The Reconfigured Eye

VISUAL TRUTH IN THE POST-PHOTOGRAPHIC ERA

WILLIAM J. MITCHELL

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■ Combined with this was another perversity—an innate preference for the represented subject over the real one: the defect of the real one was so apt to be a lack of representation. I like things that appeared; then one was sure. Whether they *were* or not was a subordinate and almost always a profitless question.

Henry James, *The Real Thing*, 1892

NOTES

1 Beginnings

1

Pliny the Elder, *Natural History* xxxv, 15, first comments: "The origin of painting is uncertain. . . . Some Greeks claim it was discovered in Sicyon, others in Corinth; but there is universal agreement that it began by the outlining of a man's shadow." Later (xxxv, 151) he recounts the tale of Butades, the daughter of a potter from Sicyon: "She was in love with a young man, and when he was going abroad she drew a silhouette on the wall round the shadow of his face cast by the lamp. Her father pressed clay on this to make a relief and fired it with the rest of his pottery."

Athenagoras (*Embassy*, 17) has a variation: "Linear drawing was discovered by Saurias, who traced the outline of the shadow cast by a horse in the sun, and painting by Kraton, who painted on a whitened tablet the shadows of a man and woman. The maiden invented the art of modeling figures in relief. She was in love with a youth, and while he lay asleep she sketched the outline of his shadow on the wall. Delighted with the perfection of the likeness, her father, who was a potter, cut out the shape and filled in the outline with clay; the figure is still preserved at Corinth."

2

In the late eighteenth century, a few decades before the birth of photography, this process eventually was mechanized. A contraption called the physiognotrace was invented for the purpose of accurately capturing portrait silhouettes.

3

Fox Talbot's reminiscences are recorded in "A Brief Historical Sketch of the Invention of the Art," conveniently reprinted in Alan Trachtenberg (ed.), *Classic Essays on Photography* (New Haven: Leete's Island Books, 1980), 27–36.

4
This, at least, is the standard story. If it is not quite true, it should be.
5
R. A. Kirsch, L. Cahn, C. Ray, and G. H. Urban, "Experiments in Processing Pictorial Information with a Digital Computer," in *Proceedings of the Eastern Joint Computer Conference* (New York: Institute of Radio Engineers, 1958), 221–29.
6
Reprinted in Trachtenberg, *Classic Essays on Photography*, 37–38.
7
Edward Weston, "Seeing Photographically," *Encyclopedia of Photography* 18 (New York: Greystone Press, 1965). Reprinted in Trachtenberg, *Classic Essays on Photography*, 169–78.
8
It is important to distinguish carefully between analog and digital electronic images. Video images are analog, not digital. Although video images are subdivided into a finite number of horizontal scan lines, the variations in intensity along scan lines are represented by a continuously varying signal.
9
This is not to say that a photograph has unlimited resolving power. Grain appears and the image begins to break up at high levels of enlargement: fine-grained film records more information than coarse-grained film. Any photographic image also has limited acutance—edge sharpness. Resolving power of film is tested by photographing a target of closely spaced black-and-white lines. The point is that photographic images degrade *gradually* with enlargement, and although resolution can be measured approximately, it cannot be specified exactly.
10
The replicability of digital information has important implications in other areas. The introduction of digital audio tape into the United States was long delayed because of fears that its capacity to make perfect copies would lead to extensive and uncontrollable piracy of recordings. And biologists have suggested that, because replicability is so important, the DNA code *must* be digital.
11
Weston, "Seeing Photographically," in Trachtenberg, *Classic Essays on Photography*, 169–78.
12
Paul Strand, "Photography," *Seven Arts* (August 1917): 524–26. Reprinted in Trachtenberg, *Classic Essays on Photography*, 141–44. Similarly, Lewis Mumford articulated a standard modernist view when he wrote: "As for the various kinds of montage photography, they are in reality not photography at all but a kind of painting, in which the photograph is used—as patches of textiles are used in crazy-quilts—to form a mosaic. Whatever value the montage may have derives from the painting rather than the camera" (*Technics and Civilization* [New York: Harcourt Brace Jovanovich, 1934], 339).
13
For comparisons of modernist and postmodernist stances, see Terry Eagleton, "Awakening from Modernity," *Times Literary Supplement*, February 20, 1987; and David Harvey, *The Condition of Postmodernity* (Oxford: Basil Blackwell, 1989).

2 The Nascent Medium

1
In particular, they performed digital filtering operations to remove camera and transmission imperfections and to bring out fine detail with maximum clarity. This type of filtering is discussed in chapter 5.
2
John Noble Wilford, "On the Trail from the Sky: Roads Point to a Lost City," *The New York Times*, Wednesday, February 5, 1992, A1, A14.
3
John Noble Wilford, "Lofty Instruments Discern Traces of Ancient Peoples," *The New York Times*, Tuesday, March 10, 1992, C1, C6.

rd Binnig and Heinrich Rohrer, "The Scanning nnelling Microscope," *Scientific American* (Au- st 1985): 50–56.

Kumar Wickramsinghe, "Scanning Probe Micro- opes," *Scientific American* (October 1989): 98– 5.

r a popular account of the recent development of edical-imaging systems, see Stephen S. Hall, "Ve- lius Revisited," in *Mapping the Next Millennium: e Discovery of New Geographies* (New York: Ran- m House, 1992), 141–54. A comprehensive survey technologies for acquiring and processing body- age data is provided by Martin R. Stytz, Gideon eder, and Ophir Frieder, "Three-Dimensional edical Imaging: Algorithms and Computer Sys- ns," *ACM Computing Surveys* 23:4 (December 91): 421–500.

thew Turk and Alex Pentland, "Eigenfaces for cognition," *Journal of Cognitive Neuroscience* 3:1 91): 71–86.

general introductions to this technology, see a Ballard and Christopher Brown, *Computer Vi-* (Englewood Cliffs, NJ: Prentice Hall, 1982); and in D. Levine, *Vision in Man and Machine* (New k: McGraw-Hill, 1985). Important research papers collected in Martin Fischler and Oscar Firschein), *Readings in Computer Vision* (Los Altos, CA: gan Kaufmann, 1987). A concise, popular ac- t of some of the central issues is provided by mas O. Binford, "The Machine Sees," in Marvin sky (ed.), *Robotics* (New York: Anchor Press/ bleday, 1985), 98–121.

n Rifkin, "The Giants Focus on the Image of a k," *The New York Times*, Sunday, March 11, , F9.

n analysis of the videogame effect of Gulf War ling, see Timothy J. McNulty, "In Gulf War, TV Was Both Friend, Foe," *Chicago Tribune*, Monday, December 23, 1991, 1–12. This was a war in which, as W. J. T. Mitchell has pointed out, "a major objective . . . was the erasure of the human body from the picture" ("Culture Wars," *London Review of Books* 14:8, April 23, 1992. 7). US General H. Norman Schwarzkopf quickly made it clear that there would be no announcements of body counts, as there had been in Vietnam, and no images of body bags. Later, as the effects of this style of reporting took hold, that same general felt compelled to complain, "This is not a Nintendo game."

11

Color scanners came into widespread use in the publishing industry in the 1970s, replacing earlier photographic techniques for producing color separations. Sophisticated color electronic prepress systems (CEPS), capable of retouching, editing, correcting, and combining digital color images, emerged with the introduction of the Scitex system at the Print '80 show in 1980. This system was powerful but expensive (up to about one million dollars for a full installation). It soon achieved considerable success: the newspaper *USA Today*, for example, quickly came to rely on it. Competing systems were introduced by Hell and by Crosfield. For a discussion of color prepress technology, see Peter Johnston, "From Computer to Page," *Computer Graphics World* 13:1 (January 1990): 28–34.

12

Clare Ansberry, "Alterations of Photos Raise Host of Legal, Ethical Issues," *The Wall Street Journal*, January 26, 1989, B1.

13

Mike Gerrard, "Computers Make a Clean Breast . . . Or Do They?" *Guardian Weekly*, July 9, 1989.

14

This picture appeared on the cover of the February 1982 issue (vol. 162, no. 2). The story of the incident is recounted in Fred Ritchin, *In Our Own Image* (New York: Aperture, 1990), 14–15. Many journalists and photographers saw this unacknowledged (but

later admitted) manipulation as a paradigmatic case of ethically questionable use of the new technology, and there was considerable criticism. Ten years later, the editors of *National Geographic* (less insouciant than the editor of *Mayfair*) were still so chagrined about being caught at it that they adamantly refused repeated requests to allow reproduction of the offending image in this book. The Director of Illustrations rather disingenuously replied: "I regret that our answer still is: 'No.' We feel that this early instance of digital manipulation, when the means first became available to do such things, is not representative of how *National Geographic* uses electronic imaging technology in the preparation and correction of its color separations for printing."

15

The Fifth Annual Digital Photography Conference was held by the National Press Photographers Association in Washington, DC, on February 8–10, 1990. For a critical discussion see Timothy Druckrey, "News Photography and the Digital Highway," *Afterimage* 17:10 (May 1990): 3.

16

John Long, "Truth, Trust Meet New Technology," in *The Electronic Times*, a publication produced at a National Press Photographers Association workshop on electronic photojournalism at Martha's Vineyard, Massachusetts, October 6, 1989.

17

For a discussion of threats posed to the traditional role of the photojournalist, see Gary Hoeing, "Assignment: Survival," *Region One News* (National Press Photographers Association) (Spring 1990): 18–19.

18

Andy Grundberg, "Ask It No Questions: The Camera Can Lie," *The New York Times*, Sunday, August 12, 1990, Section 2, 1, 29.

19

Recounted by Pliny, *Natural History*, xxxv, 64–66. Not to be outdone even by this, Zeuxis's rival Parrhasius painted a curtain that fooled Zeuxis into requesting that it be drawn back. "When he realized his mistake, with an unaffected modesty, he conceded the prize, saying that whereas he had deceived birds, Parrhasius had deceived him, an artist."

20

André Bazin, "The Ontology of the Photographic Image," in *What is Cinema?* (Berkeley: University of California Press, 1967), 16.

21

This point is illustrated not only by electronic manipulation, but also by photographers who have used staged and appropriated images to insist on photography's fictional possibilities. See for example Cindy Sherman's "Untitled Film Stills."

22

Sony demonstrated its Mavica prototype in 1981.

23

The ScanBack fits on a standard Rolleiflex camera. Exposure times are long—seconds or minutes—and the system is intended for high-precision studio work. In essence, it converts a Rolleiflex into a three-dimensional scanner.

24

John Durniak, "New from Japan: Photographs You Can View on a Television Screen or Personal Computer," *The New York Times*, September 22, 1991, 61. Fuji first developed a digital camera in 1988 and marketed it in Japan in 1989. The Fujix is a $5,000 portable system that records twenty-one color images on a credit-card-sized memory card. It is the approximate functional equivalent of a 35-mm SLR.

25

"Kodak Introduces Electronic Camera," *The New York Times*, May 29, 1991, D4. The Kodak Professional DCS is a $20,000 system intended primarily for use by photojournalists and in surveillance tasks. It consists of a Nikon F3 body with a digital camera back. Images are captured by a 1024 by 1280 CCD array. The camera back is connected by cable to a rather bulky shoulder-pack digital storage unit (DSU). The digital storage unit contains a 200-megabyte Winchester disk for image storage and a LCD display monitor. Up to six hundred images can be stored on the disk in compressed format. The DSU provides immediate image-analysis and manipulation capabilities.

26
The Fotoman was one of the first of these to appear in the United States. It is packaged with image-processing software for the IBM PC. The Dycam Model 1 is a similar product. See Peter H. Lewis, "New Ways to 'Paste' a Photo Into Your Documents," *The New York Times*, Sunday, January 19, 1992, F9.

27
"Shuttle Missions Turn to Hands-On Imaging and Image Processing," *Advanced Imaging* 6:11 (November 1991): 8.

28
Among the first sophisticated systems to achieve widespread use were Digital Darkroom, Adobe Photoshop, and Letraset Color Studio.

29
A key development was the introduction by Apple Computer of an operating system extension called Quicktime. This provided a "movie" file format for digital video, together with utilities for handling such files. Microsoft introduced similar extensions to their Windows system. See John Markoff, "Mouse! Movie! Sound! Action!" *The New York Times*, Sunday, October 27, 1991, F11.

30
John Holusha, "New Kodak System for Showing Photos on TV," *The New York Times*, Tuesday, September 18, 1990, D6; and John Durniak, "Coming Soon to Your TV Screen: Family Snapshots, Brought to You by CD Technology," *The New York Times*, Sunday, January 19, 1992, Y19. On the history of CD technology, see the special issue of *IEEE Spectrum* 25:11 (1988): 102–8.

31
This sort of simulation can be accomplished either through storage of multiple versions of images or by means of the digital filtering techniques that are discussed in chapter 5.

32
See "Call for a Code at NPPA," in *The Electronic Times, a publication produced at a National Press* Photographers Association workshop on electronic photojournalism held at Martha's Vineyard, Massachusetts, October 6, 1989. Some of the published comments by attending photographers were: "This is ours. We need to retain control of the images." "This stuff is seductive and needs control by experts." "NPPA should be willing to take the high road in setting a moral and ethical standard for the industry." *Partly in response to concerns about digital manipulation*, the NPPA has distinguished between photojournalism and so-called editorial illustration, and has eliminated the editorial illustration category from its Pictures of the Year awards.

33
On Associated Press and the Norwegian Press Association, see the report by Phil LoPiccolo, "What's Wrong with This Picture?," *Computer Graphics World* (June 1991): 6–9.

34
Deborah Starr Seibel, "Splitting Image: Film Technology's Ability to Mix and Match Past and Present Divides Entertainment Industry," *Chicago Tribune*, Monday, December 30, 1991, Section 5, 1–3.

35
There has, for example, been a growing tendency *among American newspapers to supplement tradi*tional news photographs with contrived, set-up, or manipulated editorial illustrations in order to produce a more graphically appealing product.

36
Early digital images—especially those produced by first-generation still-video and digital cameras—were considerably inferior to the best silver-based photographs, and this limited their application. But the level of quality obtainable in digital images is primarily a function of available digital storage capacity *and processing speed, and these constantly improve,* so the digital image will seem increasingly attractive as time goes by.

37
Heinrich Schwarz, Art and Photography: Forerunners and Influences (Chicago: University of Chicago Press, 1987). On the optical side, the direct ancestor *of the photographic camera was the camera obscura,* which had become particularly popular in the eighteenth century as an aid to artists. On the chemical

side, it had long been known that sunlight could darken human skin and fade dyes, and the darkening effect of sunlight on silver nitrate, in particular, had been known since the early eighteenth century. Daguerre in France and Fox Talbot in England found ways of combining the two in service of nineteenth-century ideals of realistic depiction. For further arguments along these lines, see Chris Titterington, "Construction and Appropriation," in Mike Weaver (ed.), *The Art of Photography 1839–1989* (New Haven: Yale University Press, 1989); and Geoffrey Batchen, "Burning With Desire: The Birth and Death of Photography," *Afterimage* 17:3 (January 1990): 8–11. For resistance to the standard story of the birth of photography, see Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge, MA: The MIT Press, 1990).

38

Erwin Panofsky, "Style and Medium in the Moving Pictures," in Daniel Talbot (ed.), *Film* (New York: Simon and Schuster, 1959).

3 Intention and Artifice

1

See Robert Pear, "U.S. Downs 2 Libyan Fighters, Citing Their 'Hostile Intent'; Chemical Plant Link Denied," *The New York Times*, Thursday, January 5, 1989, A1; and Richard Halloran, "U.S. Says Tape Shows Missiles on a Libyan Jet," *The New York Times*, Friday, January 6, 1989, A1, A10. Halloran commented, "The quality of the tape was poor and what is said to be missiles appears as a darkened blur." An Agence-France Presse photograph showing Ambassador Walters exhibiting a very indistinct, but carefully labeled still at the United Nations was widely published on Saturday, January 7. The wrangle about this photographic evidence is reported in William G. Blair, "U.N. Hears Defense in Downing of Jets," *The New York Times*, Saturday, January 7, 1989, 4; and "Soviets Say U.S. Lacks Proof of Libyan Arms Plant," *Chicago Tribune*, Saturday, January 7, 1989, 3.

2

This sort of political drama had been enacted before. During the Cuban missile crisis the US ambassador to the UN, Adlai E. Stevenson, produced aerial photographs to document the claim that the Russians had installed offensive missile bases in Cuba, and the Soviet ambassador Valerian A. Zorin declared that they were faked.

3

For perspectives on this issue, see Nelson Goodman, *Languages of Art* (Indianapolis: Hackett, 1976); Margaret A. Hagen, *Varieties of Realism* (Cambridge: Cambridge University Press, 1986); David Novitz, *Pictures and Their Use in Communication* (The Hague: Martinus Nijhoff, 1977); Flint Schier, *Deeper into Pictures* (Cambridge: Cambridge University Press, 1986).

4

For a brief, clear introduction to correspondence and coherence theories of truth, see W. V. Quine, "Truth," in *Quiddities* (Cambridge, MA: The Belknap Press of Harvard University Press, 1987), 212–16. Those committed to the correspondence theory will claim that "grass is green" is true if and only if grass is green, and may want to extend this line of argument to photographs of green grass.

5

Susan Sontag, *On Photography* (New York: Farrar, Straus & Giroux, 1977). For criticism of this view, see Joel Snyder, "Picturing Vision," *Critical Inquiry* 6 (Spring 1980): 499–526.

6

Significantly for the theme of this book, the authenticity of the Holy Shroud has been hotly disputed. Perhaps it is the world's first fake photograph.

7

John Berger, "Understanding a Photograph," in Alan Trachtenberg (ed.), *Classic Essays on Photography* (New Haven: Leete's Island Books, 1980), 291–94.

8

Aaron Scharf, "The Representation of Movement in Photography and Art," in *Art and Photography* (New York: Penguin, 1986).

9
This is conveniently reprinted in Roman Jakobson, *Language in Literature* (Cambridge, MA: The Belknap Press of Harvard University Press, 1987), *19–27.*

10
Roland Barthes, "The Reality Effect," in Tzvetan Todorov (ed.), *French Literary Theory Today* (Cambridge: Cambridge University Press, 1982), 11–17.

11
See Ewa Kuryluk, *Veronica and Her Cloth: History, Symbolism, and Structure of a "True" Image* (Cambridge, MA: Basil Blackwell, 1991).

12
Thus Rosalind E. Krauss rehearses the standard cliché that a photograph is "an imprint or transfer off the real" and dutifully mentions fingerprints and the Shroud of Turin, but provides a less expected twist by connecting photography and writing via André Breton's remark that "automatic writing, which appeared at the end of the 19th century, is a true photography of thought" ("The Photographic Conditions of Surrealism," in *The Originality of the Avant-Garde and Other Modernist Myths* [Cambridge, MA: The MIT Press, 1986], 87–118).

13
André Bazin, "The Ontology of the Photographic Image," in *What is Cinema?* (Berkeley: University of California Press, 1967). Others have produced similar formulations. Lewis Mumford, for example, wrote in *Technics and Civilization* (New York: Harcourt Brace Jovanovich, 1934) that "photography differs from the other graphic arts in that the process is determined at every state by the external conditions that present themselves." Stanley Cavell has observed in *The World Viewed* (New York, 1971): "So far as photography satisfied a wish, it satisfied a wish not confined to painters, but the human wish, intensifying since the Reformation, to escape subjectivity and metaphysical isolation. . . . Photography overcame subjectivity in a way undreamed of by painting, one which does not so much defeat the act of painting as escape it altogether: by *automatism*, by removing the human agent from the act of reproduction." Rudolf Arnheim has spoken of "the fundamental peculiarity of the photographic medium: the physical objects themselves print their image by means of the optical and chemical action of light" and suggested that, as a result of this peculiarity, *"we are on vacation from artifice" when we look at* photographs ("On the Nature of Photography," *Critical Inquiry* 1 [1974]: 149–61). There are not too many more ways to say it! For an argument that the "automatic" character of photography has been exaggerated, see Joel Snyder and Neil Walsh Allen, *"Photography, Vision, and Representation," Critical Inquiry* (Autumn 1975).

14
Christopher Isherwood, "A Berlin Diary," in *The Berlin Stories* (New York: New Directions, 1963).

15
Roger Scruton, "The Eye of the Camera," in *The Aesthetic Understanding* (London: Methuen, 1983). On intentionality and representation, see also Richard Wollheim, "On Drawing an Object," in *On Art and the Mind* (Cambridge, MA: Harvard University Press, 1974), 3–30; and "What the Spectator Sees," in Norman Bryson, Michael Ann Holly, and Keith Moxey (eds.), *Visual Theory: Painting and Interpretation* (New York: HarperCollins, 1991), 101–50.

16
John Canaday, *Mainstreams of Modern Art* (New York: Simon and Schuster, 1959), 103. The supermarket tabloid *Weekly World News* has no such scruples. It has published (March 24, 1992), with an accompanying photograph, an article entitled "Baby Born with Angel Wings: He Really IS a Gift from Heaven Says Joyful Mom."

17
Lewis Hine, "Social Photography," in Trachtenberg, *Classic Essays on Photography,* 111.

18
For a discussion of the role of the camera obscura in drawing and painting, see Svetlana Alpers, *The Art of Describing: Dutch Art in the Seventeenth Century* (Chicago: University of Chicago Press, 1983). Alpers comments, on critical attitudes to use of the camera obscura, "Art is assumed to be that which is not due to an instrument but to the free choices of a human maker." See also Jonathan Crary, "The Camera

Obscura and its Subject," in *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge, MA: The MIT Press, 1990), 24–66.

19

A similar analysis can be made of constructed perspective renderings. Before the Renaissance there were drawings and paintings in roughly correct perspective, but there were no complete, well-defined perspective-construction algorithms, so the results of attempts to depict architectural space were unpredictable. The Renaissance perspective theorists succeeded in establishing such algorithms. If a perspective construction algorithm is rigorously applied by a draftsperson to geometric data (measurements from a survey of a building, say), the results are highly predictable. However, architectural drafters have often taken liberties in order to "improve" the appearance of a perspective drawing, and these may be difficult to detect. Computer generation of a perspective image from geometric data is an entirely algorithmic process, and we can trust the objectivity of the results.

20

Perhaps the most algorithmic form of photograph is one produced by a mechanism that has nobody looking through the viewfinder when the button is pushed; for example, an unmanned spacecraft that takes pictures at preprogrammed moments. It is certainly within the current capability of artificial-intelligence technology to go a step further and produce a photographer-robot that could independently decide, according to programmed criteria, to make an exposure whenever something "interesting" appeared within the viewfinder frame. At this point, photography is only very indirectly related to human intention.

21

Another line of attack is to concede that the standard algorithm was followed but to claim that the event itself was staged—that the photographer acted in a "directorial" rather than "straight" mode. I shall be only peripherally concerned with the dispute that has raged between proponents of these two modes. For an introductory discussion, see A. D. Coleman, "The Directorial Mode: Notes toward a Definition," *Art Forum* (September 1976).

22

See Eastman Kodak Company, *Clinical Photography* and *Basic Police Photography* (Rochester, NY, 1974).

23

This task is analogous to that of a literary scholar who undertakes to demonstrate that a text cannot be genuine. See Anthony Grafton, *Forgers and Critics* (Princeton: Princeton University Press, 1990), on the interplay between textual forgery and the development of techniques of textual authentication.

24

For discussions of impossible objects, see L. S. Penrose and R. Penrose, "Impossible Objects: A Special Type of Illusion," *British Journal of Psychology* 49:31 (1958); D. A. Huffman, "Impossible Objects as Nonsense Sentences," *Machine Intelligence* 6 (1971): 295–23; and Marianne L. Teuber, "Sources of Ambiguity in the Prints of Maurits C. Escher," *Scientific American* 231:1 (1974).

25

For a detailed discussion of the standard approach to computer interpretation of line drawings as three-dimensional scenes, see D. Waltz, "Understanding Line Drawings of Scenes with Shadows," in P. H. Winston (ed.), *The Psychology of Computer Vision* (New York: McGraw-Hill, 1975), 19–91. On the use of intensity information in scene-interpretation procedures, see Berthold K. P. Horn, "Understanding Image Intensities," in Martin A. Fischler and Oscar Firschein (eds.), *Readings in Computer Vision: Issues, Problems, Principles, and Paradigms* (Los Altos, CA: Morgan Kaufmann, 1987), 45–60.

26

This point might be connected to Michael Riffaterre's thesis, developed in *Fictional Truth* (Baltimore: Johns Hopkins University Press, 1990), that the ring of truth in successful fiction depends on richly tautological representation within the text rather than on exterior referentiality.

27

See for example Norman Bryson's analysis of the difference between Vermeer's *The Artist in His Studio* and a photographic transcription in *Vision and*

Painting (New Haven: Yale University Press, 1983), 111–17.

28

In similar fashion, we can cross-check narratives. There is a well-known inconsistency to be discovered in *Robinson Crusoe*, for example. Defoe has Crusoe swim naked to the wreck, then fill his pockets with things found there.

29

The importance of cast shadows in establishing credibility was demonstrated by the film *Who Framed Roger Rabbit?*. Drawn cartoon characters were inserted into photographed scenes with no attempt to produce an illusion of continuity. Indeed, the difference between cartoon and live characters was part of the point and was graphically emphasized. But live and cartoon characters were made to seem as if they occupied the same pictorial space by casting convincing shadows from the drawn characters onto photographed surfaces.

30

Edouard Manet's *Bar at the Folies Bergère* is a well-known example of a picture in which a prominent reflection is clearly *not* consistent with our spatial interpretation of the scene. The reflection of the woman's back in the mirror behind the bar cannot be consistent with the viewer's location directly in front of her. This produces a discomfiting effect of spatial ambiguity. Conversely, in the film *Terminator 2: Judgment Day*, a computer-synthesized metallic cyborg inserted into photographed scenes was made to seem convincingly solid and real by the reflection of surrounding scenery in its shiny body. See Peter Sorensen, "Terminator 2: A Film Effects Revolution," *Computer Graphics World* 14:10 (October 1991): 56–62.

31

A basic discussion is provided in G. A. Collingwood, *The Idea of History* (Oxford: Clarendon Press, 1967 [1946]). For a more recent view see Carlo Ginzburg, "Checking the Evidence: The Judge and the Historian," *Critical Inquiry* 18 (Autumn 1991): 79–92. Ginzburg attacks the view that a historical document is like a naively understood photograph—"a transparent medium . . . an open window that gives us direct access to reality."

32

A more extreme case of this sort of deception is that of the fifteenth-century *Nuremberg Chronicle*, which was illustrated with a large number of woodcuts of personages and places. Images from the same block are used in different places with different captions: one view is used to illustrate eleven different towns. See William M. Ivins, Jr., *Prints and Visual Communication* (Cambridge, MA: The MIT Press, 1969), 38.

33

William D. Montalbano, "From the Ice Comes a Mystery," *Los Angeles Times*, Monday, October 21, 1991, A1, A12.

34

Paul Wallich, "Polar Heat: The Argument Continues over an Explorer's Good Name," *Scientific American* 262:3 (March 1990): 22–24.

35

Phillip Knightley, *The First Casualty* (New York: Harcourt Brace Jovanovich, 1975), 209–12. See also Richard Whelan, *Robert Capa* (New York: Knopf, 1985), 95–100.

36

Frederic Ray, "The Case of the Rearranged Corpse," *Civil War Times* (October 1961).

37

See Karal Ann Marling and John Wetenhall, *Iwo Jima: Monuments, Memories and the American Hero* (Cambridge, MA: Harvard University Press, 1991). There was, indeed, a dramatic flag-raising on the summit of Suribachi a few hours after the Marines invaded Iwo Jima. But Rosenthal's photograph is of a staged event, with a different flag, which took place hours later.

38

"Viet War Photo Is Challenged," *Washington Post*, January 19, 1986.

39

Similar questions are sometimes raised about literary works, and the charge of fraud may be made if claims about authorship and date do not seem to correspond to the facts. A celebrated recent instance was the 1981 publication in *Harper's Magazine* of a

piece that the historian Peter Gay presented as a translation of a newly discovered contemporary review of Freud's *The Interpretation of Dreams*. Gay later said that it was a spoof, but Freudians who had been taken in angrily denounced it as a fraud. The argument between Gay and his detractors turned on the questions of what claims about provenance had explicitly and implicitly been made, whether these had been made with lighthearted or deceptive intent, and whether those deceived had been insufficiently alert to the cues that normally allow us to distinguish fiction from evidence.

40

For a fuller account of this episode, see Clifford Krauss, "A Photo Said to Show 3 Lost Fliers Jogs Congress on Vietnam Missing," *The New York Times*, Wednesday, July 24, 1991, International Section, A6.

41

Andrew Rosenthal, "Pentagon Casts Doubt on Photo," *The New York Times*, Friday, July 26, 1991.

42

Ibid.

43

"MIAs Photo Was From Magazine, US Says," *Boston Globe*, August 9, 1991, 70.

44

Barbara Crossette, "New Interest in Missing Servicemen May Imperil Move Toward Hanoi Ties," *The New York Times*, Monday, January 6, 1992, A3; Barbara Crossette, "U.S. Cites New Data on Picture," *The New York Times*, Sunday, July 19, 1992, A12.

45

Benjamin C. Bradlee, "Lies, Damned Lies, and Presidential Statements," *Guardian Weekly*, December 1, 1991, 21.

46

The print that I have on the wall before me as I write is a dramatic example. It depicts the Elephant Stables at Vijayanagara, India. The large-format glass-plate negative was exposed by the British photographer Alex Greenlaw in 1856. The print was made, using modern techniques that were not available to Greenlaw, by the Australian photographer John Gollings in 1982. Similar issues are raised by casts made after the death of a sculptor. See Rosalind E. Krauss, "The Originality of the Avant-Garde," in *The Originality of the Avant-Garde and Other Modernist Myths*, 151–70.

47

This is connected to the question of what we are to make of hearsay—verbal reports of reports. You can look at hearsay as an indirect (and therefore probably untrustworthy) report of the original incident, or you can look at it as a direct report of what a witness said—a report of a speech act. Similarly, you can look at a photograph of a photograph as an indirect image of the original three-dimensional scene or as a direct image of a two-dimensional graphic artifact. This becomes particularly clear when the photographed photograph contains halftone dots or other graphic elements that were not in the original scene.

48

Charles Hagen, "The Debate Over Photo Negatives Fires Up Again," *The New York Times*, Tuesday, March 3, 1992, C13, C16.

49

Nelson Goodman, *Languages of Art* (Indianapolis: Hackett, 1976). For an alternative view, see Nicholas Wolterstorff, "Works," in *Works and Worlds of Art* (Oxford: Clarendon Press, 1980), 33–105.

50

Consider, for example, William Blake's watercolored relief etching *The Ancient of Days* in the British Museum and his *The Ancient of Days* in the Fitzwilliam Museum, Cambridge. Although the two are very similar, and have the same title, they differ in numerous subtle ways. They are different works with elements in common, not different instances of the same work.

51

Some modernist photographers, however, have emphasized standardized, precisely controlled printing processes, so that results are highly predictable and one print is *almost* indistinguishable from another. Ansel Adams, in particular, explicitly compared negatives to musical scores and prints to performances of them.

52
Closure eventually occurs when a tradition dies. The Homeric epics must have evolved through many versions as they were retold, but we now regard them as closed, finished works.

53
Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction," in *Illuminations*, ed. Hannah Arendt, trans. Harry Zohn (New York: Harcourt Brace & World, 1955). For a more recent treatment of the theme, see David Harvey, "The Work of Art in an Age of Electronic Reproduction and Image Banks," in *The Condition of Postmodernity* (Oxford: Basil Blackwell, 1989).

54
Not only does DNA carry hereditary information, it apparently does so in digital form—allowing replication without degradation.

55
Many theorists of the postmodern would, no doubt, assimilate this point to a general argument that subjects are constructed by symbol systems and that photographic, print, film, video, and digital images now do much of the work of construction. See for example Jean-François Lyotard, *The Postmodern Condition: A Report on Knowledge* (Minneapolis: University of Minnesota Press, 1984); and Jean Baudrillard, "Simulacra and Simulations," in *Jean Baudrillard: Selected Writings*, ed. Mark Poster (Stanford: Stanford University Press, 1988). The role of digital information is explicitly addressed in Mark Poster, *The Mode of Information: Poststructuralism and Social Context* (Chicago: University of Chicago Press, 1990). On the idea of cyberspace—electronic "virtual reality," see William Gibson, *Neuromancer* (New York: Ace Books, 1984); and Michael Benedikt (ed.), *Cyberspace: First Steps* (Cambridge, MA: The MIT Press, 1991).

56
For general discussion of copyright protection for works in electronic form, see US Congress, Office of Technology Assessment, *Intellectual Property Rights in an Age of Electronics and Information* (Washington, DC, 1986).

57
On the issues raised by colorization, see "Moral Right Protections in the Colorization of Black and White Motion Pictures: A Black and White Issue," *Hofstra Law Review* 16 (1988): 503; "Motion Picture Colorization, Authenticity, and the Exclusive Moral Right," *New York University Law Review* 64 (1989): 628; and Stuart Klawans, "Colorization: Rose-Tinted Spectacles," in Mark Crispin Miller (ed.), *Seeing Through Movies* (New York: Pantheon, 1990).

58
Quoted by Deborah Starr Seibel in "Splitting Image," *Chicago Tribune*, Monday, December 30, 1991, Section 5, 1–3.

59
See Richard Jay Solomon, "Vanishing Intellectual Boundaries: Virtual Networking and the Loss of Sovereignty and Control," *Annals of the American Academy of Political and Social Science* 495 (January 1988): 40.

60
Rights of photographic subjects are discussed extensively in Larry Gross, John Stuart Katz, and Jack Ruby (eds.), *Image Ethics: The Moral Rights of Subjects in Photographs, Film, and Television* (Oxford: Oxford University Press, 1988).

61
Anne W. Branscomb, "Common Law for the Electronic Frontier," *Scientific American* 265:3 (September 1991): 154–58.

62
John Szarkowski provided the canonical formulation of this point in *The Photographer's Eye* (1966): "The invention of photography provided a radically new picture-making process—a process based not on synthesis but on selection. The difference was a basic one. Paintings were made . . . but photographs, as the man on the street put it, were taken."

63
Oliver Wendell Holmes, "The Stereoscope and the Stereograph," *Atlantic Monthly* 3 (June 1859). Reprinted in Trachtenberg, *Classic Essays in Photography*. For commentary see Alan Trachtenberg,

Reading American Photographs (New York: Hill and Wang, 1989). The metaphor of photographic images as wealth is also used, with an ironic twist, in Jean-Luc Godard's *Les Carabiniers:* two peasants, induced to join an army by the prospect of looting, end up with a suitcase full of picture postcards.

64

Susan Sontag, *On Photography* (New York: Farrar, Straus & Giroux, 1977).

65

See *The New York Times,* March 2, 1988, A12. The idea of this sort of comprehensive photographic documentation is an old one. In 1899 *The British Journal of Photography* called for formation of an archive "containing a record as complete as it can be made . . . of the present state of the world" (vol. 36, p. 688).

4 Electronic Tools

1

Pierre Bourdieu, *Photography: A Middle-brow Art* (Stanford: Stanford University Press, 1990), 77.

2

Edward Weston, "Seeing Photographically," *Encyclopedia of Photography* 18 (New York: Greystone Press, 1965). Reprinted in Alan Trachtenberg (ed.), *Classic Essays on Photography* (New Haven: Leete's Island Books, 1980), 169–78.

3

NTSC video format is used. Each 2-by-2-inch (approximately the size of a 35-mm slide) still-video floppy disk has fifty concentric tracks and can store twenty-five "frame" images or fifty "field" images. A frame image has full NTSC video resolution, but a field image stores only every other raster line.

4

On exposure control with electronic cameras and other digital image-capture devices, see Don Lake, "Electronic Cameras, Sensors, and Electronic Exposure Control," *Advanced Imaging* 6:11 (November 1991): 24–30. On the effect of noise in images, see L. Harmon and B. Julesz, "Masking in Visual Recognition: Effects of Two-Dimensional Filtered Noise," *Science* 180 (1973): 1194–97.

5

See Nigel Henbest and Michael Marten, *The New Astronomy* (Cambridge: Cambridge University Press, 1983), for discussion and examples of the use of astronomical CCD cameras. Details of the construction of these cameras are given in Christian Buil, *CCD Astronomy: Construction and Use of an Astronomical CCD Camera* (Richmond, VA: Willmann-Bell, 1991).

6

George Garneau, "Turning TV Footage into Newspaper Photos," *Editor and Publisher,* November 23, 1985.

7

For an introductory discussion of satellite scanning systems, see Arthur Cracknell and Ladson Hayes, *Introduction to Remote Sensing* (London: Taylor and Francis, 1991).

8

John Noble Wilford, "Spacecraft's Maps Show Evidence of Active Volcanoes on Venus," *The New York Times,* Wednesday, October 30, 1991, A21; Corey S. Powell, "Venus Revealed," *Scientific American* 226:1 (January 1992): 16–17; and Stuart J. Goldman, "Venus Unveiled," *Sky and Telescope* 83:3 (March 1992): 258–62.

9

John Noble Wilford, "Photos by Radar Hint at Ice Poles of Mercury," *The New York Times,* Thursday, November 7, 1991, A22.

10

See Gerd Binnig and Heinrich Rohrer, "Scanning Tunnelling Microscopy—From Birth to Adolescence," *Reviews of Modern Physics* 59:3 (July 1987): 615–25.

11

Nicholas P. Negroponte, "Products and Services for Computer Networks," *Scientific American* 265:3 (September 1991): 106–15. On the technology for capturing three-dimensional models, see Alex Pentland and Stan Sclaroff, "Closed-Form Solutions for Physically Based Shape Modeling and Recognition," *IEEE Transactions on Pattern Analysis and Machine Intelligence* 13:7 (July 1991): 715–29; and Alex