolving a cyberspatial theory, film and literature are popular sources as references. To gain a deeper perspective of technology and culture, several individuals (Tomas, 1991; Benedikt 1991, Mitchell 1995) also make reference to literature, such as the book titled *Neuromancer* (Gibson,1984). Television and film references are also valuable, as illustrated in Claudia Springer's *Virtual Representation: Hollywood's Cyberspace and Models of the Mind* (1998) and Steven Best and Douglas Kellner's chapter 'Technological Revolution and Human Evolution" in the book *The Postmodern Adventure: Science, Technology, and Cultural Studies at the Third Millennium* (2001).

in other media and social contexts provides…a vital grounding for practice in an unpredictable world" (p.21).

The inquiry also makes reference to three case studies. Groat and Wang (2002) attest, case studies help ground theoretical analysis. In very simple terms, it can make the conceptual appear tangible or accessible through a connection to more literal representation. Case studies can be an effective means to expand a body of criticism and theory for the profession to understand itself, and a means to create greater links and access to outside professions (Francis, 2001).

Immaterial culture cannot simply be broken down or linked to one event. Case studies are useful in that they continue to support a big-picture approach to understanding. As Psychology professors Robert Sommers and Barbara Sommers (2002) explain:

> Unlike other methods that carve up a whole situation into smaller parts, the case study tends to maintain the integrity of the whole with its myriad of interrelationships. It represents a *holistic* approach to research, and rests on the assumption that understanding is increased by the entire entity than breaking it into it's constituent parts. (p. 203)

To compliment the textual analysis and the case studies, the research also incorporated three personal interviews. The interviews support an interactive interview style and process. Open-ended questions were used. Instead of preparing a list of questions, I prepared an interview guide that would remain flexible as new information was revealed during the interview process. Remaining attentive and reflexive in the process is called "active interviewing" and delivers a rich narrative during the course of the interview session (Holstein & Gubrium, 2000). An open-ended style of interview allows for "maximum recall, since [the respondent] was allowed to speak about an issue or event as a whole rather than answer isolated questions which might appear inappropriate or inapplicable" (H. Graham, 1984 p. 111).

Participants:

One of the dominant features of immaterial culture is supported through an array of highly complex and changing advanced technologies. To avoid getting lost in the intricacies of computer science jargon, I selected participants who were well versed in both architecture and advanced technologies. Participants were selected who are noted as leading researchers or practitioners dealing with space, advanced technology and design issues simultaneously.

The three interview participants are noted and described in the sequence below:

(1) William J. Mitchell is Academic Head of the Program in Media Arts and Sciences at the Massachusetts Institute of Technology [MIT]. Professor and Former Dean of the School of Architecture and Planning at MIT, Mitchell is recognized as a pioneer and leading researcher in architecture in relation to advanced electronic and digital technologies.

(2) Peter Anders is a practicing architect and principal of Anders Associates. He is a visiting professor at the University of Michigan and New Jersey Institute of Technology. As an architect, educator and information theorist, Anders is a leading voice on the spatial relationship between physical space and cyberspace.

(3) Francis [Frank] Duffy is a workplace design researcher and the founder of the firm DEGW, a leading international strategic design consultancy. Lead designer at

DEGW, he is also a visiting professor at MIT Duffy is internationally recognized as a leader in workplace design and strategic planning.

Instruments:

The case studies for this research are supported through diagrams and photos. Two of the case studies, The New York Stock Exchange (Chapter 2) and ING Direct Internet Café (Chapter 3), used photographic images and textual data as sources for analysis. In the case study of the file room (Chapter 1) a combination of images, text and personal diagrams were used as instruments.

The interviews were held throughout the year 2004. The interview with William J. Mitchell was held in person on the MIT campus, Cambridge, Massachusetts. The interviews with both Peter Anders and Frank Duffy were held on the telephone. All interviews were approximately one hour in length, audio recorded and later coded for further analysis.

CHAPTER ONE

DEMATERIALIZATION

CHAPTER 1: DEMATERIALIZATION

Advanced technology has significant consequences on the design of the interior environment. In this chapter, I provide an in-depth analysis on the impact of digital and information technologies on material culture. This analysis will reveal the current and future role of dematerialization in western society. Specifically, the discussion reviews consequences of technologies for the character, presence and properties of physical materiality that define interior space.

Dematerialization refers to the process by which technology replaces physical, tangible events and artifacts with a digital or electronic counterpart (Novak, 1991). A prime example of dematerialization is the use of digital photographs. As images become digital, transmitted through networks and stored in virtual files on a computer, a process of dematerialization occurs in the absence of the traditional paper-backed photograph. Not only is the physical photograph dematerialized, but also it's supporting structures, such as 35 mm camera, the processing lab, the film and the photo album.

Over the last fifteen years, western society has become reliant upon, supported through, defined by, and realized in a variety of non-physical loci, as set within digital or electronic systems. Ubiquitous computing, rapid global networks, and real-time communications are transforming how society takes place.[1] As Professor of Architecture and Urbanism, at Princeton University, Christine Boyer (1996) explains, "Reality is increasingly immaterial" (p. 11). Through this chapter, I review the role and effect of immaterial culture on the status of materiality in interior space.

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[1] For an detailed account of the computer and its evolution throughout history, I refer the reader to Paul Ceruzzi's *A History of Modern Computing* (2000).

Dematerialization is not specifically a new phenomenon in western society; some form or another has existed throughout history. I begin this chapter with a brief discussion on the evolutionary cycle and effect of dematerialization within a historical context. The analysis focuses upon the evidence of a progression in dematerialization as responding to innovations in *information technology* [IT].[2]

Although evident in history, dematerialization intensified with the onset of the digital revolution.[3] The catalyst for this advancement was the advanced digital and electronic technologies introduced during the digital era. Through a brief overview, I discuss the ingredients of contemporary dematerialization prompted by evolutions in microchip design.

To provide a clear understanding of dematerialization, I provide evidence of its role and presence within interior space. Through the Case Study: The File Room, I examine the relationship between information storage technologies and physical space. This study, supported through corresponding analysis and theory, illustrates how dematerialization influences and informs interior design space-planning processes and methodology. Through design theory, I expand the analysis of the Case Study: The File Room, drawing closely upon what design theorist John Thackara calls the *cybernetic loss factor* and what workplace designer and researcher Frank Duffy, founder of the design practice D.E.G.W., calls *recovery space.*

To illustrate the domino effect of dematerialization, I reference contemporary office planning. As the dematerialization is not restricted to any one scale, I provide

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[2] All terms illustrated in italics are defined in the term list at the end of this document

[3] I refer the reader to Chapter 4, for a more extensive discussion on the historical evolution and starting date of the digital revolution.

evidence of its larger influence. I sequentially illustrate how miniaturization and dematerialization influence ergonomics and furniture, as well how this translates into the floor plan and real estate strategies.

Predominantly, the analysis of this chapter draws upon theory developed by William J. Mitchell Academic Head of the Program of Media Arts and Sciences at Massachusetts Institute Technology [MIT]. In addition, other theories on speed, information, technology and immateriality from cultural theorist Paul Virilio, are presented to gain a deeper understanding of the potential implication of dematerialization.

As interior design and architecture are bound by and derive their identity through materiality, an immaterial culture should be a pivotal point of concern. These professions rely upon materiality as a medium for manifestation, expression and effect. The most primary of material elements of interior design, such as the wall, the window, a chair, the ceiling, the floor or a light fixture, are rendered in physicality, constructed of matter. Each element, essentially a spatial tool, is carefully considered, designed and choreographed to shape and form spatial meaning and character. If in fact an immaterial culture is emerging, which is what I am arguing, what are the implications for a professional practice of interior design and architecture that are void of these spatial elements? Does this mean designers will have fewer tools to work with to create these spaces?

1.1 History: Information

The creation, storage, and dissemination of information are pivotal in understanding the origins of dematerialization. The relationship between information and the ability to advance its production and dissemination determined how societies have evolved and ordered their institutions, infrastructures and cities (Mitchell, 1995; Mumford, 1961). Information plays a central role in the organization of society.

The history of writing tools is one example where dematerialization can be clearly traced (Mitchell 1999; Mitchell 2003). In the transition from scratching into clay tablets to the use of fountain pens on the papyrus scroll, a form of immateriality presents itself. The lightweight, thin, compactable and transportable scroll replaces the heavy-weight, thick tablet.

Upon further analysis, history reveals how information technologies increase the demand for new spatial typologies.[4] As information production technologies advance, as noted in the invention of the Guttenberg Press, Mitchell (1999) reminds us that as "printed books proliferated and literacy spread, elaborate systems for storage and distribution of texts…sprang up everywhere" (p. 6).[5] The evolution of books demanded a new supporting system. Buildings and new types of interior spaces emerged to support the transmission, storage and manufacturing of information in book form. Books were collected and gathered into a central storage facility: the library. Mitchell (1999) explains that as transportation technology advanced, new "mail systems moved all this ink-on-cellulose around. Information was mobilized, and access to it decentralized" (p.13).

More recently, in the post-industrial era, information has become digital. Spawning a rapid expansion in IT, the process of *digitization* has redefined significant components of social, communal, political, urban and economical conditions in western

[4] Spatial typologies are explored further in Chapter 3.
[5] For a historical account of the impact of information technology and dissemination, I refer the reader to: *The Coming of the Book: The Impact of Printing, 1450-1800* (London: Verso 1984).

society (Castells, 1996, 1997). As digitized information is handled through sophisticated telecommunication systems, global network connections and electronic and digital information technologies, the supporting infrastructure for it is rendered as immaterial.[6] Architectural theorist Marco Diani (1989) comments, "With information technology, most operations, procedures, and acts at work become abstract and immaterial" (p. 74). The dematerialization of information spurs the dematerialization of its supporting system, as it no longer requires a physical container or a place. Mitchell (1999) explains that in the digital era, information has become "dematerialized and disembodied" (p.13).[7]

Digitized information alters interior environments. Architectural theorist Elizabeth Grosz (2001) explains "Digital technologies have transformed the storage, circulation, and retrieval of information by transforming information of all kinds into binary form *and reducing matter into silicon and liquid-crystal traces (the chip and the* screen)" (p. 76). If information is immaterial, defined through immaterial *bits*, what influence does this have on the surrounding physical space? I argue there is a domino effect. Similar to a disease or virus, immateriality starts on a smaller scale and spreads outward to infect surrounding spatial and material character. The peripheral systems of digitized information respond by also becoming immaterial. Consequently, the information housing— printed on a page, in bookbinding, on the bookcase, and in the building, the bookstore or within the library — also dematerializes. In response, institutions, support structures, building typologies, and interior environments

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[6] I refer the reader to the work of economist Manual Castells *The Rise of the Network Economy* (1996) for an overview of the cultural, social and economic repercussions of the digital era.
[7] For a detailed account on more recent history of digital information, see *Being Digital* (1995) by Nicholas Negroponte.

architecturally become immaterial. Previous director of MIT's Media Lab, Nicholas Negroponte (1995) notes, "the medium is not the message in a digital world" (p. 71). Embedded within electronic and digital technology there is an intrinsic and infectious dematerializing feature.

Throughout history, mechanical, electronic and digital innovations in technology systemically and sequentially impact the status of materiality. Providing an example, Cultural theorist Paul Virilio explains, "The essence of architecture is more and more taken over by other technologies. Take a staircase: it becomes increasingly replaced by elevators…" (as cited in Ruby, 1998, p. 181). For Virilio, the ambition and effective ability to initiate dematerialization in architecture can be found in the pre-digital era. Virilio's example highlights that as dematerialization occurs, the professional role of the designer or architect changes in tandem. Not only does the opportunity of designing a dominant spatial feature of a stair disappear as an opportunity, the engagement with the elevator by the designer is rendered as minimal. The architect or the interior designer specifies it, but the actual design can be completely removed from the medium by which architecture is created.

For Virilio, dematerialization, particularly in the digital era, has significant consequences for architectural space. He argues, "…It is space that is experiencing a crisis. It's no longer merely a problem of costs or style, it's a problem that affects the architect's [and interior designers] basic material. It's not a matter of concrete or brick, but of geometry" (as cited in Jankovic & Michel, 1998, p. 28). The spatial crisis directly impacts spatial designers, as there are fewer elements composed of atoms that designers can use. Simply put, designers have fewer material elements with which to design space.

As atoms evolve into bits, new immaterial building blocks are introduced into the design process. Artist and architectural theorist Marcos Novak (1991) calls this a *liquid architecture*. As materiality of buildings and artifacts evolve into bits, as a cyber counterpart, they become transmittable and fluid. Novak (1991) explains this fluidity as "A liquid architecture in cyberspace is clearly a dematerialized architecture. It is an architecture that is no longer satisfied with only space and form and light and all the aspects of the real world. It is an architecture of fluctuating relations between abstract elements" (p. 251). The material body, presented as shell, is rendered vacuous and decomposing.

Liquid architecture suggests a dramatic shift in paradigm. It redefines the building blocks of interior design and architecture. As Novak (1996) explains, when "bricks become pixels, the tectonics of architecture become informational" (p.8). Rendered in immateriality, these structural components, comprised of *chips* and bits, introduce a new set of invisible building blocks for architecture for culture, society, and architecture.

It would be absurd to argue that all materiality, as in architectural buildings, will completely disappear in favour of a digital counterpart. In the digital era, the building industry has not come to a halt, and there is continued investment in the creation of physical spaces. Even in one of the most technically proficient and digitally intensive settings, such as the campus at MIT, an exorbitant amount of money and attention is still going into the design and character of physical buildings (Mitchell, personal communication, June 2004). Mitchell clearly believes that although materiality will make certain things disappear, this disappearance brings enormous opportunities for spatial design.

Although Virilio's theories of dematerialization have an alarmist undertone, it should not be disregarded as mere myth. His descriptions of advancing immateriality evoke a lurking ghost-of-immateriality, set in the backdrop, hovering like a dark cloud just on the outskirts of a city. For Virilio, the dematerialized status of architecture in the digital era is always present and implied (as cited in Ruby, 1998).

1.2 Dematerialization: The Ingredients

Although states of dematerialization have been evolving throughout history, technologies have intensified and advanced immateriality over the last fifteen years (Mitchell, 1995). Music, video, photographs have been reincarnated as digitized, constructed of bits. As a result, advanced electronic and digital networks complimented with immateriality and miniaturization are changing the way society perceives space and time (Joy, 2000, March). The impact of this on the larger scale of the city has become a central focus of enquiry for several researchers. Electronic and digital technology – both as information and through communication – have greatly influenced geography, urban centers and commercial business organizations (Friedrich & Schaafsma, n.d.; S. Graham, 1997; S. Graham & Marvin, 1996; Townsend, 2001) .

Over the last fifteen years, fabrications of chips and bits have become more sophisticated. The advances in design of the microchip are a key feature of dematerialization. Technologies have consistently delivered tinier, mightier, and more nomadic chips and bits (Mitchell, 1995, 1999, 2002). The synergy amongst these three primary features, labeled here, as miniaturization, power and mobility, have become the essential cocktail ingredients for dematerialization.[8]

1.2.1 Miniaturization & Power

Microchips have rapidly diminished in material size, while at the same time becoming more powerful (Mitchell, 1995, 1999; Negroponte, 1995; Reid, 2001). Over the last fifteen years, operational upgrades in processing power, storage capacity, and transmission power have complimented this shrinkage.

Reduction in the size of these microchips has been profound. Transistors are the life force of a microchip. BBC News science and technology reporter Jo Twist (2005, April 18) explains, "A transistor is a basic electronic switch in the chip…Every chip needs a certain number of transistors, and the more there are, the more chips can do." That is, increasing the number of transistors advances the power of the microchip.

The objective to increase the power of the microchip relies upon making transistors tinier. Essentially, tinier transistors result in more of them, squeezed into tinier spaces. Mark Anderson (2005, June 9) writer for *Wired Magazine*, observes transistors have become a "million times tinier" from the post-war transistor to those embedded in most electronic devices today. Anderson explains that today's transistors in typical electronic devices measure 50 *nanometers*. To provide an understanding of the size of transistors today compared to those of the post-war era of the 1940's and 1950's,

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[8] For additional information, I refer the reader to the chapter titled "Shedding Atoms" in *Me++ the Cyborg Self and the Networked City* (Mitchell, 2003).

Anderson (2005) claims the "shrinkage would be equivalent to reducing the continental United States to the size of a hot tub."

Miniaturization has become extreme. Intel, the worlds leading microchip producer, recently introduced silicon transistors to the market that were smaller than 80 atoms by 3 atoms (Markoff, 2001, June 10). The power of the microchip relies on transmission abilities: how many bits can be sent out to satellite signals and through cable lines. Transmissions rely on transmitting more bits, more quickly, out into the ether (Negroponte, 1995). Negroponte comments, "One of the reasons that all media has become digital so quickly is that we achieved very high levels of compression much sooner than most people predicted" (1995). The transmission power drastically increased as more bits could be transmitted per second.

The *miniaturization of bits and chips has a direct impact on the tangible objects* that define the world around us. Authors of the *Digital Advantage*, Jim Davis and Michael Stack (1997) explain that the miniaturized and powerful digital bits not only become embedded in more things, they can also be stored in tinier and tinier locations. Tinier bits and chips in turn require less physical material matter to house their electronic innards (Mitchell , 2003). The housing or casing reflects the internal correlation to the miniaturizing interiors.

Over the last fifteen years, western society has used progressively tinier devices for photography, music or communication. MP3 players and cell phones are slimmed down artifacts, and the concept of "bigger is better" has never appeared more outdated. Tinier artifacts, especially techno-gadgets, are in high demand and considered fashionable. The thin, sleek design of the iPod (Apple Computers) has become a fashion item, an urban cultural symbol for cool (Canoe, 2005). The desire to possess miniaturized artifacts has perpetuated a surge in the advent of ever-tinier devices in the market place. This trend has influenced the design of mobile phones, *personal data assistants [PDA],* calculators, computer screens and laptops, giving more bulky artifacts a negative stigma. Now overweight and outdated, bulky is the new bad in the period of miniaturization; large material matter is a fashion *faux pas*. The phrase "size matters" has changed meaning.

The materiality required to encase these bits becomes progressively thinner and slimmer. Advances in material manufacturing and production contribute to the process of miniaturization. The application and fabrication technologies are more sophisticated. As an example, several household artifacts, such as finishes, furnishings and accessories, are now fabricated in plastic.[9] As a material, plastic supports a wide range of lighter artifacts.

Making lighter objects means making them more portable. Innovations in materials and construction processes refine the form of the artifact. Plastic celebrates a seamless joinery, as the concepts of joint and connection dissolve into the body of the plastic form. This ability to make objects lighter, thinner, and more refined, offers a novel application, use, and meaning for the new artifacts.

For Virilio, the more advanced features of extreme miniaturization have instigated what he calls the third revolution (as cited in Armitage, 2000c). For Virilio, the first revolution is defined through technological progress that instigated transportation such as the jet, the motor car, the invention of the steam engine, etc. The second revolution has

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[9] For an overview of the evolution of the production, fabrication and applications of plastic, I refer the reader to the book titled *American Plastic: A Cultural History* (Meikle, 1997).

evolved through advanced electronics and media, such as radio and television. The third revolution, according to Virilio is the transplant revolution, which is currently underway and defined by the process of radical miniaturization. Virilio notes this third revolution is defined as "technology is becoming something physically asssimable, it is a kind of nourishment for the human race, through dynamic inserts, implants and so on" (as cited in Armitage 2000c, p. 49). The biocompatibility of miniaturized objects makes the body a new site for techno-agency. The ideas of implants and prosthesis are expanded further in Chapter 5.

1.2.2 Mobility

Not only are artifacts becoming tinier, and concurrently more powerful, they are also becoming more mobile. As advanced technology offers new ways to access networks through remote and wireless sources, artifacts acquire a new itinerant feature, free of permanent connections to a location. This has created a generation of tiny artifacts alleviated from physical weight and the need to be tethered to a fixed point of power supply. As objects become smaller and lighter, they can move as freely as we do (Mitchell, 2003). These new artifacts call for a reinterpretation of previous relationships. A nomadic device, presented as an untethered entity, may present itself in more relational terms, each context suggesting a temporal framework.

Consider the MP3 player as an example of the impact of increasing miniaturization, power and mobility. MP3 players render their predecessors, and the support systems associated with these predecessors, obsolete (Mitchell, 1999). The cassette, the cassette player, the Compact Disc [CD], the album, the record collection and the record player have gradually been replaced. Previously, the album and the record player were firmly positioned into place — heavy, fragile, difficult to maintain and typically anchored to a power supply. MP3 players, on the other hand, reflect the new, tiny, powerful, and not tethered — features of the new generation of nimble artifacts. Dematerialization becomes evident as one traces the dissolving of materiality in a historical and evolutionary context.

1.3 Case Study: The File Room

I will refer to the case study of the file room (Figure 1.1 to Figure 1.5) to illustrate the consequences of advanced technology, as an accelerating dematerialization, upon the interior environment. The planning scenarios provide evidence of the increasing ability to instigate immateriality with the evolving variations of technologies.

Each study differs from the next in that each one supports a different storage device to house the project program. The physical room and program requirements act as constant variables throughout the scenarios. The program here has been established at a minimum of 125 lineal feet of paper file storage.[10]

The objective of this study is to isolate the process of dematerialization, to frame it for further analysis and investigation. The primary benefit of the sequence offered in the planning scenarios is that they enable the evaluation of the rate and state of its procession. Using the square foot as a unit of measurement, the plans expose an extractable piece of quantifiable data to compare and contrast the schemes. Through this study, it becomes possible to visibly capture material presence and material absence.

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[10] It is an industry standard, to convey quantity of file storage data in a lineal foot measurement.

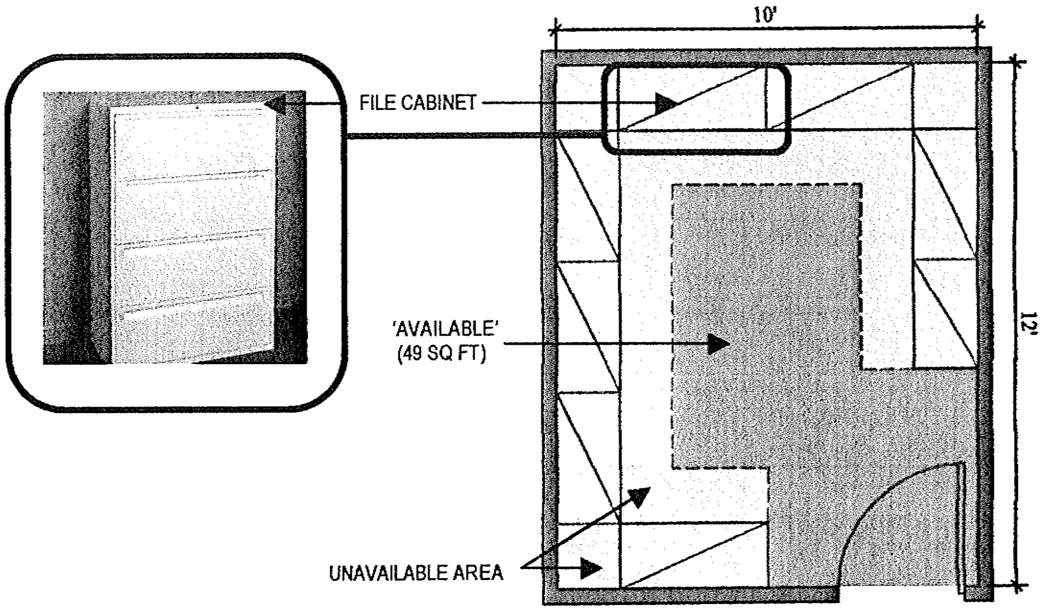

Figure 1.1 Case study: File Room (120 square feet). This planning scenario supports a configuration of 5 drawer high, industry standard lateral filing cabinets. This configuration yields a total of 125 lineal feet of paper file storage. Floor areas that are inaccessible, as corners or as required for full drawer-opening access are labeled as 'unavailable'. The open floor area labeled 'available' represents a total 49 square feet.

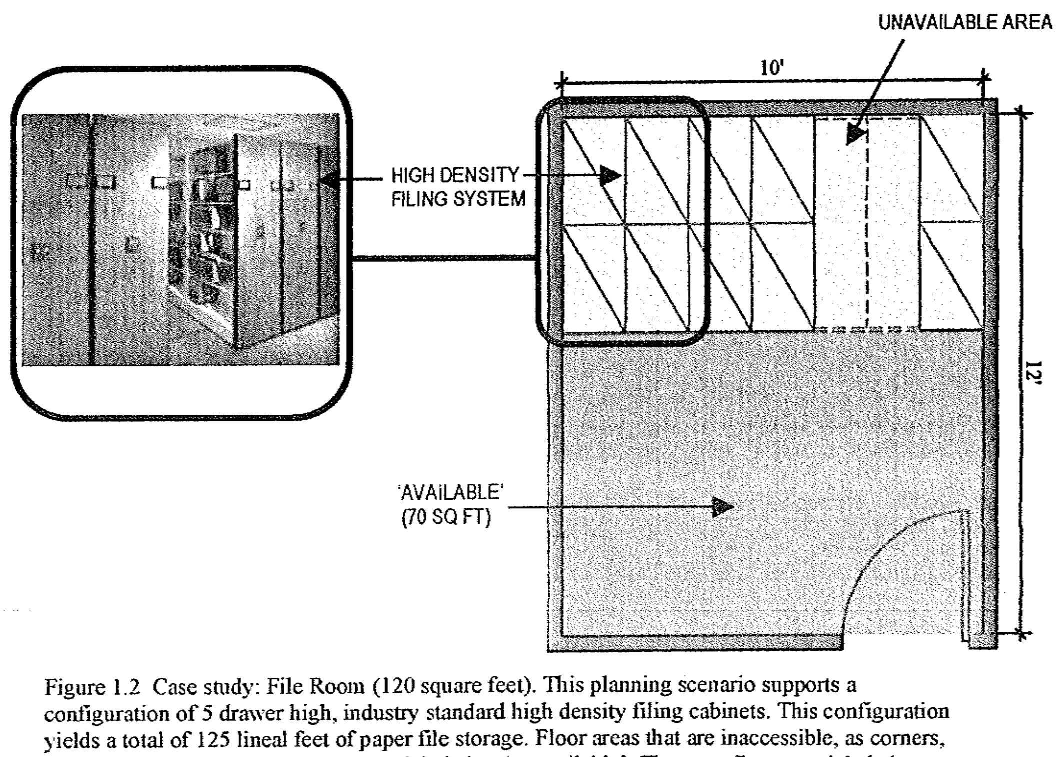

Figure 1.2 Case study: File Room (120 square feet). This planning scenario supports a configuration of 5 drawer high, industry standard high density filing cabinets. This configuration yields a total of 125 lineal feet of paper file storage. Floor areas that are inaccessible, as corners, aisle clearance required for access are labeled as 'unavailable'. The open floor area labeled 'available' represents a total 70 square feet.

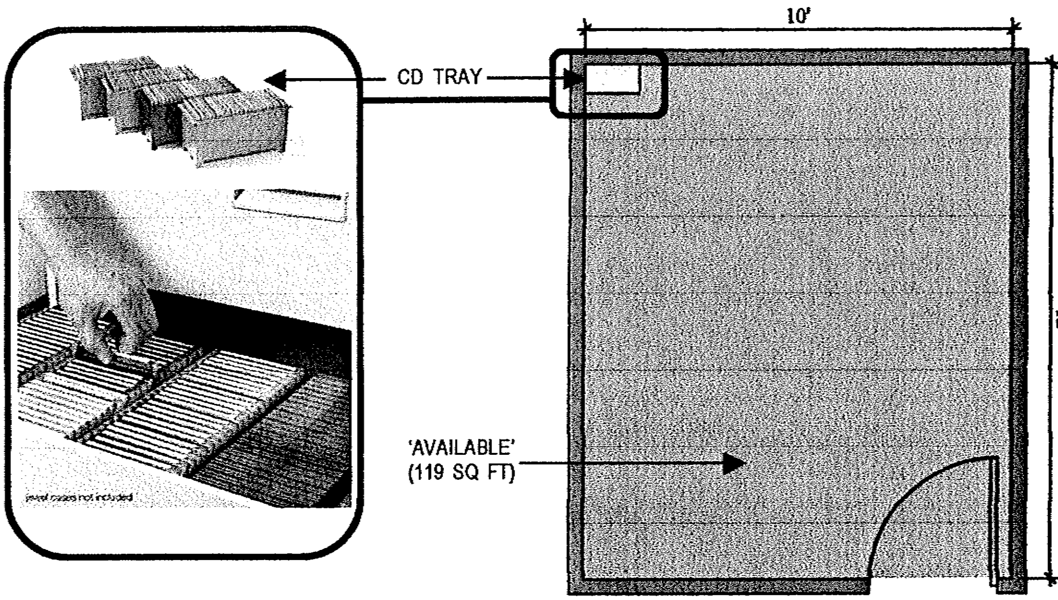

Figure 1.3 Case study: File Room (120 square feet). This planning scenario supports a configuration of industry standard stackable C.D. trays. This configuration yields information storage capacity that is (at minimum) equivalent to 125 lineal feet of paper file storage. The open floor area is labeled 'available' and represents a total 119 square feet.

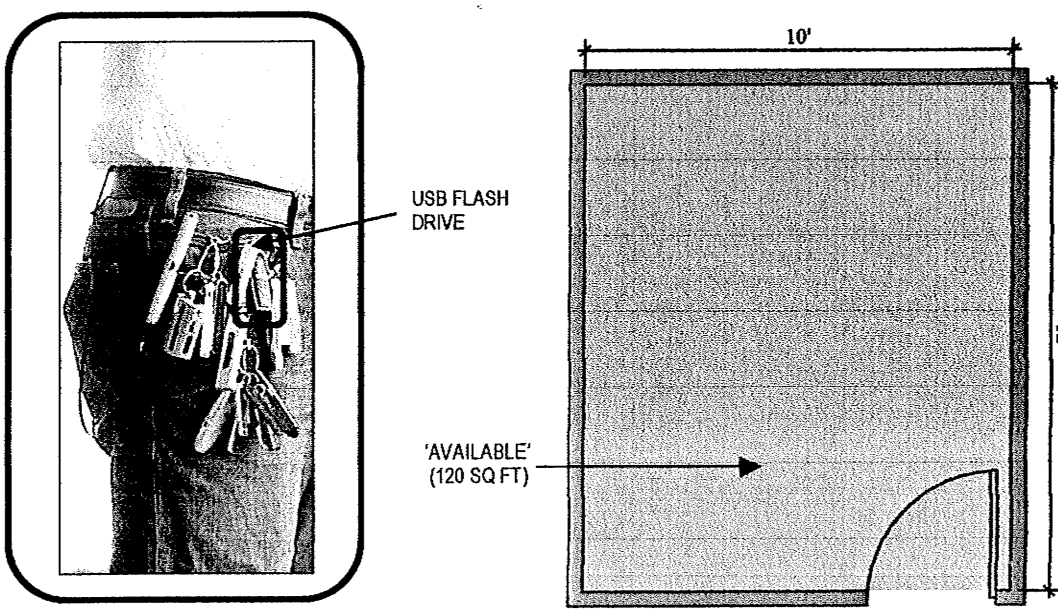

Figure 1.4 Case study: File room (120 square fee). This planning scenario supports individual portable storage devices. The USB flash drive device is 'clipped onto' the independent user. This device supports information storage capacity that is (at minimum) equivalent to 125 lineal feet of paper file storage. The open floor area labeled 'available' represents the entire room area, at 120 square feet.

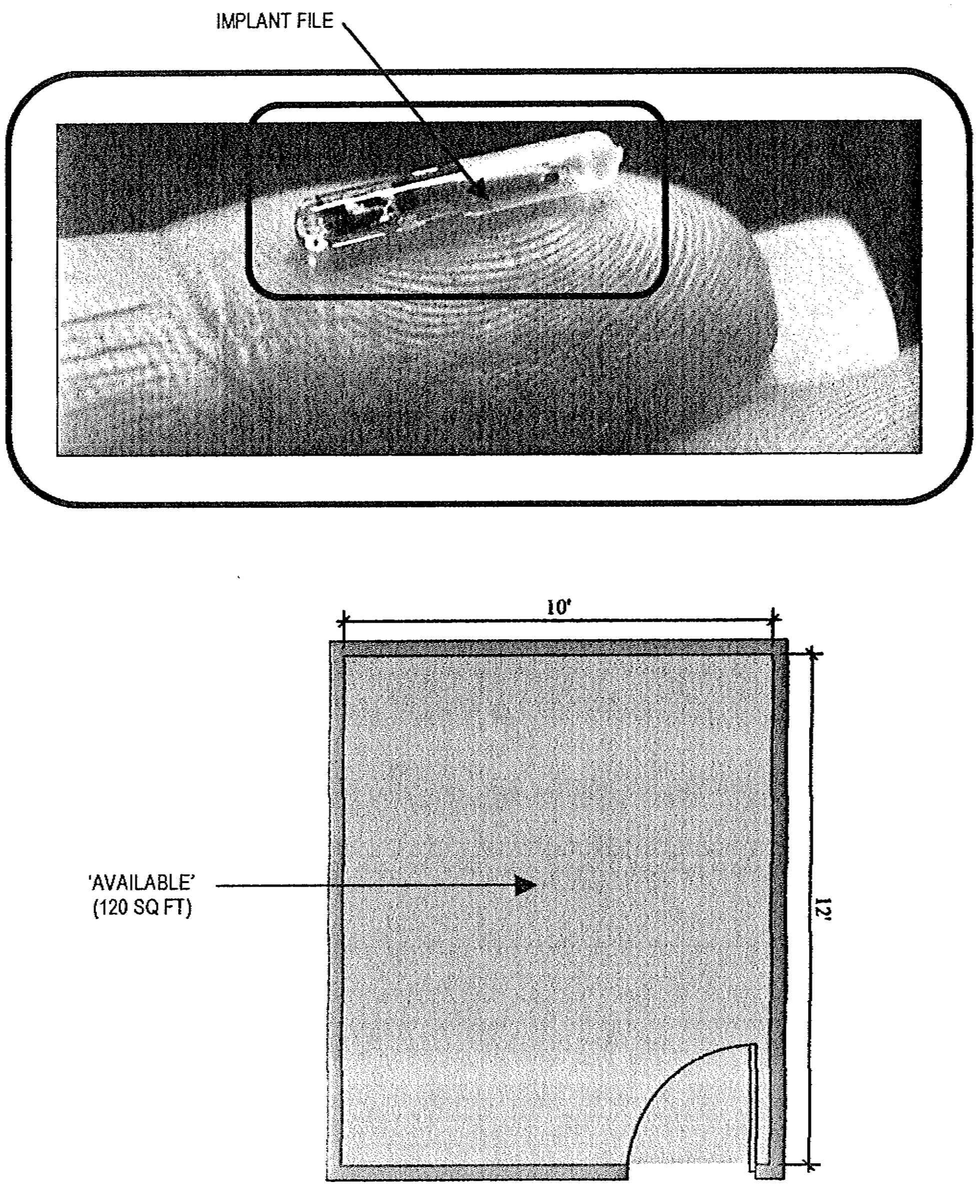

Figure 1.5 Case study: File Room (120 square feet). This planning scenario supports individual implantable file storage devices. A combination of implantable devices supports information storage capacity that is (at minimum) equivalent to store 125 lineal feet of paper file storage. The open floor area labeled 'available' represents the entire room area, at 120 square feet.

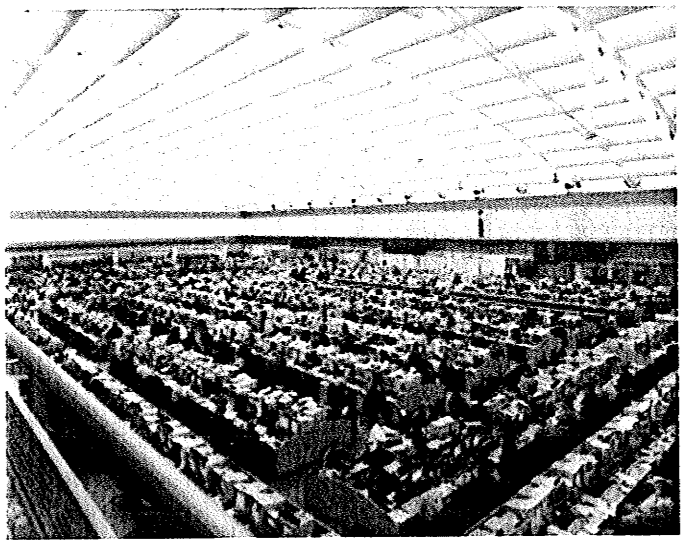

Figure 1.6 UBS trading floor. Designed by Skidmore, Owings & Merrill LLP, located in Stamford, Conneticut.

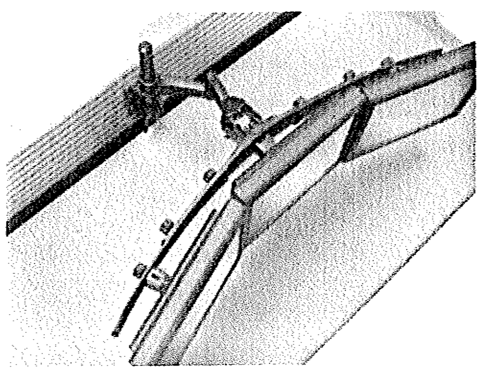

Figure 1.7 View of trading desk with triple-monitor arm by Ergotron.

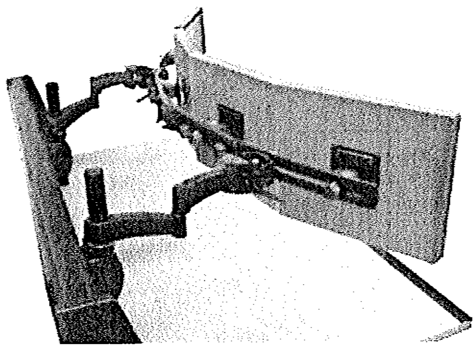

Figure 1.8 View of trading desk with quad-monitor system by Ergotron.

Figure 1.9 View of trading desk configuration with standard flat screen technology.

The planning scenarios illustrated in Figure 1.1 and Figure 1.2 reflect the most common paper file-storage solutions in commercial office design today. Figure 1.2 differs from Figure 1.1 in that it supports a high-density filing system, which offers the ability to compress the files into a tighter configuration within the given floor area. The high-density system enables the planning scenario in Figure 1.2 to yield an additional 21 square feet of available space (in comparison to Figure 1.1). This new available space is what Duffy calls *recovery space.*[11] The 18% recovery space in this planning scenario is of great value to the designer. The ability to gain this recovery space through this type of compression strategy is well known and well documented.

Although Figure 1.1 and Figure 1.2 provide efficient planning scenarios to meet the program requirements, they also reflect the inherent limitation of analogue space: the *natural resistance of materiality.* The *inherent resistance of material boundaries in walls,* ceiling and floor reflects the evidence of this limitation. As Virilio reminds us, architecture relies on the rigidity through "...statics, resistance of materials, equilibrium, and gravity" (as cited in Ruby, 1998, p. 181). This reinforces the properties attributed to the medium of analogue space and represents the ultimate example of complete restriction and limitation.

The solution offered in Figure 1.2 pushes the boundaries of architecture as it challenges the resistance embedded in the materiality. As the high-density solution compresses materiality, it in turn sets an enormous strain upon the boundaries of the material resistance. A widely accepted strategy, this compression scheme shifts all the

[11] The term recovery space was first introduced in interview with Frank Duffy of DEGW (personal communication, October 19, 2004).

physical weight into a concentrated area of the floor. This in turn creates new concentrated loads for the floor. The high-density file solution often requires new structural measures to support these systems and adds to the expense of the project.

By the mid-1980's several concerns were raised in response to the impact of digitization and the introduction of the personal computer. As information started to migrate out of the physical (material) realm and into the digital (immaterial) realm serious concerns were raised in the design community. The early discussions revealed alarm over the potential impact of virtual offices to completely obliterate the need for office buildings all together (Duffy & Tanis, 1993; Toffler 1980). Some (Albrect & Broikos, 2000) would later argue that the anticipated paperless office is "a concept that will likely remain an unfulfilled dream" (p. 98). Others (Lappalainen, 1998) are not as convinced, claiming, "Believe it or not, the paper-free office will one day become a reality"(p. 23). This discussion will need to be revisited essentially to verify what has actually transpired over the course of the last fifteen years.

Something more profound is happening than mere paper evasion. Several of these earlier predictions were just that: prediction as reaction. Arguments became flattened by the mid-1990's — as the argumentation was approached as an either/or scenario. An absolute duality of virtual versus physical office space and the virtual file versus paper file appeared to stifle the discussion.

The generalizations that dominated the popular discourse in the early 1990's appear to have tainted the topic of the relationship between interior design and cyberspace. The over-saturated use of cyber jargon has perhaps numbed us and has left a residual effect. The issue is, we need not prove if a virtual office has or has not arrived, but rather, uncover what has actually arrived. I argue the focus needs to expand and shift into a deeper analysis.

The more critical analysis should look closely at the relationship between matter and immateriality. As atoms become digitized in the information age, what is left behind? What becomes lost? Founders of the Architectural design firm Asymptote, Lise Anne Couture and Hani Rashid (2002) note, "dematerialization begs the question: What is the net residual effect? And what is left in place of the original material artifact" (p.102).

In the translation between material and virtual, something tactile or material is lost. Thackara (1988) calls this a *cybernetic loss factor.* The planning scenarios presented in Figure 1.3, Figure 1.4 and Figure 1.5 provide evidence of how dematerialization, delivers a cybernetic loss factor, into the file room case study.

As information goes digital, and the cybernetic loss reveals itself, plenty of new recovery space emerges. As illustrated in Figure 1.3, the digital storage device as a miniaturized physical body, the CD, allows for an intense compression and tight material configuration within the room. This in turn offers 99% recovery space of the floor area, as 119 square feet is now open and available.

More recent innovations in technology offer even greater recovery space. As illustrated in Figure 1.4, the Universal Serial Bus (USB) flash drive delivers a 100% recovery space. The USB flash drive, takes up approximately at most one cubic inch. The cybernetic loss factor, as recovery space here, reveals something profound: The entire floor area of the room is now available. And so the question becomes, what is the status of the material interior room?

Once the information is stored on a USB flash drive, as illustrated in Figure 1.4, it is able to latch onto the human body. These devices are embedded and catalogued in a variety of portable devices, such a lipstick tube, a necklace, a ring, a belt decal, a pen or a watch (Marriott, 2004, September 23). This example also illustrates how innovations in miniaturized technologies shifts design responsibility. What was once considered an industrial design project becomes a piece of jewelry or an accessory, removing the project from one area of design focus and transferring it to another. Trendy, must-have fashion accessory, these drives are becoming popular as "pendants signifying a cult of convenient computing" (Marriott, 2004, September 23).

Similar to Figure 1.4, the planning scenario illustrated in Figure 1.5 also yields a 100% recovery space within the file room. The implantable file, as recently approved by the Food and Drug Administration [FDA], represents the next generation of the miniaturized information-storage device (Fedder & Zeller, 2004). As implant, the bits and chips are located beneath the skin's surface, invisible to the human eye. Evading any involvement in fashion iconography, the implantable file looks toward other professional areas such as medicine, plastic surgery and biotechnology for its 'space planning' and design.

Ripe with ethical issues, the creation and approval of implantable devices have raised some alarm. This highly advanced form of dematerialization, as implanted devices, will push us ever more closely toward a advanced cyborg culture (Fedder & Zeller, 2004; Haraway, 1985; Stelarc, 1995). The concept and features of cyborgs are explored in more detail in Chapter 5.

Although this specific case study was set within a nominal 120 square foot file room, the idea can be applied to a larger piece of real estate. The impact of dematerialization moves across a variety of scales, reflecting similar repercussions. If this study were imposed onto a 500,000 square foot office, the resulting recovery space would deliver in proportion. As larger pieces of real estate are considered, the impact of the cybernetic loss factor can be tracked through various degrees of scale and scope. Considering a micro and macro level of analysis, the cybernetic loss factor impacts everything: the artifact, the interior space, the building, the city and the globe (Benedikt, 1991B; Mitchell, 1995, 1999).

1.4 Speed & Flows

In his groundbreaking review of the new economy and the ways of working, economist Manuel Castells (1996) argues that the current digital era is defined by a "space of flows". The space of flows, according to Castells, defines the current networked economy spread out globally through advanced communication systems. Advanced information and communication technologies make these flows accessible.

In the digital era, accessing and transmitting information as quickly as possible has become a pivotal objective in technological innovation. Virilio (1998B) explains, "reality of information is contained in the speed of its dissemination" (p. 156). The power embedded into real time technologies and advanced networks, as the vessels for instant information, become pivotal in supporting western culture. Virilio argues that the information age devotes enormous amounts of attention to continue to "speed up" or upgrade the accessibility, reminding us "information is of value only if it is delivered fast" (p. 156). Virilio's theories on speed are discussed more extensively throughout later chapters.

For architectural theorist Mahesh Senagala (n.d.), this evolution has created a shift in design paradigm, from a space-centric focus toward a time-centric focus. In spatial terms, the shift occurs from a (material) space-time architecture toward a (cyber) time-like architecture. Senagala explains, "Architecture has traditionally worked with configuring a body's position in space in relation to another body or activity. This configuration created notions of here, there, orientation, direction, juxtaposition, adjacency, distance etc. These notions are now being replaced with the arrival of ubiquity" (p. 6).

It is inevitable that the current cultural shift to immateriality will continue. The position of the immaterial network will continue to challenge the notions of its material counterpart. They may appear in complete opposition to one another – with each application undermining the impact and effect of the other. As Virilio warns, the battle has already been won as he explains "any kind of matter is about to vanish in favor of information" (as cited in Ruby, 1998, p. 187). Interior designers and architects are forced to revisit their own process, to consider and contemplate the relevance of what they do and, most importantly, how they do it. What does the immaterial imply for the design of physical space?

The effects of dematerialization ripple outward, as suggested earlier in this chapter. To illustrate this, I refer to a typical brokerage-house trading floor, as shown in Figure 1.6. The overall plan is densely populated with work settings. As traders are engaged with a steady and rapid flow of information throughout their day, they rely upon the closest proximity to these streams of data for their success. A successful trading floor hosts a minimal amount of materiality positioned between the trader and their information flows, to ensure a maximized interface between the trader and the second-by-second updates of information.

The design of a typical trading desk has evolved very differently from that of a typical workstation (see Figure 1.7, Figure 1.8 and Figure 1.9). The traders desk is slimmer and thinner, hosting less materiality overall. Immateriality in this sense supports the maximized accessibility for the range of eyes, hands and ears of the trader. Materiality here would just get in the way and suggest acting as a barrier.

The trading desk becomes a mere prop, a tool, an extension — designed with full intention to close or eventually eliminate the gap between body and flow. Growing the tension between two opposing realms, the objective is to create the closest proximity possible between sensory devices as inherently human to that of the immaterial flows of data. To achieve this the goal appears there is a subversive design objective to remove the inherent bulk of materiality that disrupts the path to the flows. As a result, trading desks have become one of the tiniest allotments of real estate to an employee in commercial office design.

There is evidence of a domino effect stemming from the miniaturization and dematerialization of artifacts. It enables different ways to configure, compress and order these objects in spaces. Design, on a larger scale, infuses a rippling effect as highlighted in Figure 1.6 and Figure 1.9. Similar in conceptual framework to the case study (Figure 1.3), the miniaturized trading desks have a significant impact on overall trading floor plan and support the ability to maximize population densities into the planning.

The cybernetic loss factor emerges in the trading floor scenario as an exploitable gain. It becomes used and reintegrated with intention and effect in space planning. Figure 1.6 represents a typical layout for a brokerage-house trading floor. This space plan reflects the effective compression to maximize overall density of the floor population. The compression strategy with miniaturized artifacts offers designers the ability to place more physical artifacts — desk and bodies — into less space.

1.5 Design Strategy

The features offered in the trading floor scenario have become tempting to designers who are under mounting pressure to drive down occupancy costs. As "Office workers are having to be accommodated more and more economically" (Duffy & Tanis, 1993, p. 3), these types of solutions have become *enticing to designers of office space who need to fit* a maximum number of individuals into an office floor plan. The economics translate directly into real estate lease savings.

Extreme densification using the methods as illustrated in Figure 1.6 and Figure 1.9 has recently become popular, influencing not only trading floors, but also a wide range of other businesses (Pristin, 2004). Investment companies, entertainment companies and even architectural practices have subscribed to using a trader-style desk and flat-screen computers to achieve the more-in-less scenario. This is becoming possible as all office work "involves the use of fewer physical artifacts as people create, store, and manipulate files, documents, and images in a two-dimensional, digital world" (researchers at HermanMiller, 2000). Noting the impact of this phenomena, Herman

Miller has found that the area allocated for work area has drastically changed, reporting a 25-50 percent reduction in personal work space over the past ten years (2000).[12]

Within US urban centers, various office types shrank by 14% between 1997 and 2002. (Pristin, 2004). This same report, featured in the *New York Times*, notes that employees who were once allotted 227 square feet in the 1980's are now allotted spaces that range from 150 to 200 square feet. Acknowledging the new trend of densification, reporter Terry Pristin (2004) casually mentions that accommodating more staff in less space is inevitable and that "everyone is just going to have to squeeze in". Pristin goes on to verify the popularity of this approach, as companies want to " take advantage of innovations in office design that allow for greater density" (Pristin, 2004). Yet this begs the question as to where exactly is the innovation in the "squeezing them in" approach? What role do space planners play in this process?

In the early 1990's, at the start of the digital revolution, office-design jargon took on a variety of new terms. New ideas in alternative officing strategies, spread out into the design industry (Johnson, 2000). Terms such as *hoteling* or *hot desking* arrived quickly on the scene to define the new design approaches and strategies. For designer Jan Johnson (2000), the development and application of these strategies often arrived as a "wolf in sheep's clothing." Johnson observes that they captured a lot of attention "because of their seeming potential to save space, and therefore money" (Johnson 2000). Additional research and inquiry into these strategies may reveal a complex web of

[12] Based on my own experience of planning office space, I have noted this change in my own practice. 10 years ago, people were allotted a much larger workspace setting than they are today.

motivations, vested interests to save money and perhaps a more insufficient application methods than their innovators had hoped for.

For Duffy and Tanis (1993), there is a greater trend toward these types of densification strategies in the US and in the UK. They describe a blind willingness to apply the intense densification schemes without thorough consideration of broader implications. Not only does a deeper analysis need to occur, but Duffy also argues there are more effective and creative ways to save on real estate costs (Duffy, personal communication, October 19, 2004). Duffy (1997) observes that North American and U.K. designers "have tended to overestimate efficiency and glorify cost minimization" (p. 47). This focus can cloud and undermine the objectives of design. That is, quality becomes seriously compromised. Duffy observes this as "Architecture in North America had become technocized; *its focus is on the delivery of a cheap product*" (as *cited in* Antonelli, 2001, p. 62).

Upon further analysis, there is a far more complex and significant issue for interior designers and architects surfacing here. As designers become – consciously or subconsciously – better acquainted with the ability of dematerialization to aid them in their space planning, the more this will become integrated and used within the design process. The predominant cost-saving agenda places increasing pressure on designers to exploit dematerialization, as a real-estate cost-saving motivation. This presents a catch-22 to the design industry. As designers implement a conscious agenda of immateriality, are they in turn operating to diminish their own effect? Designers will realize that the opportunities of dematerialization meet the economics, as they can use it to deliver more cost effective strategies, yet on the other hand it robs them of some of the very tools (materiality) used to construct the spaces they create. I argue that it is important for designers to be highly conscious of their role in implementing, advancing and participating in dematerialization.

To expand on this further, it is important to reinforce the strong links between the current cost-saving agenda and the desire for less materiality. There are economic incentives at work within late capitalism that are a major driving force in the dematerialization of the physical materiality that surrounds us (Davis & Stack, 1997). These forces also have a ripple effect: as fewer employees take up less space with smaller equipment and smaller desks, designers can squish more into less space. Thackara explains, "Hard questions are being asked about all the physical assets owned by businesses, with buildings being singled out as an albatross hanging around their necks. In the extreme view, *ownership of any kind of asset other than information is becoming a* liability" (p. 39).

Although motivations are tricky, late capitalism defines itself through an obsession, with maximizing cost savings as its primary, and often only, driver. Encouraged to accelerate dematerialization in the workplace, late capitalism plays a pivotal role in driving the design process. Highly seductive economic factors are associated with digitizing information as it offers "resource-conservative, cheap to store and transport, and easy to copy, meter and manipulate" (Davis and Stack, 1997, p. 6)

Dematerialization also features an attractive ability to facilitate resource conservation. Electronic and digital communication and information systems are unobtrusive, having a minimal impact on the natural surroundings and environments (Heisknaen *et al.*, 2000; Mitchell, 1999). Reducing the use of natural resources is an attractive feature from an environmental and conservation perspective. As noted by researchers at the Helsinki School of Economics, "Dematerialization has become an important goal for ecological sustainability in recent years" (Heisknaen et al., 2000).

Upon further review, the more seductive qualities of cybernetic loss, as offered to late-capitalism, reveal themselves. Movie watching is one example. Once the filmstrip becomes digitized and downloadable over a network connection, numerous questions emerge about the support systems that were set in place prior to digitization. As things dematerialize, what happens to the cinema and the video-rental facility, the staff that run them and the distribution companies that stock them? The real agenda is revealed in the language used: "'Efficiency', 'down-sizing', 'cost-cutting' — the euphemisms that accompany the dispersal of the new knowledge — are code-words for the squeezing-out of human activity from production and it is in the digital revolution assumes its greatest significance" (Davis & Stack, 1997, p. 10). The impact of the ripple effect of dematerialization on the social, economical, political and labor facets of society are of serious concern.

There is evidence that interior designers are working with space as if the digital era never arrived. Designer Christopher Budd (2001) observes, "the work environment model of 1960 is still with us, and it remains potent today" (p. 35). The impact of remaining within a framework dating back to the pre-digital era is disconcerting. Design continues to rely upon what worked in the past and perpetuates an unhealthy reliance on an outmoded paradigm (Duffy & Tanis, 1993). Using this outmoded model, designers are missing the opportunities emerging in the digital era. Duffy (2004) criticizes the current compression model to approach office design as missing the objective:

> People talk about real estate savings in a conventional sense. They usually have no idea that they could use space three to four times more intensely than they do at the moment. Instead of this shaving 6" off from the cube size, it's time to revolutionize the way space is used completely. (personal communication, October 19)

As miniaturized, powerful and mobile artifacts emerge into our spaces, their consequence for our social dynamics require consideration. The most important feature of dematerialization is that it has introduced a series of new spatial relationships. Advanced technologies have altered "objects, functions, forms, and project and building techniques, as well as changed the relationship between us and the objects" (Morgantini, 1989, p. 44). As the body and content of the artifact changes, so too does its physical and digital relationship to other artifacts and users. How do these new spatial models and parameters challenge old standards in space planning?

Designers need to reconsider the user and their experience in the digital era. To illustrate the relevance, I present the case of renting a Digital Video Disc [DVD] from my local video store. The recent shift of technology from videotape to DVD creates a similar situation as to that in the case study of the file room, when the information moves to a CD (in Figure 1.3). My local video store, displays their DVD's within a compressed configuration similar to that of the CD's discussed earlier. The densification here upon first glance appears natural, as the artifact of the DVD is smaller than its predecessor, the videotape. Yet, upon further review this configuration is highly inappropriate for DVD browsing in a public space. As the object becomes miniaturized, our bodies become the new points of resistance. The configuration creates awkward moments with strangers as they attempt to gain visual and physical access to the same row of DVD's. The experience is unpleasant, calling for a reconsideration of how the new artifact emerges with a new set of relational structures.

The challenge for designers is to contend with the social issues arising as a result of dematerialization. As items become immaterial, they leave the realm or scope of interior design. I argue that the progression of dematerialization does not necessarily mean activities are going away. Instead, they are being redefined –becoming relocated, mobile, unpredictable, or transformed.

Some common features that arise in the digital era with great frequency illustrate this point further. On close examination, there is evidence found in the everyday of new patterns instigated by dematerialization and digitization. Mitchell offers an everyday account of a common occurrence:

> Why is a cell phone so annoying in a restaurant? One of the reasons is that there is no discreet graceful way for somebody who gets the cell phone call to quietly retire from the group for a moment…[this could be resolved by] the rough equivalent of the very elegant old fashioned phone booth, except you take your own telephone into this space" (personal communication, June, 2004)

The issue as presented by Mitchell, is quite a simple design problem. As landline telephones are being rendered obsolete with the advances in mobile phone use, the material container for the landline telephone evades. Yet the condition of talking on a phone has not gone away. It has only become more complex to discern 'where' this will occur in physical space. Several emerging conditions are ripe for rethinking due to the new relational patterns, new behavior, movement and social interaction evolving in the digital era. As space is being used in different ways, a new level of investigation is required to unravel the unique mysteries it delivers to designers.

1.6 Repositioning Materiality

Materiality and the design of it needs to be repositioned into a different context to avoid being marginalized in the digital era. Theoretically, dematerialization conflicts with the agenda of interior designers and architects who are attempting to add value to the experience of physical spaces. The conflict places materiality in a vulnerable position, appearing as a deer in the headlights, waiting to be annihilated by a new technological invention or a cost-saving capitalist. The challenges of this unfavorable position are reinforced by the fact that "architecture in the post-industrial landscape has become commodified, designed to be consumed, and therefore is inherently of temporary value" (Dunham-Jones, 1997, p. 10).

The intention of this chapter is not to be alarmist. But it is challenging to watch the very tools, used to create and define interiors, rapidly shrink, miniaturize, digitize and be implanted without a larger discussion. This is not to suggest that all materiality will disappear. But its value, effect and ability to support cultural and social conditions will continue to dissolve. As Senagala (n.d.) reminds us, "Time and speed have come to the major realms of world action today. Architecture has become impotent, immaterial and marginal…" (p. 1).

For Virilio, the future of architecture is highly unstable. He warns architecture "will continue to exist, but in a state of disappearance" (as cited in Ruby, 1998p. 187). If the design of space continues down its current course, it will only perpetuate a very slow, painful and, perhaps never realized, death. The only means to slow or alter its current course of prolonged disappearance is for designers to reposition the status of materiality.

Others remind us of the potential backlash against an entire submission and immersion into the digital realm. As more becomes immaterial, that which remains material attains the status of the exotic, of the rare, and perhaps of the more meaningful. Thackara (1996) explains there are new opportunities made available to design as physical spaces can become islands of salvation in a sea of endless streams of information, media and digital saturation. In response to our overexposure to digital objects and environments delivered in immaterial culture, that of which remains tangible, tactile and material has the power to potentially "root us to the ground, as human beings" (Thackara, 1996, p. 119). The potential to reconstitute the material relevance is an option in the immaterial culture of the future.

Yet, on a very basic level, the movement toward immateriality brings into question *whether human beings are losing anything of great value in this process.* The cybernetic loss factor not only translates into a square footage, but also raises significant issues for humans as tactile creatures. What of the tangible, the sensual in the process of increasing immaterial culture? As nostalgic as it may sound, it is imperative that designers embrace a deep investigation of dematerialization to ascertain what is leaving, what is remaining, what is redefined and what is changing in the world. It is imperative for designers to gain a critical analysis on dangers and opportunities offered through dematerialization, and develop a deeper understanding of how it will continue to evolve and expand into the future

CHAPTER TWO

NEW CRAFT:

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The relationship between the digital space of cyberspace and the physical space of our material world has become more and more complex. In this chapter, I analyze and explore the evolving complexities of the relationship between the two spatial domains and how these complexities manifest in the physical interior environment.

To illustrate this, I provide an analysis of the Case Study: The New York Stock Exchange [NYSE]. Through this case study, I demonstrate how the domains of digital space and physical space are moving toward a state of greater convergence and reciprocity in the digital era. This discussion is grounded in an analysis of the direct repercussions of this on interior design and architecture.

In this chapter, I argue that the evolving condition challenges current interior design process and practice. Also, I demonstrate how this condition demands an expanded fluency in spatial language, theory and understanding of digital spatial terrain. Through the analysis, I explain how design process requires an increasing amount of new attention to be directed towards what Thomas Horan, Professor and Executive Director of the Claremont Information and Technology Institute, defines as threshold connections. The exploration draws upon pertinent theories from architecture, post colonialism and cyberspatial theory. The research outlines and expands upon the ideas of *cybrid space* as introduced by architect, educator and information design theorist Peter Anders. The analysis reviews ideas of hybrid design as proposed by design theorist John Thackara and features of hybrid culture as discussed in postcolonial theories of Hommi K. Bhabha.

Several of the concepts explored in this chapter are grounded in ideas the of *recombinant architecture* as illustrated by William J. Mitchell, Academic Head of the Program for Media Arts and Sciences at Massachusetts Institute Technology [MIT].

Immateriality is poised to threaten material culture that designers rely upon. In this chapter, I expand the discussion of dematerialization as previously introduced in Chapter 1. Through this discussion, I evolve the ideas of the apocalyptic nature often associated with dematerialization and shift the focus onto the new opportunities for interior design and architecture.

In this chapter, I reveal how the emerging relationship between materiality and virtuality challenges the practice and process of interior design and architecture. Further, I illustrate how this relationship between the two domains delivers a plethora of viable new design opportunity to these professions.

2.1 Separation Toward Convergence

Digital space and physical space are often considered as separate spatial domains. That is, they are often created, executed, approached and reflected upon in isolation, disconnected from one another (Bouman, 1998a). To further describe this approach to the relationship, I will refer to it as the separation model, as illustrated in the concept diagram of Figure 2.1. In this model, the approach to spatial understanding fully acknowledges the existence of each spatial domain yet maintains each of them as independents, isolated from each other. Architectural theorist, Ole Bouman (1998a) describes the "two domains are seen side by side, as two parallel worlds" and are considered as having minimal to no effect upon each other (p. 55).

New sophisticated states of technology challenge the separation model as presented in Figure 2.1. Technologies such as the Internet, wireless networks, mobile gadgets, real-time global networks and smart environments or systems place an increasing number of complex states of digitalia into an ever-increasing number of physical locations.[1] Design theorist John Thackara (2001) notes the consequence as "the real and the virtual, the artificial and the natural, the mental and the material, coexist in a new kind of hybrid space" (p. 40). The integration of these spatial domains challenges the separation model, as illustrated in Figure 2.1. The merger of digital space and physical space evolves more closely to the model as illustrated in the convergency model of Figure 2.2. Through the convergence, there is a hybridization between the domains.

The term hybrid has been used excessively over the past few decades and requires some clarification for grounding its use here. According to postcolonial theory, hybridity has been defined as "the margin where cultural differences come into contact and conflict, unsettle all the stable identities that are constructed around oppositions such as past and present, inside and outside, or inclusion or exclusion" (Bhabha, as cited in Macey, 2000, p. 192). The margin represents the edges of where oppositional features begin to intertwine, overlap and blur. The framework of hybrid space considers the overlapping features of the virtual and real, digital and physical, mental and material,

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[1] The term *Smart* here refers to responsive materiality. That is, materiality that is laced with computer technology to respond to human activity. This idea is explored more extensively in Chapter 5.

conceptual and tangible and that they work on the similar defining principles offered in postcolonial theory. The spatial domains come together and challenge the definition and boundaries of the other, and increasingly morph into a hybrid.

Hybrid space has no fixed or stable identity. The dynamic state of the hybrid relies upon the evolution of conflicting identities to play out in order to rebuild and inform its own creation. The hybrid reveals how "Physical and virtual architecture have entered a state of symbiosis" and are morphing into a new spatial condition (Schmitt, as cited in Sperlich, 2001, p. 103). It relies on the relationship of the physical and the digital to actively engage one another — to inform and influence, add and subtract, flex and bend as it emerges into its evolving identity.

Hybrid design requires a dynamic understanding of spatial design. Bouman (1998b) comments:

> Architecture, too, is on the move, it travels, multiples. Becomes a migrant. Rather than creating a place, designers stage-manage movable situations. The relation between the individual and object becomes the relation between dynamic places and (sometimes manipulated) states of mind. This architecture belongs in neither the physical nor the virtual domain; it is a hybrid. Space becomes genuinely fluid; it forms the link by which the digital space can flow into the real space of daily life. And vice versa." (p. 79)

For Bouman, the new entity is original in identity and strikingly different than its ancestors. For this reason, it requires a new design approach.

The construction of hybrid space rests in the hands of the design professions. The individuals who will juxtapose or supplement one domain with the other are responsible for the constructions of the hybrid. Bouman (1998) believes that most designers have chosen to ignore the emergence of hybrid space in the digital era. Designers, who are trained in physical spatial understanding, may continue to practice in only one realm or domain and not the other. Traditionally, this would have been a highly appropriate response. Yet, in the digital era, this approach is starting to be criticized as narrow in design scope and focus. Architectural theorist Stanley Mathews (1993) argues that this approach is typical yet inadequate, outdated at best, for contending with the new design problems and spatial reality emerging in the post-industrial world. The approach to stubbornly continue to address the spatial domains as separate is reflected in Figure 2.1.

2.2 The Cybrid

To illustrate the hybridization of space, it is essential to refer to and expand upon what Anders calls *cybrid space*. According to Anders (1999), cybrid space is "an environment or artifact that incorporates both physical and cyberspaces" (p. 195).[2] Today, there are several examples of cybridity found in everyday settings from the office to the retail store to the contemporary library. In the example of the contemporary library, the collection incorporates and is defined by physical books or journals as well as online sources found in cyberspace. The domains of cyberspace and physical space, together, actively define the contemporary library collection. The collection expands and transcends across both domains to support the library.

There are varying degrees of cybridity. Defining the degree to which an environment or artifact is a cybrid relies upon an understanding of the integration

[2] The relevance of the term *cybrid* should not be overlooked. It "marries together the actual and the virtual in one term, rather than resting in the ambiguity of 'hybrid space', 'mixed reality' and 'augmented space' (Kinsley, 2000, p. 2). It reinforces the relevance of the connection point directly at the overlapping intersection between domains.

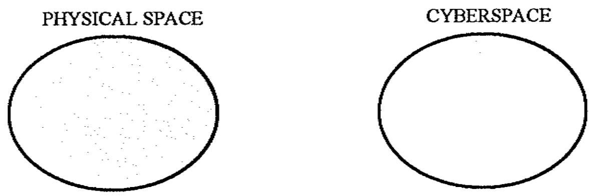

Figure 2.1 *Seperation Model.* Based on the Distinct physical space and cyberspace model, by Peter Anders (1999) Envisioning Cyberspace.

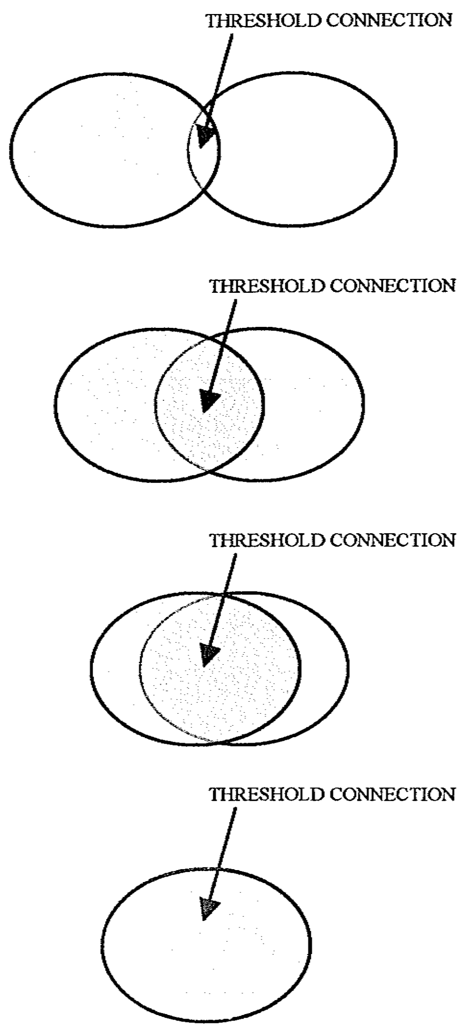

Figure 2.2 *Convergency Model.* Based on the Congruent Model and Overlapping Model, by Peter Anders (1999) *Envisioning Cyberspace*. The configurations represent the various degrees of convergency between physical space and cyberspace.

between the elements of physical space and cyberspace. Anders (1999) defines three specific and separate scenarios of the cybrid: (a) distinct, (b) congruent or (c) overlapping. As distinct, Anders presents a model that is similar to the separation model I discussed earlier (see Figure 2.1). Anders (1999) argues the distinct model is commonly represented, as the "logical structure of a computer network rarely has anything to do with the layout of its host building" (p. 197). The distinct model reflects the design disparity between the information networks and the physical building layout.

The other models presented by Anders (1999), overlapping and congruent, represent a greater integration between the domains. I have taken the liberty to revise these original models proposed by Anders and have introduced them through what I call the *convergency model*, as discussed previously in reference to Figure 2.2.[3] The congruency model integrates the models proposed by Anders and instead represents them as one mode depicted as a sliding scale or as different stages of progressive integration and convergency.

As convergence occurs at the instant any overlap between the spatial domains occurs, the convergency model reflects a more flexible condition, representing a number of degrees for potential integrated scenarios (see Figure 2.2). These scenarios, reflecting intensification or increased potency for physical and virtual to overlap, penetrate and morph into one and other. To illustrate this idea further, a photograph hanging on a wall may be understood as a convergent model support with a minimal or fractional overlap.

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[3] The convergency model derives from a merger of models proposed by Anders (1999). Anders provides models titled 'Overlapping' and 'Congruent'. The model I have devised, titled the convergency model, is a readaptation of these two models by Anders. The convergency model captures the full spectrum of options available in the varying degrees of cybridity.

The model becomes advanced in its overlap (see Figure 2.2) as the technology becomes more sophisticated, powerful and plentiful. The model evolves as in the cases where videoconferencing, real-time security surveillance or advanced interactive holographic capabilities are introduced.[4] The digital era has revealed how greater and more effective states of convergency between the domains are possible.

Founders of the firm Asymptote Architecture, Lise Anne Couture and Hani Rashid (2002) identify the influence of convergence in architecture. Couture and Rashid claim "the paths that both architectures, the real and the virtual, inevitably take will be one of convergence" (2002, p. 69). Preparing for an intensified convergence between domains implies the construction of the cybrid deserves greater attention. If these paths are going to come together, it is important to find where they are compatible, how they are oppositional and resistant, and ultimately, how they are seamless.

Cybrid space, on a path toward greater convergence, demands an expanded and unique design process. The design process, according to Anders (1999), would need to address each domain individually. He claims designers would need to fully understand the abilities of each domain in order to "...employ each mode of space its best advantage" (1999, p. 195). This implies designers will need to find effective and critical ways to understand both domains of space. As designers consider cybridity, they can establish and develop a set of criteria to be able to assess 'best advantage' as integrated into a holistic design approach. The designer of cybrid space considers each spatial domain in terms of its benefits, features, limitation and boundaries it offers to each

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[4] These technologies are explored in more detail in Chapter 5.

project. The design process needs to embrace this multi-spatial problem-solving approach, as ultimately designers can effectively "determine which functions need to be rendered physically and which might take form in cyberspace" (Anders, 1999, p. 206). The consequences of deployment rely heavily upon the critical thought and judgment made by designers to effectively resolve the complexities of the cybrid design model.

The design process of the cybrid relies upon each domain to inform and influence the other. In this sense, each spatial domain supports and yields to the other, a form of morphology illustrating what Anders (1999) describes as "resulting designs would become chimeras of physical and cyberspaces, overlapping where appropriate and necessary" (p. 199). This mutual and compatible identity of the cybrid challenges existing notions of physical spatial boundary, limitation and ability.

Cybridity entails contending with multispatial phenomena. Anders (1999) explains, the "reciprocity between these spaces can lead to objects that straddle both modes of being" (p. 199). Cybridity challenges defined whole entities, structures and organizations. Geometry, platonic solids and the unity of artifacts, as grounded in space, unravel into a distributed or straddled condition. These multi-modal and distributed spatial configurations present new challenges to phenomenological understanding and designing spatial entities. The condition of a splintered spatial identity is explored throughout Chapter 4.

The cybrid design model poses to expand the design process for interior design or architectural design. Horan (2000) argues, "The rise of cyberspace begs an examination of its connection to the physical world, the world of bricks and mortar. How and where do cyberspace and physical space intersect?" (p. 6) To fully gain an understanding of cybridity, a careful study is required at the point where the domains meet and become compatible. Interior design and architecture play a significant role in the creation, integration and formation of future cybridity. How does cybridity alter the spatial character, features and configurations that define interior design and architecture? How do options for cybridity inform interior design and architecture?

2.3 The Interface: Threshold Connections

As technologies become more sophisticated, a greater symbiotic nature is available for executing the cybrid. The gateway or connection point becomes a new place for analysis and study. Horan (2000) defines this point where cyberspace and physical meet as a "threshold connection" (p. 18). The conceptual location and idea of a threshold connection is illustrated in Figure 2.2. The connection is at the overlapping point where both domains come together, becoming mutually engaged and available to inform one another.

Horan (2000) defines the objective for the design of cybridity as reliant upon a seamlessness. In *Digital Places*, he notes, "When we move from one realm into the other, our passage [between these domains] should be as seamless, easy, and clean as we can possibly make it" (2000, p. 18). The ability to pop in and out, straddle, or cut across into cyberspace will be supported by creating more seamless connections between the domains. The design objective of Anders' cybrid is grounded in an ability to intensify a seamless integration and smooth transition between the domains.

The threshold connection introduces itself as a study of a new complex joinery, as new design craft. Similar to the attention paid to details in physical space, of the material-to-material design connections, the new challenge at the threshold is to provide serious analysis of the connection detail between the virtual and the physical. It is through this type of inquiry and study that we can begin to ascertain the effective elements that establish and reinforce seamlessness between them.

Over the last fifteen years, the complexity of the threshold connection has increased. Advanced technology promises to move us away from the screen-mouse-keyboard [SMK] interface experience toward limitless variations of this condition. The SMK has consistently represented the more restrictive features of technology, as it has merely tethered us to the location of a machine that has limited the real potential of the cybrid. The SMK *creates confining situations in which to create cybrid conditions.* Anders (1999) notes, "screen displays disrupt the continuity of the two spaces by 'containing' the cyberspace environment" (p. 201). Cyberspace as a framed entity, or dedicated portal, is disengaged from the spatial language in physical space. This disjointed feature creates enormous challenges for infusing a transcending spatial experience, of seamlessness, as straddling the domains. Each shift in or out of each domain requires a concerted effort. It becomes a deliberate and conscious choice.

But this will surely evolve. As technology advances, it promises to introduce new options for the design, location and integration of these threshold connections. Architectural theorist Elizabeth Grosz (2001) asks with great relevancy, "can the computer screen act as the clear-cut barrier separating cyberspace from real space, the space of mental inhabitation from the physical space of corporeality? What if the boundary is more permeable than the smooth glassy finality of the screen?" (p. 88) Technology has progressively moved out and beyond the traditional façade of the screen. Today, advanced electronic and digital technologies distribute cyberspace into an increasing number of spaces and artifacts: mobile phones, MP3 players or wireless environments.

The collapse of the existing boundary line, at the screen, is inevitable. As Mitchell (1995) notes "with higher bandwidth, ever greater processing power, and more sophisticated input/output devices…the boundary that has traditionally been drawn to the edge of the computer screen will be eroded" (p. 20). As the screen boundary continues to dissolve, new boundaries take its place.

The new location and identity of the boundary, or threshold connections, can be found in a distributed and sophisticated interface. There is no one fixed location. Already a profound spatial characteristic and identity in the digital era, threshold connections are agile and sophisticated. Romero (1998) observes, "The nebula, loosely called interface, has surrounded us, penetrated us, and become frequently invisible part of our daily existence" (p. 46).

The increasing ability to converge virtual and physical spaces will multiply as the technologies evolve. The interior design and architectural professions will become active participants in contending with the shifting boundary line and the impact of the migrating interface. Mitchell (1995) anticipates, "In the end, buildings will become computer interfaces and computer interfaces will become buildings" (p. 105).[5] The question shifts toward: how will interior design and architecture contend with a distributed interface, multi-spatial conditions, threshold connections and seamless integration?

2.4 Case Study: The New York Stock Exchange

To illustrate and expand upon the notion of cybrid space, I move the analysis toward an exploration of the design of The New York Stock Exchange [NYSE] (see Figure 2.3 to Figure 2.12). I provide evidence of and discuss how this project represents a cybrid condition. This analysis illustrates the challenges, and some of the opportunities, that cybrid space introduces to the design process.

Designer Robert Propst (1968) once claimed that the NYSE was the "super office-of-all-offices" and that it should be a point of reference for all those concerned with future office design. Although stated back in 1968, this still has relevance today. As one of the most intensive and active information hubs in the world, the NYSE maintains its prominent position as a design reference.

In 1998, the NYSE hired design firm Asymptote for the design and renovation of their trading floor.[6] Asymptote developed and completed two projects simultaneously for the NYSE. One project was a renovation and redesign of an area called the ramp within the existing facility of the NYSE (see Figure 2.3 to Figure 2.7). The ramp is situated

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[5] Environmental interface is explored further in the discussion on smart systems, in Chapter 5.

[6] Asymptote is a multidisciplinary architecture firm based in New York City. Firm principles are Hani Rashid and Lisa Ann Couture. Their work has been highly publicized and recognized as a multi-disciplinary architectural practice. Portfolio of their work can be found on line at *www.Asymptote.com* and is reflected in their book *Flux* (2002).

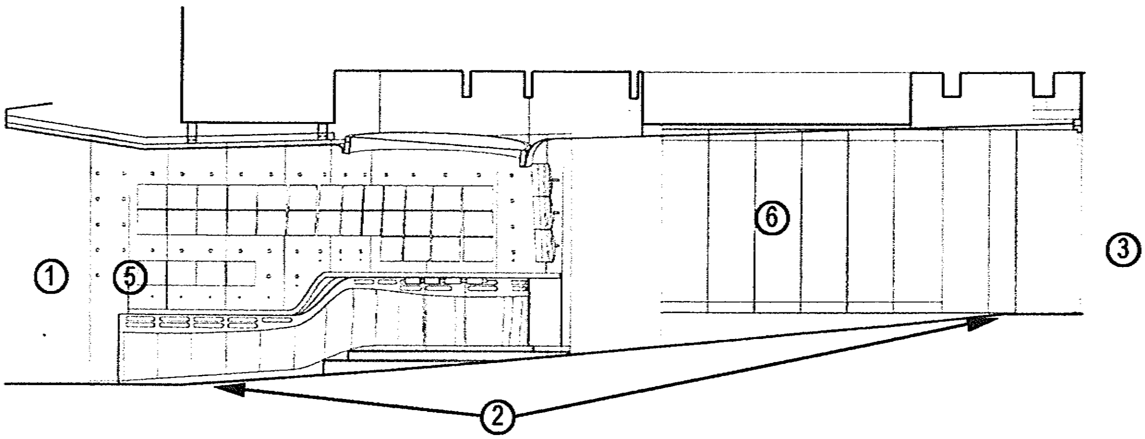

Figure 2.3 New York Stock Exchange, NY. Elevation fo east side to the Advanced Trading Floor Operations [TFOC]. Cross reference tags to the adjacent legend on this page. Designed by Asymptote, 1999. Drawing is not to scale.

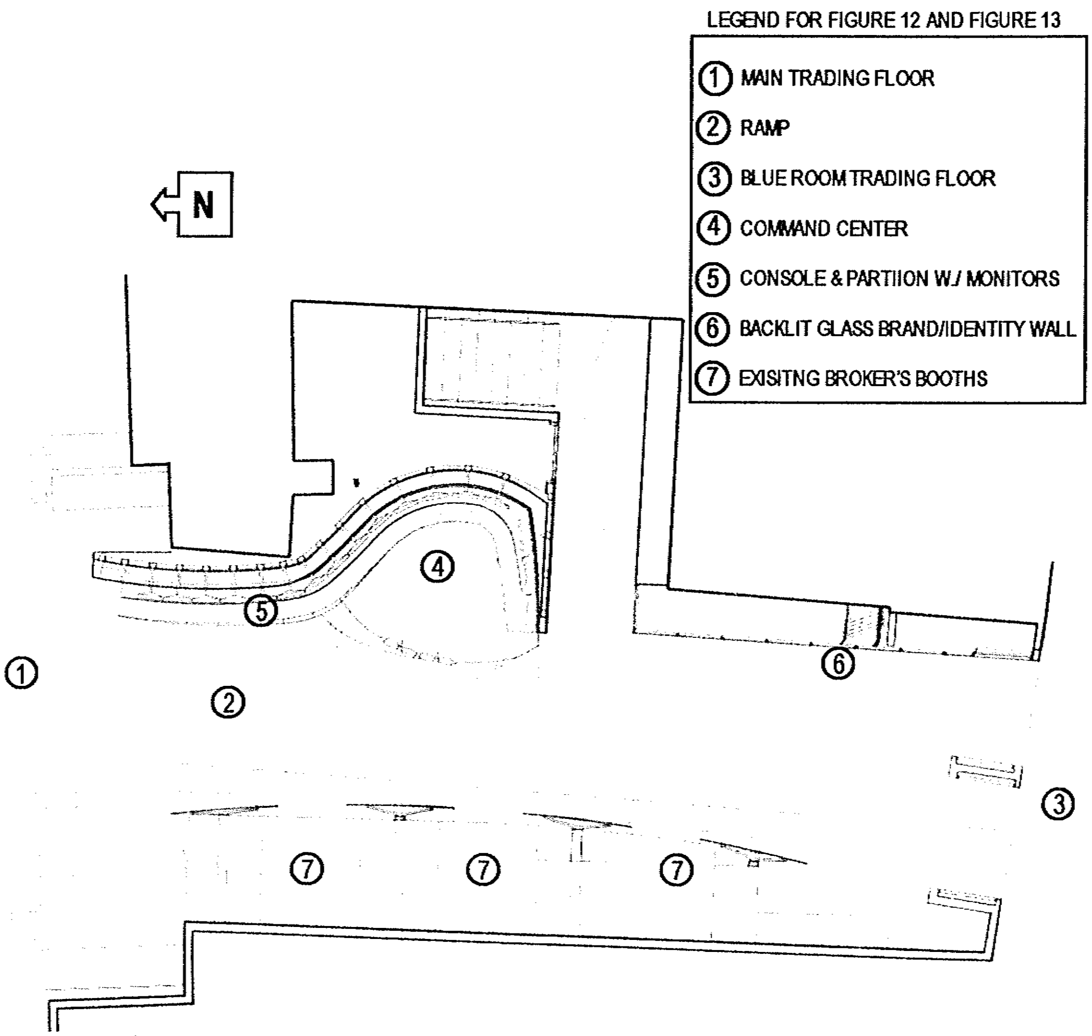

Figure 2.4 New York Stock Exchange, NY. Floor plan of the Advanced Trading Floor Operations [TFOC]. Cross reference tags to the adjacent legend on this page. Designed by Asymptote, 1999. Drawing is not to scale.

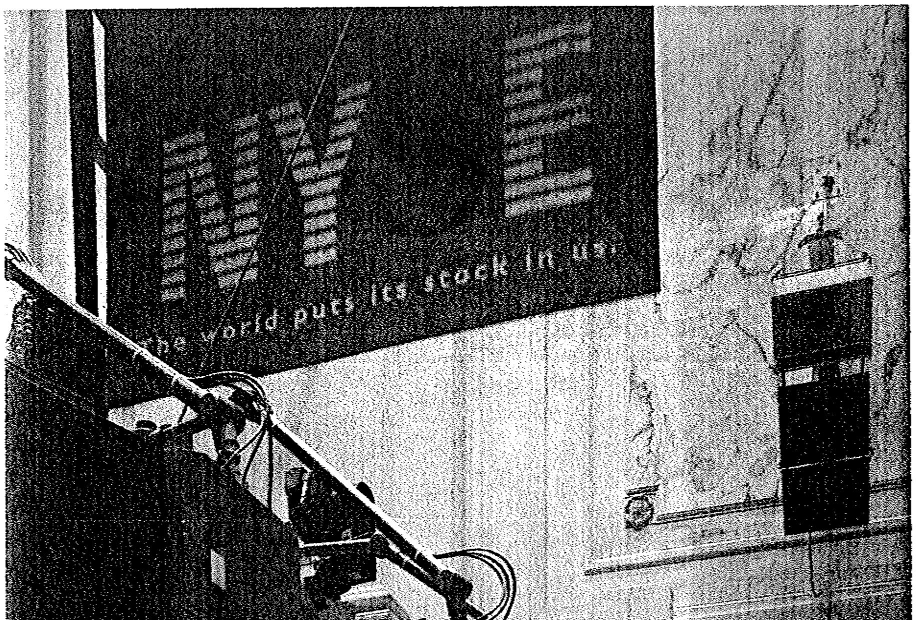

Figure 2.5 New York Stock Exchange, NY. View looking south, from main trading floor towards Advanced Trading Floor Operations [TFOC]. Designed by Asymptote, 1999. Refer to Figure 2.3 and Figure 2.4 for orientation.

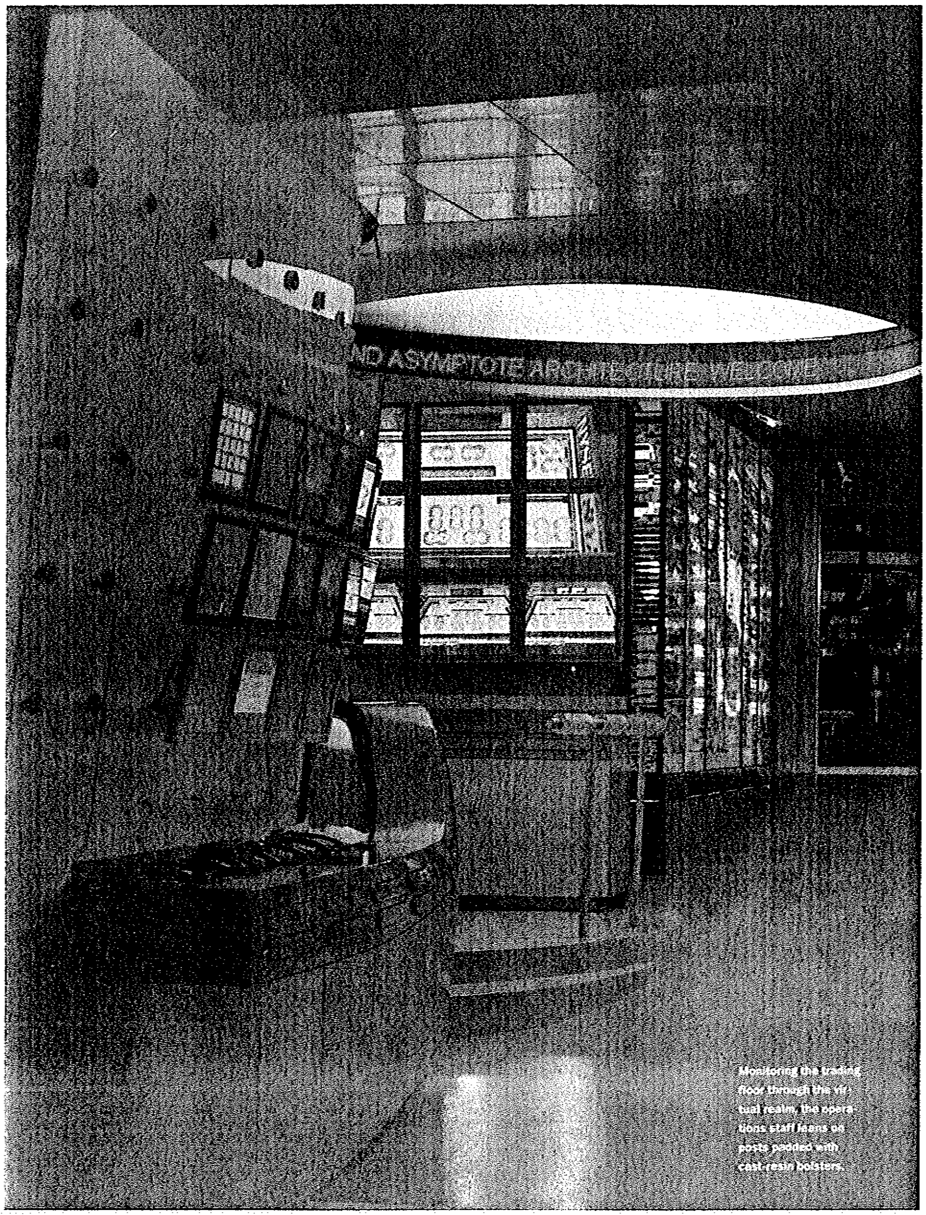

Figure 2.6 New York Stock Exchange, NY. View looking south, from north end of ramp of Advanced Trading Floor Operations [TFOC]. Designed by Asymptote, 1999. Refer to Figure 2.3 and Figure 2.4 for orientation.

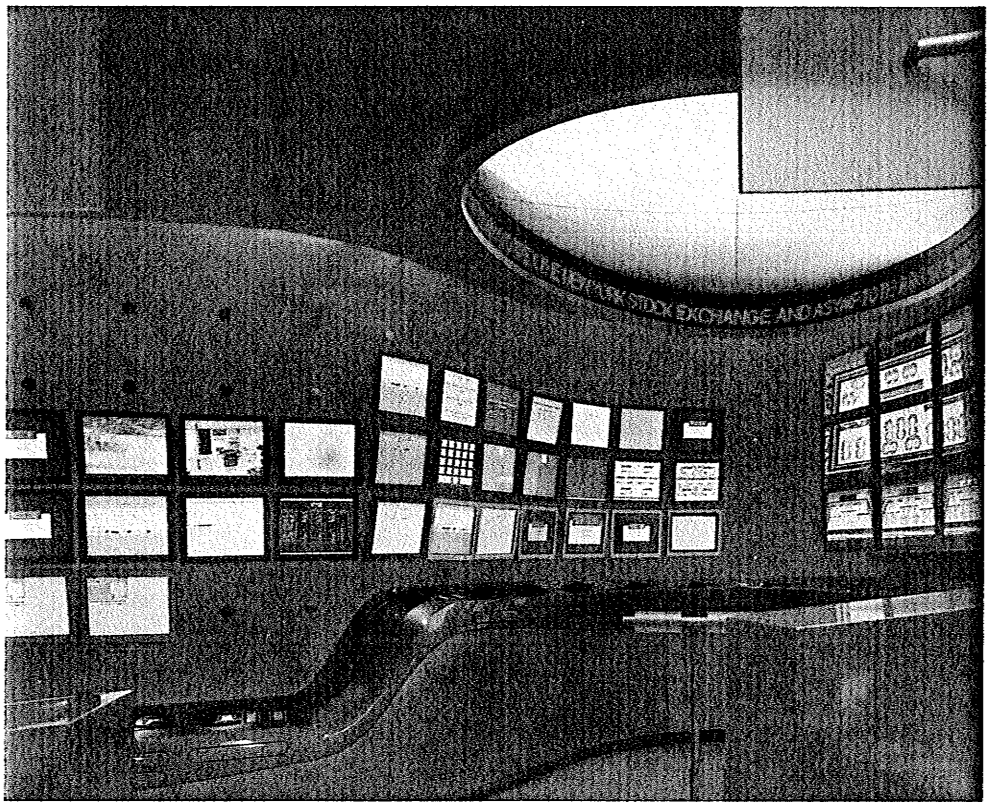

Figure 2.7 New York Stock Exchange, NY. View looking east, at console with monitors, from ramp of Advanced Trading Floor Operations [TFOC]. The Designed by Asymptote, 1999. Refer to Figure 2.3 and Figure 2.4 for orientation.

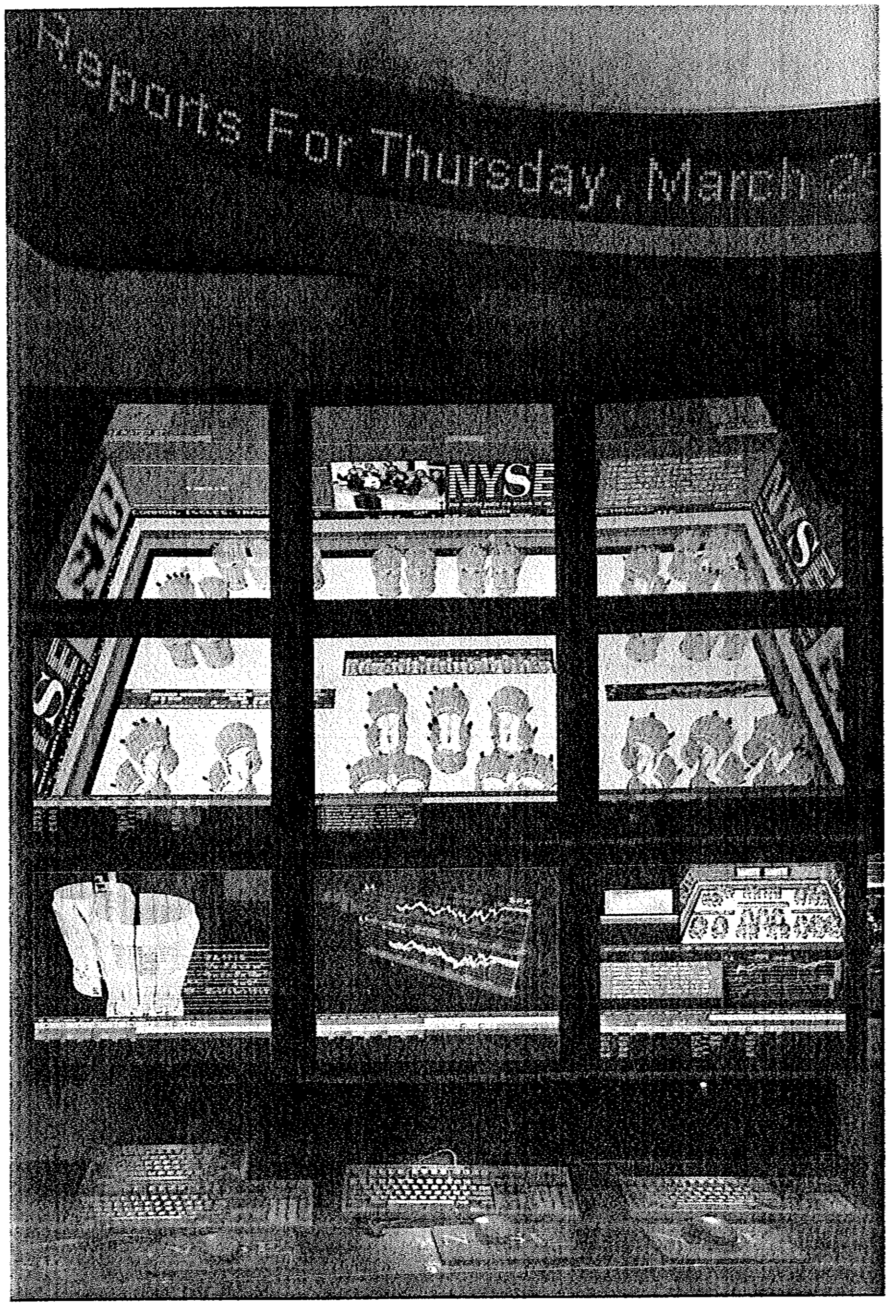

Figure 2.8 New York Stock Exchange, NY. Command Center of the Advanced Trading Floor Operations Center [TFOC], looking south at the flat screen monitors of the Console. Upper monitors show a birds-eye view of the virtual trading floor [3DTF]. The lower monitors shown supporting other views of the 3DTF. Designed by Asymptote. Refer to Figure 2.3 and Figure 2.4 for orientation.

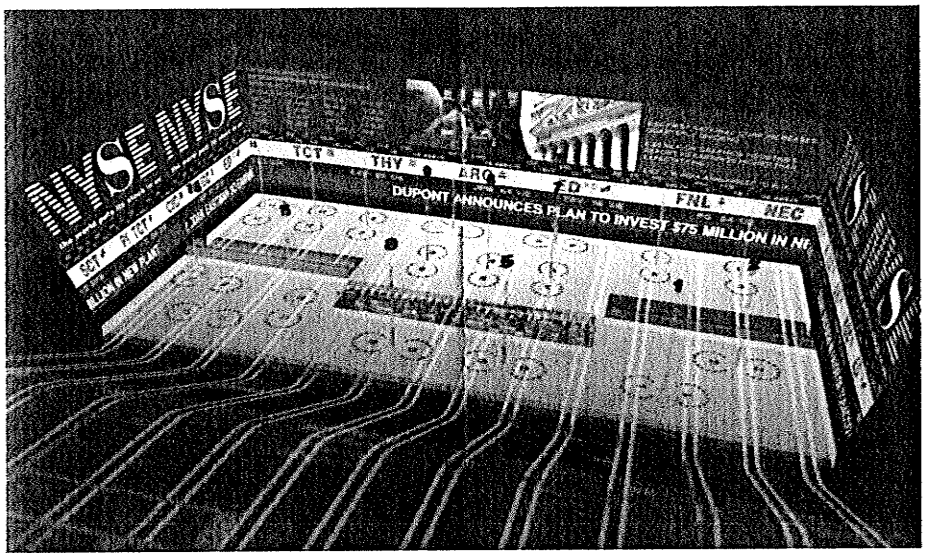

Figure 2.9 New York Stock Exchange, NY. View of the virtual trading floor [3DTF]. The 3DTF supports live-data streams, interactive stock information, running stock tickers and live news feed broadcasting. Designed by Asymptote. Refer to Figure 2.3 and Figure 2.4 for orientation.

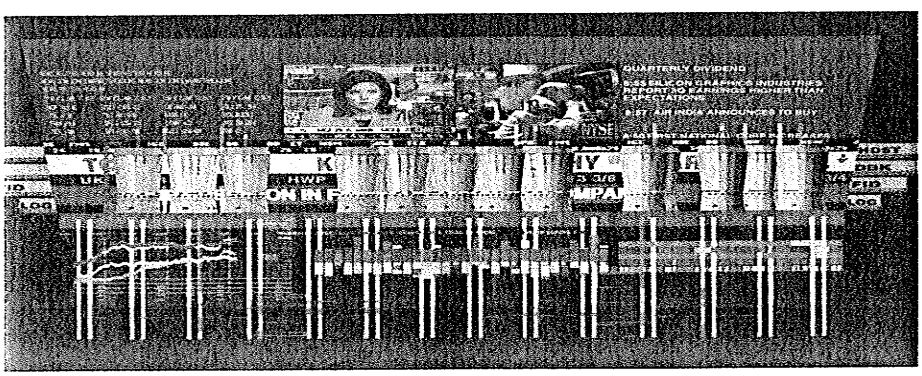

Figure 2.10 New York Stock Exchange, NY. Elevation of the virtual trading floor [3DTF]. The 3DTF supports live-data streams, interactive stock information, running stock tickers and live news feed broadcasting. Designed by Asymptote. Refer to Figure 2.3 and Figure 2.4 for orientation.

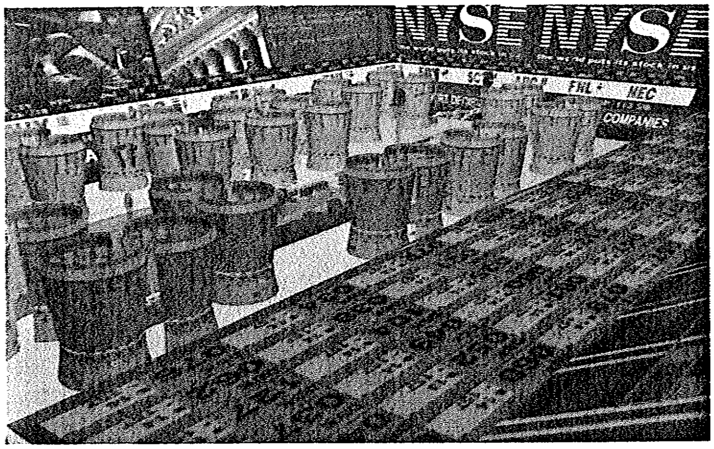

Figure 2.11 New York Stock Exchange, NY. View of the virtual trading floor [3DTF]. The 3DTF supports live-data streams, interactive stock information, running stock tickers and live news feed broadcasting. Designed by Asymptote. Refer to Figure 2.3 and Figure 2.4 for orientation.

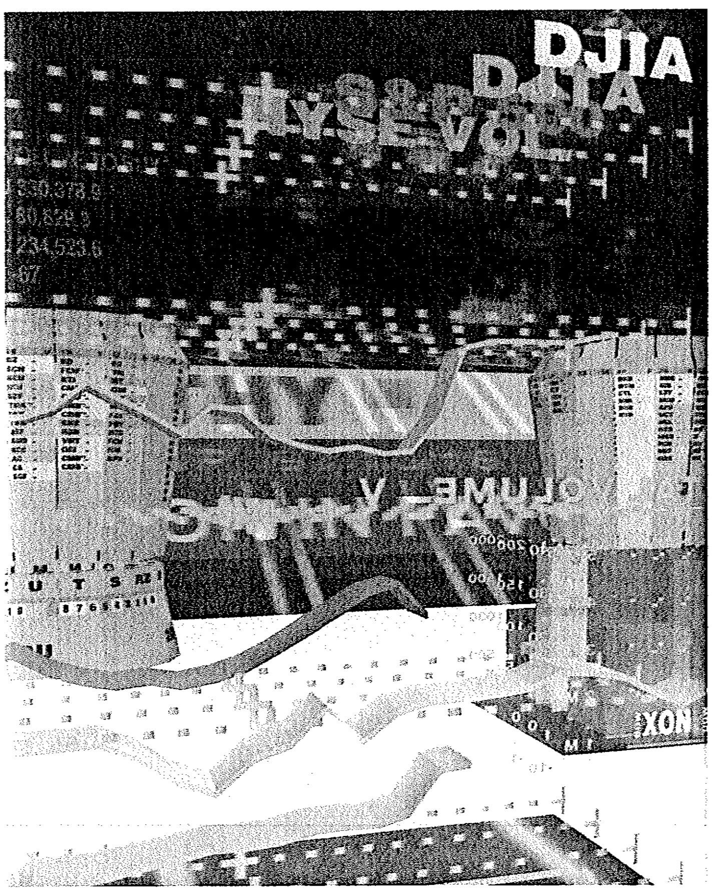

Figure 2.12 New York Stock Exchange, NY. Moving through the streams of data, virtual trading floor [3DTF]. The 3DTF supports live-data streams, interactive stock information, running stock tickers and live news feed broadcasting. Designed by Asymptote. Refer to Figure 2.3 and Figure 2.4 for orientation.

between two adjoining buildings and acts as the main thoroughfare for passage between the buildings. The main trading floor of the NYSE flanks the north side of the ramp, while the Blue Room trading floor rests to the south (see Figure 2.3 and Figure 2.4 for orientation). This portion to the project was called the advanced Trading Floor Operations Center [TFOC].

The other project for the NYSE was the design of a virtual trading floor (see Figure 2.8 to Figure 2.12). This project was to be positioned in cyberspace. Asymptote (Couture & Rashid, 2002) aimed to execute an "architecture that brings together both virtual and real space" (p. 5). The firm was asked to design and develop the two projects simultaneously. For the virtual floor, the design team needed to create an environment "that would facilitate the reading, correlation and navigation of massive amounts of *information*" (Couture & Rashid, 2002p. xx). The *virtual trading floor was designed* to reflect the real-time operations and activities of the physical main trading floor. The virtual trading floor project was called the 3DTF and has been an integral feature to trading floor operations at the NYSE.

The challenge for the design at the NYSE is that employees and traders rely upon rapid fire, ubiquitous streams of second-by-second real-time information flows. These come into the physical trading floor typically through stock reports, stock tickers, news broadcasts, trade updates, client contact and company announcements. The design objective for the NYSE, or any other trading floor, is to place traders in direct contact with these flows of data as much as possible. By introducing the sophisticated 3DTF into the NYSE, this was achieved with raging success.

At the NYSE, the 3DTF circumvent the limitations imposed by the interior architecture. Reflecting the idea that "conventional architectures tend to be based on permanence and geometric certainty whereas virtual architecture utilizes digital technologies to augment real events, times and space" (Couture & Rashid, 2002, p. 50). The physical space and fixed solid materiality of interior architecture may in fact pose to disrupt the flows of data. In contrast, Couture and Rashid (2002) state, "the 3DTF allows for one to occupy several virtual spaces, scales, and points of view simultaneously" (p. 36). It enables the trader to skirt the restrictive features embedded in the traditional materiality of architecture and design.

Virtuality can deliver benefits to business management and operations. As the 3DTF provides a real-time representation of the overall trading-floor operations, it offers a full surveillance of the events on the floor. The advantage is "the deployment of the 3DTFV [3DTF] alongside the actual trading floor allows the operations personnel to gain a deeper and more precise understanding of the many variables and complexities that unfold during a trading day" ("Asymptote: Rashid + Couture", 1999 A + U: Architecture and Urbanism p. 25). The various options for viewing and interacting are extremely beneficial to a moment-to-moment intensive environment. What architecturally could have been presented as a tunnel-like experience, in passing through the TFOC, became instead activated and connected to the events on the trading floor. That is, what could have merely been rendered physically as a vortex, a disjunction or void of information flow, in passing between the two buildings, remerges instead as a data palace.

Complimenting physical space with an integrated virtual space, such as the 3DTF, is becoming noted as highly beneficial operational feature. It is identified as an innovative approach to deal with contemporary business management and organizational issues. As "operations managers can fly through a representation of the NYSE systems, quickly scan the virtual floor to gauge trading activity, or zoom" (Wired, 1999, June). By delivering an entire floor to the fingertips of the trader or operations manager, the trader becomes bionic.[7] Through the 3DTF, traders are able to circumvent the distances and spatial challenges inherent in the physical trading floor. By supplementing the physical environment with an interactive virtual one, traders activate both realms. Traders are empowered to dissolve the whole Cartesian geometry of topography through the actions afforded them in technology of immediacy.

It is important to consider how Asymptote executed the threshold connection in the design projects of the NYSE. In what ways did the multi-spatial design team implement the joints or threshold connections between cyberspace and physical space? (see Figure 2.7, Figure 2.8 and Figure 2.4 for orientation). Unfortunately, traditional and more restrictive interface tools are used in the TFOC to connect, navigate and access information in the 3DTF, through more cumbersome features of the SMK interface. More impressive is the screen used to engage with the 3DTF. The screen used in the TFOC is projected through 60 flat-screen monitors. The monitors here, ordered like wall-tile, work together to create a large portal into the 3DTF. The effect is powerful. The juxtaposition of the multi-screens, as a mosaic, integrates into one dynamic image, bound together

[7] In Chapter 5, an analysis of evolving bionic ability is further explored.

through perception. This multi-screened portal acts as a large threshold connection between the domains. The 3DTF punctures the physical space of the TFOC (see Figure 2.6 and Figure 2.7). Through this enlivened pictorial space (see Figure 2.8) the TFOC visually and operationally stretches and extends out into a larger landscape. Within the physical setting, set and restricted within approximately 1200 square feet of the TFOC, a new trading floor is revealed with the flick of a switch.[8]

It is important to note that the virtual trading floor was created to act as an addition to the existing environment. The 3DTF was intended to act as extension and not as replacement. As noted by Asymptote (2002), it was to "supplement the main trading floor, allowing users to enter a parallel 'reality' and exist in an entirely different place" (p. 50). As a supplementary tool, the virtual environment is used to prop up and provide features that are not possible through the physical design. The prosthetic features offered through cybridity hint at moving humans and buildings toward greater congruency. The 3DTF reconfigures and redefines traditional design elements of space: the notions of distance, geography, reach, site, position, direction, access, approach, movement and proximity.

The 3DTF is embedded with enough power to supersede the existing trading floor. It reveals a potential threat to the practice of design and architecture, reminding us that the proportioning and balancing act of the cybrid is a delicate matter. The potential for advancing states of dematerialization may emerge without consciously intending or

[8] The notion of a 'flick of a switch' is referring to a comment made by Hani Rashid (2002), as in 'turn the lights out'. Rashid is reinforcing the fact that once the power goes out, this all fades away.

understanding it is happening. Designers and architects need to be aware of the potential impact upon increasing states of immaterial culture their decisions in the design process may have. And further, how their role and involvement in projects may evolve or devolve the balance introduced in the cybrid. Understanding the new evolving opportunities, an increasing number of design firms, like Asymptote, have become bilingual in spatial construction.

The benefit of fluency between the spatial domains is that it decreases the potential for marginalization. The fluency empowers firms like Asymptote to remain actively and acutely aware of the evolving multi-spatial conditions in the digital era with an increased advantage. The expanded, and perhaps more complete, sphere of understanding enables the design team to actively engage in a discourse and problem solving solution through both domains.

2.5 Design Principles: 3DTF. of the New York Stock Exchange

The design language for the 3DTF correlates to the design language and principles of its physical counterpart. Asymptote (2002) carefully executed spatial language and representation to construct the virtual trading floor through a synthesis of their architectural understanding of space. That is, the design principles of the 3DTF are grounded in the experience and knowledge of the design of physical space.

Anders (1999) argues that the design of cyberspace and physical space are based upon similar anthropic principles. Anders argues, "Spatial, anthropic cyberspace links to a pre-linguistic knowledge of the world – a knowledge crucial to navigation, operation, and communication (1999, p. 10). These foundations of design principles are available for translation and transfer between realms, such as the NYSE.

Although the design for the 3DTF is grounded in an intimate understanding of physical space, it is not a mere reproduction of it. Through translation, Asymptote evolved and expanded their design ideas to interpret a multi-spatial language. The challenge of this approach is that interior designers and architects will be working with abstract and unfamiliar design elements. As outlined on the New York Stock Exchange webpage, the 3DTF is constructed as "Real-Time data is integrated from several sources to create a visual display that uses three dimensions, animation, colors and geometric shapes to identify business and systems events" (NYSE web). The building blocks used to construct this space are radically different from the building blocks of physical space.

Several design features of the 3DTF become liberated as they are executed in the virtual realm. Design elements no longer are limited by the more restrictive elements of physical architecture. For example, ideas about permanency, strength and gravity – inherent in the materiality of physical architecture — evade in the virtual realm. Design process and inquiry is challenged to expand. In the design process of the 3DTF, Asymptote (2002) recalls, "primarily one had to consider how to navigate a realm of data" (p.35). This challenges the traditional notion of navigation, as embedded only through the relationship between the body and physical space. The investigation of moving through data is different from preparing to move bodies through traditional architectural and design elements such as corridors, hallways, aisles or pathways.

Navigating data requires further inquiry into areas such as access, memory, visualization, cognition and perception.

In developing the 3DTF, Asymptote aimed to infuse an experiential quality into the interactive virtual space. The objective was to derive a unique cyber-spatial language from the experiences of architecture within physical space. In their approach, the design team of the 3DTF infused "…the tectonic qualities that make real-world architecture vibrant, legible, and visually stimulating: scale, color, light, texture, graphics, and formal invention" (Amelar, 1999, June, p. 141).

The 3DTF is an unfinished project. It is an expanding and evolving environment. Although it was intended for NYSE employee use, its intention and scope has expanded significantly since it was initiated. Access to the 3DTF has become available more recently to a wider audience, as various brokerage houses, banks and individuals can move through the virtual floor from their various access points around the globe (Couture & Rashid, 2002). Thus, the physical space of the 3DTF will remain unfinished as it continues to expand outward.

As the NYSE expands out to a wider audience through cyberspace, the need for the physical location of a trading floor space becomes questionable. As discussed thoroughly in Chapter 1, the relationship between the virtual and physical is coaxial and volatile. Identified by the designers of the NYSE, who claim, "The mutations and elaborations of the project have further architectural implications as the virtual realm slowly usurps the real trading floor as a 'place'" (Couture & Rashid, 2002, p. 37). The evolving and unfinished condition of the virtual site is repositioned as an undefined threat.

2.6 Exploring Cybridity in the Design Studio

The reciprocal relationship between cyberspace and physical space exposes this as a critical point for further inquiry. The complexity is revealed when Mitchell (1998) comments, "…the material now appropriates from the virtual, and the virtual from the material" (p. 208). Design inspiration, reference and information cut across both spatial domains to activate and engage the other. Reciprocity, as an active design ingredient, which requires further analysis.

In *Envisioning Cyberspace*, Anders (1999) introduces a case study, whereby he poses a design problem to his architecture graduate students, from the University of Michigan. The intention of the inquiry was to instigate a deeper inquiry into cybrid design principles through the design studio. According to Anders, the students responded by exploring a dual site investigation simultaneously, resolving the design using both domains as deemed adequate and executing the resolution partially through cyberspace and partially in physical space.

Anders' students demonstrated an ability to translate spatial design principles between and across the domains of cyberspace and physical space. Students were challenged to critically assess which elements would be executed or housed in cyberspace and which elements would be rendered in the physical spatial solutions. Through this assessment, students demonstrated an ability to constructively identify the benefits as well as the limitation inherent in each domain.

Design instructors Sally Levine and Warren Wake (2000, 2002) embed similar enquires into design studio projects. Levine and Wake challenge their students to explore principles of cybridity in relation to interior design and architecture. They integrate this into their advanced level interior design and architecture design studio at the Boston Architectural Center [BAC]. Students are challenged to expand projects through a dual site location. Using what Levine and Wake (2000) call *siamese sites,* students were encouraged to grow a single and independent design program into a dual realm design project. The students effectively handled the multi-spatial complexities. As explained by Levine and Wake, "Students considered the unique characteristics of each realm as well as the connections between the two" (2002, p. 19). Similar in response to Anders' students at Michigan, the students at BAC were capable of distinguishing unique advantages inherent and characteristic of each domain.

The nature of reciprocity between cyberspace and physical space is an important area for study in design and architecture. The BAC students came to understand the connection between the two domains was volatile and challenging to compose (Levine & Wake 2002). Students understood that design changes, as decisions made in one spatial domain, had a direct and perhaps drastic effect or consequence upon the other. Exploring this in studio helped students develop skills to critically assess the pros and cons of each domain. For each domain, students could explore through design process the spatial limitation, ability, boundaries, capabilities and effect – and in turn, experiment with several opportunities to overcome these.

Levine and Wake's studio embraced sophisticated computer software. Experimenting with what they call complementary virtual architecture [CVA], the students were able to explore a virtual and physical environment simultaneously. The project encouraged the use of interactive virtual architectural models, multimodal site design principles and the use of avatars. Of particular interest, to execute a successful project, students would be challenged to find ways to translate experiences from physical space into virtual and vice versa. For example, in developing an avatar, students would be challenged to translate human experiences. Ideas such as movement and spatial relationships, as founded in physical space, would need to be effectively translated into the virtual spatial design. The exploration of these types of projects required advanced learning beyond physicality and may include video game software, interface design or artificial intelligence technologies

2.7 Design Principles: Cybridity & Aesthetics

The aesthetic features of cybridity are a valuable area for further analysis. If the intention is to create a more cohesive integration between cyberspace and physical space, it is imperative to consider the role of aesthetics in this integration. As these spatial domains move into a state of convergence, how do they visually collide? How can aesthetics in interior design aid, or hinder, the integration?

Interior designers and architects participate as team members in the overall construction project of the threshold connection between the cyberspace and physical space. These professions are not the sole designers in the final crafting or joinery between the domains. Rather, they are responsible for the physical spatial aesthetics involved and applied to support or hinder this joinery. Other team members – interface, industrial and information designers - work on a variety of levels to also contribute to the overall impact of seamlessness at the threshold connection.

The study here shifts the discussion toward an analysis of the aesthetic characteristics of physical space in relation to its correlating virtual spaces. And vice versa. How do these domains inform and influence one another in the overall design aesthetic? I argue to achieve advanced seamlessness, not only will functional considerations need to be supported across the two domains, but also a deeper understanding of the aesthetic features of each domain independently and in relation to one another.

The design of cyberspace should be much more than mere illustrations of the physical world in which we inhabit (Anders 1999; Asymptote 2002). A literal representation undermines the inherent capabilities of cyberspace. By restricting cyberspace through exact representation, Anders (1999) claims it "fixes the cyberspace into a map of its physical counterpart. Defined so rigidly, the on-line architecture can't benefit from cyberspace's inherent fluidity" (p. 198). These restrictions defeat the opportunity to evolve a new spatial language. Rather, an online architecture should take advantage of and reflect its advanced abilities to be reflexive, stretch out globally or retract.

Aiming to represent cyberspace as a literal rendition of physical space is not effective. Representations in cyberspace of elements such as rooms with walls, doors, ceilings, floors, light fixtures, and finishes of traditional interior spatial elements translate into mere decoration. The elements are grounded in a response to environmental conditions, such as gravity, temperature, acoustics, structure and tactility. By implementing them into cyberspace, they appear lost or out of place, as trivialized versions of their physical counterparts.

To illustrate this further, I refer again to the design of the 3DTF at the NYSE (see Figure 2.8 to Figure 2.12). If the virtual trading floor merely mimicked the physical trading floor, as a mere literal representation of the physical trading floor, some of the most striking benefits and features offered in the 3DTF would disappear. Features such as the effective use of interactive hyperlinks, navigating along with the streams of data and real-time global connectivity's would not be available.

The design of a purely abstracted representation of cyberspace proves frustrating. Although supporting the agenda of highly creative individuals, advanced abstraction raises significant issues about orientation, legibility and the human interface. The challenge is that familiar spaces become trivial, yet highly advanced abstractions of the unfamiliar can be unsettling. As Romero (1998) explains, "…we cannot break clean from our past experiences in order to envision and create a visualization model for the open system of the web or any number of systems of information architecture" (p. 50). The environment and artifacts become the tools used to represent the spaces of cyberspace, as these are the familiar and the comfort zones. Individuals in physical or cyberspace understand the functional features and metaphors associated with door, window or file.

At the NYSE, the design team for the 3DTF integrated a combination of inherent characteristics of both spatial domains. The design team spatially derived the foundation of the model from the physical character of the NYSE trading floor (see Figure 2.5 and Figure 2.6). The intention was to avoid disorientation. Yet the final model also reflects the design process, integrating the more fluid on-line features of cyberspace (Amelar, 1999, June). Using physical spatial representation to ground the abstractions of cyberspace was also a popular design approach by Anders' (1999) students at the University of Michigan. Anders explains that students used sources as found in the physical architectural *site or building as inspiration.*

Aesthetic characteristics can effectively translate between domains. For example, at the NYSE, the design of TFOC derives distinct inspiration and influence from the virtual trading floor of the 3DTF (see Figure 2.3 to Figure 2.7). The design supports some noteworthy features such as the "backlit and video-blue" glow of " the command center evokes cyberspace" (Amelar, 1999, June p. 145). Through the use of colour and light, the environment of cyberspace can transcend the design language within the interior environment. This representation of design character strengthens and reads as a cohesive cybrid design aesthetic. The "Sleek, sexy and high-tech" design of the TFOC "contrasts with the visual cacophony of the gritty, paper-strewn trading rooms that flank it" (see Figure 2.3, Figure 2.4 and Figure 2.5) (Amelar, 1999, June p. 145). This implies there is a stronger design link created within the threshold connection between virtual and physical than there is in the relationship between the physical space of the TFOC and rest of the physical trading floor.

Architect and lecturer Sarah Chaplin (2002) argues the visual quality of cyberspace is growing as an aesthetic reference for designers. Cybervisuality has a significant influence to inform the design of our build environments. In reviewing the design of London's Segaworld, Chaplin describes the design and lighting as intending to make it feel like an ephemeral or as a 'virtual' space (2002, p. 42). This cross-domain design ideation strengthens the connections between the physical and cyber worlds. Once translation and fluency are established, the integration can become more intense.

To comprehend the impact of cybervisuality on interior design, further studies must be pursued. Chaplin (2002) encourages further enquiry into the relationship between spatial design derived from cyber-like environments, such as those developed in video gaming, sci-fi films and other emerging online environments. The value in this, she argues, is to "ascertain which metaphors are dominant, which operational systems are presupposed, and which aesthetic codifications are being established" (2002, p. 43). Gaining an additional grasp and fluency on the origins of the cyber derived design language requires further exploration and attention.

There is something chic about a cyber-like aesthetic infused into the design of inhabitable space. Not only is it novel, it also represents the ambition of cyber space to free itself from the confines of the screen. According to Horan (2000), there is a trend in interior design and architecture to embed an advanced technological aesthetic edge as integral to the "overall design aesthetic" (p. 44). Glowing screens as feature walls, surfaces that change colour or texture, interactive surfaces or sensor-controlled fixtures reflect a computer-like spatial quality. The impact of this trend may inform new ideas for material creation or textile design that reflect a cybervisual quality.

Advanced technologies can be used to inform a design inquiry. In the case of the design studio conducted by Peter Anders (1999) at the University of Michigan, some of his students used the technology as a tool to inform their form making and design processes. This approach has become common among studios and design firms where the cyber abstractions and studies will influence the design process. The current trend in design schools and progressive design offices relies heavily upon emerging virtual modeling software programs to execute and inform the form making process.

The virtual model may inform the design process in powerful ways. Similar to the argument made earlier, that cyberspace should not be a mere representation of the physical places we inhabit, the reverse is equally true: physical space should not be mere representations of the cool abstractions made available through modeling software programs. The current whirlwind and complete adoration of a software aesthetic is reflected in contemporary avant-garde architectural buildings. There is the possibility that through these modeling programs, formation can quickly appear banal, as literal interpretations of the software. The inherent concern is that the cool effects of advanced software may erode investigation. Just because one is capable of modeling organic flamboyant forms, does one need to build them? Some of these forms demand an excessive use of materials to effectively deliver the shape and design intent.[9] Also, these highly customized pieces of architecture prove to present increasing challenges for a readaptive use in the future.

The reciprocal nature of this relationship between cyberspace and physical space deserves further study. As more advanced technologies evolve, there will be more opportunity to study the aesthetic connection between these domains. Anders (1999) notes, "The problem of the interface between 'contiguous' physical and cyberspaces remains a promising subject for research" (p. 201). The seamless integration between virtual and physical space relies upon investigations into both the functional and aesthetic qualities as inherent in each domain.

2.8 *Evolving Practice*

Design practice is at a critical crossroads. The options appear limited. In the first option, the professions may remain isolated in practice methodology from the profound influences of cyberspace. In the second option, the professions may choose to accept and embrace this influence, becoming effective participants in the creation of future cybrid. I argue that interior design and architecture need to pursue the latter of these two options as they have a significant role to play in the creation of the future cybrid.

The challenge is that interior design and architecture may need to redefine their practice and process to effectively evolve with the cybrid model. Mitchell (1999) claims the consequences of this to be profound, as it will "redefine the intellectual and

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[9] 'Excessive waste' is not applicable to all scenarios. The ability to be resourceful through the of advanced computer software is explored further in Chapter 5.

professional agenda" of spatially reliant design professions. It is important to discuss some of the greater challenges and hurdles the professions will face in moving forward in cybrid design.

The design of the cybrid introduces new challenges for professions to maintain their identity. The cybrid introduces new potential roles and responsibilities to the design process. Professional boundaries are blurred as more designers choose to work more fluidly between, or within, physical and virtual spaces. The practices may abandon previous alignments with professional organizations as they may appear too restrictive to their evolving fluid identity. The professional organizations may feel threatened by the ability to create, a cybrid design practice.

One of the greatest challenges in cybrid design is that designers need to delve into complex philosophical investigations to evolve their discourse. Current practice needs to expand into areas of ontology, phenomenology and perhaps into areas of metaphysics to help redefine the new cybrid spatial features. Designers will need to evolve what constitutes the design problem into unfamiliar territory. For example, designers can explore new networks and relationships never contemplated before. They may be challenged to investigate the design connections between skin and font, pixels and fabric or interior volumes and hypertext. The design process will need to open up to a broader base of discourse to evolve the cybrid.

Cybrid design presents increasing challenges to previously established design metrics. For example, one of the most profound features of the cybrid is that it challenges traditional features of design practice as reliant upon topography, geography, platonic solids and pure Cartesianism. Cybrid space introduces and supports the claim that "there has been a morphological breakdown in the dimensional field" (Virilio, 1998D, p.61). New dimensional relationships emerge that demand a reinterpretation on concepts of proximity, adjacency and access. Designers are challenged by this task. Chaplin (2002) argues:

> To respond to and also bring about the recoding of perception if it is to remain effective in terms of creating the kinds of environment that people can relate to in the twenty-first century. Design professionals need to be able to develop a revised understanding of perception that might lead to the creation of more exciting ontologically hybrid spatial conditions." (p. 43)

Cybridity challenges tried and true design methodology. There is minimal history and discourse to consult with here, there is no road map, and there are few references to learn from as we embark on future creations of the cybrid. Horan (2000) observes, "While the electronic and physically based layers of experience are moving together, there is no one design solution for this interweaving. There are many permutations possible to achieve the recombinant design axiom of threshold connections" (p.120).

There are several possibilities for the future execution of cybridity. Anders (2004) perspective is grounded in the belief that "...digital technology, embodied in cyberspace, offers new opportunities for architects and designer" (p. 9). The issue is that in order to take advantage of these opportunities, individual designers will first need to understand the underpinning and phenomena of the conditions of cybridity. Although relatively new and still in its infancy, cybridity will evolve into an increasingly complex phenomena.

The condition will require a dedicated level of constant surveillance and evolving research to monitor its evolution.

The design professions have reached a crossroad, a choice between continuing along a road that is familiar versus one that is unknown. Whichever road they take, survival of the profession relies heavily upon how they choose to engage and remain informed on the evolutions of cybrid space. An active and educated awareness of its effect on interior environments is the only means to prepare for its significant role in the future of design and architecture.

CHAPTER THREE

SPATIAL TYPOLOGIES

CHAPTER 3: SPATIAL TYPOLOGIES

In this chapter, I present evidence of how traditional spatial typologies are changing in the digital era. Over the last fifteen years, the condition has come to directly reflect what Academic Head of the Program in Media Arts and Sciences at Massachusetts Institute Technology [MIT] William Mitchell (1995) presents as *recombinant architecture.*[1] According to Mitchell, recombinant architecture is a prominent new spatial typology that now defines much of twenty-first century architecture in Western culture. Responding to the infusion of advanced technologies, buildings systematically have reformulated in composition. Currently, buildings and spaces are defined through a physical material presence as well as the invisible networks of advanced systems of technology that support it (Horan, 2000; Mitchell, 1995, 1999). In Mitchell's view, recombination alters and influences the foundation of spatial language.

Recombination relates closely to notions of *cybrid space*, as introduced by Peter Anders (1999).[2] As cybrid, the new architectural recombination and its emerging identity in culture can be understood through the complex and intertwined combination of elements that are both visible and invisible constituent parts.

In this chapter, I review the current status of Mitchell's recombinant characteristics of space as they have evolved into the interior environment. Drawing closely upon ideas of *digital places*, as introduced by Professor and Executive Director of

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[1] For additional details, see the chapter titled "Recombinant Architecture" in William J. Mitchell's *The City of Bits: Space, Place and the Infobahn* (1995).
[2] *Cybrid Space* is explored in further detail in Chapter 2.

the Claremont Information and Technology Institute, Thomas Horan, I discuss the evidence of spatial typologies. Through analysis, I provide evidence of the emerging spatial typologies in contemporary digital culture. And further, I illustrate the role of these spatial typologies on the design, practice and methods of interior design and architecture.

Within the first section of the chapter, I present an analysis of how typologies are understood in interior design and architecture. Drawing closely upon cultural analysis and theory, I discuss how individuals refer to design as narrative to understand the world they inhabit. To ground these ideas, I refer to theories in Structural linguists as introduced by Ferdinard de Saussure and expanded through Semiotics as modeled by Charles Sanders Peirce. Through this approach, theory is integrated as a tool to illustrate in what ways typologies are constructed and how they are integral to the design of space. I illustrate how design actively shapes spatial language. Further, I review how this contributes to interpretation and meaning making.

In the second portion of this chapter, I give a detailed account and analysis of the Dutch bank ING Direct Internet Café, located in New York City. Through this case study, I illustrate how technology reformulates interior design and architectural spatial language. As a new recombinant bank typology, ING presents itself as a progressive model reflecting a complete disengagement from traditional spatial identity. I review where opportunities and challenges emerge in the new typology through this discussion.

Introduced through the Swiss psychologist and philosopher Jean Piaget's notion of *mental schemata* and architectural theorist Christian Norberg-Schulz's ideas of socialized design formulas, I argue that unfamiliar typologies present challenges for the design process and practice. Through further analysis, I illustrate how typologies inform interior design and architecture programming and process. I highlight how recombinant design is a sign of a shifting design paradigm. And further, I discuss how design specialization may be an inhibiting factor in effectively progressing this shift in the paradigm.

Through this chapter, I draw attention to how advances in technology are redefining the stable and established spatial typologies that have defined many familiar environments of Western society. Interior environments such as the library, the bank, the office, the school and the museum have become unstable in their identity. I present this chapter as an introductory analysis to these *instabilities*.

3.1 Constructing Typology

To best understand the recent evolution of spatial typology, it is important to first discuss how spatial identity is constructed, what a typology is, how individuals define them, and what significance they play in framing and reinforcing cultural identity.

The term *spatial typology* refers to a categorization of types of spaces, facilities and/or buildings. For example, a library space is one typology, an office another typology and a bank another. The term typology is defined as "the study or systematic classification of types that have characteristics or traits in common" (Dictionaries, 2000b). To understand a spatial typology, individuals must first sift through a variety of visual sources, cues, characteristics and traits in spatial language. People use these sources to activate a classification process where they mentally order and categorize these characteristics and traits into groupings.

Classification systems support the evolving definition of a spatial typology. To illustrate this further, I refer to Structuralism's contributions to assessing meaning and interpretation. Saussure claims that language, and the interpretation of it, relies heavily upon an underlying system of cultural symbols and signs (Dictionaries, 2000b; Eagleton, 1983; Sarup, 1989; Silverman, 1983; Storey, 1998). This approach is later adapted through the work of American philosopher Charles Sanders Peirce in evolving what he calls *Semiotics*.[3]

Semiotics delivers a deeper understanding of how language assembles to support interpretation. As cultural theorist Mieke Bal (1998) notes, "Semiotics focuses on *construction and representation, considering 'texts' as specific combinations of signs* yielding meaning" (p. 74). Each space, supporting a combination of design elements, can support the role as texts and can be mined for a deeper reading and understanding of spatial interpretation.

There is great value in applying Semiotics to design and architecture. Reviewing space as a language provides designers with an opportunity to explore how spaces become coded, synthesized and categorized, and in turn, available for interpretation. Interior design professor and researcher Cathy J. Ganoe (1999) explains, "Semiotics has helped designers to understand how design images create a culturally shared visual language that is ordered and read like a sentence" (p. 3). As language, design elements

[3] For a more extensive review of Semiotics, I refer the reader to *The Subject of Semiotics* by Kaja Silverman (1983).

present themselves as tools for analysis, synthesis and classification. Ganoe argues, "Use of a narrative framework made specific to interior design can assist the designer in making wise concrete decisions about complex and abstract phenomena" (p. 3). This framework can ground complex unknowns in design and evolving phenomena, such as the alterations to spatial understanding in the digital era.

Interior design and architecture provide a plethora of props and elements in visual language to support a reading of space, similar to the reading of text. According to Saussure, the *sign* acts as the basic unit of analysis for language (as cited in Macey, 2000). Each sign is defined through two features: the *signifier* and the *signified.* The signifier, or the *sound-image,* is any item or "form capable of eliciting a concept" (Silverman, 1983, p. 6). It is an item that triggers thought, such as a word on a page, an element in a photograph or, in spatial terms, a furniture piece in an interior space. The signified, on the other hand, "designates the concept which the form evokes" (Silverman, 1983, p. 6). The signified, known as the *concept-image*, is the thought that comes to mind upon viewing or identifying the signifier. The signified can be understood as the concept or mental picture. The signifier and the signified together support an interpretation of the sign.

The interpretation of one sign relies heavily upon the interpretation of other signs. A sign, according to Saussure, relies upon "the result of the interplay of a network of relationships between combination and selection, similarity and difference" (as cited in Storey, 1998, p.75). Signs become compared and contrasted. Meaning and interpretation hinges upon an active engagement with this larger system, comprising a variety of other signs. A sign is not ascertained through the review of it in isolation; rather, it relies upon an active engagement with a variety of other signs to define what it is and what it is not.

Meaning associated with spatial typology works on similar language principles. For example, a library is understood as a distinct spatial typology in that it differs in design character from other non-library spaces. An individual can identify contrasting design characteristics between the library and other typologies, such as the bank or the office. During classification, or typology construction, individuals also attempt to find correlations in design features that reinforce commonalities in design language. According to the Structuralists, a typology, as in the library, becomes understood when there is a mental affiliation of design attributes associated to or synonymous with "library-ness" (Palmer, 1997). This cultural understanding of "library-ness" is constructed through a combination of learned experiences, such as memory recall of inhabiting library spaces; visual or other references to libraries in cultural media; or, for the designer, the activity of designing libraries. The library typology becomes identified through the act of this split affiliation of comparing and contrasting both library-like and non-library-like typologies.

Through Semiotics, the construction of a spatial typology can be further explored. For instance, the library as a typology can be understood as a sign. Specific design features, such as rows of books, can act as the signifiers. These signifiers work to trigger the mental image of the signified, which is the mental conception of what a library is. Classification, as in defining a space as one typology and not the next, relies heavily upon this type of active association between the signifiers (the books) and the signified (concept of 'library-ness').

Design language, and the reading of it, can occur at a variety of scales. Ganoe (1999) argues that there are variations in the depth of these and presents three degrees of readings: low-level, mid-level and high-level readings. In terms of the library typology, a low-level reading conveys the library as merely an interior space that houses rows of books. On a more intense reading, additional detail is sourced as elements for narrative. For example, in the case of a high-level reading, details such as the character and sequence of space become available for further review and are scrutinized more closely for meaning. These high-level readings reveal cultural messages. A traditional library typology, such as the Rose Reading Room at the New York Public Library, conveys messages about the institution's dedication to formalism, tradition, classicism and scholarly research. As a municipal institution, the interior conveys notions of a commitment by the city in that it celebrates literacy, progress and enrichment of its citizens through knowledge.

To assemble meaning and understanding of a typology, a multitude of elements in design language can be consulted. Elements such as spatial proportions, materiality, furnishings, equipment, placement of objects, sequencing of spaces and volumes and various other design characteristics inform this process. It is through location, sequence, product and material specification that design embraces and embeds systems of codes to elevate, evolve or reinforce meaning and the construction of typology.

Challenges of this type of inquiry are revealed in Peirce's model of Semiotics. According to Peirce, "An interpretant [signified] can become a sign [signifier] which produces a new interpretant [signified], and the same operation can occur with each subsequent interpretant [signified]" (as cited in Silverman, 1983, p. 15).[4] In other words, a sign yields an interpretant, which in essence becomes another sign that yields another interpretant and so on. Film critic and professor of rhetoric and film at the University of California, Berkley, Kaja Silverman, describes this as "the quality of endless commutability" (as cited in Silverman, 1983p. 15). This exposes one of the primary criticisms of structuralism, as defined and grounded in post-structuralist discourse (Belsey, 2002; Sarup, 1989). This endless looping effect contributes to claims there are no secure meanings and interpretations.

Although *meaning appears diverse and fluid, consistency in design and* architectural language provides opportunity to infuse some stability. Saussure argued, "The relationship between the two [signifier and signified] is simply the result of convention of cultural agreement" (as cited in Storey, 1998p. 74). There are no rational and secure associates between the signifier and the signifier; rather, they become learned through familiarity. The association is one of cultural agreement through the patterns of acceptance and repetition (Silverman, 1983). Through regular and consistent design language, the notion of randomness fades, and cultural meaning has opportunity to be infused and reinforced. Through repetition, typologies evolve in this manner and become

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[4] To understand the key differences and evolution of Saussure's structuralism expanded into Peirce's semiotics, I refer the reading to the chapter titled "From the Sign to the Subject, A Short History" in *The Subject of Semiotics* by Kaja Silverman (1983).

firmly grounded. Consistency in design language acts as the glue that secures and reinforces the meanings that define these spatial typologies.

Through repetition or design standardization, individuals in Western culture associate and come to expect certain signifiers – signified- sign relations. Individuals come to expect that office interiors house workstations, living rooms have sofas and kitchens have sinks. This is not to argue that a designer could not break away from these standards, but through repetition the relationship between these items becomes more secure. When these occur with enough regularity, they become design standards, appearing as expected and necessary features to define the spatial typology.

Interior designers and architects actively engage and activate codes in spatial language. Western society has secured codes in a variety of frequently used finish materials of interior environments. For example, one can draw links between marble stone as a finish to convey notions of wealth, strength, tradition and classicism. Designers will reference these underlying messages and codes when considering a marble application. Designers actively consider if the codes embedded in the material option is appropriate for the intention (as desired code) of the space.

Clients also actively engage in spatial reading and interpretation. These are often expressed through the early phases of the design project, voiced as project hopes, aspirations or objects. In commercial office design, they may express hopes for the future project to convey accomplished business success, flattened hierarchies or enlivened energy of the business organization.

More recently, my clients have been requesting that I don't "make it look like a dot-com". At the close of the twentieth century, dot-com's had evolved with enough regularity to establish a distinct office typology.[5]

After the dot-com crash of 2001, I noticed clients became concerned about which design elements may convey "dot-com-ness." Unfortunately, some of the progressive design innovation that marked the dot-com era quickly became tainted with codes of failure after the bubble burst. Design elements carried a new set of potent codes that could convey business aloofness, unstable identity and organizational immaturity. As narrow and perhaps as paranoid as these interpretations may appear, it conveys the strength and speed upon which new associations can become established through spatial language.

3.2 Langue & Parole

To illustrate the rules of language more clearly, I briefly refer again to the foundations of Structuralist theory. Saussure provides an analogy between language and a game of chess (as cited in Palmer, 1997; Sarup, 1989; as cited in Silverman, 1983). He claims that language is split into two components: the *langue* and the *parole*. The analogy of chess provides an example of these two primary components that influence its use and meaning. The *langue* refers to the underlying structure that informs the parameters of

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[5] Dot-com businesses took hold between 1998-2001 in New York City and helped reinstate innovation in commercial office design. Based on my own experience, dot-com clients were typically young and wanted something specifically 'fun-looking' and 'non-traditional'. For example, one client (Opus 360) requested a video game den and a doghouse. Other clients had requested hammocks and slides between interconnecting floors.

each game. This can be understood as the governing rules and regulations of the game. *Parole*, on the other hand, represents the independent moves that occur within each game of chess. The relationship between the two is essential to understand language and meaning, as neither operates independent of the other. For example, if an individual wants to play or follow a game of chess, they need to have some familiarity with the rules (langue) in order to understand the strategic moves, operations and motives of the game. Without the rules (langue), the independent physical artifacts used for the game loose their meaning. Items such as the token of the king or the queen are understood as mere woodcarvings, trinkets or sculptures. The patterned checker board upon which these tokens rest can be viewed as little more than a tray for the trinkets.

To understand how this can translate into spatial language, consider some common trends in design today. In Western culture, workstations or systems furniture are a widely accepted design standard in the interior design and architecture offices. These evolved out of the International Style of the 1960's and have continued to proliferate into our office environments to this day with regularity (Budd, 2001). Yet as office environments become wireless, what role will the workstation play? I argue that the digital revolution will continue to highlight outmoded elements in design standards and present opportunities for new responses. The workstation, in its current form, hosted by static materiality complimented with electrified panels, will surely be rendered as inappropriate in a wireless environment. Some individuals believe workstations are already outdated (Mitchell, personal communication, June, 2004). If they continue to be used within wireless environments, it presents a potential disengagement between the parole and the langue in design. That is, the material features of the workstation, may shift into a position of trinket, as discussed previously in Saussure's chess analogy.

Even if the digital revolution promises to continue to rapidly evolve, it is important to take stock of what is currently unfolding. As recommended by Saussure, "the system of language is a vast structure that is always changing... we need to take a snapshot of a language at a particular time, and examine all the rules that hold it together" (as cited in Fillingham, 1993, p. 94). The emergence of unfamiliar typologies suggests that the rules that hold language together are changing. This change in the rules, or the langue, is the premise behind the recent changes to spatial typologies. To illustrate how evolutions in typology have emerged into our built environment directly, I provide the following analysis on the interior design of banks.

3.3 Case Study: ING Direct Internet Cafe

Some of the most stable spatial typologies of the twentieth century are showing signs of change. There is mounting evidence that some of Western societies' most traditional and secure typologies are going through a dissolve and recombination (Anders, 1999; Horan, 2000; Mitchell, 1995, 1999). Mitchell (1995) observes "Digital information decomposes traditional building types" (p. 47). The familiar, secure and traditional spatial typologies, as presented in design and architecture, are going through a process of dematerialization as outlined earlier in Chapter 1. Mitchell explains, "The spatial linkages that we have come to expect are loosened. The constituent elements of hitherto tightly packaged architectural and urban compositions can begin to float free from one another, and they can potentially relocate and recombine according to new logics" (p.47). Through the integration of technology, designers and architects can effectively dissolve and then reformulate spaces into new innovative typologies.

To illustrate an evolving typology, I provide a detailed account of a new banking typology: ING Direct Internet Cafe. Through this examination, I will illustrate how traditional banking models, modern banking and technology support the dissolve and recombination as presented by Mitchell.

Money has become increasingly abstract in the digital era. The activities of banking have been deployed toward the virtual domain, into cyberspace (Castells 1996; Castells 1997). The impact of this is noted in the work of Mitchell (1995), who argues that the results render the classical and more traditional notion of the bank moot.[6] As electronic and digital networks enable us to transact, transmit and deal with money digitally through global network connections in cyberspace, "Bank buildings, then, are no longer where the money is" (p. 47). As features in the traditional bank typology – walls, a ceiling, teller windows and a safe – become the questionable features of the new banking typology, the question then arises: What supports the act of modern day banking?

The introduction of the Automated Teller Machine [ATM] marked a serious alteration to spatial sequencing and banking at the standard bank branch. The creation and wide-spread popularity of the ATM reflects the idea that "a distributed presence mitigates against large central facilities" (Anders, 1999, p. 194). As a consequence, the need for the bank as a building was reduced and in some cases eliminated. The dissolving

[6] Making reference to the impact of technology on banking and the bank typology in architectural analysis is common (Anders 1999, Mitchell 1995).

of the traditional bank in the presence of the ATM is a primary example of dematerialization, as outlined in a previous chapter. The bank, once symbolized and distinguished by impressive facades and dazzling interior spaces, fades in the digital era (Mitchell, 1995). As noted by Eden Muir and Rory O'Neill (1995), researchers at Columbia University, "for many customers, the only thing that distinguishes banks is their software – the color of the touch-screen buttons and the number of taps it takes to view a checking balance". How does the dematerialized bank, in its dissolve, find new identity through other mediums? Is there any opportunity to recapture identity, spatially, once they are rendered through screens, buttons and graphics?

Sophisticated and distributed network systems can place ATM's everywhere and anywhere. Site and context shift and evolve. The impact of placing these powerful and complex digital machines into various places alters the previously established pattern of the place into which it is set. The introduction of an ATM demands a redefinition of the previously defined spatial typology. I argue that the act of placing these machines into these settings have significant consequences for the space. There are new design problems, new relationships, and new interpretations of spatial identity that emerge as a result.

As ATM's are released from their origin point — that of the vestibule of the bricks-and-mortar banking facility — they have become embedded into a series non-traditional banking locations. With minimal spatial consideration, they are now lodged into corners of gas stations, hair salons and convenient stores. How does the act of banking and buying milk overlap? What new identity emerges spatially? As programs and facilities that were once considered different and separate begin to converge, overlap and morph in the digital era, they represent a hybridization of space. Functions and programs, once distinct and segregated, can now move together. As the space becomes enlivened with layers of technology, as in the ATM, the space can also represent a model of cybrid space as discussed in Chapter 2.

Advanced technology promises to render the ATM itself as obsolete. A majority of bank transactions now take place through temporal, mobile or online services. These place the ATM, as artifact, onto its own path toward dematerialization. Banking has rapidly evolved and can now take place through a wide variety of scenarios: through the hand held PDA while riding in a taxi, on a laptop in an airport or at home in front of the television. What does the distributed act of banking suggest for these places? How should design reconsider the taxi, the airport and the living room? The temporary nature of appropriation here reflects the ideas proposed in an earlier chapter: spatial identity through hybridization and cybridization. In this example, its temporal appearance flirts with our understanding of its presence. Advanced technology enables some of these cybrid conditions to surface momentarily, appearing and disappearing in the spaces we travel in, through and between.

The introduction of the ATM and rise in use of online banking services caused widespread panic in the banking industries in the early 1990's. Several of the large American banking institutions took initiatives to review the potential impact upon their standards of business practice. Their research reveals several facilities merely responded by "directing their customers out to their ATM's," while other institutions were seizing the moment to reinvent what it was to bank (Buttitta, 2004). Contributing writer to Workspace Magazine, Ifsha Buttitta (2004) refers to research from the 1990's revealing that customers found the overall experience of banking uninspiring, inefficient and unpleasant. Customers expressed frustration with hierarchies and operations and a sense of intimidation and discomfort from standing in long line-ups. Put simply, no one considered the traditional banking typology a desirable destination. The traditional image of the bank as an old fortress disappeared as institutions started to redefine themselves, overhauling their image, interiors, brand identity and business model in one swoop.

One of the most notable examples of capturing design opportunity through recombinant architecture is reflected in ING Direct Internet Café [ING] in Midtown Manhattan (see Figure 3.1 to Figure 3.4). Prior to the construction of this location of ING, the bank only had an online banking presence for New York. It had no spatial presence in New York City and only functioned within the spatial domain of cyberspace. The café facility in Manhattan was created to infuse ING into the built environment to "enhance its online visibility with a brick and mortar presence" ("Nasfm's 31st annual retail design awards: Outstanding merit", 2002, April 18).

The vibrant new typology responds to the reinvention of the banking experience. It reflects some familiar strategies in retail design to attract new customers through its vibrant street-front presence. Its café offers a lively social and informal banking atmosphere for its clientele. This modern bank completely disengages from its roots to an older banking typology. One of the most successful design strategies was how designers "replaced the expected row of tellers with an upbeat café staffed by trained bankers and

LEGEND FOR FIGURE 3.11A AND FIGURE 3.11B

① ENTRY

② INFORMATION BAR

③ INTERNET STATIONS

④ STAIR

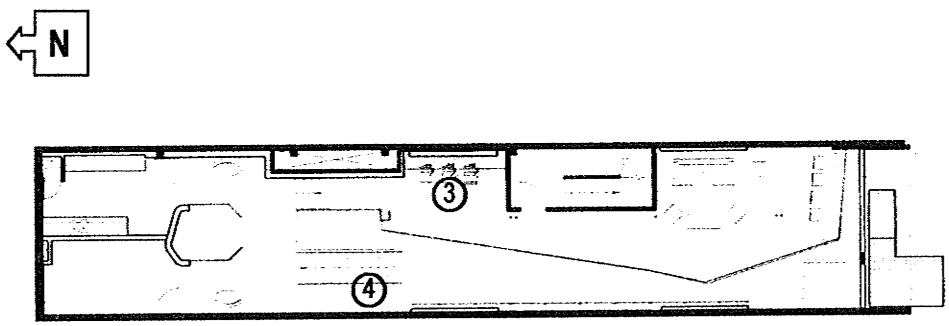

Figure 3.1 ING Direct Internet Café, New York City. Floor plan: Mezzanine level. Key notes on plan, correspond to the legend at the top of this page. Designed by Gensler, 2000.

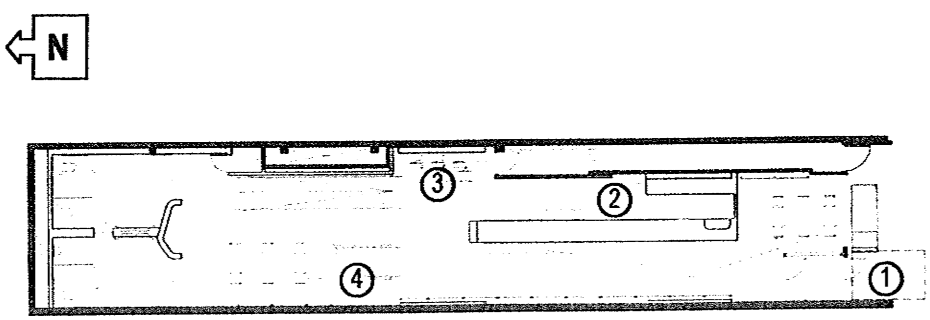

Figure 3.2 ING Direct Internet Café, New York City. Floor plan: Ground level. Key notes on plan, correspond to the legend at the top of this page. Designed by Gensler, 2000.

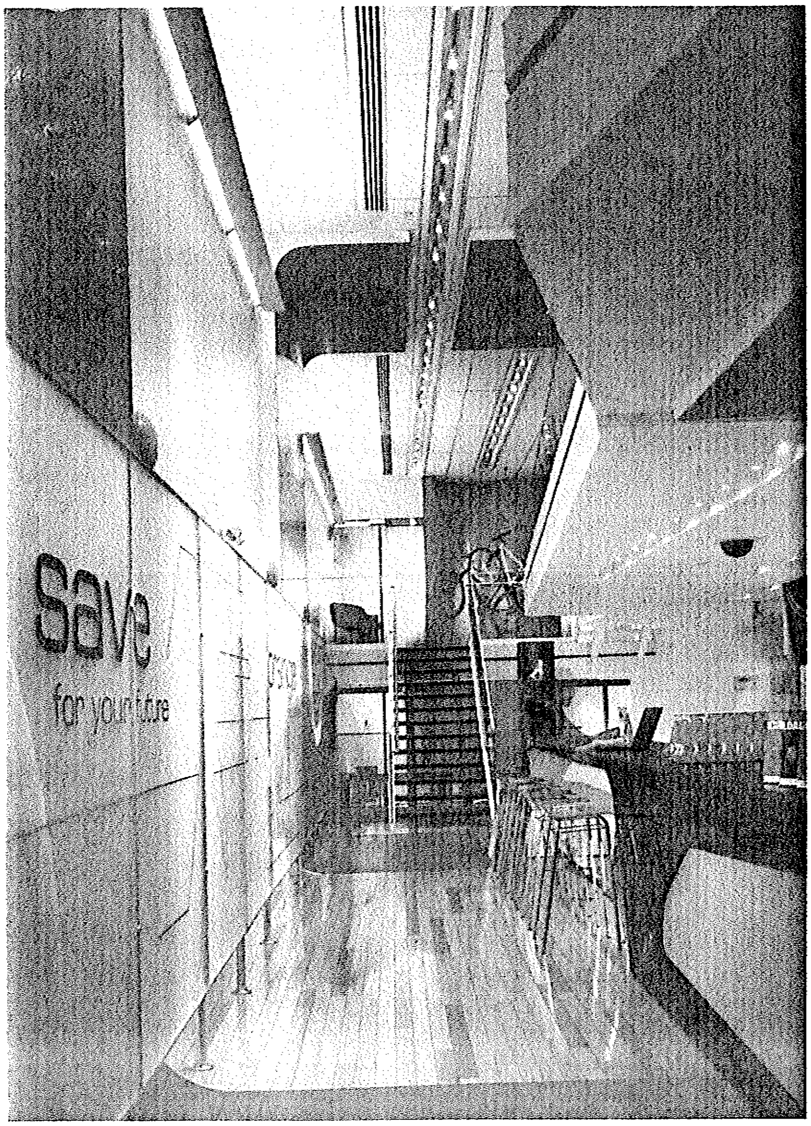

Figure 3.3 ING Direct Internet Café, New York City. View is set at the entry to the café, looking north. Informaton bar is located on the rightside of the photo (blue counter area). Designed by Gensler, 2000.

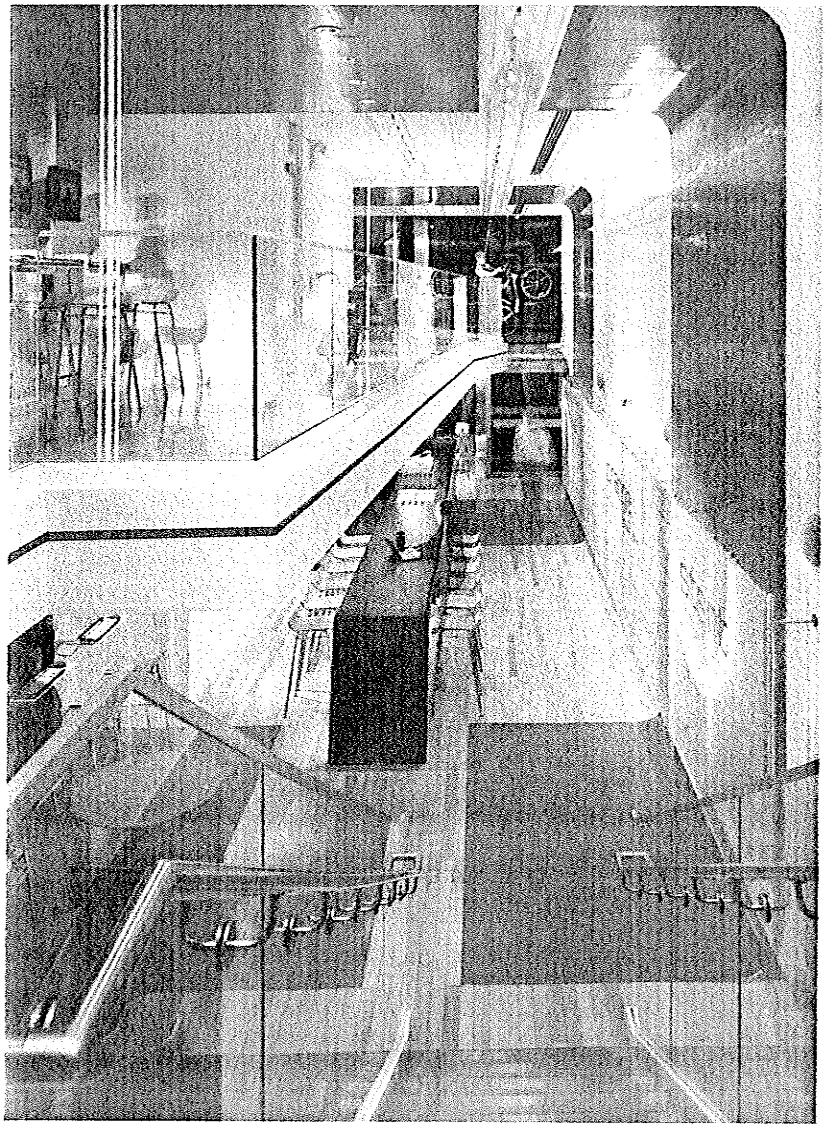

Figure 3.4 ING Direct Internet Café, New York City. View is taken from the top of the stairs, looking south towards the entry of the café, Informaton bar is located on the ground floor, (blue counter area). Personal computer terminals are located to the left at the bottom of the stairs, as well as to the left of the photo, on mezzanine level. Designed by Gensler, 2000.

featuring coffee, soft drinks, and food, with free internet access, newspapers and magazines, and branded merchandise in a modern trendy setting" ("ING direct", 2002).

The new design as a recombinant typology embraces the features of both cybridity and hybridity.[7] The hybridization of physical space is reflected in the cross-pollination of programs that have traditionally remained separate, in different typologies. The evidence of cybridization is noted in the multi-domain spatial sequence that defines ING. Cyberspace and physical space operate together to innovatively and effectively form and support this example of modern banking. The online systems support various banking activities, while the physical space supports other activities unavailable in a cyber rendition.

The multi-spatial condition delivers new opportunity for innovative design. Commenting on the design process for ING, designer Peter Wang notes, "in terms of a program and a space typology, it was a café, but it also had to be more than a café." as cited in Buttitta, 2004). Challenging the design elements that are familiar as design standards to both a café and a banking institution, Wang pushed beyond the tried and true formulas grounded in traditional typologies.

To illustrate this further, I will refer to one of the dominant design features of ING, called the information bar (Figure 3.3 and Figure 3.4). Strangers interact along both sides of the information bar, socializing with each other, ordering lattes and lunch as they consult with the barista staff on account updates and mortgage rates. This design element is a reinterpretation of what previously would be identified as a teller window at a bank

[7] For definitions of hybrid space and cybrid space, see Chapter 2.

and a service counter at a café and cross-pollinates them to form the information bar. The information bar is unique. It is directly responding to service and support the new requirements of the recombinant form of the new banking typology. It is responding to the new evolving set of design criteria and conditions as unique to this design problem.

The information bar at ING challenges the spatial features of traditional banking typologies. The design of the information bar breaks down the often fixed and separated formal employee and customer interaction bestowed at both the bank and the café. At a traditional bank, a teller row is segmented and demarcated with individual stalls integrated into the counter. This also typically supports a formal employee set behind the counter with the customer set in front of the counter. Traditional banks in the United States feature bulletproof glass as well as restricted access to behind the counter, which are designated for employees only. In terms of Semiotics, the traditional model, with bulletproof glass and no backside access, becomes spatially coded and suggests the institution has as a lack of trust in its citizens, fears its customers, and reinstates its power through controlling the interaction. ING Direct, on the other hand, with its open-ended and stylized information bar, invites customers to sit and move along both sides of it. This suggests a complete dissolve of the formal boundary and traditional spatial language of banking. The design of the information bar is coded and conveys trust, relaxation, freedom, social atmosphere and a flattened hierarchy of staff and customers.

ING disengages from traditional banking typology standards in a variety of other ways. It illustrates a commitment to a bold expression of gloss, bright colours in alliance with a commitment to brand integration. A distinct and bold design gesture is the sweeping curve that takes the floor finish material, as a Mondo product, up the wall and onto the finished ceiling surface.[8] The unpredictable nature of the form, finish, context and colour appear rebellious to the traditional bank design typology (see Figure 3.3 and Figure 3.4). The cultural associations in traditional banking typologies were aiming to convey security, formality and order. This is whimsical, playful and organic.

The design of ING supports a strong aesthetic relationship between physical space and digital space. Through an effective understanding of brand and spatial language, the design aesthetic is unified across both domains. Ideas of design transfer and reciprocate between the domains of the interior physical space and digital spaces of cyberspace. The design criteria and objective was to ensure a consistent banking image with their online brand and identity. As you enter into ING, the design impact is intended for an individual to spatially experience the feeling of "walking into their Website" (Peter Wang *cited in* Buttitta, 2004).

One of the most striking features of ING direct is how design effectively manifests alongside an evolving business model. Design here works from the earliest phases, integrated directly into the development of the physical facility of the business model instead of being introduced to support the model after the fact. Architectural theorist Marcos Novak (1996) explains:

> Unlike the disjunction of collage that has characterized much of this century, the new disjunction is one of morphing. Where collage merely superimposes materials from different contexts, morphing operates through them, blending them…the character of morphing is genetic, not surgical, more like genetic cross-breeding than transplanting (p. 8).

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[8] Mondo is the name of a company that produces the type of vinyl floor covering material as used in the ING project.

Similar to the programming computer software, this suggests that design, can effectively move into the earliest phases of the business model's development.

As advanced technology enables customers to bank in a variety of locations, such as the gas station, the airport, or at home, the competition for business becomes complicated in the digital age. As technologies continue to support activities in anytime-anywhere conditions, the design problem needs to incorporate an understanding of the optional visitor. Evolving typologies, such as ING, successfully reflects this. Urban researchers Sabine Friedrich and Maurits Schaafsma (n.d.) note, "The functional need to go to places, do things and meet people probably gets replaced by the psychological and recreational wish to go to places, meet people and be entertained. The favored places to go will be different ones and their character will be different" (p. 29). All places, virtual or physical, become optional destination spots. Competition expands endlessly. This demands a deeper investigation into interior design and architecture as a study of desire.

New spatial typologies will need to remain flexible for re-appropriation. As technologies encourage humans to move freely away from cubicles and designated office environments, a tribe of wanderers, or what have also been called *corridor warriors* will likely emerge. This group requires optional and temporal spaces to support their wandering movements. The fixed, highly detailed and project-specific program becomes questionable as some claim it to be useless and outmoded when advanced technologies are present (Mitchell, 1995).[9] Mitchell explains that as wireless networks and advanced

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[9] Program is the premise or functional objects of the design project

technologies have been implemented at the MIT campus, spaces are no longer required to adhere to strict programming methods (personal communication, June, 2004). Typology distinction may no longer be required, as spaces need to remain highly flexible for readaptive use. Does this mean a homogenization of design aesthetics? Yes, if a detailed program is challenged, so to is the design that derives out of it. I argue that space and character of space need further inquiry to avoid a movement towards a nondiscriptive or flattened characterization of space.

For Mitchell, the recently completed Strata Center on the MIT campus, designed by architect Frank Gehry, is the future direction for design and architecture (personal communication, June 2004). According to Mitchell, the design supports what he calls a *multi-plexing* of space, where any space can become instantly reappropriated for other purposes. The Strata Center was designed with an abundance of sophisticated technology that is robust, portable and which carefully disappears into the woodwork. The technology deflates the need for a building program Sophisticated technology creates an effective disengagement between designers and their practice of collecting highly detailed programming information. Mitchell explains, "Because the better the technology is, the less you really have to build the architecture on the demands of the technology" (personal communication, June 2004). As more buildings adopt a multi-plexing model, as described at the Strata Center, designers will need to reconsider the current methodology used in strategic planning, programming and space planning in practice.

3.4 Fear of Fossilization

Stable spatial typologies are significant for interior designers and architects for a variety of reasons. Design firms often rely on an association with practice-area specialization to elevate and define their identity. Practice expertise varies in typology, such as office design, arena design, airport design or hospitality design. Becoming a master of a specific spatial typology is often essential to a firm's direction, pivotal in marketing and ability to gain client confidence.

Specialization and expertise in the digital era may create more challenges than benefits. Specialization relies on a depth of knowledge of tried and true formulas in similar project types. Architectural theorist Christian Norberg-Schulz claims the approach is typical for spatial designers, as they tend to reference their own personal collection of mental schemata (as cited in Gelernter, 1995, p. 270). Designers test previously successful design solutions and, reflexively, situate and develop them to respond to new design problems. Norberg-Schulz claims, "Culture and socialization guide the individuals experimentations along pre-established lines, and lead to a particular language, set of classifications and patterns of socially accepted behaviors" (as cited in Gelernter, 1995p. 270). He warns that this approach can lead to an over reliance upon old schemata. Design standards can potentially do more harm than good, as it suggests design standards refer to other design standards that then refer to other design standards, and so on. This notion illustrates a circular, self-referential loop. Norberg-Shulz warns that this self-referential strategy inhibits creative effect and produces what he calls *fossilized design concepts* (as cited in Gelernter, 1995, p. 270).

Breaking out of the cycle is not simple. Professor of Architecture at the University of Colorado, Mark Gelernter (1995) notes that unfamiliar works may be most useful as a reference, as when a

> Particularly creative artist will see that old schemata no longer appropriately account for a changed world. Through Piaget's mental process of accommodation, this artist experiments to realign his [or her] schemata with the new outside realities. Although this work is not understood by others at first, it possibly offers genuinely new and appropriate insights which can enrich our understanding of the world." (p. 272)

New spatial typologies present themselves as examples of an abandonment of perhaps popular or most common schemata. Innovation may be found in the places designers do not expect, and designers should maintain a broad and expansive critical debate on design solutions. It reminds the design community to not only reference the already celebrated and beautiful, but also to open up a dialogue on solutions that specifically appear as perhaps failures, or at first as inappropriate or inadequate design responses. Evolving a more critical debate would extend the focus and perhaps uncover some extraordinary opportunity.

3.5 Opportunity

As the digital era has introduced enormous change in a relatively short period of time, careful and extra attention may be required to assess where the opportunities exist. As illustrated in the case study of ING, advanced technologies allowed for designers to respond in a unique way. The design response allowed for maximum reinvention. Design can effectively reinvigorate space even if society is spiraling into a world predominantly mediated and experienced in cyberspace.

ING reinforces that in the digital age there is an enormous area of new opportunity emerging for design. Not only in the branding and design arena, but also to actively inform the business model. Designers working side-by-side with owners can help inform what the new typologies can become, and in turn, inform what 'the business' is. That is, if typologies are open for change – designers can actively engage to guide the client through the recreation or invention of what the new typology becomes. For example, if a client approached a designer to design a 'video store' – there needs to be a deeper investigation other than – defining a program. What on-line services compliment the physical space? Can videos be delivered, stored, ordered on-line? Can the space activate a social arena – a café or film screenings? The point of this is – designers can actively reinvent, through exploiting technologies, the objective of the business through design process. An enormous amount of creative potential is waiting to be explored.

As it is still early in the digital age, the discussion here is intended to act as an introduction to the condition of opportunities in the emerging typologies. As old typologies prove to be inadequate, designers will be required to realign mental schemata to understand the new ones as they take form. As technology is the driving force behind this, it will require designers to take note of new innovations in technology. As recombinant formations promise to expand and populate more places we inhabit, it is essential to keep a close eye on the developments of how these typologies are reassembled. It is important to take stock of how technologies impact spatial relations, alter business strategies and influence spatial language. It will become essential to fine new tools to track and study the anomalies and the irregularities as they emerge.

Ultimately, interior design and architecture can no longer rely on what Virilio has labeled *ancient space* (as cited in Armitage, 2000c). Design process as restricted to the physical material realm is isolated and promises to challenge designers to maintain their influence as effective 'problem-solvers' in the digital era.

CHAPTER FOUR

FRACTURE

CHAPTER FOUR: FRACTURE

In the last fifteen years, advanced digital technologies have drastically altered the manner in which individuals define their understanding of space.[1] Such technology has consistently illustrated a profound ability to destabilize some of Western society's primary and foundational modes of understanding (Mitchell, 1995, 1999, 2002). In addition to this destabilization of space, advanced electronic and digital technologies have created other challenges in the fundamental notions of self and identity.[2] Burgeoning in complexity, these technological advances are revolutionizing the ways in which individuals define themselves, their relation to others and the environments they inhabit (Grosz, 2001).

In this chapter, I discuss the dominant features of splintered spatial identity in the digital era. I present and review the conditions of what I call *fractures*, that refer to the disruptions occurring to our spatial understanding.[3] Through an exploration of

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[1] Space in this context refers to the understanding of the 'location of being', and character grounded in contemporary architectural theory and active in the discipline of interior design. Space in this context embraces space as social, political, and active – and includes the physical material properties of architecture. This is grounded in Henri Lefebvre's notion of an all-encompassing spatial experience, as illustrated in his *The Production of Space* (1991). Also, see the collection of writings in *Cyberspace: First Steps* (Benedikt 1993) for an expanded discussion on spatial theory in relation to contemporary technology. Unless noted otherwise, this inquiry integrates the realm of material artifact of space (comprised of atoms) and the realm of cyberspace (that of the immaterial) to define an 'overall' spatial understanding.

[2] The discussion here derives from a phenomenological study of the relationship between the subject and the object. The discussion embraces a phenomenological approach as it embeds the meaning-making experience into that of the individual, and does not remove it, outside of the subjective perception (Macey, 2000).

[3] Dramatic terms have often been used in Postmodern theory to reinforce the sever between the subject and the object. Terms such as: *splitting* or *smashing* (Virilio, as cited in Der Derian, 1998), *shatter* (Lee, 2002), *fragmentation* (Chaput, 1988;Jameson, 1998) and *rupture* (Krauss, 1983)

methodological paradigms of cultural, cyberspatial and architectural theory, I present evidence of advanced technologies abilities to redefine our spatial understanding.

Within a historical framework, I begin the analysis of fractures, by introducing its evolution. I present a brief overview, illustrating how innovations in science and technology have a long history of contributing to alterations in spatial understanding. Expanding the chronology up to the present, I introduce the dominant events that spawned the Digital Revolution and cyberspace. The intention of this chronological overview is to contextually convey technology's role, as historically, altering spatial understanding.

I provide analysis concentrating on the evidence of an emerging splintered spatial identity. The discussion expands upon ideas of tele-topology and virtual dimensions as introduced by French cultural theorist Paul Virilio. Expanding the discussion further, I discuss how contemporary technologies have widely executed and intensified the ideas of postmodern theorist David Harvey (1989) through fragmentation as discussed in *The Condition of Postmodernity.* This analysis reviews ideas of what architectural theorist Michael Benedikt refers to as a new spatiology. The analysis evolves through a critical analysis of the complex dominant features of technology to simultaneously create spatial expansions and intensify it compression features.

As fractured identity is not restricted to the spatial features of geography and architecture, I expand the discussion to consider the implications of how this fracture applies to the disjointed identity of the individual. I expand upon theories of splintered spatial conditions as presented by science journalist and commentator Margaret

Wertheim and cybertheorist Allucquère Roseanne Stone. This theoretical odyssey ultimately seeks to illustrate how these *fractures* of individual identity of the self in relation to others and the spaces surrounding them constitute an apparent and complex condition.

Fractures introduce complexity nature to some of the most basic elements of spatial understanding. The issue is really one of ontology.

> Humans structure the world in fundamental ways by making a boundary between us as human beings, and the other, that is, the things we make, the places we inhabit, and the world as given. The fundamental typological distinction between us and not-us not only structures the material world, but frames the way we think about and re-present this world. The boundary secures us, places us in our habitats; it infuses the world and us with meaning.
> (Franck & Schneekloth, 1994, p. 41).

Throughout this chapter, I illustrate the method and means by which the boundaries discussed by cyberspatial theorist Karen Franck, have moved and increasingly broken down. This is to say, the boundary lines described by Franck and Schneekloth are subjected to a growing dissolution in the digital era. My intention in this chapter is not to resolve the condition, but rather to provide a deeper understanding of what this suggests for interior design and other spatially reliant professions.

The theoretical foundations of the design process would benefit from a serious consideration of the phenomena associated with fracture. Stated simply, interior designers and architects design *spaces* for *human beings.* If the structures that define the identity of space and the human being's relationship to that space are in a state of change, or fracture, it threatens the process by which space is configured and designed by these professions.

The premise of this investigation of the above-noted complexity is that it needs to contend with how we define space.[4] The definitions of space rely heavily upon the philosophical conceptions of being and reality (Dyson, 1998; Vidler, 1998). It is not my intention to answer such questions as "What is space?" Rather, the focus here is to explore the evolving conditions and characteristics of space in the digital era. The fundamental question becomes: How do new spatial features represent challenges to our previous understandings of space? Further, what are the dominant features of a splinter spatial identity or fracture?

If, as Wertheim (1998) suggests, "a new space is evolving," the discussion needs to address from what this new space is evolving and to what this evolution is moving toward. The complexity emerging guarantees to launch the discussion into the lofty epistemological and teleological heights of abstract, transhistorical and universal philosophical questions concerning the nature of being, space and reality. To adequately ground the exploration of these abstract theoretical dimensions, the discussion begins as rooted and introduced within a historical framework.

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[4] For an expanded discussion on philosophical underpinnings of space, I refer the reader to *Architecture: Ecstasies of Space, Time and the Human body* by David Farrell Krell (1997), *The Production of Space* by Henri Lefebvre (1991), *Space, Time and Architecture* by Siegfried Giedion (2003), K. Michael Hays editorial collection titled *Architecture Theory Since 1968* (1998) For a brief and concise historical account of the evolving influences of philosophy and architectural spatial theory refer to: *Sources of Architectural Form: A Critical History of Western Design Theory* by Mark Gelernter (1995).

4.1 Historical Evolution

Technological innovation and scientific breakthroughs have evolved society's spatial understanding throughout history. Their influence has been distinguished and recognized as a primary catalyst in contributing to our principal social and economic organizations (Bartlett, 1998; Mitchell, 1999; Mumford, 1961). Technologies have contributed to the evolving definition of the framework upon which societies advance their ontological constructs and understandings of space.

As opposed to bearing a recent phenomenon, the digital era presents an advanced and intensified version of a longstanding set of conditions that are well established in the historical arena. The complexities associated with fracturing of the subject, the object and the spaces they inhabit can be traced back into the depths of history.[5] As Academic Head of the Program in Media Arts and Sciences at Massachusetts Institute Technology [MIT], William J. Mitchell (1995) reminds us that the current Digital Revolution, "It's an old script replayed with new actors. Silicon is the new steel, and the Internet is the new railroad" (p. 16).

Historically, advances in technology have dissolved previous established understandings of the spatial boundary. Whether through science or artistic illustration, boundaries give way to open up for discoveries of "other" space.[6] The discovery of other space has enormous impact upon how we, as individuals, construct and formulate our fundamental understanding of the world that surrounds us.

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[5] For a concise overview on *the subject* and *the object*, see *The Penguin Dictionary of Critical Theory* (Macey 2000) and *The Encyclopedia of Contemporary Literary Theory* (Loughlin, 1993)
[6] The term 'other space' is used by Frances Dyson (1998).

The discovery of other space, illustrated through science immediately preceding the Enlightenment, had a significant influence on reformulating spatial understanding. This suggests that through technological progress, science offered enormous opportunities to extend spatial limitation.[7] Galileo, who used Copernicus' telescope to extend spatial realm from the immediate physical reach outward, extending space upward toward the sky. Extending the contemporary cognitive reach, enormous fissures emerged in how society established and understood spatial boundaries. The boundary, dissolves as a new extended limitation emerges. With equivalent power, the invention of the microscope had similar impact on society's understanding of space. By shifting the direction of focus from expanding outwardness toward an increasing inwardness, the defining boundary of skin evades. Both the telescope and the microscope extended our gaze, exposing limitless realms of spatial territory never before known.

For philosopher Don Ihde (2002) , the visual constructions of our world through these devices reconfigured our understandings of space. Ihde notes "Lensing, in the telescope and microscope, transformed the phenomenological sense of space-time" (p. 46). The new boundary line as extended challenges the unity of the old boundary line. The new boundary line is defined becomes reliant on technology. That is, the discovery of 'other' space hinges on how good the technology is to reveal it to us.

Advances in science and technology have also progressively expanded the gateways to and from the space of imagination. What was once considered intimate,

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[7] For a further and more extensive discussion on extensions as it relates to spatial boundary, I refer the reader to the on-line article *Boundary Debates: Extensions From Analog to Digital Spaces* by Dirk Donath, Thorsten M. Loemker and Katharina Richter (2001).

internal and private – such as the spaces of the mind - has found new avenues and destinations. Ideas, thoughts and stories, previously limited through local physical social realms, increasingly moved outward to an expanding, shared public realm (Mitchell, 1999). Using pens, paper and early forms of the press machine, the written word in journals, diaries and personal correspondence shifted thoughts out from the mind and into the universe. Thoughts and ideas rapidly cut across established notions of great distance. The boundary lines that define, establish and separate the realms of private and public dissolve and are challenged.

The artists of the Renaissance instigated an effective means to extend or recreate spatial boundary in innovative ways. The ability to accurately represent and construct mind space most vividly arrived when these artists invented the techniques of constructed perspective.[8] Through a mathematically based method of construction, artists depicted, with extraordinary accuracy, 3-dimensional space on a 2-dimensional surface, translating the ambition to extend space into a visual field (Bertol, 1997). The expanding depth challenges and extends the boundary lines of the walls' physical surface. The boundary of the surface plane dissolves; the accuracy extends the space, moving beyond the 2-dimensional surface back into the picture and beyond. By placing these perspectives onto the walls, artist and architectural theorist Daniela Bertol (1997) observes, "the wall where the perspective scene is painted became a window, apparently breaking the wall surface. A relation is created between the *actual* space of the wall and the *virtual* space of the representation. The actuality of the physical wall is transformed into the virtuality of the

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[8] Believed to be noted as the earliest writings about constructing accurate perspective, refer to Leon Battista Alberti *Della Pittura,* in 1435 (Bertol 1997).

painting" (p. 13). The relationship reflects the earliest forms of virtual space and hyperspace.[9]

The ability to expand space and extend its boundaries is an optical trick instigated by designers and artists throughout history. Illusion through the use of mirrors and murals, interrelationships of paint colour, *tromp d'oeile* and sources of light have been incorporated into physical settings to penetrate our perception and activate a sense of spatial extension. For Virilio, the Hall of Mirrors at Versailles Palace in France is a prime example of an earlier rendition of virtual space (as cited in Jankovic & Michel, 1998). The narrowness of the long expansive corridor at Versailles optically widens through the exploitation of multiple reflections and through the use of natural light, windows and mirrors. Stone (1992) observes, "Proto-cyberspace has been around for many years in various forms – visually as dioramas and botanical gardens, aurally as radio dramas, kinesthetically as carnival rides and textually, perhaps, as novels" (p. 610). The ability to construct the imagination extends physical spatial experience and boundary.

As the progression of modernity wore on, space became a target of objectification. Innovations in Cartesian mathematics and graphing enabled the individual to chart and map out space through early methods of cartography (Benedikt, 1991A). This mapping presented space first as terrain for understanding and then for possession. The map evolved into a graphic to chart opportunities for plotting property, defining territory and identifying political boundaries. It became the foundational means to convey and evolve boundary lines. The crafting quality of the artist, or the drawing skills of the

[9] A more extensive discussion of hyperspace and the hyperreal is pursued in Chapter 5.

cartographer, defined and represented limitation. The power of mathematics and geometry executed the notion that "space was knowable, and through Euclidean geometry, conquerable" (Powell, 1998, p. 119). The map became an indicator of territory and evolved to reflect symbols of power, identity and ambition.

Renaissance perspective worked in combination with cartography to both deconstruct and reconstruct spatial understanding. Powell (1998) notes, "Perspectivism shifted the angle of vision from God to that of an individual human being free of the naïve superstitions of myth and religion" (p. 117). Destabilizing a blind belief system, individuals were forced to create a new world.

Prior to this shift in belief, the map was interpreted as a literal reference in understanding the individual's body position in relation to space. Powell (1998) explains that *prior to this shift liberation, individuals would take as literal map readings, the end of* their extended spatial reach. Individuals believed that "at the edge of such maps was the end of the world and a cosmic dragon waiting to swallow anyone who would dare venture too close to the edge and fall into his [her] mouth" (Powell, 1998, p. 117). This afforded new parameters upon which individuals formulated their understanding of self and others.

The visual reference of the map, the illustration or the painting, delivered individuals a framed identity in relation to a larger contextual setting or landscape. The impact of this was profound, as Stone (1992) suggests, "Social order, in this sense, implied spatial accountability – that is, knowing where the subject under the law was" (p. 613). Construction of identity was embedded into spatial definitions of cartography:

country, province, city, town, longitude and latitude. This provided a multitude of potential reference points for the individual to construct self-identity couched in the quantitatively defined coordinate system of a charted world. Self and location were bound together.

As early as the seventeenth century, Pascal introduced a seemingly limitless dimension into humankind's technical repertoire. Proportions of maximized extensions were revealed and expressed in his mathematical equations of infinity. The ability to mathematically illustrate something limitless challenged the notion of boundary or limit.[10]

Through the eruption of transportation systems and communication networks of the Industrial Revolution, established understandings of space were challenged. The influence of advancing production and mechanization altered significant aspects of culture and identity in unprecedented ways (Harvey, 1989; Mitchell, 1995). The evolving technology in this era propagated a fissure in the conceptual construction and understanding of the subject, the object and the spaces that surrounded them. For Harvey, this was instigated as it created new relationships between space and time.

During the modern era, private space became a new frontier to conquer. What was understood as inherently private space, as in mind space, quickly evolved under the guidance and growing influence of the social sciences, such as Psychology. Mind space

[10] This is not to suggest infinity did not exist prior to Pascal. It is integrated into thought space of the imagination. Yet, Pascal developed advanced mathematical and calculable means to represent limitless.

became a place for others to explore, interpret and define (Stone, 1992). Psychoanalysis delivered mind space as a place first for exploration, and then for capture, by others.[11]

Spatial understanding evolved further through the influence of advanced abstractions in mathematics. These new abstractions presented space as a new landscape with limitless potential and were revealed through the work of non-Euclidean mathematicians (Tomas, 1991).[12] Space became an object to predict and define; its potential future action something to calculate. The ability to build upon a new system of space through mathematics, beyond what the eye could see, further expanded spatial limitation and understanding. As noted by Benedikt (1991B), "Physical space, we learned, is not passive but dynamic, not simple but complex, not empty but full. Geometry was once again the most fundamental science" (p. 125). That is, through advanced calculations individuals could accurately predict how space would respond or act in future conditions. Metaphysics fractured our understanding of object as static construction and transformed it into an evolving potential subject. Space became predictable with increasing accuracy (Benedikt, 1991A). A new evolving place of agency was thereby exposed and made available.

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[11] Earlier psychoanalysis as evolved through Freud was based on exploring and exposing the hidden levels of the subject's subconscious. The idea of attaining this was profound, as it suggests removing the subjective understanding of self, outside to alternative sources. That is, the outside individual, of the psychologist could acquire and assemble a deeper level of understanding of how an individual understands their world, more so than the individual themselves (Macey 2000). The term 'capture' is metaphorical in this context.

[12] Euclidean space in the context of this paper makes reference to Cartesianism. It is referred to as the tangible and physical space we inhabit. For a broader analysis of the ideas of Euclidean space in relation to architecture and cyberspace, see: *Cyberspace: First Steps* (Benedikt, 1991).

Introducing a new relationship between space and time, transportation technologies from the industrial era challenged stable spatial understanding as grounded in Euclidean terms. The evolutions of high-speed transit, such as the train, car and the airplane, radically repositioned time in relation to space. Time became an integral feature and definition in spatial construction (Benedikt, 1993; Harvey, 1989; Novak, 1995).[13] Benedikt (1993) reminds us, "By the twentieth century, space could no longer be thought of without *time*" (p. 4).

The introduction of the telephone created new challenges to understanding the relationship of speed-time. Individuals struggled to comprehend new asynchronous communication abstractions delivered through real-time interaction through telecommunications systems (Mitchell, 1995, 1999). For Benedikt (1993), the invention of the telephone marks the first effective source of a cyber or virtual experience. Real-time communications proposed new understandings of presence in physical space (Mitchell,1995). Through the telephone, the once perceived distances as set out between individuals could dissolve. The impact of an evolving non-presence, supported through continued advancing telecommunications, has shaped the urban fabric and organization of society (Toffler, 1980).

Virilio (1991) explains that the invention of both photography and film marked the beginning of a destabilization of reality, or what he calls a state of an *aesthetic of disappearance*. Virilio claims, "At this stage, persistence is no longer material but

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[13] Immanuel Kant was one of the initial instigators in the dialogue on the symbiotic relationship of space and time. The *Critique of Pure Reason, and Other Writings in Moral Philosophy*, published in 1781, grounded the space and time dialogue that would gain currency later in the Industrial Revolution.

cognitive, it is in the eye of the beholder. Things owe their existence to the fact that they disappear, like they do on a screen for instance. They are there, they appear, and are in motion, because they vanish afterwards" (as cited in Armitage, 2000c, p. 41). Reflective of the more primitive virtual spaces as explained earlier through constructed perspectivism, the photographic space was more sophisticated visual experience. The realistic quality of the photograph and film were complex as they were also introduced as purely temporary. Through projected film, the walls of the cinema become portals, opening outward and extending previous defining features of space and boundary. What was previously defined as limitation of interior space — plaster wall and physical boundary — first dissolves then extends. And enabled to instantly return when the lights come back on.

Motion was the dominant new feature of modern culture. The splintering spatial identity and shifting boundaries during the industrial era became a popular point of focus for inquiries and investigations in culture. The modern space-time relationship was to have an enormous influence upon the artists of the twentieth century (Benedikt, 1993; Dalrymple Henderson, 1983). This relationship became the focus of several investigations to manifest in literature, philosophy and art.

It is through artistic movements, such as Cubism, that the most prolific expressions of fractures are found. The Cubists' investigations and illustrations captured and exposed a unique representation of an activated pictorial spatial field. The Cubists captured "different viewpoints and aspects of an object could be superimposed over each other in a free, more calligraphic fashion and subsequently fused in to a single, 'simultaneous' image" (Golding, 1974, p. 61). Through the representation of the act of motion, the previous mode of static, is enlivened. Space, object and subject are consistently represented and placed as visually splintered, set within a multi-dimensional spatial setting. Painter Georges Braque noted, "there is in nature a tactile space, a space I might almost describe as manual... what most attracted me and what was the governing principle of Cubism, was the materialization of this new space I sensed" (as cited in Vallier, 1954, p.16). The new space of motion became the focus. Cubists added more dimensions, additional spaces and multiplicity to their picture plane. This representation of multi-dimensionality suggests a distinct fracturing of the subject, object and space.

The Futurists embraced a similar spirit to explore and celebrate the emerging technological progress at the start of the twentieth century. In the *Futurist Manifesto* of 1909, the poet Filippo Tommaso Marinetti wrote, "...*the splendor of the world has been* increased by a new beauty: the beauty of speed" (as cited in Lynton, 1974, p.97). Referencing the new speeds achievable through vehicles of rapid transportation, the ambition of futurism was deeply rooted into technological progress. Throughout this manifesto, Marinetti encourages a release of self from historical routes; the older, more stable and static structures onto which society grounded and defined itself are available to dissolve.

4.2 The Digital Revolution

Similar to the industrial era, the technologies introduced in the digital era have evolved and caused ruptures in our spatial understanding (Mitchell, 1995; Toffler, 1980; Harvey, 1989). For Harvey (1989), "...we have been experiencing, these last two decades, an intense phase of time-space compression that has had a disorienting an disruptive impact upon political –economic practices, the balance of class power, as well as upon cultural and social life" (p. 284). The more recent advanced electronic and digital technologies found in real time simulations, synchronous communications, wireless networks, interactive and miniature silicon chips and immersive digital environments are the dominant features, defining the current era of the *Digital Revolution*. These evolutions in technology have fueled the dialogue of spatial fracture insofar as they promise to continue destabilizing previous understandings of space and construct new ideologies of spatial understanding.

The Digital Revolution has been applied to a variety of time frames, several laying claim to different starting points. Although the exact starting point of it execution is contestable, it is well noted that the origins of the Digital Revolution link back to the US military defense systems and government research in and around World War II (Mitchell, 1995). Several media and technology developments followed and radically expanded the digital influence and effect on Western culture.

In step with the technological progress from 1950 to 1990,was a wave of cultural analysis to ascertain what a new digital era would expand into. By the 1980's, there was a growing body of visionary prediction that claimed radical change would come with the new arriving technologies (Li et al., 2001). For example, media theory introduced Marshall Mcluhan's ideas of a *global village* (McLuhan, 1964) and Toffler's ideas of the *electronic cottage* (Toffler, 1980), conveying the anticipation of radical change to urban and social life. These ideas provided new cultural analysis on the more dramatic effects of technologies. For Benedikt, these earlier discussions laid the foundations of cybertheory and the Digital Revolution. That is, these notions dominated the discourse of cyber theory well into the 1990's.

By the mid 1990's, advanced electronic and digital technologies had grown to significantly penetrate and alter all aspects of life in Western society (Negroponte, 1995). This penetration served to and continues to impact and effect the evolution on investigations implicit in a wide range of areas such as ontology, philosophy, phenomenology, graphic representation, identity, embodiment, gender studies, power, urban studies, economic, architecture, psychology, art and cultural theory and science (Beckmann, 1998; Leach, 2002). The voices captured in these inquiries have unanimously put forward the notion that the influence of the Digital Revolution has ruptured our previous ways of understanding the world. By the mid-1990's, the force of advanced technologies was elevated to a status of ubiquity and omnipotence in the everyday populace of Western society with the launch of the internet and sophisticated networks (Mitchell, 1999). The influence was a result of the enormous technological advances, progress and political change of the 1980's (Jameson, 1998). For Jameson (1998), these advances were the catalyst that launched the intensification of communications technologies that "abolished space and time" by the 1990's. Jameson refers to this as the "cybernetic revolution" (p. 143).

4.3 Cyberspace

The term cybernetics had a long-standing history before its application to a technological revolution at the close of the twentieth century. The term dates back to the nineteenth century in research on magneticism by scientist Andre Marie Ampere (Spiller, 2002). The more modern developments of cybernetics are grounded and attributed to the mathematician Norbert Wiener (1948) and his seminal *Cybernetics or Control and Communication in the Animal and the Machine.* Architectural theorist Neil Spiller (2002) observes that in the twentieth century "the term was subsequently rearticulated to describe...how systems work and respond to outside stimuli" (p. 7). This definition created a foundation for cybernetics to be applied to a range of technological progress, such as advanced networks and telecommunication systems that were under development toward the last half of the twentieth century.

The term *cyber* became fused with spatial understanding through the release of the book *Neuromancer* by science-fiction writer William Gibson (1984). It was in *Neuromancer* that Gibson coined the term cyberspace to define the immersive environments populated by his characters. Gibson's characters traveled through the matrixed environments, at the time associated with the space represented in video games (Spiller, 2002). Readers were introduced to a world where characters split their time between realities, partially embedded in the familiar physical material world, and the more provocative world offered in the digital matrix of cyberspace. The reader is challenged to understand a binary sense of reality introduced by the matrix beyond the screen. Gibson's characters moved between domains, between the realities of the physical and the virtual. The virtual environments introduced by Gibson are considered predictive of the Internet and the widespread introduction of the cyberworld that followed only a few years later (Benedikt,1991B). Technological innovation and science fiction were becoming strikingly similar. Spiller (2002) observes, "...As Gibson was writing his stories, the history and ambition of computation had been long established. Cyberspatial fact was developing hard on the heels of cyberspace fiction" (p.7).

For Benedikt, Gibson's work is more than insightful; it framed much of the earlier debate, discussion and trajectory of investigations in the field of virtual systems (Benedikt, 1991B). By the mid 1990's, new areas of inquiry in academic research opened up and expanded to encompass the impact of cyberspace on culture. Specialized departments and courses are now offered in a variety post-secondary study, exploring issues such as *cyberculture studies, popular cyberculture, cyberspatial theory, cyberpunk* and the cyborg.

As society becomes inundated with exponentially growing amounts of information, the design of information networks and systems have responded to support this growth. A flourishing array of sophisticated navigational tools and frameworks has evolved to navigate, operate and engage with this technological climate (Benedikt, 1991A). There was a response to reference spatial metaphors to gain familiarity through new computer 'spatial' experiences. For example, desktop, chat rooms, the mouse, pull-down menu, folder, and windows-based software reflect attributes of familiar physically tangible objects or the experience of these abstractions (Anders, 1999; Benedikt, 1991A). Software design has been grounded in these principles consistently, called spatialization metaphors, to aid in the orientation and meaning of computer iconography (Lakoff & Johnson, 1980). Consistently pushing the boundaries of complexity, advanced technologies today are supported through a wide-variety of multi-mediums that embrace a rich combination of text, graphic icons, sophisticated graphic illustration, 3-dimensional modeling, animation, photography and video. These have evolved to support advanced matrices of 3-dimensional representations and interactions. These may be reflected in the evolving technologies that support a physical-spatial immersion, offered through a data-gloved-goggled presence into these 3-dimensional matrices environments, or the more digitally ethereal conditions offered through an interactive holographic experience.

Although definitions of cyberspace vary widely, there is a consistent theme that appears; its definition always operates in relational terms, to physical space. This *definition is embedded in highly debatable and challenging spatial terms.*[14] *It maintains a* spatial position in the literature and is commonly considered "a separate entity…an extension to real space…a part of real space…overlapping real space" (Friedrich and Schaafsma, n.d.). For example, individuals describe their experiences with advanced electronic and digital technologies using terms related to physical spatial experience; or rather, metaphorically suggests a body position or activity in relation to a spatial context: in cyberspace, terms such as 'surfing' the Internet, 'entering' cyberspace and 'going' online. Wherever or however cyberspace evolves, it is heavily reliant upon meaning and experience in physical space.

[14] The debates and the discussions of cyberspace in relation to architecture essentially have been grounded in the seminal book *Cyberspace First Steps by Michael Benedikt* (1991A, 19991B).

Cyberspace delivered through advanced technology challenges the foundations of ontology. For philosopher Michael Heim (1991), "Cyberspace is more than a breakthrough in electronic media or in computer interface. With its virtual environments and simulated worlds, cyberspace is a metaphysical laboratory, a tool for examining our very sense of being" (p. 59). As the laboratory presents an increasing number of experiments, with new evolving results, cyberspace as laboratory requires increasing observation and analysis. The experiment is open ended, with a limitless number of arising possibilities to restructure the foundations of understanding the space surrounding us. It is a cultural-shaping phenomenon that is altering notions of self, identity and space.

Advanced technology changes the ways individuals view, interpret and interact with objects and other humans. For Stone (1992), cyberspace creates opportunities "for new social forms that arise in a circumstance in which 'body', 'meeting', 'place', and even 'space' mean things quite different from our accustomed understanding" (p. 610). The emergence of effective online interaction, virtual immersion and real-time communications challenges the defining foundations of understanding that inform and constitute what reality is.

Virilio argues, ".... the proliferation of highspeed, realtime, cinematic, global, computer networked – in a word - virtual systems of how we see, has changed how we know, the other" (as cited in Der Derian, 1998, p.5). "The other" refers to all that is set out in front of us, around the body.[15] These technologies dissolve and reformulate the characteristics that frame the world around us. Several relationships become unstable:

[15] This is grounded in a phenomenological perspective. That is, it embraces the subjects view as the source and center for how knowledge (of reality) is created (Macey, 2000).

identity and self, self to others, self to community, self to spaces, spaces to object, and all the other permutations, and therefore become increasingly difficult to ascertain.

Although the Industrial Revolution delivered the advent of Modernism that launched a systematic dissolution and compression of space, and the Renaissance artists laid the foundations of a virtual, visual extension of space, it was not until the emergence of cyberspace that the potential of these earlier efforts could realized. Cyberspace, delivered through advanced technologies today, deconstructs or *fractures* the unified understandings of an intact subject, object and spaces in-between. In the following sub-sections of this chapter, I break down and provide analysis on the status of the subject, the object and the spaces in-between them in the digital era.

4.4 The Status of Spatial Identity:

I argue that we are at a point in history where space as a whole, unified entity can no longer be understood in merely physical spatial terms. Cyberspace, delivered through advanced technologies, is instigating a far more complex condition. The narrative that comes to mind is the childhood fairytale of Humpty Dumpty. In the tale, Humpty Dumpty is sitting on a wall and accidentally falls off. Upon hitting the ground, Humpty shatters into a bunch of little pieces. All these seemingly bright, educated smart people rush to the scene of the accident, in an attempt to "put him back together again." The story reveals that no matter how hard these people try, they cannot get the pieces to fit back into an egg – the original configuration. In his new condition, Humpty is redefined –

no longer an egg but instead unfinished, incomplete and fractured — a bunch of little eggshells. Humpty is simply no longer an egg.

In 2005, at the time of writing this, I argue that Western society is contending with its own version of a shattered Humpty Dumpty. The current condition of spatial identity appears strikingly similar to that illustrated in the story of Humpty Dumpty. The conditions of space today are proving to be far more complex and reflective of features found in Humpty after his fall – separate, fractured and scattered pieces.

This is a metaphorical commentary of course. In using the term fracture, I imply broken or disjointed. The term fracture is used to illustrate something that is no longer whole and unified. How space was understood prior to the 1990's is radically different from how it is understood today. The digital evolution has spurred an intensification of fractures to the identity and status of the artifact, the individual and the spaces in-between.[16]

Again, I am not attempting to propose how to reassemble what has already fractured. Rather, I aim to frame an inquiry into what it is we are working with. I intend to provide a deeper understanding of the digital era and the emerging fractured identity in the artifact (the object), the individual (the subject) and the in-between spaces (the environment).

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[16] In-between in this context refers to the void, in the mass-and-void composition of architectural space. It is the portion of physical space not defined by solidity – of atoms - through material. The term is used by Elizabeth Grosz (2001).

4.4.1 Fractured Identity: The Artifact (the object)

The understanding of what an object is, whether it is a space or material artifact, has become more complicated in the digital era. The previous understanding of a world dominated by objects, composed of atoms, as a piece of matter, narrowly defines the environment around us. Design theorist Thierry Chaput (1988) explains, "objects can no longer be apprehended as aesthetic and technical wholes: they have been fragmented" (p. 183). Artifacts, once laced with a virtual matrix host significant new features with a new identity. As a result, Spiller (1999) declares, "the statis [status] of the object is in question" (p. 306). The fragmentation and identity crisis of the object creates new challenges and great instability for those attempting to discern and define space. This suggests that as complexity continues to pervade the design process, interior designers and architects who select, assemble, arrange, organize and design objects will need to propel an increasing number of investigations to explore the nature of the evolving status of a variety of objects.

Discussion of what constitutes the object is complex. One of the most significant debates, materiality vs. immateriality, directs us to a critical question: Is an immaterial experience supported through virtuality, or through cyberspace real? The constitution of this complexity is most clearly illustrated by Wertheim (2002), who argues:

> ... [Cyberspace] is no less real for not being material... Just because something is not material. Let me stress this point: *Just because something is not material does not mean it is unreal*, as the oft-cited distinction between 'cyberspace' and 'real space' implies. Despite its lack of physicality, cyberspace is a real place. *I am there* – whatever this statement may ultimately turn out to mean. (p. 301))

For Wertheim, advanced technologies merely introduce new experiences that are equivalent in value to those found in traditional spaces through material artifacts. I understand this when I consider valuable dialogue I have through online sources, as I acknowledge this as a real conversation or experience has occurred. Wertheim (2002) explains the challenge when she writes, "In the 'age of science' many of us have become so habituated to the idea of space as a purely physical thing that some may find it hard to accept cyberspace as a genuine 'space" (p. 300). An over reliance or pure faith in the value of artifacts as the dominant source of experience is challenged by cyberspace.

As artifacts become enlivened with advanced technology, they provide valuable extensions beyond the physical environment supported through interior design and architecture. For architect, educator and information theorist Peter Anders (1999), cyberspace is an extension of human senses. He claims, "Space is a medium by which we understand our world, ourselves and each other. And cyberspace is its electronic extension" (1999, p. 217). Anders' position is rooted in phenomenology, whereby individuals establish an understanding of an environment through a blurred combination of realms of physical space and cyberspace. These ideas of cybrid space are explored more fully in Chapter 2.

Limitless extensions of cyberspace challenge the traditional models of spatially reliant professions. Architect Stephen Perrella (1998) argues, "we can no longer rely on foundational, traditional notions of space and time, the existing dimensions of Cartesianism, especially as they ground our understanding of architecture and urbanism" (p. 236). But if designers and architects can no longer rely on this, what are they working with? As technologies become more sophisticated, designers will need to find ways to either work with the instability or find ways to create more stabilizing conditions. It would prove useful for the design professions to critically assess the relevance and resonance of Cartesianism in the act of their own space making. And further, consider how Cartesian space has become volatile in the digital era.

The challenge for design is that it is grounded in the physical realm. Virilio explains, "so far, architecture has taken place within the three dimensions of space and time" (Virilio as cited in Ruby, 1998, p. 182). Yet the extensions of cyberspace appear to introduce more dimensionality to space. Advanced technologies have evolved: "Recent research on virtual space has revealed a virtual dimension" (Virilio as cited in Ruby, 1998 p. 182). A virtual dimension dissolves the understanding of physical space or an artifact being a static entity, complete and whole. Rather, the virtual condition introduces new identity and features to space as enlivened, challenging meaning and understanding of space that is rendered as static or fixed in materiality.

It is essential to remember that the object, as artifact or space, has always been embedded with layers of multiple meanings. For Anders (1999), all artifacts are grounded with a dual nature for our understanding, reflecting to us both form and meaning. Explorations between form and meaning have been pivotal in formulating most of the foundational discussions of spatial theory and architecture for most of this century (Giedion, 1941; Hays, 1998). Anders (1999) explains the relationship, "we participate in the material space they [artifacts] occupy as well as the cognitive space of their illusion. They operate symbolically, using physical space for both presence and subject" (p. 49).

Although a traditional feature in the pursuit of design and architecture is grounded in this relationship between form and meaning, this becomes more complex in the digital era. The spatial identity is redefined, as "Continuous like film, an architecture based on duration and flow, from actual to the virtual, and from the virtual to the actual" (Beckmann, 1998, p. 15). Stable and static spatial understanding evades.

For Novak (1991), advances in technology deliver an identity of space that is unfinished. Novak explains, "notions of city, square, temple, institution, home, infrastructure are permanently extended" in the face of cyberspace (1991, p. 249). As the technology is unfinished, continuing to evolve, the expansions are continuously redefined. Through the introduction of highly fluid spatial identity, the previously defined artifact, that of the city or the room, as static and finished, simply evades. This fluidity challenges some of our most simple means to ascertain limitations that define what has been established as our tangible world.

4.4.2 Fractured Identity: the In-between Spaces

The term in-between spaces refers to the spaces or distances laid out between material artifacts and individuals within the physical environment. This term makes reference to the non-material, open space or air that surrounds individuals and their artifacts. In this section, I provide an analysis of how advanced digital technologies deconstruct previous understandings of these in-between spaces and, address how these spaces dissolve in the digital era. I argue that advances in technology not only support the extension of space, but also, in the same gesture, deliver space compression. This is not to say that these technologies expand or compresses space, rather, I argue that the issue is far more complex; technology executes expansion and compression simultaneously. The global networks stretch outward and at the same time inward, erasing the traces of previously defined distances in-between (Benedikt, 1993; Novak, 1991; Mitchell, 1999). Benedikt (1993) suggests these features demand their own discipline, calling for a new spatiology.

The notion of space compression has intensified over the last fifteen years. According to Harvey (1989), this intensification is directly linked to the emergence of effective real-time communication systems and their abilities to forge a new relationship between space-time. Open distance, as physical terrain and space, is supplanted in cultural importance to speed and time (Senagala, n.d.). For Mahesh Senagala (n.d.), the architectural impact of this is marked by the shift from a space-like architecture to a time-like architecture. The cultural focus moves out and away from the physical features of architecture as grounded in Euclidean space and toward the information or cyber architecture of networks. As advanced technologies continue to deliver instantaneous, remote-interactivity and advanced global networks, there is evidence of collapsing distance and time. That is, ideas of distance translate into seconds, minutes or hours in its new measurement. Speed of transportation and information transmission become the integral ingredients. No longer is the question “How far?” Rather, the attention shifts to “How long?”

Speed becomes the defining new feature of the digital era. Virilio (1998B) explains that an information society is completely reliant upon speed as “information is of value only if it is delivered fast; better still, that speed is information itself” (p. 156)

The ability to speed-up toward absolute instantaneous transmission and real-time interaction through global networks is radically redefining cultural expectations. For Virilio (1998B), there has been a historical progression, migrating toward this intensity toward real-time. He notes, "Once more a certain observation regarding the change in the speed of history comes into its own: long-term, short-term, real-term" (1998B, p. 156).

Globalization distributed through advanced media and technologies contributes to the notions of space compression. Through these technologies, new opportunities to superimpose, the once very separate conditions, as distributed globally, and migrate them closer together. Harvey (1998) explains, "Spaces of very different worlds seem to collapse upon each other, much as the world's commodities are assembled in the supermarket and all manner of sub-cultures get juxtaposed in the contemporary city" (p. 302). The compression places strain and pressure on individuals or cultures to maintain their original identity. The intensified integration, or homogenization, dissolves the distinct features of a culture (Dyson, 1998).

Real-time media has altered the way in which individuals experience news and events from around the world. Prior to the introduction of complex media networks and cyberspace, events on the other side of the world arrived into our realm of understanding through slower mechanisms. With increasing effect, advanced new real-time media dissolve the spaces that once rested between an individual and all the events around the world. Real-time dissemination of events creates a sensation of being closer to the event than we actually are (Boyer, 1996). Sophisticated graphics of televised, instant online news updates or the word of mouth as transmitted from person to person often connect people to events, even if they are physically far apart.

Upon further analysis, the compression of space challenges the separation of public space and private space. The advanced global media systems that enter into my apartment challenge the notion of privacy and disconnection from the city outside my apartment walls. The room as shelter, as protection from the outside, comes into question. The defining features of private and public boundary line shifts. Powell (1998) explains, "This means that the Other increasingly encroaches upon what had once been our private space" (p. 150). The distinct and separate domains of private and public merge in the compression of the spaces in-between.

Advanced technology restructures the proximity and unity that define design and architecture. Professor of Urban Technology at the University of Newcastle, UK Stephen D.N. Graham (1997) explains, the result "undermines the old notion of integrated, unitary, city which has an identifiable physical boundary, and is separated from others by Euclidean space and the all-powerful friction of distance" (p. 122). The intensification of global networks and real-time communications will continue to challenge the friction of distance.

The continued intensification of space compression is inevitable as more sophisticated advances in technology become available. The evolving technologies promise to deliver an increasing level of sophistication that complicates our understandings of distance, adjacency, subject and object. The remaining gaps will become areas for dissolve, places to take over, to seal up, to tighten and close. To make that disappear, French philosopher Maurice Marleau-Ponty proposes compression: "the world will then close in on itself" (as cited in Virilio, 1998B, p. 156).

4.4.3 Fractured Identity: The Individual (the subject)

As objects and the in-between spaces reveal fractures through expansion and compression, the identity of the individual is evolving with strikingly similar features. The defining features of identity are challenged and splintered in the face of sophisticated advanced networks and communication systems. These systems promise to revolutionize how the individual assembles new meaning of self as a splintered identity.

However, investigations and discourse around identity and its instability are not new to the digital era. The concept of a fracturing identity and subject has been a pivotal and central theme to numerous postmodern investigations for over 30 years now (Butler, 2002; Harvey,1989). The fracture, supported through Postmodernism, is clearly one that is divided or fragmented. Jameson notes:

> Spatial peculiarities of post-modernism as symptoms and expressions of a new and historically original dilemma, one that involves the insertion as individual subjects into a multidimensional set of radically discontinuous realities, whose frames range from the still surviving spaces of bourgeois private life all the way to the unimaginable decentering of global capitalism itself. (as cited in Harvey, 1989, p. 304)

The digital era delivers a new ability to advance the previous ideas set forth through Cubism. Cyberspace fractures the subject and shifts it toward multi-dimensionality in real-time in real-space. The premise is no longer reserved for the artistic representations or interpretation. The fractured and growing instability of the subject becomes central in the digital era and is a feature distinctly descriptive of Western society at the close of the twentieth century (Boyer, 1996).

Cyberspace continues to unravel the identity of the subject as initially proposed by postmodernists. As media artist and theorist Francis Dyson (1998) explains, "Cyberspace is established as an 'other' place to enact the deconstructed self: a self whose multiplicity and ambiguity is continually reinforced as the body seems to increasingly inhabit the dematerialized world that technology creates." (p. 31). A stage for the performance of the unraveling and reassembly of self implies that identity is optional.

The challenge here is that the very foundations of the subject have become riddled with contradictions in the digital era. A plethora of new meanings attempt to resolve the puzzle of what constitutes the subject in the digital age. The digital era proposes a consistent, reliable state of increasing instability by means of an ever-changing state of multiplicity. The instability becomes the new stability, a consistent theme embedded in deconstructionist theory (Butler, 2002). Professor of English Language and Literature at Oxford University, Christopher Butler (2002) explains, "Not only is our knowledge of the world not as direct as we like to believe – metaphor-ridden and entirely relative to the scope of our conceptual systems – but we have been all too confident about the ways in which central categories within those systems work to organize experience" (p. 20). Butler suggests there has been a blind faith of sorts in the references sourced by individuals to construct an understanding. The feature of unreliable or at least unfamiliar information being used to inform understanding is a pivotal evolving condition in the digital era.

The age-old philosophical question reappears in our foreground. The struggle between the mind and body resurfaces with new energy and meaning in the digital era. Most notably, the Descartes notion claiming "I think therefore I am" becomes reinstated with new force through the conditions of cyberspace (Wertheim, 1998). Wertheim (1998) explains that at the entry into the new millennium, cyberspace delivers a "being not in body, but in the immateriality of mind" (p. 49). Cyberspace severs the mind from the physical body.

Cyberspace challenges the fundamental constructions of spatial limitation as it splinters space. An experience of being in two places at one time is possible through the virtual systems of cyberspace and challenges the fundamentals of empirical science (Wertheim, 1998; Stone, 1992). This condition of being splintered, of being in more than one place at any given time, is what Virilio calls *tele-topology* (Redhead, 2004; Ruby, 1998). In fact, being in several places at one time is becoming available through these systems. This resurrects the notion of the dualist reality inherently available through cyberspace and embedded into the new construction of identity of the self (Wertheim, 1998).

Cyberspace intensifies the separation between the body and the mind. The body, located in physical space, remains, yet the mind proceeds to wander out into the new terrain of other spaces offered through cyberspace (Franck, 1999)The sophisticated constructions of spaces offered through these virtual systems are an alluring option for exploration. Wertheim (2002) describes the impact of this duality, "when I 'go into' cyberspace, my body remains at rest in my chair, but 'I' – or at least some aspect of myself – am teleported into another arena which, while I am there, I am deeply aware has its own logic and geography" (p. 300). Identity, as connected to body, becomes contestable in the digital era. Wertheim (1999) adds, "The location of the self can no longer be fixed purely in physical space" (p. 54).

The identity of the individual becomes dependent upon advanced technology to define what it knows. Advanced technologies remove the experience from the human and embed it into the technological supporting device. For Virilio (1998C), this is most commonly found in surveillance and recording devices that dominate the power of the eye or of vision. Virilio observes, "…to the philosophical question of the splitting of viewpoint, *the sharing of perception of the environment between the animate* (the *living* subject) and the inanimate (the object, the seeing machine)" (1998C, p. 134). Sight is splintered into a wide variety of technological agencies illustrating an increasing fracture of that which was once unified. Human senses, such as sight, are defined through the power of camera, video recorder or other surveillance technology. This implies that somehow the ability to see, to acquire the vision, is defined through financial costs or the ability to acquire these technologies.

To illustrate a fractured spatial condition, I refer to the sophisticated *Personal Data Assistants* [PDA], such as the Blackberry. The emergence of this technology into the conference room alters the status of the conference room. The physical properties that define the room are challenged. These sealed off rooms are designed to keep those on the outside of the room, the uninvited, out, and help maintain the focus of those inside on the meeting. If you are inside the room, the objective is to focus, communicate and concentrate with your immediate physical surroundings. The BlackBerry is altering the social structure of communication that takes place here. Even if the physical bodies are present in these conference rooms, the BlackBerry supports a continuous, rapid cyber connection beneath the table surface. This is not a prediction; it is currently a condition that is drawing increasing attention. The ability to remain discrete about "mentally leaving a room" is what makes the BlackBerry a huge hit over something acoustically more disruptive such as a mobile phone. This introduces the idea that a person who is physically located in the meeting location may, for extended periods of time, choose to support a multiple presence. Ihde (2002) describes this multiple-roled enactment of the individual a "dance of new agency" (p. 84). *Individuals can choose which reality they* will engage with. The presence is defined by the on/off switch, satellite signals and eye contacts. Can anyone tell, through sight or sound, that you are text messaging under the table surface?

The individual is confused as to which reality to engage. The subject is bombarded with a highly sophisticated and constant stream of data, images and other sensory information. The stimulus that the brain must process has become overwhelming. For example, as I am jumping into a cab, talking on a cell phone and surfing the Internet on a BlackBerry hand-held device, which reality am I participating in? Which reality shall I choose?

The subject stretches out through space and time and becomes mentally fractured and overextended, while at the same time under increasing pressure to select which signals from which reality will be processed, be absorbed, and become foundations for our new construction. For Boyer (1996), this is a primary experiential feature of she calls the Cybercity. Boyer explains the condition of Cybercity as "...the postmodern body is surrounded and bombarded with incoherent fragments of space and time..." (1996, p. 19). As distributed and fragmented, the individual becomes stretched thin, exhauster and disoriented. Dyson (1998) concurs, "The ever-expanding, continuously on-call individual, becomes another kind of interface, for ever screening, filtering, ignoring, accepting and repressing the plethora of inputs, information and demands for action that absorb his or her private space and individual time" (p. 30). The juggling act between mediums emerges as the new foundation that defines my understanding. The multiple selves, space and others that surface into my experience, virtually or physically superimpose to create the experience of the temporal, evolving and fractured being.

The ability to choose reality creates new challenges for the individual. The selection process demands a continuous and arduous amount of energy to sustain itself. To maintain presence and identity, one needs to be consciously and consistently executing it. Wertheim (1998) argues, "Subjectivity is performed as a new kind of text while the body becomes a permeable surface, adorned with signs and riddled with inscriptions and prescriptions of culture" (p. 30). Interior designers and architects will be challenged to decipher the evolving codes of the performing individual. Who are they designing for? How will designers and architects prepare the space for the performing subject?

Identities represented in cyberspace have become complex. For example, in online video games or in chat room interaction, individuals can choose from a variety of features to represent themselves to the online community. The question of "Who am I?" moves to the center of consciousness, as it becomes a password to enter and activate a new self in online communities of cyberspace. Which avatar body represents me? Questions that were once left to philosophical or religious quests are now answered randomly and momentarily. Am I Caucasian? African? Am I a female or a male? Or am I an animal? How we choose to construct self and present ourselves to others informs and constructs new social structures (Franck, 1999). The identity of self, as fractured, expanded, multiplied and grown, can be deconstructed and reconstructed at whim.

If the subject's identity is unstable in cyberspace, how do other individuals interpret their engagement with the subject? Understanding the identity of "the other" represents itself in potentially challenging ways in cyberspace. Stone (1992) explains, "…we become aware of new kinds of beings who inhabit the phantasmic spaces of technology" (p. 610). Cyberspace delivers a mysterious flirtation with the unknown. Who are we socializing with in these virtual systems?

The complexity of identity in cyberspace introduces new challenges for establishing trust in social relationships. Identity as enactment rolls into a complex network and social structure that may be based more on a convincing performance than that of authenticity of self (Stone, 1992). Some online individuals may or may not be who they appear. Yet, according to French cultural theorist Jean Baudrillard's (1988) theories on simulacra, this may no longer be of relevance.[17]

Fractures imply splintered and segregated elements used to assemble identity. The utopian vision of setting the subject free from physical material grounding is the ultimate, and obvious, impossible challenge. For Stone (1992), "One thread of this tangle is that subjectivity is invariable constituted in relation to a physical substrate – that subjects must be associated with bodies" (p. 611). Bodies, in this view, are completely grounded and housed in the physical realm. This reinforces the need for physical space, as enclosure, as interior to situate the body. But the evolving status of the conditions delivered within these bodies remains an unfinished project and future challenge for interior designers and architects.

4.5 Missing Tactility

The potential rising of a backlash toward technology is slowly assembling in cultural references, art and theoretical discourse. There is a new enthusiasm to question the pure abandonment to technology. As recently claimed by theorist Nicholas Rombes (2005), "the real has become the new avant-garde" (p. 1). Evidence of this was reflected in the Whitney Biennale 2004, where a new emergence and concentration in mechanical arts, of hand drawing and painting, was selected for the exhibition. Also, design magazines started to embrace and reflect this commemoration for real (Blueprint: Architecture,

[17] Simulacra as introduced by Jean Baudrillard is discussed more extensively in Chapter 5. For an additional reading on simulacra as introduced by Baudrillard, I refer the reader to *Simulacra and Simulation* (Jean Baudrillard, 1981) and to Mark Poster's, *Jean Baudrillard: Selected Writings* (1988).

Design, Culture. Feb 2005; Interior Design, January 2005). *Blueprint* magazine featured an array of stacked leather hides piled in an unordered assembly on its cover page. The cover page for *Interior Design* magazine recently featured the highly tactile celebration of natural materiality of an interior space, lined with fur walls and ceilings in combination with various woods. The runways in fashion are also responding, and perhaps instigating their own interpretation of this longing for the real. The new Sherman broach craze, rhinestones, decorative floral patterns, wooly tweeds, are emerging as the new trend in tandem with a heavy set of accessories of furs, suede and leathers.

The idea of attaining a stronger connection to worlds constructed through natural processes requires additional attention. Do these examples illustrate a sincere longing for a reconnection or reengagement with the tactile, the organic or the real? Or are these merely surface ideas, void of anything deeper than a momentary identity – posing, performing and soon, fading? Although it is probable that a backlash against advanced technologies may appear in momentary fashion, we are too far along to radically change the course.

More realistically, the fervor for advances in technology will continue to expand and evolve in effect. They will continue to present more complexities in previous understandings of spatial identity. The identities described in this chapter will continue to evolve as multiple, unstable, fluid and fractured. The boundaries that maintain our understanding of the subject, the object and the in-between spaces as defined and set within physical boundaries will continue to evade. I anticipate the future holds an intensification of the condition and will continue to introduce subjects, objects and the in-between spaces as fractured, splintered and spread out globally across space and time.

The concepts introduced in this chapter will continue to grow in complexity, as the debates will remain unfinished and in a state of evolution for some time. The growing complexity of evolving fractures of self, other and the space promises to be one of value and significance.

Interior design and architecture, grounded and locked into a system of Cartesianism will need to consider how their practice supports these fractures. How do design solutions perhaps introduce increasing fractures? How do their choices decrease the effects of fracture? Interior design and architecture need to consciously and critically develop a framework in which to engage the conditions of fracture presented throughout this chapter. They need to explore and investigate the ways they engage, execute and even ignore the mere existence of the fractures.

Design will need to take a conscious and active position in each new design problem. If there are options in selecting realities, in the construction of identity of self, object and the in-between spaces, designers will need to identify which reality or realities they are designing for.

CHAPTER FIVE

THE BIONIC GENERATION

CHAPTER 5: THE BIONIC GENERATION

Historically, fear and trepidation are a central theme in scientific and technological progress. Individuals, attempting to understand future implications of progress, construct visions of its potential influence on society. Carrying over from generation to generation in Western society, evidence of fear can be traced through a variety of myth, fiction, critical debate and cultural analysis (Best & Kellner, 2001). For example, the industrial era sparked widespread anxiety of the potential impact of the machine. Posed as a threat, mechanical progress through automation and sophisticated systems drastically reduced or eliminated human labour (Harvey, 1989). Upon entering the twenty-first century, a similar anxiety can be traced through the criticism and analysis of the advanced technologies introduced during the digital revolution. Concerns over the impact of technologies introduced in smart systems, telecommunications, robotics, artificial intelligence [AI], molecular engineering, biotechnology and nanotechnology have sparked a new enthusiasm into the debate of humans vs. the machine (Joy, 2000, July).

This chapter focuses upon the evolving status of the human body and the interior environments they inhabit. I argue that contemporary technology has drastically altered the status of architecture and the biological human body and promises to continue to do so. The analysis reveals how technology repositions and redefines what traditionally has been defined as static physical space (architectural) and the natural biological systems of the body (humans).

Because interior designers and architects design *spaces* for *humans*, the status of space and the human are of great concern to these professions. I review how the evolving generation of electronically, biologically and digitally augmented environments and individuals alters the foundations of design process and practice. I argue that traditional models of architectural space, constructed in static material matter and inhabited by natural biological humans, is proving to be irrelevant in the digital era.

Throughout the chapter, I present current application strategies, theories, research and the anticipated ambitions of these advanced emerging technologies. I argue these technologies represent the emergence of a super or *bionic generation.*[1] Illustrating examples of enhanced bodies, environments, furniture, materials, molecules and software programs, I argue that the bionic generation presents significant challenges and complexities for design in the twenty-first century.

This analysis draws closely upon contemporary discourse rising out of architecture, cyber and cultural theory. Also, it studies the significant contributions in research coming out of Media lab at Massachusetts Institute of Technology [MIT], through individuals such as Academic Head of the Program in Media Arts and Sciences William J. Mitchell and professor Kent Larson's House_n Research group. I also provide examples of the invention and application of bionic materials and bionic software as presented by researchers at The Association of Computer-Aided Design in Architecture [ACADIA] 2004 conference. The discussion expands in its review of the representation and evidence of smart, or bionic, environments found in television, literature, film, theory, research, and other everyday environments.

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[1] Gareth Branwyn refers to the term *bionic* in his essay titled *The Desire to be Wired* (1998).

Bionic humans are also explored. Expanding on the idea of cybernetic organisms, I discuss the distinguishing features of cyborg's in their relation to biological humans, transhumans, posthumans and robots. The analysis is grounded in the work of feminist and cultural critic Donna Haraway's (1985) *Cyborg Manifesto* and explores the provocative ideas of the body and technology as explored in the performance's of Australian artist Stelarc. I expand this discussion through ideas presented by theorists such as philosopher Don Ihde, English professor N. Katherine Hayles and the visionary Director of the Carnegie Mellon Mobile Robot Laboratory, Hans Moravec.

I also examine the potential influence of nanotechnology on interior design and architecture. Expanding on ideas from architectural theorist, Neil Spiller, in his discussions on the nanotheory of B.C. Crandall. I illustrate the potential implications of future nanotechnology on design process and practice. Through critical analysis, I review the suggested implications of an expanded nanotechnology on both the challenges and opportunities for design. This discussion also considers the seminal predictions of leading nanotheorist K. Eric Drexler.

In this analysis, French cultural theorist Jean Baudrillard's hyperreality and Philosopher Albert Borgmann's ideas on Hypermodernism are also explored. I discuss how features of the bionic generation suggest significant complexity in framing the current era through theories of modernism or postmodernism. I argue that characteristics of the bionic generation are more in line with the evolving discourse of Hypermodernism, based in the theory of technology developed by French cultural theorist Paul Virilio.

I argue that the future bionic generation – populated by sophisticated cyborgs and smart environments – will alter what designers do and how they do it. Ideas once restricted to science fiction are migrating effectively into cities, offices and homes.

Some of the conditions outlined in this chapter appear apocalyptic. I do not deny this. Yet it is important to note that my intention in this chapter is not to instill angst amongst readers. Rather, the intention is to present important features of a bionic generation that will influence design and architecture. Although the bionic generation will impact a variety of social, political and cultural issues, my intention is to present the more specific consequences it presents to interior design and architecture.

Whether positive or negative, dystopian or utopian, technology has a reputation for never fully measuring up to the predictions of its visionaries. Somehow, the application and effect of technology often falls short of the original hope or aspiration. Mitchell states that this is no longer the case as something more profound is underway. He claims, with a sense of relief, that finally "the technology just got good enough" (personal communication, June, 2004). In this view, Mitchell affirms these new technologies will drastically alter how and in what ways design and architecture takes place. It is important to assess these technologies and to ascertain what it is that 'just got good enough'. Further, if these technologies are going to alter how design 'takes place', it is imperative to consider what the new technologies are and specifically assess what they imply for the future generation of design and architecture.

5.1 Bionic Architecture: Smart Systems

Some of the most ambitious examples of cross breeding space and contemporary technology can be found in the set of Hollywood's science fiction [sci-fi] films. Director Steven Spielberg (2002) delivers an extraordinary number of examples of a seamless integration between technology and the interior environment in the film *Minority Report.* In the film, detective John Anderton, played by actor Tom Cruise, interacts with sophisticated technologies in scenes set within his workspace (see Figure 5.1 to Figure 5.8). Anderton, adorned with a *data-glove*, rapidly sifts through streams of data embedded in the live-data wall.[2] Anderton swiftly organizes and navigates through a multitude of data using his body motions to direct and sort images, video and text (see Figure 5.3 to Figure 5.5).

The live-data wall in *Minority Report* is made of a transparent material. At first, it suggests a non-material presence (see Figure 5.1 and Figure 5.2). Once detective Anderton engages the data, the wall enlivens and becomes apparent to the viewer. The data makes the wall known as it transforms from transparent to translucent. The streams of data merge within the wall, superimposed and morphed into each other. The collage also incorporates the physical architectural elements and individuals in the room set beyond the live-data wall. Design composition becomes challenged as layers, or sequences of text, graphics, videos, material translucency, colour, partition, space, furniture and lighting move into one canvas (see Figure 5.8).

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[2] The term *live-data wall* here is used to describe the interactive wall in the film, as there is no specific formal name for this type of architectural element.

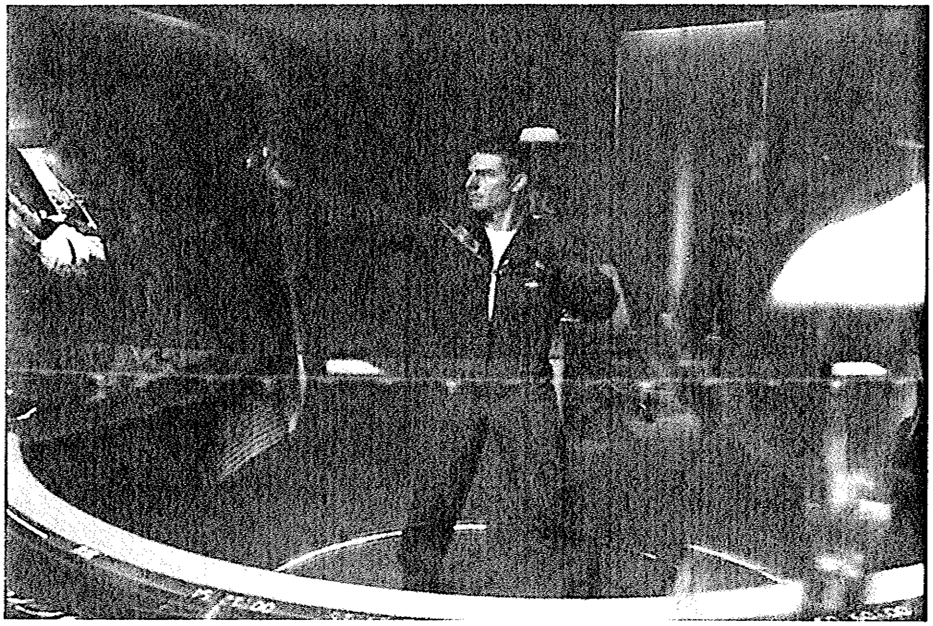

Figure 5.1 *Minority Report* (Spielberg 2002): Detective Andertson using data glove and body motions to direct information on live-data wall. View is taken, looking through the live-data wall.

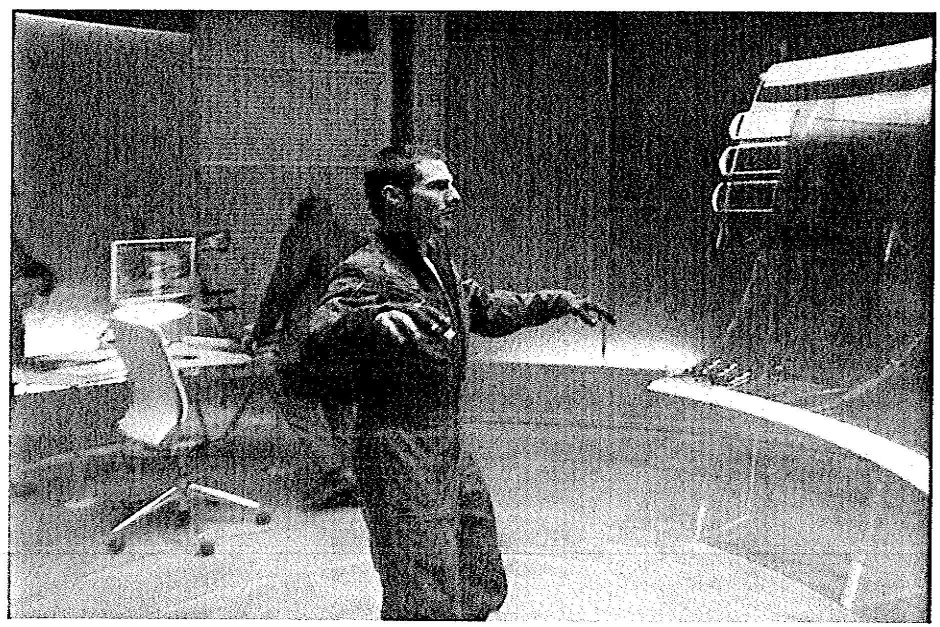

Figure 5.2 *Minority Report* (Spielberg 2002): Detective Andertson using data glove and body motions to direct information on live-data wall. View is taken, looking into the work place, adjacent to the live-data wall.

Figure 5.3 *Minority Report* (Spielberg 2002): Detective Andertson using data glove and body motions to direct information on live-data wall. View is taken, from behind Andertson, at the live-data wall.

Figure 5.4 *Minority Report* (Spielberg 2002): Detective Andertson using data glove and body motions to direct information on live-data wall. View is taken, from behind Andertson, at the live-data wall.

Figure 5.5 *Minority Report* (Spielberg 2002): Detective Andertson using data glove and body motions to direct information on live-data wall. View is taken, from behind Andertson, at the live-data wall.

Figure 5.6 *Minority Report* (Spielberg 2002): Detective Andertson using data glove and body motions to direct layering of information on live-data wall. View is taken, from behind Andertson, at the live-data wall.

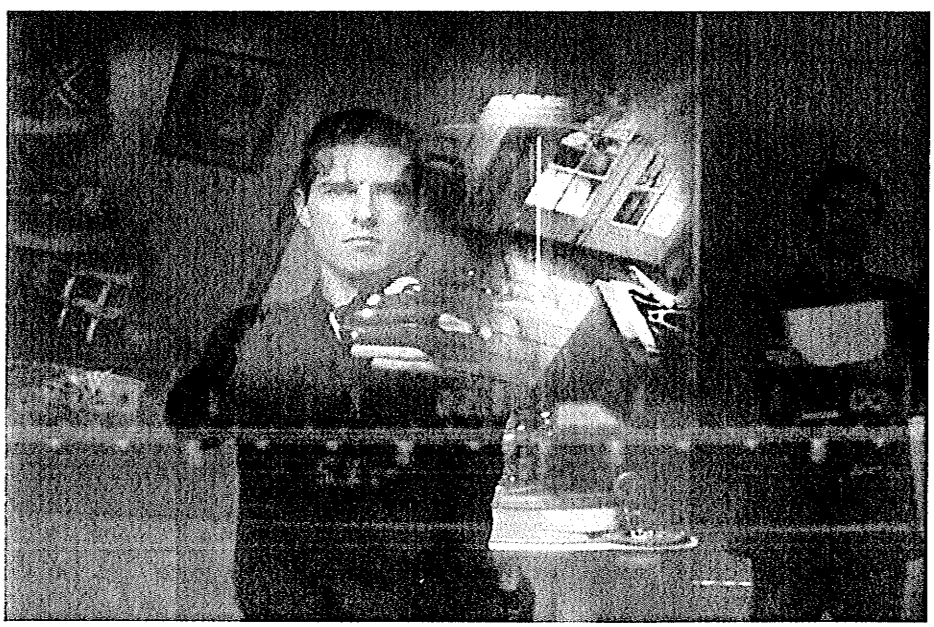

Figure 5.7 *Minority Report* (Spielberg 2002): Detective Andertson using data glove and body motions to direct layering of information on live-data wall. View is taken, looking through the live-data wall at Andertson.

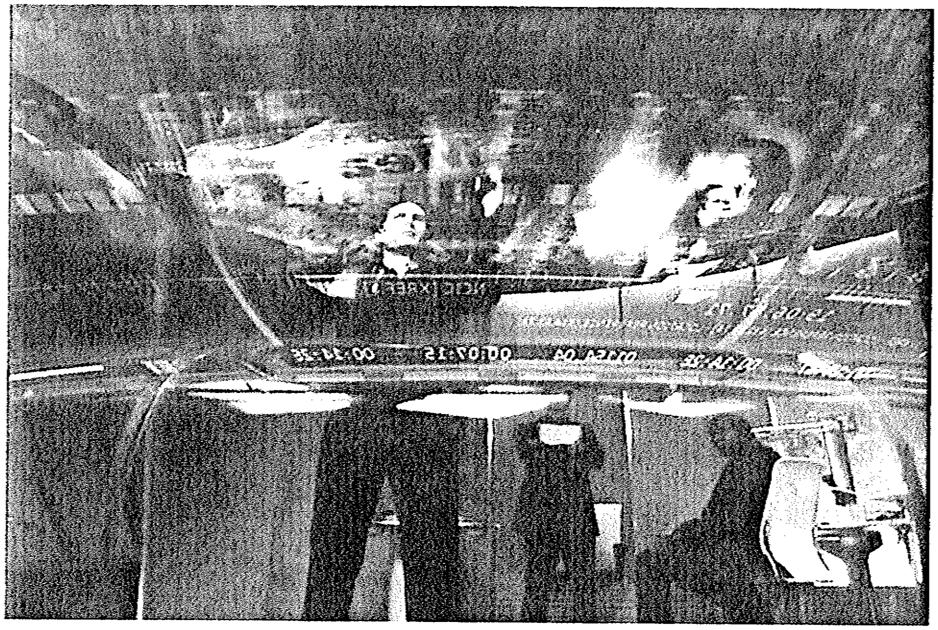

Figure 5.8 *Minority Report* (Spielberg 2002): Detective Andertson using data glove and body motions to direct layering of information on live-data wall. View is taken, looking through the live-data wall. Co-workers and workspace are visable behind Andertson (lower right corner).

Such enlivened surfaces raise significant questions for designers. What role does the interior designer or the architect play in designing these new compositions in the interior environment? Is the wall a screen? Is the text a wall? Or is the screen a wall and the text a screen? Which profession becomes responsible for designing this spatial element: interior design, the industrial design, interface design or the software design?

Although defined as a science fiction or futurist representation, several of the ideas presented in *Minority Report* are no longer restricted to a fictitious future. Advanced technologies have become sophisticated and are now compatible and embeddable into a variety of static elements, such as architecture, buildings, furniture and fixtures. Static architectural elements or environments are animated as they become laced with responsive electronic and digital technologies. The enlivened and responsive artifact is *smart* or *intelligent.* Smart systems are pre-programmed to respond to the natural movements or motions of humans. Static elements appear to "think" for themselves. These systems are predominantly supported through a variety of advanced technologies, such as AI and miniaturized motion or heat sensors.

As an example, IBM has introduced *DreamSpace,* an interactive and collaborative environment that features most of the characteristics found in *Minority Report's* live-data wall. DreamSpace is a collaborative interior environment that operates on what is called a *natural interface* or *natural computing* (IBMCorporation, 1996). The elements of the space, such as the walls, respond to human movement, gestures and voices. The effect is strikingly similar to the live-data wall of *Minority Report*, with one prominent exception: data-gloves are not required for the DreamSpace. MIT researcher Mark Lucente explains, "DreamSpace uses a device less multimodal user interface" eliminating the need for cumbersome extra equipment (as cited in IBM Corporation, 1996). The interface enables humans to interact with sophisticated technologies through intuitive and natural human movements.

Currently, smart technology is embedded into many everyday objects. These can be found in a variety of standard design and architectural applications, such as plumbing fixtures, personalized temperature-control systems, sensor-based light systems, automatic door operations and more recently in security controls and retina scanners. Other innovations, such as voice-recognition software, miniaturized sensors or face-recognition software are rapidly expanding the effect and potential application of these systems.

Smart technology delivers society with an assortment of benefits. For example, these technologies can be found in public restrooms, such as airport facilities designed with auto-flush toilets and automatic on-off faucet operations to ensure water management and conservation. The sensors ensure, elements such as faucets or lights, turn off when not in use, as humans sometimes forget. In commercial offices, more recently applications include sensor-based light-control operations or security systems and HVAC systems.[3]

The influence and opportunities of these smart technologies in design are just being realized. Research teams have designed successful smart office environments, such as *Project Office 21* created by the Frauenhofer Institute and *Roomware* designed by Norbert A. Streitz (FORM, 1999). Project Office 21, is similar in ability and effect as the

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[3] HVAC is an industry term, referring to Heating Ventilation and Air Conditioning.

environment represented in the film *Minority Report*. *Roomware* is a new product designed to use elements integral to office environments as a site for smart technologies. For example, Roomware designers use the surface of the walls to host their electronic smart wallpaper, *Dynawall* (FORM). This implies a means to relocate cyberspace, where once it was beyond the screen of a computer, and can now move out into the physical spatial setting and become inhabitable.[4] Furniture companies, such as Wilkhahn, have developed a variety of smart furniture pieces such as chairs, data walls and a range of conference equipment (FORM, 1999).

MIT research team the House_n Research Group [House_n], headed up by professor Kent Larson, is exploring these ideas through their full-scale laboratory called *Place Lab* (Architecture, 2003-2005; Barron, 2004, October 21; Weisman, 2004, October 4). This lab is a flexible housing facility that has been constructed with an advanced sensor-based network and infrastructure system. Place Lab is a full-scale apartment that houses research participants who live within the facility for a specific research endeavor. It not only enables researchers to test and explore new advances in technologies, materials and systems, but also to collect qualitative and quantitative detail that give interior designers and architects a real-time, accurate and detailed account of how space is actually being used (Mitchell, personal communication, June 2004).

There are several ideas emerging from application strategies for smart technologies. During my interview with Mitchell, he described the ability of technologies such as those used in Place Lab to improve larger social issues. There are possible

[4] The migration of cyberspace out of the screen interface experience is explored more extensively in a theoretical inquiry in Chapter 2.

application opportunities being explored through MIT to use these ideas to support living facilities for senior citizens (Hart, n.d.; Mitchell, personal communication, June, 2004). Mitchell explains, the application and intention would be to deliver effective relief for the already over-burdened health care industry in the US (personal communications, June 2004). As baby boomers move into retirement, the ideas emerging through PlaceLab suggests supporting the extra demand this will place on the health care system.

Place Lab suggests homes can be linked, via sensors or other technologies, to be highly responsive to individual needs. They are wired and constructed to correspond to a larger network of resources outside of the physical home. They can effectively sense human activities taking place within it. Should individuals require help due to an accident or injury, the necessary medical professional, pharmacist, family member or other health care provider can be notified. In terms of everyday activities, these environments can be designed to automatically notify individuals if a medication dose or a meal is missed. Other aspects of daily living, such as monitoring of food, products or medication, could be verified and an automatic order placed should inventory levels drop. (Mitchell, personal communication, June, 2004).

Interior designers and architects can also benefit from this technology to improve their practice. One of the benefits of a smart environment is that it can inform designers on how spaces are used. As a research tool, the smart system "generates a constant stream of information, sensitive information" that can be used to inform design teams on the effectiveness or success of their design solutions (Mitchell, personal communication, June, 2004). Mitchell claims these technologies are a far more accurate depiction of space use than the data gathered in post-occupancy evaluations.[5] As miniaturized and sophisticated technology systems can be placed "into the woodwork," says Mitchell, it promises to be a less obtrusive way to gather data without compromising the quality of information (personal communication, June, 2004).[6] From private settings such as the home and office, to the more public settings of parks or libraries, the application of these systems will prove valuable to a variety of design professionals.

Some design professionals are already using sophisticated technologies to inform their design process. For example, the international design firm DEGW, founded by Frank Duffy, uses Ubisense, a technology that tracks the movement and paths of individuals. This system tracks people through the use of global-positioning software [GPS]. Duffy explains that the benefit of this global surveillance is that it delivers an entire picture of space-use (Duffy, personal communication, October 19, 2004). That is, it includes a variety of spaces beyond the settings of an interior space or room. By restricting the observation setting, Duffy argues these observations can fall short. It ignores a larger contextual piece of information, such as where else individuals or teams work and how else they use space. Duffy explains that these GPS based systems become more important as individuals become more mobile. He explains that these systems,

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[5] Post-occupancy evaluation is an industry based term. It refers to the inquiry and analysis of a particular space. Often, these are used to understand how successful or effective a completed design project is, after it is 'occupied' and in full use by it's occupants.
[6] This terminology 'into the woodwork' is often used by William J.Mitchell (1999; personal communication, June, 2004). He uses it to describe the ability to embed miniaturized sensors, essentially invisible to the human eye, into standard architectural and deign elements. He is referring to technology that is unobtrusive and unnoticed.

supported through wireless means, can capture the most accurate story of space use and patterns – inside, outside and in-between buildings.

Although there are several benefits to smart technologies, there is also growing concern over their application. As interest in surveillance systems grow, especially in a post-9-11 world, technologies will likely be used more often to track and record a range of behaviors. These technologies enable sensitive information to be compiled and distributed rapidly and effectively. Who will gain access to this information and how will it be used? For example, employers may use it to track employees, marketing agents may use it to track consumer behaviors, parents can use it to monitor children or spouses can use it to monitor each other. As the technology can become embedded "into the woodwork,"; the building, the furniture and the millwork all become agents in detective work – a new society of virtual spies is made available. Interior designers will become actively engaged in the choreography of these 'spies' as they will become increasingly responsible for embedding the technology into the woodwork and strategically locating and specifying the smart products.

As the integration and use of these advanced and miniaturized smart technologies expand, interior designers and architects should be prepared to be asked to implement them into a variety of spatial settings. Morally, the motivational use and applications of these technologies can come into direct conflict with beliefs about freedoms and privacy.

Interior designers and architects can anticipate debates as these technologies advance the evolution of Orwellian environments.[7]

5.2 Going Airborne: Holography

Complimentary to these smart technologies are the evolving developments in Holographic technology. Holography can be understood as a virtual 3-dimensional [3-D] representation of an image. These can be found embedded in the 2-dimensional [2-D] surface found on credit cards. The more sophisticated form of this technology, called electro-holography, is capable of projecting a 3-D virtual image, constructed through light and laser beams, that can be positioned in open spaces.

Although some examples of holographic conferencing are in use today, this is rare, and most applications represent the more primitive abilities of the technology. To illustrate the more dynamic future ambition of interactive holography, I refer to the film *Star Wars: Episode III - Revenge of the Sith* (Lucas, 2005). One of the scenes takes place within the Jedi council meeting chamber (see Figure 5.9). Some council members are physically present in the room and seated within the formal seating arrangement, a circle. Those who are not physically present are beamed in using 3-D holographic techniques. They are represented in a translucent light, monochromatic, yet featured as interactive, in real-time as a fully enlivened 3-D body (Figure 5.10). Individuals who are both present and non-present are able to engage with one another and appear to be all seated within the

[7] The term Orwellian refers to conditions introduced by George Orwell, of advanced surveillance systems described as Big Brother in the book *1984*.

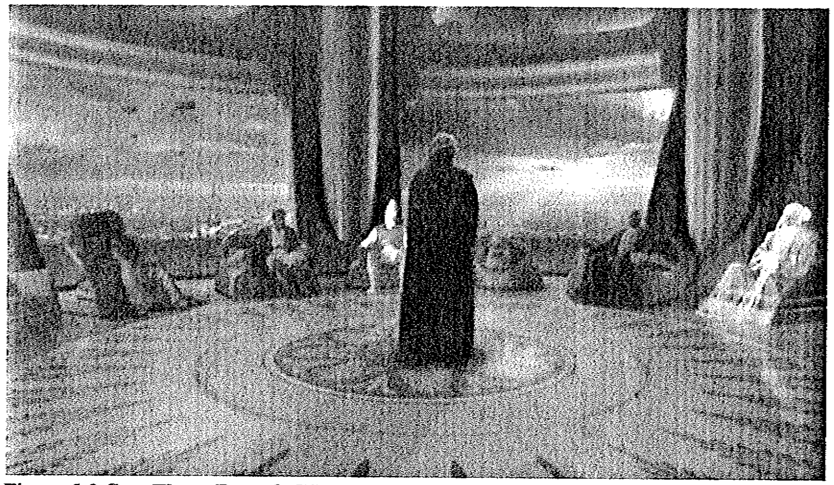

Figure 5.9 *Star Wars: Episode III – Revenge of the Sith* (Lucas 2005): Jedi council meeting in-session. Holographic conferencing used to support communincation with council members who are not present (represented in image as transluscent and blue/grey tone).

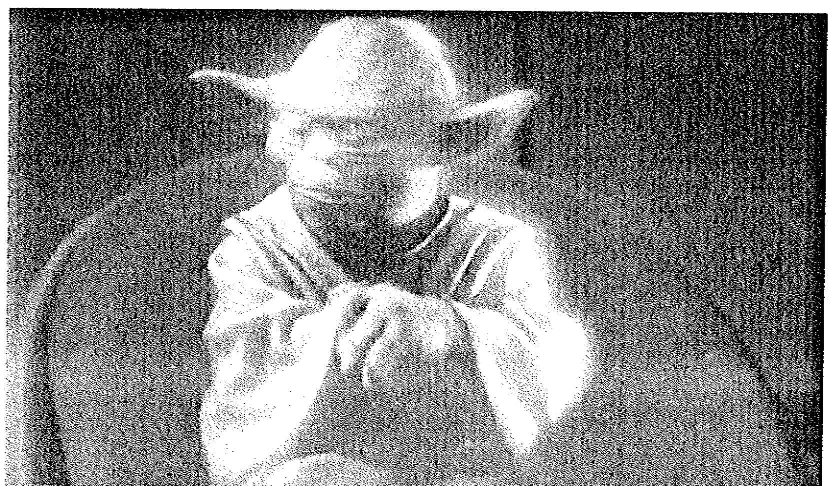

Figure 5.10 *Star Wars: Episode III – Revenge of the Sith* (Lucas 2005): Jedi council meeting with Yoda rendered as seated and 'present' through the use of holographic technology.

physical setting. The non-present council members appear equally as involved in the meeting as their present counterparts.

To further understand the more advanced ambitions of holography, I refer to the television and film series of *Star Trek* (Roddenberry, 1966).[8] The feature of interest is what is named the Holodeck. The Holodeck has been described as "a technology that combines transporter, replicator and holographic systems".[9] In *Star Trek*, the holographic technology is represented as incredibly more sophisticated than the ideas hosted in Star Wars. The Holodeck can beam in a person, or beam in an entire environment. In *Star Trek: First Contact*, where Captain Picard in an attempt to escape the enemy, the Borg, races 'into' the Holodeck for protection (Frakes, 1996). Picard selects a Holodeck that is an interior room of an ornate banquet facility. The setting is full of energy, festivities of dancing and socializing party attendees. Picard uses the Holodeck interior space and social activities to camouflage his presence. He successfully escapes (only temporarily) his enemy, as his presence dissolves and integrates in the crowded and bustling Holodeck setting.

Interactive holography is not specifically restricted to the sci-fi film or television set. As early as 1990, researchers at the MIT Media Lab's *Spatial Imaging Group* launched the first realistic 3-D holographic and interactive images in real-time (Lucente, 2003), called *Holovideo*. These holographs can be viewed from all sides in full detail and

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[8] Star Trek has been featured in a variety of mediums since the mid-1960's, such as television episodes, motion pictures and video games.
[9] For full details of replicator and or transporter in 'Trekian' terms, see web: http:www.startrek.com/startrek/view/library/technology/article/105222.html. A further description is also available through the on-line community based encyclopedia, Wikipedia.

colour. Ford Motors recently introduced and showcased concept cars at a trade show, at full scale and in full colour, in holographic form (Heller, 2003, July 17). A number of other applications exist, such as 3-D movies replacing video conferencing in office settings or providing an exploration tool to mine for oil and gas (Heller, 2003, July 17).

The 3-D holography implies bionic features in that it removes bits from the artifact. Data can move freely off and away from any material object or entity. Holography does not rely on the prop of an architectural surface or tangible furniture product to contain it, severing any confinement as images become airborne.

How will this influence interior design and architecture? How will designers exploit this tool and design spaces to host airborne bits? As a tool, designers can use holography in two ways. First, it can aid designers in expressing design intent to their client. Currently, design is often expressed as renderings on paper or as video walk-throughs on screens developed and presented by 3-D modeling software packages. In contrast, a rich and detailed holographic representation promises to be more effective for client comprehension. Similar in example to Ford's use to present their concept car, designers will be able to launch a concept space. A second use for 3-D holographic technology is as a tool for the design team during the design development. Designers and consultants would be able to go in and around their designed spaces to gain strikingly realistic perspective, and meetings can be hosted in the holograph.

Interior spaces are the destination for holograph. Holographs rely on laser technology and light control to effectively execute presentations. Whether their use will be applied for interactive communication purposes or entertainment, or to represent a static object, these holographs will be embedded into interiors. Designers can expect that as these technologies become more sophisticated, and proposed for varying uses, designers will be asked to incorporate the holograph as part of their project, requiring an increasing familiarity of how these systems are supported and how they interact with the physical spaces they are set within.

5.3 Bionic Software

Design process and production has become reliant upon computerized technologies. Software development has become a fully integral part of the design industry over the last fifteen years (Anders, 2004). Both 2-D and 3-D software programs are widely used today. Programs like AutoCAD, Microstation, PowerCad, 3D Studio max, Form Z, Rhino and MIA are some of the more popular programs used in the professions of interior design and architecture.

As technologies become more sophisticated, there has been a greater integration of these modeling software programs and fabrication output techniques. Intended to streamline production and reduce waste materials, rapid prototyping strategies in combination with compatible and complex 3-D modeling software is a growing area of interest in architecture. [10] The liaison between Computerized Numerically Controlled machines [*CNC* machines] and *CATIA* software systems is integral to the success of executing complex yet highly accurate geometry in architecture. Firms, such as The

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[10] The theme of fabrication was explored at the 2004 AIA/ACADIA conference. For a more extensive overview of the research, I refer to the reader to the conference proceedings titled: *Fabrication: Examining the Digital Practice of Architecture* (Ed. Beesley, Cheng and Williamson, 2004)

Gehry Partners use CATIA programs to create the seamless integration between the design intention and production of the complex Strata Center at MIT in Cambridge (Matsushima, 2004).

These technologies promise to revolutionize the building industry. The investigations of researchers in the MIT House_n group, are aimed at altering the housing industry through the use of smart geometry and technology systems (Hart, n.d.). The intention is to streamline the design and construction phases on residential projects. The current method of building each house on the site as if it were completely unique is redundant, wasteful in both material resources and labour costs. Designers and architects should consider innovative ways to develop these ideas of pre-fabrication while maintaining design control and integrity. Technologies promise to integrate these systems with increasing effect, sophistication and seamlessness, proving essential for designers to remain up-to-speed with manufacturing trends (ACADIA 2004).

These programs support complex form investigation and execution. The developments grounded in these strategies are what I call *Bionic Software*. The ability to embed advanced knowledge into software is expanding through research. Axel Kilian (2004), a PhD candidate at MIT, introduced sophisticated software in his paper *Linking Digital Hanging Chain Models of Fabrication* at last year's ACADIA conference. Kilian's objective is to deliver software that helps designers understand the structural repercussions of their design solutions, as they are unfolding, in real time. He (2004) explains the value in this pursuit:

> Current design software supports the creation of geometry through geometric operations aimed at creating solids, wireframe, and surfaces. This geometry captures the design intention to a point and serves as the communication platform for many interdisciplinary discussions. Structural analysis is usually done using this geometry, or on specifically created geometry based on it. This analytical step requires relatively large investment of time and does not easily allow the designer to go back and change things. In addition, the results of the analysis do not immediately provide a remedy for correcting the potential problem. (p. 120)

The software proposed by Kilian is an effective tool to empower designers. It not only saves time and resources among the multi-disciplinary team members, it may also further educate designers about their process. The program can intelligently respond and inform designers during the design process. Kilian's (2004) explains the software's benefits as "a designer can directly observe the range of structural responses while exploring possible forms" (p. 120). Software that is responsive in real-time is profoundly valuable. The *program presents structural alternatives or solutions to the designer* as *the* ideas are unfolding.

There is ample opportunity to apply these notions of pre-programmed, responsive and intelligent software features to other areas of design. I anticipate an evolution of architectural responsive programs to contend with loads, temperatures, wind and power supplies. It is feasible that a variety of corresponding programs, such as space planning, electrical circuitry and lighting layouts, will migrate into the bionic software market as well.

The impact of intelligent software on practice and the professions requires further commentary. Kilian's software carries the potential to alter how professionals in practice engage in the design process. To illustrate this idea, I will present three potential scenarios of the impact of Kilian's software in reference to the professional body of structural engineers. First, the structural engineers may use these programs to aid and advance their own cause; that is, their project work may advance their own learning process and abilities to work on complex forms and structures. In another scenario, structural engineers may focus on the upfront stages of the software's development directly working alongside computer programmers. This team of programmers working with structural experts will be able to predict the permutations of structural scenarios in the program. The third scenario is more ominous than the others. In this scenario, other disciplines outside of the structural engineers adopt this bionic software. This in turn may diminish the need for the structural engineers' services. This is not to argue that all professions will disappear, Rather, the influence of professional services suggests to become challenged as individuals are armed with the proper bionic software package.

As the concerns over bionic software are amplified, there is mounting anxiety over job security in a global market. Over the last few years, western-owned interior design and architectural firms have sent some of their project work out to design offices in India or Bangladesh.[11] With advanced communication networks and global CAD systems, subcontracting out phases of the design project, such as construction drawings and renderings is a viable option for design professionals. More recently, these jobs have been shifting to countries like Columbia, where the labor prices for architectural services are even lower than those in India and Bangladesh. This transfer to cheaper labor centers

[11] In 2004, I was introduced to overseas outsourcing in the design industry at a client meeting. One such company that provides the coordination to offshore architectural services is called Blue Solutions.

is reflective of what activist and author Naomi Klein describes as *swallow factories* (Klein, 1999). Longevity and impact of the professional integrity becomes an area for additional research and study. The long-term and short-term impact of this combination of bionic software systems and outsourcing will impact how the design process evolves.

5.4 Bionic Molecules I

Nanotechnology, the science of constructing and building objects at a microscopic, atomic or molecular scale, has received an inordinate amount of attention lately. It has been hailed as a prominent new area for research and development (BBC, 2005, May 23). Several industries and businesses are beginning to apply nanotechnologies to advance their products. This form of science has already evolved in the production of a wide variety of products, such as sunscreen, paint, window treatments, healthcare, food and clothing.

Nanotechnology redefines the foundations of elementary material property. Molecular alterations challenge the understanding of the scientific properties, content and character of basic materials. The restructuring or re-engineering of *molecules* creates enormous new challenges for designers to maintain an understanding of evolving material properties. Tinkering with the molecular content of materials such as wool fiber, natural wood or stainless steel will challenge the professional knowledge base of interior designers. This suggests designers will be required to increase the attention paid to changes in material construction and engineering in order to understand what it is they are dealing with.

To illustrate the impact of these molecular reconstruction ambitions on design, I will refer to a paper presented at last year's ACADIA conference. Collaborating researchers from the University College of London, Sean Hanna of the Bartlett School of Architecture and Siavash Haroun Mahdavi from the Faculty of Computer Science (2004), introduced a technique to maximize the structural properties of a material at the molecular level. In their paper, they provide data and examples of how they used *stereolithography* to create a microstructure that defies the natural material property and structural capability of steel. Their research reveals how it is possible to transfer the load and resistance features of structure down to a microscopic scale. Hanna and Mahdavi (2004) introduce an opportunity for design to become lighter and more refined without compromising the structural integrity. In the research, they give examples of using molecular technology to design an over-extended and exceptionally thin cantilever using steel. The molecules that are part of the cantilever have been reconstructed to become super-molecules. Joined together, these super-molecules form a superstructure. The slimmed down cantilever proposed by Hanna and Mahdavi can withstand an elevated level of force that under typical conditions would buckle and break.

5.5 Bionic Super Human

Advances in science and technology have enabled the human body to fuse with cybernetic technologies. This condition is strikingly reminiscent of the cyborg introduced in Haraway's (1985) seminal text, *A Cyborg Manifesto: Science, Technology and Social Formation in the Late Twentieth Century.* Haraway (1985) explains, advanced electronic, digital and biotechnologies are essentially recrafting the human body. For Haraway, this recrafting takes place as advanced technologies disassemble and then reassemble. Cyborgs, or cybernetic organisms, are understood to be a hybrid — half computer and half human (Powell, 1998). Originating at birth as biological humans, cyborgs evolve as enhancement or augmentation occurs throughout the life cycle of the human.

But what constitutes augmentation? An ever-growing debate has focused on the degrees to which augmentation occurs to the body in terms of permanency, proximity and implantability. Does augmentation only constitute of technogadgets that are permanently attached to the body or embedded beneath the skins surface? Not necessarily. Media professor and author Peter Lunenfeld (1999) argues that augmentation today surrounds us and is accepted, including everything from eyeglasses and prosthetics to hearing aids and bioengineered proteins. In this view, internal, external, peripheral of embedded devices create cyborg conditions.

If this variety in augmentation defines human transcendence into cyborg states, are we not a society already populated by cyborgs? Yes, according to the views of Donna Haraway (1985) and N. Katherine Hayles (1999a, 1999b), — the cyborg is the dominant being and feature in western society at the close of the twentieth century. Over the last fifteen years, Humans have become reliant upon a variety of peripheral technical devices for work, entertainment and communications. The mobile phone, the Personal Data Assistant [PDA], network connections and the computer deliver numerous links to distant places or memory storage banks. In each of these devices, the abilities of the human body are enhanced beyond the inherent limitations of its natural biology.

Ihde (2002), argues that an extreme cyborg lifestyle is most attractive to those who suffer mental, social or physical shortcomings. As an example, Ihde explains that those who are social misfits can find reprieve in the online communities and networks — cyberspace can act as camouflage for their social dysfunction.

Advanced technologies have also overcome the hurdles and restrictions placed on those with physical disabilities. Several research initiatives are underway in the health care and medical industry to use these technologies to empower those suffering from spinal chord injuries. Recently, researchers used brain-computer interface [BCI] technologies to allow a paralyzed individual to operate a computer cursor through thought control (Duncan, 2005). Technology Review writer David Ewing Duncan (2005) explains that brain surveillance and control technologies in clinical trial volunteer and participant Matthew Nagle were successful. Nagle, who was paralyzed in 2001, recently became the first to operate a prosthetic arm through BCI technologies. Duncan explains:

> …Surgically implanted beneath Nagle's skull, is an array of electrodes on a chip contiguous to the part of his brain that controls motor activity. The chip is the size of a baby aspirin: its 100 tiny hair thin electrodes pick up the electrical signals transmitted by the brain, each electrode capturing signals from a few nearby neurons…When Nagle's neurons fire, the impulses are read and decoded by software… (2005)

Beyond the medical and rehabilitation industry, these forms of technology are moving into the interest of multinational corporations and other businesses in the commercial sector. Reuters (2005, April 7) recently reported that Sony Corp. had been granted a patent to manipulate the sensory information within the human brain. Sony researcher, Thomas Dawson explains the intention is to track and alter experiences through neurological intervention (as cited in Reuters, 2005, April 7). Dawson explains the technology is capable of directing pulses toward areas of the brain that are responsible for sensory comprehension. According to Dawson, Sony (makers of PlayStation), intend to use this process to heighten, alter or introduce sensory experiences such as sounds and smells to the video game experience (as cited in Reuters, 2005, April 7).

Enhancing human ability through technology is not new to human ambition and aspirations. Two examples can be found in the highly popular 1970's TV series *Six Million Dollar Man* (Martinson & Doheny, 1974) and *The Bionic Woman* (Martinson & McDougall, 1976). Both TV shows featured lead characters that, after suffering a critical body injury, were rehabilitated with bionic mechanisms. *The Six Million Dollar Man's* character, Steve Austin, was retrofitted with a variety of mechanical components that created the bionic features of superhuman running speeds and enhanced eyesight. Jaime Sommer's character, in *The Bionic Woman*, underwent surgical upgrades to provide her with prosthetic legs, an arm and a superhuman ear. Both Steve Austin and Jaime Sommer were presented as cyborgs.

The physical shortcomings from Austin and Sommer's independent injuries were not merely repaired; the surgical upgrades and enhancements were far superior to the original organs and limbs lost in their accidents. The voice in the introductory sequence of *The Six Million Dollar Man* (1974) reminded the viewer, "We can rebuild him. We have the technology. We have the capacity to make the world's first Bionic Man. Steve Austin will be that man. Better than he was before. Better…Stronger…Faster." The ability to by-pass the original shortcomings appear simple and are presented as an inherent property of technology.

Bionic capabilities are integral to the features of the cybernetic organism. The term bionic has been defined as "having extraordinary strength, powers or capabilities; superhuman…having anatomical structures or physiological processes that are replaced or enhanced by electronic or mechanical components" (online dictionary term). The ability to achieve superhuman abilities through the use of these advances in technology is a key feature.

5.6 Advancing the Cyborg

Over the last fifteen years, it has become difficult to determine the differences between natural biological humans and cyborgs. Advances in technology, pharmacy and biology have combined to alter the perception and status of the natural biological human. The popularity of steroid use to enhance physical strength, pharmaceutical drug use for acute mental operation and a surge in Viagra use illustrate a growing desire and capability to gain superhuman status. The expanding popularity of Viagra among males aged 18 to 45 has increased over 300 percent between 1998 and 2002 (Medical NewsToday, 2004, August 6).

Not only are physiological or psychological performance enhancements up for reinvention, so too are superhuman physical features. It appears most common to amplify physical features that maintain youth or exaggerate beauty. Through plastic surgery, anyone can construct their own cyborg self. The popularity of using Botox injections, facelifts and implants has contributed to the reported 22 percent increase in cosmetic surgery procedures in the US in 2004 ("Americans increase use of cosmetic surgery, procedures", 2005). The ability to retain or acquire youthful appearances enables individuals to bypass the natural biological course, and in turn, are represented as superhuman. Reality TV shows, such as ABC's *Extreme Makeover*, perpetuate a belief that these alterations are simple and available reconstructions.

The drastic alterations to the biological body create increasing challenges to actually ascertain what it means to be human. In 1965, Fereidoun Estandiary, philosophy professor at the UCLA, used the term *transhuman* to describe the rite of passage between human and posthuman stages (Vita-More, 2000). Transhumans are understood as integrated into the evolutionary cycle of cyborgs and represent it's early or "first phase" of becoming a cyborg (wikipedia).[12] Philosopher and chair of the Extropy Institute, Max More (2003) defines posthumans as:

> Overcome biological, neurological, and psychological constraints built into humans by the evolutionary process. Posthumans would have a far greater ability to reconfigure and sculpt their physical form and function; they would have an expanded range of refined emotional responses, and would possess intellectual and perceptual abilities enhanced beyond the purely [biological] human range.

More's transhumans are highly representative of many individuals currently found in western society. Plastic surgery, antidepressants and the ability to store endless information, as extended mind space, into digital storage devices, are primary examples.

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[12] Wikipedia is an online community resource webpage. Although it is not an academic source, it is occasionally referenced in this research. The relevancy for it's use derives from the fact that some of the conditions or technologies cited here are irregular and absent from formal academic sources. In some cases the technology is evolving as the paper is being written – presenting a greater challenge to infuse stable – or secure – definitions or descriptions.

The contested term *posthuman* will inevitably spark an alarmist response. It does not imply the end of the human race. Rather, it bridges the gap between the transhuman state and a full-blown cyborg. As described in the on-line community resource Wikipedia,

> Posthumans could be artificial intelligences, or they could be uploaded consciousnesses, or they could be the result of making many smaller but cumulatively profound augmentations to a biological human. The latter alternative would probably require either the redesign of the human organism using advanced nanotechnology or its radical enhancement using some combination of technologies such as genetic engineering, psychopharmacology, anti-aging therapies, neural interfaces, advanced information management tools, memory enhancing drugs, wearable computer and cognitive techniques. (Wikipedia)

Several of the contemporary technologies that dominate Western society reflect and support this definition of posthumanism. As technologies become more sophisticated, and a greater symbiosis between the human (body) and the machine (computer) evolves, the posthuman condition may no longer apply.

The symbiotic nature between the body and the machine is integral to the posthuman state, as described by N. Katherine Hayles in *How We Became Posthuman*:

> The posthuman view configures human beings so that they can be seamlessly articulated with intelligent machines. In the posthuman, there are no essential differences or absolute demarcations between bodily existence and computer simulation, cybernetic mechanism and biological organism, robot teleology and human goals. (as cited in Abbas, 1999, April 25, p. 5)

Is it possible for this morphology to advance us beyond the posthuman state? If technology is set on a course to become compatible to humans, the ultimate goal would be an absolute symbiosis.

Another definition claims that the posthuman "refers to a hypothetical future being whose basic capacities so radically exceed those of present humans as to be no longer human by our current standards" (wikipedia). Yet this definition suggests that this advanced stage of the cyborg is never truly achievable, in that it is defined as out there in the hypothetical future. But what if this future is now? French theorist Jean Baudrillard refers to the inability to discern between utopian ideas of science fiction and reality emerging today (as cited in Christopher Horrocks, 1999). Baudrillard argues, "it is no longer necessary to write science fiction since we now live it" (as cited in Abbas, 1999, April 25). Advances in technology will continue to challenge the boundary between fact and fiction, and real from simulation. This collapsing distinct feature of culture is explored further toward the end of this chapter.

5.7 Posthumanism: Stelarc

The growing symbiotic relationship between the human body and technology requires additional discussion. I again refer to the film *Minority Report* (Spielberg, 2002). As described earlier in this chapter, the main character, detective Anderton, interacts with information using the live-data wall and a *data glove* (Figures 5.1 to Figures 5.8). The use of the data-glove, as depicted in Figure 5.7, symbolically reflects the process of dematerialization as discussed in an earlier chapter. The glove and the wall eliminate the intermediate tools of the more bulky elements of the set of screen-mouse-keyboard [SMK] interactive tools. This glove illustrates a more seamless integration, ergonomically snug, and highlights the migration of the technology to adhere to the body.

Upon further analysis, Anderton directs the data through what looks like a body sign language (see Figures 5.1 to Figure 5.8) exaggerated and animated, as well as intuitive. This migration to greater intimacy between the human body and the computer enables a more intuitive use of the body to direct data. As illustrated in Figure 5.3, Figure 5.4 and Figure 5.5, the body is highly active in this process. As if directing air traffic or passionately conducting a symphony, the exaggerated and conscious body movements are fluid, evading the limited and constrictive motions required for operating data through the typical screen, keyboard and mouse. As the wall becomes a screen, the new-gloved body becomes the mouse.

This data-gloved hand and screen interface reinstates the breakdown of barriers between humans and machines. With each new rendition of technology, there are more opportunities to strengthen intimacy and compatibility. Media artist and theorist Frances Dyson (1998) describes this proximity evolution: "The arms length distance (literal and metaphorical) between user and computer screen begins to shorten: the computer now sits on our laps, or is attached to our belts; it becomes a pair of goggles, then glasses, and finally (according to predictions of nanotechnology), implants" (p. 40). This procession is analyzed and illustrated diagrammatically in Chapter 1.

Technology is on a swift migration toward the inner regions of the human body. Australian performance artist and theorist Stelarc has been exploring this migration and its influence on perception, consciousness and power for a long time. Stelarc conducts what has been labeled "cyborg experiments" on his body (Fernandes, 2002, November

13). Stelarc uses his body as a laboratory for advanced technologies such as prosthesis and implants.

In *Hollow Body Events* (Massumi, 1998), Stelarc implants miniaturized video cameras to capture activities within the interior of his stomach and lungs. The video was connected to the Internet where images of this interiority were viewed globally. Through this piece, Stelarc reminds us that advanced technologies challenge boundaries between private, interior space, and public, transmitted through the exterior. Stelarc (1992) notes, "Today technology is no longer exploding out from the body, in an external fashion, but is imploding and sticking to the skin. It is imploding and entering into the interior of the body" (p. 29). As technology becomes tinier, mightier, smarter, and more biocompatible, this implosion will intensify.

Virilio also has an interest in this imploding aspect of contemporary technology. Professor of Law and Popular Culture at Manchester Metropolitan University, Steve Redhead (Redhead, 2004) explains that for Virilio, "technology now aspires to occupy the body. The body itself is the last remaining territory" (p. 42). The body, through technology, becomes a new landscape for exploration, agency and penetration. It becomes a place where technology can deliver opportunities for public safaris of the private body. This exploratory quality and deconstruction of boundary is clearly convened in Stelarc's (1995) use of technology. Stelarc argues the "skin no longer signifies closure" (p. 93) In *Fractol Flesh*, Stelarc provided remote-control access to strangers, through the Internet, to operate the prosthetics attached to his body (1995). The public, groups of anonymous and distant strangers, electromagnetically directed the movements of his augmented body. Illustrating the ultimate transfer of power and control, Stelarc's body becomes globalized.

Implants as introduced in the bionic generation have instigated a radical redefinition of how the body engages with other bodies and the spaces they inhabit. The body is no longer a body of understanding; in pace with technology. It is continuously changing and being redefined, and outmoded by technology.

At the start of the twenty-first century, the human body is no longer good enough for the technology with which we engage and rely upon. The biological human cannot keep up. Stelarc (1995) argues:

> The problem with space travel is no longer the precision and reliability of technology but with the vulnerability and durability of the human body. In fact, it is now time to redesign humans, to make them more compatible to their machines; it is not merely a matter of 'mechanizing' the body. (p. 94)

There is a growing need to redesign the human body through technology. Stelarc (1995) reviews the value of this project as he refers to the emerging flaws of the current medical and health care systems. These systems, he argues, are ill-equipped and unable to detect diseases at the critical early stages of development. There is an increasing need for the body to possess its own "internal surveillance system" (Stelarc, 1995, p. 95). Stelarc (1995) argues nanobots are a growing possibility. Through advances in *nanotechnology* and biotechnology, a pre-emptive set of nanobots may be able to review malfunctions within the body, as they are first occurring, long before the symptoms become evident.

Cultural theorist Frederic Jameson (1998) argues a similar viewpoint. He notes that both humans and architecture have not kept pace with the evolutions in space. He anticipates that "new architecture... stands as something like an imperative to grow new organs to expand out sensorial and our bodies to some new, as yet unimaginable, perhaps ultimately impossible, dimensions" (p. 11). Through the bionic generation, the conditions of the status of architecture, space, artifact and humans become increasingly challenging to understand and simply reintegrate into design process.

5.8 The Competition

Humans most commonly fear that they will be displaced by, or placed in direct competition with, robots (Beckmann-Springer 1998). In 1950, science-fiction writer Isaac Asimov reinforces this underlying fear in a collection of stories called *The Robot Series: I, Robot.*[13] In the story, humans enforce a set of rules for robots in an attempt to keep them under, and not above, human control and supervision. Yet, despite from this underlying tension, robots have come to replace humans in a variety of roles throughout the last century.

First, it is important to clarify the differences between a cyborg and a robot. Cyborgs are comprised of a combination of biological organics and augmentation devices. They begin as humans. They are organic beings that have been augmented by technology to extend or enhance its organic mental or physical capabilities. Robots, on the other hand, are not constructed of organic matter; they are defined purely as machine.

[13] The series was recently readapted and released as a film on June 16, 2004 by Twentieth Century Fox, starring actor Will Smith.

They are a "mechanical device, which performs automated tasks, either according to direct human supervision, a pre-defined program or a set of general guidelines using artificial intelligence techniques. These tasks either replace or enhance human work, such as manufacturing, construction or manipulation of heavy or hazardous materials" (Biology_Daily, 2005).

The robotic industry has become extremely sophisticated over the last fifteen years. The industry has matured beyond the industrial models of robotics as initially hosted by and limited to the assembly lines out on the factory floor (CNN, 2005, June 10). One of the most popular applications of human-like or humanoid robots is found in the reception area. Honda's headquarters in Japan uses robots as receptionists instead of humans (Bhattacharjee, 2003, March 6). Other institutions have also implemented *roboreceptionists, such as Valerie at Carnegie Mellon University and Inkha at London* College. The new generation of robots is highly skilled and can play baseball, draw human portraits, act as emergency rescue workers and provide stand-up comedy routines as entertainment (CNN, 2005, June 10). Still in its infancy, significant growth in the industry of sophisticated robots is anticipated in the coming years. The Japan Robot Association recently published projected future growth of 1.5 million Yen (14 billion U.S. dollars) by 2010, and to more than 4 trillion Yen (37 million U.S. dollars) by 2025 (CNN, 2005, June 10). The success of this industry is just starting to be recognized by a variety of investors, organizations, businesses and researchers. The more popular robots currently on the market are featured as pets, workmates, domestic helpers or ballroom dancing partners.

The ability to effectively add a human-touch to robots has steadily improved.[14] The robot *Repliee Q1expo* was recently introduced to the market and bears incredible human-like features (CNN, 2005, June 10). It is finished with an external layer of skin-like material and can mimic movements associated with human breathing. Human-like features in robots are desirable. Robotics Engineer Shuji Hashimoto explains that robots are becoming more human-like to ensure that they function effectively in the environments they are placed (as cited in Bhattacharjee, 2003, March 6). The design teams are attempting to make robots operate like humans in feature and form, as they will be embedded into environments that are designed for human use.

How will interior design and architecture support the evolving cyborg and robots? Designers may focus further inquiry on the spatial use of and dynamics between robots and cyborgs as they cohabitate. If there is growing use for robots, how will they navigate and move through our interior environments? The primary spatial impact will be the introduction of new sets of user groups into design problems. Spaces will need to meet new standards to support these evolving groups. The growth of this industry will influence the social, economic and political fabric of Western society and will, in turn, influence the design process.

As the technology becomes more biomorphic, expanding cyborg states are inevitable. Humans will need to evolve in response to intensifying competition introduced in robots. Leading robotic researcher and author Hans Moravec (1998) notes "Biological humans can either adopt the fabulous mechanisms of robots, thus becoming

[14] The term Humanoid has been applied to robots with human-like features.

robots themselves, or they can retire into obscurity" (p. 87). Moravec highlights that as biological humans take on more robot-like features, robots progressively are capable of taking on more human-like features. And so the competition is exposed as each is in a race to become more like the other.

5.9 Nanotechnology

Leading nanotechnology researcher and theorist K. Eric Drexler introduced the world to the ambitions of nanotechnology in a paper back in 1986. Drexler's initial ideas were predominantly grounded in abstract sciences and research as theories, yet today they are proving to be valuable sources for understanding the underpinnings and potential of this science. Nanotechnology has emerged as the avant-garde science entering into the twenty-first century.

In *Engines of Abundance*, Drexler (1990) presents a futuristic vision of a new generation of bionic molecules. According to Drexler, not only would the molecules be re-engineered and reconfigurable, they would be self-reproducing. The offspring, second-generation *atoms* born from the originally pre-programmed atom, emerge with a set of self-replicating potential. These theories stem from recent scientific advancements and research in DNA structures and bacteria reproduction processes. Each molecule becomes a micro-nanobot. These can be designed to execute a self-replicating system, inducing a nano-army. Drexler, through his nanotechnology theory, delivered material for the science-fiction industry from his analysis of DNA models. It was Drexler, in 1986, who stated, "[if] cells do replicate; robots could replicate" (1990, p. 118). He was pivotal in laying the foundations and ambition for what is evolving today.

To illustrate this idea further, I will explain how an everyday artifact, such as a plate, can be created through Drexler's nanotechnology. The first atom, or initial replicator, holds all the key data for this atom and future atoms it will replicate. The original atom is embedded with a set of codes, similar to DNA that is passed on to the next generation. After the initial replicator reproduces itself, it can also be designed to reproduce itself again, expanding the population as "Regular doubling means exponential growth" (Drexler, 1990, p. 118). Each offspring in turn can create new offspring.

Replicators are engineered to fuse together into a pre-established pattern. The atoms join together based on their coded structure. Each atom builds onto the next atom, arranging itself into the pattern specified in the original blueprint or program embedded in the initial replicating atom. Each replicator participates as both as an independent and as a team member within a community of other replicators. The replicator may be understood first as a birthing tool for future nanobots. It also partakes in the nano factory work, actively participating in the team, moving other molecules along the assembly line to their destination.

Nanotechnology will eventually produce larger-scale objects. Drexler (1990) describes the limitless, unrestricted nature of this science: "Molecular machines can nonetheless build objects of substantial size – they build whales, after all" (p. 118). He argues that any DNA process of nanoscience will be able to construct anything. The premise of the process reflects what BC Crandall refers to as a *memes* process of engineering, which resembles processes of viral life creation (Kroker & Kroker, 1996, June 5).

Ultimately, the ability to breed molecules implies that science can cultivate a limitless number of everyday physical artifacts in a wide-variety of sizes. From a cup to a sofa, the construction model and process is based on the same pre-programming structures. Spiller, argues, "if you apply it [Nanotechnology] to buildings, you may be able to grow buildings like you grow plants out of vats..." (as cited in Dalton, 2003). Planning for the long term can also be incorporated into the design of the seeds. Through more research, Spiller anticipates nanotechnology may prepare buildings for a variety of future uses and may be able to "adapt and evolve on their own" (as cited in Dalton, 2003). Today the space can function as an office, tomorrow a residence and in 30 years a school.

Nanotechnology will alter much of today's production techniques. For example, *RepRap* was recently introduced in the UK.[15] It is a small robot, not much bigger than a hand. The machine can both "copy itself and manufacture everyday objects quickly and cheaply" (Hooper, 2005, June 2). Based on *rapid prototyping* technology, RepRap outputs similarly to a 3-dimensional printer. It has successfully produced a variety of products such as plates, hair combs and musical instruments, ranging in size from a few millimeters up to 30 centimeters. These forms of nanotechnology will prove useful for social and global issues. Devices like the RepRap are being prepared to enter the market as an ideal mechanism to support the growing demand for products in poorer nations

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[15] RepRap is operable yet will need to be fine-tuned prior to a large release into the market.

(Hooper, 2005, June 2). Eliminating production costs, transportation and the demand for raw materials would be most beneficial for countries that are facing severe poverty. The expense, in theory, can be directed to the initial start up costs of purchasing the original breeding machine. The rest would ultimately take care of itself.

Nanotechnology also holds potential benefits for green or sustainable design. As noted by Dr. Adrien Bowyer, inventor of the RepRap: "If the machine can copy itself, it can make its own recycler…". (Hooper, 2005, June 2). The machine recycles all the energy and waste it produces. In the big picture of construction, nanotechnology proposes to cut back on costs associated with labour-intensive manufacturing, raw materials, transportation and fabrication techniques. This would have significant repercussions for the conservation of energy and resources. The machine operates in its own universe, *reflecting a miniaturized self-sustaining echo system.*

Several businesses are using nanotechnology in their production. Current uses for nanomaterials include nanoscale titanium bioxide found in some cosmetics, silica found in dental fillers and nanocoatings featured on fabrics and sports equipment (Lovy, 2005, June 10). Howard Lovy (2005) writer for *Wired*, explains that nanocoatings have successfully enhanced the bounce of a basketball or tennis ball, as well as the jump quality on the soles of sneakers. Stain-resistant fabrics used for clothing in North America are becoming more popular. Nano-tex, a highly successful US based company, has been supplying these types of fabrics to several multinational clothing companies such as The Gap, Old Navy, Nike, Levi's and Eddie Bauer. In essence, the nanomaterials strive to be smarter or bionic when compared to their predecessor.

Although there are benefits to nanotechnology, there is also a growing concern. Lovy describes grassroots organizations that recently demonstrated in the Eddie Bauer store in Chicago to protest the use of these fabrics in clothing (2005, May 23 June 10). The potential risk in nanotechnologies is prompting new research to determine if they are safe. As nanotechnologies are developed on a micro scale, their evolution occurs far from public view. The average citizen is unaware what this technology is or how it is being applied and integrated into everyday products.

Recently, in the UK, a group called the nanojury was formed to expand research into the pro's and cons of nanotechnologies (BBC, 2005, May 23). The nanojury aims to create more transparency and discern the health hazards of nanoscience.

Drexler (1990) also warned of the potential dangers embedded in nanotechnology. His original predictions focused on the dangers of accidentally forming an out-of-control nanoarmy. Drexler was most concerned about a potential programming glitch or a malfunction to execute an unlimited supply of self-replicating robots. Several science fiction plots have been based on the premise of an inevitable catastrophe such as this, where human civilization is at risk and in battle with a society of self-sustaining robots (Springer, 1998). As mentioned earlier, human fear of an out-of-control robot species was the basis for the laws of the *I, Robot* series (Asimov, 1950). The objective of these laws was to maintain control over the robot species and not have it reverse to where the robots would threaten or control the human species.

It is inevitable that nanotechnology will have significant repercussions for the disciplines of interior design and architecture, requiring new processes and practice methods. Founder and director of Molecular Realities, BC Crandall, explains: "Several traditional fields are becoming molecular and more will soon join them" (as cited in Kroker & Kroker, 1996, June 5). What will a molecular-based design practice, field or office look like? Through nanotechnology, Spiller anticipates these changes will radically modify the design of the environments we inhabit (as cited in Dalton, 2003).

5.10 'Super' Pacification

The cyborg relies upon compatibility between the biological and the technological. Although machines will adapt and evolve to become increasingly compatible with the body, the body will also need to adapt to the evolving technologies. The body will be challenged to adhere to strict rules imposed by the implantation or attachable technology. The predominant trait required will be one of subservience. A symbiotic integration between the human body and new evolving technologies demands the body become compliant to the machine. As Stelarc (1995) notes:

> Technology pacifies the body and the world, it disconnects the body from many of its functions... the body plugged into a machine network needs to be pacified. In fact, to function in the future, to truly achieve hybrid symbiosis, the body will need to be increasingly anaesthetized (p. 94).

For Stelarc, the latent body is an accessible body. The body will need to continue to be numbed in order to advance alongside technology. The requirements for strict adherence imposed on humans by advanced technology is what Virilio (1998B) calls *cybernetic domination.* Virilio (1998B), cynical of the future prospects of the advancing interface, argues that the idea of symbiosis, "...is just a metaphor for the subtle enslavement of the human being to 'intelligent' machines..." (p. 153)

The body as a latent entity becomes highly susceptible to outside influences. The private entity may become progressively more public. The cyborg is "always 'logged on', the once private space of Internet communication becomes a space of surveillance..." (Dyson, 1998, p. 40). An anaesthetized body can become a site for foreign agents. Computer viruses and hackers may be able to infect and deconstruct an individual's bodily functions. A dulled, pacified body will be unable to effectively defend against invasion.

The most dangerous issue for a vulnerable body may be the copyright or patent laws associated with molecular engineering. New legal organizations are emerging to protect the intellectual property [IP] *rights associated with nanotechnology (Bastani &* Fernandez, n.d.). As companies prepare the IP rights, the control over entitlement to artifacts or bodies can become contestable. As multinational corporations preserve their territorial claim through patents, there is reason to be concerned about the issues of control, power and licensing of the interior body. As discussed earlier in the example of Sony, some multinational corporations are interested in using neuro-sensory manipulation technology to advance their own product development. The ideas introduced in the Sony example can be applied to other industries as well. I anticipate multinational corporations will pursue a variety of ways to apply this technology to increase sales. For example, Starbucks and McDonalds may attempt to alter or reengineer senses such as smell and taste. They may enter into a wild new state of competition, laying claim to my saliva glands, stomach or taste buds.

As outrageous as these notions sound, one should remember that not so long ago, individuals held similar disbeliefs about the ownership of water, air and food. No one initially thought it possible that powerful multinational companies would be entitled to sue poor farmers in India and Africa over molecular reengineered seeds for food. Farmers in the poorest areas of the world are currently in legal battles with Monsanto in an attempt to gain back their legal rights to plant their own seeds for their crop (Shiva, 2000). Leading environmental writer, physicist and activist Vandana Shiva (2000) explains how corporations now legally own seeds, which have fed millions of poor people for well over a millennium. Shiva notes that this ownership is acknowledged and approved by global governing bodies. Multinational corporations, such as Monsanto, are legally entitled to enforce seed patent laws under the World Trade Organization [WTO].

Monsanto seed is a prime example of a destructive use of nanoscience. Into each of these seeds, Monsanto embeds terminator technology, or a terminator gene, to ensure that the seed is eradicated at the close of each season (Shiva, 2000). Each seed is pre-programmed to self-destruct at the end of the harvest. Farmers, who typically would sustain crops annually by recycling their seed, are now forced to re-purchase the expensive Monsanto seeds for each harvest or face a lawsuit.[16] In 2004, the Supreme Court of Canada ruled in favor of the Monsanto patent in the legal battle between

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[16] Multinational corporations seed patent lawsuits have maintained a level of silence until recently. Lawsuits have evolved worldwide. In India alone, trials were being conducted in 40 locations across 9 states (Shiva, 2000).

Monsanto and Saskatchewan canola seed farmer Percy Schmeiser (CBC, 2004). If air, food and water are up for ownership, why not anticipate the sale of a latent body?

Although body ownership may be troubling for humanity, for interior design and architecture in particular, it poses to threaten the nature of the premise of the design problem. Once subjectivity is removed from the body, the design objective poses to become lost. Designing environments for individuals who have become owned or operated from external sources creates complexities for understanding who it is designers are designing for, or what. A latent body essentially raises significant issues of who or what the new entity or client is? The idea references some of the splintering identity issues, as raised earlier in Chapter 4.

5.11 Understanding Seamless Integration: Theory

Postmodernism has been the dominant discourse in cultural theory for over thirty years in Western society. Art, literature, film and architecture have made significant contributions to the evolutions and developments of the Postmodern movement. As Western society is rapidly evolving in the digital era, it is now necessary to revisit the primary principles of this movement and constructively analyze its current effectiveness. The question is: Does Postmodernism provide enough, to represent a theoretical framework for the conditions evolving at the start of the twenty-first century?

Jameson (1984) argues that these intensifications, viewed through late capitalism, are distinctly a postmodern trait. I argue that the evolutions of technology, described in this chapter as bionic, go beyond the postmodern intensifications proposed as the primary postmodern features of Jameson. Instead, I argue that culturally there has been a hyperintensification, which in effect weakens some of the principle foundations of Postmodernism. In Chapter 1, *Dematerialization* and in Chapter 4, *Fracture*, I reference and launch most discussions from a postmodern position. Upon further analysis, introduced through the bionic generation, I argue the discussion of theory needs to expand. Although the bionic generation reflects some typical and prominent characteristics of the Postmodern movement, it also features an intensification of characteristics symbolic of earlier ambitions of Modernism. This duality is symptomatic of a growing new movement described as Hypermodernism.

Social theorist John Armitage (2000b) defines Hypermodernism as:

> … A tentative term and embryonic tendency in the contemporary critical social sciences and the humanities that seeks to move away from the polarized assumptions of modernism and postmodernism and toward a deeper theoretical understanding of the 'excessive' intensities and displacements inherent within cultural and social thought about the modern world and how it is represented. (p. 19)

For Armitage, the intensities introduced at the close of the twentieth -century can no longer be framed as a postmodern idea. It is important to remember that Postmodernism, was firmly established prior to the digital revolution (Best & Kellner, 2001). The effectiveness of Postmodernism proliferated through the sophisticated advances in network and real time technology.

The hypermodern movement is still in its infancy. For this reason, there is very little material that has developed. Hypermodernism has also been understood as a:

"... movement distinguished from Modernism and Postmodernism chiefly by its extreme and antithetical approach... it has come to have some aspects of modernism filtered through the latest technological materials and approaches to design or composition." (Wikipedia).

Technology is one of the primary features of the modern era that emerged during the first half of the twentieth century. Advances in science and technology, originally sparked by the industrial revolution, delivered expanding and rapid growth in urban centers, advanced transport lines and expanding commerce and factories. The enthusiasm for the new technologies, as the machine, evolved into the prominent theme in modern literature, myth and metaphor (Edgar & Sedwick, 2002). As an example, the domestic setting – private, a place for relaxation, family – was reinterpreted by the modern architect Le Corbusier. He proclaimed houses should be conceptualized and designed as "Machines for living" (as cited in Edgar & Sedwick, 2002, p. 131). This metaphorical translation from the domestic setting into a center for production is profound; space of any sort can now be understood as a tool. For interior design and architecture, the implied objective would be to design spaces that would support the cultural values of the modern era: function, efficiency and progress.

The foundations of modernism emerged though the expanding dedication and knowledge grounded in positivist or empirical sciences. Philosophically and culturally, this translated into the belief of "attaining absolute true knowledge... and moral and political values that are valid for all cultures and all periods of history" (Edgar & Sedwick, 2002, p. 234). Rational certainty guided Modernism, or rather directed society to remain dedicated to the grand metanarratives of the era. Theorist David Harvey (1989) explains that by mid-twentieth-century Modernism evolved:

> The belief 'in linear progress, absolute truths, and rational planning of ideal social orders' under standardized conditions of knowledge and production was particularly strong. The modernism that resulted was, as a result, 'positivistic, technocentric, and rationalistic'... imposed as the work of an elite avant-garde of planners, artists, architects, critics, and other guardians of high taste" (p. 35)

Modern design strived for simplicity and clean lines to reinforce function. The elimination of all but the barest essentials and the necessary; decoration and ornamentation were frowned upon in design. Its intention was to clearly express progress, reveal the inherent truth of materials and expose the fabrication techniques.

On the other hand, Postmodernism evolved in resistance to the directives issued and imposed by Modernism. Philosopher Jean-Francois Lyotard (1984) dismantled the myth of grand narratives, or metanarratives, presented in Modernism. Lyotard noted the use of the metanarrative as a legitimizing tool used by "the authority of institutions that claim to have a monopoly on truth and which suppress dissent... " (as cited in Macey, 2000, p. 236). Evolving as a backlash in opposition to the unidirectional idioms of Modernism, Postmodernists came to "distrust metanarratives" introduced as imposed Modernism (Sarup, 1989, p. 132). Instead, postmodernists embraced diversity and nonhierarchical structures (Butler, 2002) or rhizomic structures (Deleuze & Guattari, 1987). In design and architecture, its followers opposed the puritism and sterility of the International Style of Modernism (Macey, 2000). The principles of postmodern's aesthetic called for a new celebration of multiplicity through histories, cultures and voices. It encouraged playfulness, a morphing of character and an application of the ironic.

Technological progress and innovation significantly contributed to the paradigmatic shifts that lead to both Modernism and Postmodernism. These shifts are grounded in what Harvey (1989) describes as the ability to alter societal perceptions of space and time. The premise of these alterations are further explained by architectural theorist, Stanley Mathews (1993), "Since time and space are the vehicles through which we perceive reality, as out perceptions of space and time change, so do our experiences of that reality" (p. 1). In the Industrial Revolution, speed became repositioned to time through mechanical processes, mass production and rapid new transportation systems. Space dissolved as individuals cut across the landscapes at increasing speeds in the automobile, train and the airplane. Speed also unhinged the voice or mental thought from the individual body through the delivery of the telegraph and the introduction of the telephone. Later, Postmodernism introduced a new position of space in relation to time and became further unhinged in the proliferation of the digital revolution. Computers played a major role in the transition to postmodernity (Macey, 2000). The technologies as introduced during the 1980's, dissolved Modernism's linear sequences in production, direction and ways of knowing (Harvey, 1989; Castells, 1996). Technologies, through hyperlinks, hypertext and through the Internet, evade the origins of truth, "Its nodes intersect in random, unregulated networks in which any node can interconnect with any other node" (Powell, 1998, p. 114). The truth or knowledge source with a location in time and space, evades as it dissolves into evolutions of *simulacra.*

Although technological progress is a common denominator between Modernism and Postmodernism, it also helps define their differences. Professor of philosophy and author Albert Borgmann (1992) explains, "Postmodernism shares with modernism an unreserved allegiance to technology, but differs from modernism in giving technology a hyperfine and hypercomplex design" (p. 82) The technologies of the postmodern era are highly sophisticated in electronic, digital and cybernetic design. This type of Postmodernism feature is what Borgmann refers to as Hypermodern.

These hyperfine technologies are a primary ingredient of the emerging bionic generation. Borgmann (1992) explains the effect delivers "…an artificial reality…but it is not a poor substitute. It surpasses traditional and natural reality in brilliance, richness, and pliability" (p. 83). The bionic generation is defined as humans who have become *superhuman* and environments that have become *superenvironments*. Evolving generations of bionic humans (as cyborgs) and bionic space (as smart environments) will render the static or organic inferior.

The bionic generation relies upon what postmodern French philosopher Jean Baudrillard calls *simulacra*, or simulations. In his definition, Baudrillard (1988) notes "Simulation is no longer that of a territory, a referential being or a substance. It is a generations by models of a real without an origin or reality..." p. 166). The reproductions become more powerful and defining than the original source. The condition is what Baudrillard calls h*yperreal* (1988). Original meaning and authenticity are no longer needed or desired as the simulations, or new reproductions, supersede the originals in effect. Philosophy professor Cynthia Freeland (2001) defines the hyperreal, as "something 'more real than real': something fake and artificial that comes to be more real than reality itself" (p. 194). That is, it comes to represent and stand for reality, more so, than the original.

The bionic generation is hyperreal; cyborgs and smart environments evolve to replace their original sources (the natural biological human) and the primitive machine (the computer). For Baudrillard, advanced technologies, such as digital, genetic and cybernetic, are key sites and perpetrators of simulation. Subsequently, in the evolution of the cyborg and the smart environment, the bionic generation will continue to supersede their predecessors, setting up an endless production of simulation promised through each future generation of technology.

Simulations blur reality. In the case of the bionic generation, fact and fiction morph within our interior environments. Theorists Chris Horrocks and Zoran Jevtic (1996) explain, "Simulation is the collapse of the real with the imaginary, the true with the false" (p. 109). Advanced technologies are closing the gap between dream space, imagination, representation, actuality and ability. Horrocks and Jevtic claim "science fiction is no longer science fiction. It is our world – nothing is invented" (p. 109).

The hyperrefined technologies in the bionic generation aim to stretch beyond the hyperreal. The hyperreal example of an earlier human or environment suggests evolving into superhumans (cyborg) and a superarchitecture (smart environment). Yet, as technologies continue to advance, they promise to increase the intensification and seamless integration between humans, environments and technologies. This suggests a super-, extreme- or hyper-unification. Is this possible? It is fair to anticipate that if humans and technology merge on the one hand, and environments and technology on the other; the remaining piece of the puzzle would be to intensify the compatibility between the human and the environment. Through advances in technology, this will be possible. Interior designers and architects may revisit the original objectives of designing spaces and define where and how individuals may become fused to the environments they inhabit. If the ambition is to gain a fully seamless integration as science fiction collapses into reality, boundaries will continue to blur between what was once separate or sacred. The future abilities of the bionic generation will surely collapse the remaining hindrances that are keeping the body, the environment and the technology from morphing together.

Although the current era is often associated in theory to Postmodernism, the bionic generation challenges this. The bionic generation – in both character and ambition – evades several key defining features and goals of Postmodernism. Upon further analysis, it is often more symptomatic in character and ambition of Modernism. The bionic generation, as outlined throughout this chapter, has intensified – set into motion, with a widespread effect of being emblematic of Hypermodernism.

Technologies deliver a successful means of camouflaging power structures. Through streams of data, trash media and a sea of endless information, contemporary technology provides limitless masks to conceal hierarchies through simulation. The bionic generation reaffirms a source of control point similar to that of Modernism. That is, the control is located again within a small, elite populace. The bionic generation comes from a unidirectional control and power source: the programmer. The power source moves further outside of the body, or physical artifact and ever increasingly in toward the microchip. The molecular engineer will program the data and molecules, embedding them with the new values, codes and rules of society. Programmers will predetermine how individuals will adhere, alter or engage with the technologies. As Borgmann (1992) reminds us, " The distinctive discourse of modernity is one of prediction and control" (p. X). The bionic generation will be defined, predicted and controlled by others. This small group of individuals will become the new power elite – the new avant-garde.

There is no specific definition for a design aesthetic or characterization of Hypermodernism. Yet in viewing Hypermodernism as an intensification of Modernism, it is of value to consider how contemporary examples of design may be reinterpreted through this analysis of modern design principles. There appears to be two distinct streams of design aesthetics emerging that I see as reinforcing some early modernist design objectives and sensibilities. The first aesthetic stream derives from a rare techno-elite group of designers. These firms or individuals derive tectonics through a committed exploration and reliance upon advanced computer technologies. An example can be found in the design work of architect Frank Gehry. Shiro Matsushima (2004), of Toyohashi University of Technology in Japan notes that buildings like the Strata Center at MIT gain their dynamic form and complex geometry through these advanced computer systems.

Another stream for modernist design sensibility today can be found throughout North America. Modernist principles, such as functionalism or utilitarianism, are reinterpreted and intensified in today's interior design and architecture of suburbia.

Stripping away decorative elements, taking design down to the bare and essential, void of ornamentation or historicism has become a common design aesthetic. References to histories, location or community dissolve into a global design aesthetic. Ikea in Richmond, British Columbia is laid out and designed to match the Ikea in China or Dubai. No longer the elaborate design of the department store — rich with detail and custom design — strip malls, box stores and fast-food drive-throughs reinforce the character of a unified global Modernism – as extreme minimalism.

The bionic generation enables the ideals of Modernism to return with a vengeance. Redhead (2004) explains, " 'Modernity' as a concept is undergoing an enormous renaissance in global theorizing… " (2004 p. 48). The ambitions of Modernism, through advanced technologies, can be executed with new potency and effect. Haraway argues that the emerging culture of advancing cyborgs is an inevitable effect of late capitalist technology and "is at once an all-embracing and controlling reality and a utopia full of promise" (as cited in Vidler, 1996, p. 161). Reflecting the visionary idealism of Modernism, Hypermodernism translates the utopian vision through technology and intensifies it. Expanding efficiencies, cost-effective, productive and functional, are achievable like never before. As technology advances, the bionic generation expands and continues infusing a little more utopian Modernism into the everyday.

Although the bionic generation reflects modern principals, this is not to argue an allegiance as only connected to modern idioms. Rather, I argue the bionic generation hosts a variety of features symptomatic of both postmodern and modern movements.

Although this integration, or duality, may be considered unorthodox to the puritans of each movement, it aligns with the contemporary discourse of Hypermodernism.[17]

Hypermodernism is expanding through a variety of sources including cultural theory (Armitage, 2000b; Kroker & Kroker, 1997), literary theory (Pope, n.d.) and social theory (Lippens, 1998). Hypermodernism is also associated with a strategy found in the game of chess. The references have merged into other areas to describe cultural change in terms of social and political strategies (Pirie, n.d.). Dr. Madsen Pirie (n.d.) explains the term in chess refers to a deliberate strategy of gaining powerful control of the board from a peripheral position point. This approach is unique in chess, as a more prominent power position typically may be pursued to gain power through occupancy from the center of the board. This view point of hypermodernism can also be applied to the strategic peripheral power and control embedded in the cyborg, globalized multi-national corporations and contemporary military power. As in the case of the cyborg, the control and power of the pre-programmed or designed prosthesis embeds the power point far outside of the individual body and into the lab.

In cultural theory, Hypermodernism is a relatively recent and rarely used term. French cultural theorist Paul Virilio has frequently been referred to as a leading hypermodern thinker (Armitage, 2000, November 15, 2000b; Pope, n.d.) Unlike Borgmann, Virilio's hypermodern ideas are a complete departure from postmodern discourse. Virilio associates with the idioms of Modernism. Armitage (2000a) explains,

[17] Very little has been written on hypermodernism – as it is still in its infancy. As it relates to cultural and social theory, pioneers are noted by Armitage (2000) as Arthur and Marilouise Kroker (p. 18). Specific individuals who have also become associated with the early rising of the movement include Paul Virilio, Jean Nouvel, Stelarc, Deleuze and Guattari (Armitage 2000).

"Virilio's hypermodern does not articulate itself as a divergence from modernism and modernity but as a critical analysis of modernism and modernity through a catastrophic perception of technology" (p. 15). As the bionic generation illuminates an unyielding allegiance with advanced technology to execute modern principles, ambitions and utopias, it firmly reflects a connection to Virilio's cultural analysis and theory.

For Virilio, much of the current era can be explained through his ideas of *dromology*, or the science of speed (Redhead, 2004a, p 48; Armitage, 2000). Virilio explains dromology as "The diverse phenomena of acceleration in this era of the 'global village.' The focus on my research has shifted from topology to dromology i.e. the study and analysis of the impact of increasing speed of transport and communications" (Virilio as cited in Redhead, 2004, p. 49). Virilio's cultural analysis focuses on the impact of technology in relation to territory, geography, space, speed and architecture.

Redhead argues that Virilio's ideas can best be understood as representative of an "accelerated culture" or "accelerated modernity" (Redhead, 2004). I argue that the bionic generation is the ultimate and most profound example of an accelerated or hyper-intensified culture. Real-time and instant technologies – acceleration of transmission, production, information and communication – can erase geography and architecture, and represents Virilio's idea of *absolute speed.* That is, there is an absolute collapse of space-time reflecting the most intensified scenario of a utopian seamlessness where distance and geography evade as speed enables a drastic intensification and compression (Redhead 2004a).

Anticipating the absolute integration between cyborgs and bionic space, the ultimate collapse appears possible. Absolute speed translates into absolute materiality. An intensification of maximized integration of the skin, the body, the microchip, the nanobot and the wall. They compress, suggesting a hyperunification – the cyborg/cybrid united.

Boundary lines are increasingly blurred through an introduction to a bionic generation. As bits and chips transcend one element and invade the next, an absolute fluidity and compatibility defines the era. Professor of Criminal Law and Criminology, Ronnie Lippens (1998), explains:

> ...[Hypermodernism] refers to a cultural space in which multiple contexts of strategize ambivalence (or ambivalent strategies) and reflexive flexibility (or flexible reflexivity) fluidly interconnect, merge, diverge – crossing boundaries of everyday, the political, the economic, and the cultural. 'Hypermodernity' can also be read as a thoroughly globablised modernity. (p.17)

For Lippens, transcending boundaries is an integral feature of Hypermodernism. The ability to skip over or dissolve boundary lines is distinctly a bionic feature delivered through advanced technologies. As technologies become more sophisticated, more boundaries will evade. This suggests an intensification of a full seamless integration. Morphing cyborgs, nanobots and smart environments will become more available and integrated into the future bionic generation. It will be important to expand this analysis on the Hypermodernism as the future unfolds.

5.12 Future Influence

The bionic generation will alter the professions of interior design and architecture. The linear sequence of fabrication, project execution, and labor in various industries will be reinvented. As design process can migrate toward the scale of minutia or the microscopic, design process will also shift down to the smallest scale available. As theorists Arthur and Marilouise Kroker (1996, June 5) anticipate, "Materiality would be addressable atom by atom."

In response, designers can evolve their design process. They can choose to work at a smaller scale. Instead of working on plans scaled at 1/8 inch equals one foot, they may choose to use these technologies to narrow their focus toward the tiniest scale and detail. A fluency in molecular engineering and biotechnology can expand their design abilities. Designers can choose to work in an expanding and diverse multi-disciplinary team structure. These types of projects would involve a diverse group of professionals coming from molecular engineering, textile design, interior design, biology, IT or medicine. Instead of specifying products, such as furniture, fixtures, drywall or materials, designers can pursue radical customization, now that they are able to grow the project. With the emergence of the bionic generation, most professionals will need to shift their participation in the project to the beginning phases. There is a growing possibility that design of all kinds, including interior design, will shift further from the design studio or office and deeper into the laboratory.

Interior designers and architects can evolve with the new hypermodern condition. To achieve this, the profession, as we know it, will need to consider some drastic changes. How it will change must be formulated by expanding research and dialogue between design professionals, as well as outside professionals. The design community can expand their own body of knowledge through the support of professional organizations, funding in universities or conferences dedicated to advancing the critical discourse on technologies and the future. By expanding the dialogue, the design community will be empowered to contend with the uncertainties of the bionic future. Creating a deep and critical analysis of how the bionic generation relates to and influences design will be the only way to remain effective in dealing with it in the future.

It is important to reinforce that I am not arguing that the professions of interior design and architecture are going to disappear and be replaced by programmers. Rather, these professions will need to expand their role and process to remain effective with the future generations of bionics. Advances in technology are occurring rapidly, moving quickly from the ideation phase out into the marketplace. A steady inspection of what is around the corner is essential to prepare designers to use technologies effectively.

Most design practices are currently unprepared to critically assess these technologies or address the significant issues raised on cyborgs, nanotechnology and smart environments. It is not a matter of when or if the bionic generation is coming. Rather, it has arrived. The question becomes: how are interior designers and architects going to deal with this now that it has arrived? And further, how will design prepare and respond to the bionic generations of the future?

CONCLUSION

CONCLUSION

Immaterial culture is inherently complex. My study reveals there are several new challenges, as well as arising opportunities, to consider for the future practice, profession, process and education of interior design. The study exposes a growing need to formally address and contend with the implications emerging in immaterial culture. It is essential for the design community to construct a means to monitor, assess and prepare for its expansion and effect in the future.

The profession can anticipate several challenges to current procedures and methods of practice. My study suggests three probable paths or streams for the future of interior design practice. The first stream will operate much as it does today; bound through the material realm, with a strong association to the traditional approach and methods of interior design. The second stream of the profession will gravitate towards participating with the creation of new spatial frontiers. This stream, following the lead of some other spatial design professions, such as architecture, will become a subsidiary or progressive sect who may choose to abandon contending with physical space altogether. This stream will focus upon the development of information design, virtual architecture and advanced spatialization and information software. The third stream, which my research suggests to be the most compelling of them all, will adopt and advance the cybrid design model and methodology into design process.

My research does not suggest the first and second stream of practice will become obsolete or inoperable design models. These models will continue to expand and develop in the future. Yet, my study indicates these *uni-spatial* streams (as presented here as, stream one and stream two) will be plagued by limitation. That is, these streams will continue to operate yet they will remain within a restricted paradigm. Also, the paths of these streams suggest an increasing potential for interior design to become marginalized in scope, affect and influence.

To avoid potential marginalization, I encourage designers to expand the dialogue and research on immaterial culture. Expanding this dialogue within the discipline of interior design is essential, yet it is also relevant to extend this dialogue outward, into other disciplines. For example, design research can direct a focus upon leading institutions in technological innovation, such as MIT's Media Lab. To enrich the inquiry, designers should be questioning how new technologies, emerging in areas such as nanoscience, biotechnology, smart systems, AI and robotics specifically impact the professional practice of interior design.

Also, overlapping and extending research into areas such as anthropology, sociology and psychology would enrich and extend the dialogue further. Studies on the social implications and effect of cybernetic loss on the human psyche is essential. How does the absence of tactility, as introduced through cybernetic loss –effect or inform the sociological being? What are the implications of immateriality on the human experience within the interior environment?

Expanding research into areas of human cognition and perception would also enrich this study. Specifically, how are multi-spatial domains recognized, used and navigated? How can designers contend or evolve designs through the multi-spatial arena?

How do individuals participate and experience the cybrid model? If a cybrid model demands a seamless integration between the realms of cyberspace and physical space, designers would benefit in learning how and in what ways individuals cognitively perceive and identify seamlessness in spatial terms. How can design support, evolve or adapt to further enhance this perception?

Future inquires on immaterial culture will need to remain accessible to design practitioners. How will the conceptual ideas of immaterial culture become discernable and available to interior design practice? Discourse grounded in theory, philosophy or detailed research endeavors are extremely effective in gaining a deeper understanding of the underpinnings of immaterial culture – yet, extending this to the design community will be challenging. Finding new ways to directly inform daily practice would be beneficial to the future practice and profession of interior design.

My study illustrates the cybrid design model offers new opportunities for design. Yet, these opportunities are not readily accessible. To effectively contend with the cybrid, designers will need to first gain a deep understanding on the nature of cybridity. Designers will need to explore how cybridity can manifest in the interior environment. How do designers work with cybridity today – and how will they work with it in the future? Further research will need to reveal: what are the challenges, weaknesses and strengths of immateriality and the evolution of the cybrid design model?

As cybridity defines the spatial setting of the twenty-first century, it is essential for interior design students to become comfortable and consciously aware of the phenomena. Design curriculum needs to provide opportunities for students to fully embrace and explore the features of the cybrid design model.

The design studio is the optimal setting to expand the concepts introduced by the cybrid design process and model. During my instruction of a third-year undergraduate Environmental Design studio at The University of Manitoba [U of M], I introduced elementary design principles of cybridity into the design studio curriculum. I presented the students with a project that provided an opportunity to assess how advanced technology directly informs the design of the interior environment.

Each student developed his or her design solution as set within the same physical space. The site selected was the fine arts and architecture slide library on campus at the University of Manitoba. Their final design solutions were to manifest only in the physical material space. I encouraged the students to contemplate the consequences of various abstractions, afforded through advanced, and their implications in relation to their physical site.

Through this exercise, advanced technologies were used to navigate, access and resource off-site slide collections. By removing the bulk of the physical artifacts off-site, and out of the library space, the prime real estate was reappropriated for other use. Through off-site storage and technological support systems, such as palm pilot catalogue search, downloadable digital slides and wireless networks, the design project program exposed an exploitable cybernetic loss factor. That is, students were exposed to an incredible amount of new recovery space. Students, through exploiting this recovery space, were able to innovatively respond to the objective of hosting new social space.

The slide library became a new social arena, as a student lounge with a café, comfortable seating areas and a periodical magazine section.

As public space dissolves ever-increasingly under the economic crunch to privatize property and as individuals continue to be drawn to immaterial experiences in cyber realms – the ability to reignite the physical setting with increased social space is profound. Designers should continue to study how and in what ways social space can be extracted through design process? How can technology help this cause? What types of technologies should be used to support this mission? The area is ripe for expanding further investigation, research and inquiry.

The U of M students were not asked to execute a virtual space as part of their design problem. In contrast to the projects introduced by Anders (1999), Levine and Wake (2000; 2002), the students at the U of M were restricted to resolve a design solution in only one domain: physical space.[18] Although the design response was executed in one domain, the evolution of the project program (by myself) and the investigative inquiry during the design process (by the students and myself), presented incredible opportunities to consider spatial influence beyond the physical realm. Contending with abstraction and immateriality provided an ideal forum to witness the links between immateriality delivered through technology and the material spaces being developed by the students.

The study proved to be valuable as a means to begin basic experimentation with the cybrid model in the classroom. Expanding these inquiries in design studio – through

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[18] Design studio projects presented to students of Anders (1999) and Levine & Wake (2000,2002) are explored in more detail in Chapter 2.

more complex design problems – would be extremely beneficial. More advanced assignments, similar to those discussed by Anders (1999), Levine and Wake (2000; 2002), would be complimentary to the one I introduced to the U of M students.

Finding ways to encourage students to disengage – freely – from the physical domain will be useful to fully explore opportunities afforded through the cyber spatial realm. Encouraging concepts, through highly abstract design problems, explored through information systems or siamese sites can be used to develop spatial language. Developing ideas through reference to memory, metaphor, navigation, iconography, cybervisuality and sensory perception will further enhance the necessary skills required by students to contend with future cybrid design scenarios.

Interior design education is one of the most fertile areas for further exploration and advancement on cybrid design process. Developing multispatial problem-solving exercises is not a simple undertaking. Yet, as Levine and Wake (2002) observe it is extremely important to provide opportunities for students to develop skills to contend with these types of projects. Levine and Wake (2002) note:

> As a large and steadily increasing public participates in activities in virtual spaces, complimentary virtual architecture becomes an indispensable corollary to traditional building needs. As this develops, architects will need to recognize that the architectural needs of their clients extend well beyond the physical world. (p. 22)

Evolutions of cybridity will have significant consequences on the historical applications, interpretations, status and meaning of interior design. Most challenging will be gaining access to and incorporating spatial understanding that extends beyond the physical realm.

Finding a balance between new professional identity and preserving the more traditional values long associated with the profession will prove to be a challenge. Expanding an understanding of the historical identity of interior design and the increasing implications of immateriality will prove to be essential.

My study suggests it is important for students, educators and practitioners of interior design to instigate a further inquiry into the direct implications of advanced technology on what they do and how they do it. As the conditions promise to evolve and remain in flux, it is essential to expand the dialogue, research and critical body of analysis to maintain an assessment of its future development. As technology continues to become tinier, more invisible, mightier, smarter and more biocompatible, the survival of an effective practice will rely heavily upon adopting the proposed agenda for an expanded inquiry.

Interior designers are ideal candidates to evolve and define the new spatial paradigm. The research reveals that the question is not one of competence, but rather one of interest and understanding. Expanding the research agenda is imperative to gain an increase in awareness and of understanding the phenomena.

My research clearly indicates there is a need to develop a deeper inquiry into spatial understanding. An evolving spatial condition in the digital era will require an expanded area of spatial theory and study emerging from the discipline of interior design. It is important to develop an acute awareness and understanding of the expanding influence of an immaterial culture on the methodology, process and practice of interior design.

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GLOSSARY OF TERMS

Atom: The tiniest possible particle of matter.

Bionic: An exceptional and unique ability, power or strength. Enhancements delivered through technologies to become superior in physiological, anatomical or psychological capabilities.

Bit: The tiniest unit of data in computer language. It has a binary unit of a *1* or a *0*. It derives originally from the term: binary digit.

CATIA: Integrated software package developed by Dassault Systems and available through IBM. It is popular in production of parts in the automotive and aerospace industry. CATIA software uses the same system, from the earlier phases of design development to the final stages of output and fabrication.

Chip: Jargon or slang term for the microchip.

CNC: An abbreviation for Computerized Numerically Controlled machines. It refers to a computer controlled manufacturing machine and technique. These have become popular in manufacturing facilities world-wide; to produce millwork, stone, metal and glass. These computerized systems deliver an unprecedented error reduction through profound precision and accuracy in manufacturing through the use of advanced software. The software typically supporting the CNC machine is called CAM software Computer-aided machining [CAM] software.

Corridor Warrior: Office employees who are mobile – yet their mobility is predominately within the interior environment of the office. They spend considerable amounts of time running around to meetings, battling the distances and spatial issues imposed by architecture, to get to and from meetings, and back to their desks.

Cybervisuality: Refers to the perception of virtual or cyber realms as integral to the construction of meaning through vision. Sarah Chaplin explains "Cybervisuality implies that we have to some extent absorbed or acquired the capacity to perceive and process visual information in a slightly different way, and that the visual logic of computer-mediated communication is in some senses becoming naturalized" (2002, p. 38).

Cybrid Space: An environment or artifact that incorporates both physical and Cyberspaces (Anders 1999).

Data-glove: A glove that is embedded with advanced technologies. Most commonly, the gloves are laced with miniaturized sensors and through motion will activate or navigate computer systems.

Dematerializaton: The condition caused by advanced technology to miniaturize, digitize or replace physical artifacts with an electronic or digital counterpart. The process refers to the disappearance of material properties of physical space, as culture has become increasingly inundated and defined through immaterial means.

Digitization: Refers to the process of creating a digital counterpart of an item that previously had been hosted in physical space.

E-commerce: Business services conducted on-line, through the internet.

Hoteling: Type of work place setting and strategy for alternative officing. This settings is not designated to any one individual or for long term use. Instead, hotel space is optimally used by individuals who are rarely present in the office (such as sales people). In some cases, these become used on a first come first serve basis.

Hot Desking: Type of work setting and strategy for alternative officing. This setting is is not designated to any one individual – but rather, it is designated to more than one individual (2 or more). These individuals will work in rotating shifts at the same work setting.

Information Technology [IT]: Is a broad term, that has come to refer to all things relating to computer science and technology.

Memes: Is information (culture, thoughts, ideas or emotions) that move, replicate or transfer between human beings.

Mental Schemata: The term refers to the Swiss cognitive psychologist Jean Piaget principal ideas on adaptation and organization through mental structures of the mind. The mental schemata is the structure used for individuals to assimilate external events through conversion, by readapting them to fit into a mental profile in order to understand them.

Molecule: Two or more atoms joined together through a chemical bond.

MUD: MUD stands for multi-user domain. It is a text based on-line multi-player or multi-community game supported through the internet and digital systems.

Nanometer: Term of measurement, a billionth of a meter. To gain some additional perspective on this: The diameter of a human hair has been noted to be approximately 100,000 nanometers. The size of DNA is 2.3 nanometers.

Nanotechnology: A miniaturized form of technology. It is a science of engineering at the molecular level. The term derives from the unit of measurement, of the *nanometer*.

Natural Computing or Natural Interface: A generation of computers that are intuitive and simple for human usage. Humans can direct navigation through voice, pointing or other human body movements that appear 'natural', and not directed through keyboards and mouse operatives. It is expected to be available sometime in or before 2007.

Personal Data Assistants [PDA]: although the capabilities of the PDA changes yearly, they are defined as a hand held 'mini computer'. They often act as a day-time organizer, search engine and mobile phone.

Rapid-prototyping: Is a type of CAM software that can be output to produce 3-d products. It operates as 3-d printer.

Siamese sites: Refers to a dual or multispatial site condition for a design problem. The design develops in both physical space as well as in cyberspace simultaneously.

Stereolithography: is a highly accurate form of rapid manufacturing – supported through rapid prototyping.

Techno-gadgets: Electronic or digital technologically powered artifacts. Typically, this are small and portable devices used for business, home or entertainment purposes. An example of a techno-gadget is the mobile phone, the PDA or the MP3 player.