Navigable space

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Doom and Myst

Looking at the first decade of new media — the 1990s — one can point at a number of objects which exemplify new media's potential to give rise to genuinely original and historically unprecedented aesthetic forms. Among them, two stand out. Both are computer games. Both were published in the same year, 1993. Each became a phenomenon whose popularity has extended beyond the hard core gaming community, spilling into sequels, books, TV, films, fashion and design. Together, they defined the new field and its limits. These games are Doom (id Software, 1993) and Myst (Cyan, 1993).

In a number of ways, Doom and Myst are completely different. Doom is fast paced; Myst is slow. In Doom the player runs through the corridors trying to complete each level as soon as possible, and then moves to the next one. In Myst, the player is moving through the world literally one step at a time, unraveling the narrative along the way. Doom is populated with numerous demons lurking around every corner, waiting to attack; Myst is completely empty. The world of Doom follows the convention of computer games: it consists of a few dozen levels. Although Myst also contains four separate worlds, each is more like a self-contained universe than a traditional computer game level. While the usual levels are quite similar to each other in structure and the look, the worlds of Myst are distinctly different.

Another difference lies in the aesthetics of navigation. In Doom's world, defined by rectangular volumes, the player is moving in straight lines, abruptly turning at right angles to enter a new corridor. In Myst, the navigation is more free-form. The player, or more precisely, the visitor, is slowly exploring the environment:

she may look around for a while, go in circles, return to the same place over and over, as though performing an elaborate dance.

Finally, the two objects exemplify two different types of cultural economy. With Doom, id software pioneered the new economy which the critic of computer games J.C. Herz summarizes as follows: "It was an idea whose time has come. Release a free, stripped-down version through shareware channels, the Internet, and online services. Follow with a spruced-up, registered retail version of the software." 15 million copies of the original Doom game were downloaded around the world.[1] By releasing detailed descriptions of game files formats and a game editor, id software also encouraged the players to expand the game, creating new levels. Thus, hacking and adding to the game became its essential part, with new levels widely available on the Internet for anybody to download. Here was a new cultural economy which transcended the usual relationship between producers and consumers or between “strategies” and “tactics” (de Certeau): the producers define the basic structure of an object, and release few examples and the tools to allow the consumers to build their own versions, shared with other consumers. In contrast, the creators of Myst followed an older model of cultural economy. Thus, Myst is more similar to a traditional artwork than to a piece of software: something to behold and admire, rather than to take apart and modify. To use the terms of the software industry, it is is a closed, or proprietary system, something which only the original creators can modify or add to.

Despite all these differences in cosmogony, gameplay, and the underlying economic model, the two games are similar in one key respect. Both are spatial journeys. The navigation though 3-D space is an essential, if not the key component, of the gameplay. Doom and Myst present the user with a space to be traversed, to be mapped out by moving through it. Both begin by dropping the player somewhere in this space. Before reaching the end of the game narrative, the player must visit most of it, uncovering its geometry and topology, learning it logic and its secrets. In Doom and Myst — and in a great many other computer games — narrative and

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[1] J.C.Hertz, Joystick Nation (Boston: Little, Brown and Company, 1997), 90, 84.

time itself are equated with the movement through 3-D space, the progression through rooms, levels, or words. In contrast to modern literature, theater, and cinema which are built around the psychological tensions between the characters and the movement in psychological space, these computer games return us to the ancient forms of narrative where the plot is driven by the spatial movement of the main hero, traveling through distant lands to save the princess, to find the treasure, to defeat the Dragon, and so on. As J.C. Herz writes about the experience of playing a classical text-based adventure game Zork, "you gradually unlocked a world in which the story took place, and the receeding edge of this world carried you through to the story's conclusion."[2] Stripping away the representation of inner life, psychology and other modernist nineteenth century inventions, these are the narratives in the original Ancient Greek sense, for, as Michel de Certau reminds us, "In Greek, narration is called 'diagesis': it establishes an itinerary (it 'guides) and it passes through (it 'transgresses").[3]

The central role of navigation through space is acknowledged by the games' designers themselves. Robyn Miller, one of the two co-designers of Myst pointed out that "We' are creating environments to just wonder around inside of. People have been calling it a game for lack of anything better, and we've called it a game at times. But that's not what it really is; it's a world."[4] Richard Garriott, the designer of classical RPG Ultima series, contrasts game design and fiction writing: "A lot of them [fiction writers] develop their individual characters in detail, and they say what is their problem in the beginning, and what they are going to grow to learn in the end. That's not the method I've used... I have the world. I have the message. And then the characters are there to support the world and the message."[5]

Structuring the game as a navigation through space is common to games

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[2] Ibid., 150.

[3] Michel de Certeau, The Practice of Everyday Life, trans. Steven Rendall (Berkely, University of California Press, 1984), 129.

[4] Chris McGoman and Jim McCullaugh, Entertainment in the Cyber Zone (New York: Random House, 1995), 120.

[5] Qtd. in J.C.Hertz, Joystick Nation, 155-156.

across all the game genres. This includes adventure games (for instance, Zork, 7th Level, The Journeyman Project, Tomb Raider, Myst), strategy games (Command and Conquer) role-playing games (Diablo, Final Fantasy), flying, driving, and other simulators (Microsoft Flight Simulator), action games (Hexen, Mario), and, of course, first person shooters which have followed in Doom's steps (Quake, Unreal). These genres follow different conventions. In adventure games, the user is exploring an universe, gathering resources. In strategy games, the user is engaged in allocating and moving resources and in risk management. In RPGs (role playing games), the user is building a character, acquiring the skills; the narrative is one of self-improvement. The genre conventions by themselves do not make it necessary for these games to employ a navigable space interface. Therefore, the fact that they all consistently do use it suggests to me that navigable space represents a larger cultural form. In other words, it is something which transcends computer games, and in fact, as we will see later, computer culture as well. Just like a database, navigable space is a form which already exists before computers; however, the computer becomes its perfect medium.

Indeed, the use of navigable space is common to all areas of new media. During the 1980s, numerous 3-D computer animations were organized around a single, uninterrupted camera move through a complex and extensive set. In a typical animation, a camera would fly over mountain terrain, or move through a series of rooms, or maneuver past geometric shapes. In contrast to both ancient myths and computer games, this journey had no goal, no purpose. In short, there was no narrative. Here was the ultimate "road movie" where the navigation through the space was sufficient in itself.

In the 1990s, these 3-D fly-throughs have come to constitute the new genre of post-computer cinema and location-based entertainment — the motion simulator.[6]

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6 For critical anaylsis of motion simulator phenomenon, see Erkki Huhtamo, "Phantom Train to Technopia," in Minna Tarkka, ed., ISEA '94. The 5fth International Symposium on Electronic Art Catalogue (Helsinki: University of Art and Design, 1994); "Encapsulated Bodies in Motion: Simulators and the Quest for Total Immersion," in Simon Penny, ed., Critical Issues in Electronic Media (State University of New York Press, 1995).

By using the first person point of view and by synchronizing the movement of the platform housing the audience with the movement of a virtual camera, motion simulators recreate the experience of traveling in a vehicle. Thinking about the historical precedents of a motion simulator, we begin to uncover some places where the form of navigable space already manifested itself. They include *Hale's Tours and Scenes of the World ,* a popular film-based attraction which debuted at the St. Louis Fare in 1904; roller-coaster rides; flight, vehicle and military simulators, which used a moving base since the early 1930s; and the fly-through sequences in *2001: A Space Odyssey* (Kubrick, 1968) and *Star Wars* (Lucas, 1977). Among these, *A Space Odyssey* plays particularly important role; Douglas Trumbull, who since the late 1980s produced some of the most well-known motion simulator attractions and was the key person behind the rise of the whole motion simulator phenomenon begun his career by creating ride sequences for this film.

Along with providing a key foundation for new media aesthetics, navigable space also became a new tool of labor. It is now a common way to visualize and work with any data. From scientific visualization to walk-throughs of architectural designs, from models of a stock market performance to statistical datasets, the 3-D virtual space combined with a camera model is the accepted way to visualize all information (see the section "The Language of Cultural Interfaces"). It is as accepted in computer culture as charts and graphs were in a print culture.

Since navigable space can be used to represent both physical spaces and abstract information spaces, it is only logical that it also emerged as an important paradigm in human-computer interfaces. Indeed, on one level HCI can be seen as a particular case of data visualization, the data being computer files rather than molecules, architectural models or stock market figures. The examples of 3-D navigable space interfaces are the Information Visualizer (Xerox Parc) which replaces a flat desktop with 3-D rooms and planes rendered in perspective; [7]

[7] Stuart Card, George Robertson, Jock Mackingly, "The Information Visualizer, an Information Workplace," in CHI'91: Human Factors in Computing Systems Conference Proceedings (New York: ACM, 1991) , 181-186; available online at http://www.acm.org/pubs/articles/proceedings/chi/108844/p181-card/p181-card.pdf, accessed June 18, 1999.

T_Vision (ART+COM) which uses a navigable 3-D representation of the earth as its interface;[8] and The Information Landscape (Silicon Graphics) in which the user flies over a plane populated by data objects.[9]

The original (i.e. the 1980's) vision of cyberspace called for a 3-D space of information to be traversed by a human user, or, to use the term of William Gibson, a "data cowboy."[10] Even before Gibson's fictional descriptions of cyberspace were published, cyberspace was visualized in the film *Tron* (Disney, 1982). Although *Tron* takes place inside a single computer rather than a network, its vision of users zapping through the immaterial space defined by lines of light is remarkably similar to the one articulated by Gibson in his novels. In an article which appeared in the 1991 anthology Cyberspace: First Steps Marcos Novak still defined cyberspace as "a completely spatialized visualization of all information in global information processing systems."[11] In the first part of the 1990s, this vision has survived among the original designers of VRML (The Virtual Reality Modeling Language). In designing the language, they aimed to "create a unified conceptualization of space spanning the entire Internet, a spatial equivalent of WWW."[12] They saw VRML as a natural stage in the evolution of the Net from an abstract data network toward a "'perceptualized' Internet where the data has been sensualized," i.e., represented in three dimensions.[13]

The term cyberspace itself is derived from another term— cybernetics. In his 1947 book Cybernetics mathematician Norbert Wiener has defined it as "the science of control and communications in the animal and machine." Wiener conceived of

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8 http://www.artcom.de/projects/t_vision/, accessed Dec. 26, 1998.

9 http://www.acm.org/sigchi/chi95/proceedings/panels/km_bdy.htm, accessed Dec. 26, 1998.

10 William Gibson, Neuromancer (New York: Ace Books, 1984).

11 Marcos Novak, "Liquid Architecture in Cyberspace," in Michael Benedict, ed., Cyberspace: First Steps (Cambridge, Mass.: The MIT Press, 1991).

12 Mark Pesce, Peter Kennard and Anthony Parisi, "Cyberspace," 1994. Http://www.hyperreal.org/~mpesce/www.html, accessed June 17, 1999.

13 Ibid.

cybernetics during World War II when he was working on problems concerning gunfire control and automatic missile guidance. He derived the term cybernetics from the ancient Greek word *kybernetikos* which refers to the art of the steersman and can be translated as “good at steering.” Thus, the idea of navigable space lies at the very origins of computer era. The steersman navigating the ship and the missile traversing space on its way to the target have given rise to a whole number of new figures: the heroes of William Gibson, the “data cowboys” moving through the vast terrains of cyberspace; the "driver" of a motion simulator; a computer user, navigating through the scientific data sets and computer data structures, molecules and genes, earth's atmosphere and the human body; and last but not least, the player of Doom, Myst and their endless imitations.

From one point of view, navigable space can be legitimately seen as a particular kind of an interface to a database, and thus something which does not deserve a special focus. I would like, however, to also think of it as a cultural form of its own, not only because of its prominence across the new media landscape and, as we will see later, its persistence in new media history, but also because, more so than a database, it is a new form which may be unique to new media. Of course both the organization of space and its use to represent or visualize something else have always been a fundamental part of human culture. Architecture and ancient mnemonics, city planing and diagramming, geometry and topology are just some of the disciples and techniques which were developed to harness space's symbolic and economic capital.[14] Spatial constructions in new media draw on all these existing traditions — but they are also fundamentally different in one key respect. For the first time, space becomes a media type. Just as other media types — audio, video, stills, and text — it can be now instantly transmitted, stored and retrieved, compressed, reformatted, streamed, filtered, computed, programmed and interacted with. In other words, all operations which are possible with media as a result of its conversion to

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[14] Michael Bendedict explores the relevance of some of these disciplines to the concept of cyberspace in the introduction to his groundbreaking anthology Cyberspace: First Steps, which remains one of the best books on the topic of cyberspace. Michael Benedict, ed., Cyberspace: First Steps (Cambridge, Mass.: The MIT Press, 1991).

computer data can also now apply to representations of 3-D space.

Recent cultural theory has paid increasing attention to the category of space. The examples are Henri Lefebvre's work on the politics and anthropology of everyday space; Michel Foucault's analysis of the Panopticon's topology as a model of modern subjectivity; and the writings of Frederick Jameson, David Harvey, and Edward Soja on the post-modern space of global capitalism.[15] At the same time, new media theoreticians and practitioners have come with many formulations of how cyberspace should be structured and how computer-based spatial representations can be used in new ways.[16] What received little attention, however, both in cultural theory and in new media theory, is a particular category of navigation through space. And yet, this category characterizes new media as it actually exists; in other words, new media spaces are always spaces of navigation. At the same time, as we will see later in this section, this category also fits a number of developments in other cultural fields such as anthropology and architecture.

To summarize, along with a database, navigable space is another key form of new media. It is already an accepted way for interacting with any type of data; an interface of computer games and motion simulators and, potentially, of any computer in general. Why does computer culture spatialize all representations and experiences (the library is replaced by cyberspace; narrative is equated with traveling through space; all kinds of data are rendered in three dimensions through computer visualization)? Shall we try to oppose this spatialization (i.e., what about time in new media?) And, finally, what are the aesthetics of navigation through virtual space?

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[15] Henri Lefebvre, The Production of Space (Oxford: Blackwell Publishers, 1991); Michel Foucault, Discipline and Punish: the Birth of the Prison (New York: Pantheon Books, 1977); Fredric Jameson, The Geopolitical Aesthetic: Cinema and Space in the World System (Bloomington : Indiana University Press, 1992); David Harvey, The Condition of Postmodernity (Oxford, England: Blackwell, 1989); Edward Soja, Postmodern Geographies: the Reassertion of Space in Critical Social Theory (London: Verso, 1989).

[16] See, for instance, Benedict, Cyberspace: First Steps; the articles of Marcos Novak (http://www.aud.ucla.edu/~marcos).

Computer Space

The very first coin-op arcade game was called Computer Space. The game simulated the dogfight between a spaceship and a flying saucer. Released in 1971, it was a remake of the first computer game Spacewar programmed on PDP-1 at MIT in 1962.[17] Both of these legendary games included the word space in their titles; and appropriately, space was one of the main characters in each of them. In the original Spacewar the player was navigating two spaceships around the screen while shooting torpedoes at one another. The player also had to be careful in maneuvering the ships to make sure they would not get too close to the star in the center of the screen which pulled them towards it. Thus, along with the spaceships, the player also had to interact with space itself. And although, in contrast to such films as *2001*, *Star Wars,* or*Tron*, the space of Spacewar and Computer Space was not navigable — one could not move through it — the simulation of gravity made it truly an active presence. Just as the player had to engage with the spaceships, he had to engage with the space itself.

This active treatment of space is an exception rather than the rule in new media. Although new media objects favor the use of space for representations of all kinds, most often virtual spaces are not true spaces but collections of separate objects. Or, to put this in a slogan: there is no space in cyberspace.

To explore this thesis further we can borrow the categories developed by art historians early in this century. Alois Riegl, Heinrich Wölfflin, and Erwin Panofsky, the founders of modern art history, defined their field as the history of the representation of space. Working within the paradigm of cyclic cultural development, they related the representation of space in art to the spirit of entire epochs, civilizations, and races. In his 1901 Die Spätrömische Kunstindustrie, (The late-Roman art industry) Riegl characterized mankind's cultural development as the oscillation between two ways of understanding space, which he called haptic and

[17] http://icwhen.com/the70s/1971.html, accessed November 21, 1998.

optic. Haptic perception isolates the object in the field as a discrete entity, while optic perception unifies objects in a spatial continuum. Riegl's contemporary, Heinrich Wölfflin, similarly proposed that the temperament of a period or a nation expresses itself in a particular mode of seeing and representing space. Wölfflin's Principles of Art History (1913) plotted the differences between Renaissance and baroque styles along five axes: linear/painterly; plane/recession; closed form/open form; multiplicity/unity; and clearness/unclearness.[18] Erwin Panofsky, another founder of modern art history, contrasted the "aggregate" space of the Greeks with the "systematic" space of the Italian Renaissance in his famous essay Perspective as Symbolic Form (1924-25).[19] Panofsky established a parallel between the history of spatial representation and the evolution of abstract thought. The former moves from the space of individual objects in antiquity, to the representation of space as continuous and systematic in modernity. Correspondingly, the evolution of abstract thought progresses from ancient philosophy's view of the physical universe as discontinuous and "aggregate", to the post-Renaissance understanding of space as infinite, homogeneous, isotropic, and with ontological primacy in relation to objects — in short, as systematic.

We don't have to believe in grand evolutionary schemes in order to usefully retain such categories. What kind of space is virtual space? At first glance the technology of 3-D computer graphics exemplifies Panofsky's concept of systematic space, which exists prior to the objects in it. Indeed, the Cartesian coordinate system is built into computer graphics software and often into the hardware itself.[20] A designer launching a modeling program is typically presented with an empty space defined by a perspectival grid; the space will be gradually filled by the objects created. If the built-in message of a music synthesizer is a sine wave, the built-in

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[18] Heinrich Wölfflin, Principles of Art History, translated by M. D. Hottinger (New York, Dover Publications, 1950).

[19] Erwin Panofsky, Perspective as Symbolic Form, translated by Christopher S. Wood (New York: Zone Books, 1991).

[20] Lev Manovich, "Mapping Space: Perspective, Radar and Computer Graphics," in SIGGRAPH '93 Visual Proceedings, ed. Thomas Linehan (New York: ACM, 1993.)

world of computer graphics is an empty Renaissance space: the coordinate system itself.

Yet computer-generated worlds are actually much more haptic and aggregate than optic and systematic. The most commonly used computer-graphics technique of creating 3-D worlds is polygonal modeling. The virtual world created with this technique is a vacuum containing separate objects defined by rigid boundaries. What is missing from computer space is space in the sense of medium: the environment in which objects are embedded and the effect of these objects on each other. This is what Russian writers and artists call prostranstvennaya sreda. Pavel Florensky, a legendary Russian philosopher and art historian has described it in the following way in the early 1920s: "The space-medium is objects mapped onto space... We have seen the inseparability of Things and space, and the impossibility of representing Things and space by themselves."[21] This understanding of space also characterizes a particular tradition of modern painting which stretches from Seurat to Giacommetti and De Kooning. These painters tried to eliminate the notions of a distinct object and an empty space as such. Instead they depicted a dense field that occasionally hardens into something which we can read as an object. Following the example of Gilles Deleuze's analysis of cinema as activity of articulating new concepts, akin to philosophy,[22] it can be said that modern painters which belong to this tradition worked to articulate the particular philosophical concept in their painting — that of space-medium. This concept is something mainstream computer graphics still has to discover.

Another basic technique used in creating virtual worlds also leads to aggregate space. It involves superimposing animated characters, still images, digital movies, and other elements over a separate background. Traditionally this technique

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[21] Quoted in Alla Efimova and Lev Manovich, "Object, Space, Culture: Introduction," in Tekstura: Russian Essays on Visual Culture, eds. Alla Efimova and Lev Manovich (Chicago: University of Chicago Press, 1993), xxvi.

[22] Gilles Deleuse, Cinema (Minneapolis: University of Minessota Press, 1986-1989).

was used in video and computer games. Responding to the limitations of the available computers, the designers of early games would limit animation to a small part of a screen. 2-D animated objects and characters called sprites were drawn over a static background. For example, in Space Invaders the abstract shapes representing the invaders would fly over a blank background, while in Pong the tiny character moved across the picture of a maze. The sprites were essentially animated 2-D cutouts thrown over the background image at game time, so no real interaction between them and the background took place. In the second half of the 1990s much faster processors and 3-D graphics cards made it possible for games to switch to real-time 3-D rendering. This allowed for modeling of visual interactions between the objects and the space they are in, such as reflections and shadows. Consequently, the game space became more of a coherent, true 3-D space, rather than a set of 2-D planes unrelated to each other. However, the limitations of earlier decades returned in another area of new media — online virtual worlds. Because of the limited bandwidth of the 1990s Internet, virtual world designers have to deal with constraints similar to and sometimes even more severe than the games designers two decades earlier. In online virtual worlds, a typical scenario may involve an avatar – a 2-D or 3-D graphic representing the user — animated in real time in response to the user's commands. The avatar is superimposed on a picture of a room, in the same way as in video games the sprites were superimposed over the background. The avatar is controlled by the user; the picture of the room is provided by a virtual-world operator. Because the elements come from different sources and are put together in real time, the result is a series of 2-D planes rather than a real 3-D environment. Although the image depicts characters in a 3-D space, it is an illusion since the background and the characters do not "know" about each other, and no interaction between them is possible.

Historically, we can connect the technique of superimposing animated sprites over the background to traditional cell animation. In order to save labor, animators similarly divide the image between a static background and animated characters. In fact the sprites of computer games can be thought of as reincarnated animation characters. Yet the use of this technique did not prevent Fleischer and Disney

animators from thinking of space as space-medium (to use Floresky's term), although they created this space-medium in a different way than the modern painters. (Thus while the masses run away from the serious and “difficult” abstract art to enjoy the funny and figurative images of cartoons, what they saw was not that different from Giacommetti’s and De Kooning’s canvases.) Although all objects in cartoons have hard edges, the total anthropomorphism of the cartoon universe breaks the distinctions both between subjects and objects and objects and space. Everything is subjected to the same laws of stretch and squash, everything moves and twists in the same way, everything is alive to the same extent. It is as though everything — the character’s body, chairs, walls, plates, food, cars and so on — is made from the same bio-material. This monism of the cartoon worlds stands in opposition to the binary ontology of computer worlds in which the space and the sprites — characters appear to be made from two fundamentally different substances.

In summary, although 3-D computer-generated virtual worlds are usually rendered in linear perspective, they are really collections of separate objects, unrelated to each other. In view of this, the common argument that 3-D computer simulations return us to Renaissance perspective and therefore, from the viewpoint of twentieth-century abstraction, should be considered regressive, turns out to be ungrounded. If we are to apply the evolutionary paradigm of Panofsky to the history of virtual computer space, we must conclude that it has not reached its Renaissance stage yet. It is still at the level of ancient Greece, which could not conceive of space as a totality.

Computer space is also aggregate yet in another sense. As I already noted using the example of Doom, traditionally the world of a computer game is not a continuous space but a set of discrete levels. In addition, each level is also discrete — it is a sum of rooms, corridors, and arenas built by the designers. Thus, rather conceiving space as a totality, one is dealing with a set of separate places. The convention of levels is remarkably stable, persisting across genres and numerous computer platforms.

If the World Wide Web and VRML are any indications, we are not moving any

closer toward systematic space; instead, we are embracing aggregate space as a new norm, both metaphorically and literally. The space of the Web in principle can't be thought of as a coherent totality: it is a collection of numerous files, hyperlinked but without any overall perspective to unite them. The same holds for actual 3-D spaces on the Internet. A 3-D scene as defined by a VRML file is a list of separate objects that may exist anywhere on the Internet, each created by a different person or a different program. A user can easily add or delete objects without taking into account the overall structure of the scene.[23] Just as, in the case of a database, the narrative is replaced by a list of items, here a coherent 3-D scene becomes a list of separate objects.

With its metaphors of navigation and home steading, The Web has been compared to the American Wild West. The spatialized Web envisioned by VRML (itself a product of California) reflects the treatment of space in American culture generally, in its lack of attention to any zone not functionally used. The marginal areas that exist between privately owned houses, businesses and parks are left to decay. The VRML universe, as defined by software standards and the default settings of software tools, pushes this tendency to the limit: it does not contain space as such but only objects that belong to different individuals. Obviously, the users can modify the default settings and use the tools to create the opposite of what the default values suggest. In fact, the actual muti-user spaces built on the Web can be seen precisely as the reaction against the anti-communal and discrete nature of American society, the attempt to substitute for the much discussed disappearance of traditional community by creating virtual ones. (Of course, if we are to follow the nineteenth century sociologist Ferdinand Tönnies, the shift from traditional close-knit scale community to modern impersonal society already took place in the nineteenth century and is an inevitable side-effect as well as a prerequisite for modernization.[24]) However, it is important that the ontology of virtual space as

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[23] Jed Hatman and Josie Werneke, The VRML 2.0 Handbook (Reading, Mass.: Addison-Wesley Publishing Company, 1996).

[24] See Ferdinand Tönnies, Community and Society, trans. Charles P. Loomis (East Lansing, Michigan State University Press, 1957).

defined by software itself is fundamentally aggregate, a set of objects without a unifying point of view.

If art historians, literary and film scholars have traditionally analyzed the structure of cultural objects as reflecting larger cultural patterns (for instance, Panofsky's reading of perspective), in the case of new media we should look not only at the finished objects but first of all at the software tools, their organization and default settings.[25] This is particularly important because in new media the relation between the production tools and the products is one of continuity; in fact, it is often hard to establish the boundary between them. Thus, we may connect the American ideology of democracy with its paranoid fear of hierarchy and centralized control with the flat structure of the Web, where every page exists on the same level of importance as any other and where any two sources connected through hyperlinking have equal weight. Similarly, in the case of virtual 3-D spaces on the Web, the lack of a unifying perspective in U.S. culture, whether in the space of an American city, or in the space of an increasingly fragmented public discourse, can be correlated with the design of VRML, which substitutes a collection of objects for a unified space.

The Poetics of Navigation

In order to analyze the computer representations of 3-D space, I have used theories from early art history; but it would not be hard to find other theories which can work as well. However, navigation through space is a different matter. While art history, geography, anthropology, sociology and other disciplines have came up with many approaches to analyze space as a static, objectively existing structure, we don't have the same wealth of concepts to help us think about the poetics of navigation through space. And yet, if I am right to claim that the key feature of computer space is that it is navigable, we need to be able to address this feature theoretically.

As a way to begin, we may take a look at some of the classical navigable

[25] One importance exeption was the Apparatus theory developed by film theoreticians in the 1970s.

computer spaces. The 1978 project Aspen Movie Map , designed at the MIT Architecture Machine Group, headed by Nicholas Negroponte (which later expanded into MIT Media Laboratory) is acknowledged as the first publicly shown interactive virtual navigable space, and also as the first hypermedia program. The program allowed the user to "drive" through the city of Aspen, Colorado. At each intersection the user was able to select a new direction using a joystick. To construct this program, the MIT team drove through Aspen in a car taking pictures every three meters. The pictures were then stored on a set of videodiscs. Responding to the information from the joystick, the appropriate picture or sequence of pictures was displayed on the screen. Inspired by a mockup of an airport used by the Israeli commandos to train for the Entebbe hostage-freeing raid of 1973,Aspen Movie Map was a simulator and therefore its navigation modeled the real-life experience of moving in a car, with all its limitations.[26] Yet its realism also opened a new set of aesthetic possibilities which unfortunately later designers of navigable spaces did not explore further. Al of them relied on interactive 3-D computer graphics to construct their spaces. In contrast, Aspen Movie Map utilized a set of photographic images; in addition, because the images were taken every three meters, this resulted in an interesting sampling of three dimensional space. Although in the 1990s Apple's QuickTime VR technology made this technique itself quite accessible, the idea of constructing a large-scale virtual space from photographs or a video of a real space was never tried out systematically again, although it opens up unique aesthetic possibilities not available with 3-D computer graphics.

Jeffrew Shaw's Legible City (1988-1991), another well-known and influential computer navigable space, is also based on the exiting city.[27] As in Aspen Movie Map, the navigation also simulates a real physical situation, in this case driving a bicycle. Its virtual space, however, is not tied to the simulation of physical reality: it is an imaginary city made from 3-D letters. In contrast to most navigable spaces whose

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[26] Stewart Brand, The Media Lab (New York: Penguin Books, 1988), 141.

[27] Manuela Abel, ed., Jeffrew Shaw - a User's Manual (Kalsuhe, Germany: ZKM, 1997), 127 - 129. Three difirent versions of Legible City were created based on the ground plans of Manhattan, Amsterdam and Karlsruhe, Germany.

parameters are chosen arbitrarily, in Legible City (Amsterdam and Karlsruhe versions) every value of its virtual space is derived from the actual existing physical space it replaces. Each 3-D letter in the virtual city corresponds to an actual building in a physical city; the letter's proportions, color and location are derived from the building it replaces. By navigating through the space, the user reads the texts composed by the letters; these texts are drawn from the archive documents describing the city history. Through this mapping Jeffrew Shaw foregrounds, or, more precisely, "stages," one of the fundamental problematics of new media and the computer age as a whole: the relation between the virtual and the real. In his other works Shaw systematically "staged" other key aspects of new media such as the interactive relation between the viewer and the image, or the discrete quality of all computer-based representations. In the case of Legible City, it functions not only as a unique navigable virtual space of its own, but also as a comment on all the other navigable spaces. It suggests that instead of creating virtual spaces which have nothing to do with actual physical spaces, or the spaces which are closely modeled after existing physical structures, such as towns or shopping malls, (this holds for most commercial virtual worlds and VR works), we may take a middle road. In Legible City, the memory of the real city is carefully preserved without succumbing to illusionism; the virtual representation encodes the city's genetic code, its deep structure rather than its surface. Through this mapping Shaw proposes an ethics of the virtual. If, according to a well-known statement by Walter Benjamin, all history is the history of barbarism and destruction, and if, according to a number of modern critics from Roland Barthes to Jean Baudrillard, all signification involves violence, with a sign displacing the object it stands for and ultimately "killing" the real, Shaw suggests that the virtual can at least preserve the memory of the real it replaces, encoding its structure, if not aura, in a new form.

While Legible City was a landmark work in that it presented a symbolic rather than illusionistic space, its visual appearance reflected the default real-time graphics capability of SGI workstations on which it was running: flat-shaded shapes attenuated by a fog. Char Davies and her development team at SoftImage have consciously addressed the goal of creating a different, more painterly aesthetic for

the navigable space in their interactive VR installation Osmose (1994-1995).[28] From the point of view of history of modern art the result hardly represented an advancement. Osmose simply replaced the usual hard-edge polygonal Cézanne-like look of 3-D computer graphics look with a softer, more atmospheric, Renoir or late Monet-like environment made of translucent textures and flowing particles. Yet in the context of other 3-D virtual worlds it was an important advance. The “soft” aesthetic of Osmose is further supported through the use of slow cinematic dissolves between its dozen or so worlds. Like in Aspen Movie Map and in Legible City, the navigation in Osmose is modeled on a real-life experience, in this case, of scuba diving. The "immersant” is controlling navigation by breathing: breathing in sends the body upward, while breathing out makes it fall. The resulting experience, according to the designers, is one of floating, rather than flying or driving, typical of virtual worlds. Another interesting aspect of Osmose's navigation is its collective character. While only one person can be "immersed" at a time, the audience can witness her or his journey through the virtual worlds as it unfolds on a large projection screen. At the same size, another translucent screen enables the audience to observe the body gestures of the “immersant” as a shadow-silhouette. The "immersant" thus becomes a kind of ship captain, taking the audience along on a journey; like the captain, she occupies a visible and symbolically marked position, being responsible for the audience's aesthetic experience.

Tamás Waliczky’s The Forest (1993) liberated the virtual camera from its typical enslavement to the simulation of humanly possible navigation, be it walking, driving a car, pedaling a bicycle or scuba diving. In The Forest the camera slides through the endless black and white forest in a series of complex and melancholic moves. If modern visual culture exemplified by MTV can be thought of as a Mannerist stage of cinema, its perfected techniques of cinematography, mise-en-scene and editing self-consciously displayed and paraded for its own sake, Waliczky's film presents an alternative response to cinema’s classical age, which is now behind us. In this meta-film, the camera, part of cinema’s apparatus, becomes

[28] http://www.softimage.com/Projects/Osmose/

the main character (in this we may connect The Forest to another meta-film, A Man with a Movie Camera). On first glance, the logic of camera movements can be identified as the quest of a human being trying to escape from the forest (which, in reality, is just a single picture of a tree repeated over and over). Yet, just as in some of the Brothers Quay animated films such as The Street of Crocodiles, the virtual camera of The Forest neither simulates natural perception nor does it follow the standard grammar of cinema's camera; instead, it establishes a distinct system of its own. If in The Street of Crocodiles the camera suddenly takes off, moving in a straight line as though mounted on some robotic arm, and just as suddenly stops to frame a new corner of the space, in The Forest it never stops at all, the whole film being one uninterrupted camera trajectory. The camera system of The Forest can be read as a comment on a fundamentally ambiguous nature of computer space. On the one hand, not indexically tied up to physical reality or human body, computer space is isotropic. In contrast to human space, in which the verticality of the body and the direction of the horizon are two dominant directions, computer space does not privilege any particular axis. In this way it is similar to the space of El Lissitzky's Prouns and Kazimir Malevich's suprematist compositions – an abstract cosmos, unencumbered by either Earth's gravity or the weight of a human body. (Thus the game Spacewar with its simulated gravity got it wrong!) William Gibson's term "matrix' which he used in his novels to refer to cyberspace, captures well this isotropic quality. But, on the other hand, computer space is also a space of a human dweller, something which is used and traversed by a user, who brings her own anthropological framework of horizontality and verticality. The camera system of The Forest foregrounds this double character of computer space. While no human figures or avatars appear in the film and we never get to see either the ground or the sky, it is centered around the stand-in for the human subject — a tree. The constant movements of the camera along the vertical dimension throughout the film — sometimes getting closer to where we imagine the ground plane is located, sometimes moving towards (but again, never actually showing) the sky — can be interpreted as an attempt to negotiate between isotropic space and the space of human anthropology, with its horizontality of the ground plane and the horizontal and

vertical dimension of human bodies. The navigable space of The Forest thus mediates between human subjectivity and the very different and ultimately alien logic of a computer — the ultimate and omnipresent Other of our age.

The computer spaces just discussed, from Aspen Movie Map to The Forest, each establish a distinct aesthetic of their own. However, the majority of navigable virtual spaces mimic existing physical reality without proposing any coherent aesthetic programs. What artistic and theoretical traditions can the designers of navigable spaces draw upon to make them more interesting? One obvious candidate is modern architecture. From Melnikov, Le Corbusier and Frank Lloyd Wright to Arhigram and Bernard Tschumi, modern architects elaborated a variety of schemes for structuring and conceptualizing space to be navigated by users. Using a few examples from these architects, we can look at the 1925 USSR Pavilion (Melnikov,), Villa Savoye (Le Corbusier), Walking City (Arhigram), and Parc de la Villette (Tschumi).[29] Even more relevant is the tradition of "paper architecture" — the designs which were not intended to be built and whose authors therefore felt unencumbered by the limitations of materials, gravity and budgets.[30] Another highly relevant tradition is film architecture.[31] As discussed in the "Theory of Cultural Interfaces" section, the standard interface to computer space is the virtual camera modeled after a film camera, rather than a simulation of unaided human sight. After all, film architecture is The architecture designed for navigation and exploration by a film camera.

Along with different architectural traditions, designers of navigable spaces can find a wealth of relevant ideas in modern art. They may consider, for instance, the works of modern artists which exist between art and architecture and which, like

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[29] For a discussion of Archigram group in the context of computer-based virtual spaces, see Hans-Peter Schwarz, Media-Art-History. Media Museum (Munich: Prestel-Verlag, 1997), 74-76.

[30] See, for instance, Visionary Architects: Boullee, Ledoux, Lequeu (Houston: University of St. Thomas, 1968); Heinrich Klotz, ed., Paper architecture: New Projects from the Soviet Union (Frankfurt: Deutsches Architekturmuseum, 1988).

[31] See, for instance, Dietrich Neumann, ed., Film architecture: Set Designs from Metropolis to Blade Runner (Munich: Prestel, 1996).

projects of paper architects, display spatial imagination not tied up to the questions of utility and economy: warped worlds of Jean Dubuffet, mobiles by Alexander Calder, earth works by Robert Smithson, moving text spaces by Jenny Holzer. While many modern artists felt compelled to create 3-D structures in real spaces, others were satisfied with painting their virtual worlds: think, for, instance, of melancholic cityscapes by Giorgio de Chirico, biomorphic worlds by Yves Tanguy, economical wireframe structures by Alberto Giacometti, existential landscapes by Anselm Kiefer. Besides providing us with many examples of imaginative spaces, both abstract and figurative, modern painting is relevant to the design of virtual navigable spaces in two additional ways. First, since new media is most often experienced, like painting, via a rectangular frame (see "The Screen and the User"), virtual architects can study how painters organized their spaces within the constraints of a rectangle. Second, modern painters who belong to what I call the "space-medium" tradition elaborated the concept of space as a homogeneous dense field, where everything is made from the same "stuff" — in contrast to architects which always have to work with a basic dichotomy between the build structure and the empty space. And although virtual spaces realized until now, with the possible exception of Osmose, follow the same dichotomy between rigid objects and a void between them, on the level of material organization they are intrinsically related to the monistic ontology of modern painters such as Matta, Giacometti, or Pollock, for everything in them is also made from the same material – pixels, on the level of surface; polygons or voxels, on the level of 3-D representation). Thus virtual computer space is structurally closer to modern painting than to architecture.

Along with painting, a genre of modern art which has a particular relevance to the design of navigable virtual spaces is installation. Seen in the context of new media, many installations can be thought of as dense multimedia information spaces. They combine images, video, texts, graphics and 3-D elements within a spatial layout. While most installations leave it up to the viewer to determine the order of "information access" to their elements, one of the most well-known installation artists, Ilya Kabakov, elaborated a system of strategies to structure the

viewer's navigation through his spaces.[32] According to Kabakov, in most installations "the viewer is completely free because the space surrounding her and the installation remain completely indifferent to the installation it encloses."[33] In contrast, by creating a separate enclosed space with carefully chosen proportions, colors and lighting within the larger space of a museum or a gallery, Kabakov aims to completely "immerse" the viewer inside his installation. He calls this installation type a "total installation."

For Kabakov, "total" installation has a double identity. On the one hand, it belongs to plastic arts designed to be viewed by an immobile spectator — painting, sculpture, architecture. On the other hand, it also belongs to time-based arts such as theater and cinema. We can say the same about virtual navigable spaces. Another concept of Kabakov's theory which is directly applicable to virtual space design is his distinction between the spatial structure of an installation and its dramaturgy, i.e. the time-space structure created by the movement of a viewer through an installation.[34] Kabakov's strategies of dramaturgy include dividing the total space of an installation into two or more connected spaces; creating a well-defined path through the space which does not preclude the viewer from wandering on her own, yet prevents her from feeling being lost and being bored. To make such a path, Kabakov constructs corridors and abrupt openings between objects, he also places objects in strange places to obstruct passage where one expects to discover a clear pathway. Another strategy of "total installation" is the choice of particular kinds of narratives which lead themselves to spatialization. These are the narratives which take place around a main event which becomes the center of an installation: "the beginning [of the installation] leads to the main event [of the narrative] while the last part exists after the event took place." Yet another strategy involves the positioning of text within the space of an installation as a way to orchestrate the attention and navigation of the

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[32] Ilya Kabakov, On the "Total Installation" (Bonn: Cantz Verlag, 1995).

[33] Ibid., 125. This and the following translations from Russian text of Kabakov are mine — L.M.

[34] Ibid., 200.

viewer. For instance, placing two to three pages of texts at a particular point in the space creates a rhythmic stop in the navigation rhythm.[35] Finally, Kabakov "directs" the viewer to keep alternating between focusing her attention on particular details and the installation as a whole. He describes these two kinds of spatial attention (which we can also correlate with haptic and optic perception as theorized by Riegl and others) as follows: "wandering, total ("summarnaia") orientation in space — and active, well-aimed 'taking in' of partial, small, the unexpected."[36]

All these strategies can be directly applied to the design of virtual navigable spaces (and interactive multimedia in general). In particular, Kabakov is very successful in making the viewers of his installations carefully read significant amounts of text included in them — something which represents a constant challenge for new media designers. His constant emphasis on always thinking about the viewer's attention and reaction to what she will encounter — "the reaction of the viewer during her movement through the installation is the main concern of her designer… The loss of the viewer's attention is the end of the installation"[37] — is also an important lesson to new media designers who often forgot that what they are designing is not an object in itself but a viewer's experience in time and space.

I have used the word "strategy" to refer to Kabakov's techniques on purpose. To evoke the terminology of The Practice of Everyday Life by French writer Michel de Certeau, Kabakov uses strategies to impose a particular matrix of space, time, experience and meaning on his viewers; they, in their turn, use "tactics" to create their own trajectories (this is a term actually used by de Certeau) within this matrix. If Kabakov is perhaps the most accomplished architect of navigable spaces, de Certeau can very well be their best theoretician. Like Kabakov, he never dealt with computer media directly, and yet his The Practice of Everyday Life has a multitude of ideas directly applicable to new media. His general notion of how a user's "tactics" which create their own trajectories through the spaces defined by others (both

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[35] Ibid., 200-208.

[36] Ibid., 162.

[37] Ibid., 162.

metaphorically, and, in the case of spatial tactics, literally) is a good model to think about computer users navigating through computer spaces they did not design:

Although they are composed with the vocabularies of established languages (those of television, newspapers, supermarkets of established sequences) and although they remain subordinated to prescribed syntactical forms (temporal modes of schedules, paradigmatic orders of spaces, etc.), the trajectories trace out the rules of other interests and desires that are neither determined, nor captured by, the system in which they develop.[38]

The Flâneur and The Explorer

Why is navigable space such a popular construct in new media? What are the historical origins and precedents of this form?

In his famous 1863 essay "The Painter of Modern Life", Charles Baudelaire documented the new modern male urban subject — the flâneur.[39] An anonymous observer, the flâneur navigates through the space of a Parisian crowd, recording and immediately erasing the faces and the figures of the passers-by in his memory. From time to time, his gaze meets the gaze of a passing woman, engaging her in a split-second virtual affair, only to be unfaithful to her with the next female passer-by. The flâneur is only truly at home in one place — moving through the crowd. Baudelaire writes: "To the perfect spectator, the impassioned observer, it is an immense joy to make his domicile amongst numbers, amidst fluctuation and movement, amidst the fugitive and infinite… To be away from home, and yet to feel at home; to behold the world, to be in the midst of the world and yet to remain hidden from the world." There is a theory of navigable virtual spaces hidden here, and we can turn to Walter Benjamin to help us in articulating it. According to Benjamin, the flâneur's navigation transforms the space of the city: "The Crowd is the veil through which the familiar

[38] de Certeau, The Practice of Everyday Life, xviii.

[39] Charles Baudelaire, "The Painter of Modern Life," in My Heart Laid Bare and Other Prose Writings (London: Soho Book Company, 1986).

city lures the flâneur like a phantasmargonia. In it the city is now a landscape, now a room."[40] The navigable space thus is a subjective space, its architecture responding to the subject's movement and emotion. In the case of the flâneur moving through the physical city, this transformation of course only happens in the flâneur's perception, but in the case of navigation through a virtual space, the space can literally change, becoming a mirror of the user's subjectivity. The virtual spaces built on this principle can be found in such films as Waliczky's The Garden and The Dark City (Alex Proyas, 1998).

Following European tradition, the subjectivity of the flâneur is determined by his interaction with a group – even though it is a group of strangers. In place of a close-knit community of a small-scale traditional society (Gemeinschaft) we now have an anonymous association of a modern society (Gesellshaft).[41] We can interpret the flâneur's behavior as a response to this historical shift. It is as though he is trying to compensate for the loss of a close relationship with his group by inserting himself into the anonymous crowd. He thus exemplifies the historical shift from Gemeinschaft to Gesellshaft, and the fact that he only feels at home in the crowd of strangers shows the psychological price paid for modernization. Still, the subjectivity of the flâneur is, in its essence, intersubjectivity: the exchange of glances between him and the other human beings.

A very different image of a navigation through space — and of subjectivity — is presented in the novels of nineteenth century American writers such as James Fenimore Cooper (1789-1851) or Mark Twain (1835-1910). The main character of Cooper's novels, the wilderness scout Natty Bumppo, alias Leatherstocking, navigates through spaces of nature rather than culture. Similarly, in Twain's Huckleberry Finn, the narrative is organized around the voyage of the two boy heroes down the Mississippi River. Instead of the thickness of the urban human crowd which is the milieu of a Parisian flâneur, the heroes of these American novels

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[40] Walter Benjamin, "Paris, Capital of the Nineteenth Century," in Reflections (New York: Schocken Books, 1986), 156.

[41] The distinction between Gemeinschaft and Gesellshaft was developed by Tönnies in Community and Society.

are most at home in the wilderness, away from the city. They navigate forests and rivers, overcoming obstacles and fighting enemies. The subjectivity is constructed through the conflicts between the subject and nature, and between the subject and his enemies, rather than through interpersonal relations within a group. This structure finds its ultimate expression in the unique American form, the Western, and its hero, the cowboy — a lonely explorer who only occasionally shows up in town to get a drink at the bar. Rather than providing the home for the cowboy, as it does for the flâneur, the town is a hostile place, full of conflict, which eventually erupts into the inevitable showdown.

Both the flâneur and the explorer find their expression in different subject positions, or phenotypes, of new media users. Media theoretician and activist Geert Lovink desribes the figure of the present-day media user and Net surfer whom he calls the Data Dandy. Although Lovink's reference is Oscar Wilde rather than Baudelaire, his Data Dandy exhibits the behaviors which also qualify him to be called a Data Flâneur. "The Net is to the electronic dandy what the metropolitan street was for the historical dandy."[42] A perfect aesthete, the Data Dandy loves to display his private and totally irrelevant collection of data to other Net users. "Wrapped in the finest facts and the most senseless gadgets, the new dandy deregulates the time economy of the info = money managers... if the anonymous crowd in the streets was the audience of the Boulevard dandy, the logged-in Net-users are that of the data dandy."[43] While displaying his dandyism, the data dandy does not want to be above the crowd; like Baudelaire's flâneur, he wants to lose himself in its mass, to be moved by the semantic vectors of mass media icons, themes and trends. As Lovink points out, a data dandy "can only play with the rules of the Net as a non-identity. What is exclusivity in the age of differentiation?...Data dandyism is born of an aversion of being exiled into a subculture of one's own."[44] Although Lovink positions Data Dandy exclusively in data space ("Cologne and pink

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[42] Adilkno, The Media Archive (Brooklyn, New York: 1988), 99.

[43] Ibid., 100.

[44] Ibid.

stockings have been replaced by precious Intel"), the Data Dandy does have a dress code of his own. This look is popular with new media artists of the 1990s: no labels, no distinct design, no bright colors or extravagant shapes — a non-identity which is nevertheless paraded as style and which in fact is carefully constructed (as I learned while shopping in Berlin in 1997 with Russian net.artist Alexei Shulgin.) The designers who exemplify this style in the 1990s are Hugo Boss and Prada, whose restrained no-style style contrasts with the opulence of Versace and Gucci, the stars of the 1980s. The new style of non-identity perfectly corresponds to the rise of the Net, where endless mailing lists, newsgroups, and sites delude any single topic, image or idea — "On the Net, the only thing which appears as a mass is information itself... Today's new theme is tomorrow's 23 newsgroups."[45]

If the Net surfer, who keeps posting to mailing lists and newsgroups and accumulating endless data, is a reincarnation of Baudelaire's flâneur, the user navigating a virtual space assumes the position of the nineteenth century explorer, a character from Cooper and Twain. This is particularly true for the navigable spaces of computer games. The dominance of spatial exploration in games exemplifies the classical American mythology in which the individual discovers his identity and builds character by moving through space. Correspondingly, in many American novels and short stories (O'Henry, Hemingway) narrative is driven by the character's movements in the outside space. In contrast, in the 19th century European novels there is not much movement in physical space, because the action takes place in a psychological space. From this perspective, most computer games follow the logic of American rather than European narrative. Their heroes are not developed and their psychology is not represented. But, as these heroes move through space, defeating enemies, acquiring resources and, more importantly, skill, they are "building character." This is particularly true for Role Playing Games (RPG) whose narrative is one of self-improvement. But it also holds for other game genres (action, adventure, simulators) which put the user in command of a character (Doom, Mario, Tomb Rider). As the character progresses through the game, the user herself or himself

[45] Ibid.

acquires new skills and knowledge. She learns how to outwit the mutants lurking in Doom levels, how to defeat the enemies with just a few kicks in Tomb Rider, how to solve the secrets of the playful world in Mario, and so on.[46]

While movement through space as a means of building character is one theme of American frontier mythology, another is exploring and "culturing" unknown space. This theme is also reflected in computer games' structure. A typical game begins at some point in a large unknown space; in the course of the game, the player has to explore this space, mapping out its geography and unraveling its secrets. In the case of games organized into discrete levels such as Doom, the player has to systematically investigate all the spaces of a given level before he can move to the next level. In other game which takes place over one large territory, the game play gradually involves larger and larger parts of this territory (Adventure, War Craft). In contrast, fighting games very popular in Japan do no involve any movement through space. Instead, reflecting traditional Japananese idea about identity, they focus on competition between warriors.

This is one possible theory, one historical trajectory: from flâneur to Net surfer; from nineteenth century American explorer to the explorer of navigable virtual space. It is also possible to construct a different trajectory which will lead from the Parisian flaneurie to navigable computer spaces. In Window Shopping film historian Anne Friedberg presents an archeology of a mode of perception which, according to her, characterizes modern cinematic, televisual, and cyber cultures and which she calls a "mobilized virtual gaze."[47] This mode combines two conditions: "a received perception mediated through representation" and a travel "in an imaginary flanerie through an imaginary elsewhere and an imaginary elsewhen."[48] According to Friedberg's archeology, this mode emerged when a new nineteenth century technology of virtual representation — photography — merged with the mobilized

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[46] This narrative of maturation can be also seen as a particular case of an initiation ceremony, something which traditionally was a part of every human society.

[47] Anne Friedberg, Window Shopping: Cinema and the Post-modern (Berkeley: University of California Press, 1993), 2.

[48] Ibid.

gaze of tourism, urban shopping and flanerie.[49] As can be seen, Friedberg connects Baudelaire's flâneur with a range of other modern practices: “The same impulses which send flâneurs through the arcades, traversing the pavement and wearing thin their shoe leather, sent shoppers into the department stores, tourists to exhibitions, spectators into the panorama, diaroma, wax museum, and cinema.”[50] The flâneur occupies the privileged position among these practices because he embodied most strongly the desire to combine perception with motion through a space. All that remained in order to arrive at a “mobilized virtual gaze” was to virtualize this perception – something which cinema accomplished in the last decade of the nineteenth century.

While Friederg’s account ends with television and does consider new media, the form of navigable virtual space fits well in her historical trajectory. Navigation through a virtual space, whether in a computer game, a motion simulator, data visualizations or a 3-D human-computer interface, follows the logic of a “virtual mobile gaze.” Instead of Parisian streets, shopping windows and the faces of the passers-by, the virtual flâneur travels through virtual streets, highways and planes of data; the eroticism of a split-second virtual affair with a passer-by of the opposite sex is replaced with the excitement of locating and opening a particular file or zooming into the virtual object. Just as the original flâneur of Baudelaire, the virtual flâneur is happiest on the move, clicking from one object to another, traversing room after room, level after level, data volume after data volume. Thus, just as a database form can be seen as an expression of ‘database complex,’ an irrational desire to preserve and store everything, navigable space is not just a purely functional interface. Ii is also an expression and gratification of psychological desire; a state of being; a subject position — or rather, a subject’s trajectory. If the subject of modern society was looking for refuge from the chaos of the real world in the stability and balance of the static composition of a painting, and later in cinema’s image, the subject of the information society finds peace in the knowledge that she can slide over endless

[49] Ibid., 184.

[50] Ibid., 94.

fields of data, locating any morsel of information with the click of a button, zooming through file systems and networks. She is comforted not by the equilibrium of shapes and colors, but by the variety of data manipulation operations at her control.

Does this mean that we have reached the end of the trajectory described by Friederg? While still enjoying a privileged place in computer culture, flanerie now shows its age. Here we can make an analogy with the history of GUI (Graphical User Interface). Developed at Xerox Parc in the 1970s and commercialized by Apple in the early 1980s, it was appropriate when a typical user's hard drive contained dozens or even hundreds of files. But for the next stage of Net-based computing in which the user is accessing millions of files it is no longer sufficient.[51] Bypassing the ability to display and navigate the files graphically, the user resorts to a text-based search engine. Similarly, while a "mobilized virtual gaze," described by Friederg, was a significant advancement over earlier more static methods of data organization and access (static image, text, catalog, library), in the information age its "bandwidth" is too limited. Moreover, a simple simulation of movement through a physical space defeats a computer's new capabilities of data access and manipulation. Thus, for a virtual flâneur such operations as search, segmentation, hyperlinking and visualization and data mining are more satisfying than just navigating through a simulation of a physical space.

In the 1920s Dziga Vertov already understood this very well. A Man with a Movie Camera is an important point in the trajectory which leads from Baudelaire's flanerie to Aspen Movie Map, Doom and VRML worlds not simply because Vertov's film is structured around the camera's active exploration of city spaces, and not only because it fetishizes the camera's mobility. Vertov wanted to overcome the limits of human vision and human movement through space to arrive at more efficient ways of data access. However, the data he worked with is raw visible reality — not reality digitized and stored in computer's memory as numbers. Similarly, his interface was a film camera, i.e. an anthropomorphic simulation of human vision — not computer

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[51] See Don Gentner and Jakob Nielson, "The Anti-Mac Interface," Communications of the ACM 39, no. 8 (August 1996), 70-82. Available online at http://www.acm.org/cacm/AUG96/antimac.htm.

algorithms. Thus Vertov stands half-way between Baudelaire's flâneur and computer user: no longer just a pedestrian walking through a street, but not yet Gibson's data cowboy who zooms through pure data armed with data mining algorithms.

In his research on what can be called "kino-eye interface," Vertov systematically tried different ways to overcome what he thought were the limits of human vision. He mounted cameras on the roof of a building and a moving automobile; he slowed and speed up film speed; he superimposed a number of images together in time and space (temporal montage and montage within a shot). A Man with a Movie Camera is not only a database of city life in the 1920s, a database of film techniques, and a database of new operations of visual epistemology, but it is also a database of new interface operations which together aim to go beyond a simple human navigation through a physical space.

Along with A Man with a Movie Camera, another key point in the trajectory, from the navigable space of a nineteenth century city to the virtual navigable computer space, is flight simulators. At the same time when Vertov was working on his film, young American engineer E.A. Link, Jr. developed the first commercial flight simulator. Significantly, Link's patent for his simulator filed in 1930 refers to it as a "Combination Training Device for Student Aviators and Entertainment Apparatus."[52] Thus, rather than being an after-thought, the adaptation of flight simulator technology to consumer entertainment which took place in the 1990s was already envisioned by its inventor. Link's design was a simulation of a pilot's cockpit with all the controls, but, in contrast to a modern simulator, it had no visuals. In short, it was a motion ride without a movie. In the 1960s, visuals were added by using new video technology. A video camera was mounted on a movable arm positioned over a room size model of an airport. The movement of the camera was synchronized with the simulator controls; its image was transmitted to a video monitor in the cockpit. While useful, this approach was limited because it was based on physical reality of an actual model set. As we saw in the "Compositing" section, a filmed and edited image is a better simulation technology than a physical construction; and a virtual image

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52 Benjamin Wooley, Virtual Worlds (Oxford, UK and Cambridge, USA: Blackwel, 1992), 39, 43.

controlled by a computer is better still. Not surprisingly, soon after interactive 3-D computer graphics technology was developed, it was applied to produce visuals for the simulators by one of his developers. In 1968, Ivan Sutherland, who already pioneered interactive computer-aided design ("Sketchpad," 1962) and virtual reality (1967), formed a company to produce computer-based simulators. In the 1970s and 1980s simulators were one of the main applications of real-time 3-D computer graphics technology, thus determining to a significant degree the way this technology was developed (see "Synthetic Realism as Bricolage.") For instance, simulation of particular landscape features which are typically seen by a pilot, such as flat and mountain terrain, sky with clouds, and fog, all became important research problems.[53] The application of interactive graphics for simulators has also shaped the imagination of researchers regarding how this technology can be used. It naturalized a particular idiom: flying through a simulated spatial environment.

Thus, one of the most common forms of navigation used today in computer culture — flying through spatialized data — can be traced back to the 1970s military simulators. From Baudelaire's flâneur strolling through physical streets we move to Vertov's camera mounted on a moving car and then to the virtual camera of a simulator which represents the viewpoint of a military pilot. Although it was not an exclusive factor, the end of the Cold War played an important role in the extension of this military mode of perception into general culture. Until 1990, such companies as Evans and Sutherland, Boeing and Lockheed were busy developing multi-million simulators. As the military orders dried up, they had to look for consumer applications of their technology. During the 1990s, these and other companies converted their expensive simulators into arcade games, motion rides and other forms of location-based entertainment. By the end of the decade, Evans and Sutherland's list of products included image generators for use in military and aviation simulators; a virtual set technology for use in television production; Cyber Fighter, a system of networked game stations modeled after networked military

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[53] For more on the history of 3-D computer graphics, see my article "Mapping Space: Perspective, Radar and Computer Graphics," SIGGRAPH '93 Visual Proceedings, edited by Thomas Linehan, 143-147. New York: ACM, 1993.

simulators; and Virtual Glider, an immersive location-based entertainment station.[54] As the military budgets continued to diminish and entertainment budgets soared, entertainment and military often came to share the same technologies and to employ the same visual forms. Probably the most graphic example of the ongoing circular transfer of technology and imagination between the military and the civilian sector in new media is the case of Doom. Originally developed and released over the Internet as a consumer game in 1993 by id software, it was soon picked by the U.S. Marine Corps who customized it into a military simulator for group combat training.[55] Instead of using multi-million dollar simulators, the Army could now train soldiers on a $50 game. The Marines, who were involved in the modifications, then went on to form their own company in order to market the customized Doom as a commercial game.

The discussion of the military origins of navigable space form would be incomplete without acknowledging the pioneering work of Paul Virilio. In his brilliant 1984 book War and Cinema Virilio documented numerous parallels between military and film cultures of the twentieth century, including the use of a mobile camera moving through space in film in military aerial surveillance and cinematography.[56] Virilio went on to suggest that while space was the main category of the nineteenth century, the main category of the twentieth century was time. As already discussed in "Teleaction," for Virilio, telecommunication technology eliminates the category of space altogether as it makes every point on Earth as accessible as any other — at least in theory. This technology also leads to real time politics, which require instant reactions to the events transmitted at the speed of light, and ultimately can only be handled efficiently by computers responding to each other without human intervention. From a post-Cold War perspective, Virilio's theory can be seen as another example of the imagination transfer from the military to civilian sector. In this

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54 http://www.es.com/product_index.html, accessed January 27, 1999.

55 Elizabeth Sikorovsky, "Training spells Doom for Marines," Federal Computer Week, July 15, 1996, available online at http://www.fcm.com/pubs/fcw/0715/guide.htm.

56 Paul Virilio, War and Cinema (London and New York: Verso, 1989).

case, techno-politics of the Cold War nuclear arms equilibrium between the two super powers, which at any moment were able to strike each other at any point on Earth, came to be seen by Virilio as a fundamentally new stage of culture, where real time triumphs over space.

Although Virilio did not write on computer interface, the logic of his books suggests that the ideal computer interface for a culture of real time politics would be the War Room in Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb (Stanley Kubrick, 1964) with its direct lines of communication between the generals and the pilots; or DOS command lines with their military economy of command and response, rather than the more spectacular but inefficient VRML worlds. Yet, uneconomical and inefficient as it may be, navigable space interface is thriving across all areas of new media. How can we explain its popularity? Is it simply a result of cultural inertia? A left-over from the nineteenth century? A way to make the ultimately Alien space of a computer compatible with humans by anthropomorphizing it, superimposing a simulation of a Parisian flanerie over abstract data? A relic of Cold War culture?

While all these answers make sense, it would be unsatisfactory to see navigable space as only the end of a historical trajectory, rather than as a new beginning. The few computer spaces discussed here point toward some of the aesthetic possibilities of this form; more possibilities are contained in the works of modern painters, installation artists and architects. Theoretically as well, navigable space represents a new challenge. Rather than only considering topology, geometry and logic of a static space, we need to take into account the new way in which space functions in computer culture: as something traversed by a subject, as a trajectory rather than an area. But computer culture is not the only field where the use of the category of navigable space makes sense. I will conclude this section by looking at two other fields – anthropology and architecture – where we find more examples of navigable space imagination.

In his book Non-places. Introduction to an Anthropology of Supermodernity French anthropologist Marc Auge advances the hypothesis that “supermodernity produces non-places, meaning spaces which are not themselves anthropological

places and which, unlike Baudelairean modernity, do not integrate with earlier places."[57] Place is what anthropologists have studied traditionally; it is characterized by stability, and it supports stable identity, relations and history.[58] Auge's main source for his distinction between place and space, or non-place, is Michel de Certeau: "Space, for him, is a 'frequent place,' 'an intersection of moving bodies': it is the pedestrians who transform a street (geometrically defined as a place by town planners) into a space"; it is an animation of a place by the motion of a moving body.[59] Thus, from one perspective we can understand place as a product of cultural producers, while non-places are created by users; in other words, non-place is an individual trajectory through a place. From another perspective, in supermodernity, traditional places are replaced by equally institutionalized non-places, a new architecture of transit and impermanence: hotel chains and squats, holiday clubs and refugee camps, supermarkets, airports and highways. Non-place becomes the new norm, the new way of existence.

It is interesting that as the subject who exemplifies the condition of supermodernity, Auge picks up the counterpart to the pilot or a user of a flight simulator — an airline passenger. "Alone, but one of many, the user of a non-place has contractual relations with it." This contract relieves the person of his usual determinants. "He becomes no more than what he does or experiences in the role of passenger, customer or driver."[60] Auge concludes that "as anthropological places create the organically social, so non-places create solitary contractuality," something which he sees as the very opposite of a traditional object of sociology: "Try to imagine a Durkheimian analysis of a transit lounge at Roissy!"[61]

Architecture by its very definition stands on the side of order, society and

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[57] Marc Auge, Non-places. Introduction to an Anthropology of Supermodernity, translated by John Howe (London and New York: Verso, 1995), 78.

[58] Ibid., 53-53.

[59] Ibid., 79-80.

[60] Ibid., 101, 103.

[61] Ibid., 94.

rules; it is thus a counterpart of sociology as it deals with regularities, norms and "strategies" (to use de Certeau's term). Yet the very awareness of these assumptions underlying architecture led many contemporary architects to focus their attention on the activities of users who through their "speech acts" "reappropriate the space organized by the techniques of sociocultural production" (de Certeau).[62] Architects come to accept that the structures they design will be modified by users' activities, and that these modifications represent an essential part of architecture. They also took up the challenge of "a Durkheimian analysis of a transit lounge at Roissy," putting their energy and imagination into design of non-places such as an airport (Kansai International Airport in Osaka by Renzo Piano), a train terminal (Waterloo International Terminal in London by Nicholas Grimshaw) or a highway control station (Steel Cloud or Los Angeles West Coast Gateway by Asymptote Architecture group).[63] Probably the ultimate in non-place architecture has been one million square meter Euralille project which redefined the existing city of Lille, France as the transit zone between the Continent and London. The project attracted some of the most interesting contemporary architects: Rem Koolhaas designed the masterplan while Jean Nouvel built Centre Euralille containing a shopping center, a school, a hotel, and apartments next to the train terminal. Centered around the entrance to the Chunnel, the underground tunnel for cars which connects the Continent and England, and the terminal for the high speed train which travels between Lille, London, Brussels and Paris, Euralille is a space of navigation par excellence; a mega-non-place. Like the network players of Doom, Euralille users emerge from trains and cars to temporarily inhabit a zone defined through their trajectories; an environment "to just wander around inside of" (Robyn Miller); "an intersection of moving bodies" (de Certeau).

EVE and Place

[62] De Certeau, The Practice of Everyday Life, XIV.

[63] Jean-Claude Dubost and Jean-Francois Gonthier, eds., Architecture for the Future (Paris: Éditions Pierre Terrail, 1996), 171.

We have come a long way since Spacewar (1962) and Computer Space (1971) — at least, in terms of graphics. The images of these early computer games seem to have more in common with abstract paintings of Malevich and Mondrian than with the photorealistic renderings of Quake (1996) and Unreal (1997). But whether this graphics evolution was also accompanied by a conceptual evolution is another matter. Given the richness of modern concepts of space developed by artists, architects, filmmakers, art historians and anthropologists, our computer spaces have a long way to go.

Often the way to go forward is to go back. As this article suggested, the designers of virtual spaces may find a wealth of relevant ideas by looking at twentieth century art, architecture, film and other arts. Similarly, as I pointed out, some of the earliest computer spaces, such as Spacewar and Aspen Movie Map, contained aesthetic possibilities which are still waiting to be explored. As a conclusion, I will discuss two more works by Jeffrey Shaw who draws upon rich cultural traditions of space construction and representation probably more systematically more than any other new media artist.

While Friedberg's concept of virtual mobile gaze is useful in allowing us to see the connections between a number of technologies and practices of spatial navigation, such as Panorama, cinema and shopping, it can also make us blind to the important differences between them. In contrast, Shaw's EVE (1993 —) and Place: A User' Manual (1995) emphasize both similarities and differences between various technologies of navigation.[64] In these works, Shaw evokes the navigation methods of Panorama, cinema, video and VR. But rather than collapsing diffirent technologies into one, Shaw "layers" them on side by side. That is, he literally encloses the interface of one technology within the interface of another. For instance, in the case of EVE the visitors find themselves inside a large semi-sphere reminiscent of the 19th

[64] Abel, Jeffrey Shaw, 138-139; 142-145.

century Panorama. The projectors located in the middle of the sphere throw a rectangular image on the inside surface of the semi-sphere. In this way, the interface of cinema (an image enclosed by a rectangular frame) is placed inside the interface of Panorama (a semi-spherical enclosed space). In Place: A User' Manual a different "layering" takes place: Panorama interface is placed inside a typical computer space interface. The user navigates a virtual landscape using first-person perspective characteristic of VR, computer games and navigable computer spaces in general. Inside this landscape are eleven cylinders with photographs mapped on them. Once the user moves inside one of these cylinders, she switches to a mode of perception typical of Panorama tradition.

By placing interfaces of different technologies next to each other within a single work, Shaw foregrounds the unique logic of seeing, spatial access and user's behavior characteristic of each technology. The utopia of perfect simulation and perfect seeing promised by panorama is downplayed. In EVE, the image, rather than filling the whole dome, is cut by the rectangular cinematic frame; while in Place the user is placed outside the panoramas. The tradition of the framed image , i.e. a representation which exists within the larger physical space which contains the viewer (painting, cinema, computer screen), meets the tradition of the "total" simulation, i.e. a simulated space which encloses the viewer (Panorama, VR). of

Another historical dichotomy staged for us by Shaw is between the traditions of collective and individualized viewing in screen-based arts. The first tradition spans from magic lantern shows to twentieth century cinema. The second passes from the camera obscura, stereoscope and kinetoscope to head-mounted displays of VR. Both have their dangers. In the first tradition, individual's subjectivity can be dissolved in a mass-induced response. In the second, subjectivity is being defined through the interaction of isolated subject with an object at the expense of intersubjective dialogue. In the case of viewers' interactions with computer installations, as I already noted when talking about Osmose, something quite new begins to emerge: a combination of individualized and collective spectatorship. The interaction of one viewer with the work (via a joystick, a mouse, or a head mounted

sensor) becomes in itself a new text for other viewers, situated within the work's arena, so to speak. This affects the behavior of this viewer who acts as a representative for the desires of others, and who is now oriented both to them and to the work.

EVE rehearses the whole Western history of simulation, functioning as a kind of Plato's cave in reverse: visitors progress from the real world inside the space of simulation where instead of mere shadows they are presented with technologically enhanced (via stereo) images, which look more real than their normal perceptions.[65] At the same time, EVE's enclosed round shape refers us back to the fundamental modern desire to construct a perfect self-sufficient utopia, whether visual (the nineteenth-century panorama) or social. (For instance, after 1917 Russian Revolution architect G.I. Gidoni designed a monument to the Revolution in the form of a semi-transparent globe which could hold several thousand spectators.) Yet, rather than being presented with a simulated world which has nothing to do with the real space of the viewer (as in typical VR), the visitors who enter EVE's enclosed space discover that EVE's apparatus shows the outside reality they just left. Moreover, instead of being fused in a single collective vision (Gesamtkunstwerk, cinema, mass society) the visitors are confronted with a subjective and partial view. The visitors only see what one person wearing a head mounted sensor chooses to show them, i.e. they are literally limited by this person's point of view. In addition, instead of a 360^{o} view they see a small rectangular image -- a mere sample of the world outside. The one visitor wearing a sensor, and thus literally acting as an eye for the rest of the audience, occupies many positions at once -- a master subject, a visionary who shows the audience what is worth seeing and at the same time just an object, an

[65] Here I am describing the particular application of EVE which I saw at "Multimediale 4" exhibition, Karlsruhe, Germany, May 1995.

interface between them and outside reality, i.e., a tool for others; a projector, a light and a reflector all at once.