

teresting that one architectural project that explicitly refers to computer culture—The Digital House (Hariri and Hariri, project, 1988)—systematically employs such semitransparent layers throughout.<sup>27</sup> If in the famous glass house of Mies van der Rohe, the inhabitant looks out at nature through glass walls, the more complex plan of “The Digital House” creates the possibility of seeing through a number of interior spaces at once. Thus the inhabitant of the house is constantly faced with complex visual composites.

Having discussed compositing as a general operation of new media and as a counterpart of selection, I will now focus on a more particular case—compositing in the narrow sense, that is, the creation of a single moving image sequence from a number of separate sequences, and (optionally) stills, using special compositing software. Today, digital compositing is responsible for an increasing number of moving images—all special effects in cinema, computer games, virtual worlds, most television visuals, and even television news. Most often, the moving image constructed through compositing presents a fake 3-D world. I say “fake” because, regardless of whether a compositor creates a totally new 3-D space from different elements (*Cliffhanger*, for example), or only adds elements to live action footage (*Jurassic Park*, for example), the resulting moving image shows something that does not exist in reality. Digital compositing thus belongs together with other simulation techniques. These are the techniques used to create fake realities and thus, ultimately, to deceive the viewer—fashion and makeup, realist painting, dioramas, military decoys, and VR. Why has digital compositing acquired such prominence? If we are to create an archeology that will connect digital compositing with previous techniques of visual simulation, where should we locate the essential historical breaks? Or, to ask the question differently: What is the historical logic driving the evolution of these techniques? Shall we expect computer culture gradually to abandon pure lens-based imaging (still photography, film, video), replacing it instead with composited images and ultimately with 3-D computer-generated simulations?

### Archeology of Compositing: Cinema

I will start my archeology of compositing with Potemkin’s villages. According to the historical myth, at the end of the eighteenth century, Russian ruler

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27. Terence Riley, *The Un-private House* (New York: Museum of Modern Art, 1999).

Catherine the Great decided to travel around Russia to observe firsthand how the peasants lived. The first minister and Catherine's lover, Potemkin, ordered the construction of special fake villages along her projected route. Each village consisted of a row of pretty facades. The facades faced the road; at the same time, to conceal their artifice, they were positioned at a considerable distance. Since Catherine never left her carriage, she returned from her journey convinced that all peasants lived in happiness and prosperity.

This extraordinary arrangement can be seen as a metaphor for life in the Soviet Union where I grew up in the 1970s. There, the experience of all citizens was split between the ugly reality of their lives and the official shining facades of ideological pretense. However, the split took place not only on a metaphorical but also on a literal level, particularly in Moscow—the showcase Communist city. When prestigious foreign guests visited Moscow, they, like Catherine the Great, were taken around in limousines that always followed a few special routes. Along these routes, every building was freshly painted, shop windows displayed consumer goods, and drunks were absent, having been picked up by the militia early in the morning. The monochrome, rusty, half-broken, amorphous Soviet reality was carefully hidden from the view of the passengers.

In turning selected streets into facades, Soviet rulers adopted the eighteenth-century technique of creating a fake reality. But, the twentieth century brought with it a much more effective technology for creating fake realities—cinema. By replacing the window of a carriage or car with a screen showing projected images, cinema opened up new possibilities for simulation.

Fictional cinema, as we know it, is based upon lying to the viewer. A perfect example is the construction of a cinematic space. Traditional fiction film transports us into a space—a room, a house, a city. Usually, none of these exists in reality. What exists are a few fragments carefully constructed in a studio. Out of these disjointed fragments, a film synthesizes the illusion of a coherent space.

The development of techniques to accomplish this synthesis coincides with the shift in American cinema between approximately 1907 and 1917 from a so-called primitive to classical film style. Before the classical period, the space of film theater and the screen space were clearly separated, much like in theater or vaudeville. Viewers were free to interact, come and go, and maintain a psychological distance from the cinematic narrative. Corre-

spondingly, the early cinema's system of representation was *presentational*: Actors played to the audience, and the style was strictly frontal.<sup>28</sup> The composition of shots also emphasized frontality.

In contrast, as I discussed earlier, classical Hollywood film positions each viewer inside the fictional space of the narrative. The viewer is asked to identify with the characters and to experience the story from their points of view. Accordingly, the space no longer acts as a theatrical backdrop. Instead, through new compositional principles, staging, set design, deep focus cinematography, lighting, and camera movement, the viewer is situated at the optimum viewpoint of each shot. The viewer is "present" inside a space that does not really exist.

In general, Hollywood cinema has always been careful to hide the artificial nature of its space, but there is one exception: the rear-screen projection shots introduced in the 1930s. A typical shot shows actors sitting inside a stationary vehicle; a film of a moving landscape is projected on the screen behind the car's windows. The artificiality of rear-screen projection shots stands in striking contrast to the smooth fabric of Hollywood cinematic style in general.

The synthesis of a coherent space out of distinct fragments is only one example of how fictional cinema fakes reality. A film in general is comprised of separate image sequences. These sequences can come from different physical locations. Two consecutive shots of what looks like one room may correspond to two locations inside one studio. They can also correspond to locations in Moscow and Berlin, or Berlin and New York. The viewer will never know.

This is the key advantage of cinema over older fake-reality technologies, be they eighteenth-century Potemkin villages or nineteenth-century panoramas and dioramas. Before cinema, simulation was limited to the construction of a fake space inside a real space visible to the viewer. Examples include theater decorations and military decoys. In the nineteenth century, panorama offered a small improvement: By enclosing a viewer within a 360-degree view, the area of fake space was expanded. Louis-Jacques Daguerre introduced another innovation by having viewers move from one set to another in his London diorama. As described by the historian Paul Johnson, its

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28. On the presentational system of early cinema, see Musser, *The Emergence of Cinema*, 3.

“amphitheater, seating 200, pivoted through a 73-degree arc, from one ‘picture’ to another. Each picture was seen through a 2,800-square-foot-window.”<sup>29</sup> But already in the eighteenth century, Potemkin had pushed this technique to its limit: He created a giant facade—a diorama stretching for hundreds of miles—along which the viewer (Catherine the Great) passed. In contrast, in cinema a viewer remains stationary: what moves is the film itself.

Therefore if the older simulation technologies were limited by the materiality of a viewer’s body, existing in a particular point in space and time, film overcomes this spatial and temporal limitation. It achieves this by substituting recorded images for unmediated human sight and by editing these images together. Through editing, images that could have been shot in different geographic locations or at different times create the illusion of a contiguous space and time.

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. The first technique of temporal montage is much more common; this is what we usually mean by “montage” in film. It defines the cinematic language as we know it. In contrast, montage within a shot is used more rarely throughout film history. An example of this technique is the dream sequence in *The Life of an American Fireman* by Edward Porter in 1903, in which an image of a dream appears over a man’s sleeping head. Other examples include split screens that, beginning in 1908, show the different interlocutors of a telephone conversation; 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 Gance Abel’s 1927 *Napoléon*); rear-screen projection shots; and deep focus and special compositional strategies used to juxtapose

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29. Paul Johnson, *The Birth of the Modern: World Society, 1815–1830* (London: Orion House, 1992), 156.

close and faraway scenes (for instance, a character looking through a window, as in *Citizen Kane*, *Ivan the Terrible*, and *Rear Window*.)<sup>30</sup>

In a fiction film, temporal montage serves a number of functions. As I have already pointed out, it creates a sense of presence in a virtual space. It is also utilized to change the meaning of individual shots (recall Kuleshov's effect) or, more precisely, to construct a meaning from separate pieces of profilmic reality. However, the use of temporal montage extends beyond the construction of an artistic fiction. Montage also becomes a key technology for ideological manipulation, through its employment in propaganda films, documentaries, news, commercials, and so on. The pioneer of the ideological montage is, once again, Vertov. In 1923 Vertov analyzed how he put together episodes of his news program *Kino-Pravda* ("Cinema-Truth") from shots filmed in different locations and at different times. Here is one example of his montage: "the bodies of the people's heroes are being lowered into the graves (filmed in Astrakhan in 1918); the graves are being covered with earth (Kronshtad, 1921); gun salute (Petrograd, 1920); eternal memory, people take off their hats (Moscow, 1922)." Here is another example: "montage of the greetings by the crowd and montage of the greetings by the machines to the comrade Lenin, filmed at different times."<sup>31</sup> As theorized by Vertov, film can overcome its indexical nature through montage, by presenting a viewer with objects that never existed in reality.

### Archeology of Compositing: Video

Outside cinema, montage within a shot becomes a standard technique of modern photography and design (the photomontages of Alexander Rodchenko, El Lissitzky, Hannah Höch, John Heartfield, and countless other lesser-known twentieth-century designers). However, in the realm of the moving image, temporal montage dominates. Temporal montage is cinema's main operation for creating fake realities.

After World War II, a gradual shift takes place from film-based to electronic image recording and editing. This shift brings with it a new

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30. The examples of *Citizen Kane* and *Ivan the Terrible* are taken from Aumont et al., *Aesthetics of Film*, 41.

31. Dziga Vertov, "Kinoki: Perevorot" (Kinoki: A revolution), *LEF* 3 (1923): 140.

technique—keying. One of the most basic techniques used today in any video and television production, keying refers to combining two different image sources. Any area of uniform color in one video image can be cut out and substituted with another source. Significantly, this new source can be a live video camera positioned somewhere, a prerecorded tape, or computer-generated graphics. The possibilities for creating fake realities are multiplied once again.

When electronic keying became part of standard television practice in the 1970s, the construction not only of still but also moving images finally began routinely to rely on montage within a shot. In fact, rear projection and other special effects shots, which had occupied a marginal place in classical film, became the norm: the weatherman in front of weather map, announcer in front of news footage, singer in front of animation in a music video.

An image created through keying presents a hybrid reality, composed of two different spaces. Television normally relates these spaces semantically but not visually. To take a typical example, we may be shown an image of an announcer sitting in a studio; behind her, in a cutout, we see news footage of a city street. The two spaces are connected through their meanings (the announcer discusses events shown in the cutout), but visually they are disjointed, as they share neither the same scale nor the same perspective. If classical cinematic montage creates the illusion of a coherent space and hides its work, electronic montage openly presents the viewer with an apparent visual clash of different spaces.

What will happen if the two spaces seamlessly merge? This operation forms the basis of the remarkable video *Steps* directed by Polish-born filmmaker Zbigniew Rybczynski in 1987. *Steps* is shot on videotape and uses keying; it also utilizes film footage and makes inadvertent reference to virtual reality. In this way, Rybczynski connects three generations of fake-reality technologies: analog, electronic, and digital. He also reminds us that it was the 1920s Soviet filmmakers who first fully realized the possibilities of montage, possibilities that continue to be expanded by electronic and digital media.

In the video, a group of American tourists is invited into a sophisticated video studio to participate in a kind of virtual reality/time machine experiment. The group is positioned in front of a blue screen. Next, the tourists find themselves literally inside the famous Odessa steps sequence from Sergei Eisenstein's *Potemkin* (1925). Rybczynski skillfully keys the shots of

the people in the studio into the shots from *Potemkin*, creating a single coherent space. At the same time, he emphasizes the artificiality of this space by contrasting the color video images of the tourists with Eisenstein's original grainy black-and-white footage. The tourists walk up and down the steps, snap pictures of the attacking soldiers, play with a baby in a crib. Gradually, the two realities begin to interact and mix: Some Americans fall down the steps after being shot by soldiers from Eisenstein's sequence; a tourist drops an apple that is picked up by a soldier.

The Odessa steps sequence, already a famous example of cinematic montage, becomes just one element in a new ironic remix by Rybczynski. The original shots, already edited by Eisenstein, are now edited again with video images of the tourists, using both temporal montage and montage within a shot, the latter done through video keying. A "film look" is juxtaposed with a "video look," color is juxtaposed with black and white, the "presentness" of video is juxtaposed with the "always already" of film.

In *Steps*, Eisenstein's sequence becomes a generator for numerous kinds of juxtapositions, superimpositions, mixes and remixes. But Rybczynski treats this sequence not only as a single element of his own montage but also as a singular, physically existing space. In other words, the Odessa steps sequence is read as a single shot corresponding to a real space, a space that could be visited like any other tourist attraction.

Along with Rybczynski, another filmmaker who systematically experimented with the possibilities of electronic montage within a shot is Jean-Luc Godard. While in the 1960s, Godard was actively exploring new possibilities of temporal montage such as jump cut, in later video works such as *Scénario du film "Passion"* (1982) and *Histoire(s) du cinéma* (1989–) he developed a unique aesthetics of continuity that relies on electronically mixing a number of images together within a single shot. If Rybczynski's aesthetics is based on the operation of video keying, Godard's aesthetics similarly relies on a single operation available to any video editor—mixing. Godard uses the electronic mixer to create very slow cross-dissolves between images, cross-dissolves that seem never to resolve in a singular image, ultimately becoming the film itself. In *Histoire(s) du cinéma*, Godard mixes together two, three, or more images; images gradually fade in and out, but never disappear completely, staying on the screen for a few minutes at a time. This technique can be interpreted as the representation of ideas or mental images floating around in our minds, coming in and out of mental focus. Another

variation of the same technique used by Godard is to move from one image to another by oscillating between the two. The images flicker back and forth over and over, until the second image finally replaces the first. This technique can be also interpreted as an attempt to represent the mind's movement from one concept, mental image, or memory to another—the attempt, in other words, to represent what, according to Locke and other associationist philosophers, is the basis of our mental life—forming associations.

Godard wrote: “There are no more simple images. . . . The whole world is too much for an image. You need several of them, a chain of images . . .”<sup>32</sup> Accordingly, Godard always uses multiple images, images cross-dissolved together, coming together and separating. The electronic mixing that replaces both temporal montage and montage within the shot becomes for Godard an appropriate technique to visualize this “vague and complicated system that the whole world is continually entering and watching.”<sup>33</sup>

### Digital Compositing

The next generation in simulation technologies is digital compositing. On first glance, computers do not bring any conceptually new techniques for creating fake realities. They simply expand the possibilities of joining together different images within one shot. Rather than *keying* together images from two video sources, we can now *composite* an unlimited number of image layers. A shot may consist of dozens, hundreds, or thousands of image layers. These image may all have different origins—film shot on location (“live plates”), computer-generated sets or virtual actors, digital matte paintings, archival footage, and so on. Following the success of *Terminator 2* and *Jurassic Park*, most Hollywood films began to utilize digital compositing to create a least some of their shots.

Thus historically, a digitally composed image, like an electronically keyed image, can be seen as a continuation of montage within a shot. But while electronic keying creates disjointed spaces that remind us of the avant-garde collages of Rodchenko or Moholy-Nagy from the 1920s, digital com-

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32. Jean-Luc Godard, *Son + Image*, ed. Raymond Bellour (New York: Museum of Modern Art, 1992), 171.

33. *Ibid.*



posing brings back the nineteenth-century techniques of creating smooth “combination prints” like those of Henry Peach Robinson and Oscar G. Reijlander.

But this historical continuity is deceptive. Digital compositing does represent a qualitatively new step in the history of visual simulation because it allows the creation of *moving* images of nonexistent worlds. Computer-generated characters can move within real landscapes; conversely, real actors can move and act within synthetic environments. In contrast to nineteenth-century “combination prints,” which emulated academic painting, digital composites simulate the established language of cinema and television. Regardless of the particular combination of live-action elements and computer-generated elements that make up the composited shot, the camera can pan, zoom, and dolly through it. Interactions between the elements of a virtual world over time (for instance, the dinosaur attacking the car), along with the ability to look at this world from different viewpoints, become the guarantee of its authenticity.

The new ability to create a virtual world that moves—and that can be moved through—comes at a price. Although compositing fake news-footage takes place in real time in *Wag the Dog*, aligning numerous elements to create a convincing composite is, in reality, a time-consuming task. For instance, the forty-second sequence in *Titanic* in which the camera flies over the computer-generated ship, populated by computer-generated characters, took many months to produce and its total cost was \$1.1 million.<sup>34</sup> In contrast, although images of such complexity are out of reach for video keying, it is possible to combine three image sources in real-time. (This trade-off between image-construction time and its complexity is similar to another trade-off I have already noted—that between image-construction time and its functionality; that is, images created with 3-D computer graphics are more functional than image streams recorded by film or video cameras, but in most cases, they are much more time-consuming to generate.)

If a compositor restricts the composite to just a few images, as was done with electronic keying, compositing can also be created in real time. The

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34. See Paula Parisi, “Lunch on the Deck of the Titanic,” *Wired* 6.02 (February 1998) (<http://www.wired.com/wired/archive/6.02/cameron.html>).

resulting illusion of a seamless space is stronger than what was possible with electronic keying. An example of real-time compositing is Virtual Sets technology, which was first introduced in the early 1990s and since then has been making its way into television studios around the world. This technology allows compositing video-image and computer-generated 3-D elements on the fly. (Actually, because the generation of computer elements is computation-intensive, the final image transmitted to the audience may be seconds behind the original image picked up by television camera.) A typical application of Virtual Sets involves composing an image of an actor over a computer-generated set. The computer reads the position of the video camera and uses this information to render the image of the set in proper perspective. The illusion is made more convincing by generating shadows and/or reflections of the actor and integrating them into the composite. Because of the relatively low resolution of analog television, the resulting effect is quite convincing. A particularly interesting application of Virtual Sets is the replacement and insertion of arena-tied advertising messages during live TV broadcasts of sports and entertainment events. Computer-synthesized advertising messages can be inserted into the playing field or other empty areas of the arena in the proper perspective, as though they were actually present in physical reality.<sup>35</sup>

Digital compositing represents a fundamental break with previous techniques for visual deception in another way. Throughout the history of representation, artists and designers have focused on the problem of creating a convincing illusion within a single image, whether a painting, film frame, or a view seen by Catherine the Great through the window of her carriage. Set making, one-point perspective, chiaroscuro, trick photography, and other cinematography techniques were all developed to solve this problem. Film montage introduced a new paradigm—creating an effect of presence in a virtual world by joining different images over time. Temporal montage became the dominant paradigm for the visual simulation of nonexistent spaces.

As the examples of digital composing for film and Virtual Sets applications for television demonstrate, the computer era introduces a different par-

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35. *IMadGibe: Virtual Advertising for Live Sport Events*, a promotional flyer by ORAD, P.O. Box 2177, Kfar Saba 44425, Israel, 1998.

adigm. This paradigm is concerned not with time but with space. It can be seen as the next step in the development of techniques for creating a single convincing image of nonexistent spaces—painting, photography, cinematography. Having mastered this task, the culture came to focus on how to join seamlessly a number of such images into one coherent whole (electronic keying, digital compositing). Whether composing a live video of a newscaster with a 3-D computer-generated set or composing thousands of elements to create the images of *Titanic*, *the problem is no longer how to generate convincing individual images but how to blend them together*. Consequently, what is important now is what happens on the edges where different images are joined. The borders where different realities come together is the new arena where the Potemkins of our era try to outdo one another.

### Compositing and New Types of Montage

In the beginning of this section, I pointed out that the use of digital compositing to create continuous spaces out of different elements can be seen as an example of the larger anti-montage aesthetics of computer culture. Indeed, if at the beginning of the twentieth century, cinema discovered that it could simulate a single space through temporal montage—a time-based mosaic of different shots—by the end of the century, it had arrived at a technique to accomplish a similar result without montage. In digital compositing, the elements are not juxtaposed but blended, their boundaries erased rather than foregrounded.

At the same time, by relating digital compositing to the theory and practice of film montage, we can better understand how this new key technique of assembling moving images redefines our concept of a moving image. While traditional film montage privileges temporal montage over montage within a shot—technically the latter was much more difficult to achieve—compositing makes them equal. More precisely, it erases the strict conceptual and technical separation between the two. Consider, for instance, the interface layout typical of many programs for computer-based editing and digital compositing, such as Adobe Premiere 4.2, a popular editing program, and Alias|Wavefront Composer 4.0, a professional compositing program. In this interface, the horizontal dimension represents time, while the vertical dimension represents the spatial order of the different image layers making up each image. A moving image sequence appears as a number of blocks staggered vertically, with each block standing for a particular image

layer. Thus if Pudovkin, one of the theorists and practitioners of the Russian montage movement the 1920s, conceived of montage as a one-dimensional line of bricks, now it becomes a 2-D brick wall. This interface makes montage in time and montage within a shot equal in importance.

If the Premiere interface conceptualizes editing as an operation in 2-D dimensions, the interface of one of the most popular compositing programs, After Effects 4.0, adds a third dimension. Following the conventions of traditional film and video editing, Premiere assumes that all image sequences are the same size and proportion; in fact, it makes working with images that do not conform to the standard three-by-four frame ratio rather difficult. In contrast, the user of After Effects places image sequences of arbitrary sizes and proportions within the larger frame. Breaking with the conventions of old moving image media, the interface of After Effects assumes that the individual elements making up a moving image can freely move, rotate, and change proportions over time.

Sergei Eisenstein already used the metaphor of many-dimensional space in his writings on montage, naming one of his articles *Kino cheturekh izmerenii* (The Filmic Fourth Dimension).<sup>36</sup> However, his theories of montage ultimately focused on one dimension—time. Eisenstein formulated a number of principles, such as counterpoint, that can be used to coordinate changes in different visual dimensions over time. The examples of visual dimensions he considered are graphic directions, volumes, masses, space, and contrast.<sup>37</sup> When the sound film became a possibility, Eisenstein extended these principles to handle what, in computer language, can be called “synchronization” of visual and audio tracks; and later he added the dimension of color.<sup>38</sup> Eisenstein also developed a different set of principles (“methods of montage”) according to which different shots can be edited together to form a longer sequence. The examples of “methods of montage” include metric montage, which uses absolute lengths of shots to establish a “beat,” and

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36. Sergei Eisenstein, “The Filmic Fourth Dimension,” in *Film Form*, trans. Jay Leyda (New York: Harcourt Brace and Company, 1949).

37. Eisenstein, “A Dialectical Approach to Film Form,” in *Film Form*.

38. Eisenstein, “Statement” and “Synchronization of Senses,” in *Film Sense*, trans. Jay Leyda (New York: Harcourt Brace and Company, 1942).

rhythmic montage, which is based on pattern of movement within the shots. These methods can be used by themselves to structure a sequence of shots, but they also can be combined within a single sequence.

The new logic of a digital moving image contained in the operation of compositing runs against Eisenstein's aesthetics with its focus on time. Digital compositing makes the dimensions of space (3-D fake space being created by a composite and 2½-D space of all the layers being composited) and frame (separate images moving in 2-D within the frame) as important as time. In addition, the possibility of embedding hyperlinks within a moving sequence introduced in QuickTime 3 and other digital formats adds yet another spatial dimension.<sup>39</sup> The typical use of hyperlinking in digital movies is to link elements of a movie with information displayed outside of it. For instance, when a particular frame is displayed, a specific Web page can be loaded in another window. This practice "spatializes" a moving image: No longer completely filling the screen, it is now just one window among many.

In summary, if film technology, film practice, and film theory privilege the temporal development of a moving image, computer technology privileges spatial dimensions. The new spatial dimensions can be defined as follows:

1. spatial order of layers in a composite (2½-D space),
2. virtual space constructed through compositing (3-D space),
3. 2-D movement of layers in relation to the image frame (2-D space),
4. relationship between the moving image and linked information in the adjustment windows (2-D space).

These dimensions should be added to the list of visual and sound dimensions of the moving image elaborated by Eisenstein and other filmmakers. Their use opens new possibilities for cinema as well as poses a new challenge for film theory. *No longer just a subset of audio-visual culture, the digital moving image becomes a part of audio-visual-spatial culture.*

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39. For an excellent theoretical analysis of QuickTime and digital moving images in general, see Vivian Sobchack's "Nostalgia for a Digital Object."

Of course, simple use of these dimensions in and of itself does not result in montage. Most images and spaces of contemporary culture are juxtapositions of different elements; calling any such juxtaposition “montage” renders the term meaningless. Media critic and historian Erkki Hutamo suggests that we should reserve the use of the term “montage” for “strong” cases, and I will follow his suggestion here.<sup>40</sup> Thus to qualify as an example of montage, a new media object should fulfill two conditions: Juxtapositions of elements should follow a particular system, and these juxtapositions should play a key role in how the work establishes its meaning, and its emotional and aesthetic effects. These conditions would also apply to the particular case of new spatial dimensions of digital moving images. By establishing a logic that controls the changes and the correlation of values on these dimensions, digital filmmakers can create what I will call *spatial montage*.

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. I will conclude this section by invoking a few more works, which, together with videos by Rybczynski and Godard, point to the new aesthetic possibilities of digital compositing if it is not used in the service of traditional realism. Although all these works were created before digital compositing became available, they explore its aesthetic logic—for compositing is, first and foremost, a conceptual, not only a technological operation. I will use these works to introduce two other montage methods based on compositing: *ontological montage* and *stylistic montage*.

Rybczynski’s film *Tango* (1982), made when he was still living in Poland, uses layering as a metaphor for the particular overcrowdedness characteristic of socialist countries in the second half of the twentieth century, and for human cohabitation in general. A number of people perform various actions moving in loops through the same small room, apparently unaware of each other. Rybczynski offsets the loops in such a way that even though his characters keep moving through the same points in space, they never run into one an-

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40. Private communication, Helsinki, 4 October 1999.

other. Compositing, achieved in *Tango* through optical printing, allows the filmmaker to superimpose a number of elements, or whole words, within a single space. (In this film, each person moving through the room can be said to form a separate world.) As in *Steps*, these worlds are matched in perspective and scale—and yet the viewer knows that the scene being shown could not occur in normal human experience at all given the laws of physics, or is highly unlikely to occur given the conventions of human life. In the case of *Tango*, the depicted scene could have occurred physically, but the probability of such an occurrence is close to zero. Works such as *Tango* and *Steps* develop what I will call an *ontological montage*: the coexistence of ontologically incompatible elements within the same time and space.

The films of Czech filmmaker Konrad Zeman exemplify another montage method based on compositing, which I will call *stylistic montage*. In a career spanning from the 1940s to the 1980s, Zeman used a variety of special effect techniques to create juxtapositions of stylistically diverse images in different media. He juxtaposes different media in time, cutting from a live-action shot to a shot of a model or documentary footage, as well as within the same shot. For example, a shot may combine filmed human figures, an old engraving used for background, and a model. Of course, such artists as Picasso, Braque, Picabia, and Max Ernst were creating similar juxtaposition of elements in different media in still images already before the World War II. However, in the realm of the moving image, stylistic montage only came to the surface in the 1990s when the computer became the meeting ground for different generations of media formats used in the twentieth century—35mm and 8mm film, amateur and professional video, and early digital film formats. While previously, filmmakers usually worked with a single format throughout the whole film, the accelerated replacement of different analog and digital formats since the 1970s made the coexistence of stylistically diverse elements a norm rather than the exception for new media objects. Compositing can be used to hide this diversity—or it can be used to foreground it, creating it artificially if necessary. For instance, the film *Forrest Gump* emphasizes stylistic differences between various shots; this simulation of different film and video artifacts is an important aspect of its narrative system.

In Zeman's films such as *Baron Právil* (Baron Munchhausen, 1961) and *Na komete* (On the Comet, 1970), live-action footage, etchings, miniatures, and other elements are layered together in a self-conscious and ironic way. Like

Rybczynski, Zeman keeps a coherent perspectival space in his films while making us aware that it is constructed. One of his devices is to superimpose filmed actors over an old etching used as a background. In Zeman's aesthetics, neither graphic nor cinematographic elements dominate; the two are blended together in equal proportion, creating a unique visual style. At the same time, Zeman subordinates the logic of feature filmmaking to the logic of animation; that is, the shots in his films that combine live-action footage with graphic elements position all elements on parallel planes; the elements move parallel to the screen. This is the logic of an animation stand where the stack of images is arranged parallel to each other, rather than live-action cinema where the camera typically moves through 3-D space. As we will see in the "Digital Cinema" section, this subordination of live action to animation is the logic of digital cinema in general.

St. Petersburg artist Olga Tobreluts, who uses digital compositing, also respects the illusion of a coherent perspectival space, while continuously playing tricks with it. In *Gore ot Uma* (1994; directed by Olga Komarova), a video work based on a famous play written by the nineteenth-century Russian writer Aleksandr Griboedov, Tobreluts overlays images representing radically different realities (a close-up of plants; animals in the zoo) on the windows and walls of various interior spaces. In one shot, two characters converse in front of a window behind which we see a flock of soaring birds taken from Alfred Hitchcock's *The Birds*; in another, a delicate computer-rendered design keeps morphing on the wall behind a dancing couple. In these and similar shots, Tobreluts aligns the two realities in perspective but not in scale. The result is an ontological montage—and also a new kind of montage within a shot. Which is to say, if the avant-garde of the 1920s, and MTV in its wake, juxtaposed radically different realities within a single image, and if Hollywood digital artists use computer compositing to glue different images into a seamless illusionistic space, Zeman, Rybczynski, and Tobreluts explore the creative space between these two extremes. The space between modernist collage and Hollywood cinematic realism is new terrain for cinema ready for exploration with the help of digital compositing.