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CODES OF POWER

DIMENSIONAL SEMIOTICS AND PHOTONIC PERSPECTIVES

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ABSTRACT

Codes of power are scripted into the dimensions we inhabit. Ingrained as perspectival constructs, they shape our perceptions of time and space and automate our relations within spheres of communication transfer. With this systemization, the human body relinquishes its power as a primary site of perspective. Instead, views of the world are filtered through the hegemonic codes of the physical empire. Today however, we are also witnesses to the induction of light as a new sphere of communication transfer. Here, the codes of power are concealed by their explicitness as they transpose themselves onto a new horizon of definition. Thus, the purpose of this text will be to expose the 'command lines' behind the codes by utilizing a series of perceptual inversions. The aim will be to provoke a new paradigm for understanding the codes of power as they rise with the dawn of the virtual empire.

SOMMAIRE

Les codes du pouvoir sont inscrits dans les dimensions dans lesquelles nous vivons. Implantés comme mode de construction de pespectives, ils définissent notre perception spatio-temporelle et automatisent nos relations, au sein des sphères de transfert de communication. Cette systématisation signifie la fin de la domination du corps humain comme lieu primordial de perspectives. La compréhension du monde qui nous entoure se trouve dorénavant filtrée par les codes hégémoniques de l'empire physique. De plus, nous assistons aujourd'hui à l'induction de la lumière comme nouvelle sphère de communication. Au sein de cette sphère, les codes du pouvoir sont dissimulés par leur propre 'clarté' et se transposent sur un nouvel horizon de définition. L'objet de ce mémoire est d'exposer les 'lignes de commandes' sous-jacentes aux codes de pouvoir, en utilisant une série d'inversions perceptuelles. Son but sera de provoquer un nouveau paradigme permettant la compréhension des codes du pouvoir tels qu'ils émergent à l'aube de l'empire virtuel.

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This thesis is dedicated to their light.

PREFACE

This text is written rhyzomatically in the form of hypertext exposures. That is, it has no real beginning and no real end. It is network-centric in the sense that each node finds expression within itself and at other points as well. Thus, while the Base Node serves as the general theoretical framework, the reader is also invited to jump or start from any numbered node, as links within the text thread concepts together at various levels.

The hard copy format represents hyperlinks by their node and page number [e.g., 6.4: 5]. In addition, all text in bold refers to the glossary included at the end of the text. The online format will be made available through the McGill University Electronic Theses Pilot Project as part of the Digital Collections Program: <http://imago.library.mcgill.ca/>.

BASE NODE: THE CODES OF POWER

The obscure we see eventually. The completely apparent takes a little longer.
- Edward R. Murrow

Power twines itself in a double helix[1] of perception and perspective. Codes, or the principles by which human beings come to interpret the world, are always manifestations of the will to order. The dimensions of space and time, those numinous spheres, become fixed down as 'systems' of the environment. Here, quotidian rules are processed to confront a "measureless universe" and to keep us bound even amidst lucid experiences of such Absurdity (Camus, 1955). Thus we live, as Zygmunt Bauman has observed, in a "society...[that] is a massive and continuous cover-up operation. And yet the best escape we ever succeed in coming up with is a thin film of order that is continuously pierced, torn apart and folded up by the Chaos over which it stretches..." (Bauman, 1995: 13-4).

Hegemony emends these seams and scripts itself into our daily life as code. It is a force that operates in society when the worldview, social principles and practices of the ruling group are so internalized by subjects that the order in which hegemony is exercised appears natural and/or inevitable. As Stuart Hall suggests, these codes are so ubiquitous and may be "learned at so early an age, that they appear not to be constructed [...] but to be 'naturally' given" (Hall 1980: 132). Thus, the bequest of the code is deliberately made obvious and apparent to all, for indeed it is in this very manner that it obscures its encrypted power.

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[1] The double helix forms the primary structure of the human DNA code. 'Helix' is also a type of hardware description language (i.e., in contrast to the codes used in software programming language).

The purpose of this text will be to unravel these strings of code by learning to read between the command lines, so to speak. And as such, the first thing that must be noted is that power, as the creative force behind order, is never itself bound by such codes. As Henri Lefebvre (1991) points out:

> Whether or not it is constitutional, whether or not it is disseminated through institutions and bureaucracies, power can in no wise be decoded. For power has no code. The state has control of all existing codes.[2] It may on occasion invent new codes and impose them, but it is not itself bound by them, and can shift from one to another at will. The state manipulates codes. Power never allows itself to be confined within a single logic. Power has only strategies...(Lefebrve, 1991: 162).

These strategies however, always comply with a distinctive codification *process*. That is, in order for a code to be developed and disseminated as information,[3] it must itself follow a particular course of ordinance. The following will introduce the 'programming' of the code within communications systems as it serves to define the root structure of the present research focus:

At the first stage, a code is devised through *abstraction*. That is, for a conceptual 'thing' to exist or be defined, a form of volume must emerge from the vacuum.[4] Consciously, of course, we are aware of this manifestation. We know for example that the concept of space does not lie within space, nor does the concept of

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[2] Today power lies not only within the domain of the state, but also within the realm of (corporate) culture. Consequently, there are two forces that seek acquiescence through coded formations. The former limits its subject's agency within space, while the latter confiscates the will of its subjects through time.

[3] For an etymological examination of the words 'Information' and 'Development' as they relate to the process of codes of power I refer the reader to Appendix A.

[4] As a Zen Buddhist might declare, "Things are made out of Emptiness".

time exist with any true referent to time itself (ibid.). Instead, the contours of these invisible spheres are drawn into abstract boundaries; and the lines chosen to define them become the very impressions of the forms they seek to 'represent'. As such, these defining lines are the first marks of power.[5] Invisible traces which eventually come to dominate all aspects of our daily life. However, the code in this first state is still raw. It requires further authentication if it is to be accepted as system that has the power to govern 'reality'. Therefore, the second phase, *authorization*, is perhaps the most important in the codification procedure. It is here that 'obvious value' is bestowed upon the code by state, religious, economic, or scientific authorities of the time. That is, power always imports its designs under the guise of 'utility' or 'value'. As Jean Baudrillard reveals, "It is the cunning of form to veil itself continually in the evidence of content. It is the cunning of the code to veil itself and to produce itself in the obviousness of value" (Usenet: HREF). Thus, 'the magic of the code' (Levin in Baudrillard, 1981) is its ability to feint perception and conceal the modes which form its power.

At this point, the code may precisely be understood as an applied convention[6] with the capacity to act as an organizing principle for social entities (Kellner, 1987). However, before being (re)proximated into the public realm two conditions must first be met. To extrapolate from Witold Kula's analysis of standardization (Kula, 1986: 122), in order for codes as 'pure conventions' to be adopted there must both be equality before the law and an alienation from the code

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[5] As Brian Massumi suggests, "Every formation is a power formation" (Massumi, n.d.: HREF).

[6] That is, by virtue of ratification within a closed system (authorization), codes of power are not "shared conventions" (open systems) but rather "imposed conventions" for ordering and organizing information.

as a commodity[7]. The former provision ensures that the system will function within a consensus, and that all members of a given population will be subject to the same interpretations of the code. The second criterion however, enables an equivalent *currency* of the code, and an ability to purchase its constructs within a symbolic system of exchange. Inasmuch, an underlying thread of this text will examine the manner in which dimensions come to be bought, sold and traded by virtue of their coded properties.

With the institution, exchange and adoption of the code within the public schema, individuals come to regard the universe in a profoundly normalized manner.[8] That is, the *Lebenswelt*, or the taken-for-granted world (Lyman, 1997) forms the basis for understanding the 'alienation of perception'. Here the codification of dimensions will be analyzed to gain a fuller understanding of manner in which power seeks to control the will and agency of its subjects. Specifically, the aim will be to demonstrate how time and space, as spheres of information transfer,[9] are externalized into codes in order to maintain hegemony over the physical empire. Correspondingly, with the current developments in photonic communications, this thesis will provide a framework for understanding the codification of a new sphere of transfer -- the expansion of a *virtual* empire -- where lines of code are just beginning to weave a scrim over the dimension of light.

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[7] As Kellner has suggested, our society has "moved from a focus on the "mode of production" to a focus on the "code of production" (1987: 61).

[8] "The 'normally' alienated person, by reason of the fact that he acts more or less like everyone else, is taken to be sane...The condition of alienation, of being asleep, of being unconscious, of being out of one's mind, is the condition of the normal man. Society highly values its normal man. It educates children to lose themselves and to become absurd, and thus to be normal. Normal men have killed perhaps 100,000,000 of their fellow normal men in the last fifty years" (Laing, 1990: 24).

[9] Time and space are spheres of transfer which allow information to be passed on by virtue of codification. Thus, in this manner, one "can transmit from one person to another a memory picture which can be experienced, but not perceived through the senses" (Elias, 1992: 10).

Finally, a new paradigm for understanding power, both within the physical and virtual realms, will be forwarded by provoking a series of perceptual inversions. The rationale for this method is based upon a doubled reading of the code. That is, as telematic communications increasingly render the individual subject *secondary* to interpretations deciphered by the machine,[10] the perceptual environment affords a situation where the codes may come to be seen in their pure form: *as precise reproductions of random noise.* This perceptual paradigm emerges as the result of dimensional overcoding. That is, a possibility exists to 'see' the reality of the code when it begins to feed back on its own systems of construction. These bifurcation points or ruptures within "the thin film of order" (Bauman, 1995), are brief openings in the system[11] which release the free flows of chaos that underlie the surface codes of power. As Gilles Deleuze and Felix Guattari (1987) suggest:

> The principle evolution is internal, whatever the external factors that contribute to it. *The archaic State does not overcode without also freeing a large quantity of decoded flows that escape from it.* Let us recall that "decoding" does not signify the state of a flow whose code is understood (*compris*) (deciphered, translatable, assimilable), but, in a more radical sense, the state of a flow that is no longer contained in (*compris dans*) it (sic) own code, that escapes it (sic) own code. On the one hand, when the primitive codes cease to be self-regulating and are subordinated to the higher agency,

[10] W.I. Thomas has observed that most of everyday life is conducted in accordance with habits, or 'common sense' "definitions of the situation" (cit. in Lyman, 1997: 287). With the advent of telematic communication however, codes, or "definitions of the situation" are not only habitualized but rather, computerized.

[11] That is, while closed systems adhere to precise definitions of the code, open systems allow for varied interpretation. Thus, during the brief windows into open systems, "in reaction and response to such moments, individuals are in a position to perceive as it were for the first time the sense- (and the nonsense-) structures of their conscious life and to reconsider their adherence to them" (Lyman, 1997: 292).

> flows that had been coded in a relative way by the primitive communities find the opportunity to escape. But on the other hand, *the overcoding of the archaic State itself makes possible and gives rise to new flows that escape from it* (emphasis original, 1987: 448-9).

Thus, it is with the recent advent of lightwave telematics that we are able to see the old systems of code begin to transpose themselves anew. Inasmuch, this text will focus on the various coding processes that are *currently in formation* in order to understand the direction that power is taking within the virtual realm.

Codes form the basic fabric of 'reality'. As human subjects however, we have sadly lost our fascination with the dimensions in which we live: we have lost sight of our own ability to interpret the Abyss.[12] Instead, we live our lives through codes; banalized readings that situate us in an "unreflected-upon world", where systems of power go unnoticed and largely uncriticized (Lyman, 1997). Here, power is enabled, and silently reproduces itself[13] toward its ultimate goal: to reduce the perceptual world to code. If the underlying *telos* of the codes of power is never apparent on the surface, this is because its true aim is to obliterate the human body as a site of perspective. Already, as we shall soon see, remote sensors and lightspeed transmissions render the human perceptual system useless in this new 'order of things.' Thus, in order to expose the codes of power, the following analysis will approach them *obscurum per obscurius*, that is; in a manner that explains the obscure by means of the even more obscure: or perhaps, the obvious.

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[12] As Cornelius Castoriadis has observed, human beings fear the notion of Chaos: "they cannot stand up straight and confront the Abyss" (cit. in Bauman, 1995: 13-4).

[13] As Charles Levin observes, "as we 'consume' the code, in effect, we 'reproduce' the system" (cit. in S(t)imulacrum(b), 1996: HRÈF).

NODE 1.1: THE MACROCODES OF DEEP SPACE

Nothing puzzles me more than time and space, and yet nothing puzzles me less,
as I never think about them.
- Charles Lamb

Measurement is the pivot of human perspective. It scales each dimension to fit 'reality', and suspends our disbelief by creating 'structure' through the division of 'things', meaning and order in an otherwise incomprehensible universe. In doing so, it clears open a path for the 'precession of simulacra',[1] a parade of numbers and symbols that reproduce themselves in an infinite tautology of logic. Here, the hegemony of symbolic distance signals the gap between the universe and our memetic translation of Being. And, within every dimension of space and time, it is the power of these codes which claims control over chaos.

The standard, as the keystone of measurement, has become so normalized that its construction has largely been locked out of social memory. Existing as a defined property of course, the standard never had a pure Platonic form to correspond to. As an arbitrary numerical construction, it referred not to a 'thing' in advance, but rather to itself as a simulation. Thus, it could be said that in the instance of the standard, it was the simulacrum that gave birth to the 'original': a materialized version of immaculate conception.

The 'original', the 'authentic', the exemplary model of the standard however, was created so that it could be usurped by its copies. As Jean Baudrillard has

[1] Jean Baudrillard suggests that 'As simulacra, images precede the real to the extent that they invert the causal and logical order of the real and its reproduction', as such 'reality' becomes the 'effect of the sign' (cit. in Jervis, 1988:300).

suggested, this liquidation occurs with the extermination of its use value (Baudrillard, 1981). For example, even though the advent of the metric system is in itself fairly recent, the 'original' form of the meter has already become evanescent. The 'official' platinum meter, which is housed at the Breteuil Pavillion in Sèvres, is now perhaps nothing more than a tourist attraction. Like a token monarch, it reigns not by virtue of its actual use value, but because of its hegemonic force on the populace.[2] The 'real' meter is of course only a simulation of its power. For what would it mean if one were to sever it? In 'reality' would it not render all other meters obsolete?

Accordingly, power holders have often taken precautions to maintain the security of their standards. In later czarist Russia, the official measures were actually kept in the fortresses of St Peter and St. Paul (Kula, 1986). Similarly, the archstandard of the global metric system in Sèvres is vigilantly guarded by a complex system of fire alarms and anti-theft devices (ibid.). But with these standards posed as the bastions of the 'real', even such elaborate precautions were not deemed secure enough. As Witold Kula (1986) writes,

> The thought that someday, through an earthquake or a calamitous fire, the world might be "without the meter" was indeed a nightmare. The new regulations, introduced in 1961, have done away with the very concept of "standard". Today, the true or invariable meter is defined as "a length equal to 1,650,763.73 wavelengths of the orange light emitted by the Krypton atom of mass 86 in vacuo" and it is

[2] To quote Baudrillard: "Power did not always consider itself as power, and the secret of the great politicians was to know that power does not exist. To know that it is only a perspectival space of simulation, as was the pictorial space of the Renaissance, and that if power seduces, it is precisely - what the naïve realists of politics will never understand - because it is a simulation and because it undergoes a metamorphosis into signs and is invented on the basis of signs" (cit. in Kroker & Cook, 1991:95).

> reproducible the world over in any properly equipped scientific laboratory (1986: 81).[3]

As such, the notion of a "primary standard" has given way to a "transfer standard" (Virilio, 1991), where dimensions are no longer measured by humanly observable qualities but rather by invisible and abstract *quantities*. It is this will, seemingly toward 'precision', which effectively destroys the accessibility of the 'real' and eludes it through an increase in the dematerialization of its referents. In essence, the human perspective is negated in favor of an abstract, invisible sign: one that eschews local resistance by enveloping it within a larger, systemized and intangible order.

In *Measures and Men* (1986), Witold Kula comprehensively argues that the human body acted throughout history quite literally as 'the measure of everything'. In fact, it was not until the development of the state that the body was disposed of as the primary site of perspective. Up until this time, the world was a somatic measure of feet, arms' lengths and handfuls. But power does not bide well in a state of unique interpretation. Indeed, it seeks standards in order to govern the trade of symbolic exchange. As Zygmunt Bauman (1998) has suggested, in a ruled territory, the very difficulty is that one handful or one basketful is not like any other. Bauman argues that such 'anthropomorphic' and 'praxeomorphic' contingencies needed to be neutralized whenever power-holders wished to accord uniform treatments (i.e., taxes or levies) on a populace. As a result, diversity and variety had to be subsumed by the "...imposition of standard, and binding measures of distance, surface or volume, while forbidding all other local, group- or individual-based renditions". Furthermore, "The task boiled down to the substitution of administrative practices of the state for

[3] In 1972 a proposal was set to again redefine the meter to "the length crossed by light in a vacuum in

all other, local and disperse practices, as the sole and universally binding reference point for all measures and divisions of space" (Bauman, 1998: 28-9). Therefore, the body as a site of perspective could no longer offer itself unto the smooth [5.1: 2] and unmarked perceptions of dimensionality. As Deleuze and Guattari suggest, the essential enterprise of the State, and specifically its conquest of the war machine, creates a "striation of space-time, a subjectification of free action, [and] a nullification of smooth spaces" (1987: 491). To this degree, the standard simultaneously defined and destroyed the local(e), while its very elevation (abstraction) became an invisible hegemonic force. In reality, it could not be otherwise. No state system could survive without an accession to the standard. For without an internalized respect for the system of measurement, boundaries would simply collapse into subjective variables.

The persistence of measures is intimately linked with communal memory (Bloch in Kula, 1986). And so it goes, that with any new state formation, it is this anamnesis which must be reprogrammed. Naturally, there is an increased efficiency in the task when the authority of spatial definitions is externalized. In the case of modern space war, the goal was to subject and invalidate all opposing spatial interpretations by instituting an exclusive state endowed map.[4] In essence, this foreordained the font of a legible map [3.1: 3] for state agencies, which concurrently restricted local interpretations, and resistances of spatial meaning (ibid.). This extension is readily apparent today as the entire institution of warfare (the ultimate manifestation of state power) is based on the idea of such secured measurements. However, Baudrillard warns us, "when there is no longer any virgin territory, and

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1/299,792,458 of a second" (cit. in Virilio, 1991: 41).

[4] Bauman suggests that the stake of the battle in modern warfare was the right to control the cartographic office (Bauman, 1998:31).

thus one available to the imaginary, *when the map covers the whole territory, something like the principle of reality disappears*" (Baudrillard, 1994: 123). The usurpation of space by its own map is clearly manifest in the realm of today's postmodern warfare. "Project 2851", the new American armed forces' standard for digital terrain, substitutes the map for the territory with horrifying accuracy. This system, which allows for shared databases on any number of different machines, allows the military to move through virtual space in order to conquer its real counterpart. As Bruce Sterling writes:

> Project 2851 is about the virtual reproduction and archiving of the entire planet. Simulator technology has reached a point today in which satellite photographs can be transformed automatically into 3-D virtual landscapes. These landscapes can be stored in databases, then used as highly accurate training grounds for tanks, aircraft, helicopters, SEALS, Delta Force commandos. What does this mean? It means that soon there will be no such thing as "unknown territory" for the United States military. In the future...the United States military will know the entire planet just like the back of its hand. It will know other countries better than they know themselves" (Sterling, 1993: 12).

Knowledge of the virtual battlefield's dimensions has already proven to be more important than knowing the physical territory upon which war takes 'place'. For example:

> During the Battle of 73 Easting, an American tank regiment came roaring out of an Iraqi desert that the Iraqis themselves could not navigate. The Iraqis couldn't enter their own desert, because they would have died there. But the Americans had satellite navigation units, so the Americans knew where they were on our planet's surface right down to the yard. The Stealth pilots who blew downtown Baghdad into

> hell-and-gone had already flown those urban landscapes before they ever put their butts in the cockpit seat. They knew every ridge, every skyline, every road - they'd already seen them on console screens (1993: 12).

Power however, cannot rely solely on spatial codes of representations in order to materialize. It also requires a concentration in time[5] (Wark, 1988). The vector that exists as a potential trajectory across this space is *coordinated* through temporal accuracy and acceleration. As a result, the will to code has even transposed itself into another dimensional measure, as space is now most accurately defined in units of time via light[6]. It should be remembered that the current institution of warfare in fact relies completely on the deregulation of time and space (ibid.). As McKenzie Wark explains, "This is why the technical manoeuvre that consists of complexifying the vector by constantly improving its performance has now totally supplanted tactical manoeuvres on the terrain..." (ibid.). However, as the map of space folds into its temporal creases, *the illusion of space itself begins to be exposed by time* [3.1: 3].

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[5] US Naval Observatory historian, Stephen Dick, has noted that each nanosecond (billionth of a second) of error translates into a GPS error of one foot. Thus, a nanosecond "may not seem like much, unless you are landing on an aircraft carrier, or targeting a missile" (cit. in University of Wisconsin, 1998: HREF).

[6] The meter may now be defined as the distance traveled by light in 0.000000003335640952 seconds. In addition the light-second, or the distance light travels in one second, can be used to define both space and time (Levine, 1997: 59; Hawking, 1988: 23).

NODE 1.2: THE MACROCODES OF LIGHT TIME

What if time does not exist, what if, in fact, it is malleable because it is merely a perception?
- Mark Helprin

Distance is always a matter of definition. That is, both spatial and temporal dimensions require reference systems to function in society if they are to act as dimensional coordinates. But time expands out of itself, as it both models and is modeled by its subjects. According to Norbert Elias, "...the concept of time refers to...neither a conceptual 'copy' of a flow existing objectively, nor a category of experience common to all people and existing in advance of all experience" (1992: 10). This is because Time is quite literally a variable; it admits an infinite number of values for the same expression. And although all societies do possess a concept of time (Levine, 1997), these are often invested intimations of the public will.

Temporal cadence shifts with history even though it unwinds the same strings of time through space. The human agent marks these qualitative shifts symbolically through naming them 'the ages'. An age, be it human or historical, grasps moments of the future and the past within its boundaries. It cannot be felt or perceived just as the present moment cannot be imagined. And so the story of time falls within arbitrary boundaries: one unnoticed moment is perhaps not different from the next, except in its proximity to the force of entropy.[1]

Only recently did time come to prevail as a 'thing-in-itself', a dimension so abstracted from human perception that it could seemingly be captured or replicated.

Instead, throughout much of history, time was marked in a relatively personal and irregular manner (Dohrn-van Rossum, 1996). This is because, up until the invention of the clock, *time was still a measure of bodies.* The human physical body (e.g., circadian rhythms) and stellar bodies (e.g., astronomical calendars) were privileged as primary markers of temporal movement. Early divisions of time were delineated by virtue of their social function and were often measured by the *passage of visible matter through space.*[2] Night*time* was also in*visible* time. For the ancient Egyptians, the measurement of time ceased during the hours of darkness (Devlin, 1998: HREF). As one ancient sundial's inscription read: "*Absque sole, absque usu*" or "without sun, without use" (Levine, 1997: 54). The water clock or *clepsydra*, became the device that compensated for times that fell outside the realm of light [4.4: 1-3]. It functioned as an approximate measure of intervals by gauging the amount of time it took for water jugs to drain (Levine, 1997; Dohrn-van Rossum, 1996). From shadows to water, and from stars to sand, time flows of the past were analog.[3]

The arrival of mechanical time, the clock as an autonomous time dispenser, was originally to be kept outside of 'real time'. In fact, mechanical time was so indicated by the phrase "of the clock", which was later abbreviated to "o'clock" (Devlin, 1998). Clock time however, is now so ingrained that it has become difficult to stand back and observe it as a human invention. Specifically, we have forgotten

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[1] Immortality is linked to Eternity. Without death, time has no meaning. Or, as Jorge Luis Borges once put it, "Death is just infinity closing in" (cit. in Nisker, 1990: 202).

[2] Time however, was not always measured by its 'visibility'. For example, early clocks, which had neither hands nor a face, used chimes to sound the time. The Chinese moreover, used incense clocks which allowed people to actually *smell* the time (Levine, 1997: 56).

[3] For a comprehensive introduction to the measurement of time, I direct the reader to Gerhard Dohrn-van Rossum. *History of the Hour: Clocks and Modern Temporal Orders.* Trans. Thomas Dunlap. The Chicago: University of Chicago Press, 1996.

the fact that the thing being measured is actually created by the devices that do the measurement (ibid.).

Once time was lifted out and could be experienced as an order outside of the body, it could also be turned back to control human behavior.[4] For only when human beings could be separated from their subjective time, could they then be considered "behind the time". The increase in precision with respect to time recording devices condensed moments, and levied a force on human interaction that was heretofore unparalleled. For it was only shortly after the introduction of the mechanical clock that the term "speed" (originally spelled "spede") entered the English vocabulary (Levine, 1997: 57). Likewise, the word "punctual" (which originally described someone who was a stickler for details), was soon redefined to describe the adherence to an exact arrival at an appointed time (ibid.). The 'virtue' of punctuality however, did not emerge simply because of the clock, but in fact coincided with the marketed notion of the 'standard.' That is, Time could never be regarded as a resource if it did not integrate the ideals of repeatable quantification. Time had to become exact for everybody.

It is well known that much of the pressure for time coordination came from the railroads and weather forecasters who needed to synchronize temporal information[5] (Giddens, 1990; Levine, 1997). However, there were also entrepreneurs who took advantage of the idea that time itself could become a commodity. Samuel

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[4] Harold Innis has likewise suggested that temporal measurements facilitate temporal management. He states: "Measurement of time facilitated the use of credit, the rise of exchanges, and calculations of the predictable future essential to the development of insurance" (Innis, 1995: 72).

[5] As Keith Devlin notes: "Rail travel necessitated coordination of all...different local times. The end result of this change is our system of time zones, with a uniform notion of time within each zone. After two thousand years, a completely abstract, human-made notion of time had been put in place. Human life would never be the same" (Devlin, 1988: HREF).

P. Langley and Leonard Waldo both understood that a profitable 'service' could come about through the marketing of "official" time signals.[6] Of course, what this also meant was the necessity for the marketing of the values and virtues of *being on time*. As Leonard Waldo asserted: "The furnishing of correct time is education in its nature, for it inculcates in the masses a certain precision in doing the daily work of life which conduces, perhaps, to a sounder morality" (cit. in Levine, 1997: 66). In a report to the railroad commissioners he further remarked, "Any service which will train these persons into habits of accuracy and punctuality, which will affect all employers and all employees with the same strict impartiality, so far as wages for time employed is concerned, will be a great benefit to the State" (ibid.).[7]

By the late 1800's, an aggressive marketing strategy imposed by the new clock and time recording companies had normalized the values of punctuality and "respect for time". The corollary was that individuals who did not conform to this value were considered idle, lazy and immoral. Promptness, routine and order had become commonplace. Time stamping systems further enabled workers to check in and out of the workplace with a monitored precision. These punch clocks [4.3: 3] allowed supervisors a means for "extending their reach beyond their vision" (Levine, 1997: 68). Appositely, by 1907 most of these card stamping system manufacturers had been consolidated and bought up by one organization, the International Time Recording Company, which later came to be known as IBM (ibid.).

The consolidation of time as a discrete entity allowed it to enter into transfers with other symbolic systems of exchange. Today, it is evident that money and time

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[6] Both Langley & Waldo personally profited from the creation of time as a commodity. These two men were the first to sell their time signals via telegraph for substantial fees (Levine, 1997).

[7] The effect on today's waged practices can clearly be seen as certain institutions charge right down to

have formed an intricate union, with dollar values assigned to hours, minutes, seconds and even fractions of a second. But it would be a fallacy to consider the exchange unidirectional, for money not only buys time, it must itself be invested *in time*. And, as the 1987 stock exchange crash surely exemplified, if the *currency of time* is not taken into account, then we can afford no reprieve from such immanent 'accidents' (Oliveira, 1996; Virilio, 1998).[8] As such, it has been argued that the International Office of Weights and Measures in Paris (BIPM), is in fact the most powerful institution in the world (*Colors*, 1998). It coordinates time from atomic clocks in 30 countries and relies on 24 Global Positioning Satellites to provide additional reference (ibid.). The BIPM acts as the conductor of a finely tuned global synchrony.[9] It sets the tempo for spatial movement[10] and streams the noises of chaos into harmony.[11] But as Virilio reminds us, built into this massive construction is also the capacity for massive destruction. Of this, he writes:

> The old kind of accidents were localized in space and time: a train derailment took place, say, in Paris or in Berlin; and when a plane crashed, it did so in London or wherever in the world. The catastrophes of earlier times were situated in real space, but now, with the advent of the absolute speed of light and of

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the second.

[8] Jean Baudrillard has likewise suggested that we may soon see a 'Black Sunday of culture' (cit. in Leith, 1998: 14).

[9] As Fred B. Wrixon, the author of *Codes, Ciphers & Other Cryptic & Clandestine Communication* suggests, the organization of time makes synchronized codes more 'practical' and precise timing expands code options (1998: 428-9).

[10] "City traffic lights work on different schedules depending on how much traffic is circulating. Radio receivers linked to atomic clocks tell them which ones to adopt. In the morning, for example, they're supposed to change more quickly to speed up commuter traffic. Without time signals, traffic jams would clog city streets in no time" (*Colors*, 1998: 73).

[11] In industrialized countries, police stations, hospitals and fire departments all rely on atomic time to synchronize their activities. Moreover, without time signals to coordinate their frequencies, computers, cellular phones, faxes and all other telecommunications would be rendered useless (*Colors*, 1998).

> electromagnetic waves, the possibility of a global accident has arisen, of an accident that would occur simultaneously to the world as a whole (Virilio, cit. in Oliveira, 1996: HREF).

What Virilio speaks of is the advent of 'the information bomb' (ibid.), or quite literally, a '*time* bomb' ticking in an invisible silence, completely undetectable to human senses. For time is now measured at a speed beyond the realm of human physical perception [2.1: 5]. While computers can easily measure time in nanoseconds or in the billionths of a second, for human beings, "events that last for less than a few milliseconds are perceived as instantaneous, without duration" (Levine, 1997: 28). Furthermore, we have come to believe that our own subjective experience of time, the time we "feel", is inadequate compared to "official time". Today the time marked out by our own sensations is considered illusory while the symbolic time that we have constructed is real. However, a new form of illumination is rapidly rising above the (event) horizon. But before this dawn's upon us, we must first re-adjust our perceptions [1.3: 1-4] of space and time if we are to see how these liminal dimensions are becoming Lumina(l).[12]

[12] Lumina is Latin for "light or an opening for light" while Luminal is "a long-acting barbiturate used as a sedative" (WordNet 1.6, 1997: HREF).

NODE 1.3 MAKING SENSE OF MAP

Measurement is what allows man and machine to interact fully.
It's how machines extend man's senses.
- Hewlett Packard Advertisement

Perception-in-itself, Merleau-Ponty has argued, does not exist. It is dependent upon spatial and temporal positioning and varies as such perspectives shift. In *Phenomenology of Perception* (1962) he writes, "The world is...the natural setting of, and field for, all my thoughts and all my explicit perceptions. Truth does not "inhabit" only "the inner man", or more accurately, there is no inner man, man is in the world, and only in the world does he know himself". (Merleau-Ponty, 1962: xi). "The World", however, is no longer presented to us as concrete or unified whole: a place where one subject's positioning accounts for the perception of a singular spatio-temporal environment. Instead, the position itself as a site of experience has multiplied [5.1: 5]. With the recent creation of digital perceptual space--specifically computer mediated physical space (CMPS)[1]--knowledge of the external environment is no longer *a priori* the domain of the human senses. As such, a case could be made that it is not, as Merleau-Ponty argues, through the world that man comes to know himself, but rather, through its double [0: 5].[2]

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[1] Remote space as defined here refers to **Computer Mediated Physical Space (CMPS)**. For the purposes of this analysis the terms Remote Space and Virtual Space will hereafter be used interchangeably to refer to mediated space in general. For specific instances such as **Computer Generated Virtual Space (CGVS)**, I will include the defined acronyms beside the text.

[2] The double acts as a site of recognition and reflection. As Jean Baudrillard writes in *Simulacra and Simulation* (1994): "...the double is precisely not a prosthesis: it is an imaginary figure, which, just like the soul, the shadow, the mirror image, haunts the subject like his other, which makes it so that the subject is simultaneously itself and never resembles itself again, which haunts the subject like a subtle

To clarify the effects of this manifestation, a distinction must be drawn between organic and digital notions of sensation and perception. On the organic level, sensation is what occurs anatomically at the end organ, while perception involves the seemingly instantaneous recognition of patterns (e.g., an object, a face, movements, remembered experience). Perception is generally considered a higher level process in the brain in that it utilizes sensation to create the emergence of spatial/temporal orientation and organization (Darley et al., 1988). In digital sensation and perception however, there is an inversion of the two qualities; for the mediated world relies on exo-sensory systems for proprioception. As McLuhan predicted in *Understanding Media* (1964):

> By putting our physical bodies inside our extended nervous systems by means of electric media, we set up a dynamic by which all previous technologies that are mere extensions of hands and feet and teeth and bodily controls - all such extensions of our bodies, including cities - will be translated into information systems. Electromagnetic technology requires utter human docility and quiescence of meditation such as now befits an organism that wears its brains outside its hide and its nerves outside its skin (cit. in Kroker, 1995: HREF).

The dimension of time is usually associated with perception, while the dimensions of space are intuited by the senses. For Deleuze and Guattari, striated space can be conceptualized as an oriented space, a space comprised of dividing lines [1.1: 1], and a space which is marked by distant vision (1987: 493). Remote digital space offers itself as a clear example of striated space as every point is mapped into a

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and always averted death. This is not always the case, however: when the double materializes, when it becomes visible, it signifies imminent death" (1994: 95).

pattern of recognition from its inception. Here, localization precedes sensory recognition[3] and algorithms define all vectors in advance. What this implies then, is that in remote space, one must *already be oriented* (perception) in order for sensation to take place. The digital equivalent of sensation is manifest through the wired appendages of distal sensors. Herein lies the analogous relation to organic 'higher level processing', for in remote sensing, *input processing is secondary to orientation.* That is, sensation must first be rendered through a perceptual schema. While the organic sense functions to process external input (e.g., burn {sensation} = high temperature {defined perception}) the remote sense processes internal *output* (e.g., high temperature {defined sensor} = burn {perception}). Or, more simply put, a remote sense would not 'feel' a burn, it would compute it.[4]

In his 1994 book *The Vision Machine,* Paul Virilio anticipated the arrival of such a 'doubled point of view': a field where the analysis of objective reality would be delegated to a machine:

> Aren't they also talking about the new technology of 'visionics': the possibility of achieving *sightless vision* whereby the video camera would be controlled by a computer? The computer would be responsible for the machine's - rather than the televiewer's - capacity to analyse the ambient environment and automatically interpret the meaning of events (1994: 59).

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[3] NASA's telerobotic Nomad project clearly illustrates the function of position and orientation in 'distance perception'. That is, in order to "sense" an object, the robot must first know "where it is". This is done with the aid of Global Positioning Satellites. Once the robot knows where it is, it is able to use its stereo cameras to 'detect' an object. By using the laser rangefinder which it comes equipped with, Nomad sends out a pulse of laser light and times how long it takes for the light to come back. The longer it takes, the farther away an object is (*The Robotics Institute*, 1998: HREF).

[4] There are robotics researchers however who are examining "bottom-up" perceptual faculties in machines. Most notably I direct the reader to the work of Mark Tilden, founder of BEAM robotics

Virilio's awaited 'synthetic vision' has now finally been realized. The Computational Sensor Laboratory at Carnegie Mellon's Robotics Institute has created a computational sorting sensor chip which functions as a perfect example of 'higher level processing'. As a description from their website states:

> The sorting computational sensor detects an image focused thereon, and sorts pixels by their intensities. In contrast to conventional cameras which detect and output light intensity, the sorting sensor computes and outputs the order (or index) of each detected pixel. Such an output is a histogram equalized version of the sensed image. *The fundamental advantage of this approach is that the computation on an image is performed before the image is readout and digitized* (emphasis mine, *The Robotics Institute*, 1996: HREF).

But our ability to render the environment as a coded playback should press us to pause. And, perhaps here we should be reminded of the body's intimate relationship to sentience. The word 'sentient' comes from the Latin, 'sentire' or the ability to perceive or feel. Thus, in the truest sense of the word our virtual selves are increasingly becoming sentient, while our physical beings are un-becoming, or are augmenting themselves into a realm of insentience [4.3: 1-2]. The 'automation of perception' is rapidly becoming a reality. As the above sensor demonstrates, synthetic visual perception is manifest *'by the machine for the machine'* [5.3: 1-3] (Virilio, 1994). If perception can be understood as an illusion learned through experience, then 'experience' in a pre-programmed world produces its necessary corollary; a world unlike Merleau-Ponty's, where Perception-in-itself exists.

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and inventor of the 'photovore'. An overview of his work can be found online at: <http://nis-www.lanl.gov/robot/>.

NODE 2.1 DEEP TIME AND LIGHT SPACE

The reverse side also has a reverse side
- Japanese Proverb

Depth is the illusion of dimensional ingression. It extends the reach of perception by acting as a temporal tunnel though surfaces of space. In stillness we perceive depth as a projection of *space*, while in movement we perceive it as a projection of *time*. The traditional notion of the former view places the primacy of perception on the eye [5.1: 1-8]. The human eye draws in depth and infers a three-dimensional world even though only two-dimensional patterns of light are projected onto each retina. In understanding the perception of distance, human beings utilize what psychologists call *depth cues* in order to assist them in interpreting distal environmental data. These cues, however, are not biologically inherited but are rather acquired and learned from experience. As Colin Turnbull suggests, the depth cue of relative size can be understood as a cultural artifact. To illustrate, in his book *The Forest People* (1963), Turnbull describes his travels into the open plains with Kenge, a BaMbuti pygmy, who had spent his entire life in the dense Ituri forest:

> And then he saw the buffalo, still grazing lazily several miles away, far down below. He turned to me and said, 'What insects are those?' At first I hardly understood, then I realized that in the forest the range of vision is so limited that there is no great need to make an automatic allowance for distance when judging size. Out here in the plains, Kenge was looking for the first time over apparently unending miles of unfamiliar grasslands, with not a tree worth the name to give him any basis for comparison. When I told Kenge that the insects were buffalo, he roared

> with laughter and told me not to tell such stupid lies...
>
> The road led on down to within about half a mile of where the herd was grazing, and as we got closer the 'insects' must have seemed to get bigger and bigger. Kenge, who was now sitting on the outside, kept his face glued to the window, which nothing would make him lower. I even had to raise mine to keep him happy. I was never able to discover just what he thought was happening -- whether he thought that the insects were changing into buffalo, or that they were miniature buffalo growing rapidly as we approached. His only comment was that they were not real buffalo, and he was not going to get out of the car again until we left the park (Turnbull, 1963: 217).

Perspective acts to situate and habituate a Subject. To that end, we would be foolish to gibe Kenge's perceptions of distance, or to ethnocentrically dismiss them as "primitive". For what has gone almost completely unnoticed in our own (current) perspectival revolution, is that in a sense, we too have Kenge's eyes.

Today, the artistic renditions of three-dimensional space are largely taken for granted. The visual cues of interposition, elevation, shadowing, texture gradients and linear perspective are seemingly automatically processed as perceptual rules.[1] As an *invention* however, this modern notion of perspective only emerged in the 15th century. And, as Paul Virilio explicates, "It has still not been emphasized enough how profoundly the city, the politics, the war, and the economy of the medieval world were revolutionized by the invention of perspective" (Virilio, 1995: HREF). For Henri Lefebvre (1991), the establishment of these 'codes of linear perspective' meant that people (i.e., inhabitants, builders, politicians) "stopped going from the

[1] For example, most of us are aware that the closer the object is to the level of the horizon, (usually near the middle of our eye line), the farther away the object appears.

urban messages to the code in order to decipher reality, to decode town and country, and began instead to go from code to messages, so as to produce a discourse and a reality adequate to the code" (1991: 47).

This Renaissance notion of three-dimensional perspective is largely credited to the architect Filippo Brunelleschi (1377-1446) and the painter Leon Alberti (1404-72),[2] who utilized linear perspective to allow 3 dimensions of space (length, width and depth), to be portrayed on a 2 dimensional canvas (Rodgers, 1998). By creating the illusion of parallel lines that converged at a point before the eye (the vanishing point), viewers were for the first time, able to see objects represented at a distance (Wright, 1983). Moreover, by introducing a systematic method for the representation of space one could view a represented scene without even having to be there; as such, this enabled, in Harold Innis' terms (1995), a spatial bias [4.1: 1] for the distribution of graphic information across vast distances. This privileging of perspective however, invested the viewer's eye as the starting point of *all* perspective, and as such, completely presupposed a Western organization of space.

Despite that fact that linear perspective appears to be a logical representation of three-dimensional space, the readings of this approach are not universal. For example, a study conducted by W. Hudson et al. suggested, that visual perception amongst Bantu, European and Indian workers, and children in South Africa and Ghana differed in their interpretations of geometric optics[3] (Lloyd, 1972). While it

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[2] Leon Alberti was a master of code. He is also considered the Father of Western Cryptology. (Wrixon, 1998).

[3] Using a set of picture cards, the study suggested that at the beginning of primary school, all the children had difficulty perceiving the pictures as three-dimensional, regardless of the depth cues used. By the end of the primary school, practically all of the European children interpreted the pictures in three dimensions, although some Ghanian, South African Indian, and Bantu children still tended to see them as two-dimensional, as also did non-literate workers, both Bantu and European.

should not be surprising that cultural factors *influence* perspective, it has also been noted that the cues for linear perspective are also almost effortlessly mastered (Kennedy, 1974). But if linear perspective appears, as is the case, to be virtually second nature, then why was it not discovered earlier? And, if it is probable that the early Chinese and Japanese were aware of such perspectival cues, as has been suggested (Rodgers, 1998), then why did they choose not to utilize them? Perhaps, it could be postulated that instead of reflecting on linear space as a representation of *potential kinesthetic space*, earlier cultures might have considered it inconsequential to capture (or replicate) depth on a two-dimensional plane, *if depth was instead considered in terms of potential kinesthetic time.*

It is the notion of *potential kinesthetic time*, I shall argue, that is now bringing the six hundred year legacy of the Renaissance to an end. With the advent of optoelectronics we are constantly arriving at the horizon [3.3: 2]. If the virtual eye does not see the vanishing point, it is because the vanishing point itself was never fixed, it was always a trajectory, a vector, *a path of movement.* The digital viewer's position itself has vanished in this blur. And as we move with a vector's perspective *it is the depth of space that is destroyed.*

The Quattrocento elucidated depth as a spatial quality: a representation of progressive surfaces that could be penetrated. In fact, scientific views at large still revolve around uncovering the micro and macro layers of 'deep space'. However, unlike the scientific eye [5.1: 3] that held its focus on the depths of space, the virtual eye [5.1: 5] appraises depth by zooming through it in time. Indeed, it is the classical notions of space which no longer hold *weight* in the virtual sphere. The digital figure, has in a sense, become indistinguishable from its electric ground. For the figure itself,

the object on the plane, has an entirely different relation in digital space. The appearance of relative size as a dimensional cue for example, has virtually no meaning at all. That is, size is no longer a measure of width or height or even potential mass, but only of speed. To illustrate this more clearly, an image (file) size on the digital canvas can be shrunk or enlarged without any noticeable effect to the naked eye. For human vision is inadequate in detecting depth or volume within the digital realm. What it can gauge however, is the time it takes for an image to load, for a site to come into view. But the organic eye, having evolved for space perception can only watch time in slow motion. And, as the urbanization of *real time* supercedes the urbanization of *real space* [2.1: 9-10] (Virilio, 1997), the organic eye becomes vestigial. Left only to fool itself with perceptual constancies, the screen sweeps light over the surface of the eye like a nictitating membrane,[4] a flickering cataract that moves faster than the blink of an eye.[5]

Foucault once wrote that it is light that renders all representation visible (Foucault, 1970). From the mounting of the canvas to the exposure of the camera, and on to the development of film, light as a source of information has always projected *onto* a surface. That is, all these forms utilize a perspective plane[6] where the images are either drawn or projected before they are perceived. It is from this plane that the eye detects the image or object, both by gauging the light that falls upon it

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[4] A nictitating membrane is a type of "third eyelid" found in certain species of birds, reptiles and mammals.

[5] Human eyes are subject to what is called "retinal lag". They can register a new image no more than every sixteenth of a second. As such, when a scene changes, the retina continues to send signals to the brain a fraction of a second afterward. The result is that rapid movement appears blurred. (Rodgers, 1998).

[6] To be distinguished from the ground plane as the surface on which objects are delineated

(its illumination) and by the manner in which it reflects some wavelengths and absorbs others (color) (Darley et al., 1988).

In virtual space this perspective plane has vanished. Images in virtual space do not appear as reflections of light, but rather as *emissions* and *transmissions*[7] of light. As the information is actually contained *within* the pulsed optical signals (e.g., in fiber-optic communications), there exists no definitive perspective plane for the information to project onto. This is because *the light itself has become the surface* [4.4: 1] and the image within it is dissolved in a *temporal* perspective plane. Unlike film or photography, there is no negative. The bits of data cannot simply be projected onto a surface, as information digitally carried within light has a completely different approach to the 'screen'. As Toshiharu Itoh remarks:

> In the case of the digital image, there is no need for this intermediary device through which to capture the world, and there is no attempt to represent anything. The digital image is not an optical reproduction of an original object, nor does it coexist with an object which it itself is depicting. It does not present an actual object which already exists. It is just a screen filled with program language that lies somewhere between the object and the image. For the person viewing this computer language, it is an unapproachable, intangible, invisible thing... (Itoh, 1994: HREF).

The medium is no longer the message, in McLuhan's sense, because "the medium" is no longer *a priori* the terminus or the outlet of the information. The once solid surface of inscription [4.2: 1-2] has become malleable and fluid. And, for all but

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[7] With respect to the role of light on the perspective plane, the primary difference between television and the computer is the latter's ability to utilize the medium of light for tele*action* as opposed to simply tele*vision*.

practical purposes, it has virtually disappeared. One can already see hints of this trend emerging in the music sector. As it is becoming increasingly clear (well to the dismay of the recording industry), digitized music is no longer dependant on its surface. As *coded information* [4.3: 1] its transfer does not require a singular medium as such (e.g., cassette, disc, or vinyl), instead the transfer of music now depends almost exclusively on its method of encoding. With the advent of the MPEG[8] compression standards and players, silent strings of code can stream into symphonies. The music, infinitely reproducible, has become a light current which can meander endlessly in the open channels of the Datanet. Likewise, A. D. Coleman suggests in *MIT's Technology Review* (1999) that even our notions of the video display terminal (VDT) as the refractory surface of inscription will soon begin to dim. "Prepare yourself" Coleman writes, "for a wider variety of photographic images not attached to objects--or attached to unfamiliar objects" (1999: 91). The author suggests that we may soon see Paint-on VDT (i.e., "an emulsion-based pixellated liquid that can be applied to any surface in any pattern and activated by attachment to a CPU"), VDT by-the-yard, and digitally produced holographic projection to replace the surface of the screen (ibid.).

As such, these shifts signal a need to re-route our discourse from the outmoded debate over a medium's form versus its content to a medium's form versus its *format*. That is, as traditional ideas of the interface start to disappear we should look toward the multiple (virtual[9] & physical[10]) forms that emerge as the

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[8] MPEG is an acronym for Moving Picture Experts Group.

[9] For example, "skins" are purely aesthetic and interchangeable surfaces that can be downloaded for various programs. WinAmp, a popular MP3 player has thousands of skins which can be downloaded to make the basic music player look like an extremely expensive stereo system. Avatars in games and virtual worlds also utilize "skins" to change the appearance of the user's representation.

interface, in addition to the manner in which these (file) formats are themselves coded.[11] Specifically, we should pay attention to the fact that as the mediums are increasingly miniaturizing[12] (Virilio, 1997) or disappearing in space, data is becoming *compressed* for later *expansion* through codes in time (e.g., Winzip, Stuffit). Correspondingly, we should look toward temporal density if we are to understand the inversion that is currently taking place. The "shallow" surfaces of (light) space serve to obscure us from the fact that events are now packed into the *depth of time*, not the depth of space. As we begin to harness technologies of light, there are two simultaneous processes that must be heeded: the *eversion* of time and the *inversion* of space.

Virtual space is an architecture of numbers and symbols which manifest as their own 'representations' of reality. Their referents are *after-the-fact manifestations* which do not exist prior to their cause. As Michitaka Hirose has commented, the increased use of Computer Aided Design (CAD) by architects leads us to sites where "...urban space itself ceases to be developed as a thing, and begins to be developed as a condition" (1998: HREF). But even less obliquely, on the digital plane, these

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[10] The physical form for example can be seen with the use of implant chips. In 1998 Professor Kevin Warwick, director of cybernetics at the University of Reading, implanted a microchip into his arm which allowed him to communicate with the department's "intelligent building". By alleviating the use of an interface (i.e., he was his own interface) all nodes which had sensors were able to recognize and respond to him (i.e., doors opened, lights turned on, his computer would say "hello" when he arrived). As Warwick suggests, by taking the measurements off muscles and tendons and feeding them into a transponder, the technology "means, ultimately, that you wouldn't need a computer mouse anymore. You wouldn't need a keyboard" (cit. in Witt, 1999: HREF). Virilio (1997) also writes of "eyeball cinema" research that is investigating the possibilities for the direct transmission of images (i.e., without pixels) through directly stimulating the rods and cones of the retina. Thus if we could indeed speak of a "surface wound" in the telematic environment it would be the rupturing of the organic skin itself.

[11] That is, while the debates since the inception of the World Wide Web have focussed on the corporate monopolies over source code (e.g., the browser wars), this author feels that we must look not only at such (virtual/surface) codes but also examine the (physical/internal) codes that are obscured.

symbols can be used directly as commands [4.3: 7] that come to dictate the emergent 'reality' (e.g. telerobotics). Here, the perspective plane no longer offers itself in a 1:1 relationship with the projection of light. Instead, the signals of light, read as ones and zeros, become strings of numbers and symbols that are understood as codes. And when these codes are assembled as programs (e.g. Artificial Intelligence), they even have the capacity to manifest in their own right as autopoetic systems.

To reiterate once more then, objects or images which appear on the monitor are *not the result* of reflected light, but are instead, quite literally 'brought to light' by their own coded properties. As data packets they do not posses the qualities of depth or relief (Virilio, 1997), and as information carried within the light, the perspective plane is no longer a site of illumination. Indeed, virtual space contains and is contained by "an architecture that casts no shadows" (Beckmann, 1999: 15).

The (speed of) light now renders representation *in*visible. As Paul Virilio, a leading thinker in the discourse on telematics has suggested, space is being superceded by time (Virlio, 1997). Remote or virtual space, for example, can only emerge through real-time. But further, real-time also leads to the abrogation of 'real' physical space. The signs of disappearance are everywhere *except* in sight. Physical space is increasingly becoming surplus space. This redundancy is perhaps no where more apparent than within the economic sphere. Here, the 'solid' architecture of surplus space becomes liquid(ated) when it no longer matches the speed, efficiency or cost-effectiveness of its virtual counterpart. The National Association of Security Dealers Automated Quotation (NASDAQ) system, for example, is the world's third

[12] Moore's Law, set forth by Intel co-founder Gordon Moore, suggests that the number of transistors that can fit on a chip doubles every 18 months (ZDNET, 1999: HREF) and that "As size decreases, power increases geometrically" (Downes & Mui, 1998: HREF).

largest *and* fastest growing stock exchange,[13] yet it only exists as a system of telephone lines and computer screens (Wark, 1988). As their website states:

> ...in an electronic age, it is no longer necessary for people to meet face-to-face on a trading floor to trade securities. Today's technology enables Nasdaq Market Makers to trade from around the world...The Nasdaq Stock Market *transcends the trading floor* and enables securities firms across the country and around the world to compete freely with one another in a *screen-based, floorless environment* (emphasis mine, *Nasdaq*, 1999: HREF).

As space becomes surfeit, time becomes scarce. In fact, the acceleration of communication technologies functions for the sole purpose of capturing and processing, or quite simply "stuffing" as many possible events in one time.[14] NASDAQ for instance now boasts that it can process up to 560 transactions in one second (ibid.). The important thing to note here is that in remote space, these channels of transaction are no longer located in 'space' but solely in *time*[15]. As such, it should be increasingly evident that we need to reconsider our static terminology

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[13] Today Nasdaq lists more companies than any other stock market in the world (*Nasdaq FAQ*, 1999: HREF).

[14] Forbes *ASAP* has similarly noted this condensation of time. In an article on technological time they write: "We are becoming increasingly haunted by the span of time in the microelectronic world. Nothing in the daily experience of living things has ever had such time "density". Studying the timescape of technical time, the growing list of events occurring in tiny corners of a single second, and you begin to see not only a chronology but a cosmology" (1998: 21).

[15] The intricate union between money and time [1.2: 3-5] can also be exhibited by the fact that microprocessor prices are framed against MIPS (millions of instructions per second). The authors of the *New Economy Index* (1998) have charted a decline in recent years for the prices of MIPS as time processing capacities grow ever deeper. That is, while the cost of processing one million instructions per second was $480 in 1978, by 1995, processing costs had dropped to $4 per MIPS (Atkinson & Court, 1998: 8).

which links depth with space, and light with time,[16] as these concepts actually more accurately define the *constructs of their measurement* [1.1: 2-3; 1.2: 2-3]. Indeed, in order to understand this revolution of perspective fully, we must seek to uncover the inverse: That is, we should no longer place our focus on deep space and light time, but rather, DEEP TIME and LIGHT SPACE.

[16] Although Virilio explores the notion of the 'depth of time', his emphatic focus on 'time-light' (or time at the speed of light) obscures the primary inversion that this author believes is evident in virtual space.

NODE 2.2 SHIFTING THE PLANES OF PERSPECTIVE

James J. Gibson, the forerunner of studies in motion perception, was perhaps the first to explicitly envisage the environment as a layout of visible textured planes or surfaces (Sedgwick, 1986: 21-2). The dictionary defines a plane as "a surface, real or imaginary, in which, if any two points are taken, *the line which joins them lies wholly in that surface*" (emphasis mine: *Webster's Revised Unabridged Dictionary*, 1998: FTP). In using such a 'connect-the-dots' schema to visualize space, it becomes evident that in remote space, (which inherently involves conveyance), the line is the vector, the connector of the consecutive planes through 'space' in time. But unlike the traditional "arrow of time" which moves alongside space, the vector is a hard speed which inverts the spatial surface through its puncture point. That is, as opposed to the Renaissance notion of the vanishing point as a hypothetical convergence of parallel lines, in *light space* it is the *light point*[1] or interstice that is created by a rupture of orthogonal vectors (space and time). *Light becomes its own surface which it penetrates through space as time.*

The idea of permeable space as composed of light, or more specifically, the electromagnetic spectrum[2] is what gives us the perception of motion through such

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[1] Through a different line of reasoning Virilio reaches a similar conclusion in *Lost Dimension* (1991).

[2] The Australian Communications Authority for example uses the term "spectrum space". As defined on their website: "The concept of 'spectrum space' is fundamental to the ACA's approach to spectrum licensing. Spectrum space is conceptually like other examples of three dimensional space. It covers an area and it has a height. Spectrum space, if thought of as a cube, covers a geographic area authorised by a licence. The area is like the floor of the cube. The radiofrequency bandwidth is represented by the height of the cube" (*ACA*, 1998: HREF). For more information see Appendix B and Appendix C.

'textured surfaces'. Given that we know that there is no 'ether' through which light moves, we might consider that light itself moves through light (space) [4.5: 5-6]. And, that the 'textures' that we encounter are the charged, slower and heavier particles of matter which appear to stand still as they are washed through by illuminations. With these notions taken into consideration then, it may become clearer that *only the plane* of space is disappearing with the advent of real-time technologies. Space itself however has not vanished any more than it was originally occluded [3.2: 3] to us by its cover of light. And, it is probable that because our will now moves with the speed of light, we are, for the first time, able to see it as its own surface, not as a surface of space-time, but as a surface of **light space** *in* **deep time**.

NODE 3.1 HIDDEN ILLUMINATIONS

When one does not see what one does not see,
One does not even see that one is blind.
- Paul Veyne

Movement at the speed of light is a quantum leap away from the perspectival inertia that belied classical optics. It is the transfer of pure hard information actualized in deep time. The once impervious **surface** of the screen has thawed into a fluid membrane; the optical flow streams through the **interface** as code, liquefying representations as they are pumped in and out of the perspective plane. Yet the greatest illusion - that of stillness - remains, the unblinking 'trompe-l'oeil'[1] of the Quattrocento endures, frozen in the frames of our perceptions.

Today we spend an increasing amount of time in a telematic world, a world paradoxically indurated by its own speed and movement. As Baudrillard observes: "Speed creates pure objects. It is itself a pure object, since it cancels out the ground and territorial reference-points, since it runs ahead of time to annul time itself [5.3: 1-2], since it moves more quickly than its own cause and obliterates that cause by outstripping it..." (Baudrillard, 1989: 6). *Light* is that pure hard speed: it is the force that creates and illuminates our global telematic circuits. Writing in *Open Sky* (1997), Virilio suggests that alongside space and time (intervals), we are witnessing the emergence of a 'third interval' one which does not follow the classical attributes of chronological temporal *successions*, but rather opens events up in time in the form of

[1] A technique in painting that fools the eye by creating an impression of depth when the surface is really just two-dimensional.

illuminated *exposures.*[2] What he writes of is the exposure of light space, where capsules of code unfold in trajectories through the depth of time. But at the helm of such velocity, our perception of speed vanishes. The vector dissolves the past and future into a rapid present whose "...only rule is to leave no trace behind" (Baudrillard, 1989).

We are faced with an interface that locks down perspective. We peer merely through a single 'keyhole' to the expanse of light travelling within the networks.[3] Increasingly, research findings suggest that the 'perspective' offered by computer relay terminals is so compressed that "people are prone to getting lost and losing the sense of what is happening in the system as a whole" (Burns, 1997: 57; see also: Roth et al., 1993; Woods et al., 1990; Elm & Woods, 1985). This is because the plane before us is actually siteless: it exists as a series of potentials, actualized through light-speed transmissions. What we actually see on the monitor is the nullification of time, distance, space and *perspective.* This is because, as McLuhan once noted, "The information environment and effects created by the computer are as inaccessible to literate vision as the external world is to the blind" (McLuhan & Fiore, 1968: 36).

For wont of ordering and perceiving this speed, we have turned once again to the map [1.1: 4] as a guide. But in a sense, cybermaps (or 'network visualization' maps) most clearly adduce Virilio's notion of the loss chronological time to

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[2] Virilio's use of the word 'exposure' is actually quite ironic, for unlike space which is exposed through light (e.g., film negatives), time is exposed through its own passage, which of course cannot be exposed in a visible sense at all. As he writes: "the interval of the light kind (the interface) taking over in the future from those of space and time, the notion of exposure in turn takes over from the notion of succession in the measurement of present duration as well as from the notion of extension in the immediate physical expanse" (Virilio, 1997: 15).

[3] That is, while we were able to adapt our vision to 3 dimensions of space projected on to a 2 dimensional surface (Renaissance perspective), the inclusion of the 4th dimension -time- has proven much more difficult to accommodate. Unlike television, film, paintings or photography, the computer

exposures. For trajectories of speed can only be mapped, to use his term, in a 'chronoscopic' manner. That is, the *movement of light* over the globe can only be visualized in potential (under-exposed), or actualized (over-exposed) forms (see Figure 1). To visualize or map the exposure of the present[4] on a grand scale is of course, impossible.[5] And so, the present becomes isolated (Virilio, 1997), and the translucent globe increasingly appears to us in the form of 'information' *about the present itself.* But in reality, more often than not, the maps of light (transmissions) are not even 'exposed' at[6] all. Instead, as McLuhan surmised, we find ourselves 'looking forward through the rearview mirror' (McLuhan, 1967). Focussed on the 'message' (surface information), we have lost sight of the 'medium' (information surface) which contains it. As an article from telegeography.com suggests:

> The hardware side of cyberspace, the physical architecture of computers, switches (routers), transmission facilities and embedded software, is largely invisible to most people. The industry describes this as being "transparent to the user", meaning "opaque" in common speech. You can't see the wires. That's part of the Net's beauty. What most people want to see (and do) is the Net's other side--

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monitor displays only a minute portion of the available surface to the viewer And, almost endless surfaces can be called up in time in order to refresh the screen content.

[4] The closest thing to date is the *Internet Weather Report* (IWR) which offers times network latencies in the form of 'dynamic' updates of internet traffic across the globe. Here, the split of the 'present' becomes apparent. As their tagline reads: "Animated maps of current Internet lag" (IWR, 1999: HREF).

[5] It is 'impossible' (Fr. Latin 'in' + 'possible') as it implies the actualization of the vanishing point of the potential of a trajectory. But further, moving from a semantic to a physical level, the ability to map light as it reaches the present on such a large scale is not possible with our current optoelectronic technology, for the processing time which takes place with electronics (electrons) is slower than the speed of light. But, then again, as we shall soon see, this potential may be unleashed with our steady movement towards 'photonics' technology.

[6] The @ sign of space [5.2: 1-3] signals itself as a trajectory, a route which is locked on to a spatial 'location' which can be accessed through points on a grid (Kawash, 1997: HREF). To quote Samira Kawash "@ signals the perfect and complete technologization of place, a newly created possibility of global positioning in an objective coordinate system that removes all subjective measures and all possibilities of error" (ibid).

> the information architecture. That is really what cyberspace is all about and, as such, is the logical point of departure for cybermaps.
>
> It is hard to overemphasize this basic definitional point...What the user wants to know is how one piece of information (message, image, sound) is connected to another, not the underlying physical structure of the computer and communication systems (Staple, 1995: HREF).

To a viewer then, the opaque screen becomes a false lens which filters out movement, it occludes the lightwave transmissions in invisible matrices, and eludes the expanse of the **(n)etherface**, or the underside through which light travels. As such, while today's terminal citizen[7] [3.3: 1] may not suffer from vertigo (the dizziness of viewing still objects as if in motion), we are witnessing the emergence of another type of 'light-headedness'--a form of *invertigo,* if one could call it that--an illusion of object stillness in a world of motion.

[7] Virilio suggests that today's citizens are much like 'spastics' in the sense that they are wired up to control their environment but are stationed inertly (Virilio, 1997: 33).

NODE 3.2 THE ILLUSION OF STILLNESS

From the micro to the macro, all systems are in flux. Reality, as we are occasionally reminded (Hawking, 1988; Watson, 1973), does not exist. What we call "reality" is in fact a compression of frequencies filtered in by our perceptions.[1] But the waves of darting particles that once only *reflected* our physical existence have now been harnessed; coded channels of light pulses serve in the emission and creation of a new reality perceived by proxy. It is still a physical world, a world comprised of vibrations much like our own, and a world that moves at imperceptible speeds. Yet, while human beings are quite adept at perceiving spatial *relations*, we are unfortunately, quite *inept* when it comes to sensing high-speed motion *in relation* to distant objects.[2] For example, we know that the firm(less) ground upon which *we* seemingly rest, is actually hurtling through space at 67,000 miles per hour (*Earth Facts*, 1997). Moreover, from physics we know that movement and time are inseparable (Wood & Grant, 1998). Nonetheless, while we do not perceive the earth's movement, we do perceive the time it passes in. This is because without motion, time does not exist. With respect to human perception, it is *our movement* across the solar system which constitutes our perception of *time moving*. Each day, month, or year is only perceived as such because of the constancy of our motion in these cycles. Yet beset with the illusion of inertia, our perceptual schemas filter velocity into an experience of still motion.

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[1] Our eyes can be considered 'receivers' in much in the same way as other electronic devices (i.e., they have particular frequencies that they are attuned to).

[2] For example, a view from an airplane makes space appear to pass by in slow motion.

Perhaps even more curious still however, is that in a world so streamed in flows *the human sensory system should perceive constancy at all*, for this semblance of fixidity contradicts the fundamental manner by which we acquire spatial perceptual orientation: that is, by kinesthesis, or our sense of movement. Human beings are rarely immobile. In filtering out the spectral noise, our eyes are not static but saccadic; they leap from point to point in order to scan a given environment. Images cast onto the retina constantly shift and change with our head movements or alter as our bodies move us through the environment. Yet, almost algorithmically, our minds create a form of location constancy by accounting for changes in the direction of our gaze along with our bodies' position (Darley, Glucksberg & Kinchla, 1988: 139). It is in fact only when these two factors seem insufficient to account for changes in our field of view that objects finally come to be perceived as moving.[3]

In one sense, pure stillness, or the illusion of pure stillness may be considered that which simply moves too fast for human perception. But even at a hominine scale, our own motion, which garners changes in the optic environment, often eludes our awareness. In fact, it was not until James J. Gibson formally articulated his observations in *The Ecological Approach to Visual Perception* (1979) that this *Lebenswelt* became conspicuous. As the forerunner of motion perspective, Gibson studied the continuous changes in the way objects look as an observer moves about the world. For example, he noted that as we move closer to a particular point or object within a given field, the scenes successively entered appear to "expand" before our eyes. Or,

[3] An interesting illustration of this can be seen in a small experiment. If you cover one eye and move the other eye by gently pressing on the eyeball in a given direction, the outward scene appears to be moving. This is because your brain did not directly give your eye the command, and so the image is perceived as an outward movement rather than an inner directed one (Darley et al., 1988: 140).

that certain surfaces are "occluded"[4] or blocked by opaque structures (e.g., walls) within a moving field. With his widely accepted concept of "affordances", Gibson also suggested that surfaces ostensibly signal motifs for their usefulness or function (e.g. a chair has a sit-on-ability, or large flat space has walk-on-ability). As such, an affordance emerges as the combined result of the interaction of a properties' substance and surface as cognized by a sentient being [1.3: 4] (Gibson, 1979). Affordances [5.4: 2] then, as traditionally perceived, are aspects of our physical world. Within Renaissance perspective, only their apparitions are projected onto a 2 dimensional scene. While the still painting or photograph allows space to be *projected* onto a surface, without movement, the perspective plane itself occludes the temporal dimension. Advances in this area of representation however, came about with the advent of motion pictures. Again though, the viewer was stationary, unable to interact with the surface. But the Phi illusion, or the illusion of movement presented by consecutive pictures (Darley, et al., 1988: 141), permitted the projection of time on to a screen.[5] Thus, cameramen and editors utilized knowledge of human perceptual systems (psychological dimensions) to elide space and time (physical dimensions) by allowing cuts and edits to seamlessly construct representations of a temporal visual field. Consequently, the environment could be captured and

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[4] In an article entitled *Measuring Visible Information in Mediated Environments*, Catherine M. Burns suggests the virtual landscape remains mostly occluded to the telematic observer. Here, "only small quantities of...information can be displayed at a single time while the bulk of the information remains effectively obscured" (1997: 57).

[5] Metro Cinevision Film GmbH utilized an interesting inversion of the Phi illusion. The company projected still images on to the wall of the Berlin subway enabling passengers to see short movies when the subway car reached a speed which corresponded with the frames of the film. As Jörg Moser-Metius, the head of the project stated, the viewer becomes "the machine, pushing through the film" (Hudson, 1998: HREF).

projected via a critical flicker frequency; leading Jean-Luc Godard to illustriously remark that 'Cinema is truth, 24 times a second'.

The Phi illusion generates the perception of *apparent motion.* Furthering this idea, Gilles Deleuze has referred to film as a field of "motion without action" (Novak, 1995: HREF). In his commentary on early cinema, Deleuze suggested that time here was appraised kinesthetically in that it manifest the "movement-image", whereas contemporary cinema is typified by what he calls the "time-image". The former utilizes time as it is generally perceived "in expected sensory-motor action or plot" (ibid.), and as such it exhibits sequential and linear causality. The latter "time-image" however, functions by using "association, memory, imagination, illusion or hallucination" (ibid.). Thus while early cinema placed its focus on recording serial events (e.g., a person filmed exiting a house would first be seen walking towards a door, turning the doorknob, then walking down the steps outside and then opening the door to the car, shutting the door, turning the lights and ignition on before driving away), movie-goers today are accustomed to ellipses, and film and video editors work with the assumption that the viewer will be able to fill in or imagine scenes without need for full projections of spatio-temporal congruity (e.g., a person exits the scene and is next seen driving off in a car). Therefore, as Marcos Novak observes:

> An object is thus enveloped by an aura of its own trajectory through time that is immensely different from the sequence of images that would describe its motion through space. The "movement-image" records positions in space while the "time-image" records states in time. The cinema of the time-image adds to this the combination of disparate objects, each with its own, implied aura, and constructs a

> language of nuances in place of the language of actions. Actions themselves can be lifted from the simplicity of the movement-image and placed within the time-image (Novak, 1995: HREF).

In contrast to film however, what is entirely new in telematic communication is that it functions as an open system of bilateral communication. Here, a viewer interacts with the screen, and can not only download images from diverse places and have them emitted from a single surface, but through telepresence, s/he can also be "present" at these various locations. In this manner, the viewer enters time and is "virtually" able to affect change over physical & material "realities" from a distance (Manovich, 1996: HREF). Understood in this manner then, it is useful to return to Deleuze's notion of the "movement-image", for telepresence similarly merges motion and time in a format that cannot be severed (it does however, elude space which is key in Deleuze's conception of the cinema). For example, to move an object via a robotic arm in a foreign country requires the synchronization of real time with "real-time" (technologies). Thus in contrast to the movement-image, which holds a chronology of a past, present and future, instead, here we have an 'intensive present' that is restricted only by the limit-speed of electromagnetic waves (Virilio, 1997: 28). With the erosion of surfaces [2.1: 6], which once prohibited an open release of information transfers, *the virtual self merges with the perspective plane and itself becomes the "movement-image"*. In the telematic world, we no longer only witness the quick flickers of "apparent motion", for this is combined with a dynamic form of "virtual motion". *Not stillness masquerading as motion, but motion masquerading as stillness.* Or, to invert Deleuze's description, virtual motion differs from apparent motion in that it is not "motion without action", but rather "action without motion".

NODE 3.3 THE ILLUSION OF MOTION

The static nature of the human physical body in our present high-speed world is accented by the tele- prefix.[1] Existing in our language for the last 400 years, it had, for the most part, maintained its original connotation from the Greek *tele*, meaning 'at a distance' (Quinion, 1998). However, as Michael Quinion writes, since "the middle of this century it started to developed (sic) a number of subtly different new senses as its usage has explosively increased" (ibid: HREF). That is, what used to mean 'at a distance' now means 'a distance that is close at hand'. As Virilio (1997) laments, our speed increasingly renders us 'terminal citizens'. Terminal, in this authors reading, in that we are locked both before *and in* our screens [4.3: 5], terminal in that our physical bodies are ever more stationary,[2] and terminal, in that our bodies (as agents of our wills) are dying as they enter, and are transposed by the power of light [4.3: 6-7]. As Virilio avers:

> The actual body of the city dweller, this citizen-terminal soon to be decked out to the eyeballs with interactive prostheses based on the pathological model of the 'spastic', wired to control his/her domestic environment without having physically to stir: the catastrophic figure of an individual who has lost the capacity for immediate intervention along with natural motricity and who abandons himself, for want of anything better, to the capabilities of captors, sensors and other remote control scanners that turn

[1] For more information on the etymology of the tele- prefix, see: "Action at a distance: The evolving tele- prefix" which can be found at: <http://www.quinion.demon.co.uk/words/articles/tele.htm>.

[2] As Virilio suggests, we are no longer mobile, but mobile on the spot (Virilio, 1997).

> him into a being controlled by the machine with which, they say, he talks" (Virilio: 1997: 20).

As such, what 'tele-' now implies is not distance but presence. Today the will finds its expression through the field of light *at the speed of light* [4.3: 7-8]. Telepresencing, teleaction, telesurgury, telebanking, and the televersity, all imply one thing: they have become those (no) places where (virtually) everybody attends but nobody goes.

With the seizure of mobility the somatic domain has been conquered. Our will to move can be actualized through abstractions in code at the speed of light. Today we have become immersed in a plane that allows the body to act at a distance without physically having to pass through space at all. As McLuhan and Fiore write in *War and Peace in the Global Village* (1968), "Whereas the wheel is an extension of the foot, the computer gives us a world where the hand of man never set foot" (McLuhan & Fiore, 1968: 53). But for McLuhan, the impact resultant from these 'extensions' produces a corollary analgesic effect. Central to his thesis is the idea that for each technology that distalizes the agency of the body, a corresponding part of the sensorium simultaneously goes "numb" (Kroker, 1984). To extrapolate back to our analysis then, our rather conspicuous *lack* of motion perception in the telematic world may indeed be indicative of the ablation of our kinesthetic senses.[3] Increasingly, motion from afar substitutes motion that is near. We have begun to achieve absolute mobility through total immobility.

With our wills coded [3.2: 5] and actualized through waves of light we see only the halcyon blur of speed. As Marcos Novak maintains, "our horizon has shifted from the edge of what is visible to our naked eyes to that which is visible

electronically at the speed of light, that is to say, at the scales of non-Euclidean geometries. Actually, everything we see, we see at the speed of light" (Novak, 1995: HREF). But the virtual eye [5.1: 5-6] no longer catches reflections. It moves in a vector of narrow transit. There is no depth in this line of site; moving closer into a field of view, the focus no longer expands but contracts. As Jennifer Fisher notes, "The fibre-optic view does not permit a visual field: no figure, no ground, no discernable object. In the body's negative space verticality and horizon line are indiscernible: there is *no perspective except that of constant movement*" (emphasis mine, Fisher, 1997: 7). That is, at the speed of light, motion *perception*[4] vanishes and is replaced by the invented constructions of motion *perspective*. The optic array[5] dissipates and the "irreducible gap" (Virilio, 1997) becomes filled in by the shallow depths of designed aesthetics[6]. Gibson's notions of motion perspective for example, have already been incorporated[7] into gaming modules, flight simulators, and virtual reality (VR) worlds to serve merely as simulations of movement for the terminal

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[3] As such, while our organic kinesthetic senses have been ablated, our virtual selves are now able to move through the perspective plane as actualizations of potential kinesthetic time [2.1: 4].

[4] Einstein tried to envision what our perception would be like if we were to travel at the speed of light. He suggested that at this limit speed the "lengths along the direction of motion would become so contracted as to disappear altogether, and clocks would cease to run entirely. Three-dimensional objects would actually appear rotated so that a stationary observer could see the back of a rapidly approaching object. To the moving observer, all objects would appear to be converging on a singly blinding point of light in the direction of the motion" ((Kafatos, & Nadeau, 1990: 25). But while nothing with a mass can reach the speed of light (ibid.), light itself or (photons) can even exceed this speed [4.5: 5-6].

[5] The optic array can be defined as notion perspective and focus of expansion in optical textures that is potentially available as visible information (Regan, Kaufman, Lincoln, 1986: 28)

[6] For an interesting interview on the subject of telepresencing and design aesthetics I direct the reader to: William Buxton. "Telepresence as a Design Philosophy" in *InterCommunication* No. 25, Summer, 1998. Also available online at: <http://www.ntticc.or.jp/pub/ic_mag/ic025/contents_e.html>.

[7] While filmmakers did not need to have any knowledge of perspective, computer mediated or generated space has necessitated a rediscovery of the laws of perspective (Hochberg, 1986: 3). It should be noted however, that these 'laws' still focus on reproducing the structure of the light reaching the eye from a scene rather than on understanding how the visual system deals with this light to deduce information. Thus, computer graphics are still allied with the Renaissance technique of painting, as opposed to computer vision which is more akin to space perception (Sedgwick, 1986: 3).

citizen.[8] Moreover, studies on vection or the visually induced sense of self-motion (Sedgwick, 1986) have been applied to create the 'reality' effects[9] witnessed in VR. But in the reality of the telepresent world, the depths of space vanish because we are always *already* at the vanishing point itself. We are *constantly* arriving at that point of convergence on the horizon.

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[8] The notion of affordances has become of great interest to interface designers who seek to generate the idea of a surface's usability or function (Mohnkern, 1997).

[9] Our eyes adapt to special effects over time. For example, viewers watching older films today are very aware of the 'poor quality' of earlier special effects which appear transparent and obvious in terms of their 'realism.'

NODE 4.1 MONOPOLIES OF LIGHT

The dialectics of space (territory) and time (duration) have begun to evaporate under the focal point of light. Today we are not mocked by a simple dualism, the balancing act of the "biases" of communication once described by the Canadian thinker Harold Innis.[1] For Innis, civilizations are based on "staple commodities"[2] which are either run by "monopolies of time" [4.6: 4-6] or "monopolies of space" [1.1: 3] (Innis, 1995). His work suggested that a spatial bias fostered distal communication and created links among persons separated by space, while a temporal bias encouraged the preservation of information over time. In Innis' estimation, these two dimensions were in constant interplay and a shift toward either held significant political, economic and cultural consequences. (Katsh, 1995) As he writes:

> Large-scale political organizations such as empires must be considered from the standpoint of two dimensions, those of space and time, and persist by overcoming the bias of media which over-emphasize either dimension. They have tended to flourish under

[1] Innis' work however has had a profound impact on our current understandings of political communications and should not be overlooked. He introduced the idea that each new communications medium impends deep changes within a society's institutions by re-structuring its spatio-temporal orientations. In fact, more than a decade before McLuhan suggested that "the medium is the message", (McLuhan, 1964: 23) his mentor Innis, had asserted that "the materials on which words were written down have often counted for more than the words themselves" (cit. in Riesman, 1956: 12-3). He asserted that although the public's attention often focussed on the content of the new medium (e.g., today we see many debates about violent content etc. on the Internet) the real catalyst for long term change lay primarily in whether the new form hindered or promoted information in time or space. For a thorough examination of Innis' perspective on the role of time and space in empires of communication, please see Harold Innis. *The Bias of Communication.* Toronto; Buffalo; London: The University of Toronto Press, 1995.

[2] Staple commodities can be understood as the resources available to a given community

> conditions in which civilization reflects the influence of more than one medium and in which the bias of one medium toward decentralization is offset by the bias of another medium toward centralization" (cit. in Kroker, 1984: 111).

But today a new monopoly has emerged –that of light– a curious form which equally codes the properties of space and time [1.1: 6] (i.e., light seconds/years = space {distance} in time {duration}). It fuses these two dimensions into a vector of movement and dissolves the previous distinctions between the "center and the margin". Here, we are no longer reliant on the myths of the centralization or decentralization of power.[3] Light becomes *a central node for distributed power.* For example, a recent article entitled "Photonics on the Battlefield" suggests that military powers now favor the term "network-centric warfare" (after network-centric computing)[4] to denote the tactic of utilizing integrated networks among space-based, airborne and mobile sensors, weapons and command functions in order to *simultaneously* allow military forces to 'function as a single combat unit' (McCarthy, 1999: 116). This strategy, coupled with the advances in photonics technology [4.5: 2], leads them to suggest that "the speed of command could increase to the degree that an enemy's strategic resources are eliminated *before he knows they are threatened*" (emphasis mine, ibid.). No longer sealed into the "bi-polar tendencies" of time and space, we are, as Virilio writes: "in the grip of a new kind of

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[3] The idea of the center vs. the margin, that is, whether we extend ourselves toward a medium (e.g., print) or whether it extends itself toward us (e.g., radio), needs to be reconsidered. With satellites for example, there is no 'center' to speak of as such, as the centers are everywhere. Concentrations of power now hide within the nodes of distributed networks. With electromagnetic speed, empires can be both centralized and decentralized simultaneously. As Virilio (1997) suggests, the virtual city is not a metropolis but an omnipolis whose center is nowhere in particular, but whose circumference is everywhere (1997: 74).

[4] This notion is borrowed from Metcalfe's Law of network-centric computing which maintains that "the power of a network is proportional to the square of the number of nodes within it" (McCarthy, 1999: 116).

illuminism, or rather luminocentrism, capable of hoodwinking them about the profound nature of space and of time, the old perspective of the real space of the Quattrocento once again blocking the perspective of the real time of a horizonless cosmos" (Virilio, 1997: 5). Thus, while Innis originated his analyses with the biases of staple commodities embedded primarily either in space or time, today we must acknowledge that our staple commodities[5] can increasingly be found in the development of information[6] (data transport), while our 'current' empire itself focuses these transfers in lightwave telecommunications (Brinkman & Lang, 1999).

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[5] Likewise, Arthur Kroker has suggested that "there never was, anyway, such a great difference between the "staples of cod, lumber, fur pulp and paper and the "communicative media" of papyrus, stone, radio and television". He suggests that it was Innis' awareness of this that led him to extrapolate his earlier analyses of the Canadian staples economy into a broader examination of the philosophy of civilization (Kroker, 1984: 115).

[6] As an article in *Canadian Telecom* suggests, "In today's high-tech world, it's worth recalling that at the turn of the century, resource production drove the wealth of this country. And that in the post-war era, manufacturing generated most of Canada's economic growth. But since the 1980s; producing, moving and sharing information has become the new economic engine. Now anyone can bring a product to global markets or be a broadcaster to the world. Ideas, knowledge and services are more important than equipment and physical resources. Money can move around the world with the touch of a keyboard. Nothing, no-one; not a single company, industry or country; will ever be the same" (Blythe, 1999: HREF). For more information on the 'development of information' please see Appendix A.

NODE 4.2 BODIES OF LIGHT

Everybody at the speed of light tends to become a nobody.
- Original source unknown

All communication requires a sender and a receiver. And, all communication is comprised of a will that is expressed in space and time. Historically, this expression was carried through the site of the body itself.[1] However, for long-range transfers - disembodied messages that could be passed on without the sender's presence - inscribed surfaces were utilized to transport messages across the spatio-temporal dimensions. Thus, in the case of space-based communications, lightweight materials (e.g. papyrus/paper) were inscribed as they were portable and could therefore cover larger territories (McLuhan, 1962). As Innis (1995) observed, this bias favored control over information in expanding empires (e.g. the margins of the Roman Empire). However, with time-based mediums, the surface was usually more durable (e.g. stone) and enabled a reach of cultural influence as messages could be passed on to the future (e.g., the historic centers of the Pyramids or the Wailing Wall) (McLuhan, 1962).

In a tele-mediated world however, both territory and time collapse into frequencies [1.1: 2; 1.2: 5]. Information filters through these terrestrial instants and *re-surfaces* through code. The body as a site of expression (as a transmitter of information) relinquishes its power. Instead, it becomes a 'digital body' (Kroker &

[1] In fact, face-to-face contact is still the direct communication link (and will probably continue to be so) for over 1.5 billion peasants and 900 million illiterates in Africa, Asia and Latin America (Gonzalez-Manet, 1988).

Kroker, 1996a) a signal processed on and off in the global switches of light. Thus, power over the will and its expression (translated *en masse* as the empire itself), can be kept close at hand *and* controlled at all instants from a distance. In this dominion there is a surfaceless system of administration. Here the transfer of communication is no longer reliant on solid surfaces of inscription, but rather, information dissemination takes place in the 'form' of optical signals; codes of light which are not read by virtue of their inscription but rather by the manner of their encryption.[2] Within this sphere all physical bodies are reduced to quantities. Consequently, in the virtual empire, a display of power need not even inhibit a body's agency directly (e.g. through physical violence) as it can exercise control over the body's agency *indirectly* by controlling the dimensions within which the body as information flows.

The key to virtual power is its invisibility. And the hegemonic re-ordering of the (virtual) environment is silent in its organization. As such, the instatement of new codes of power promote only their advantages and benefits: their emphasis on the 'common good'. Indeed, as Michel Foucault has repeatedly stressed, for power to secure itself, it must come to be regarded as a positive force. As he insists:

> What makes power hold good, what makes it accepted, is simply the fact that it doesn't only weigh on us as a force that says no, but that it traverses and produces things, it induces pleasure, forms knowledge, produces discourse. It needs to be considered as a productive network which runs through the whole social body, much more than a negative instance whose function is repression (Foucault, 1972:119).

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[2] This is why complex encryption [5.3: 2-3] (touted under the rhetoric of individual privacy) has become so important in recent years. In fact, cyphered codes are developed primarily for protecting national security (space = state interests) and for safeguarding economic transactions (time = corporate interests).

In fact, the notion of the Internet as a tool of oppression contradicts virtually everything that is published today on the World Wide Web. The contemporary discourse surrounding the communications revolution is dominated by those spearheading the industry. Articles in leading cyberculture magazines are rife with assertions that the Internet is a politically potent, democratic and uniting force. The rhetoric is all pervasive, and indulges us to believe that a ubiquitous networked computer system will harvest all the fruits that come with job creation, democracy and freedom. And so today, pleased and placated with a 'happy consciousness' (Marcuse, 1964) terminal citizens [3.3: 1] begin their upload into the codes and networked nodes of light.

NODE 4.3 THE MICROCODES OF LIGHT

Light *is* information (Kennedy, 1974) and its transport signals an entirely new mode of power. To begin this analysis however, we must first recognize this empire's turn toward pure 'data' (in pulses of light), as the desire to turn the physical body into information. To do so requires that we also take into account the skewed reasoning that propels the Information Revolution. Information is *marketed* as the proverbial first step on the road to freedom. As the *Interrogate the Internet* group suggests, the logic, summed up in the following linear equation, fallaciously hails the Western perspective of data as equated with freedom:

data = information = knowledge = wisdom = truth = freedom (1996: 125).

However, the idea that a free flow of data equally means a free society requires a huge leap of faith rather than logic; but this of course is the hegemony of the "virtual class" (Kroker & Weinstein, 1994). While there certainly are positive aspects to possessing 'information' (as we are often reminded by the old adage: 'Knowledge is Power'), it is seldom recognized that information is always formed and produced for vested interests. Inasmuch, there may be another equation to keep in mind when examining the *telos* of this new 'network-centric' Information Age; one that is often applied but not often *implied*:

knowledge = technology = speed = efficiency = control = power.

In *Data Trash* (1994), Arthur Kroker and Michael Weinstein remind us of this "Illusion of (Cyber) Knowledge". As they perceptively write:

> What is not said...is that for the virtual class, true knowledge is cold data, and the very best data of all is the willing read-out of the human sensorium into the info-net...When knowledge is reduced to information, then consciousness is stripped of its lived connection to history, judgement, and experience. What results is the illusion of an expanded knowledge society, and the reality of virtual knowledge. Knowledge that is, as a tightly controlled medium of cybernetic exchange where thought has a disease, and that disease is called information (1994: 24).

But for the sake of "information" and "knowledge" those of us unheeded have willingly begun to code ourselves into the physical datastream. Bit by bit we are feeding ourselves to the machine. Already there are over 10,000 locations that cannibalize a body part as a form of identity construction or password: Iris and retinal scans, hand geometry, voice patterns, heart beats, fingerprints, facial scans, wrist-vein recognition, and even body odors are being digitized and entered into biometric databases (Davis, 1997). Our bodies and our identities are being uploaded in the name of freedom. This "freedom" usually comes in the form of "privileges" for those who donate their biodata. As a few examples will illustrate:

*Biometric hand readers are currently being used at several US airports.[1] The system "takes three-dimensional readings of the size and shape of a person's hand, then verifies the user's identity in less than a second. The program, which is currently free, enables pre-screened participants to bypass long customs lines". As the company manufacturer Recognition Systems Inc. states, "Now, your hand is your passport" (Recognition Systems, 1999: HREF).

*Employees at Hawaiian Airlines no longer use the "antiquated clock and manual time card system". Now, "with Recognition Systems HandPunch® ...Employees simply enter an ID number into the HandPunch's built-in keypad and place their hand for verification". As the Senior Director of Information Technology at Hawaiian Airlines states: "The system is great. It is more accurate and *allows us to quickly add or delete employee IDs.* Our cost of maintenance is low. Most importantly, the employees find it very easy to use" (emphasis mine, ibid.).

*"The EyeDentification 2001 retinal scanning terminal from EyeDentify recognizes an individual's retinal vascular pattern in less than five seconds. On May 20, 1996, Illinois Governor Jim Edgar announced that the state had launched the nation's first retinal eye scanning project to identify eligible welfare clients and prevent fraud" (cit. in Beckmann, 1999: 5). Similar devices are also being used in corrections institutions. Here, booking, parole and probation pre-release verification and house

[1] The biometric hand reader is currently in use in Los Angeles, Newark, Miami, New York City's Kennedy airport as well as Pearson International Airport in Toronto. Plans are already underway to introduce the system to five additional airports: San Francisco, Seattle, Washington-Dulles, Vancouver, and Honolulu (*Recognition Systems*, 1999: HREF).

arrest are coming under biometric mobility monitoring devices (Alliance Wireless Communications, 1997).

*Iris scans are also increasingly used in the private sector as a type of "complex human barcode" (IriScan, 1999: HREF). A few examples include: ATMs, wire transfers, anti-fraud services; entry and access control; day care access control and patient identity verification (Alliance Wireless Communications, 1997). As the IriScan Company extols: "Imagine the ability to unlock the door, obtain money from a machine, authenticate a credit card, or even start a car with just a glance at a camera...no invasion, no intrusion, no contact...no problem" (IriScan, 1999: HREF).

But of course, there is a problem. "Freedom" is never free; it always comes at a price. As these new biometric codes[2] slowly gain acceptance in our society, the problem is that they not only become signs, superimposed *over* our bodies, but in the equation of data as "truth" they even begin to *supercede* our bodies. The willing read-out of information does not come without consequences. The datafication of identities privileges the computer's truth over human truth. For example, in a case studied by *Dateline NBC*, due to a computer error in the California State database, two women's identities were merged in a keystroke. The effects were horrendous for one of the women (Linda A. Jones) who was wrongly incriminated for the other's (Linda L. Jones') offences. Despite her letters and legal efforts, her driver's license was revoked by the California Department of Motor Vehicles, who insisted that she had failed to

[2] The IriScan Company is quite explicit about its codification precision. As their website boasts: "...based on the amount of independent variation within IrisCodes™, the probability that two irises

pay more than $1,600 worth in traffic fines in San Francisco - a city in which she had never lived or ever driven in. Moreover, she had a warrant out for her arrest and was being sued in a child abandonment case for the support of 2 children. As she had previously refused to undergo DNA testing to "prove" that they were not her children (as she stated: "My blood work is none of their business") her pleas attesting her own identity went unheard for over two years (*Dateline NBC*, 1999: HREF). That is, her claims were not deemed valid as they contradicted the "information" given by the state databases. But even in simpler circumstances, there are burgeoning complications. Any refusal to 'become information' means the loss of privilege. For example, an acquaintance of mine had rented videos from the same small-town video store for years. He knew the clerks by name, they knew who he was and where he lived, and thus until recently, the rentals were based on a type of honor system. However, after they had instituted a datafication policy for use on their new computers (common in most video stores today) whereby membership requires "valid identification" such as a driver's license or credit card (of which he had neither), they were unable to offer him any further services. His credentials could not be codified and thus his *credibility* was nullified.

What needs to be recognized is that these lines of code are becoming digital cages.[3] They force us into relinquishing control over our own physical identities and,

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could produce exactly the same IrisCode is approximately 1 in 10^78. (The population of the earth is around 10^10) (*IriScan*, 1999: HREF).

[3] The body as a site of codification is well documented. For more information I direct the reader to: The *Human Genome Project* <http://www.oml.gov/TechResources/Human_Genome/home.html> which aims to create an entire map of the human genetic code, and The *Visible Human Project* <http://www.nlm.nih.gov/research/visible/visible_human.html> which is a millimeter by millimeter 3D rendering of the human body. Additionally, with the recent developments in the area of DNA steganography, molecular biologist have even been able to encrypt secret messages on to the DNA code itself <http://www.wired.com/news/news/technology/story/20136.html>.

increasingly, they are even coming to limit our physical mobility. By creating invisible boundaries these access codes as "passports" even come to limit our free movement in space and time [4.6: 1-2]. As Gilles Deleuze writes:

> In the societies of control...what is important is no longer either a signature or a number, but a code: the code is a password...The numerical language of control is made of codes that mark access to information, or reject it. We no longer find ourselves dealing with the mass/individual pair. Individuals have become "dividuals", and masses, samples, data, markets, or "banks" (Deleuze, 1992: HREF).

The code is power and access to the code is paramount if we are to gain some form of control over our physical bodies. As we become 'information', those who can have access to, or can crack such **microcodes**[4] also have the ability to control the physical and virtual domains.[5] Consequently, an advenient question comes to mind: If the microcodes of our physical data are what control or manipulate our physical bodies in time and space (spheres of transfer), then what **macrocodes** are manipulating and controlling our *virtual bodies* now that our mobility is vested in light?

Before answering this question however, it will be necessary to first address an important inversion that takes place in virtual space. The Cartesian dichotomy

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[4] The microcode implies coded data. In contrast, the macrocode refers to a code that regulates the medium of transfer (e.g., standard measurements of space or time). A command code refers to a microcode that can actualize within the sphere of a macrocode (e.g., a program). Additional clarification can be found in the glossary.

[5] The code enables the power of manipulation over both virtual (**CGVS**) and telematic spaces (**CMRS**). As John Beckmann illustrates with respect to the former: "At AlphaWorld, one of the first virtual VRML (Virtual Reality Modeling Language) communities, settlers have already formed the first gang, called The Order, a name taken from the neo-Nazi group in the race-war novel *The Turner Diaries*. Its members have discovered how to use aliases on line and then, using other people's names, have cursed and taunted some settlers. Russ Freelander, who is one of the few AlphaWorld settlers with the power to destroy structures, has occasionally gone out to The Order's headquarters at coordinates 666 North, 0 West to erase profanity. The Order has fought back by erecting a castle and a wall on which they post insults against Freelander and demands for freedom of expression" (Beckmann, 1999: 9).

between the mind and body takes on a new form in the field of light. As such, while contemporary discourse primarily focuses on the loss of our bodies to a privileged (codified) virtual body, it becomes necessary to examine on another level what a 'virtual body' really is. To clarify this analysis we should return very briefly to the traditional conception of dualism, or the notion of the mind/body split.

The mind can be conceived of as a system of *wills*.[6] As such, the mind could be likened to a container of **command codes**. Each command code is expressed through the vehicle of the body (surface of inscription) in order to act out these wills through the dimensions of space and/or time. Thus, this paradigm would suggest that the mind is analogous to potential energy, while the body is analogous to kinetic energy. Or to a degree, the body acts by virtue of the mind's volition. What we are faced with today however, is a new vehicle or surface of inscription. The body itself has been replaced with *light* (i.e., carrier agent) which can transfer the **will** across space and time at lightspeed. Moreover, the wills of the mind can now be encoded independently as data commands. Consequently, the command codes no longer reside solely in the mind, for they too can be externalized into a Body of Light.[7] Thus to summarize: if a will can be externalized into information,[8] and (as we know from physics) *all information is physical*,[9] then the externalized mind as information, in fact

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[6] The use of the word "will" in this text refers to the faculty of choice. It exists as a form of potential energy, and as written in the *Dictionary of the Philosophy of Mind*, it is "a psychological phenomenon with a force-like character which is evident in our acting or trying to act and is necessary for these types of events" (1999: HREF).

[7] As Géza Szamosi writes "Light may count as an "object" or a "body" because it carries energy and we know from special relativity that energy is equivalent to mass" (1986: 172).

[8] That is, the will to move an object for example, can be signaled through an organic system (human agency) or else it can be coded and made manifest through an inorganic system (computer agency).

[9] As an article from *Physics World* states, "Information is physical and any processing of information is always performed by physical means" (Deutsch and Ekert, 1993: HREF).

becomes a physical entity. Thoughts at the speed of light can exercise power in the physical realm[10] [3.2: 5; 3.3: 2]. In essence then, *a virtual body is a physical mind.*

We are no longer witness to the Cartesian split which separated mind from body, for in the virtual realm they are now one and the same. The mind itself has merged into the field of action, a field of mobility at the speed of light. The only binary severance today is actually between our coded selves and our organic selves. As Arthur and Marilouise Kroker write in 'Code Warriors': "technology terminates with the radically divided self: the self, that is, which is at war with itself. Split consciousness for a culture that is split between digital and human flesh" (1996a: HREF). A will to actualization through virtualization.

[10] Mark Nunes similarly observes, "A virtual potential space replaces real kinetic space or, rather, 'real' potential translates...into a virtual 'kinetic' energy" (1997: 165).

NODE 4.4 THE MACROCODES OF LIGHT

I have insisted that any new structure for codifying experience and moving information...has the power of imposing its structural character and assumptions upon all levels of our private and social lives - even without befit of concepts or of conscious acceptance...
- Marshall McLuhan

Light requires no surface for the transmission of information, for it embeds code within itself and requires no external medium to carry it.[1] In this sense, light does have a pure form. It becomes both the transporter and the transported. Moreover, it contains information in the form of digital signals that cover both territory (space) and duration (time). It becomes a wireless link between the mental (code) and physical (coded transfer) spheres and forms a new empire through this dialectic: we call it cyberspace. As William Gibson evocatively reminds us in *Neuromancer*, Cyberspace is:

> A consensual hallucination experienced daily by billions of legitimate operators in every nation...A graphical representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the non-space of the mind, clusters and constellations of data. Like city lights... (1984:51)

The last two lines of this excerpt however, require us to bring forward an important distinction if we are to examine the macrocodes of light. The light that we can

[1] As such, if a manner were devised to take coded light signals and transform them (i.e., through photonics technology), into visible light signals, then holography would become a reality and no surface of inscription would be required. Invisible light would reveal the code as a projection in visible

actually see--visible light--is in fact a very small part of the electromagnetic spectrum. Our retinas are only sensitive to the light that falls within the 400 to 760 nanometer range (Darley, et al., 1988: 116). The rest of the light spectrum is invisible (see Figure 2). In the field of optics, these "rays which are not luminous or visible, and which in the spectrum are beyond the limits of the visible portion" are referred to as 'obscure rays' (*Dict.org*, 1999: HREF). It is in these obscure regions [0: 6] of the electromagnetic spectrum however that wavelengths of light are utilized for telecommunications[2] (e.g., satellites, radio, television broadcast etc.) Thus the mediums that we employ to receive information from light are akin to extensions of both the eye and the ear,[3] for light is able to encode both signals at ranges beyond our normal reception thresholds.

Throughout most of history our powers over light were restricted to its visible form.[4] Through advances in optics however, we came to be able to manipulate visible light to the point that it became an integral part of our civilization. As Gyorgy Kepes of Harvard University writes:

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light. Holographic storage mediums however, which use lasers to store approximately a terabyte of memory in a small crystal are already in use today (Pescovitz, 1997).

[2] With the exception of AM radio, the majority of telecommunications formats utilize the range from 30 MHz to 30 GHz (Lo, 1997).

[3] It should be noted however, that sound waves are very different from light waves. Lightwaves are able to encode digital forms of sound, but sound waves are not a part of the electromagnetic spectrum. Sounds and electromagnetic signals are only both described as waves, because they each exhibit wavelike characteristics. Sound waves are carried by compressions and rarefactions of air. Electromagnetic waves are a completely different phenomenon, needing no transmission medium whatsoever (Kaku, 1994; Sundberg, 1997: HREF).

[4] That is, it was only in 1865 that James Maxwell arrived at his electromagnetic theory of light. His theory posited that the speed of an electromagnetic wave should be the same as the speed of light. As such he concluded that light is a form of electromagnetic wave. His theory however, did not gain acceptance until 1887 when Heinrich Hertz's discovered radio waves (University of Glasgow - Department of Physics and Astronomy, 1997: HREF).

> The wealth of light available to us is almost beyond belief. Our light technology, on which our cities depend for their very existence, is overwhelming in richness and power...We are flooded with light. We switch light on and off, send it where we will, and, when we will, negate it. We project, reflect, fix, focus, chop, diffuse and scatter it... (cit. in Shim, 1996: HREF).

However, within the realm of classical optics we were still limited to the examination of the role of vision and properties of light, with respect to the latter, specifically the laws by which light could be *modified* by opaque and transparent bodies. Thus, while light could be modified, its essential properties remained the same.[5] That is, until recently, unlike time and space, macrocodes were not applied to light in order to quantify (modify) its inherent qualities (representations). Thus, while macrocodes came to govern the invisible properties of time [1.2: 1-6] and space [1.1: 1-6] and subsequently controlled populations by creating shifts in the cultural understanding of these terms, light blinded us for centuries, it was not subject to such macrocodes for the very reason that it was actually visible! As such, unlike the invisible forms of time and space which were manipulated into representations (e.g., maps, clocks) and standardizations (i.e., measurements), light (as the illuminator of representations [2.1: 5]) stood as a testament to itself.

Humanity, it seems, has always been on a quest to "see" reality. And, light, both metaphorically and physically served as the force behind such "visions". It struck as 'Illumination' in the divine texts and 'Enlightenment' in the sciences. It was the power that levied the eye [5.1: 1-8] as the privileged sensor of reality. But

[5] Although light signals have long been in use as a form of communication (e.g. Morse code) these codes are based on patterning the light but not by changing is fundamental form (Wrixon, 1998).

research into light has found it to be a most peculiar property.[6] As Kafatos & Menas write: "The irony is that the study of the phenomenon of light in the twentieth century leads to a vision of physical reality that is not visualizable, or which cannot be constructed in terms of our normative seeing in everyday experience" (1990:14). As such, light signals the beginnings of a new form of perspective [5.5: 1-3]. And, a corresponding (though less understood) perceptual shift will be required if we wish to 'see' its coded properties.

[6] For instance, light exhibits dual characteristics. It is both a particle and a wave (Hawking, 1988).

NODE 4.5 THE POWER OF THE PARTICLE

Most people are familiar with the basic idea behind electronics. We know for example, that many of our household devices utilize the moving matter of electrons[1] (subatomic particles with a negative electrical charge): the emission and effects of which, act as processing signals which can be translated to produce a given effect or event. Currently however, we are at a transition point, we are as Virilio (1997) observes, in an age of *optoelectronics*. According to a definition from the *sci.optics* discussion forum:

> Optoelectronics can be defined as a branch of science and art, where the information brought by...light is transformed into the electronic signal in order to be able to process it according to the laws of electronics and finally transform it to forms which can be seen by the human eye (Leskinen, 1999: HREF).

For example, the networks that comprise the Internet are run through backbones of light (fiber optic cables). The information then circuits through an electrical current, with bits of data transmitted via electrons, which are then processed in a manner that can be read by a computer. But the problem with electrons is that they are slow, much slower than the speed of light. And so, guided by the ethos of speed and 'growth' we are weaning ourselves off this torpid fuel, and beginning to nurse from

[1] Electrons are **fermions**. Unlike light particles (**bosons**), no two fermions can occupy the same space at the same time.

the liquid streams of a more powerful force: one that is not fed by the power of electrons but the power of *photons*, or the quantum particles known as light.[2]

Photonics is the full use of light in all its capacities. As *Photonics Spectra*, a leading magazine in the field states, the term 'photonics' is increasingly replacing the use of the word 'optics' in computer industries as a more inclusive term. Photonics is defined as:

> The technology of generating and harnessing light and other forms of radiant energy whose quantum unit is the photon. The science includes light emission, transmission, deflection, amplification and detection by optical components and instruments, lasers and other light sources, fiber optics, electro-optical instrumentation, related hardware and electronics, and sophisticated systems. The range of applications of photonics extends from energy generation to detection to communications and information processing" (*Photonics Spectra*, 1999: HREF).

Research is this area is now focussed on the production of "all optical" or photonic computers. These are computers in which the electronic circuits (which process data serially) "are transposed by photonic circuits capable of parallel processing and thus of much greater speed and power" (ibid.). Scientists at the Quantum Device Laboratory at the University of North Carolina are currently testing a computer chip that conducts photons in order to create a system that bypasses the use of electrons entirely, and operates at the speed of light (Koprowski, 1998). This "ultra-fast computer chip...would allow it to run approx. 100,000 times faster than current semiconductors (ibid., HREF).

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[2] The photon, as we shall soon see, displays extremely bizarre properties. At once, it both is and is not.

On a network level, operators are rapidly gaining interest in the possibilities offered by photonic switches. These new switching systems allows "Internet service providers or phone companies to efficiently move wavelengths of light carrying voice, video, and data from point to point in their networks without routing them through old-fashioned electrical switching in a central office along the way" (Koprowski, 1997: HREF). As Dawn Hogh, of *Lucent Technologies* suggests:

> The analogy we use with optical networking is that if the light wave were a person in a car, it could get from point A to point B in one car. But if you have to go to the electrical level, you would have to stop and change your engine, or get a different car to get from point A to point B. By staying at the optical level, the transport is quicker and more efficient (cit. in Koprowski, 1997: HREF).

However, while a "true top-to-bottom" all-photonic or all-optical network is still several years away, photonic components are already in use and are rapidly being implemented (Carter & Chinone, 1998). For example, in fiber optic communications, the striation of light space [2.2: 1] and the exposure of deep time [2.1: 10] are evident with the "latest push" of wave-division multiplexing (WDM). As a recent article suggests, light itself, or wavelengths of light are being divided into lines of code:

> WDM achieves its bandwidth efficiencies by sending packets of data over multiple wavelengths. Although the information travels on light beyond the visible spectrum, a useful way to visualize the process is to imagine data being sent along on the particular color waves of the spectrum. Most of today's systems allow carriers to use 40 separate waves, which translates

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In fact, it is "an elementary particle that is [also] its own antiparticle" (WordNet, 1997: HREF).

> into 40 times as much bandwidth. Before WDM, telcos [telephone companies] transmitted long-haul traffic with time-division multiplexing (TDM). Instead of dividing bandwidth into multiple wavelengths, TDM divided it into time slots. Think of TDM as a train, where each car represents a different time slot. When a train leaves the station, the first car is carrying data from User One, the second car is carrying data from User Two, and so on. As you step up the bandwidth, trains speed by faster and faster, making it a lot harder to pull off a single car (Steinberg, 1998: HREF).

Thus the TDM method was less efficient as it utilized pulsed on/off signals (translated to ones and zeros) which turned on and off the entire optical bandwidth. By using WDM the various wavelengths are utilized *at the same time*. Thus multiple signals of coded information flow through another system of code as they are transferred through divisions of light. As such, light not only obscures our move toward **synchronoptic** communications. If this thesis is correct in assuming that each sphere of transfer must fall under macrocodes of power,[3] (while the information it contains is controlled by microcodes of power), then with the doubled properties of light [4.5: 2] (i.e., light as both the container of information and the information itself) we should expect to witness a doubled (i.e., micro & macro) coding of the properties of light. And, indeed we do. Light today is currently in the most vital stage of the coding process: that of authorization (e.g. scientization) [0: 3]. It is gaining veracity to enact itself as a code of power.

As light increasingly comes to be the conduit for information, we begin to see its manipulation increase as well. To harness the power of light we are now doing the previously unthinkable: We are beginning to measure and manipulate [1.1: 2; 1.2:

3-4] the one fundamental constant[4] of light - its speed. As Marilouise and Arthur Kroker were the first to critically observe, there are profound implications that underlie the ability to manipulate the speed of light (Kroker & Kroker, 1999). Citing a recent discovery by Danish physicist Dr. Lene Vestergaard Hau who managed to slow the speed of light (normally 186,171 miles a second) down to a mere 38 miles an hour,[5] the Krokers state that we should brace ourselves for a slow speed of impact. For here even "hyperreality crashes under the accumulated weight of deceleration" (ibid.). This 'slow speed of light' (ibid.) will be milked for profit. Indeed, these tests were set up with commercial applications in mind. As an article from the *New York Times* states:

> Laser-condensate combinations may...lead to ultrafast optical switching systems useful in computers that would operate using one **light** beam to control another **light** beam. Such a system could function as an optically switched logic gate, replacing the electronic logic gates computers now use. **Slow light** could also be exploited in filtering noise from optical communications systems" (emphasis original, Browne, 1999).

But speed of course works both ways. Today we can also manipulate light at **superluminar** speeds. As an experiment conducted by Dr. Nicolas Gisin of the University of Geneva demonstrated, light (photons specifically) can be split in a

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[3] As noted earlier, macrocodes are those codes which manipulate the transfer dimensions by obscuring their "pure forms" to the populace.

[4] The principle underlying Einstein's theories of relativity is that the speed of light is constant and nothing travels faster than the speed of light (Hawking, 1988; Szamosi, 1986).

[5] Browne, Malcolm W. "In a Major Breakthrough, Danish Physicist Slows the Speed of Light" in *The New York Times*, Feb 18 1999.

manner that allows them to "communicate" faster than the speed of light itself.[6] The split photon experiment can be summarized as follows:

> In essence, Gisin sent pairs of photons in opposite directions to villages north and south of Geneva along optical fibers of the kind used to transmit telephone calls. Reaching the ends of these fibers, the two photons were forced to make random choices between alternative, equally possible pathways. Since there was no way for the photons to communicate with each other, "classical" physics would predict that their independent choices would bear no relationship to each other. But when the paths of the two photons were properly adjusted and the results compared, the independent decisions by the paired photons always matched, even though there was no physical way for them to communicate with each other (Browne, 1997).

Photons or "entangled particles" as physicists refer to them, exhibit a peculiar property in that the measurement of one particle will instantaneously determine the state of the other. (Buchanan, 1997). Moreover, as Gisin himself remarked, "In principle, it should make no difference whether the correlation between twin particles occurs when they are separated by a few meters or by the entire universe" (Browne, 1997). The photon has the power to fill the gaps of space-time. Thus, to borrow from the Krokers' earlier proposition, with the ability to communicate at superluminar speeds, hyperreality may here instead become an open portal under the distributed *lightness of acceleration.* That is, as the codes of light space become superimposed on deep space, and the codes of deep time begin to supercede those

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[6] Browne, Malcolm W. "Signal Travels Farther and Faster Than Light" in *The New York Times*, July 22, 1997. Also, for more information see the *New Scientist* article by Mark Buchanan entitled "Light's spooky connections set distance record" which can be accessed online at: <http://www.newscientist.com/ns/970628/nlight.html>.

of light time, the rules governing space-time itself begin to fall into question [5.3: 1-2].

Thus far we have focussed primarily on the coding of **coherent light**. However, the (naturally occurring) electromagnetic spectrum is also progressively (and aggressively) being codified (see Appendix B). As one article's tagline stated, "Spectrum is the real estate on which the wealth of the 21st century will be built" (Lo, 1997). And, as this light space comes to fall under more "management" policies[7] and further expands into the commodity markets, we should begin to see power struggles develop over the rights to its use. Already, access to the light spectrum (see Appendix C) has become an issue for the Maori peoples of New Zealand. This is because the government wants to auction off[8] the 2-gigahertz band - the frequency sought by wireless broadband service providers. However, under the 1840 *Treaty of Waitangi*, the government must take the indigenous populations interests into account whenever there are questions over the development or use of the island's resources (Taggart, 1999). At the time of this writing, the New Zealand government has postponed the auction as it is still debating the question of whether or not the spectrum can be considered a "resource" like forests, fish, gold or oil (ibid.).

The spectrum as a resource may be infinite (i.e., it cannot be depleted), but its division is finite (i.e., spectrum allocations cannot be shared for transmissions) (Lo, 1997). In North America the government allots particular frequencies for its military and defense purposes. The rest of the spectrum is both "competitively licensed" and auctioned off. These licenses moreover can further be bought, sold or

[7] For regulatory issues related to the U.S. Spectrum Management Policy I direct the reader to: <http://www.ntia.doc.gov/osmhome/91specagen/1991.html>.

traded as commodities.[9] And, although certain countries (e.g., Canada) do have "spectrum aggregation limits" (i.e., there are "set-asides" for new companies to "ensure diversity in the marketplace")[10] monopolies on light [4.1: 2] can still be maintained through corporate loopholes (i.e., the purchase of the spectrum through various company names). Thus whoever comes to control the light, controls not only its means of transport, but also the information embedded within it.

Presently, the spectrum is coveted by two types of enterprise: content providers (e.g. TV, Radio) and conduit providers (e.g., data services) (Lo, 1997). Catherine Lo has suggested that, "Monopolies among content providers are considered more dangerous to society at large because they can stifle the free flow of ideas" while "Monopolies in infrastructure companies can bring beneficial economies of scale..." (1997: 142). But what Lo fails to recognize is that the control of light by conduit providers may be even more dangerous for those who inhabit a virtualized society. With the ability to stifle the free flow of pure data, they also have the ability to limit the free flow of our virtual selves. That is, now that we have started to upload ourselves as data, *we are the content* [4.3: 2-4] that can be controlled. As such, the capacity to regulate transmissions & emissions of light also comes to mean the capacity to control and regulate a population's virtual mobility.

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[8] The United States, the United Kingdom, Australia and Canada are all holding (silent?) auctions of the radio spectrum (*Strategis*, 1999).

[9] The entrance of light as a commodity signals its macrocodification. That is, much as time can be bought and sold in units (Rifkin, 1987), and space can be bought and sold in units, the same now applies to the light spectrum which can now also be bought, sold and traded in units.

[10] For more information I direct the reader to Canada's *Spectrum Management and Telecommunications* website: <http://strategis.ic.gc.ca/sc_mrksv/spectrum/engdoc/spect1.html>.

NODE 4.6 THE DARK (VELO) CITIES OF LIGHT

To speak of bandwidth is to speak of the volume of data that can be transmitted. This can be translated, in common terms, as speed. The maximum speed that we are aware of is the limit speed of light. Now that we are able to transmit information and communication within light, it is this force of this speed that affects our (virtual) mobility. But it is also the force of this speed that is increasingly coded outside of the individual citizen's domain. Two examples will serve as illustrations. In the first instance, the level of speed that an average individual can access from the home is dependent upon the carriers (e.g., telephone companies) and on the manner in which they transmit information to their local customers (i.e., from the central office to the local loop). As the installation of fiber optic wires or cables is "labor intensive", phone companies have instead opted for a new system called ADSL. ADSL or Asymmetric Digital Subscriber Lines and its implementation mode G.Lite (also known as Universal ADSL) have already been initially approved by the International Telecommunication Union as a standard [1.1: 1] (*Whatis*, 1999: HREF). The basic premise (and "labor intensive" wiring?) underlying this system, means that while an individual's Internet Service Provider is hooked into the speed of light, this speed is braked at the point of transmission to the home. Essentially, the use of ADSL, and the reason it is "asymmetrical" is because "most of the channel [is used] to transmit downstream to the user and only a small part to receive information from the user" (ibid.). As such, ADSL offers transmission speeds of up to 7 megabits per second from the central office to the

subscriber, but only up to 576 kilobits per second transmission speed from the home to the central office (Baldwin, McVoy & Steinfield, 1996). This equates to roughly 13 times more speed coming in than going out. Thus, as Howard Besser (1995) submits:

> This kind of asymmetrical design implies that only a limited number of sites will have the capability of outputting large volumes of bandwidth onto the information superhighway. If such a configuration becomes prevalent, this is likely to have several far-reaching results: it will inevitably lead to some form of gatekeeping. Managers of those sites will control all high-volume material that can be accessed. And for reasons of scarcity, politics, taste, or corporate preference, they will make decisions on a regular basis as to what material will be made accessible and what will not. This kind of model resembles broadcast or cable television much more than it does today's Internet (1995: 63).

But we must look beyond merely the World Wide Web and its content. Again, this obscures the more important regulation of our (virtual) mobility. *Movement* (here it might be more helpful to think of telepresencing or teleconferencing), becomes limited by the physical infrastructure that routes the codes of light. There are invisible ground rules that are being laid for speed and they are changing the (virtual & physical) architecture of telematic space. To master speed is to master motion. And, the ability to withhold speed, is power.

The codes of power [0: 1-6] have mastered time and space and are now etching themselves into the speed of light. But what are the implications of this speed? Why should it matter if it is imperceptible? To be anywhere at any time should surely be a good thing. To answer these questions, to find the darker side of

light, we must focus on the converse, or we must shift our attention instead to what it means to live in a world devoid of speed.

Speed is the mechanism *extraordinaire* of control. As Virilio has exemplified in his treatises on *dromology* (Virilio, 1997; 1998), for the First World "*the constraint of terrestrial infrastructure is as intolerable as ever for the development of communication speeds*" (emphasis original, 1997: 84). As such, our moves toward lighter & 'lighter' forms of transmission (e.g., Bill Gates' *Teledesic* Satellite Project that aims to create an entire 'Internet in the Sky') are attempts to move us away from the materiality and territoriality of geopolitical space. Instead, physical space will be controlled invisibly. It will be controlled by the power holders in the *telecontinents* (Virilio's term), who reside in **deep time** and **light space**. That is, as First World citizens increasingly dwell in the "lightness" of space, for citizens of the Second and Third Worlds, space becomes ever more deep, unmovable and "heavy" (see Figure 3). As Zygmunt Bauman (1998) has observed:

> Residents of the first world live in *time*; space does not matter for them, since spanning every distance is instantaneous...Residents of the second world, on the contrary, live in *space*: heavy resilient, untouchable, which ties down time and keeps it beyond the resident's control. Their time is void...For the inhabitants of the first world - the increasingly cosmopolitan, extraterritorial world of global businessmen, global culture managers or global academics, state borders are leveled down, as they are dismantled for the world's commodities, capital and finances. For the inhabitant of the second world, the walls built of immigration controls, of residence laws and of 'clean streets' and 'zero tolerance' policies, grow taller...(1988: 88-9).

Individuals in developing countries are still predominantly governed by the macrocodes of space [1.1: 3]. Their opportunities for free action are marked by invisible rule(r)s which "attach boundaries to space and command access to or exclusion from territories" (Lyman & Scott, 1970: 90). 'Secured' in the confines of these perimeters, their (virtual) mobility is also cut off by virtue of their *temporal* deprivation. As Jeremy Rifkin has accurately observed, today "temporal ghettos are no less important than physical ghettos" (Rifkin, 1987:165). In fact, time may have even denser boundaries. Without access to time, the slums of space *do not even exist* in the memory banks of the telematic globe; and consequently, residents of deep space are also not privy to its cache flows. Instead this space becomes the domain of the virtual class (Kroker & Weinstein, 1994), a transnational citizenry who move exclusively in the clean slipstreams of data. Here whole economies dance and dip at the speed of light. But this realm of rapid transaction, as Arthur Kroker and Michael Weinstein (1994) assert, is not accessible to all:

> ...[T]he information superhighway with its accelerated transfers of data, voice, and video is open only to those possessing the privileged corporate codes. And not evident to everyone, the information superhighway is also a site of global power because it remains an invisible, placeless, floating electronic space to the un-virtualized classes, to those, that is, who have been abandoned by the flight of the virtual class to the telematic future. *Here, virtual power is about invisibility*; the endocolonization of the unwired world of time, history and human flesh...(emphasis mine, 1994: 19).

Speed becomes the mantra for the virtual classes. But its intoned rhetoric, which equates speed with "saved time" [2.1: 10] (Dell, 1998), produces an almost

humorous tautology. For one would think then, that "saved time" would become "free time", but in fact, as Anthony Giddens has noted, it is always "free time" which must be killed (e.g., as the phrase "killing time" implies). As such, "free time" is wasteful, idle time "...it is the time which is filled in, in between the more consequential sectors of life" (Giddens, 1991: 113). To maximize efficiency then, to minimize "free time" and to wipe out "saved time" altogether, speed must span all space, and the codes which govern it must be utilized to "program the temporal affairs of local communities" and indeed, "whole continents" (Rifkin, 1987: 163). As an illustration, we need only look at the recent creation of Third World silicon annexes (also called silicon "parks", and "plateaus"). The move on the part of the major technology corporations (e.g., Dell, Microsoft, IBM, and Hewlett-Packard) to set up work nodes in these countries is actually twofold. For not only do they have access to a cheaper domestic labor force (D'Souza, 1996; Graham & Marvin, 1996), but equally important, they can also take advantage of the "time differences" in these foreign countries. As such, when the sun sets over the Western horizon, it rises in the East for coders and programmers in wired hubs (e.g., Bangalore, India) who work through our nights so that no time is wasted in a "working day". This is because a "working day" is now 24 hours a day.

The wired world is a tired world. Business at the speed of light invites insomnia for profit. Increasingly, keen investors opt to stay awake at night in order to keep pace with their stocks in foreign markets. This move toward a tele-global lifestyle however, suggests that we are "closing down the real world" while "opening up the virtual world" (Kroker & Kroker, 1996b: 36), a move that may have even been prophesized in the Bible. As Mackenzie Wark paraphrases from Revelations 21:

"'The people of the world will work by its light, and the rulers of the earth will bring their wealth into it. The interface of the city will stand open all day; they will never be closed, because there will be no night there'" (Wark, 1988: HREF).

Our rhythms are only now adapting to Paul Virilio's augury of a "'world-time' in global time" (Oliveira, 1996:HREF). With the recent induction of the Swatch® Corporation's official Internet time signal, the Swatch Beat,[1] "the era of time zones has disappeared" (Swatch, 1999: HREF). As Nicholas Negroponte, director of MIT's Media Laboratory declared at the inauguration ceremony: "Cyberspace has no seasons. The virtual world is absent of night and day...Internet Time is absolute time for everybody. Internet Time is not geopolitical. It is global" (Business Wire, 1998, Allan, 1998). Built into the concept of this lightspeed clockwork is the notion that it will allow "events" (virtual labor?) to occur at a faster rate than that which could be accomplished by global coordinated time (Whatis, 1999). Or, as Elliott Masie states: "Internet Time" is in fact, "no time. In the old days, you might finish a day's work and announce, 'I'm done.' Nobody ever does that now. There's never enough time" (cit in. *Internet Time Group*, 1999: HREF). At the speed of light, the virtual world leaves the physical world behind, and our organic selves can only watch blindly as time vanishes before our eyes.

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[1] A day in Internet Time (or Universal Time as it is also called) is divided into 1000 beats. As such 1 Swatch Beat is the equivalent of 1 minute and 26.4 seconds. A 'day' in Internet time begins @000 Swatch Beats (based on BMT, Biel Mean Time, or the new meridian based on the corporation's headquarters). That means that 12 noon in the old system is the equivalent of @500 Swatch Beats. Internet users use Swatch's converter in order to calculate their time against the global Beats (Swatch, 1999: HREF).

NODE 5.1 RENDERING I-SITES

The eye sees not itself, but by reflection, by some other things.
-William Shakespeare

The eye's ability to interpret light has rendered it the most acute sensor of distal space (Sedgwick, 1986). On a clear night, the unaided human eye has the ability to detect a single candle flame over 50 kilometers away (Darley et. al., 1988: 102). The eye perceives this light in an instant as the luminous patterns strike the retina at a speed of 299,792 kilometers per second. The discovery however, that the organic eye actually acts as a ***receiver*** of light was not known until the turn of the first millennium. Hasan Ibn al-Haitham, today recognized as the father of modern Optics, was the first to contradict Ptolemy's and Euclid's longstanding theory of vision which suggested that the eye sends out visual rays to the object in sight. Instead, al-Haitham forwarded the converse, and today it is not questioned that the rays originate from the object of vision and not from the eye itself at all (Zahoor, 1998: HREF).

In the digital universe however, the eye is no longer a passive filter of spatial noise, as it also moves at the speed of light. The organic eye, not content to move in the orbit of a slow body, has now transfigured to the point where it roams freely as an extension from electric sockets. It has become a virtual eye, an enucleated globe that views currents of space through speed. And through this vision today, there is no site beyond sight. The vanishing point, which once signaled the limits of human vision, has disappeared through the blind spot of the (fiber) optic nerve.

The organic eye and the virtual eye are similar however, in that they both display haptic tendencies. As Brian Massumi (1999) has observed, the organic eye acts as a sensor of "potential touch". From a distance it can sense whether an object is hard or soft, rough, sharp or smooth. In vigilance for the flesh, the organic eye has evolved to texturize its field of potential embodiment. By associating prior visual and haptic codes it is able to project forward in *time* and "predict" the tactual properties of a distant surface. The *space* it surveys, according to Deleuze and Guattari's terminology, can be envisioned as Smooth. As they propose in *A Thousand Plateaus* (1987):

> The first aspect of the haptic, smooth space of close vision is that its orientations, landmarks, and linkages are in continuous variation; it operates step by step. Examples are the desert, steppe, ice, and sea, local spaces of pure connection. Contrary to what is sometimes said, one never sees from a distance in a space of this kind, nor does one see it from a distance; *one is never "in front of", any more than one is "in"*...(emphasis mine, 1987: 493).

It should be noted however, that the idea that close vision is not a function of 'oriented' space is not entirely accurate. In fact there is a significant body of research which indicates that the organic eye itself has evolved a virtual vantage point for spatial tactual perception (Loomis & Lederman, 1986). For example, in psychological experiments it has been found that if a pattern is drawn (e.g., a lower case *b* or an uppercase *L*) on a person's front side (e.g., forehead, torso or palm reached forward), the subject will report that the pattern is reversed or a mirror image. Conversely, if the pattern is drawn on the backside (e.g. back of the head, torso, or with the palm located behind the observer) the subject will consistently report the pattern in its

correct orientation. These findings have supported the hypothesis of a 'disembodied eye', whereby "tactile patterns are interpreted as if they were drawn on the surfaces of a transparent body and "viewed" from some point usually well behind and slightly above the observer" (Loomis & Lederman, 1986: 5).

Having evolved to reconnoiter space however, the *telos* of a magnified field of vision emerged. This subjective 'disembodied eye' found its 'objective' materialization with the advent of the mechanical eye, a refined lens of long-distance vision which could navigate the corrugations of striated space from an axial perspective. Defined by a "constancy of orientation, invariance of distance through an interchange of inertial points of reference...[and a] constitution of a central perspective" (Deleuze and Guattari, 1987: 494), this space became the site of the 'spectacle'.[1] A focussed field of view for what Jay David Bolter (1996) has referred to as the 'scientific eye'.

The novelty of the scientific eye was that while it focussed from a still perspective, it could still observe and magnify objects at a distance. But more importantly, as symbolized by the telescope or microscope, it favored the separation of the subject and object under study in order to create an 'impartial' relationship between the two. The 'objective' eye acted more precisely as an 'objectifying' eye. By seeking to control all external variables it locked itself within a grid of its own creation, a hallucinatory cage of its surroundings. As Bauman notes, the viewer's eye became an 'impersonal' eye. And, from this standpoint,

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[1] The popularization of spectacles (as instruments that assisted vision) emerged during the Renaissance. (Sorkin, 1998). And, as Neil Postman has suggested, it was with this invention that the defective organic eye could be perceived as "improvable". The microscope further, opened our eyes for the first time to the idea that the invisible has a level of control over the visible (1986: 14). Similarly, this mechanical vision magnified the 'spectacle' as representation. As Guy Debord writes: "...society

> It did not matter now who were the viewers; the only circumstance which counted was that they placed themselves at the given point of observation. It has now been asserted - indeed, taken for granted - that any viewer placed in that point will see the spatial relations between objects in exactly the same way (1998: 32-3).

This 'neutral' perspective, first fully realized in the Renaissance, soon came to be regarded as the 'best' perspective; a *de facto* 'privileged point of view'. Further, as a detached reference point, it even became "capable of accomplishing the miracle, of rising above, and overcoming, its own endemic relativity" (Bauman, 1998: 32). That is, the anthropic principle, which governed the creation of the scientific eye, became masked by its own (di)vision of subjectivity.[2]

Paul Virilio has similarly offered what might be considered an 'evolutionary' paradigm of optics. He makes a distinction between two types of visual perspective: Small Optics,[3] which distinguish between near and far, the horizon and the object; and Big Optics which designate real-time information transmissions or "the active optics of time passing at the speed of light" (Manovich, 1996). It is with the advent of the latter, he posits, that the characteristics of Small Optics are being erased and substituted (Virilio, 1997). Likewise, he laments that "If information from any point

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which eliminates geographical distance reproduces distance internally as spectacular separation" (1983: 167).

[2] In speaking about his own photography, Baudrillard has suggested that it is "the art of making the object appear, the subject disappear. In other words, me. I try, in fact, to disappear" (cit. in Leith, 1998: 17).

[3] Virilio's oversight however is that he conflates the aforesaid distinctions between the organic and scientific eyes; as human vision, painting and film are all blurred together under the rubric of Small Optics.

can be transmitted with the same speed, the concepts of near and far, horizon, distance and space itself no longer have any meaning" (Manovich, 1996: HREF).

It is this author's belief however, that Virilio's view is overstated. For what the emergence of Big Optics actually signals, is the unfolding of a dialectical *virtualism*: a new perspective of space that incorporates constructs of both the organic (subjective) and the scientific (objective) points of view. What needs to be clarified again, is that it is not so much 'space' itself which has vanished, but rather its perspective plane [2.1: 5]. With the advent of the virtual eye, sight literally merges into site. As Bolter recognizes:

> In Renaissance perspective, there is the viewer, the picture plane, and the imagined scene. The picture plane comes between the viewer and the scene. In virtual reality, the ultimate version of computer graphics, the viewer steps through the plane and can move around in the graphic environment. The moving virtual eye defines a more intimate relationship between viewer and object than that of the scientific eye. The viewer can not only occupy the same environment as the object; she can assume the perspective of the object, unite with the object's point of view. This is precisely what the scientific eye does not wish to do (Bolter, 1996: HREF).

Computer gamers are of course, already aware of this manifestation. For example, the *Free On-line Dictionary of Computing* (1997) has already defined 3 distinct forms of virtual perspective:

1) First person perspective: Viewing the world through the eyes of the primary character in three dimensions. E.g., Doom, Quake.

2) Second person perspective: Viewing the game through a spectator's eyes, in two or three dimensions. Depending on the game, the main character is always in view. E.g., Super Mario Bros., Tomb Raider.

3) Third person perspective: a point of view which is independent of where characters or playing units are. The gaming world is viewed much as a satellite would view a battlefield. E.g., Warcraft, Command & Conquer (*Free On-line Dictionary of Computing*, 1997: FTP).

Consequently, as Kim Veltman, has observed these new lines of sight require us to reconsider our traditional notions of perspective:

> During the Renaissance, artists used linear perspective to represent a static space in a picture as determined by the position of a viewer looking at the scene from a given viewpoint. In virtual reality much more is involved...[W]hereas Renaissance perspective was concerned mainly with the static space of the picture, recent developments in virtual reality integrate dynamic views of observers in their picture space. Which is one of the reasons why virtual reality has also played a major role in expanding the scope of perspective (Veltman, 1994: HREF).

The virtual perspective is like Picasso on speed. Here, it is movement that breaks the static perspective of the virtual eye. As such, Virilio is correct in arguing that Cyberspace offers a radical break in perspective for the eye no longer acts as a passive receiver of information, it now has the ability to react with the information itself. It becomes kinesthetic (bodily) in that it has become both a receiver *and* a transmitter in deep time. As he notes, "To see at a distance, to hear at a distance: that

was the essence of the audio-visual perspective of old. But to reach at a distance, to feel at a distance, that amounts to shifting the perspective towards a domain it did not yet encompass: that of contact, of contact-at-a-distance: tele-contact" (Virilio, 1995: HREF). A form of 'double perception' [1.3: 3-4] thus becomes apparent. As an early article on telepresencing entitled 'Where Am I?' suggests:

> The workers in laboratories and plants who handle dangerous materials by operating feedback-controlled mechanical arms and hands undergo a shift in point of view that is crisper and more pronounced than anything Cinerama can provoke. They can feel the heft and slipperiness of the containers they manipulate with their metal fingers. They know perfectly well where they are and are not fooled into false beliefs by the experience, yet it is as if they were inside the isolation chamber they are peering into. With mental effort, they can manage to shift their point of view back and forth, rather like making a transparent Necker cube[4] or an Escher drawing change orientation before one's eyes (Dennett, 1981: 315).

That is, while this new depth is projected on to a flat plane, the inversion suggests that this depth is neither a tunnel inwards nor outwards but both simultaneously. We are presented with a perceptual paradox, an "optical ambiguity in depth and dimensions" (Rodgers, 1998:48).

As such, a reformulation of Deleuze and Guattari's terminology is necessary if we are to understand how virtual vision is situated within such optical (network-centric [4.1: 2]) space formations. For this new type of sight no longer falls within a

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[4] The Necker cube may be a useful analogy for understanding the manner in which visual information processing is similar to light's wave/particle duality in quantum mechanics (Szamosi, 1986). That is, "the very act of observation..."forces" the object to take on one of the two possible appearances" (1986: 198). See Figure 4.

neat binary that corresponds to Smooth or Striated space.[5] Instead, the virtual eye, even as a sensor of distant space has "haptic" or "close vision" properties. It synthesizes the traits of smooth and striated space, as *the tactile perspective is the result of merging with the perspective plane.*

Perspective today should be regarded as a culmination of such paradoxes[6] and visual inversions. That is, with tele-operation (i.e., **Computer Mediated Remote Space**) the organic eye navigates the physical **macrocoded** body (e.g., telerobotics), while in cyberspace (i.e., **Computer Generated Virtual Space**) the virtual eye becomes the optical viewer for the virtual (**microcoded**) body (e.g., it brings up sights/sites in multiple perspectives). Consequently, in the case of the latter, this dynamic form of perspective forces us to examine not only what we see, or who we are when we see what we see,[7] but where we see what we see, and more specifically, where we are @ when we see what we see. That is, when space becomes a function of time, the 'where' question of place begins to taken on an entirely new dimension, it also becomes a question of 'when'.

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[5] In the words of Deleuze and Guattari: "It seems to us that the Smooth is both the object of a close vision *par excellence* and the element of a haptic space (which may be as much visual or auditory as tactile). The Striated on the contrary, relates to a more distant vision, and a more optical space" (1987: 493).

[6] Virilio states that we live "in a true culture of the paradox in which everything arrives not only without needing physically to move from one place to another but, more particularly, without having to leave" (1997: 19).

[7] As this topic is beyond the scope of this thesis and an extensive body of research has already gone in to the research on identity and cyberspace I direct the reader instead to, *Virtual Politics: Identity and Community in Cyberspace.* (Ed.) David Holmes. London: Sage Publications, 1997 and Sherry Turkle, *Life on the Screen: Identity in the Age of the Internet.* New York: Simon and Schuster, 1995 for more information.

NODE 5.2 SITE @ THE SPEED OF LIGHT

Being on line as Samira Kawash (1997) writes, "seems to suggest [that the user is in] that in-between of the connection or the transmission". A place situated in movement and time. But under the aesthetic spell of the @ sign,[1] the implications for the space it signifies have largely remained unstated. That is, @ has already been taken for granted as signaling a static form of place itself. But in fact, as Kawash argues:

> @ signals something new, some kind of relation to place that is not like those we are familiar with. Thus, @ is not at, not a simple familiar preposition. But there is a tendency, evident in both everyday use and in corporate and media appropriations of the sign, to make @ into at: to pronounce the sign as the preposition but also to make the sign mean the preposition. The ambivalence of @, both something familiar and something new, signals both the unimaginable possibilities of the "digital revolution" and the very real material, imaginative, or representational constraints in which any "revolution" unfolds...[We should] consider the tendency to make @ into at and think about both the power of this "normalization" of an unfamiliar sign and what is lost or suppressed in this transformation. @ exceeds at, but this excess and whatever creative energy it might unleash is being lost as @ is appropriated and recuperated by the logic of place and person (1997: HREF).

[1] The (corporate) aesthetic of the @ symbol hides something much greater. With place displaced from the body, or a place that can roam independent of the self, it becomes more apparent that the individual has no real hold over where their own address is @. In fact, in databanks all over the world people can access you @ your address without you being able to remove yourself (i.e., spam). The virtual subject thus becomes captured, held prisoner in a place that s/he is not even physically in.

Since 1972, the year Ray Tomlinson selected it to be a separator in e-mail addresses, the @ symbol has served as the central sign of distributed place[2] on the computer networks (Quinion, 1997). However, much like the 'information' it seeks to link (see Appendix A), the symbol's etymology has been shifted aside and its original meaning has been obscured. Thus, its intended purpose as a transformative operation (e.g., 20 barrels @ $50) has itself transformed to signify a form of dynamic placement in virtual space (Kawash, 1997). But furthermore, the proposition 'at' behind the symbol should lead us to re-think our definitions of space or place. As Kawash argues, the Aristotelian notion of space places the relation between location and object as one of static contact. The place is considered the container which holds the object or thing in question. Bodies or elements are considered distinct from their places. This assumption then means that a body may move from one place to another, yet the place itself will remain. As such any "thing" on either side of the preposition could exist independently without or before such a relation. @ however, is distinct from this relation of space in that it challenges our traditional notion which holds that only one thing can occupy one place at one time [4.5: 1]. Thus:

> To take @ seriously is to be forced to abandon the prepositional logic of place implied by at, since @ is radically disjoined from any location that "I" am in. This is not simply to say that place in "cyberspace" is different from place in ordinary space. Rather, [...it is to suggest] that @ interrupts the very logic of place (that it should be static, fixed, and non-contingent) and that this interruption is in no way confined to the elsewhere of cyberspace. As a sign of electronic "place" that calls place into question, @ marks not

[2] For another interesting reading into various cultures' etymology of the @ symbol, I direct the reader to Michael B. Quinion. "Where it's at: Names for a common symbol" in *World Wide Words*. September 7, 1997: <http://www.quinion.demon.co.uk/words/articles/whereat.htm>.

> only the difference of digital space from ordinary space, but equally the possibility that ordinary space may not be what we commonly take it for (ibid.).

The @ symbol, regarded in this manner, is thus more representative of the notion of **light space** in **deep time**. It signals the beginning of a **synchronoptic** perspective by transferring the static notion of space into a dynamic vector in speed. Sight at the speed of light then, requires the emergence of a new type of eye, a quantum eye, an eye that is neither here nor there: an eye that can be in all places @ once.

NODE 5.3 THE QUANTUM PERSPECTIVE

We have two eyes to see two sides of things,
but there must be a third eye which will see everything at the same time
and yet not see anything.
- D. T. Suzuki

At the speed of light, information bends around space-time. With the recent advances in optoelectronics, it becomes possible in a sense, to even *see into the future.* Specifically, with the convergence of virtual space **(CGVS)** and remote space **(CMRS),** the organic eye is no longer required, or even expected to see the difference. NASA, for example, currently utilizes a computer software called the Virtual Environment Vehicle Interface (VEVI). VEVI was designed to deal with teleoperation for significant time delays (e.g., tens of minutes of light travel between Earth and Mars) which made the traditional process of command-to-uplink inefficient. This is because the time between "the sensing and actuation" made the control system unstable as well as cost ineffective (Hine et. al, 1995). Waiting for the human operator to initiate a command slowed down the performance of the computer speed. As such VEVI was designed as a "rendering node" in that its main purpose is to give a 3D interactive representation of an environment *ahead of time* to a user through multiple input and output devices (Piguet et. al, 1995). In this manner, the *program optimizes the future* for the present. In another example, Marius Schamschula, a researcher at the Center for Applied Optical Sciences at Alabama A&M University has developed a paradigm for NASA called 'Synthetic Simultaneity'. Here the human being is put "back in the loop in situations where a remote

robot/rover experiences significant data transmission time delay" (*CAOS*, 1997: HREF). Schamschula's system allows the operator to "view the situation *far enough into the future* that a signal sent to the remote device arrives just in time for a command to be executed" (emphasis mine, ibid.). In an e-mail correspondence he explains: "The idea was to use Kalman filtering[1] to project the rover environment forward in time (equal to the signal time of flight) to give the operator a sense of real-time control. As an aside, your brain is doing this all the time..." [5.1: 2] (Schamschula, 1999: Personal Communication).

Light weaves through the (w)hole lattice of space-time. Advances in quantum computing and quantum optics for example, are utilizing the properties of photons [4.5: 2] to advance even beyond tele*operation* into information tele*portation*. As the twin photon experiment [4.5: 6] exemplified, light may not even have to move through space at all in order to communicate across vast distances.[2] As such, information coded in light can "move from location A to location B without moving in the space between A and B" (Arent, 1999: HREF). Although, researchers do not foresee the ability to teleport human beings anytime in the near future, the research is already being applied to the area of quantum cryptography. Using **qubits**, or quantum bits, researchers are working on a type of encryption known as "superdense coding" (Arent, 1999: HREF).[3] This format is based on Heisenberg's uncertainty principle which contends that one cannot simultaneously know a particle's position

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[1] Kalman filters are data processing tools which are used to estimate signal values in the presence of noise. They utilize the 'best estimate' which "results from the minimization of the mean-squared error of values in a time series" (Chapman, 1997: HREF).

[2] For a good introduction to the area of light teleportation, I refer the reader to, Kenneth Chang. 'Beam Up the Photons: Taking Advantage of a Quantum Mechanical Loophole' in *ABC News Science*. October 22, 1998: <http://abcnews.go.com/sections/science/DailyNews/teleport981022.html>.

and velocity, and hence, the particle itself can never be measured by an observer (Szamosi, 1986). As such, information encrypted in a quantum state would automatically be destroyed if tampered with in the stages before reaching and being decoded by the receiver. As Dr. Richard Hughes, head of the quantum-information team at Los Alamos National Laboratories states: "to break quantum encryption a cracker will have to first break the laws of physics, and then break the ciphers" (McKay, 1999: HREF). This is because, unlike digital codes which are standard units of ones and zeros, qubits defy measurement: they can be both ones and zeros simultaneously, they are in fact nullified 'forms' of code.

With these transfer standards [1.1: 3] being set in place, with the dematerialization of the code's numerical referent itself, definition is cyphered beyond the human threshold; definition becomes a domain of the machine. However, through this obscure transparency the code actually reveals itself - its encryption is exposed by its explicitness - for we are only able to see it in its true form: that is, as a precise reproduction of random noise (Chang, 1998).

[3] Unsurprisingly, this hypersecure format [1.1: 2] is being developed for satellite and military purposes as well as banking and other commercial applications (McKay, 1999).

NODE 5.4 SEEING THE LIGHT

The laws of harmony that are internal today will be external tomorrow.
- Wassily Kandinsky

The organic eye scans the potential future of the body, but the virtual body senses before it sees.[1] Immersed within the perspective plane, the skin of code becomes the distal sensor for the (organic) eye; the automation of perception [1.3: 1-4] (Virilio, 1997) turns the environment into a form of telebraille, a pixellized translation fit for human perception. Computers become our 'seeing eye' machines forcing us into a double reading of the world. And, it is this shift in orientation that we have not yet grown accustomed to.

Vanishing at the point of site itself, the quantum eye offers a perspective that is absolutely unprecedented: one is no longer situated from the inside looking out, nor from the outside looking in. Merging with the perspective plane opens up a space to fuse with the object's viewpoint, and the possibility to evoke that 'feeling' of unity that emerges when the Subject and Object, or the Self and Other share a common perspective.

It is often said that the 'eye is the window to the soul'. In a networked community however, while one cannot look directly into the eye of another, one can, for the first time, view the world from that Other's perspective. In this sense, the quantum eye "...is not content to spring from a single contact and speed through

[1] The skin, the last unintruded surface of the body has now become an orifice. It can be penetrated and manipulated by code. The artist Stelarc for example has used ping pulses sent over the Internet to move his body which are attached by wires to a CPU (Stelarc, 1996).

space; it excites the things of the world to movement and can draw even the most distant of them together. *It is a principle of mobility...*" (emphasis mine, Foucault, 1970: 23). This unique viewpoint which unites the subject with the object of representation can be likened to what Foucault termed the fourth form of resemblance, that of *sympathy*. This state, in the Smooth [5.1: 2] spaces of light, affords a position where "no path has been determined in advance, no distance laid down, no links prescribed. Sympathy plays through the depths of the universe in a free state. It can traverse the vastest spaces in an instant..." (Foucault, 1970: 23). We can speak of the quantum eye as a sympathetic eye, because as a new formation, it has not yet formalized a schema of perception. It does not "know" how to group objects in its view. Or, using Gibson's notion of affordability [3.2: 3], cyberspace is confusing in many respects as people do not inherently understand the "purposes" of objects or 'planes' in their environment. Perception here has not yet habitualized to the coded rules of space and time. That is, although the quantum eye is functionally and literally an encoded (striated) eye, it is experientially unencoded (smooth). The eye does not yet understand the 'order of things'. Thus, as Foucault once remarked on the notion of perception:

> ...an eye not consciously prepared might well group together certain similar figures and distinguish between others on the basis of such and such a difference: in fact, there is no similitude and no distinction, even for the wholly untrained perception, that is not the result of a precise operation and of the application of a preliminary criterion (Foucault, 1970: xx).

We are to a large degree, still locked into Renaissance perspective; so accustomed to regarding the world from a still viewpoint, our eyes must now learn to shift their focus from perceiving the world as planes of potential kinesthetic space [2.1: 4] and also begin to accommodate the notion of potential kinesthetic time [2.1: 4]. Moving within in a temporal orbit the quantum eye becomes a *rhyzomatic* receptor. Thus, while the virtual eye could be considered "...a wandering eye that occupies various perspectives one after another" (Bolter, 1996: HREF), the quantum eye is a wandering eye that occupies various perspectives *simultaneously*.

Existing in time, space *and* motion however, the quantum eye is by requisite an eye of uncertainty. Observation and detection cannot be fixed down in such a world of flux. No longer a view to the "truth" of the world, 'Alberti's window' which once framed perspective, has shattered. As Kim Veltman writes:

> The windows of a computer screen multiply the methodological problems of the perspectival window. In some cases the windows are truly windows onto reality at a distance. A video camera attached to computer in Berlin can be operated by a viewer in Tokyo or anywhere else in the world. A video camera on a satellite gives users throughout the world snapshots of weather from outer space. [But]...how can a viewer be sure that the view through the window is a real place when it may well represent a location which they have never visited? Or even if the view is real how can a viewer be certain that...something that appears to be happening now...is not in fact footage from some other time in the past? (Veltman, 1998: HREF).

Thus, our 'records' of the world under this new form of perspective may be dynamic, but for the viewer or the observer, the static noise inherent within the system can never be filtered out without perception (-in-) itself [1.3: 1] falling into question.

However, this *is* a plane of equal possibility, a plane of potential which may offer us a brief window into the codes of power before they conceal themselves again. To read Foucault in this light, this (non) perspective of the quantum eye may actually enable us to decipher the codes which govern it:

> Between the already 'encoded' eye and reflexive knowledge there is a middle region which liberates order itself: it is here that it appears, according to the culture and the age in question, continuous and graduated or discontinuous and piecemeal, linked to space or constituted anew at each instant by the driving force of time, related to a series of variables or defined by separate systems of coherences, composed of resemblances which are either successive or corresponding, organized around increasing differences, etc. This middle region, then, in so far as it makes manifest the modes of being of order, can be posited as the most fundamental of all: anterior to words, perceptions, and gestures, which are then taken to be more or less exact, more or less happy, expressions of it (which is why this experience of order in its pure primary state always plays a critical role); more solid, more archaic, less dubious, always more 'true' than the theories that attempt to give those expressions explicit form, exhaustive application, or philosophical foundation. Thus in every culture, between the use of what one might call the ordering codes and reflections upon order itself, there is the pure experience of order and its modes of being" (Foucault, 1970: xxi).

NODE 5.5 THE DIMENSION OF LIGHT

Horizons are the absolute presupposition within which individuals and indeed whole civilizations do their living...But what a burden falls upon the will when the horizons of definition are gone.
- George Grant

A new vision of reality is forming with the speed of light. It appears to us in the form of pure code. If we find ourselves confronted with the uneasy notion that "reality isn't what it used to be" (Anderson, 1990), this is only because *'reality' itself has always been virtual*: it has always been rendered by codes of power. But power today has a new strategy. It no longer conceals itself as a semblance of reality. Instead, it masks itself in total exposure. It reveals itself as the code and conceals itself by its flagrant claims of being *only a virtual counterpart* to reality.

To remain locked with a deep nostalgia for the 'real' is to ignore the codes of power in their new formation. And to believe the virtual exists as only a façade is to be mocked by its appropriations. For every code we impute, we forfeit our will; and for every will we *compute*, we forfeit our agency. Thus, in a telematic environment, codes not only come to define our world; they also come to define our *selves*.

Only by obscure processes are we able to witness the degree to which our perceptions have been externalized and our perspectives have been internalized. The virtual body and the physical mind exist only as codes, incompatible and independent of our organic selves by virtue of the fact that they inhabit a new dimension: their pulses beat with the speed of light.

In this new 'horizonless cosmos' (Virilio, 1997) light is a force that illuminates our 'worldview'. We now "see" through the electromagnetic light rays

which are themselves invisible to our eyes. The vanishing point has become a vector, and before this new field of movement falls under new lines of definition, we are given an opportunity to re-asses the codes of power. That is, with the inversion of space and the eversion of time, a whole new sphere of transfer quite literally comes to light. In the same manner as time and space, light can now act as a *container of coded information.* Inasmuch, this author proposes that we should begin, in fact, to consider the emergence of a 5th dimensional coordinate: the dimension opened to us by light. That is, along with the three coordinates of space and the one coordinate of time, the induction of light is signaling a brand new horizon of definition. It is becoming a "measured magnitude which can serve independently or in conjunction with other magnitudes to define the location of an event or object" (*Webster's Encyclopedia*, 1989). It is becoming a new sphere, no longer measured by length, width, depth or duration, but purely by *speed.* This is not merely conjecture. As the eminent physicist Michio Kaku has stated "Light, in fact, can be explained as vibrations in the fifth dimension" (Kaku, 1994: ix). It is a form *both apparent and obscured* to our vision because *light is cast as its own shadow*[1] to our perspective!

Thus, if there is indeed a burden upon the will today, it is to view the codes of power before they transpose themselves anew. For in the virtual empire our perceptions will not only be normalized, but *computerized.* As such, the challenge that lies before us now is to learn to "see" the codes scripted in the *obscure rays* of the spectrum, for only in this light, will a true vision of power reveal itself.

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[1] Although a 2 dimensional individual would not be able to "see" in 3 dimensions, s/he could visualize higher dimensions by examining the shadows that are cast onto a flat plane (see Figure 5). Similarly, we may not be able to "see" the 5th dimension, but we can conceptualize its presence by virtue of the fact that we can 'read' the codes that move in the obscure rays of light.

GLOSSARY

Bosons - All known particles are either bosons or fermions. Bosons (e.g. photons) can occupy the same quantum state.

Command Code - A *microcode* that finds actualization through a *macrocode* (see below). For instance, a decree from the King to execute a prisoner in a distant part of his empire requires the edict (microcode) to be transferred to a particular dimensional coordinate in space and time (macrocode) with the exercising of the *will* embedded in the former and actualized in the latter. In this case, paper (*surface*) for example would be inscribed and then passed on to an agent to enact the will. As such, a command code requires both a *transmitter* and *receiver* (see below). Similarly, with respect to telematics, information within a program (microcode) would be transferred through the medium of light (macrocode) for the actualization of the will to be enacted through the receiving agent. Thus, information (microcode) at a distance could for example signal the termination or activation of an event once it had passed through the macrocoded medium of light.

Code - The code is the manifestation of power. Three properties that are inherent within the code are: abstraction, manipulation and systemization through time and space. As such, the code works in each instance to disembed or disembody a form so that it can be transferred (and often reinvested with meaning) onto a new surface of inscription.

Coherent Light - A light source that is created and often utilized for telecommunications. The most common wavelengths in use today are within the infrared portion of the electromagnetic spectrum: 850 nanometers, 1300 nanometers, and 1550 nanometers. Lasers are examples of Coherent Light Sources.

Computer Generated Virtual Space - (CGVS) Images or information of virtual space or computer generated space. This type of space, like *light space*, is also being commodified (see below). For example, Internet Service Providers charge users for web hosting or for the amount of space (expressed in Megabytes) that a user is allowed to upload with their information. In virtual worlds, (e.g., Activeworlds.com) CGVS is also being sold by the 'meter.' Costs (for server space) are currently being expressed in terms of virtual land (real?) estate values. For example, the prices for Activeworlds' *Galexerver* and *Uniserver* are as listed below:

Prices for Activeworlds' Stand-alone World:

Total Size (Meters)	Price
1 million sq. meters of land	$1,995
1.5 million sq. meters of land	$3,995
2.2 million sq. meters of land	$4,995
4 million sq. meters of land	$9,995

Prices for Activeworlds' Universe of Worlds:

Total Size (Meters)	Price
1,000,000	$9,995
4,000,000	$24,995
9,000,000	$39,995
16,000,000	$62,495

(source: www.activeworlds.com see: Products)

Computer Mediated Remote Space - (CMRS) Images or information about 'real' physical space that is transmitted from a distance. CMRS utilizes telemetry or the science of sensing and measuring information at some remote location and transmitting the data to a convenient location for reading or recording.

Deep Time - Time, is perhaps best defined as "a function of the occurrence of events" (Watson, 1973: 264). The concept of deep time implies that time is 'expanding' for the purpose of processing events at a higher frequency. Time (and the actions/movements/processes within time) is increasingly becoming indetectable to human senses. Common uses of computer time are as follows:

> *millisecond* - (ms or msec) one thousandth of a second (commonly used in measuring the time to read to or write from a hard disk or a CD-ROM player or to measure packet travel time on the Internet).
> *microsecond* - one millionth (10^6) of a second.
> *nanosecond* - (ns or nsec) one billionth (10^9) of a second (common measurement of read or write access time to random access memory (RAM).
> *picosecond* - one trillionth (10^12) of a second, or one millionth of a microsecond.
> *femtosecond* - one millionth of a nanosecond or 10^15 of a second (measurement sometimes used in laser technology).
> *attosecond* - one quintillionth (10-18) of a second (not yet in use).

Electromagnetic Spectrum - The total range of wavelengths, extending from the shortest to the longest wavelength or conversely, that can be generated physically. This range of electromagnetic wavelengths extends practically from zero to infinity and includes the visible portion of the spectrum known as light.

Fermions - All known particles are either fermions or bosons. Fermions obey the Pauli exclusion principle in that no two fermions can occupy the same quantum state. Examples of fermions are the electron, proton, neutron, and quark.

Interface - The mediator between the individual and the telematic world. The interface obscures the (n)etherface. The interface shows the surfaces of information in the telematic world. For example, a definition from *Whatis.com* explains the term as follows: "A user interface, consisting of the set of dials, knobs, operating system commands, graphical display formats, and other devices provided by a computer or a program to allow the user to communicate and use the computer or program. A graphical user interface (GUI) provides its user a more or less "picture-oriented" way to interact with technology. A GUI is usually a more ergonomically satisfying or user-friendly interface to a computer system. As a verb, to

interface means to communicate with another person or object. With hardware equipment, to interface means making an appropriate physical connection so that two pieces of equipment can communicate or work together effectively".

Kinetic energy - The energy that a body or medium has by virtue of its motion. Utilized here synonymously with 'Agency'.

Laser - Lasers, (or light amplification by stimulated emission of radiation) are examples of coherent light sources that are used in fiber optic cables.

Light - The visible portion of the electromagnetic spectrum. The range from 400 to 760 nanometers is detectable to the human eye.

Light Space - The concept that light is becoming a form of space in itself in that it is becoming a container of objects or events. As such, it is following the lines of 'physical' space in that it is being measured and divided up much like a commodity. For example the light spectrum is auctioned or licensed of in Standard Trading Units (see appendix). Light space should be distinguished from *Computer Generated Virtual Space* & *Computer Generated Remote Space* (see above).

Microcode - Information or data that is encoded. Thus, language is a form of microcode, and digits and qubits are forms of microcodes. With respect to telematics, microcodes also have the ability to pass on *commands* through *macrocodes* as *command codes* (see above). With the property of light taken into consideration, microcodes themselves even command the transfers of macrocodes. For example the development of photonic switches allows light pulses coded into signals (information) to route light itself through time and space.
(N.B. although current debates are focussed on issues of source code and the copyrighting of digital information, these topics are beyond the scope of this thesis. Instead, this author utilizes the term microcode to illustrate its larger implied power over the physical body.)

Etymology note: The term microcode was chosen for this concept as in the dictionary (www.dict.org) micro is referred to as "Personal or human-scale -- that is, capable of being maintained or comprehended or manipulated by one human being. This sense is generalized from `microcomputer', and is esp. used in contrast with `macro-' (the corresponding Greek prefix meaning `large')

Macrocode - External codes which are superimposed on to dimensions in order to measure and/or manipulate them as constructs. For example, time has been macrocoded into hours, minutes and seconds, and space has been macrocoded into meters, kilometers, feet or inches. Light on the other hand is macrocoded on two levels. Because light already has a 'form' which can be manipulated, the macrocoding of light takes place both at the internal level (e.g., manipulating photon measurements) and at a external level (e.g., creating measurement units for the light spectrum). Macrocodes govern the transfer of microcodes but they are increasingly becoming interdependent.

Etymology note: The term macrocode was chosen for this concept as in the dictionary (www.dict.org) macro is referred to imply: "very large in scale or scope or capability". But furthermore, the term has also come to be used in computing dictionaries to refer to a single computer instruction that results in a series of instructions in machine language. Thus, in computers, a macro is any programming or user interface that, when used, expands into something larger.

The following illustrates the interaction between micro and macrocodes of power:

Imputed Conception:

Micro (external codes)	Macro (internal codes)
Will	Agency
Mind	Body
Potential	Kinetic
Information	Time/Space

Computed conception:

Micro (external codes)	Macro (internal codes)
Software	Hardware
Virtual mind & Physical body	Physical Mind & Virtual body
Will/Agency	Will/Agency
Coded pulses of Light (*internal)	Standardization of Light (*external)

(N)etherface - The largely invisible network of (underwater and overland) fiber optic cables through which light is transmitted; also, the wavelengths of the spectrum that are utilized for transmissions in wireless communications.

Etymology note: The term (n)etherface was chosen for this concept as it is a combination of the term "nether" meaning the underside or obscured region, and the use of the term 'ether' a non-existent medium which physicists once believed filled all space and was the medium through which light was propogated.

Photon - A quantum of electromagnetic energy or a particle of light. Photons have zero rest mass and travel exactly at the speed of light.

Potential energy - The energy that a body or medium has that is not yet expressed or actualized in motion. Utilized here synonymously with *Will.*

Qubit - ("quantum"+"bit") A qubit is a bit of information represented by a quantum object (e.g., a single atom, ion, or photon). Just as in a classical information system a bit is the basic unit of information, a qubit is the basic unit of information of a quantum information system. The power of a qubit is that it is not restricted to a value of 0 or 1. It can actually be in a "superposition" state of any combination of 0 or 1 simultaneously.

Receiver - An organ (e.g., eye/ear) or system that is able to decode information received from transmissions in the environment. In the case of optical receivers, the optical transmissions consist of three basic elements: the optical transmitter, the fiber optic cable and the optical receiver.

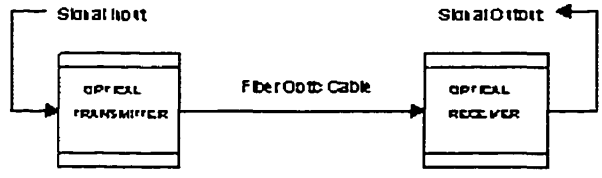


Figure 1. Basic Fiber Optic Transmission System

(source: *Introduction to Fiber Optics.* 1999. http://www.commspecial.com/fiberguide.htm)

Surface -Surfaces are those planes which are inscribed for transfer through macrocoded dimensions. Surfaces today are disappearing into digital or qubital forms.

Superluminar - Faster than the speed of light

Synchronoptic - The perspective of being able to see events at the same time

Transmitter - A system which encodes information for transmission. Specifically, with respect to optoelectronics "The basic optical transmitter converts electrical input signals into modulated light for transmission over an optical fiber. Depending on the nature of this signal, the resulting modulated light may be turned on and off or may be linearly varied in intensity between two predetermined levels".

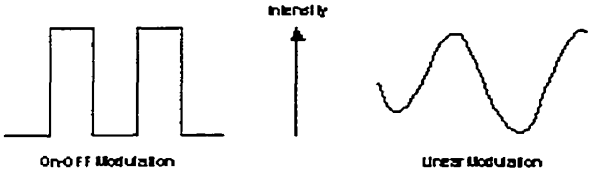


Figure 2. Basic Optical Modulation Methods

(source: *Introduction to Fiber Optics.* 1999. http://www.commspecial.com/fiberguide.htm)

Will - The use of the word "will" in this text refers to the faculty of choice. It exists as a form of *potential energy.* That is, it may be considered a psychological phenomenon which has a force-like characteristic in that it directs efforts in acting or trying to act out a chosen course of events.

APPENDIX A: DEVELOPING INFORMATION

Information and Development. Upon first glance, most people would assume that they know the 'meaning' of these two words. But how does one describe 'information' or 'development'? Is there a 'pure form' to which these words adhere? What, in essence, to they signify?

The word 'information' comes from the Latin 'informatio' which can be translated to mean "training, correction, instruction" or "image and imagination". The word actually only started to make an appearance in German dictionaries in the early 19th century, and later in English, it came to represent several designated meanings: as instruction, investigation, message or report (Poerksen, 1995). In the 1950's and 60's however, the word was appropriated by the sciences of cybernetics and information theory - though its definition in the realm of cybernetics is quite distinct. In a paper entitled *What is Information*, Bernhard Hassenstein illustrates how the word here is conceived: "The information content of a phenomenon, symbol, or signal has the same significance as a quantitative statement about the probability that something will appear somewhere" (cit. in Poerksen, 1995: 39).

But by the time 'information' had filtered its way out of the labs, the new word had displaced its old meanings almost entirely. 'Information' re-entered the sphere of the vernacular with a new sense of legitimacy and authorization. 'Information' had become something 'real':

> From 'information' as an action in time or an event, right up to the description of a result, and the use of the word as a name for an object, the transitions were smooth...Since the 1970s...the meaning has shifted completely, away from something happening in time toward its target. "Information" has become predominantly a description of a result or of a kind of object (Poerksen, 1995: 39).

By axing the etymological roots of the word, the new term became a free agent; a coded clone that could roam through discourse with the mask of its predecessor: a word with no referent.

'Information', disembedded from a specific place or locale; is now an untouchable commodity that has acquired an exchange value. And, today it is quite evident that those who do not possess 'information' are the sufferers of the manufactured notions of 'information deficits' and 'information gaps'. In fact, it is fair to say that today whole economies are arrested and are becoming dependent in part, by their apparent 'lack' of a hold over an intangible and indefinable commodity of words.

"Development" is another word that made a recent transformation into our common parlance. Again with a borrowed legitimacy from the domain of science, the word's original usage denoted the natural growth, or process through which living organisms reached their mature state. Between 1759 (Wolf) and 1859 (Darwin) however, the term also came to imply a process toward not only a complex full-form, but also a more refined and 'perfect' form. This definition still survives in contemporary dictionaries. Furthermore, in the biological sense, deviations from this process (i.e. organisms which do not follow this evolution) are considered 'abnormal' or 'pathological'. According to Gustavo Esteva, in 1768 the biological metaphor was appropriated into the social sphere by Justus Moser who used it to denote a process of gradual social change. Moser spoke of *Entwicklung* in describing

political situations as almost natural processes (Esteva, 1992). After being picked up again by various esteemed scholars (e.g. Hegel, Marx, Darwin) the expression was then leached back into the vernacular where "...it acquired a violent colonizing power, soon employed by the politicians. It converted history into a programme: a necessary and inevitable destiny" (Esteva, 1992: 9). 'Development' shifted from its grammatical status a reflexive verb to its current application as a noun. The word was re-coded with a transferred 'definition':

> [The word 'development']...is now a mere algorithm whose significance depends on the context in which it is employed. It may allude to a housing project, to the logical sequence of a thought, to the awakening of a child's mind, to a chess game or to the budding of a teenager's breasts. But even though it lacks, on its own, any precise denotation, it's firmly seated in popular and intellectual perception. And it always appears as an evocation of a net of significances in which the person who uses it is irremediably trapped (Esteva, 1992: 10).

As with 'information', all of a sudden a 'lack' could be proclaimed; and, on January 20, 1949 President Truman gave birth to the word 'underdeveloped'. All of a sudden, two billion people acquired a pathology. Today, two-thirds of the population are quarantined by the mark of the term. In contrast to the developed nations, a new condition now existed, a 'lack', and one that needed to be filled. Esteva writes:

> The metaphor of development gave global hegemony to a purely Western genealogy of history, *robbing peoples of different cultures of the opportunity to define the forms of their social life*...The very discussion of the origin or current causes of underdevelopment illustrates to what extent it is admitted to be something real, concrete, quantifiable and identifiable: a phenomenon whose origin and modalities can be the subject of investigation. *The word defines a perception. This becomes, in turn, an object, a fact* (emphases mine, Esteva, 1992: 11).

The words 'information' and 'development' have been coded in our daily parlance as though they were 'real' things: processes that have become objects. In fact, technically the world can now be divided up into those who possess 'information' and are thus 'developed' (1st world countries) and those who lack 'information' and are hence 'underdeveloped' (3rd world countries). Specifically moreover, the 'information revolution' is apparently something that two-thirds of the world's inhabitants now 'need' in order to be on par with those who are already 'developed'. But again, what is 'information'? Is it e-mail, teleconferencing, web-pages, education, news or statistics that will satiate this seemingly unending hunger for the development of information? Will the rush to buy and institute the new 'information technologies' from the 'developed world' truly provide relief from physical famines? In fact, in their desire to 'catch up' to their 'superior', 'developed' neighbors in the north, many countries have now been forced into tighter subordinate economic roles. That is, 'development' means that they continue to produce for export; suffer from great reductions in social spending and state subsidies; have sold off much of their valuable land to the private sector, and have been coerced to open their markets to foreign trade and investment (Sussman & Lent, 1991). Development as a project becomes billions of dollars in loans (which can be translated as debt) which keeps these nations in an economic gridlock. For

instance, many countries in fact owe more than they receive from development institutions such as the World Bank (Brazier, 1997). That is, more often than not, the money for 'development' circulates right back into the pockets of the 'developers' themselves (i.e. the first world nations) (Zagorin, Ganguly & McCluskey, 1994).

The terms 'information' and 'development' are codes in the sense that they form a larger framework which structures and *defines our perception* of reality. As such, they are not simply words, but in fact, *procedural systems*. That is, as *coded definitions* they are substantial in that they function in today's networked societies as *commands*; words are passed on from one individual to the next in the form of *action*.

I chose the two words 'information' and 'development' in particular, as they are part of a new development program currently being instituted by the World Bank: infoDEV or the Information for Development Program. A summary of the infoDEV project is included below. I invite the reader to examine the text considering the implications noted above.

INFORMATION FOR DEVELOPMENT PROGRAM

1. The creation of infoDev results from awareness that revolutionary advances in information and communications technologies have two concurrent and complementary impacts on developing countries and economies in transition: first, they open up extraordinary opportunities to accelerate social and economic development; second, they create a pressing reform and investment agenda both to capitalize on the new opportunities and to avoid the deterioration of international competitiveness.
2. Development opportunities that become possible are, for example, to educate more people and support lifelong learning; to make governments more efficient, accountable, and transparent; to increase effectiveness of development policy reforms (for example administrative decentralization); to improve the efficiency of customs activities; to better monitor and protect the environment; to overcome natural disadvantages; to diversify into information-intensive industries; to promote small and medium enterprises; to reduce the isolation of disadvantaged rural and urban communities and integrate them into economic life; to improve effectiveness of preventive health programs and the efficiency of health service delivery, etc.
3. The pressing reform and investment agenda aims to move countries into a different kind of economy - the information economy - where information is the key factor of production, trade and investment are global, and firms compete on the basis of knowledge, networking and agility on a worldwide basis. This agenda also leads countries into a new type of society - the information society - different from the industrial society: far better informed, much more competitive, more democratic, more decentralized, more flexible, more able to address individual needs, and friendlier to the environment.
4. Essential elements of the reform and investment agenda are: The creation of an information-friendly environment where information and communication markets are open and properly regulated; where the primary responsibility for investment and service provision rests with the private sector, and the government has primarily a regulatory role; and where laws protecting investment, intellectual property, and individual privacy are existent and enforced. The development of human resources for the information age through appropriate education and training policies and institutions. The deployment of national information infrastructures (NII) and the connection of these infrastructures to global information networks. The NII consists of both telecommunications networks and strategic information systems necessary for widespread access to communications and information services.
5. Both the extraordinary development opportunities and the reform and investment agenda are of direct concern to governments, to the World Bank in its mission of poverty alleviation and sustainable economic development, to bilateral and international aid organizations, to academia, to non-governmental organizations, and to the private sector as the primary engine of the information economy. infoDev intends to foster a partnership among these actors to support and accelerate the reform and investment agenda and to demonstrate and exploit the link between information and development.

(source: www.worldbank.org)

APPENDIX B: LIGHT SPACE (STU)

Introduction to Spectrum Licensing

Spectrum licensing is a form of licensing introduced in Australia by the Radiocommunications Act 1992. Spectrum licences were awarded for the first time in 1997, following the auction of the 500 MHz band. Spectrum licences are a tradeable, technology neutral (that is, the licence is not related to any particular technology, system or service) spectrum access right for a fixed non-renewable term. Instead of authorising the use of a specific device, spectrum licences authorise the use of spectrum space and give licensees the freedom to deploy any device from any site within their spectrum space, provided that the device is compatible with the core conditions of the licence and the technical framework for the bands.

Spectrum licences offer a new way of managing the radiofrequency spectrum. Licensees will have the flexibility to plan and deploy devices within their spectrum space. Licences are for a fixed term of up to fifteen (15) years.

Within the bounds of spectrum space and the technical coordination framework, licensees will be free to operate whatever type of communications service they choose, and be able to change that service in response to technical improvements or changes in consumer demand. The only requirement is that some types of device must be registered with the ACA before they can be operated.

Spectrum licences are tradeable. Licensees can negotiate with others to buy and sell spectrum space in the open market as the need arises, or authorise others to use their spectrum space. Spectrum licence can be aggregated or sub-divided to form new licences.

Spectrum Space

The concept of "spectrum space" is fundamental to the ACA's approach to spectrum licensing. Spectrum space is conceptually like other examples of three dimensional space. It covers an area and it has a height. Spectrum space, if thought of as a cube, covers a geographic area authorised by a licence. The area is like the floor of the cube. The radiofrequency bandwidth is represented by the height of the cube.

Standard Trading Units

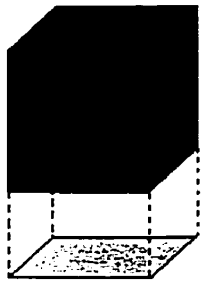
The challenge in developing spectrum licensing was the need to have a licensing and management system that was capable of maintaining exclusivity of access for each spectrum licensee, in a medium which is effectively a continuum in at least three dimensions.

The solution to this problem was to commoditise the spectrum subject to spectrum licensing; that is, to create finite indivisible three-dimensional units of spectrum space that can be aggregated into useful configurations. A necessary condition of each STU is that its ownership cannot be shared, and this allows exclusivity of access to be preserved.

Source: Australian Communications Authority. 1999
http://www.aca.gov.au/licence/spectrum/index.htm

These finite indivisible units of spectrum space are called standard trading units, or STUs (Figure 1).

Figure 1: Standard Trading Units (STUs)



Standard Trading Units are like cubes of spectrum space.

STUs are like building blocks, or house bricks. By themselves, they are too small to have much utility, but because of their regular shape, and their referential relationship with their immediate neighbours, they can be stacked vertically, or horizontally with neighbouring STUs to form larger bodies of spectrum space that do have utility (Figure 2).

Figure 2: STUs can be aggregated

STUs can be stacked vertically (left) to provide increased bandwidth, or horizontally (right) to cover a larger area.

The main use of the STU concept is in trading spectrum space. Licensees can negotiate to buy and sell spectrum space in terms of STUs. By trading at the level of STUs, the requirement for exclusivity is preserved. Licensees who wish to trade part of a licence can disaggregate the licence into its component STUs and sell them individually or in multiples. A single STU is the smallest unit of spectrum space for which the ACA will issue a licence or register trading.

The frequency bandwidth of STUs may vary in size depending on the spectrum band in which licences are being issued, but the area grid will be constant for all bands.

Source: Australian Communications Authority. 1999
http://www.aca.gov.au/licence/spectrum/index.htm

Cordless Telephones

1

43.69–46.6 MHz	base stations (channels 1 to 15)
46.6–47 MHz	base stations (16 to 25)
47–49.6 MHz	handsets (1 to 15)
49.6–50 MHz	handsets (16 to 25)

When cordless phones were first introduced, they saturated the airwaves, leading to crosstalk, interference, and eavesdropping. Random radio signals from other phones led to spontaneous ringing and weird squawking noises. Then in April 1995, the FCC allocated more frequencies for cordless phones and required that phones operating in these new frequencies have interference-prevention mechanisms. Now, a new generation of even higher quality cordless phones is moving to the 902- to 928-MHz and 1920- to 1930-MHz bands.

72.44–75.4 MHz
Instant replay: special portable radios remind at stadiums or golf courses can pick up broadcasts of sporting events.

Broadcast Television

2

54–72 MHz	VHF TV channels 2, 3, and 4
76–88 MHz	VHF TV channels 5 and 6
174–216 MHz	VHF TV channels 7 to 13
470–512 MHz	UHF TV channels 14 to 20
512–608 MHz	UHF TV channels 21 to 36
614–806 MHz	UHF TV channels 38 to 69

While broadcast TV is familiar to channel surfers everywhere, see **Digital Television** to glimpse the next wave.

608–614 MHz
No transmissions are permitted on channel 37, a scientific band reserved for radio astronomy

161.625–161.775 MHz
Back to you, Tom: this is how those TV reporters on location get a signal from the van with the telescopic antenna back to the station

Digital Tele

3

174–216 MHz
470–698 MHz
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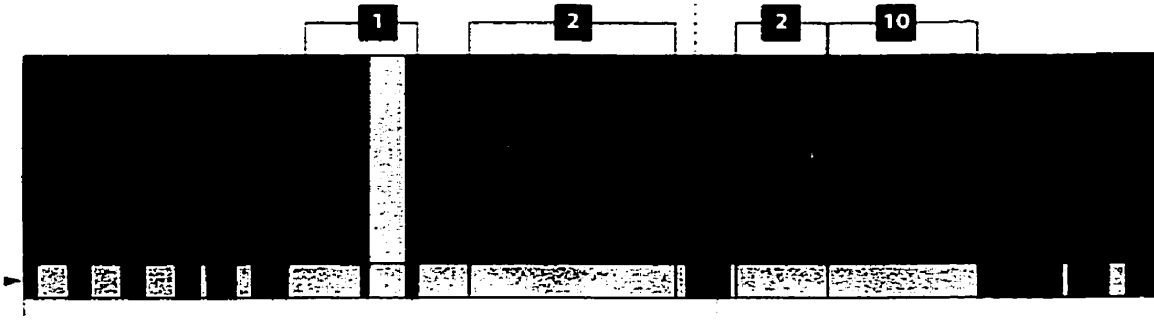


30 MHz

FM Radio Broadcasting

10

88–108 MHz
While the world of classic rock and drive-time celebs is still a very analog place, some digital experimentation is beginning – spurred by the expected arrival of satellite-based digital audio radio services.

49.82–49.90 MHz
Have a cordless phone and a baby monitor? Don't be surprised if your kid butts into the conversation. Both devices operate within the same frequency and baby monitors often cause interference

Cellular Phones

11

824–849 MHz
869–894 MHz
During the mid-1980s, the FCC decided to reallocate a portion of what was formerly UHF-TV spectrum (channels 70 to 83) to mobile services, jump-starting the wireless industry. The analog cellular standard is known as AMPS (advanced mobile phone service), first developed by AT&T in 1970. Today, there are more than 40 million analog cell phone users in the United States.

The cellular industry is developing digital equipment to keep up with new, advanced digital communications services like PCS, which have invaded the wireless market. AT&T recently introduced a digital cellular service that will provide digital paging, voicemail, and Caller ID. As analyst Mark Lowenstein puts it, "This is really the beginning of the digital wars."

72–73 MHz
75.4–76 MHz
Toy story: remote-control trucks can choose from 50 channels for model airplanes and 30 channels for model boats and cars.

259–220 MHz
Now this is not money: ETS, the electronic tracking subsidiary of ProNet, has developed instruments that are hidden in money or other valuables so police can later track them down.

The Public/Private Split

- Nongovernment-Exclusive
- Government-Exclusive
- Government/Nongovernment Shared

Spectrum is considered a natural resource that belongs to the people. The American people, through the federal government, license companies to use that resource. So all the usable spectrum is divided into three categories: *government-exclusive*, or terrain that only the government can use (including defense and public safety); *nongovernment-exclusive*, or terrain that businesses or private citizens use; and *shared*.

Digital Television

3

174-216 MHz VHF chools 7 to 13 (proposed)
470-698 MHz UHF chools 14 to 51 (proposed)

Digital TV will allow transition of a new generation of high-definition pictures and CDuality sound. Digitizing the signals without upgrading the vid and audio will enable up to six analog-style programs to transmitted simultaneously over the same channel where one keled before.

One of the most difficuasks facing the FCC this year will be orchestrating the transitorom analog to digital broadcasting. Last July, Congress reyecten FCC proposal to auction off a portion of the spectrum, emated to be worth $11 billion to $70 billion, for digital TV. Insteibroadcasters will be lent an additional 6-MHz channel at most to simulcast in both analog and digital until enough viewetuve purchased digital receivers. Upon completion of this 10 to 15-year transition, the broadcasters will return their originanalog channel to the government.

470-512 MHz
Forget Elmo. Now we've got stuffed animals that can talk in response to data signals sent on the frequency from television sets.

Specialized Mobile Radio

4

800-MHz SMR **806-821 MHz mobile-to-base frequencies**
851-866 MHz base-to-mobile frequencies
900-MHz SMR **896-901 MHz mobile-to-base frequencies**
935-940 MHz base-to-mobile frequencies

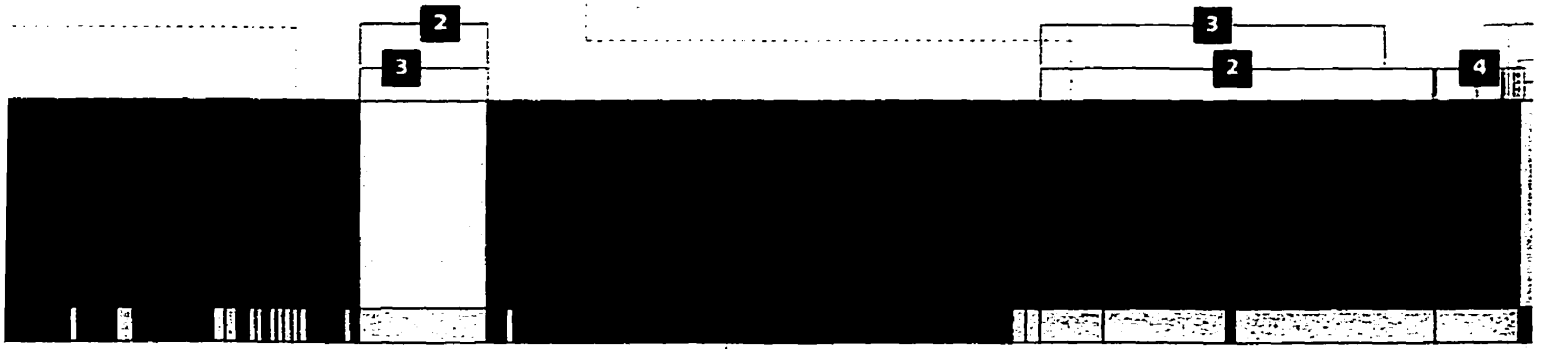
Out of the auctions emerged another formidable challenger in the wireless industry: specialized mobile radio. Plain old SMR services have been targeted to users who need to dispatch mobile units, such as those in the construction and transportation industries. But new digital SMR services are poised to compete with cellular phones and PCS for voice and data mobile communications. Nextel Communications, the leading SMR licensee, now offers an attractive mobile service free of roaming charges and is hoping to build a digital network that will cover 85 percent of the US population by the end of 1998. Craig McCaw has faith in Nextel's future success – he invested $1.1 billion.

Personal Communicatior Services (Narrowband)

5a

901-902 MHz
930-931 MHz
940-941 MHz

This narrowband PCS spectrum was the subject of the first license auction ever held by the FCC, in July 1994. This is the terrain for paging and messaging giants Mtel, AT&T Wireless, AirTouch, MobileComm, and PageNet, among others. These advanced networks can accommodate two-way paging devices and one-way alphanumeric messaging.



300 MHz

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f boats and cars.

0 MHz
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an later track them down.

Multiple Address Systems

12

928-929 MHz
932-932.5 MHz
941-941.5 MHz
952-960 MHz

Here's one you run into every day but never knew was there. Multiple address systems involve communications between a central master station and surrounding remote stations. Utilities and pipelines use MAS to monitor distribution systems; airports use it to control runway lights; banks use it for ATM transactions; retailers use it for credit card verification; and restaurants and offices use it to play elevator music. MAS spectrum is very congested and the FCC allocated new space in the 932- and 941-MHz bands to accommodate increased use. However, MAS operators are still waiting for the FCC to act on licenses pending since 1992.

173.075 MHz
Car thieves, beware. The Stolen Vehicle Recovery Service uses this FBI channel to activate a tracking beacon installed inside vehicles. Developed by LoJack Corp., these beacons will contact specially equipped police cars, which are nearly identical to these four vehicles' antennas.

Geostationary Mobile Satellite Service

13

1525-1530 MHz	lower L-band
1530-1544 MHz	lower L-band
1626.5-1645.5 MHz	lower L-band
1545-1559 MHz	upper L-band
1646.5-1660.5 MHz	upper L-band

Hovering at a stationary point 22,320 miles above the earth, geostationary satellites transmit signals for weather, television, and telecommunications services. Geostationary satellites, which travel in a geosynchronous orbit, could offer global service, but because the satellite is so far away, there is a slight delay of one or two seconds in signal transmission. The only geostationary satellite licensee in the United States is American Mobile Satellite Corp., whose $500 million satellite was launched in April 1995, offering voice, data, and fax services.

The International Mobile Satellite Organization, a.k.a Inmarsat, links these satellites to telecommunications networks through ground stations operated in each country by a designated signatory. The US signatory is Comsat Corp.

303.4, 315, 318 MHz
Muted signals while these frequencies are commonly used for remote controls and car alarms, they also carry high-powered transmissions from Air Force One. The president has been known to open garage doors throughout neighborhoods in his flight path.

THE ELECTROMAGNETIC SPECTRUM

Personal Communications Services (Broadband)

5b

1850-1990 MHz **broadband PCS**
1910-1930 MHz **unlicensed PCS**

The Guinness Book of Records declared the selloff of PCS spectrum the largest auction in history. FCC chair Reed Hundt called it "one of the most important sales of public property since Napoleon sold almost half of the west of this country to Jefferson's United States." Total broadband PCS auctions raised upward of $20 billion for the federal government.

Driving the explosive growth in the wireless industry are the champions of PCS: PrimeCo Personal Communications (a partnership of Bell Atlantic, Nynex, AirTouch, and U S West), Sprint Spectrum, AT&T Wireless, and NextWave Personal Communications. These nascent broadband personal communications services are becoming fierce competitors to their cellular phone siblings, offering rates up to 20 percent lower than cellular services. PCS devices employ digital transmission, which results in better sound quality, reliability, and security.

2450 MHz
There are more than 100 million ovens in the US pumping out microwaves in this frequency. Let's hope they cause no harm.

Digital Audio Radio Services

6

2320-2345 MHz

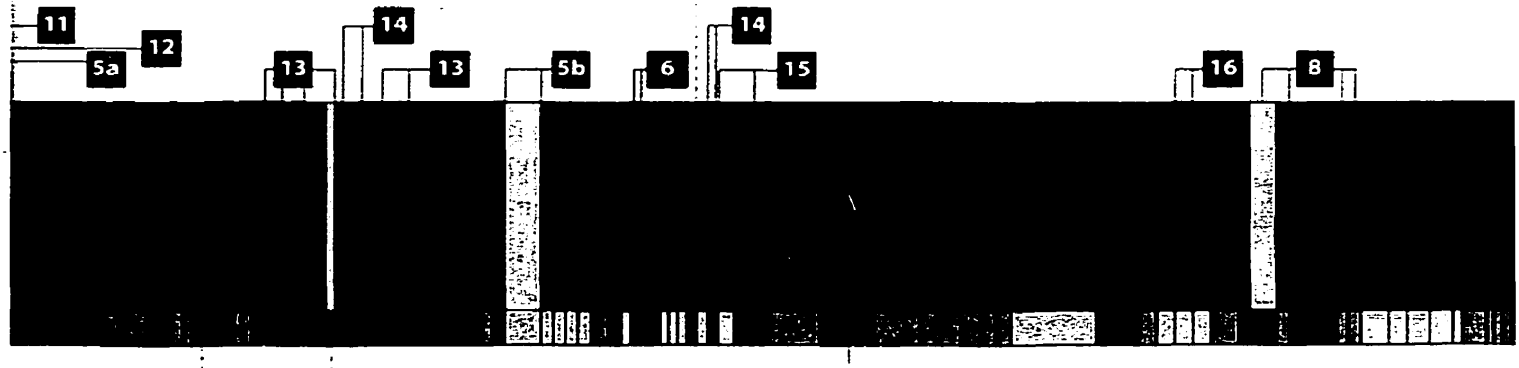
Music normally heard crackling over local radio stations soon will be coming in crystal clear on new digital channels. This spring, American Mobile Radio, CD Radio, Direct Broadcasting Satellite Corp., and Primosphere (formed by the managers of several pop stars, including Bruce Hornsby and Def Leppard) will vie in an auction for two slots allocated for digital audio satellite broadcasting. The satellites will beam 50 to 100 channels of specialized, CD-quality national programming to compete with ground-based radio broadcasters. A study by Mitre Corp. shows that 47 percent of surveyed consumers are willing to pay $5 to $10 per month for such services, but not everyone is enthused. Edward Fritts, president of the National Association of Broadcasters, declared that this "plethora of new technologies will be the death knell of local stations."

AM Radio Broadcasting

7

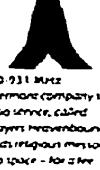
535-1605 kHz

AM radio is the granddaddy of wireless telecommunications not shown. Back in its day, the action o the wireless world took place ea down the spectrum block in the lower frequencies – so low that AM radio doesn't even map onto the chart of hot spots today.



3 GHz

902-928 MHz
This is the realm of a variety of services, including wireless bar-code readers. Another, the NineChild monitoring system, locates lost children in amusement parks and zoos; the child wears a transponder that bounces signals to fixed transmitter sites in the park.



930-931 MHz
A Vermont company's radio service, called "Prayers Heavenbound," sends religious messages into space – for a fee.

Nongeostationary Mobile Satellite Service

14

1610-1626.5 MHz **NGSO/MSS (Big LEO) uplinks**
2483.5-2500 MHz **NGSO/MSS (Big LEO) downlinks**

Known as Big LEOs (for their low-Earth orbit), nongeostationary mobile satellites orbit about 800 miles above the earth. The *nongeostationary* part of the name refers to the moving satellite; the *mobile* part of the name refers to the moving devices on the ground receiving the signals.

There are three licensed Big LEOs: Motorola's $3.7 billion Iridium, a 66-satellite system; TRW's $1.8 billion Odyssey, a 12-satellite system; and Loral/Qualcomm's $1.5 billion Globalstar, a 48-satellite system.

Big LEOs will provide worldwide digital wireless communications services (voice, data, paging, fax). The development of a "world phone" for ubiquitous telecommunications will be especially useful in rural areas and in countries with remote villages and limited wired networks. The end result: you'll be in touch wherever you are on the planet.

1420-1660 MHz
The Search for Extraterrestrial Intelligence League monitors this band for "The Signal" that will prove we're not alone.

Wireless Cable

15

2500-2655 MHz
2655-2690 MHz

Wireless cable is not an oxymoron – it's a method of moving cable television programming through microwaves. Using a microwave technology known as multichannel multipoint distribution service (MMDS), wireless cable operators can deliver up to 33 channels of programming to viewers who receive the signals with rooftop antennas and set-top boxes.

CAI Wireless Systems Inc., the largest wireless cable operator, recently received approval from the FCC to begin two-way voice, video, and data transmission. MMDS operators – especially the RBOCs – hope that these new digital systems, which increase the number of channels and offerings available to subscribers, will make them more competitive with cable and satellite broadcasters.

General Commun

16

adio Broadcasting

)5 1605 GHz
M radio is the granddaddy of wireless telecommunications hot-spots. Back in its day, the action of the wireless world took place way down the spectrum block in the lower frequencies – so low that AM radio doesn't even map onto the chart of hot spots today.

Unlicensed National Information Infrastructure

8

5.15–5.35 GHz
5.725–5.875 GHz

In the spirit of keeping some of the public airwaves public, the FCC has allocated open space for devices using this band. These devices will provide an economical means for classrooms, hospitals, libraries, and other public institutions to be linked to advanced networks without the need for wires. Rural areas can become part of the National Information Infrastructure cost-effectively, bringing us one step closer to the ideal of universal access.

Separate efforts – by Apple Computer and WINForum, a group of mostly computer and communications hardware firms – to develop wireless local-area networks (NII Band and SUPERNet, respectively) can now proceed. These networks will enable digital transfer of data, video, and imaging to occur at the rate of up to 20 million bits per second. WINForum claims SUPERNet will be able to transmit a 1,000-page, single-spaced document in a little more than three seconds.

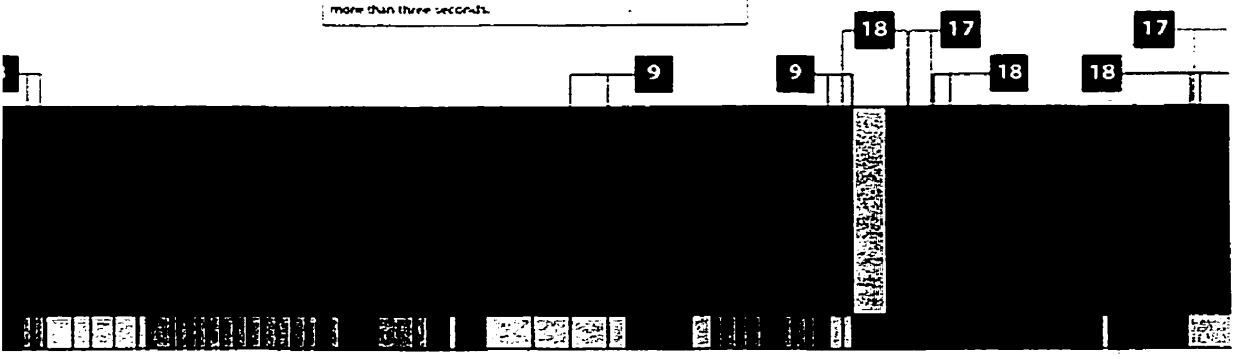
Direct Broadcast Satellites

9

12.2–12.7 GHz DBS downlinks
17.3–17.8 GHz DBS uplinks

DBS can broadcast 175 channels of specialized programming, including CD-quality audio channels and pay-per-view movies, to 18-inch satellite dishes. With more than 4 million current subscribers, DBS has quickly become a powerful new competitor to cable television.

In January 1996, MCI outbid TCI for the second to last available DBS orbital spot for the United States, paying $682.5 million for a spectrum license so they can then build a $1 billion satellite broadcast system. MCI joins DirecTV, US Satellite Broadcasting, and EchoStar as a provider in the rapidly growing market for DBS services.



30 GI

General Wireless Communications Service

16

4.66–4.685 GHz

Slated for auction this year are 875 licenses to provide general wireless communications service, which represents an important milestone in the industrywide push for spectrum flexibility. Those who secure the licenses will be permitted to offer virtually any wireless service: two-way interactive data transmission, cellular phone, microwave, dispatch, whatever. Only public broadcasting, radar systems, and satellite services are off limits. Practical applications of this latest breed of wireless communications might include in-flight airline entertainment.

Teledesic

17

18.8–19.3 GHz
28.8–29.1 GHz

This massive $9.55 billion nongeostationary fixed satellite project plans to launch 840 satellites (at the cost of $5.5 million apiece), creating a global "Internet in the sky." At a capacity equivalent to 20,000 simultaneous T1 lines, the Teledesic network will offer voice channels, videoconferencing, and interactive multimedia channels to fixed devices on the ground at transmission speeds 60 times faster than today's modems. Operation is expected to begin by 2002.

Cofounders Bill Gates and Craig McCaw, each of whom owns a third of the company, want to do nothing less than seamlessly link people and businesses anywhere on the planet. "I think this has the potential to change the world as much as the first transcontinental railway," says an admittedly biased observer. Teledesic CEO David Twyver.

24.15 GHz
Beware the cop with the K-band police radar. He's operating on this frequency.

Fixed Satellite Service

18

17.7–18.8 GHz downlinks
19.7–20.2 GHz downlinks
28.35–28.6 GHz uplinks
29.5–30 GHz uplinks

These fixed satellite systems are not to be confused with the Big LEO mobile satellite systems like Iridium and Globalstar, which are being developed for global portable phones. These geostationary satellites will provide high-speed Internet-like services including email, database access, software distribution, videoconferencing, and financial transactions to fixed equipment on the ground. In that respect, they will compete with Teledesic, which is classified as a nongeostationary fixed satellite service.

A lot of big players are lining up to develop communications services that can be reached from all over the planet. GE American Communications has proposed a system of nine satellites. Hughes Communications Galaxy has proposed a 20-satellite system. Other big system developers include AT&T, Lockheed Martin, Comm Inc., and EchoStar. Many believe that these fixed satellite systems will have a tremendous social and economic impact in the next century. We'll see.

Source: "The Manhattan Spectrum of Real Estate" in *Wired* 5.04. April, 1997.

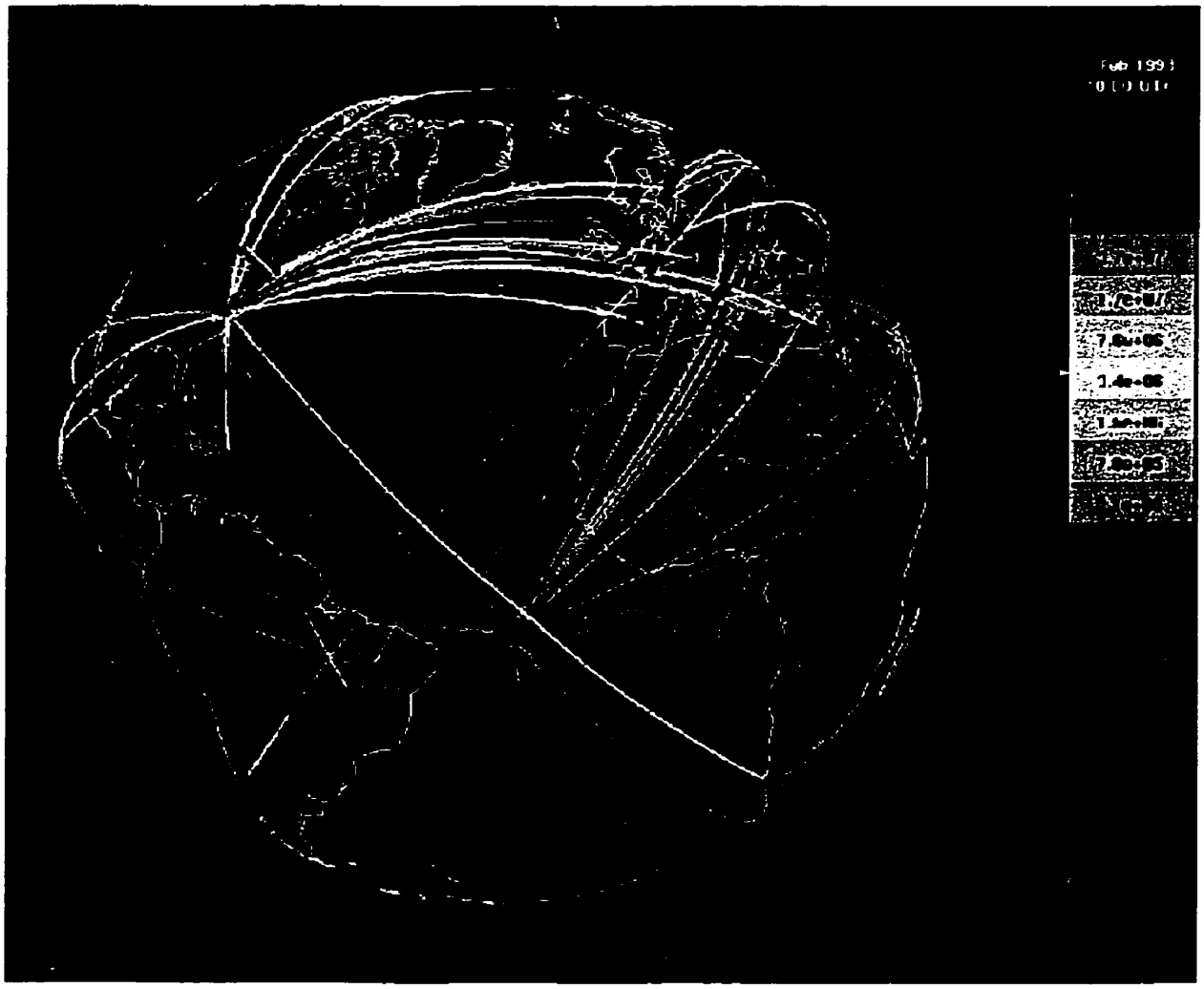


Figure 1: The Translucent Globe - Network Visualization Map

Source: Eick, Stephen G. Visualization Research Group at *Bell Laboratories*. 1996.
http://www.bell-labs.com/user/eick/NetworkVis.html

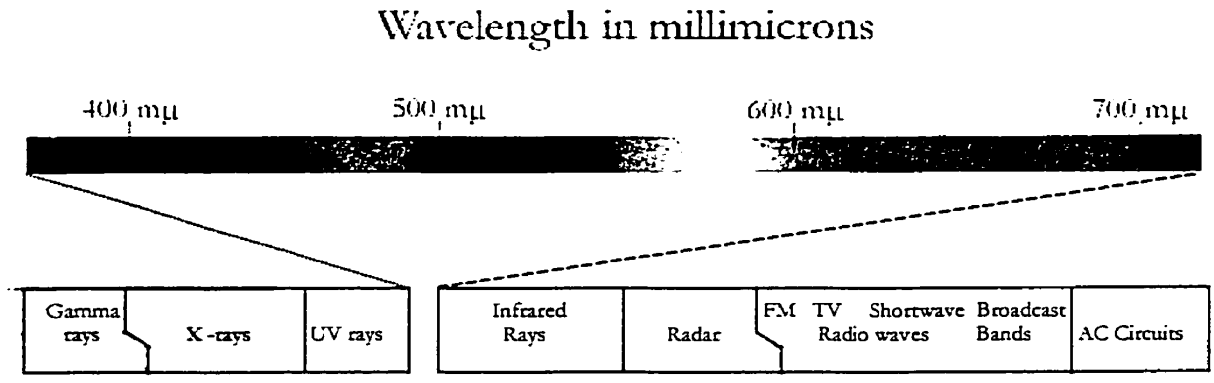


Figure 2: The Visible Portion of the Electromagnetic Spectrum

Source: Darley, John M., Glucksberg, Sam & Kinchla, Ronald A. *Psychology* (4th ed.). New Jersey: Prentice Hall, 1988: 105.

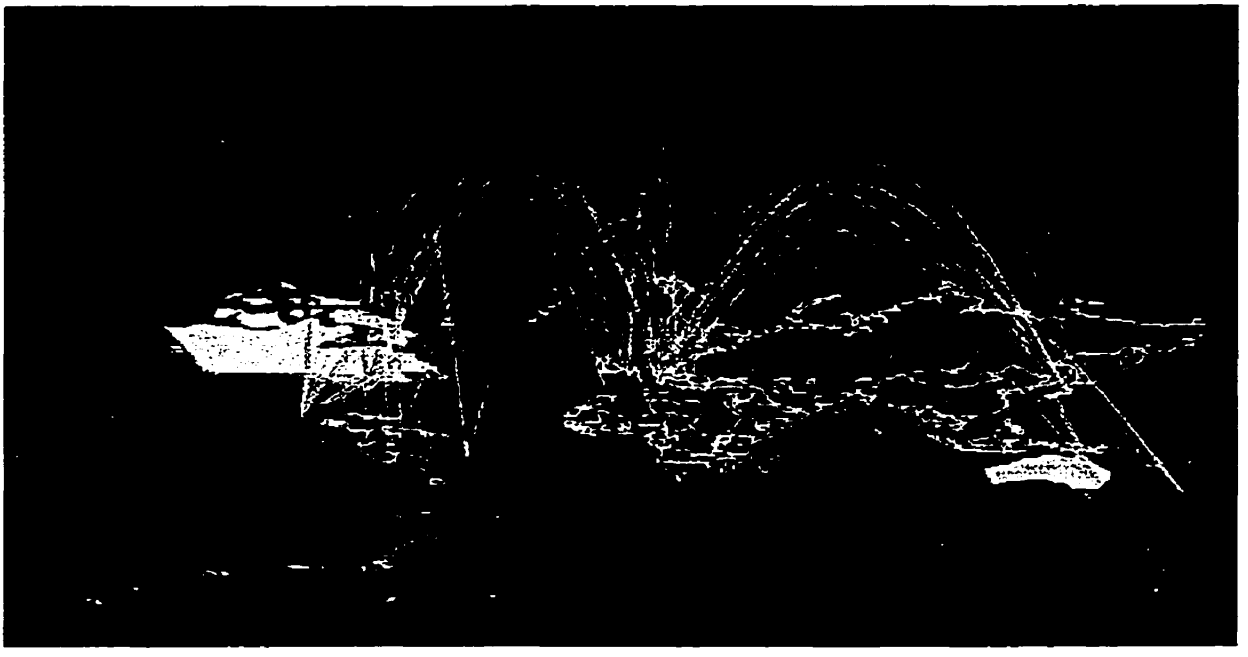


Figure 3: The Dark & Light Continents

Source: Eick, Stephen G. Visualization Research Group at *Bell Laboratories*. 1996.
http://www.bell-labs.com/user/eick/NetworkVis.html

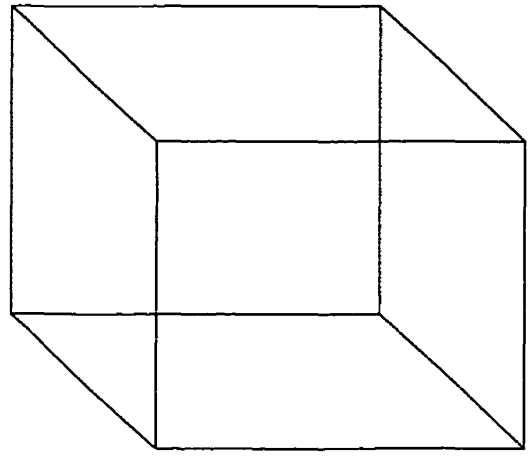


Figure 4: The Necker Cube
Stare at the figure to see its visual reversals

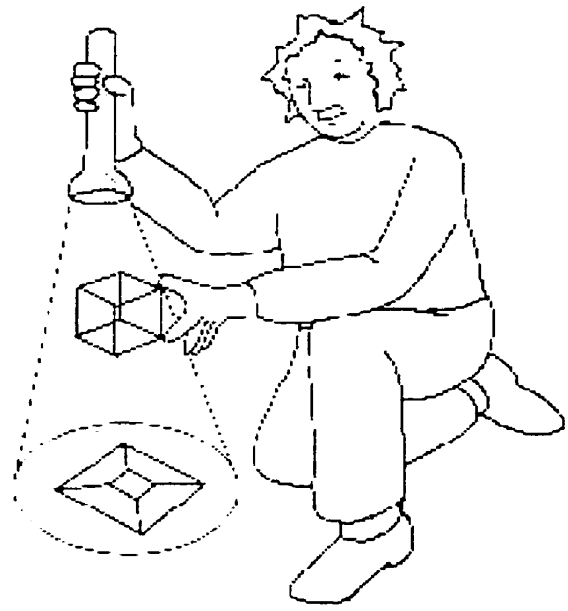


Figure 5: The Shadow of Light
"Visualizing" a 3D cube by its 2D shadow

Source: Kaku, Michio. *Hyperspace*. Oxford: Oxford University Press, 1994: 73.

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