The Language of New Media

Lev Manovich

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Prologue: Vertov's Dataset

The avant-garde masterpiece *Man with a Movie Camera,* completed by Russian director Dziga Vertov in 1929, will serve as our guide to the language of new media. This prologue consists of a number of stills from the film. Each still is accompanied by a quote from the text summarizing a particular principle of new media. The number in brackets indicates the page from which the quote is taken. The prologue thus acts as a visual index to some of the book's major ideas.

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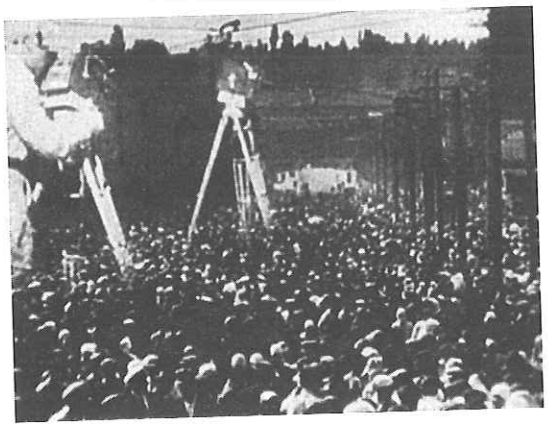

[78–79] A hundred years after cinema's birth, cinematic ways of seeing the world, of structuring time, of narrating a story, of linking one experience to the next, have become the basic means by which computer users access and interact with all cultural data. In this respect, the computer fulfills the promise of cinema as a visual Esperanto—a goal that preoccupied many film artists and critics in the 1920s, from Griffith to Vertov. Indeed, today millions of computer users communicate with each other through the same computer interface. And in contrast to cinema, where most "users" are able to "understand" cinematic language but not "speak" it (i.e., make films), all computer users can "speak" the language of the interface. They are active users of the interface, employing it to perform many tasks: send e-mail, organize files, run various applications, and so on.

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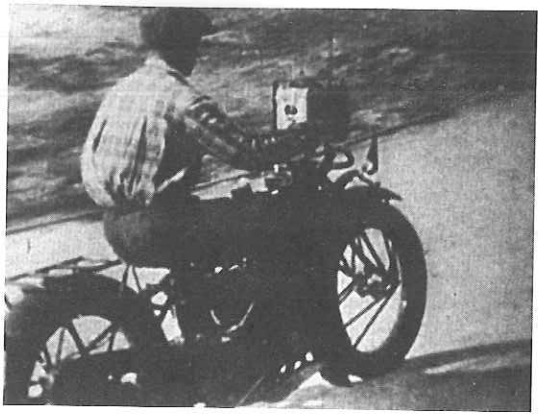

[84–85] The incorporation of virtual camera controls into the very hardware of game consoles is truly a historic event. Directing the virtual camera becomes as important as controlling the hero's actions. . . . [In computer games], cinematic perception functions as the subject in its own right, suggesting the return of "New Vision" movement of the 1920s (Moholy-Nagy, Rodchenko, Vertov, and others), which foregrounded the new mobility of the photo and film camera, and made unconventional points of view a key part of its poetics.

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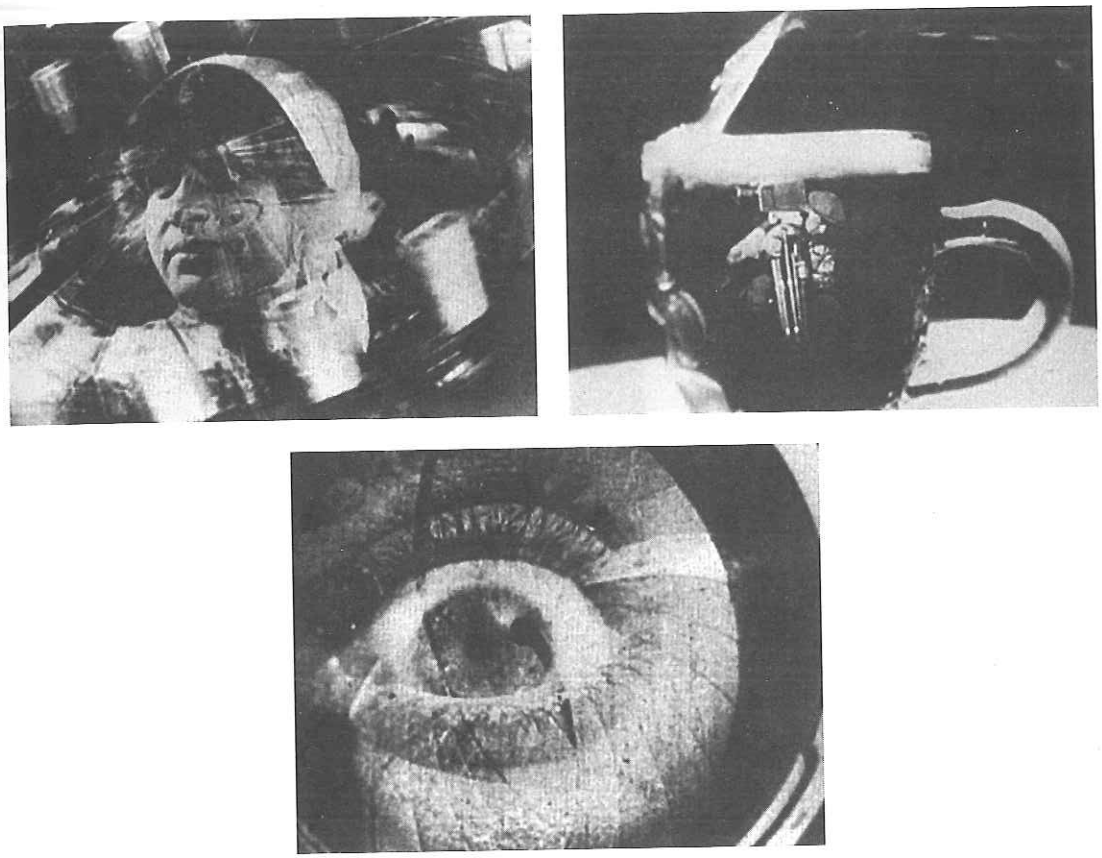

[148] Editing, or montage, is the key twentieth-century technology for creating fake realities. Theoreticians of cinema have distinguished between many kinds of montage, but for the purpose of sketching an archeology of the technologies of simulation that led to digital compositing, I will distinguish between two basic techniques. The first technique is temporal montage: Separate realities form consecutive moments in time. The second technique is montage within a shot. It is the opposite of the first: separate realities form contingent parts of a single image. . . . Examples include the . . . superimposition of images and multiple screens by avant-garde filmmakers in the 1920s (for instance, the superimposed images in Vertov's *Man with a Movie Camera* and the three-part screen in Abel Gance's 1927 *Napoléon*).

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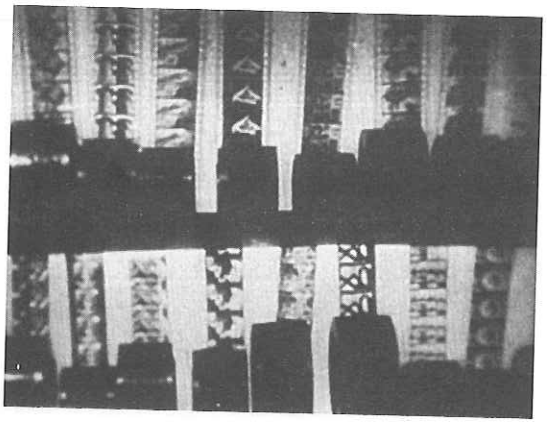

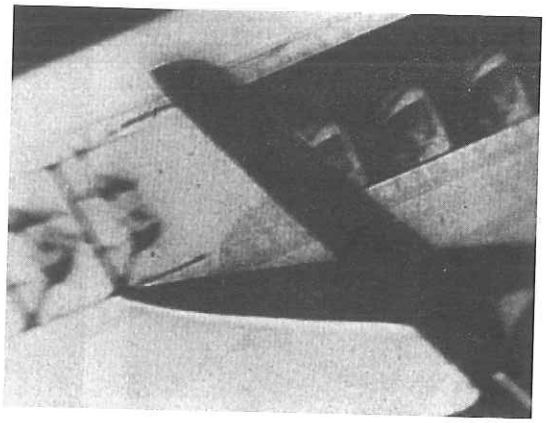

[149] As theorized by Vertov, film can overcome its indexical nature through montage, by presenting a viewer with objects that never existed in reality.

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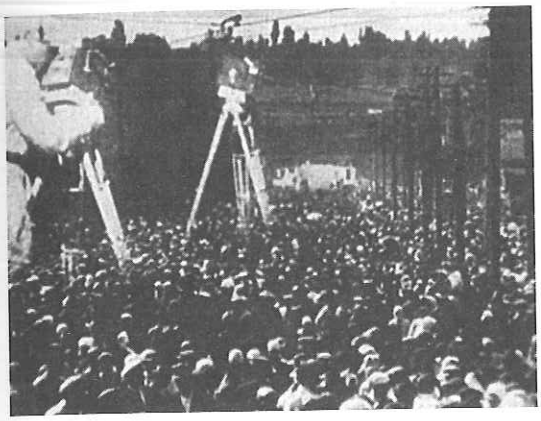
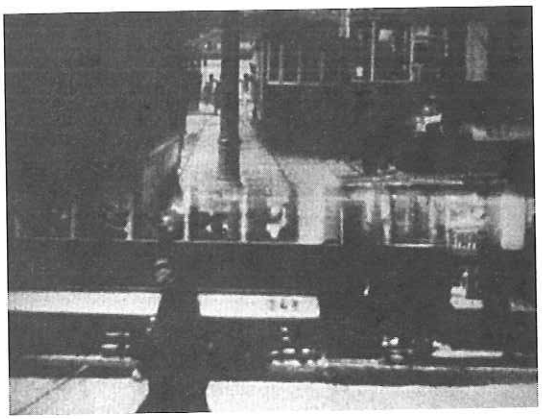
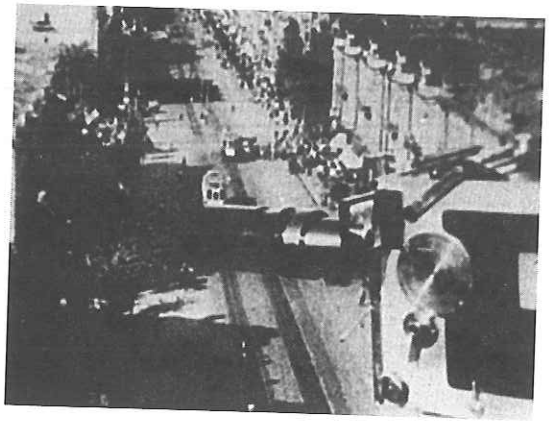
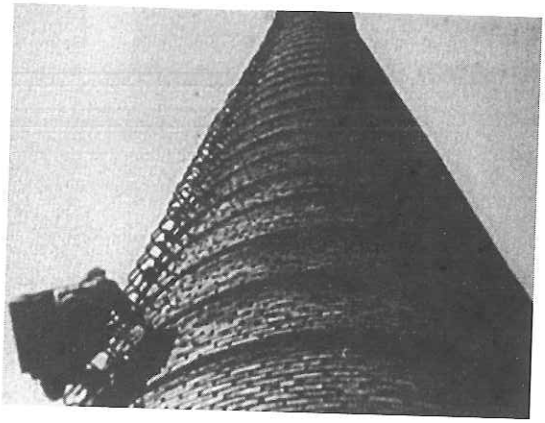
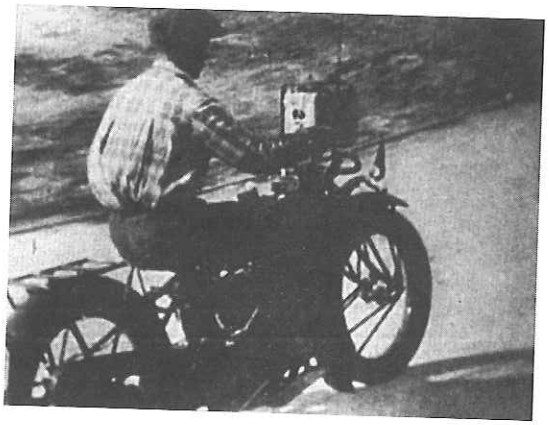




[158] Although digital compositing is usually used to create a seamless virtual space, this does not have to be its only goal. Borders between different worlds do not have to be erased; different spaces do not have to be matched in perspective, scale, and lighting; individual layers can retain their separate identities rather than being merged into a single space; different worlds can clash semantically rather than form a single universe.







[172] The cameraman, whom Benjamin compares to a surgeon, "penetrates deeply into its [reality's] web"; his camera zooms in order to "pry an object from its shell." Due to its new mobility, glorified in such films as *Man with a Movie Camera,* the camera can be anywhere, and with its superhuman vision it can obtain a close-up of any object. . . .

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When photographs are brought together within a single magazine or newreel, both the scale and unique locations of the objects are discarded—thus answering the demand of mass society for a "universal equality of things."

MARX

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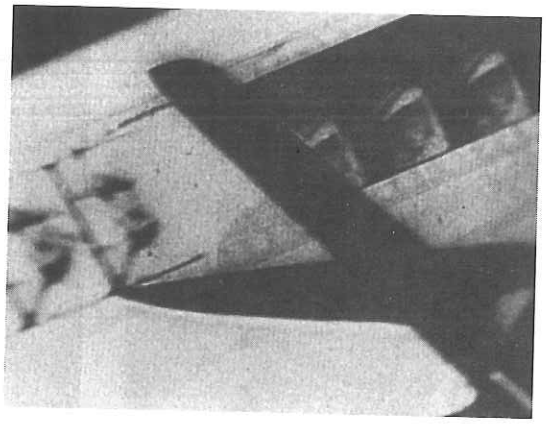

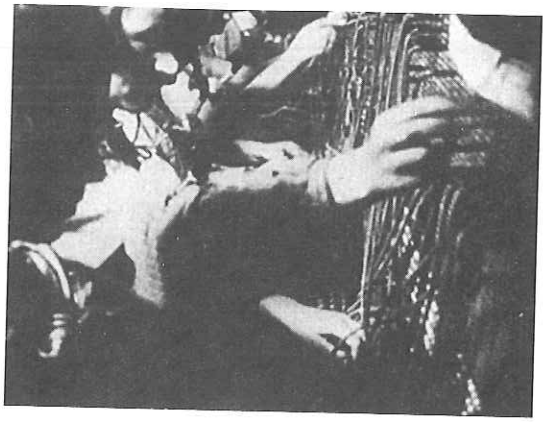

[173–174] Modernization is accompanied by a disruption of physical space and matter, a process that privileges interchangeable and mobile signs over original objects and relations. . . . The concept of modernization fits equally well with Benjamin's account of film and Virilio's account of telecommunication, the latter but a more advanced stage in the continual process of turning objects into mobile signs. Before, different physical locations met within a single magazine spread or film newsreel; now they meet within a single electronic screen.

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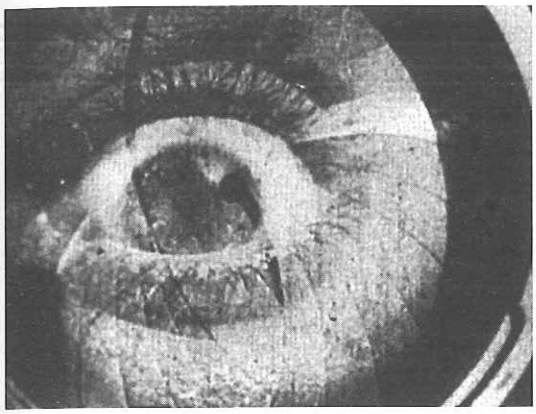
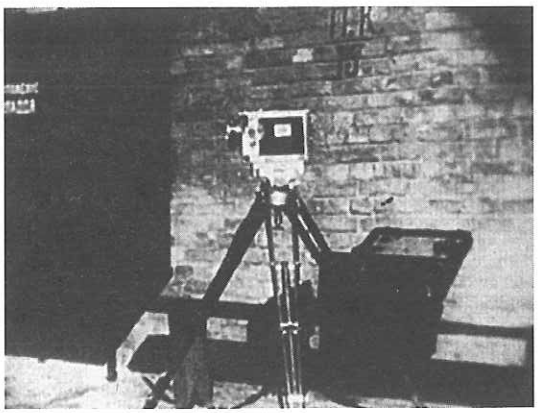
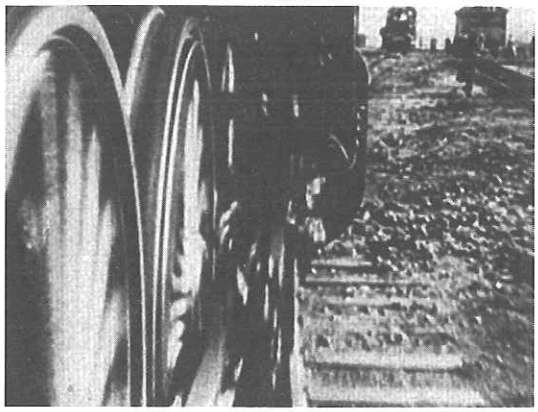


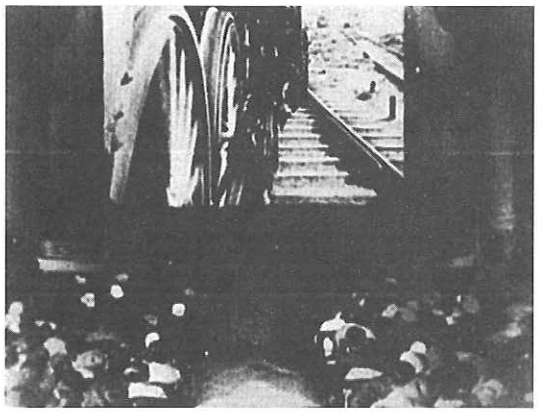


[202] Whose vision is it? It is the vision of a computer, a cyborg, an automatic missile. It is a realistic representation of human vision in the future, when it will be augmented by computer graphics and cleansed from noise. It is the vision of a digital grid. Synthetic computer-generated imagery is not an inferior representation of our reality, but a realistic representation of a different reality.

9

[239] Along with Greenaway, Dziga Vertov can be thought of as a major "database filmmaker" of the twentieth century. *Man with a Movie Camera* is perhaps the most important example of a database imagination in modern media art.





[241] Just as new media objects contain a hierarchy of levels (interface—content; operating system—application; Web page—HTML code; high-level programming language—assembly language—machine language), Vertov's film contains at least three levels. One level is the story of a cameraman shooting material for the film. The second level consists of shots of the audience watching the finished film in a movie theater. The third level is the film itself, which consists of footage recorded in Moscow, Kiev, and Riga, arranged according to the progression of a single day: waking up—work—leisure activities. If this third level is a text, the other two can be thought of as its metatexts.

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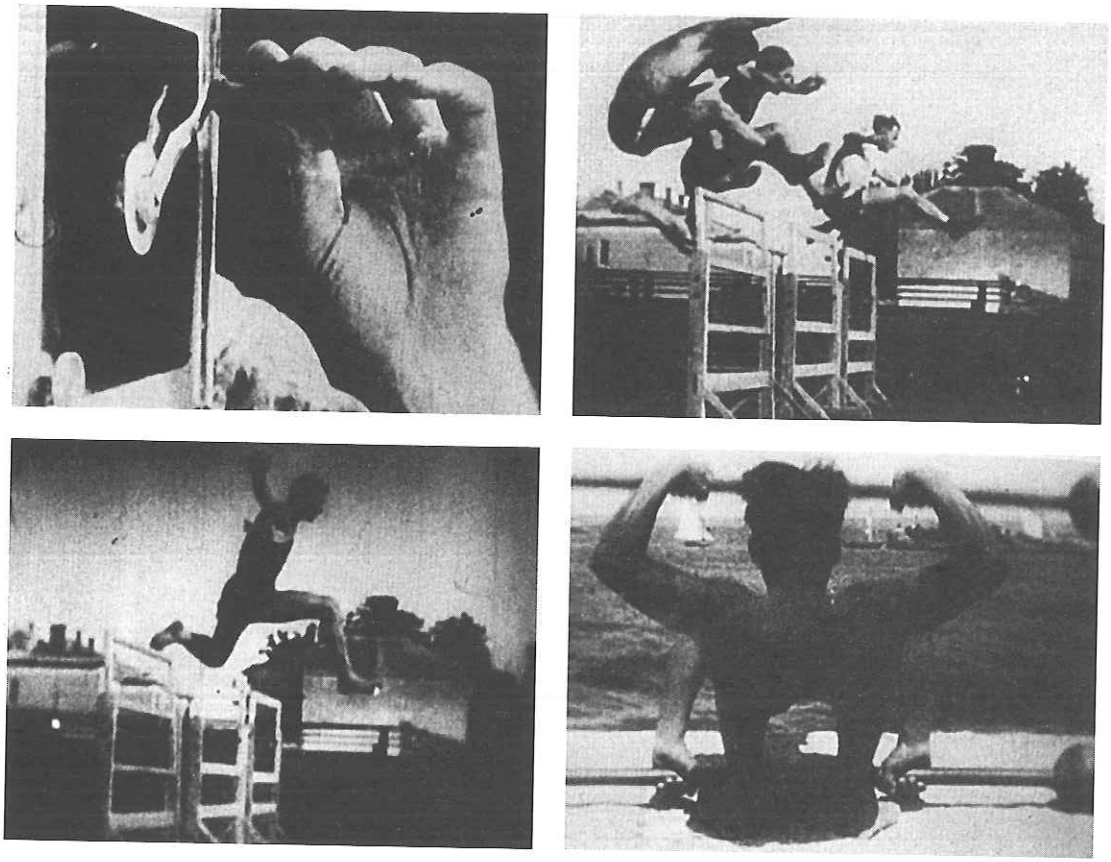
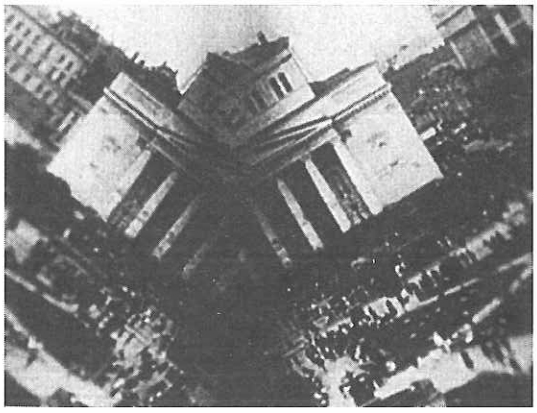


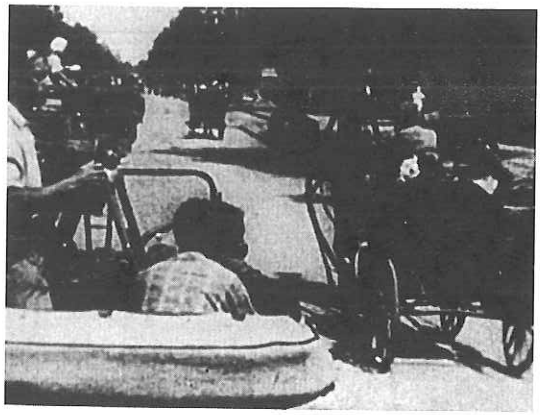
[242] If a "normal" avant-garde film still proposes a coherent language different from the language of mainstream cinema, that is, a small set of techniques that are repeated, *Man with a Movie Camera* never arrives at anything like a well-defined language.

11



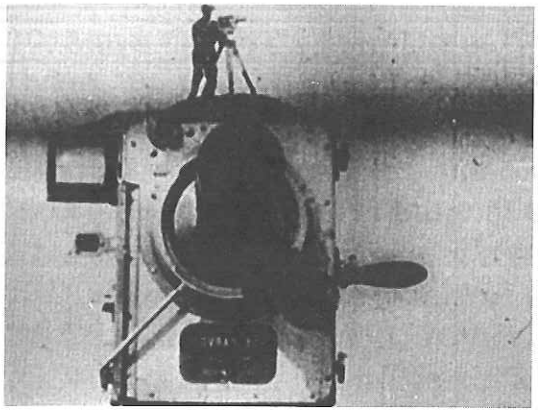
Rather, it proposes an untamed, and apparently endless, unwinding of techniques, or, to use contemporary language, "effects," as cinema's new way of speaking.

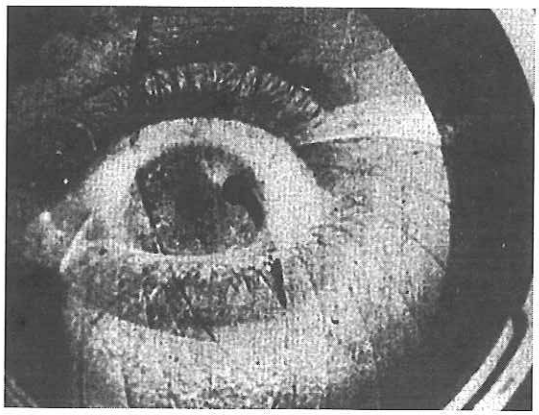
12



[243] "And this is why Vertov's film has particular relevance to new media. It proves that it is possible to turn "effects" into a meaningful artistic language. Why is it that in Witney's computer films and music videos effects are just effects, whereas in the hands of Vertov they acquire meaning? Because in Vertov's film they are motivated by a particular argument, which is that the new techniques of obtaining images and manipulating them, summed up by Vertov in his term "kino-eye," can be used to decode the world. As the film progresses, straight footage gives way to manipulated footage; newer techniques appear one after another, reaching a roller-coaster intensity by the film's end—a true orgy of cinematography. It is as though Vertov restages his discovery of the kino-eye for us, and along with him, we gradually realize the full range of possibilities offered by the camera. Vertov's goal is to seduce us into his way of seeing and thinking, to make us share his excitement, as he discovers a new language for film. This gradual process of discovery is film's main narrative, and it is told through a catalog of discoveries. Thus, in the hands of Vertov, the database, this normally static and "objective" form, becomes dynamic and subjective. More important, Vertov is able to achieve something that new media designers and artists still have to learn—how to merge database and narrative into a new form.

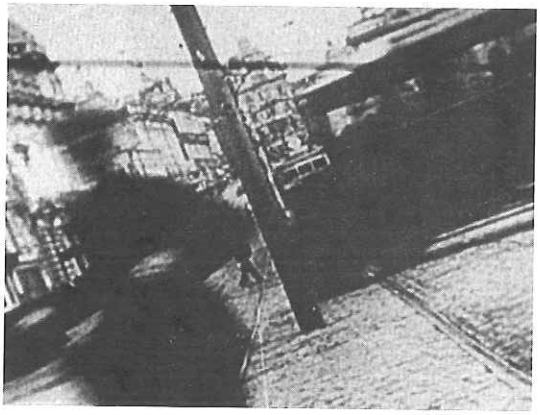
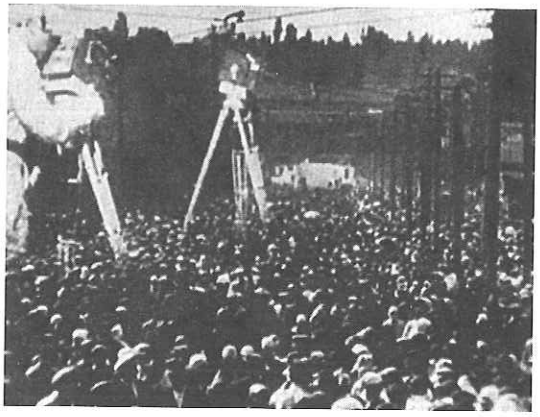
13





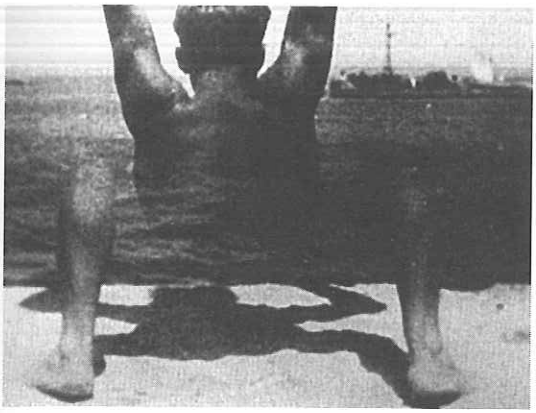
[262] If modern visual culture exemplified by MTV can be thought of as a Mannerist stage of cinema, its perfected techniques of cinematography, mise-en-scène and editing self-consciously displayed and paraded for its own sake, Waliczky's film presents an alternative response to cinema's classical age, which is now behind us. In this metafilm, the camera, part of cinema's apparatus, becomes the main character (and in this respect, we can connect *The Forest* to another metafilm, *Man with a Movie Camera*).

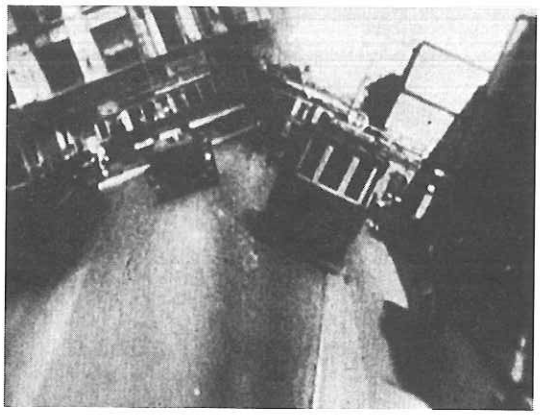


[275–276] . . . Vertov stands halfway between Baudelaire's flâneur and today's computer user: no longer just a pedestrian walking down a street, but not yet Gibson's data cowboy who zooms through pure data armed with data-mining algorithms. In his research on what can be called "kino-eye interface," 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 sped up film speed; he superimposed a number of images together in time and space (temporal montage and montage within a shot). *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 also a database of new interface operations that together aim to go beyond simple human navigation through physical space.

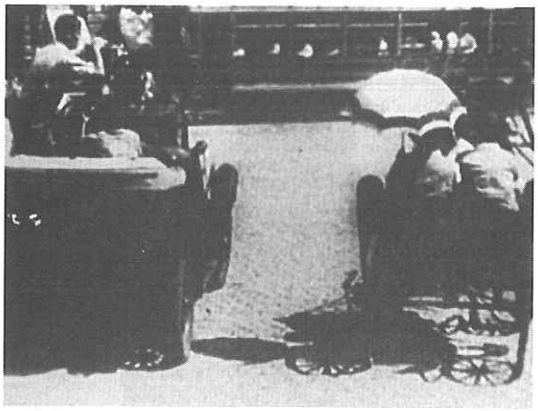
15

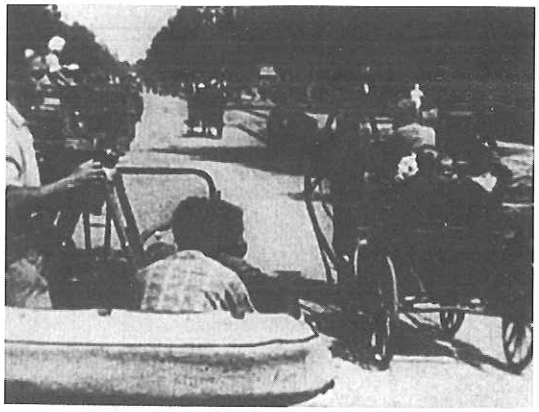




[306–307] One general effect of the digital revolution is that avant-garde aesthetic strategies came to be embedded in the commands and interface metaphors of computer software. In short, the avant-garde became materialized in a computer. Digital cinema technology is a case in point. The avant-garde strategy of collage reemerged as the "cut-and-paste" command, the most basic operation one can perform on digital data. The idea of painting on film became embedded in paint functions of film-editing software. The avant-garde move to combine animation, printed texts, and live-action footage is repeated in the convergence of animation, title generation, paint, compositing, and editing systems into all-in-one packages.

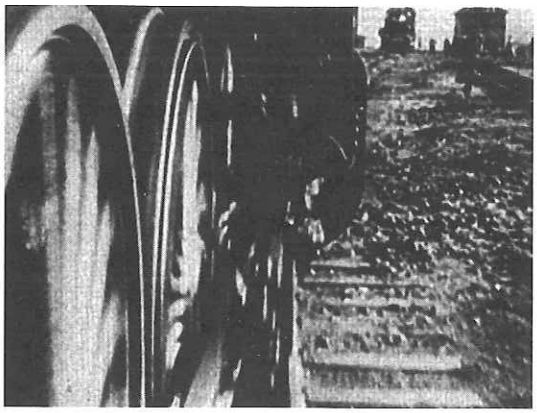
16



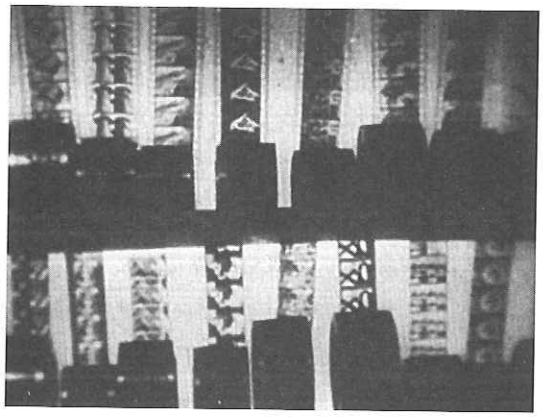


[316] Cinema's birth from a loop form was reenacted at least once during its history. In one of the sequences of *Man with a Movie Camera,* Vertov shows us a cameraman standing in the back of a moving automobile. As he is being carried forward by the automobile, he cranks the handle of his camera. A loop, a repetition, created by the circular movement of the handle, gives birth to a progression of events—a very basic narrative that is also quintessentially modern—a camera moving through space recording whatever is in its way.

17



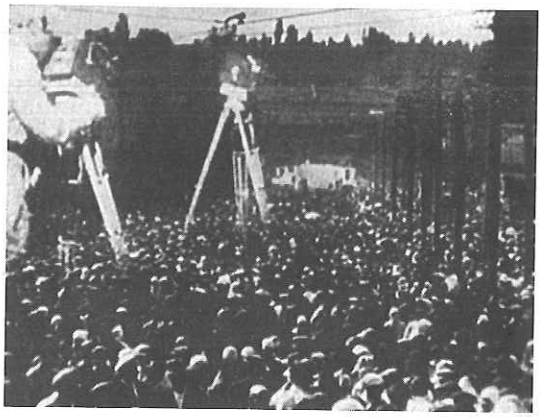
[317] Can the loop be a new narrative form appropriate for the computer age? It is relevant to recall that the loop gave birth not only to cinema but also to computer programming. Programming involves altering the linear flow of data through control structures, such as "if/then" and "repeat/while"; the loop is the most elementary of these control structures. . . . As the practice of computer programming illustrates, the loop and the sequential progression do not have to be considered mutually exclusive. A computer program progresses from start to end by executing a series of loops.

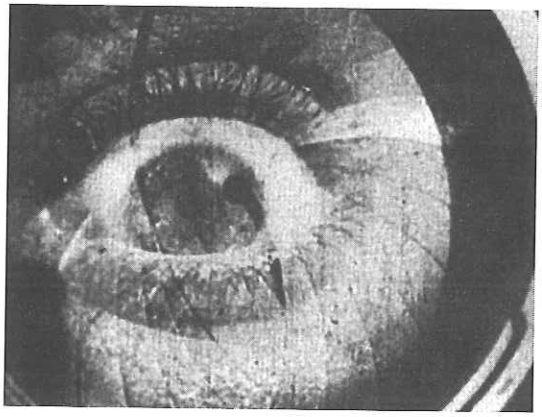


[322] Spatial montage represents an alternative to traditional cinematic temporal montage, replacing its traditional sequential mode with a spatial one. Ford's assembly line relied on the separation of the production process into sets of simple, repetitive, and sequential activities. The same principle made computer programming possible: A computer program breaks a task into a series of elemental operations to be executed one at a time. Cinema followed this logic of industrial production as well. It replaced all other modes of narration with a sequential narrative, an assembly line of shots that appear on the screen one at a time. This type of narrative turned out to be particularly incompatible with the spatial narrative that had played a prominent role in European visual culture for centuries.

19

[324] Since the development of the Xerox PARC Alto workstation, the Graphical User Interface (GUI) has used multiple windows. It would be logical to expect that cultural forms based on moving images will eventually adopt similar conventions. . . . We may expect that computer-based cinema will eventually go in the same direction—especially once the limitations of communication bandwidth disappear while the resolution of displays significantly increases, from the typical 1–2K in 2000 to 4K, 8K, or beyond. I believe that the next generation of cinema—*broadband* or *macrocinema*—will add multiple windows to its language.





[326–327] If the Human Computer Interface (HCI) is an interface to computer data, and a book is an interface to text, cinema can be thought of as an interface to events taking place in 3-D space. Just as painting before it, cinema presents us with familiar images of visible reality—interiors, landscapes, human characters—arranged within a rectangular frame. The aesthetics of these arrangements ranges from extreme scarcity to extreme density. . . . It would take only a small leap to relate this density of "pictorial displays" to the density of contemporary information displays such as Web portals, which may contain a few dozen hyperlinked elements, or the interfaces of popular software packages, which similarly present the user with dozens of commands at once.

Doom and *Myst*

Looking at the first decade of new media—the 1990s—one can point at a number of objects that 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 define 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 moves 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 in most games levels are quite similar to each other in structure and 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 moves 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, slowly explores 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 that critic of computer games J. C. Herz summarizes as follows: "It was an idea whose time had 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." Fifteen million copies of the original *Doom* game were downloaded around the world.[43] By releasing detailed descriptions of game 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 an essential part of the game, with new levels widely available on the Internet for anyone to download. Here was a new cultural economy that 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 a few examples as well as tools to allow consumers to build their own versions, to be 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 take apart and modify. To use the terms of the software industry, it is a closed, or proprietary, system, something that only the original creators can modify.

Despite all these differences in cosmogony, gameplay, and underlying economic model, the two games are similar in one key respect. Both are spatial journeys. 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 its logic and its secrets. In *Doom* and *Myst*—and in a great many other computer games—narrative and time itself are equated with movement through 3-D space, progression through rooms, levels, or words. In contrast to modern literature, theater, and cinema, which are built around psychological tensions between characters and movement in psychological

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43. J. C. Hertz, *Joystick Nation,* 90, 84.

space, these computer games return us to ancient forms of narrative in which 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 the classic text-based adventure game *Zork,* "You gradually unlocked a world in which the story took place, and the receding edge of this world carried you through to the story's conclusion."[44] 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 Certeau reminds us, "in Greek, narration is called 'diagesis': it establishes an itinerary (it 'guides') and it passes through (it 'transgresses.')"[45]

In the introduction to this chapter, I invoked the opposition between narration and description in narratology. As noted by Mieke Bal, the standard theoretical premise of narratology is that "descriptions interrupt the line of fabula."[46] For me, this opposition, in which description is defined negatively as absence of narration, has always been problematic. It automatically privileges certain types of narrative (myths, fairy tales, detective stories, classical Hollywood cinema), while making it difficult to think about other forms in which the actions of characters do not dominate the narrative (for instance, films by Andrey Tarkovskiy, or Hirokazu Kore-eda, the director of *Maborosi* and *After Life*).[47] Games structured around first-person navigation through space further challenge the narration-description opposition.

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44. Ibid., 150.

45. Michel de Certeau, *The Practice of Everyday Life,* trans. Steven Rendall (Berkeley: University of California Press, 1984), 129.

46. Bal, *Narratology,* 130. Bal defines *fabula* as "a series of logically and chronologically related events that are caused or experienced by actors" (5).

47. In *Understanding Comics,* Scott McLoud notes how, in contrast to Western comics, Japanese comics spend much more time on "description" not directly motivated by the narrative development. The same opposition holds between the language of classical Hollywood cinema and many films from the "east," such as the works of Tarkovsky and Kore-eda. Although I recognize the danger of such a generalization, it is tempting to connect the narration–description opposition to a much larger opposition between traditionally Western and Eastern ways of existence and philosophies—the drive of the Western subject to know and conquer the world outside versus the Buddhist emphasis on meditation and stasis. Scott McLoud, *Understanding Comics: The Invisible Art* (Harper Perennial, 1994).

Instead of narration and description, we may be better off thinking about games in terms of *narrative actions* and *exploration.* Rather than being narrated to, the player herself has to perform actions to move narrative forward—talking to other characters she encounters in the game world, picking up objects, fighting enemies, and so on. If the player does nothing, the narrative stops. From this perspective, movement through the game world is one of the main narrative actions. But this movement also serves the self-sufficient goal of exploration. Exploring the game world, examining its details and enjoying its images, is as important for the success of games such as *Myst* and its followers as progressing through the narrative. Thus, while from one point of view, game narratives can be aligned with ancient narratives that are also structured around movement through space, from another perspective they are exact opposites. Movement through space allows the player to progress through the narrative, but it is also valuable in itself. It is a way for the player to explore the environment.

Narratology's analysis of description can be a useful start in thinking about exploration of space in computer games and other new media objects. Bal states that descriptive passages in fiction are motivated by speaking, looking, and acting. Motivation by looking works as follows: "A character sees an object. The description is the reproduction of what it sees." Motivation by acting means that "the actor carries out an action with an object. The description is then made fully narrative. The example of this is the scene in Zola's *La Bête* in which Jacques polishes [strokes] every individual component of his beloved locomotive."[48]

In contrast to the modern novel, action-oriented games do not have that much dialog, but looking and acting are indeed the key activities performed by a player. And if in modern fiction looking and acting are usually separate activities, in games they more often than not occur together. As the player comes across a door leading to another level, a new passage, ammunition for his machine gun, an enemy, or a "health potion," he immediately acts on these objects—opens a door, picks up ammunition or "health potion," fires at the enemy. Thus narrative action and exploration are closely linked together.

The central role of navigation through space, both as a tool of narration and of exploration, is acknowledged by the games' designers themselves.

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48. Bal, *Narratology,* 130–132.

According to Robyn Miller, one of the two codesigners of *Myst,* "We are creating environments to just wander 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."[49] Richard Garriott, designer of the classic 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."[50]

Structuring the game as a navigation through space is common to games across all 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 following in *Doom*'s steps (*Quake, Unreal*). These genres obey different conventions. In adventure games, the user explores a universe, gathering resources. In strategy games, the user engages in allocating and moving resources and in risk management. In RPGs (role-playing games), the user builds a character and acquires 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. The fact that they all consistently do, therefore, suggests to me that navigable space represents a larger cultural form. In other words, it is something that transcends computer games and in fact, as we will see later, computer culture as well. Just like a database, navigable space is a form that existed before computers, even if 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 con-

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49. McGoman and McCullaugh, *Entertainment in the Cyber Zone,* 120.

50. Quoted in J. C. Hertz, *Joystick Nation,* 155–156.

trast 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 navigation through space was sufficient in itself.

In the 1990s, these 3-D fly-throughs have come to constitute the new genre of postcomputer cinema and location-based entertainment—the motion simulator.[51] By using 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 has already manifested itself. They include *Hale's Tours and Scenes of the World,* a popular film-based attraction that debuted at the St. Louis Fair in 1904; roller-coaster rides; flight, vehicle, and military simulators, which have 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 a particularly important role; Douglas Trumbull, who since the late 1980s has produced some of the best-known motion-simulator attractions and was the key person behind the rise of the motion-simulator phenomenon, began his career by creating ride sequences for this film.

Along with providing a key foundation for new media aesthetics, navigable space has also become 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. It is as accepted in computer culture as charts and graphs were in a print culture.[52]

Since navigable space can be used to represent both physical spaces and abstract information spaces, it is only logical that it has also emerged as an important paradigm in human-computer interfaces. Indeed, on one level, HCI can be

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51. For a critical analysis of the motion simulator phenomenon, see Erkki Huhtamo, "Phantom Train to Technopia," in Minna Tarkka, ed., *ISEA '94: The 5th 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.*

52. See www.cybergeography.com.

seen as a particular case of data visualization, the data being computer files rather than molecules, architectural models, or stock market figures. 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;[53] T_Vision (ART+COM), which uses a navigable 3-D representation of the earth as its interface;[54] and The Information Landscape (Silicon Graphics), in which the user flies over a plane populated by data objects.[55]

The original (i.e., the 1980s) 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."[56] 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 immaterial space defined by lines of light is remarkably similar to the one articulated by Gibson in his novels. In an article that 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."[57] In the first part of the 1990s, this vision has survived among the original designers of VRML. In designing the language, they aimed to "create a unified conceptualization of space spanning the entire Internet, a spatial equivalent of WWW."[58] 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," that is, represented in three dimensions.[59]

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53. Stuart Card, George Robertson, and 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.

54. http://www.artcom.de/projects/t_vision/.

55. http://www.acm.org/sigchi/chi95/proceedings/panels/km_bdy.htm.

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

57. Marcos Novak, "Liquid Architecture in Cyberspace," in Michael Benedikt, ed., *Cyberspace: First Steps* (Cambridge, Mass.: MIT Press, 1991), 225–254.

58. Mark Pesce, Peter Kennard, and Anthony Parisi, "Cyberspace," 1994, http://www.hyperreal.org/~mpesce/www.html.

59. Ibid.

The term *cyberspace* is derived from another term—*cybernetics.* In his 1947 book *Cybernetics,* mathematician Norbert Wiener defined it as "the science of control and communications in the animal and machine." Wiener conceived of 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 the computer era. The steersman navigating the ship and the missile traversing space on its way to a target have given rise to a whole number of new figures—the heroes of William Gibson, "data cowboys" moving through the vast terrains of cyberspace; "drivers" of motion simulators; computer users navigating through scientific data sets and computer data structures, molecules and genes, the earth's atmosphere and the human body; and last but not least, players of *Doom, Myst,* and their endless imitations.

From one point of view, navigable space can legitimately be seen as a particular kind of an interface to a database, and thus something that does not deserve special focus. I would like, however, to think of it also as a cultural form in its own right, not only because of its prominence across the new media landscape and, as we will later see, its persistence in new media history, but also because, more than a database, it is a new form that 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 planning and diagramming, geometry and topology, are just some of the disciples and techniques that were developed to harness space's symbolic and economic capital.[60] 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 now be instantly transmitted, stored, and retrieved; compressed, reformatted, streamed, filtered, com-

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60. Michael Benedikt 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.

puted, programmed, and interacted with. In other words, all operations that are possible with media as a result of its conversion to computer data can also now apply to representations of 3-D space.

Recent cultural theory has paid increasing attention to the category of space. 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, the writings of Fredric Jameson and David Harvey on the postmodern space of global capitalism, and Edward Soja's work on political geography.[61] At the same time, new media theoreticians and practitioners have come forward with many formulations of how cyberspace should be structured and how computer-based spatial representations might be used in new ways.[62] What has received little attention, however, both in cultural theory and in new media theory, is the 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 of interacting with any kind of data, a familiar interface in computer games and motion simulators, and a possible form for nearly any computing practice. 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

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61. Henri Lefebvre, *The Production of Space* (Oxford: Blackwell, 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: Blackwell, 1989); Edward Soja, *Postmodern Geographies: The Reassertion of Space in Critical Social Theory* (London: Verso, 1989).

62. See, for instance, Benedikt, *Cyberspace: First Steps* and the articles of Marcos Novak (http://www.aud.ucla.edu/~marcos).

media?) And, finally, what are the aesthetics of navigation through virtual space?

Computer Space

The very first coin-op arcade game was called *Computer Space.* The game simulated a 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.[63] 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 players navigated 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 that pulled them toward it. Thus along with the spaceships, the player had to interact with space itself. And although, in contrast to such films as *2001, Star Wars,* and *Tron,* the space of *Spacewar* and *Computer Space* was not navigable—one could not move through it—the simulation of gravity made it a truly active presence. Just as the player had to engage with the spaceships, he also had to engage with space itself.

This active treatment of space is the exception rather than the rule in new media. Although new media objects favor the use of space for representations of all kinds, virtual spaces are most often 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 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 "optic." Haptic perception isolates the object in the field as a discrete entity, whereas optic perception unifies

63. http://icwhen.com/the70s/1971.html.

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.[64] 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* (1924–1925).[65] 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 do not 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.[66] 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 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-

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64. Heinrich Wölfflin, *Principles of Art History,* trans. M. D. Hottinger (New York: Dover Publications, 1950).

65. Erwin Panofsky, *Perspective as Symbolic Form,* trans. Christopher S. Wood (New York: Zone Books, 1991).

66. See my article "Mapping Space: Perspective, Radar, and Computer Graphics."

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—an environment in which objects are embedded and the effect of these objects on each other, what Russian writers and artists call *prostranstvennaya sreda.* Pavel Florensky, a legendary Russian philosopher and art historian, 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."[67] This understanding of space also characterizes a particular tradition of modern painting that stretches from Seurat to Giacometti and de Kooning. These painters tried to eliminate the notions of a distinct object and empty space as such. Instead they depicted a dense field that occasionally hardens into something that we can read as an object. Following the example of Gilles Deleuze's analysis of cinema as an activity of articulating new concepts akin to philosophy,[68] it can be said that modern painters belonging to this tradition worked to articulate a 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 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 *Pac-Man* 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

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67. 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.

68. Gilles Deleuze, *Cinema* (Minneapolis: University of Minnesota Press, 1986–1989).

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 objects and the space in which they were located, 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 those faced by game designers two decades earlier. In online virtual worlds, a typical scenario may involve an avatar 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 sprites are superimposed on backgrounds. 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 on backgrounds to traditional cell animation. To save labor, animators similarly divided an 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 a space-medium (to use Florensky's term), although they created this space-medium in a different way than did modern painters. (Thus while the masses run away from serious and "difficult" abstract art to enjoy the funny and figurative images of cartoons, what they saw was not that different from Giacometti's and de Kooning's canvases.) Although all objects in cartoons have hard edges, the total anthropomorphism of the cartoon universe breaks 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 yet reached its Renaissance stage. 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 than 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 the original 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, cannot be thought of as a coherent totality: It is, rather, 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.[69] Just as in the case of a database, the narrative is replaced by a list of items; a coherent 3-D scene becomes a list of separate objects.

With its metaphors of navigation and homesteading, 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

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69. John Hartman and Josie Wernecke, *The VRML 2.0 Handbook.*

American culture generally, in its lack of attention to any zone that is 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 a reaction against the anticommunal and discrete nature of American society, an attempt to compensate for the much discussed disappearance of traditional community by creating virtual ones. (Of course, if we follow the nineteenth-century sociologist Ferdinand Tönnies, the shift from traditional close-knit scale community to modern impersonal society had already taken place in the nineteenth century and was an inevitable side-effect as well as prerequisite for modernization.)[70] However, it is important that the ontology of virtual space as defined by software itself is fundamentally aggregate, a set of objects without a unifying point of view.

Art historians and 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.[71] This is particularly important because in new media the relation between production tools and media objects 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 Ameri-

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70. See Ferdinand Tönnies, *Community and Society,* trans. Charles P. Loomis (East Lansing: Michigan State University Press, 1957).

71. One important exception was the apparatus theory developed by film theoreticians in the 1970s.

can 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 computer representations of 3-D space, I have used theories from early art history, but it would not be hard to find other theories that could work as well. Navigation through space, however, is a different matter. While art history, geography, anthropology, sociology, and other disciplines have come up with many approaches to analyze space as a static, objectively existing structure, we do not 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 its navigability, we need to be able to address this feature theoretically.

As a way to begin, we may take a look at some of the classic navigable computer spaces. The 1978 project *Aspen Movie Map,* designed at the MIT Architecture Machine Group, headed by Nicholas Negroponte (the group later expanded into the MIT Media Laboratory), is acknowledged as the first interactive virtual navigable space, and also as the first hypermedia program to be shown publicly. 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 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.[72] Yet its realism also opened up a new set of aesthetic possibilities, which, unfortunately, later designers of navigable spaces did not explore further. They relied on interactive 3-D computer graphics to construct their spaces. In contrast, the designers of *Aspen Movie Map* utilized a set of photographic images; in addition, because the images

72. Stewart Brand, *The Media Lab* (New York: Penguin Books, 1988), 141.

were taken every three meters, the result was an interesting sampling of three-dimensional space. Although in the 1990s Apple's QuickTime VR technology made this technique quite accessible, the idea of constructing a large-scale virtual space from photographs or a video of a real space was never systematically attempted again, despite the fact that it opens up unique aesthetic possibilities not available with 3-D computer graphics.

Jeffrey Shaw's *Legible City* (1988–1991), another well-known and influential computer navigable space, is also based on an existing city.[73] As in *Aspen Movie Map,* the navigation also simulates a real, physical situation, in this case, riding 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 parameters are chosen arbitrarily, every value of virtual space in *Legible City* (Amsterdam and Karlsruhe versions) 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's history. Through this mapping, 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 has 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. *Legible City* 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 that have nothing to do with actual physical spaces, or spaces that 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 vir-

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73. Manuela Abel, ed., *Jeffrey Shaw—A User's Manual* (Karlsruhe, Germany: ZKM, 1997), 127–129. Three different versions of Legible City were created based on the plans of Manhattan, Amsterdam, and Karlsruhe.

tual representation encodes the city's genetic code, its deep structure rather than its surface. Through this mapping Shaw proposes an ethics of the virtual. Shaw suggests that the virtual can at least preserve the memory of the real it replaces, encoding its structure, if not its aura, in a new form.

Although *Legible City* was a landmark work in that it presented a symbolic rather than illusionistic space, its visual appearance in many ways 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).[74] From the point of view of the history of modern art, the result hardly represented something new. *Osmose* simply replaced the usual hard-edge, polygonal, Cézanne-like look of 3-D computer graphics 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 *Legible City,* the navigation in *Osmose* is modeled on a real-life experience, in this case, scuba diving. The "immersant" controls 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 important 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 a 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 enslavement to the simulation of humanly possible navigation—walking,

74. http://www.softimage.com/Projects/Osmose/.

driving a car, pedaling a bicycle, 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-scène, 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 metafilm, the camera, part of cinema's apparatus, becomes the main character (and in this respect, we can connect *The Forest* to another metafilm, *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 animated films of the Brothers Quay, 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. In *The Street of Crocodiles,* the camera suddenly takes off, rapidly moving in a straight line parallel to an image plane, as though mounted on some robotic arm, and just as suddenly stops to frame a new corner of the space. The logic of these movements is clearly non-human; this is the vision of some alien creature. In contrast, the camera never stops at all in *The Forest,* the whole film being one uninterrupted camera trajectory. The camera system of *The Forest* can be read as a commentary on the fundamentally ambiguous nature of computer space. On the one hand, while not indexically tied to physical reality or the 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 the space of a human dweller, something used and traversed by a user, who brings her own anthropological framework of horizontality and verticality along with her. 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 are never shown either the ground

or the sky, it is centered around a 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 toward (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.

While the works discussed so far all create virtual navigable spaces, George Legrady's interactive computer installation *Transitional Spaces* (1999) moves from the virtual back to the physical. Legrady locates an already existing architectural navigable space (the Siemens headquarters building in Munich) and makes it into an "engine" that triggers three cinematic projections. As regular office employees and visitors move through the main entrance section and second-level entrance/exit passageways, their motions are picked up by cameras and are used to control the projections. Legrady writes in his installation proposal:

> As the speed, location, timing, and number of individuals in the space control the sequence and timing of projection sequences, the audience will have the opportunity to "play" the system, that is, engage consciously by interacting with the camera sensing to control the narrative flow of the installation.
>
> All three projections will comment on the notion of "transitional space" and narrative development. Image sequences will represent transitional states: from noise covered to clear, from empty to full, from open to closed, from dark to light, from out of focus to in-focus.[75]

Legrady's installation begins to explore one element in the "vocabulary" of the navigable space "alphabet"—the transition from one state to another. (Other potential elements of this alphabet include the character of a trajectory; the pattern of the user's movement—for instance, rapid geometric

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75. George Legrady, *Transitional Spaces* (Munich: Siemens Kultur Programm, 1999), 5.

movement in *Doom* versus wandering in *Myst;* possible interactions between the user and the space, such as the character acting as a center of perspective in Waliczky's *The Garden* (1992); and, of course, the architecture of space itself.) Earlier I invoked a definition of narrative by Bal that may be too restrictive in relation to new media. Legrady quotes another, much broader definition by literary theorist Tzvetan Todorov, according to whom minimal narrative involves the passage from "one equilibium to another" (or, in different words, from one state to another). Legrady's installation suggests that we can think of a subject's movement from one "stable" point in space to another (for instance, moving from a lobby to a building to an office) like a narrative; by analogy, we may also think of a transition from one state of a new media object to another (for instance, from a noisy image to a noise-free image) as a minimal narrative. For me, the second analogy is more problematic than the first, because, in contrast to a literary narrative, it is hard to say what constitutes a "state of equilibrium" in a typical new media object. Nevertheless, rather than concluding that Legrady's installation does not really create narratives, we should recognize it instead as an important example of a whole trend among new media artists—exploration of the minimal condition of a narrative in new media.

Each of the computer spaces just discussed, from *Aspen Movie Map* to *Forest,* establishes a distinct aesthetic of its own. However, the majority of navigable virtual spaces mimic existing physical reality without proposing any coherent aesthetic program. 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 *Archigram* and Bernard Tschumi, modern architects have elaborated a variety of schemes for structuring and conceptualizing space to be navigated by users: We can look, for instance, at the 1925 USSR Pavilion (Melnikov), Villa Savoye (Le Corbusier), Walking City (Archigram), and Parc de la Villette (Tschumi).[76] Even more relevant is the tradition of "paper architecture"—designs that were not intended to be built and whose authors therefore felt unencumbered by the limitations of mate-

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

rials, gravity, and budgets.[77] Another highly relevant tradition is film architecture.[78] As discussed in the "Language of Cultural Interfaces" section, the standard interface to computer space is the virtual camera modeled after the film camera rather than a simulation of unaided human sight. After all, film architecture is 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 situated between art and architecture, which, like the projects of paper architects, display a spatial imagination freed from the questions of utility and economy—the 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 virtual worlds: Think, for, instance, of the melancholic cityscapes of Giorgio de Chirico, the biomorphic worlds of Yves Tanguy, the economical wireframe structures of Alberto Giacometti, and the existential landscapes of 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, given that new media are most often experienced, like paintings, via a rectangular frame, 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 who always have to work with the basic dichotomy between built structure and empty space. And although the virtual spaces that have thus far been realized, with the possible exception of *Osmose,* accept the same dichotomy between rigid objects and the void between

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77. 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).

78. See, for instance, Dietrich Neumann, ed., *Film Architecture: Set Designs from Metropolis to Blade Runner* (Munich: Prestel, 1996).

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 it is to architecture.

Along with painting, a genre of modern art with 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.[79] In most installations, according to Kabakov, "the viewer is completely free because the space surrounding her and the installation remain completely indifferent to the installation it encloses."[80] 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, a "total" installation has a double identity. On the one hand, it belongs to the 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 directly applicable to virtual space design is his distinction between the spatial structure of an installation and its dramaturgy, that is, the time-space structure created by the movement of a viewer through an installation.[81] Kabakov's strategies of dramaturgy include dividing the total space of an installation into two or more connected spaces and creating a well-defined path through the space

79. Ilya Kabakov, *On the "Total Installation"* (Bonn: Cantz Verlag, 1995).

80. Ibid., 125. This and the following translations from the Russian text of Kabakov are mine.

81. Ibid., 200.

that does not preclude the viewer from wandering on her own, yet prevents her from feeling lost and bored. To make such a path, Kabakov constructs corridors and abrupt openings between objects; he also places objects in strange places to obstruct passage. Another strategy of the "total installation" is the choice of particular kinds of narratives that in and of themselves lead to spatialization. These are narratives that take place around a main event that 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 viewer. For instance, placing two to three pages of text at a particular point in the space creates a deliberate stop in the navigation rhythm.[82] 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 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 the partial, the small, the unexpected."[83]

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 at making viewers of his installations read carefully the significant amounts of text included in them—something that represents a constant challenge for new media designers. His constant concern is 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 the designer . . . The loss of the viewer's attention is the end of the installation."[84] This focus on the viewer offers an important lesson for new media designers, who often forget that what they are designing is not an object in itself but a viewer's experience in time and space.

I have purposefully used the word *strategy* to refer to Kabakov's techniques. To evoke the terminology of Michel de Certeau's *The Practice of*

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82. Ibid., 200–208.

83. Ibid., 162.

84. Ibid., 162.

Everyday Life, Kabakov uses strategies to impose a particular matrix of space, time, experience, and meaning on his viewers; they, in 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 could very well be their best theoretician. Like Kabakov, he never deals with computer media directly, and yet *The Practice of Everyday Life* contains a multitude of ideas directly applicable to new media. His analysis of the ways in which people employ "tactics" to create their own trajectories through the spaces defined by others (both metaphorically and in the case of spatial tactics, literally) offers a good model for thinking about the ways in which computer users navigate 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.[85]

The Navigator 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.[86] (Recent writings on visual culture, film theory, cultural history, and cyberculture have invoked the figure of the flâneur much too often; my justification for invoking it once again here is that I hope to use it in new ways.) An anonymous observer, the flâneur navigates through the space of a Parisian crowd, mentally recording and immediately erasing the faces and figures of passersby. From time to time, his gaze meets the gaze of a passing woman,

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85. De Certeau, *The Practice of Everyday Life,* xviii.

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

engaging her in a split-second virtual affair, only to be unfaithful to her with the next female passerby. 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 city lures the flâneur like a phantasmagoria. In it the city is now a landscape, now a room."[87] The navigable space is thus 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 Waliczky's *The Garden* and also in the commercial film *Dark City* (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 the close-knit community of the small-scale traditional society (Gemeinschaft), we now have the anonymous associations of modern society (Gesellshaft).[88] 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 a crowd of strangers shows the psychological price paid for modernization. Still, the subjectivity of the flâneur is, in essence, intersubjectivity—an exchange of glances between him and other human beings.

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

88. The distinction between Gemeinschaft and Gesellshaft was developed by Tönnies in *Community and Society.*

A very different image of navigation through space—and of subjectivity—is presented in the novels of nineteenth-century American writers such as James Fenimore Cooper (1789–1851) and 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, the milieu of a Parisian flâneur, the heroes of these American novels are most at home in the wilderness, away from the city. They navigate forests and rivers, overcoming obstacles and fighting enemies. Subjectivity is constructed through 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 saloon. Rather than providing a 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 describes 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 behaviors that 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."[89] 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."[90] 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

89. Adilkno, *The Media Archive* (Brooklyn, New York: Autonomedia, 1998), 99.
90. Ibid., 100.

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 to being exiled into a subculture of one's own."[91] Although Lovink positions the Data Dandy exclusively in data space ("Cologne and pink stockings have been replaced by precious Intel"), the Data Dandy does have a dress code of his own. This look was popular with new media artists of the 1990s—no labels, no distinct design, no bright colors or extravagant shapes—a non-identity that is nevertheless paraded as style and, in fact, is carefully constructed (as I learned while shopping in Berlin in 1997 with Russian net.artist Alexei Shulgin). The designers who best 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 era of exess. The new style of non-identity corresponds perfectly 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."[92]

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 or 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, nineteenth-century European novels do not feature 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 narratives. Their heroes are not developed, and their psychology is not represented. But as these heroes move

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91. Ibid.

92. Ibid.

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 true for other game genres (action, adventure, simulators) that put the user in command of a character (*Doom, Mario, Tomb Raider*). As the character progresses through the game, the game player acquires new skills and knowledge. She learns how to outwit the mutants lurking in the levels of *Doom,* how to defeat the enemies with just a few kicks in *Tomb Raider,* how to solve the secrets of the playful world in *Mario,* and so on.[93]

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 the structure of computer games. 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 investigate systematically all the spaces of a given level before he can move to the next level. In other games taking place in one large territory, the game play gradually involves larger and larger parts of this territory (*Adventure, War Craft*).

Although I focus in this section on navigating a space in a literal sense, that is, moving through a 3-D virtual space, this concept is also a key metaphor in the conceptualization of new media. From the 1980s concept of cyberspace to 1990s software such as Netscape Navigator, interacting with computerized data and media has been consistently framed in spatial terms. Computer scientists adopted this metaphor as well: They use the term *navigation* to refer to different methods of organizing and accessing hypermedia, even though a 3-D virtual space interface is not at all the most common method. For instance, in his *Elements of Hypermedia Design,* Peter Gloor lists "seven design concepts for navigation in dataspace": linking, searching, sequentialization, hierarchy, similarity, mapping, guides and agents.[94] Thus, "navigating the Internet" includes following hyperlinks, using menus

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93. This narrative of maturation can also be seen as a particular case of an initiation ceremony, something traditionally a part of every human society.

94. Peter Gloor, *Elements of Hypermedia Design* (Boston: Birkhäuser, 1997).

commonly provided by Web sites, as well as using search engines. If we accept this spatial metaphor, both the nineteenth-century European flâneur and the American explorer find their reincarnation in the figure of the net surfer. We may even correlate these two historical figures with the names of the two most popular Web browsers: the flâneur of Baudelaire—Netscape Navigator; the explorer of Cooper, Twain, and Hemingway—Internet Explorer. Of course, names apart, these two browsers are functionally quite similar. However, given that they both focus on a single user navigating through Web sites rather than more communal experiences, such as newsgroups, mailing lists, text-based chat, and IRC, we can say that they privilege the explorer rather than the flâneur—a single user navigating through an unknown territory rather than a member of a group, even if this group is a crowd of strangers. And although different software solutions have been developed to make Internet navigation more of a social experience—for instance, allowing remote users to navigate the same Web site together, simultaneously, or allowing the user to see who has already accessed a particular document—individual navigation through "history-free" data was still the norm at the end of the 1990s.

Kino-Eye and Simulators

I have presented two historical trajectories: from flâneur to Net surfer, and from nineteenth-century American explorer to the explorer of navigable virtual space. It is also possible to construct another trajectory, leading from the Parisian flanerie to navigable computer spaces. In *Window Shopping,* film historian Anne Friedberg presents an archeology of a mode of perception that, according to her, characterizes modern cinematic, televisual, and cyber cultures. This mode, which she calls a "mobilized virtual gaze,"[95] combines two conditions: "a received perception mediated through representation" and travel "in an imaginary flanerie through an imaginary elsewhere and an imaginary elsewhen."[96] According to Friedberg's archeology, this mode emerged when a new nineteenth-century technology of virtual representation—photography—merged with the mobilized gaze of

95. Friedberg, *Window Shopping,* 2.

96. Ibid.

tourism, urban shopping, and flanerie.[97] 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."[98] The flâneur occupies a privileged position among these nineteenth-century subjects because he embodied most strongly the desire to combine perception with motion through a space. All that remained in order to arrive at the "mobilized virtual gaze" was to virtualize this perception—something that cinema accomplished in the last decade of the nineteenth century.

Although Friederg's account ends with television and does not 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, motion simulator, data visualizations, or 3-D human-computer interface, follows the logic of the "virtual mobile gaze." Instead of Parisian streets, shopping windows, and the faces of the passersby, the virtual flâneur travels through virtual streets, highways, and planes of data; the eroticism of a split-second virtual affair with a passerby of the opposite sex is replaced with the excitement of locating and opening a particular file or zooming into the virtual object. Like Baudelaire's flâneur, 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 a "database complex," an irrational desire to preserve and store everything, navigable space is not just a purely functional interface. It is also an expression and gratification of a psychological desire, a state of being, a subject position—or rather, a subject's trajectory. If the subject of modern society looked for refuge from the chaos of the real world in the stability and balance of the static composition of a painting, and later in the cinematic image, the subject of the information society finds peace in the knowledge that she can slide over endless fields of data, locating any morsel of information with the click of a button, zooming through file systems and networks. She is comforted

97. Ibid., 184.
98. Ibid., 94.

not by an 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 Friedberg? While still enjoying a privileged place in computer culture, flanerie now shows its age. Here we can make an analogy with the history of the 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.[99] Bypassing the ability to display and navigate files graphically, the user resorts to a text-based search engine. Similarly, while the "mobilized virtual gaze" described by Friedberg was a significant advancement over earlier more static methods of data organization and access (static image, text, catalog, library), its "bandwidth" is too limited in the information age. Moreover, a simple simulation of movement through a physical space defeats the computer's new capabilities of data access and manipulation. Thus for the virtual flâneur, such operations as search, segmentation, hyperlinking, 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. *Man with a Movie Camera* is an important point in the trajectory that 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 means of data access. However, the data with which he worked is raw visible reality—not reality digitized and stored in a computer's memory as numbers. Similarly, his interface was a film camera, that is, an anthropomorphic simulation of human vision—not computer algorithms. Thus, *Vertov stands halfway between Baudelaire's flâneur and today's computer user: No longer just a pedestrian walking down a street, but not yet Gibson's data cowboy who zooms through pure data armed with data-mining algorithms.*

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99. 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.

In his research on what can be called the "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 sped up film speed; he superimposed a number of images together in time and space (temporal montage and montage within a shot). *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 also a database of new interface operations that together aim to go beyond simple human navigation through physical space.

Along with *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 as 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."[100] Thus, rather than being an afterthought, the adaptation of flight simulator technology to consumer entertainment that 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 the 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 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 its developers. In 1968, Ivan Sutherland, who had already pioneered interactive computer-aided design ("Sketchpad,"

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100. Benjamin Wooley, *Virtual Worlds* (Oxford: Blackwell, 1992), 39, 43.

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. For instance, simulation of particular landscape features typically seen by a pilot, such as flat terrain, mountains, sky with clouds, and fog, all became important research problems.[101] The application of interactive graphics to 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 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 that 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 the military mode of perception into general culture. Until 1990, such companies as Evans and Sutherland, Boeing, and Lockheed were busy developing multi-million-dollar simulators, but as military orders dried up, they were forced 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 simulators; and Virtual Glider, an immersive, location-based entertainment station.[102] As military budgets continued to diminish and entertainment budgets soared, the entertainment industry and the military often came to share the same technologies and employ the same visual forms. Probably the most graphic example

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101. For more on the history of 3-D computer graphics, see my article "Mapping Space: Perspective, Radar, and Computer Graphics."

102. http://www.es.com/product_index.html.

of the ongoing circular transfer of technology and imagination between the military and the civilian sector in new media is *Doom.* Originally developed and released over the Internet as a consumer game in 1993 by id software, it was soon picked up by the U.S. Marine Corps, which customized it into a military simulator for group-combat training.[103] Instead of using multi-million-dollar simulators, the Army could now train soldiers on a fifty-dollar 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 the 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 the military and film cultures of the twentieth century, including the use of a mobile camera moving through space in military aerial surveillance and in cinematography.[104] Virilio went on to suggest that, whereas space was the main category of the nineteenth century, the main category of the twentieth century was time. As I already discussed, telecommunication technology for Virilio 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 a real-time politics, which requires instant reactions to 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 the civilian sector. In this case, the techno-politics of the Cold War nuclear arms equilibrium between the two superpowers capable of striking each other or any point on Earth at any moment is seen as a fundamentally new stage of culture, in which real time triumphs over space.

Although Virilio did not write on computer interfaces, 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*

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

104. Paul Virilio, *War and Cinema* (London: Verso, 1989).

Worrying and Love the Bomb (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. Uneconomical and inefficient as it may be, the navigable space interface is nevertheless thriving in all areas of new media. How can we explain its popularity? Is it simply a result of cultural inertia? A leftover 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 merely the end of a historical trajectory; it is also 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 considering only the 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 now briefly look at two other fields—anthropology and architecture—in which 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."[105] Place is what anthropologists have studied traditionally; it is characterized by stability, and it supports stable identity, relations, and history.[106] Auge's main source for his distinction between place and space, or non-place, is Michel de Certeau: "Space, for him, is a

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105. Marc Auge, *Non-places: Introduction to an Anthropology of Supermodernity,* trans. John Howe (London: Verso, 1995), 78.

106. Ibid., 53–53.

'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.[107] 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 Auge chooses the counterpart of the pilot or the user of the flight simulator—the airline passenger—as the subject who exemplifies the condition of supermodernity. "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."[108] Auge concludes that "as anthropological places create the organically social, so non-places create solitary contractuality," the very opposite of the traditional object of sociology: "Try to imagine a Durkheimian analysis of a transit lounge at Roissy!"[109]

Architecture by definition stands on the side of order, society, and 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).[110] 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

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107. Ibid., 79–80.

108. Ibid., 101, 103.

109. Ibid., 94.

110. De Certeau, *The Practice of Everyday Life,* xiv.

imagination into the design of non-places such as airports (Kansai International Airport in Osaka by Renzo Piano), train terminals (Waterloo International Terminal in London by Nicholas Grimshaw) and highway control stations (Steel Cloud or Los Angeles West Coast Gateway by Asymptote Architecture group).[111] Probably the ultimate in non-place architecture is the one-million-square-meter Euralille project, which redefined the 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, and Jean Nouvel built Centre Euralille, which contains a shopping center, school, hotel, and apartments next to the train terminal. Centered around the entrance to the Chunnel, the underground tunnel for cars that connects the Continent and England, and the terminal for the high-speed train that 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*

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 the abstract paintings of Malevich and Mondrian than with the photorealistic renderings of *Quake* (1996) and *Unreal* (1997). Whether this evolution in graphics was also accompanied by a conceptual evolution is another matter. Compared to 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 section has suggested, designers of virtual spaces may find a wealth of relevant ideas by looking at twentieth-century art, architecture, film, and other arts. Similarly, some of the earliest computer spaces, such as *Spacewar* and *Aspen Movie Map,* con-

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111. Jean-Claude Dubost and Jean-François Gonthier, eds., *Architecture for the Future* (Paris: Éditions Pierre Terrail, 1996), 171.

tained aesthetic possibilities that are still waiting to be explored. In conclusion, I will discuss two more works by Jeffrey Shaw, who probably draws on various cultural traditions of space construction and representation more systematically than any other new media artist.

While Friedberg's concept of the 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–present) and *Place: A User's Manual* (1995) emphasize both the similarities and differences between various technologies of navigation.[112] In these works, Shaw evokes the navigation methods of panorama, cinema, video, and VR. But rather than collapsing different technologies into one, he "layers" them 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,* visitors find themselves inside a large semisphere reminiscent of the nineteenth-century panorama. The projectors located in the middle of the sphere throw a rectangular image on the inside surface of the semisphere. In this way, the interface of cinema (an image enclosed by a rectangular frame) is placed inside the interface of panorama (a semispherical enclosed space). In *Place: A User's Manual,* a different "layering" takes place: A panorama interface is placed inside a typical computer-space interface. The user navigates a virtual landscape using a 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 the panorama tradition.

By placing interfaces of different technologies next to one other within a single work, Shaw foregrounds the unique logic of seeing, spatial access, and user behavior characteristic of each. The tradition of the framed image, that is, a representation that exists within the larger physical space that contains the viewer (painting, cinema, computer screen), meets the tradition of "total" simulation, or "immersion," that is, a simulated space that encloses the viewer (panorama, VR).

Another historical dichotomy staged for us by Shaw is that between the traditions of collective and individualized viewing in screen-based arts. The

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112. Abel, *Jeffrey Shaw,* 138–139, 142–145.

first tradition spans from magic-lantern shows to twentieth-century cinema. The second passes from the camera obscura, stereoscope, and kinescope to head-mounted displays of VR. Both have their dangers. In the first tradition, the individual's subjectivity can be dissolved in a mass-induced response. In the second, subjectivity is defined through the interaction of an isolated subject with an object at the expense of intersubjective dialogue. In the case of viewers' interactions with computer installations, as I noted when discussing *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, mouse, or 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 into 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.[113] 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 architect G. I. Gidoni designed a monument to the revolution in the form of a semitransparent globe that could hold several thousand spectators.) Yet rather than being presented with a simulated world that has nothing to do with the real space of the viewer (as in typical VR), visitors who enter *EVE*'s enclosed space discover that *EVE*'s apparatus shows the outside reality they ostensibly just left behind. Moreover, instead of being fused in a single collective vision (Gesamtkunstwerk, cinema, mass society), visitors are confronted with a subjective and partial view. Visitors see only what one person who wears a head-mounted sensor chooses to show them; that is, they are literally limited by this person's point of view. In addition, instead of a 360-degree view, they see a small rectangular image—a mere sample of the world outside. The one visitor wearing a sensor, who thus literally acts as an eye for the rest of

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113. Here I am describing the particular application of EVE that I saw at the "Multimediale 4" exhibition, Karlsruhe, Germany, May 1995.

the audience, occupies many positions at once—master subject, visionary who shows the audience what is worth seeing, and (at the same time) mere object, an interface between them and outside reality, that is, a tool for others; a projector, light, and reflector, all at once.

Having examined the two key forms of new media—database and navigable space—one is tempted to see their privileged role in computer culture as a sign of a larger cultural change. If we use Auge's distinction between modernity and supermodernity, the following scheme can be established:

1. modernity—"supermodernity,"
2. narrative (= hierarchy)—database, hypermedia, network (= flattening of hierarchy),
3. objective space—navigable space (trajectory through space),
4. static architecture—"liquid architecture,"[114] and
5. geometry and topology as theoretical models for cultural and social analysis—trajectory, vector, and flow as theoretical categories.

As can be seen from this scheme, the two "supermodern" forms of database and navigable space are complementary in their effects on the forms of modernity. On the one hand, a narrative is "flattened" into a database. A trajectory through events and/or time becomes a flat space. On the other hand, a flat space of architecture or topology is narrativized, becoming a support for individual users' trajectories.

But this is only one possible scheme. What is clear, however, is that we have left modernity for something else. We are still searching for names to describe it. Yet the names that we have come up with—"supermodernity," "transmodernity," "second modern"—all seem to reflect the sense of the continuity of this new stage with the old. If the 1980s' concept of "postmodernism" implied a break with modernity, we now seem to prefer to think of cultural history as a continuous trajectory through a single conceptual and aesthetic space. Having lived through the twentieth century, we learned all too well the human price of "breaking with the past," "building from scratch," "making new," and other similar claims—whether involving aes-

114. See Novak, "Liquid Architectures in Cyberspace."

thetic, moral, or social systems. The claim that new media should be totally new is only one in the long list of such claims.

Such a notion of a continuous trajectory is more compatible with human anthropology and phenomenology. Just as a human body moves through physical space in a continuous trajectory, the notion of history as a continuous trajectory is, in my view, preferable to the one that postulates epistemological breaks or paradigm shifts from one era to the next. This notion, articulated by Michel Foucault and Thomas Kuhn, in the 1960s, fits with the aesthetics of modernist montage of Eisenstein and Godard—rather than our own aesthetics of continuity as exemplified by compositing, morphing, and navigable spaces.[115]

These thinkers also seem to have projected onto a diachronic plane of history the traumatic synchronic division of their time—the split between the capitalist West and the communist East. But with the official (although not necessarily actual) collapse of this split in the 1990s, we have seen how history has reasserted its continuity in powerful and dangerous ways. The return of nationalism and religion and the desire to erase everything associated with the Communist regime and return to the past—pre-1917 Russia and pre-1945 Eastern Europe—are only some of the more dramatic signs of this process. A radical break with the past has a price. Despite the interruption, the historical trajectory keeps accumulating potential energy until one day it reasserts itself with new force, breaking out into the open and crushing whatever new has been created in the meantime.

In this book, I have chosen to emphasize the continuities between the new media and the old, the interplay between historical repetition and innovation. I wanted to show how new media appropriate old forms and conventions of different media, in particular, cinema. Like a river, cultural history can not suddenly change its course; its movement is that of a spline rather than a set of straight lines between points. In short, I wanted to create trajectories through the space of cultural history that would pass through new media, thus grounding it in what came before.

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115. Another notion that belongs to this paradigm of discontinuity is René Thom's catastrophe theory. See his *Structural Stability and Morphogenesis* (Reading, Mass.: W. A. Benjamin, 1975).