20 *The Virtual Window*

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The Virtual Window

Just as water, gas, and electricity are brought into our houses from far off to satisfy our needs in response to a minimal effort, ***so we shall be supplied with visual and auditory images,*** *which will appear and disappear at the simple movement of the hand, hardly more than a sign. . . . I don't know if a philosopher has ever dreamed of a company engaged in the home delivery of Sensory Reality.*[1]

—Paul Valéry "The Conquest of Ubiquity" 1928

Paul Valéry's forecast is a stunning augury of contemporary telecommunications: images and sounds are a utility, delivering "sensory reality" to the home at "the simple movement of the hand." As the twentieth century ended, new systems of circulation and transmission began to replace the projection screen, and to link the screens of the computer and

television with the dialogic interactivity of the telephone. This paper—part of a larger project called *The Virtual Window: A Cultural History of Windows and Screens*—is, in many ways, both pre-quel and sequel to my book *Window Shopping.* It means to expand an account of the emergence of a mobilized and virtual visuality backward, in a thicker history of the framed visuality of the window, and forward, to the window's ever more virtual functions.[2] Along the way, we will reconsider a history of what used to be called "spectatorship": because, I will argue, the very term "spectatorship" has lost its theoretical pinions, as screens have changed, as has our relation to them.[3]

Here, I consider the screen—the film screen, the TV screen, the computer screen—as a component piece of architecture, a "virtual window" which renders the wall permeable to light and "ventilation" and which has dramatically changed the materiality (and—perhaps more-radically—the temporality) of built space. The window has a deep cultural history as a figurative trope for the framing and mediating of the pictorial image. The architectural role of the window changed, I will argue, with the development of its virtual analogs. And, as twentieth-century images were projected and transmitted, the window became an equally compelling metaphor for the screen.

The Architectural Window and the Virtual Window

In the film treatment of his 1933 novel, *The Shape of Things to Come,* H. G. Wells describes a scene from the year 2054, a scene that is realized (see fig. 20.2) in the 1936 William Cameron Menzies film adaptation. In a room with austerely streamlined decor, a young girl stands in front of a framed screen supported almost invisibly by plexi-glass. She declares, albeit somewhat leadenly: "I love history and I love history pictures! It's so exciting to see how the world has changed." A picture of the New York skyline appears on the screen:

> "What a funny place New York was," she shrieks, "all sticking up and full of windows!"
>
> Ralph Richardson, her wizened great-grandfather, attempts to supply an explanatory caption to the view:
>
> "They opened and shut those windows to let in the wind and the wet and the cold. I don't know how to describe these windows to you but perhaps there are pictures. . . . The age of windows," he goes on to explain, "lasted four centuries."

In H. G. Wells's fictional imaginary, the buildings of the future did not have windows, but had instead the virtual windows of tele-screens. As the above "picture" illustrates—doubling here for the double function of the "history picture" in *Things to Come*—

Figure 20.2 "The age of windows lasted four centuries"—from the film *Things to Come* (William Cameron Menzies, 1936) based on H. G. Wells's 1933 novel *The Shape of Things to Come.*

"pictures" render "history" through their evidentiary power. The picture of the New York skyline provides the only record of the architectural window and this "history picture" also serves as a window—as the architectural window is replaced by the screen, its virtual substitute.

If we conduct a rough historical calculation: Large sheets of cast glass, rolled and poured, were available as a building material in the mid seventeenth century. With this as a starting point, four centuries of windows would conclude in the middle of the twenty-first century, a moment in the not-so-far-off future.

A Brief History of Fenestration

A brief history of this "the age of windows" will demonstrate how the window as an architectural opening for light and ventilation ceded its priorities to the modern function of the window: to frame a view. The window began as an opening slit for light and ventilation (a clostra) and developed in Roman times as glazing was introduced. Representations of windows appear in wall paintings in Egypt and in reliefs from Assyria. In early Christian

and Byzantine churches, small pieces of glass were inserted into a masonry frame. But it was not until the twelfth and thirteenth centuries that the technique of using different colors of glass—stained glass—was deployed to produce detailed ornamental patterns. In the Middle Ages, as glazing improved, windows grew larger and more transparent.[4]

Glass properties were altered by changing ingredients: soda lime instead of lead alkali materials made a glass of greater transparency and strength.[5] The technologies for glass production were highly guarded secrets between the fifteenth and seventeenth century when the Venetian glassmakers dominated the European glass industry. In Lewis Mumford's account, glass played a determinant role in the scientific transformation of the modern world. "Without the use of glass for spectacles, mirrors, microscopes, telescopes, windows and containers," Mumford writes, "the modern world as realized by physics and chemistry could scarcely have been conceived."[6]

As the Germans and English began to discover and refine their own methods in the nineteenth century, glass remained a luxury, used for public buildings and optical instruments. Between 1696 and 1851 property tax in England was assessed, not by the square footage of property; but by the number of windows, enforcing both the measure of glass as a taxable luxury and the number of windows as a measure of privilege. The British taxing of windows set the precedent for the French door and window tax between 1798 and 1917. Windows were a measure of property and wealth, indicating the ideology and privilege of those possessing a window-view.[7]

The window served as the membrane between inside and outside, and light was the material that modulated this relation. In the late eighteenth century—and into the nineteenth century—middle and upper class residences demonstrated an ambivalence toward the invasion of light into the domestic interior; crystal clear window panes were heavily curtained openings, as if to enact the separation between private and public space. Improvements in cast iron architecture—the rolled wrought iron sash bar and section—meant that complete glass structures like the Crystal Palace (Joseph Paxton, 1851) and the glazed roofs of train stations (Kings Cross Station, 1851), market halls (*Les Halles*/Victor Baltard, 1853–1858) and department stores (*Bon Marche*/ *Boileau* and *Eiffel,* 1869–1887) could be built. All of these structures allowed blazing light into an uncurtained, undraped, and hence well-lit interior space.[8]

As the window grew in relation to the wall—shedding its mullions and posts—it became more and more of a permeable interface, its transparency enforced a two-way model of visuality: by framing a private view outward—the "picture" window—and by framing a public view inward—the "display" window. The shop window was a consequence of

improved glass technology and the commercial exploitation of its visual display, framing the gaze of passing *flâneurs* and *flâneuses* at commodities seductively displayed. The pane of the shop window enacted the *entre libre* principle of the department store, where the consumptive mode of "just looking" had its own price not in the obligation—but in the desire—for purchase. "Show windows lead to larger openings in the wall," Siegfried Gideon writes, "It was from these store windows that we first learned how to use large glass areas in dwelling houses."[9]

The window became a display frame and, as the architectural use of the horizontal or ribbon window demonstrated, the window could also become a wall.[10] As a material, glass offered both transparency and protection; could keep the outside out and at the same time bring it in. "Fully apprehending the outside from within, yet feeling neither cold nor wind nor moisture, is a modern sensation," argues Richard Sennett, which produced " a complete visibility without exposure of the other senses."[11] This association of visibility with isolation developed, Sennett maintains, as air-conditioning and thermal glass were perfected a half a century later; culminating in the paradigmatic modernist "glass box."

The modern house became not only a "dwelling machine" but also a "viewing machine." As Frank Lloyd Wright asserted:

> Had the ancients been able to enclose interior space with the facility we enjoy because of glass, I suppose the history of architecture would have been radically different, although it is surprising how little this material has yet modified our sense of architecture beyond the show-windows the shop keeper demands and gets . . . The machine has given to architects, in glass, a new material with which to work. Were glass eliminated now from buildings, it would be, so far as our buildings have gone, only like putting our eyes out. We could not see or see into the building. We have gone so far with it as to make it the eyes of the building.[12]

The materials of glass and its properties of transparency led Wright to this optical metaphor. Windows become the "eyes of the building," prosthetic organs for looking out and for looking in. The window is a visual metaphor with a literal analog; an architectural figure and a philosophical paradigm.

The Window and Perspective

The history of the window is inextricably linked with the history of perspective. As a representational system, perspective was a technique for re-producing the spatial coordinates of vision on the flat plane of a virtual representation.[13] The perspectival image,

organized to provide the viewer with a centered position in relation to the picture, was embodied in Leon Battista Alberti's descriptive metaphor for the painting (*pictura*) as a "an open window *(aperta finestra)* through which the subject to be painted is seen."[14] Leonardo daVinci also described techniques of perspective by imagining a "pane of glass, quite transparent, on the surface of which the objects behind that glass are drawn."[15]

In Dürer's famed illustration for his 1525 treatise on perspective, *The Painter's Manual,* the artist sits in front of a window-like grid through which he measures his subject. As Dürer explained it: "Perspectiva is a Latin word which means 'seeing through.'[16] Dürer's image with the artist, male; the subject, voluptuous, reclining and female—has often been used to indicate the gendered difference between the holder of focal point perspective and the massive 3D subject of this perspective. The grid-system—itself a prototype for dividing an image into its picture elements, or pixels, for 3D—imaging—aided the artist in transforming the three-dimensional natural world onto the two-dimensional plane of representation.

The window frame of perspectival positioning implied a subjective distance, a separation through representation. The viewer of this "windowed," monocular view of space has been commonly conflated with Descarte's description of a subject who stood outside of the world and represented its reality to him/herself. As Heidegger would posit in "The Age of the World Picture" (1938): "The fundamental event of the modern age is the conquest of the world as picture."[17] To Heidegger, the transformation of the world into "picture" (*Bild*) was coincident with the Descartes' seventeenth-century meditations on the subjectum who represents the world through thought—*ego cogito (ergo) sum.*"[18] Heidegger asserts: "That the world becomes picture is one and the same event with the event of man's becoming subjectum in the midst of that which is."[19]

The Virtual Window and the Screen

At which point does the history of the window begin to converge with its virtual substitutes? The virtual grail of representation had a history rooted in all forms of "picture-making" but was most dramatically achieved with photography's indexical record. Let's begin with the earliest extant photograph: Nicéphore Niépce's view from his window, a view that he fixed on pewter plate in 1826. For Niépce's eight-hour exposure, the window was convenient as a site, and its view is held static and fixed in virtual fashion (see fig. 20.3).

The Cinema Screen

The moving image expanded the photograph's virtuality by adding mobility, altering but not contradicting its perspectival positioning. But if the cinema provided a virtual mobility for its spectators it did so within the confines of a frame. Early panoramic films, for example, illustrate how the panorama—once a large-scale form that could be viewed by a spectator placed in the center, turning one's head—became reduced to framed images recorded by a moving ("panning") camera. Some historians of early cinema describe this early fascination with movement as a fascination with spectacle and sensation—the cinema of attractions.[20] But let's reframe that assumption thinking about the virtuality of such movement: i.e., the spectator is not really moving; his or her head and body is relatively immobile. The visuality here is compensatory—along the lines of the paradox,

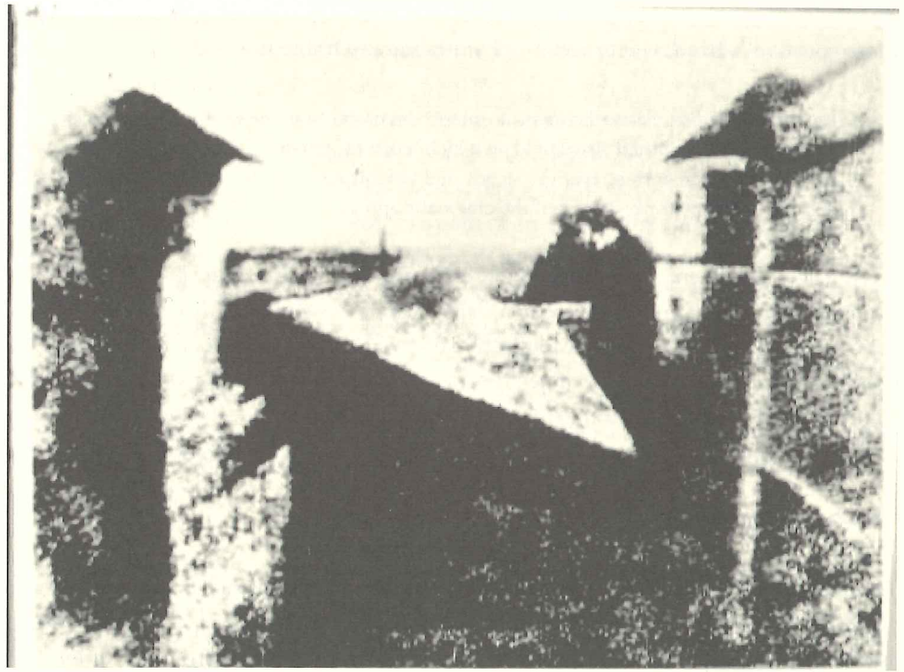

Figure 20.3 Joseph Nicéphore Niépce, view from his window at Gras, 1826.

which I'll repeat: as the mobilized gaze became more virtual, it grew to involve less physical mobility, and became located within the confines of a framed visuality. Even today's "blockbuster," "shit blows up" special effects films illustrate a limit-case fascination with explosive high-speed motion in a confined frame. In this way, the cultural force of the cinematic and televisual has produced an ingrained virtuality of the senses, removing our experience of space, time and the real to the plane representation, but in form of delimited vision, in a frame. The cinema screen transfered the sensual isolation produced by the plate-glass window onto a virtual register. A virtual window is reliant not on its transparency but on its opacity; its highly mediated modulation of light provides an aperture—not to a reality—but to a delimited virtuality.

In the critique of Jean Louis Baudry and other 1970s film theorists, it was the film frame and the perspectival monocularity of its limited window that organized the spectator's vision. Following Alberti and the spatial codes of Renaissance perspective, the film frame imbricated—interpellated—the spectator into its philosophical program and ideological consequences.[21] Stephen Heath described the relay between Quattrocento codes of perspective—from seen to scene—from camera to frame to screen:

> It may well be that classical cinema acquires "the mobility of the eye" while preserving the contained and delimited visual field on which "correct" perspectives depend . . . the eye in the cinema is the perfect eye, the steady and ubiquitous control of the scene passed from director to spectator by virtue of the cinematic apparatus.[22]

As a key component of the "basic cinematic apparatus"—consisting of the film, the film projector, the screen and spectator in a fixed relation—"apparatus theory" cast the film screen as a conflationary substitute for the film frame.[23] Apparatus theory may have been dismantled by feminist (and other) correctives to its ahistoric generalizations and disregard for oppositional strategies of style or exhibition and yet—importantly—it described the screen itself as the locus of fascination, the site of enfolding psychic space onto physical space.[24]

The Television Screen

Much of the early competition between film and television centered around screen size; the 10–12" television screen was tailored to the domestic scale of the home. Movie producers and exhibitors competed by differentiating their offerings with color, 3D and wider screen formats. Drive-in "roofless" theaters or "ozoners" catered to the mobility and domestic encapsulation of the automotive spectator; "four-walled" or "hardtop" theaters introduced Widescreen and Cinerama formats to compensate for what the small black and white screens of television could not supply.

And, as television scholars are quick to note, the placement of televisions in the home significantly alters the function of such spectatorship. Lynn Spigel, for example, likens the television's screen—a form of "home theater"—to the 1950s architectural use of the picture window, a "window-wall" designed to bring the outside in.[25] Some exhibitors tried to attract television viewers outside the home, as late 1940s experiments with "theater television" illustrate. Although both the content and the form of television competed with the film industry for viewers, television also became a delivery system for motion pictures—first in broadcast and syndicated format and later in basic and premium cable movie channels. As films were shown on television, the changes in cinema screen sizes/aspect ratios meant that films were either panned and scanned or more appropriately letter-boxed to fit in the 3X4 rectangular format of the television screen. The television "viewer" could now view films in a space that was, as Roland Barthes described it, "familiar, organized, tamed."[26] The VCR was the first technology to begin to erode the historical differences between television and film, altering as it has, the terms of electronic and cinematic viewing.[27]

Large screen televisions and high-resolution flat-screen wall displays illustrate how screens have gotten big enough and flat enough to substitute for real windows. In 1995, the *New York Times* described the wall-sized screens in Bill Gates's $30 million home in Seattle: "Instead of travelling the world to collect great art for his nooks and sky-lighted reception rooms," cyber-baron Gates "bought the electronic rights to art from museums like the National Gallery in London. With the press of a switch, the bathroom walls will become Rembrandts."[28] (If masterpieces can hang in your bathroom in electronically reproduced form; one can easily imagine a subscription service that would display the originals—a true Masterpiece theatre.) As flat-screen technology improves and screens replace real windows with a kind of "inhabited TV," a "windows environment" may give way to virtual "window-walls," an image not far from the shape of H. G. Wells's *Things to Come*.

The Computer Screen

The scale and domestic place of the television prepared us for the screens of the "personal" computer. But computer "users" are not spectators, not viewers. The "interface" may retain some immobility (with focussed attention on a cathode ray screen) but the

computer "user" interacts with the framed image on a small screen, "using" a device—keyboard, mouse, or (in the case of touch-screens) the finger—to manipulate what is contained within the parameter of the screen.[29] Software designers have worked to model "interface" to emulate the associative patterns of human thought, as we become dyadic partners in a cyber-metaphysical relationship.[30] But as complaints about the awkwardness of this relationship are surfacing, one critic has proclaimed: "Using computers is like going to the movie theater and having to watch the projector instead of the film."[31]

But it is not only a new "interface" that has changed our relation to the screen. Perhaps more importantly, the computer has produced a further metaphysical challenge in our relation to the screen. The "integral realism" of the camera image meets its most subversive challenge: the digital image takes the assaults to concepts of aura and originality produced by photography and film to new extremes; it radically subverts the photograph's evidentiary power. Digital "information" can be manipulated easily and rapidly by computer, and hence is more susceptible to alteration. As films like *Forrest Gump* and *Wag the Dog* broadly illustrate, if digitally altered images are "history pictures"—to return to H. G. Wells's term—"history" is easily revised, corrected to fit any "counter-factual" (ideological) agenda.

Beyond just the future of imaging, digital technology also transforms delivery and display. Turning Marshall McLuhan's assertion "the medium is the massage" on its head, Nicholas Negroponte asserts the "mediumlessness" of the digital: "The medium is not the message in the digital world," he writes. "It is an embodiment of it. A message might have several embodiments automatically derivable from the same data."[32] Friedrich Kittler had proclaimed this in 1986 when he wrote:

> Something is coming to an end. The general digitalization of information and channels erases the difference between individual media. Sound and image, voice and text have become mere effects on the surface or, to put it better, the interface for the consumer. Sense and the sense become mere glitter.[33]

The movie screen, the TV screen, the computer screen may still occupy separate spaces (their very location changes our concept of spectatorship—the place of the computer in the home or in the workplace is quite different from the domestic lodging of the TV set), but the types of images one sees on each of them are losing their medium-based specificity. Images have become a utility; each household has a supply that enters the home via broadcast signals, cable wires, satellite reception, or telephone modem hookups—supplied to the virtual windows that ventilate domestic space.

Microscreen (Microsoft) Windows

Yet the metaphor of the window has retained a predominant role in the technological reframings of our visual field. The computer "window" is only a portion of the computer screen, scalable in size. Pioneered by Douglas Englebart at the Stanford Institute, who developed a prototype of multiple-window screens and mice in the 1950s and 60s, "windows" became a key component of the graphical interface developed at Xerox PARC known as the (yes) WIMP interface—Windows, Icons, Mouse, Pull-down Menus—and was featured on all original 1984 Apple MacIntosh systems. The "windows" *environment* makes the screen smaller and allows for simultaneous applications. When Microsoft trademarked its second-generation software as Windows they emphasized the metaphoric nature of much of our computer usage: "mice" which scurry under our fingers at the fluid command of wrist and palm and "desktops" which defy gravity and transform the horizontal desk into a vertical surface with an array of possible colors and digital textures. As an "interface," Windows extends screen space by overlapping screens of various sizes; each "window" can run a different application; you can arrange windows on your screen in stacked or overlapping formations or decorate your windows (with wallpapers, textured patterns.) Microsoft launched its PC-based Windows (version 1.0) in 1985 and as the media-saturated campaign for Windows '95 emphasized, Windows became (and has remained) the most widely used operating system.[34]

The "Windows" trope in computer software has become emblematic of the collapse of the single viewpoint, relying on the model of a window that we can't see through; windows that overlap, obscure. Windows are re-sizable, movable. Windows make multitasking possible.[35] A 1998 *New York Times* article reported this statistic: "Microsoft says the average office user of Windows '95 has more than three programs running at a time. At home, more than 10 million American households now have a television and a personal computer in the same room."[36] Multitasking makes it possible to combine work with leisure—watching TV while checking e-mail—and hence serves to equate productivity with a fractured subjectivity.

Quattrocento perspective and its concommitant symbolic system has been challenged on many fronts: by changes in perspective in modern painting; by modern architecture's revision to the role of the window—replacing the "perspectival" window with the horizontal window, the "picture" window or the "picture" wall, and by moving image technologies which provide a temporal exponent to spatial perspectivalism. But while architectural changes in the window were coincident with changes in perspective

in modern painting early in the twentieth century, the media of film and television retained a perspectival frame through the "modern" period. The moving image offered multiple perspectives through the sequential shifts of montage and editing; yet, aside from a few historical anomalies, it has only been with the advent of digital imaging technologies and new technologies of display in the 1990s that the media "window" began to include multiple perspectives within a single frame.[37]

Now, a variety of screens—long and wide and square, large and small, composed of grains, composed of pixels—compete for our attention without any (convincing) arguments about hegemony. As screens have multiplied and divided, so has subjectivity. As we spend more and more of our time staring into the frames of television, computer, and hand-held screens—windows full of text, icons, 3-D graphics, streaming-images, streaming audio—a new post-perspectival, post-Cartesian subjectivity has emerged. The multi-screen, windowed visuality of Windows software has become an apt figurative trope for this new subjectivity. As the beholder of multiple windows, we receive images—still and moving, large and small, artwork and commodity—in fractured spatial and temporal frames. With this new "windowed" multiplicity of perspectives we can be at two (or more) places at once, in two (or more) time frames in a fractured post-Cartesian cyber-time.

Just as the instrumental base for the moving image—retinal retention of successive virtual images—produced a new experience of temporality, the instrumental (digital) base for multi-screen multi-tasking poses some new questions about the experience of temporality. For a computer to multi-task, the computer does not do tasks simultaneously but serially and yet at a high speed. Digital optics produce the illusion of simultaneity at a much faster speed than moving image technologies did. In the terms of Paul Virilio:

> The aim is to make the computer screen the ultimate window, but a window which would not so much allow you to receive data as to view the horizon of globalization, the space of its accelerated virtualization.[38]

Virtual images radically transformed the twentieth-century understanding of reality, and yet most virtual images were seen in frames and through frames. Which technologies will break through the frame and have us climb through the metaphoric window? Or will we stay fixed—nose to the glass (or as the French say about window-shopping, *leche les vitrines*/ licking the windows) fixed in front of the windows, caught in the hold of an image,

framed in display? Or perhaps, as films like *Existenz, The Matrix, Strange Days* predict, the screen will dissolve; images and data will be "uploaded" directly, bypassing the eye and the optics of vision. This new circuitry takes the subject beyond and through the window; this defenestration has new risks and pleasures. Is the "age of windows"—and by extension, the age of screens—reaching, as H. G. Wells predicted, its end?

Notes

1. Paul Valéry, "The Conquest of Ubiquity," *Aesthetics,* trans. Ralph Manheim (New York: Pantheon Books, 1964) "*La Conquete de l'ubiquite*" was first published in *De la Musique avant toute chose* (Editions du Tambourinaire, 1928); in *Pieces sur l'art* (1934) and in *Oeuvres II* (Pleiade, 1960).

2. In *Window Shopping,* I argued that the moving image emerged as a culmination of 19th-century machines of mobility (trains, steamships, bicycles, elevators, escalators, moving walkways—apparatuses that changed the relation of sight to bodily movement, producing a mobilized visuality) and of 19th-century contrivances for producing a virtual visuality (evidenced by developments in painterly realism, scale, and spectatorial involvement in devices like the panorama and the diorama but most dramatically produced by photography's indexical record). The cinema, I argued, emerged as an apparatus that combined these mobilized and virtual visualities, producing the illusion of transport not only to other places but, significantly, to other times. See Anne Friedberg, *Window Shopping: Cinema and the Postmodern* (Berkeley: University of California Press, 1993).

3. The theorization of "spectatorship"—in terms of either an ideological, psychoanalytic, phenomenological "subject position" or a historically and culturally inflected viewer of a particular race, gender, age etc.—has been at the center of Film and Media Studies debate since the 1970s. For an excellent summary account of these debates see Judith Mayne, *Cinema and Spectatorship* (New York: Routledge, 1993).

4. In a 1929 lecture, Le Corbusier described the "history of architecture" as a "history of windows throughout the ages." The changing forms and functions of windows are emblematic of a historical era: "In the Middle Ages," he wrote "they glazed all they could, using all the resources of wood," while in the Renaissance architects used, "stone mullions in a window that was made as big as possible." See Le Corbusier, *Precisions: On the Present State of Architecture and City Planning* (1930), trans. Edith Schreiber Aujame (Cambridge, MA: MIT Press, 1991), 52.

5. Frances Rogers and Alice Beard, *5000 Years of Glass* (New York, J. B. Lippincott Company, 1937); Ada Polak. *Glass: Its Makers and Its Public* (London: Weidenfield & Nicholson, 1975); R. W. Douglas and Susan Frank, *A History of Glassmaking* (Henley-on-Thames, Oxfordshire: G. T. Foulis & Co. Ltd., 1972).

6. Lewis Mumford, *Technics and Civilization* (New York: Harcourt, Brace and Company, 1934): this quote serves as a caption to an illustration plate between 180–181.

7. Daniel Boorstin, "Walls Become Windows" in *The Americans: The Democratic Experience* (New York: Random House, 1973), 336–345.

8. By the early 1900s, handmade methods were replaced by mechanized sheet glass production, ribbons of molten glass were poured from a furnace onto rollers. See Georg Kohlmaier and Barna von Sartory, *Houses of Glass: A Nineteenth Century Building Type,* trans. John C. Harvey (Cambridge, MA: MIT Press, 1986); also Richard Sennett's discussion of glass in *The Conscience of the Eye* (New York: Alfred A. Knopf, 1990), 106–114.

9. Siegfried Gideon, *Space, Time, and Architecture* (Cambridge, MA: Harvard University Press, 1991), 195.

10. Le Corbusier wished to "de-vignolize" architecture—to challenge its verticality. Le Corbusier's horizontal ribbon window was designed to give more light than vertical window. See Le Corbusier, *Precisions: On the Present State of Architecture and City Planning,* trans. Edith Schreiber Aujame (Cambridge, MA: MIT Press, 1991).

11. Richard Sennett, *The Conscience of the Eye,* 108. "Sight," Sennett writes, "is routinely insulated from sound and touch and other human beings" (109).

12. Frank Lloyd Wright, "The Meaning of Materials—Glass"(1928), *In the Cause of Architecture,* ed. Frederick Gutheim (New York: Architectural Record, 1975) 197–8.

13. The origins, practices and traditions of perspective have been the subject of voluminous scholarly treatises and remain at the center of many ongoing controversies about visual representation itself. Perspective, it is argued, is practical formula (Kemp, Edgerton, Greyson), an epistemological metaphor (Elkins), a transhistorical "symbolic form" (Panofsky), a visual system unique to Italy and distinct from the more aggregate system of visual representation relied upon by Northern Dutch painters (Alpers); the dominant visual system in Western culture or one of several (Jay); a technique for painters (perspectiva artificialis) as evidenced in the writings of Alberti or for architects *(costruzione legittima)* as evidenced in the experiments of Brunelleschi (Damisch, Pérez-Gømez and Pelletier). See Martin Kemp, *The Science of Art: Optical Themes in Western Art from Brunelleschi to Seurat* (New Haven: Yale University Press, 1990); Samuel Edgerton, *Renaissance Rediscovery of Linear Perspective Perspective* (New York: Basic Books, 1975); James Elkins, *The Poetics of Perspective* (Ithaca: Cornell University Press, 1994); Erwin Panofsky, *Perspective as Symbolic Form,* trans. Christopher S. Wood (New York: Zone Books, 1991); Svetlana Alpers, *The Art of Describing: Dutch Art in the Seventeenth Century* (Chicago: University of Chicago Press, 1983); Martin Jay. "Scopic Regimes of Modernity," in *Vision and Visuality,* ed. Hal Foster (Seattle: Bay Press, 1988), 3–23.; Hubert Damisch, *The Origin of Perspective,* trans. John Goodman (Cambridge, MA: MIT Press, 1995) and Alberto Pérez-Gómez and Louise Pelletier. *Architectural Representation and the Perspective Hinge* (Cambridge, MA: MIT Press, 1997).

14. Leon Battista Alberti, *On Painting and On Sculpture: The Latin Texts of "De Pictura" and "De Statua,"* trans. Cecil Grayson (London: 1972), 55. This quote is taken from section I.19 of the 1435 Latin text: *quod quidem mihi pro aperta finestra est ex qua historia contueatur.*

15. J. P. Richter (ed.), *The Literary Works of Leonardo da Vinci,* vol. 1 (London: Oxford University Press, 1939), 150.

16. Indeed this is the first sentence of Erwin Panovksy's *Perspective as Symbolic Form* (1924–1925): "*Item Perspectiva ist ein lateinsich Wort, bedeutt ein Durchsehung.*"

17. Martin Heidegger, "The Age of the World Picture" (1938) published in *The Question Concerning Technology and Other Essays,* trans. William Lovitt (New York: Harper and Row, 1977), 115–154. "The Age of the World Picture" was Heidegger's published version of the lecture entitled "The Establishing by Metaphysics of the Modern World Picture" given on June 9, 1938. Many of its concepts were revised, repeated in four lectures given in Bremen in 1949/1950—"Das Ding" ("The Thing"), "Das Ge-stell" ("Enframing"), "Die Gefahr" ("The Danger"), "Die Kehre" ("The Turning")—and in the lecture "Die Frage nach der Technik" given in Munich on November 18, 1955. The German text to "The Age of the World Picture" appears in *Holzwege* (Frankfurt am Main: Vittorio Klostermann, 1950) 69–104. The German text to "Die Frage nach der Technik" appears in *Vorträge und Aufsätze* (Pfullingen: Günther Neske Verlag, 1954), 13–44.

18. René Descartes, *Meditations on First Philosophy with Selections and Objections and Replies,* trans. J. Cottingham (Cambridge: Cambridge University Press, 1986).

19. The "interweaving" of these two events—"that the world is transformed into picture and man into subiectum"—became the "decisive" determinant of the modern age. "Age of the World Picture," 132. In a long appendix on Descartes, Heidegger expands upon the relation between thought and representation: "Thinking is representing, setting-before, is a representing relation to what is represented."

20. Tom Gunning, "The Cinema of Attractions," in *Early Cinema: Space, Frame, Narrative,* ed. Thomas Elsaesser (London: BFI, 1991).

21. "Apparatus" film theorists of the 1970s (Baudry, Heath, Comolli) traced a continuity between the camera obscura and photography and cinema; while more recent accounts of "vision and visuality" (Crary, Jay) have insisted on the discontinuities/ruptures in geneologies which trace a continuous link between Renaissance perspective/camera obscura and photography/cinema. See Jean Louis Baudry, "Ideological Effects of the Basic Cinematographic Apparatus" (1970), in *Narrative, Apparatus, Ideology,* ed. Philip Rosen (New York: Columbia University Press, 1986), 286–299; Jean Louis Baudry, "The Apparatus: Metapsychological Approaches to the Impression of Reality in Cinema" (1975), in *Narrative, Apparatus, Ideology,* ed. Philip Rosen (New York: Columbia University Press, 1986), 299–318; Heath, Stephen. "On Screen, in Frame: Film and Ideology," in *Questions of Cinema* (London: Macmillan, 1981), 1–18; Heath, Stephen. "Narrative Space," *Screen* 17, no.3 (Autumn 1976): 68–112; Jean

Comolli, "Machines of the Visible," in *The Cinematic Apparatus,* ed. Teresa de Lauretis and Stephen Heath (New York: St. Martin's Press, 1980), 121–133.

22. Stephen Heath, "Narrative Space," *Screen* 17, no. 3 (Autumn 1976): 31–32.

23. In fact, it was the uniformity of film frame size—its aspect ratio as distinct from the variable sizes of frames in painting—that Stephen Heath used to argue as crucial for setting the conditions of spectatorship. The film frame remained, in Heath's account, in the 1.33:1 aspect ratio or was limited to a very few ratios. Stephen Heath, "On Screen, in Frame: Film and Ideology," in *Questions of Cinema* (London: Macmillan, 1981), 10. Also see Heath on the window frame in "Narrative Space Questions of Cinema: 34. Vivian Sobchack provides a critique of film theory's use of the metaphor of the frame and the metaphor of the window and the metaphor of the mirror along phenomenological lines. See: Vivian Sobchack, *The Address of the Eye: Phenomenology and the Film Experience* (Princeton: Princeton University Press, 1992).

24. "Apparatus" here refers to work on the cinema which considers the "cinematic apparatus" as *dispositif,* a more general sense of device and arrangement which includes the metapsychological effects on the spectator and is not simply the "apparatus" as *appareil,* the machine. Unfortunately, "apparatus" has been used as the English-language translation of the French word *dispositif*—a device or arrangement that includes the metapsychological effects on the spectator—and this translation elides the difference between the *dispositif* as arrangement and the *appareil* as machine. See Joan Copjec, "The Anxiety of the Influencing Machine," *October* 23 (1982): 43–59; Constance Penley, "Feminism, Film Theory and the Bachelor Machines," *m/f* 10 (1985): 39–59 and Judith Mayne, *Cinema and Spectatorship* (New York: Routledge, 1993), 47.

25. Lynn Spigel, *Make Room for TV: Television and the Family Ideal in Postwar America* (Chicago: University of Chicago Press, 1992), 102.

26. Roland Barthes' short piece "En sortant du cinema" compares the "urban darkness" of the movie theatre where the "body's freedoms luxuriate" to the space of the television viewer. "En sortant du cinema," was first published in the famous issue of *Communications,* "Psychoanalyse et cinema," Christian Metz, Raymond Bellour, Thierry Kunzel, ed., no. 23 (1975) and translated by Bertrand Augst and Susan White, "Upon Leaving the Movie Theater" in *Cinematographic Apparatus: Selected Writings,* ed. Theresa Hak Kung Cha (New York: Tanam Press, 1980), 1–4.

27. For a lengthier discussion of the slow erosion of differences between film and television see: Anne Friedberg, "The End of Cinema: Multimedia and Technological Change," in *Reinventing Film Studies,* ed. Linda Williams and Christine Gledhill (London: Arnold Publications, 1999): 438–452.

28. Timothy Egan, "It Takes Time to Build a Xanadu for Citizen Gates." *New York Times* (i.e: 12 Jan. 1995): B1.

29. A paradox begins to emerge: The more the image becomes digital, the more the interface tries to compensate for its departure from reality-based representation by adopting the metaphors of familiar objects in space.

30. Sherry Turkle pursues the "interface" in her book *Life on the Screen: Identity in the Age of the Internet* (New York: Simon and Schuster, 1995); also see Vannevar Bush, "As We May Think," *Atlantic Monthly,* July 1945.

31. Brenda Laurel, quoted in David Kline, "The Embedded Internet," *Wired 4.10* (October 1996): 101.

32. Nicholas Negroponte, *Being Digital* (New York: Alfred Knopf, 1995).

33. Friedrich Kittler, *Gramophone, Film, Typewriter* (Berlin: Brinkmann & Bose, 1986); "Gramophone, Film Typewriter," *October* 41 (1986): 102.

34. In retrospect, many accounts of the development of the GUI interface refer to inset "windows" but it is unclear when the term "window" was first used to refer to the inset screen. See William Gates, *The Road Ahead* (New York: Viking, 1995); Paul E. Ceruzzi, *A History of Modern Computing* (Cambridge, MA: MIT Press, 1998); Michael Hiltzik, *Dealers of Lightning: Xerox Parc and the Dawn of the Computer Age* (New York: HarperBusiness, 1999); Paul Freiberger and Michael Swaine, *Fire in the Valley: The Making of the Personal Computer* (New York: McGraw Hill, 2000).

35. Computers don't actually do these things simultaneously, but serially and yet really really fast. ("Even a slow computer with 100 megahertz processor can execute a million instructions between each pair of keystrokes.") Computers can switch faster than humans can, don't have the same psychological toll or residues.

36. Amy Harmon, "Talk, Type, Read E-Mail," *New York Times,* July 23, 1998, G, 1.

37. The multiple-screen experiments of filmmakers from Abel Gance (*Napoleon,* 1927) to the multi-media work of Charles and Ray Eames suggest a few cinematic precursors to multiple-image computer screens.

38. Paul Virilio, *The Information Bomb,* trans. Chris Turner (London: Verso, 2000), 16.