Review Essay

"Visible Memory, Visual Method": Objectivity and the Photographic Archives of Science

By Jeffrey Mifflin

Photography and Science
By Kelley Wilder. London: Reaktion Books, 2009. 139 pp. Illustrations. Notes. $29.95. ISBN 978-1-86189-399-4.

Objectivity
By Lorraine Daston and Peter Galison. New York: Zone Books; Cambridge, Mass.: Distributed by MIT Press, 2007. 501 pp. Illustrations. Maps. Notes. $38.95. ISBN 978-1-890951-78-8.

Brought to Light: Photography and the Invisible, 1840–1900
Edited by Corey Keller. San Francisco and New Haven: San Francisco Museum of Modern Art in association with Yale University Press, 2008. 215 pp. Illustrations. Notes. $50.00. ISBN 978-0-300-14210-5.

Delia's Tears: Race, Science, and Photography in Nineteenth-Century America
By Molly Rogers. New Haven: Yale University Press, 2010. xxv, 350 pp. Illustrations. Maps. Notes. $37.50. ISBN 978-0-300-11548-2.

Darwin's Camera: Art and Photography in the Theory of Evolution
By Phillip Prodger. Oxford and New York: Oxford University Press, 2009. xxv, 283 pp. Illustrations. Notes. $39.95. ISBN 978-0-19-515031-5.

Philosopher of science Karl Popper characterized scientific objectivity as the responsibility (and freedom) of scientific researchers to pose refutable hypotheses; to test hypotheses with relevant evidence; and to express the results of investigations unambiguously in ways accessible to all concerned.[1] Recent scholarship in the history of science has explored the historical roots of scientific methodology, including such elements as experiments, proof, evidence, reasoning, personality, and the determination and evaluation of facts. "The coupling of evidence and photography in the second half of the nineteenth century was," historian John Tagg suggests, "bound up with the emergence of new institutions and new practices of observation and record keeping."[2] Photographic records related to scientific claims came into being in 1839 and proliferated thereafter, while photographic archives for preserving visual data grew in size and prestige, lending an air of authority and authenticity to scientific opinions and the research upon which they were based. The photographic record and the ways in which it was preserved and perceived were closely linked to evolving views of epistemology.

Visual archives pertaining to science are significant in ways not contemplated by the scientists, professional societies or other institutions, archivists, librarians, and others who were involved in their establishment. More than just a record of specific phenomena, events, or research projects, such records have potential for revealing the relationship of science to larger social and intellectual contexts, for example, changing paradigms, evolving notions of scientific objectivity, and more general viewpoints about what may or may not be true. This review essay discusses five important new books about the visual records of science (focusing especially on nineteenth-century photographic records), comments specifically on the perspectives they offer, and points to some broader implications for archives and archivists.

1 See Karl R. Popper, *Objective Knowledge: An Evolutionary Approach* (Oxford: Clarendon Press, 1972) and Popper, *Conjectures and Refutations: The Growth of Scientific Knowledge* (New York and London: Basic Books, 1962). Some of the key terms used in scientific discourse (and in this essay) can be usefully defined as follows: A "fact" in science is an observation that has been repeatedly confirmed and accepted for all practical purposes as "true." However, scientific "truth" is never final. Today's "fact" may be revised or rejected tomorrow. A "hypothesis" in science is a tentative statement that leads to deductions that can be tested, verified, and used to build an explanation. A scientific "law" is a generalization about how some aspect of the natural world functions under stated conditions. A scientific "theory" is a well-supported explanation (incorporating facts, inferences, laws, and tested hypotheses) of some aspect of the natural world.

2 John Tagg, *The Burden of Representation: Essays on Photographies and Histories* (London: Macmillan, 1988), 5.

Kelley Wilder, ***Photography and Science***

"A New Way of Achieving an Archive"

Kelley Wilder, senior research fellow in the Department of Imaging and Communication Design at De Montfort University, oversees a graduate program in photographic history and practice. In *Photography and Science*, she describes the complex relationship over time between science and photographs, an "ebb and flow of influence, information, and innovation," constituting a "symbiotic relationship." As she notes in the introduction to her succinct but informative book, the two disciplines were closely linked as soon as practical methods of photography were invented. Louis Daguerre's achievement, announced at the Paris Académie des Sciences in 1839, was greeted at its debut as "an artificial retina placed…at the disposal of physicists." Three themes emerge and recur in Wilder's book: the development of photography as a science; the representation of scientific objects or phenomena; and the use of photographs for detection and measurement in science (pp. 7–9).

Scientific trust in the photographic image in the nineteenth century was rooted in the "photographic-medium-as-scientific-eye metaphor," which in turn derived from a "camera-as-eye analogy." The special advantage of the fixed images made available by means of photography was the supposed elimination of the fatigue and subjective bias that affected drawings made by scientific observers. Nevertheless, debates simmered in scientific circles about the reliability of photography. "Each new photographic method was not just taken at face value, but was explained, controlled, verified, and re-verified." The variability of photographic emulsions was of particular concern, and emulsions were "tested in endless combinations of lighting and development" (pp. 12, 29–30).

Chapter 1, "Photography and Observation" (pp. 18–51), details the vicissitudes of photography's position as apparatus for scientific observation. Its applications varied with the employment of different assemblies of light-gathering lenses, including microscopes and telescopes.

> Nineteenth-century cultures of observation were powerfully pervasive, and they left a clear signature on the development and use of photography…. The inventions and innovations of photography, in turn, influenced the way scientists observed, and restructured the hierarchy of observations held to be valuable. Pre-photographic scientific observation required not only years of painstaking acquisition of skill, but an innate genius for concentration and attention to detail. Photography promised these skills to those who lacked such training…[and] eliminated the aggravating need to momentarily take one's eyes off the subject while jotting down notes or sketches…. But [its] two most seductive claims…were the promise of passivity and the extension of the realm

> of the visibly observable. Complete passivity, the damping down or elision of subjective decisions by scientists in the illustration of an observation, became so desirable to those striving for objectivity [that it remained] an active metaphor even in the face of significant evidence to the contrary. (pp. 18–19)

Photography "was mechanical, and so indefatigable," according to popular opinion. "It was indiscriminant, and therefore objective" (p. 18). But photography's "real calling card" was its reputation for expanding the scope of what can be seen. Its sensitivity to "invisible" radiations (e.g., X-rays and ultraviolet radiation) solidified its position as a scientific tool (pp. 19, 51). The use of strobes or sparks in a darkened room allowed photographs to freeze motion, enabling the observation of events too rapid for the unaided human eye to detect. Photographs taken in sequence (chronophotography, e.g., by Étienne-Jules Marey and Eadweard Muybridge) broke motion into discreet segments for study (pp. 44–46).

Chapter 2, "Photography and Experiment," discusses what makes "photography in experimental situations reliable, or for that matter, unreliable." The key issues relate to the amount of control afforded to the scientist conducting the experiment (p. 52) and the method of selecting representative results. Images depicting a desired result have often been "plucked from their companions to serve as carriers of the great weight of evidence produced in reality by extensive runs of experiments and multitudes of experimental image results.… The majority of experimental photographs have been lost or forgotten.…" (p. 58).

The perspectives detailed in chapter 3, "Photography and the Archive," are of particular interest to archivists. The chapter begins by enumerating some of the scientific archives started or envisioned in the nineteenth and early twentieth centuries, among them Albert Kahn's "Archive of the Planet" in Paris, Benjamin Stone's National Photographic Record Association in England, and the U.S. Geological Survey's archives of the American landscape. Oliver Wendell Holmes in 1858 called for the creation of a stereoscopic library in the United States where visitors could see and understand "any object, natural or artificial." Wilder notes that the "collect everything mentality" expressed by these photo-related efforts differs significantly from earlier attempts to organize collections of scientific knowledge by taxonomy (pp. 79–80). She summarizes the development of photographic archives as follows:

> In the latter half of the nineteenth and through the twentieth centuries there emerged the impulse to store objects in great masses, not exactly without organization, but using more pictorial and less linguistic apparatus. Photographic archives are almost exclusively this…. The impulse behind creating photographic archives for science is to gather up an infinite number of details and save as many of them as possible for the development of unforeseen and unforeseeable investigation. It accompanied the move away

> from "ideal" typological specimens and toward serial collection.... It would be claiming too much to say that the invention of photography instigated this... way of collecting and organizing archives of knowledge. But photography was deeply involved because of its singular trait of obtaining unlooked for...detail. (p. 80)

When scientific photographic archives are created (or expanded by new accessions), the stakes are high. Such collections have a special imprimatur of authority, bringing together "the knowledge that is collected and protected (for better or worse) to facilitate learning, to control the boundaries of history, to shape and colour a particular view of the world" (p. 81).

> The scientific photographic record forms knowledge in archives, not by becoming iconic or being used singularly, but by sinking in among its companions, relinquishing its individual character in order to further a much larger narrative history [often] bound up with a particular disciplinary identity. The epistemology, that is, how scientists get knowledge from these collections, is complex because an archive is always a collection.... [M]ultiple images...constitute a...visible memory, or a visual method of problem solving. (p. 100)

The particular flavor of photographic archives, scientific or otherwise, is that the collected images preserve not just the details of interest at the time of creation or accessioning, but all details captured by the photographic equipment. The pace of scientific developments in the late nineteenth century led scientists to believe that many theories would in due course be refuted or revived. Photography became an integral part of scientific archives as the need arose to build archival data against which new theories could be tested or older theories vindicated.

> Photography was on hand, offering a new way of achieving an archive, one that could retain accidental information along with the intentional. Notorious for their relentless and indiscriminate capture of detail, photographs embodied the notion of archiving for the future, for a science based not only on the accumulation of known knowledge, but also on the examination and re-examination of that knowledge in the face of new discoveries. (pp. 100–101)

Chapter 4, entitled "Art and the Scientific Photograph," is less interesting from an archival point of view, but nevertheless worth reading for its discussion of the intricate interplay between art and science:

> Photography as we know it has been shaped and continues to be informed by both art and science, which work together in complex ways. For photography, it is immaterial if the origins of an image lay, at a given point in time, wholly in science, or wholly in art. What is important is the exchange between these

two fields. Photography derives much of its power from facilitating this exchange. (p. 128)

Photography and Science is part of Reaktion's Exposures series, aimed at producing compact books about the history of photography from thematic perspectives. The text is concise, easy to read, and well integrated with judiciously selected images, which are well reproduced. The notes are brief and cogent, and the short bibliography is well chosen.

Lorraine Daston and Peter Galison, ***Objectivity***

"Where . . . Knower and Known Intersect"

The first authors to use photographs as scientific illustrations followed conventions devised long before. The urge to achieve objectivity predated the invention of photography, and the arrival of the new medium in 1839 became part of this established tradition. All scientists attempt objectivity, but what does objectivity mean, and how has the concept changed from one population, or period of investigation, to another?

Lorraine Daston and Peter Galison are historians of science at the Max Planck Institute for the History of Science and Harvard University, respectively. Their important new book, *Objectivity*, is an expansion of themes first explored in an influential 1992 article, "The Image of Objectivity."[3] The book reviews the history of scientific objectivity; analyzes the strategies employed by authors and illustrators in various periods to persuade scientific colleagues, as well as the general public, that their work was authoritative and accurate; and discusses how epistemic ideals have interacted with the practical conditions of observation and experimentation over time. Because of the complexity of the subject, the authors chose to focus on one specific genre of practice, the scientific atlas.

Not every nineteenth-century scientist was a photographer, but most, by the second half of the century, were trained to interpret photographic images. Scientific photographs in the nineteenth century were used for making discoveries, reporting results, publicizing research, and establishing visual archives. Atlases, many of which were lavishly illustrated, serve as reference standards within a particular scientific discipline (e.g., anatomy, botany, geology, or astronomy). Illustrated scientific atlases trained the eyes of beginners and refreshed the vision of seasoned specialists, functioning as repositories of images, educating scientists and physicians about what was worth studying, how it looked, and how it should be seen (pp. 22–23).

[3] Lorraine Daston and Peter Galison, "The Image of Objectivity," *Representations* 40 (1992): 81–128.

The first such atlases followed the principle that Daston and Galison call "truth to nature," whereby artists created illustrations that purported to show ideal specimens, overlooking individual differences among models in an attempt to identify and depict the underlying plan (classifying specimens, essentially by envisioning a composite of many individual examples). The "truth to nature" approach is still used today for nature guides, such as bird, wildflower, or tree identification manuals (pp. 55–113). The second approach to atlas production, enabled by photography in the mid-nineteenth century, allowed a new kind of scientific image to be made, untainted by idealism and standardization, and supposedly captured without significant human intervention. The scientist was assumed to be a passive observer (pp. 115–90). But this idea, known as "mechanical objectivity," was largely discredited by the end of the nineteenth century because of a burgeoning belief that the traits of observers and experimenters inevitably influenced their findings. In response, some disciplines drifted toward "structural objectivity," which attempted to overcome individual subjectivity by excluding images and ordinary language from scientific discourse (pp. 253–307). Another response, known as "trained judgment," acknowledged that a practitioner's personal traits could never be eliminated from scientific investigations: personal characteristics could be cultivated in ways that permit reliable knowledge to emerge from the scientific process. Individual traits, according to this view, factor into a scientist's overall expertise, and there is no need to suppress individuality in a futile search for absolute objectivity (pp. 309–61).

Each of the approaches to objectivity described in the book also resulted in a "scientific self" (pp. 35–39, 174–82, 216–33, 357–66, passim). The images selected for a particular discipline's atlases are based on decisions reinforced by the value system of the scientists within that discipline. Atlases shape the perceptions of practitioners, in addition to defining objects and molding ways of seeing them. Scientists subscribing to a paradigm tend to see, not as separate individuals, but rather as members of a scientific community.[4] When factual claims are evaluated, the personal traits of the scientist are implicated as well as the scientific procedures followed. "Ways of scientific seeing are where body and mind, pedagogy and research, knower and known intersect" (p. 369). Science, in this regard, has a recognizably human face.

[4] According to historian of science Thomas Kuhn, scientists organize themselves into paradigms that circumscribe their research and thinking. Problems to be considered are formulated inside the paradigm, and scientists in training are educated within its confines. The only scientists who have sufficient reputation and status to speak with authority or resolve disputes are those already imbued in the intellectual constructs of the paradigm (and they have a vested interest in maintaining it). Acceptance of a paradigm by a community of scientists is predicated on the paradigm's ability to explain the problems framed by that community, as well as the social relations existing within it. Data that appear to contradict a paradigm do not ordinarily discredit it. They are, instead, absorbed within it as a variation to prevailing theory or are discounted in one way or another (on the presumption that the researcher's credentials are substandard or that the problem is incorrectly framed). The edifice of a scientific paradigm crumbles when a significant percentage of scientists loses confidence in it. See Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 3rd ed. (Chicago: University of Chicago Press, 1996).

The subject matter in *Objectivity*, sometimes highly technical, is presented with crisp precision. Forty pages of color plates supplement carefully chosen black-and-white illustrations (drawings, photographs, X-rays, maps, charts, etc.) with expansive explanatory captions. The erudition is remarkable, the clear presentation of visual and text-based material is impressive, and the copious notes are interesting as well as informative. The authors freely acknowledge that they have not been able to tell the whole story. Objectivity is not the only "epistemic virtue" in science, and analysis of scientific images is not the only way of studying objectivity (pp. 371–72, passim).

Corey Keller, ***Brought to Light: Photography and the Invisible, 1840—1900***

"The Secretary and Record Keeper of Science"

Corey Keller, curator of *Brought to Light: Photography and the Invisible, 1840–1900*, an exhibit mounted at the San Francisco Museum of Modern Art (2008–2009), edited the museum's exhibit catalog of the same title. The book contains striking reproductions of more than two hundred nineteenth-century photographs and engravings on 134 pages of plates and an assortment of thoughtful essays by Keller and other photographic historians. The plates are organized into six sections (Microscopes, Telescopes, Motion Studies, Electricity and Magnetism, X-Rays, and Spirit Photography), each of which is preceded by a concise, well-written introduction by a subject specialist. A short, well-chosen bibliography (pp. 208–9) and generously detailed photo credits (pp. 210–16) round out the volume. The essays combine just the right amount of technical information and human interest and are a welcome addition to the less-than-copious literature on scientific photography. They are especially valuable because they are readily accessible to readers without extensive scientific acumen.

Keller's essay, "Sight Unseen: Picturing the Invisible," establishes the overall theme of the exhibit and book: how photography came to be seen as "the secretary and record keeper of science" (pp. 19–35). Jennifer Tucker's essay, "The Social Photographic Eye," puts nineteenth-century scientific images in their societal context (pp. 37–49). Tom Gunning explores the effects of stop-action photography, motion-study photography, spirit photography, and X-rays in "Invisible Worlds, Visible Media" (pp. 51–63). Maren Groning highlights the work of an Austrian photographer (and effective propagandist for the genre) in "Almost a Game of Chance: Josef Maria Eder and Scientific Photography" (pp. 65–72). Eder established the Training and Research Institute for Photography and Reproduction Techniques in Vienna in 1888.

The editor defines the scientific photograph broadly as "a picture of a natural phenomenon made with light sensitive materials for the documentation, illustration, or dissemination of information to a specialized or amateur audience." The deliberately expansive scope of the definition was crafted to embrace the medium's wide range of applications as well as the "multiplicity of audiences who saw the pictures" (p. 21). *Brought to Light* looks at a variety of uses for scientific photography from its inception in 1839 to its "maturation as an industrialized process" toward the end of the nineteenth century.

Brought to Light focuses primarily on a subset of scientific photography—pictures made of phenomena that, without photography, could not be observed. The book highlights

> photography's role within a new scientific culture in which seeing and knowing were understood to be inextricably linked—a relationship that grew increasingly complicated in light of rapidly accumulating evidence of the limitations of the human eye and of forces operating below the threshold of perception.... Beginning with pictures made through the two key optical devices of early modern science, the microscope and the telescope, and culminating with the discovery of X-rays at the century's close [it] considers what it meant to "see" photographically. (p. 20)

Photography's "potential contributions to science were twofold: as a mechanical replacement for the draftsman's arduous task of manually transcribing visual observations, and as a corrective for the human tendency toward subjective interpretation" (p. 21). An important early use of photomicrography was made in an 1845 book conceived by Alfred Donné, entitled *Cours de microscopie complémentaire des études médicales*, containing engravings based on daguerreotypes that recorded microscopic specimens with "rigorous fidelity" (p. 27). A groundbreaking example of early astrophotography (a photograph exposed to light through a telescope) was the 1852 "View of the Moon" recorded by John Adams Whipple (daguerreotypist) and George Phillips Bond (astronomer), using Harvard's fifteen-inch Great Refractor, equipped with a mechanism for moving the instrument in tandem with the earth's motion to allow longer exposures without blurring (pp. 25–27).

Chronophotographic motion studies such as those conducted by Étienne-Jules Marey with photographic guns that captured multiple images of movements on a single sensitized plate (pp. 57–58, 137) and Eadweard Muybridge's array of separate cameras and trip wires set up to photograph the stages of movement in sequence (p. 57, 136–41) are briefly but accurately described, as is the work of Ernst Mach, the Austrian physicist whose "instantaneous photographs" (using sparks as a light source) captured the motion of rapid events like the flight of a bullet (pp. 137, 151). In 1895, Wilhelm Conrad Röntgen discovered X-rays while working with a Crookes tube in his physics laboratory in

Würzburg, Germany. The mysterious radiation passed through many opaque objects (human flesh, for example, as well as wood, paper, and rubber) and left marks on photographic plates positioned behind them. X-rays, which astonished scientists, physicians, and the general public alike, dissolved the barriers between inside and outside and led to radical new perceptions about what could or could not be seen (p. 70, 168–91). A conceptual hurdle in nineteenth-century society's perception of photographs was that the evidence on the plate or print could not always be corroborated by a human witness. The actual truth of a medical X-ray, for example, could not be verified without cutting open the patient. But increased exposure to and familiarity with photography led to widespread acceptance of its capabilities.[5]

One of the odd circumstances surrounding views of scientific objectivity is that claims to it rested largely on the belief that machines such as the camera offered scientists freedom from subjectivity. But it was the "subjective identity" of renowned scientists (or medical lecturers or skilled photographers) that gave their pronouncements "meaning and authority." The professional identity of the scientist as well the institution with which he was associated were significant in assigning "credibility" to claims about photography's "mechanical objectivity." Photography of the unseen was associated with scientific professionalization and expertise as well as specialized instruments, equipment, and knowledge. Evaluation of scientific photographs "necessarily entailed assessments of the subjectivity of their makers and interpreters, even if the rhetoric surrounding them elided this information" (p. 42).

The book contains a wealth of historical anecdotes. For example, the widespread belief that the camera lens and sensitized plate were analogues for the human eye and retina encouraged strange, lingering superstitions. "The 1800s witnessed a number of forensic claims that an assassin could be identified by examining the retinas of his victim, which supposedly retained, as if they were photographic plates, an image of the last thing seen." Such myths were widely discussed in medical and photographic journals and subjected to testing well into the twentieth century (p. 30).

Because the images on photographic plates were often small and hard to discern, editors of scientific publications sometimes had the pictures interpreted for readers by an artist who resorted to lithographs, engravings, diagrams, or

[5] Corey Keller, interview with Apollonia Morrill, SFMOMA Open Space, at http://blog.sfmoma.org/2008/12/interview-corey-keller-on-brought-to-light-photography-and-the-invisible-1840-1900/, accessed 1 June 2011.

even cartoons.[6] Newspapers and magazines popularized the new specialty of bacteriology by drawings reinforced by written explanations. One such account "encouraged" readers to imagine "germ warfare" within the body: bacteria were dark-skinned enemies that invaded the body en masse and could only be subdued by white-skinned leukocytes and phagocytes. Amateur astronomer Percival Lowell took photographs of Mars, which were reproduced in a variety of publications (ca. 1895 to 1908), sometimes with and sometimes without artistic enhancement. The lines (indicating, he thought, canals) were (he said) "doubt-killing bullets," proving that intelligent life resided on the Red Planet (p. 47).

The book is not without its problems. Designers Jennifer Sonderby and James Williams have done the material a disservice by turning superscripts and footnotes into nearly illegible blurs of tiny turquoise print. Another misguided design concept results in the title being blind-stamped onto the cloth spine, rendering it illegible in all but the best light. The absence of page numbers for the 134-page section of plates makes them difficult to reference. More attention than necessary is given to "spirit photography," images concocted by mediums during séances or other attempts to make contact with the dead (pp. 58–63, 194–207). The faked images, for instance of Mary Todd Lincoln (p. 62) seated with a miniature Abe Lincoln hovering above and behind, are transparently spurious and more ridiculous than interesting to a twenty-first-century viewer.

Molly Rogers, ***Delia's Tears: Race, Science, and Photography in Nineteenth-Century America***

"Who Is Looking, and Why"

Molly Rogers, an independent scholar who teaches creative writing and has an abiding interest in the history of photography, approached Joseph T. Zealy's 1850 daguerreotypes of slaves forearmed with the knowledge that she could not tell the story she wanted to tell in *Delia's Tears* without blending history and fiction. The photographs themselves (commissioned by Louis Agassiz, the Swiss-born scientist who founded Harvard's Museum of Comparative Zoology in 1859) are highly evocative, but little is known about the individuals depicted, aside from accounting records kept by slaveholders and the handwritten notes on the backs of the daguerreotypes, recording the name of the slave, his or her

[6] Scientists and their publishers in the nineteenth century often supplemented photographs, using artistic enhancements, models, or imaginative explanations to convey the intended meaning more clearly. Photographic imaging in science is much more sophisticated today than it was in the nineteenth century, but scientists still rely on other media to explain what an image purportedly shows and to help viewers grasp the complexities and implications of data. Such supplementary media include charts, graphs, graphic imaging, and computer simulation.

African ethnic group or geographical area of origin, the name of the slave's owner, and, for some of the men, trade practiced (pp. 17, 228).

Nothing about Delia is known beyond the scant information preserved in slaveholder accounts and a few handwritten notes associated with Zealy's daguerreotypes. She was one of two female slaves photographed by Zealy in 1850 and probably worked in the blacksmith's shop at Edgehill, a plantation owned by Benjamin Franklin Taylor outside Columbia, South Carolina. She was born in the United States, the daughter of African-born parents. Her father, Renty (also owned by Taylor), was brought to America from the Congo. When Taylor died, his slaves passed into the possession of his wife, Sally Webb Taylor (pp. xiv, 337).

Rogers attempts to fill gaps in our perceptions about the mentality of nineteenth-century American slaves by quoting from various African American writings on the nature of oppression. These include insights put forward by sophisticated, well-read authors like escaped slave Frederick Douglass and twentieth-century novelist Ralph Ellison. "At the heart of this story," Rogers suggests, "is the question of what it means to be human…."

> Naturalists, slaveholders, politicians, even ordinary citizens were caught up in the debate on human nature that occupied the nation [in the antebellum] period. So, too, were the men and women who lived and worked as slaves on the plantations and in the cities of the South; indeed, they were the focus of the debate. These people…depicted in the photographs—Delia, Jack, Renty, Drana, Jem, Alfred, and Fassena—are at the heart of the story…yet at the same time they are strangely absent from it. (p. xxi)

The daguerreotypes, depicting seven naked or partially naked male and female slaves, were uncovered by accident in 1976 in the attic of Harvard's Peabody Museum of Archaeology and Ethnology (founded in 1866) while employees were exploring some infrequently accessed storage cabinets. Sleuthing by cataloger Ellie Reichlin revealed who owned the slaves and who Zealy was, but the meaning and purpose of the images remained a mystery. William Sturtevant from the Bureau of American Ethnology conjectured that the daguerreotypes may have been commissioned by someone who wanted to study body types, and further investigation linked the images to Agassiz. Physical anthropology around 1850 was preoccupied with the classification of people into types based on skin color and other physical attributes. The fifteen extant pictures are the earliest known photographs of identifiable American slaves.[7]

The circumstances surrounding the creation of the daguerreotypes can be briefly stated. Agassiz, one of America's most respected mid-nineteenth-century scientists, was adamant in his belief that species were fixed (not evolved or

[7] Elinor T. Reichlin, "Faces of Slavery," *American Heritage* (June 1977): 4–11.

evolving) and promoted the view that diversity among human beings was the result of separate creations (p. 99, passim). The idea that humans had no common ancestry and that each "race" was innately endowed with particular traits led to the corollary that each was inherently suited for a particular station in society. Slavery's defenders could reason from such premises that the subjugation of blacks was not "a moral abomination, as the abolitionists claimed, but a reflection of the natural order of society as God had intended it" (p. 19). Agassiz claimed to have sufficient knowledge and scientific judgment to identify racial types, even from photographs. He commissioned Zealy to shoot the images in his Columbia, South Carolina, studio after making appropriate arrangements with amenable slaveholders. He circulated the daguerreotypes among his scientific colleagues in Cambridge, Massachusetts (pp. 233–34), but never published them in any form (p. 249). Ethnological material collected by Agassiz and originally kept at the Museum of Comparative Zoology was transferred to the Peabody Museum in 1871 (p. 288).

Agassiz's supposed ability to classify people into types by looking at pictures was, according to Rogers, "a matter of constructing meaning and convincing others he was right by virtue of his authority" (p. 225). His stature as "an internationally renowned naturalist helped create a framework in which the daguerreotypes could function as scientific objects, reinforcing ethnological theories, but [not] necessarily, nor exclusively. It all depends," Rogers suggests, "on who is looking, and why" (p. 247).

> In many ways photography was the perfect tool for generating scientific proof.... [T]he camera's apparent objectivity was quickly recognized as a valuable asset in the search for Truth. Yet with photography an uncertain art, and ethnology an equally uncertain science, combining the two was not at all straightforward.... The ostensibly objective camera had its own way of seeing, one not easily adapted to the needs of the ethnologist.... To turn the camera on an enslaved woman and seek in her pictorial evidence to support a controversial scientific theory was something new in 1850, an idea that required an extraordinary leap of the imagination. Knowing that the daguerreotypes were intended to prove a theory...sheds much light on the images, but it does not tell us what they meant to the people who made them.... The daguerreotypes are implicated in multiple historical narratives—the histories of race, science, and photography in antebellum America.... (pp. 20–21)

Delia's Tears considers the period in American anthropology (before about 1860) when practices varied and standards had not yet been agreed upon, that is, before the arrival of "collective empiricism" (p. 331). Two varieties of anthropological photography developed in the 1860s (and succeeding decades) as colonial powers sought ways of understanding "the Other" and anthropology came to be accepted as a discrete scientific discipline. One entailed the inclusion of rulers within the frame of frontal and profile photographs to allow the images to be mined for quantifiable data. The second involved more natural settings, wherein the people depicted were seen in native costumes and/or engaged in some representative activity. Ethnic types were no longer evaluated solely on the basis of physical characteristics: interest grew in the depiction and description of economies and habits (p. 287–88).

Thorough credits, including dimensions, dates, and provenance,[8] are provided in the book for all illustrations (pp. 337–39). A separate section of biographical information (when it was available) is useful (pp. xiii–xviii). The text is thoughtful and replete with interesting asides in addition to a reasonably coherent explanation of scientific theories and pseudoscientific polemics. Thomas Dew's infamous, but influential, racist diatribes (e.g., "The Ethiopian cannot change his skin, nor the leopard his spots") are well described, as is the tense political and social climate of the United States in 1850. The specter of slave rebellions, such as those ignited by Denmark Vesey in South Carolina in 1822 and Nat Turner in Virginia in 1831 (pp. 141–42), formed the looming backdrop to politics and racist journalism in the South.

One of her core intentions, the author explains, is "to celebrate the dignity of human agency and self-determination in the face of adversity and to do so with historical accuracy" (p. xxiii). Rogers is not black, but she nevertheless attempts to flesh out the narrative by means of her own fictional vignettes, imagining what Delia or the other silent victims seen in the photographs might have thought or said around the time they were forced to pose in Zealy's studio. The historical sections of the book are well documented and effectively presented, but the fictional vignettes are unconvincing and detract from the overall success of the effort.

Other problems with the book are less significant, but nevertheless worth noting. The descriptions of historical photographic technologies are less detailed than one might expect, and the author seems unaware that photography of the dead (especially of deceased children) was a common practice in the Victorian era (pp. 15–16). Irrelevant data are occasionally included, such as the fact that a trip across the continent by stagecoach (p. 32) took six or seven weeks, but no such trips factor in the narrative. Dates relating to the Civil War and emancipation are mixed up, or confusingly stated (p. 274).

The original Zealy daguerreotypes at the Peabody Museum are stunning in their visual clarity and evocative intensity, and adequate reproductions of these and other daguerreotypes have appeared elsewhere. The decision of Yale University Press to skimp on the quality of reproductions in a book dealing with the social context and emotional meaning of historical photographs is disappointing.

8 For example: "Joseph T. Zealy, *Renty, Congo, B. F. Taylor, Esq., Columbia, S.C.,* quarter-plate daguerreotype, 1850. Courtesy President and Fellows of Harvard College, Peabody Museum of Archaeology and Ethnology, 35-5-10/53038."

Phillip Prodger, ***Darwin's Camera: Art and Photography in the Theory of Evolution***

"Making the Best of an Imperfect Medium"

Phillip Prodger, curator of photography at the Peabody Essex Museum in Salem, Massachusetts, tells the story in *Darwin's Camera* of the great naturalist's search for visual evidence in support of his scientific theories, in particular his attempt to establish correlations between facial expressions in human and animal behaviors. The quality of the reproductions is first rate, and the author's points are accurate, well stated, and thoroughly documented. The book reveals much about the workings of Darwin's creative intellect as he coped with conventions and boundaries while simultaneously shaping a revolution in scientific perception.

Darwin's attention turned to emotional expressions in the late 1860s and early 1870s. His earlier research on evolution (inheritance of traits, natural selection, etc.) had been largely based on the study of preserved specimens, which were static and could be examined again and again. Expressions were fleeting, typically composed of many muscular contractions, one succeeding another, causing an expression to unfold in phases. Darwin was fascinated by the ways in which emotions had been expressed in art, but he was even more seduced by the promise of photography as an objective means for recording scientific observations. His acceptance of the superiority of photographic representation reflects the majority view among scientists at the time.[9] In retrospect, it seems apparent that photographs can be as subjective and contrived as drawings or paintings, but nineteenth-century scientists were inclined to equate photography with accuracy.

In *The Descent of Man* (1871) Darwin intended to squelch criticisms of his revolutionary work, *On the Origin of Species* (1859), by going beyond an explication of how animals find food and survive harsh climates, extending the discussion to how creatures interact with other members of their own species. In *The Expression of Emotions in Man and Animals* (1872) he expanded his inquiry, exploring ways in which expressions affected survival (p. 6). *Expression* "pushed [the theory of] evolution to its limits, suggesting that human thoughts and feelings were, like fingers and toes, the result of evolutionary pressures" (p. 205). Darwin wanted photographs of evanescent emotional expressions, hoping "to discover evidence of previously undocumented similarities between species" (p. 79).

Expression includes a number of wood engravings (printed as vignettes within the text), but also contains plates of photographic reproductions, one of the earliest scientific books to do so. Darwin spent years scouring London's bookstores, studios, and exhibit galleries in a quest for photographs that

[9] See Jennifer Tucker, *Nature Exposed: Photography as Eyewitness in Victorian Science* (Baltimore: Johns Hopkins University Press, 2005).

captured the fleeting human expressions of laughter, crying, pain, fear, revulsion, and so on that he required. Such photographs were hard to find. They were difficult to produce, given the long exposures needed for nineteenth-century photography, especially before dry-plate technology. Darwin took great pains to find pictures that were just right to illustrate the points he wanted to emphasize and make his books more compelling. He rifled, says Prodger, "like an entomologist hunting for beetles…through hundreds of pictures seeking useful examples of expressive imagery," adding chosen items to his personal research collections. "Any photograph that revealed aspects of the physiology of expression seems to have interested Darwin, regardless of how and why it had been created" (p. 9).

Between 1868 and 1870, Darwin's collection of purchased and donated images grew steadily. The photographs he collected "assumed a dual role: as specimens for developing his theories and as evidence to demonstrate the validity of his ideas…. They were valuable in that they represented discrete moments in complex events and could be used to isolate constituent elements of behavior [and to some extent] stand in place of scientific specimens…." (pp. 4–5). His main purpose in accumulating photographs, however, was that he needed them to supplement his own first-hand observations (pp. 4–5). In this regard, he was disappointed by gaps in his collection. Little that he could find captured "the fleeting moments of expression that truly excited him." The new undertaking would "require photographs made expressly to Darwin's specifications" (p. 19).

He ultimately commissioned London photographer Oscar Rejlander (who was noted for photographic trickery) to produce an assortment of images. The resulting collaboration between the meticulous scientist and the manipulative photographer/entrepreneur is intriguing on many levels. Darwin hired Rejlander to provide new pictures per instructions, illustrating such emotions as crying, disgust, astonishment, and indignation (p. 187). The photographer attempted to produce what Darwin wanted using direct, unstaged methods, but when these failed he resorted to concocting simulations (p. 158). His photographs for *Expression*…

> set new standards in scientific photography [but] were produced without strictly adhering to mechanical objectivity. Rejlander believed manipulation was needed to produce convincing illustrations for the book. By posing for some of the illustrations himself he was able to control the behaviors he sought. (p. 202)

What Darwin was really seeking became routine about ten years later with the invention of faster gelatin dry plates of the type used by Marey and Muybridge to analyze the movements of humans and other animals (p. 32), but the methods to which Darwin and Rejlander resorted were necessitated by the limitations of wet-plate photography. "The empirical ambivalence with which the photographs were presented," Prodger explains, "resulted not from deceitful intentions, but from the conceptual vacuum in which they were produced" (p. 203).

> [P]hotographs [in 1871] were judged on how real they looked, not on how scrupulously they had been produced. Later, as scientists began to use photography as evidence of events invisible to the unassisted eye, viewers began to demand proof that the photographs they witnessed were accurate. Scientists began to look more carefully at the circumstances in which photographs had been produced and devised protocols for collecting reliable photographic data. *Expression* was produced at the cusp of this change in attitude…and is an important part of the story of how photography came to be accepted as "objective." (p. 32)

One of the more interesting sections in the book consists of Prodger's thoughtful response to historians, such as MaryJo Marks, who disparaged Darwin's selected illustrations as "ingenious but scientifically flawed." They assume, Prodger writes, "a dichotomy between documentary truth and artificiality in scientific photography that Darwin and his contemporaries did not comprehend" (pp. 220–25). The images Rejlander supplied to Darwin were "based in part on photographic investigation but mediated by experience, observation, and consensus. The combination of these factors, not photography alone, was the basis on which Darwin judged their suitability" (p. 221). Nevertheless, Darwin "took liberties with some of his photographs that might be considered unacceptable in scientific work today."

> He did not do this to be deceptive or tricky—he simply wanted to make the best of an imperfect medium at a time when there were no rules about what could or should be done photographically. He was…making up rules as he went along. His work, and the way in which it was received, became part of the history of how photography achieved its now widely accepted status as authoritative. (p. 32)

Darwin had many acquaintances and exchanged letters with hordes of them. He kept copies of outgoing as well as incoming correspondence and wrote and preserved well-organized notes detailing the development of his theories at every stage. The bulk of his papers are in the manuscripts department at the Cambridge University Library, but other items of interest remain at Down House in Kent (his last home) and in the John Murray Archive in London (publisher's business records). Cambridge owns some 9,000 letters sent to Darwin as well as his notebooks, personal library, manuscripts, edited proofs, newspaper clippings, a smattering of biological specimens, and an assortment of photographs, drawings, watercolors, and prints commissioned or collected by Darwin. As Prodger remarks, Darwin is "not just an extremely interesting scientist, he is also an ideal test case for how scientific theories developed and spread in Victorian England" (p. xi).

Conclusion

The term *objectivity* is heavily packed. Examined historically, it reveals itself as a shifting ideal, one that scientists have embraced, kept at a distance, or modified over time to fit the cultural values of various eras. Photographic seeing in science was a mediated social activity, as Jennifer Tucker notes, a situation "that reflects the close intertwining of science and culture in the nineteenth century" (*Brought to Light*, p. 49). It may also be, as Corey Keller suggests, that "photography contributed to a radical reevaluation of human vision." The confidence once placed in the human eye was largely replaced by "dependence on technologically inflected vision…, a system of belief rooted in the discourses of nineteenth-century scientific photography" (*Brought to Light,* p. 35).

When scientific works were illustrated by art alone, the degree to which the reader (or viewer) accepted what was written and depicted depended in large part on the reputation of the writer and the skill and repute of the artist. In the formative years of scientific photography, the photographic record was similarly judged by impressions based on plausibility, skill, convincingness, and semblance of authority. As photographic technology improved, exposure times dropped from minutes to fractions of a second, the process became increasingly mechanized, and the images produced by the camera assumed a special significance:

> It took approximately fifty years, but during the latter half of the 1800s photography moved into territory traditional drawing and printmaking could not. Once it became capable of taking pictures faster than what the naked eye could see…the vision threshold was breeched [and] new thinking was required. Photographs assumed a dual role. They illustrated something, but they were also experiments in their own right. They became more than mere pictures—they became data. At that point, scientists became concerned about exactly how their photographs were made [and] developed self-contained protocols to enable like-minded scholars to reproduce their results. (*Darwin's Camera*, p. xxiii)

Explanations in science must be based on observations and experiments that can be replicated and confirmed by others. Scientists communicate their data and conclusions to other scientists by means of publications (articles, books, illustrations, letters to journals, etc.), talks at professional conferences, correspondence, informal conversations, photographs, postings on Web sites, and other avenues of discourse. Science is a particular way of knowing about the natural world, involving "observation, experiment, and archiving" (*Photography* *and Science,* p. 16). The records of scientific achievement include burgeoning archives of images, measurements, and other data, all of which are essential to the ongoing process of testing or refuting ideas and building on pre-existing work. "If I have seen further," physicist Isaac Newton wrote to microscopist Robert Hooke in an earlier formative era in the history of science, "it is by standing on the shoulders of Giants."[10]

Photography, as the nineteenth century progressed, became an indispensible component of the archival record of scientific activity. Scientific photographs supported or undermined old theories and tested new ones. The visual records of science were created and preserved for future reference via the earnest attempts of scientists at objectivity, the mediation of photographic processes, and the appraisal, accessioning, level and accuracy of description, conditions of access, and various policies and practices of the institutions having custody of records. In recent decades, manipulation of digital images (increasingly easy and relatively hard to detect) has undercut a general but tentative confidence in photographic authority, dictating caution about the credibility of the photograph as a reliable document. How will the future perceive them?

The compass of scientific theory and practice at the time of creation or preservation of photographic records, as well as the scientific and visual literacy of archivists and curators, are major factors in the dynamic. Archivist Robert C. Binkley wrote in 1939 that archival vision is not just "trained on the remote past…." The archivist is "preoccupied with a more distant future than…any profession save…astronomy…."[11] History is shaped by the "forms, practices, and contexts of its archiving."[12] Such variables unavoidably affect scientific thinking, including the supposed reliability of the scientific photographic record. Practitioners of science and the archivists who preserve the records of science should never stop asking: How do we know what we think we know; and how do research methods, scientific institutions, and archival practices validate, discredit, or otherwise influence our changing perceptions of the elusive concepts we call *truth* and *objectivity*?

[10] Isaac Newton, letter to Robert Hooke, 5 February 1676, in *Correspondence of Isaac Newton*, ed. H. W. Turnbull et al. (Cambridge: Published for the Royal Society at the University Press, 1959), vol. 2:416.

[11] Robert C. Binkley, "Strategic Objectives in Archival Policy," *American Archivist* 2 (July 1939): 162–68.

[12] Christopher Morton and Elizabeth Edwards, *Photography, Anthropology, and History: Expanding the Frame* (Farnham, Surrey, U.K. and Burlington, Vt.: Ashgate, 2009), 8.