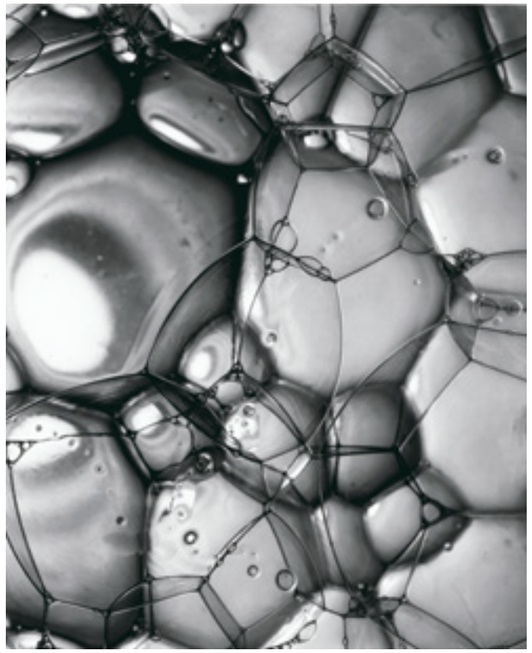


© Berenice Abbott / Commerce Graphics, Courtesy Howard Greenberg Gallery, New York.

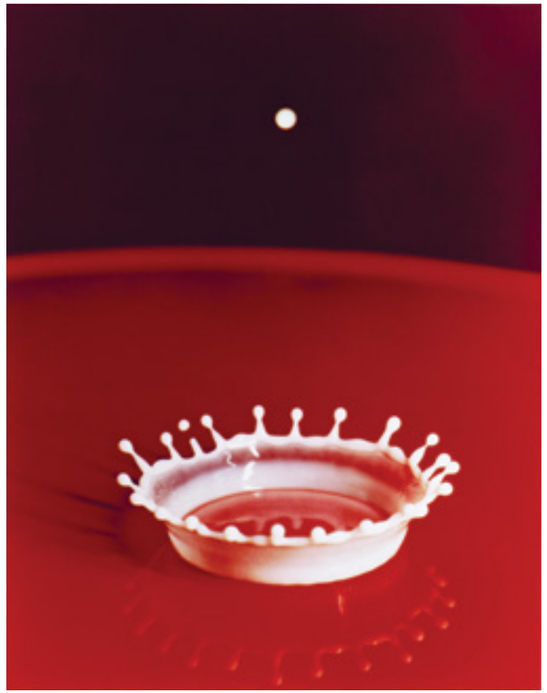
Berenice Abbott (American, 1898–1991), *Soap Bubbles*
from *The Science Pictures portfolio*, 1982
Gelatin silver print, 1946 negative

The ranks of inventors, scientists and artists who ushered in the modern technological and photographic age also include a number of important women. One of those is the famed photographer Berenice Abbott. Though primarily known for her brilliant documentation of New York City during the Great Depression and for her stewardship of the work of the renowned nineteenth-century French photographer Eugène Atget, Abbott was dedicated to visualizing scientific phenomena. She wrote extensively about photography's unique capacity to function as the "spokesman" for science and in 1939 turned her attention almost exclusively to science. Having little knowledge of it, she began poring over books and taking chemistry courses at New York University. For twenty years, Abbott worked tirelessly, inventing photographic apparatuses to assist in documenting various aspects of scientific study. She developed what she called "Projection Photography," which was remarkably like the large format camera later developed by Polaroid. The concept was to enlarge an object itself via projection rather than to take an image and enlarge the negative. While developing Projection Photography, she experimented widely with lighting techniques. After years without success, she contacted Harold Edgerton at MIT, who told her that the lighting she required was at least five years and many thousands of dollars away. Clearly, Abbott was ahead of her time.

In 1944, Abbott became the photography editor for *Science Illustrated*, a position that required her to ensure that the publication's articles were properly illustrated. Though she often utilized images that had already been produced by other photographers, she would make photographs herself if the existing illustrations did not meet her standards. During this period, she created some of her earliest wave studies, which drew on experimental work that noted artist and photographer Man Ray produced in the 1920s. (In 1923, Man Ray had hired Abbott as a darkroom assistant for his studio in Montparnasse, France. Under Man Ray's tutelage, Abbott had her first solo exhibition only three years later.) In mid-1945, *Science Illustrated* was bought by McGraw-Hill. Though Abbott disliked the resulting changes and promptly quit, she did create her famous soap bubble photograph during that time. In 1947, soon after leaving the magazine, Abbott opened the House of Photography—a commercial studio she used to design, promote and sell her inventions. One of the tools created at the House that is still widely used today is the autopole, a moveable pole that reaches floor to ceiling and can be used to mount lighting equipment in a photographer's studio or to hold large works of art in a museum storage room. The many ideas Abbott experimented with during that time distinguished her as an important designer of photographic equipment.

In 1957, the Soviet Union's launching of Sputnik, the world's first artificial satellite, inspired a renewed interest in the United States for science, as it marked the beginning of the "space race." Abbott was promptly invited to join the Physical Science Study Committee at MIT, whose mission was to improve high school science education. At long last, Abbott's insistence on the value of photography to science was validated. For the next three years, Abbott researched, designed and photographed carefully controlled experiments dealing with magnetism, electricity and motion's effects on matter. Her *Science Pictures* have the directness and simplicity inherent in all of her work, yet these images also have an idealized beauty that speaks of Abbott's hopes for the future and her insistence upon the power of photography and science together as one.

Photography and science have continued to move in lock step to this day, and the technological advances since Muybridge, Edgerton and Abbott made their groundbreaking pictures have been exponential. These developments have helped move us into a digital age that allows us to communicate via real-time video with someone on the other side of the Earth, effectively collapsing both time and space. Advancements such as these have not only helped to shape our understanding of the world; they have changed the way artists work, as well. Just as Muybridge's early documentations of motion influenced painting at the beginning of the twentieth century, the digital technologies of today have altered the way that pictures can be made.



Harold Edgerton (American, 1903–1990), *Milk Drop Coronet*, 1957
from *Seeing the Unseen: Twelve Photographs*, 1977
Dye transfer print, 1957 negative, 1976 print

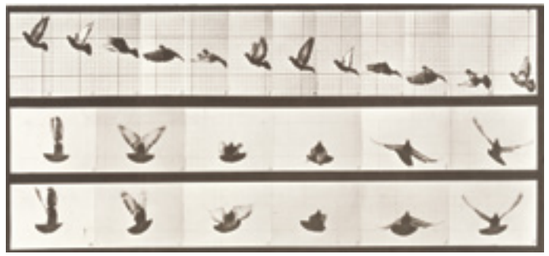
Front cover:
Eadweard Muybridge (English, 1830–1904), *Daisy Cantering, Saddled*, plate no. 616, from *Animal Locomotion: An Electro-Photographic Investigation of Consecutive Phases of Animal Movements, 1872–1885*, 1887
Collotype

SCIENCE IN MOTION

The Photographic Studies of Eadweard Muybridge, Harold Edgerton and Berenice Abbott

Works from the Bank of America Collection

McCLUNG MUSEUM *of* Natural History and Culture



Eadweard Muybridge (English, 1830 – 1904)
Pigeon Flying, Plate no. 755, from *Animal Locomotion: An Electro-Photographic Investigation of Consecutive Phases of Animal Movements, 1872 – 1885*, Collotype, 1887

...[T]here needs to be a friendly interpreter between science and the layman. I believe that photography can be this spokesman, as no other form of expression can be; for photography, the art of our time, the mechanical scientific medium which matches the pace and character of our era, is attuned to the function. There is an essential unity between photography, science's child, and science, the parent. —Berenice Abbott, "Photography and Science," 1939

Photography was born out of a passionate engagement between art and science. The medium's pioneers, including Joseph Nicéphore Niépce, Louis-Jacques-Mandé Daguerre and William Henry Fox Talbot, were inventors, scientists and artists. The combined results of their revolutionary work dramatically affected art and forged a reciprocal relationship between art and science that has continued to this day. After the invention of photography and its announcement to the world in 1839, photography became a favored tool for scientific investigation while simultaneously spawning a new art form. The nineteenth century was a heyday for scientific amateurs, whose collective curiosity and enthusiasm for experimentation yielded significant contributions to geology, astronomy, biology, chemistry, physics and the arts. Since then, photographic and scientific technologies have advanced rapidly in continuing symbiosis.

Science in Motion showcases scientific studies carried out by three groundbreaking photographers—Eadweard Muybridge, Harold Edgerton and Berenice Abbott. Each of these artists invented devices that studied and represented aspects of science and motion photographically. Muybridge and Abbott, both primarily artists, became interested in science as a photographic subject. In the course of their efforts to document scientific phenomena and motion accurately, they became inventors, as well. First and foremost a scientist, Edgerton performed stroboscopic experiments (with an instrument used to make a cyclically moving object appear to be slow moving, or stationary) and documented them photographically while teaching at the Massachusetts Institute of Technology (MIT), bringing him providentially into the world of art. Though Edgerton, Muybridge and Abbott arrived at the nexus of photography and science in different ways, they revealed to us, intelligently and artistically, that which was previously unseen. Their successful uniting of science and photography led to the creation of new technologies and new teaching strategies that have helped to usher us into the modern age.

Throughout the nineteenth century, there was a strong interest in the realistic depiction of movement, which led scientists and artists alike to experiment with ways to capture and illustrate the chronology of motion that could not be discerned by the human eye. Photography's ability to register and portray the world in the most realistic manner, paired with the fact that all pictures are, in essence, fragments of time, made it the obvious tool for such an investigation.

Eadweard Muybridge's role in this adventure was central. The story begins in America in the 1870s, a time of physical expansion and changes in the American psyche following the Civil War. Muybridge was one of the nation's most sought-after photographers due in large part to his skillful views of the American West and its indigenous residents. Also known for his technical acumen, Muybridge was contacted in 1872 by Leland Stanford, a California politician, railroad tycoon and breeder of Standardbred horses, to settle a bet.

This bet pertained to the positioning of a horse's legs while trotting at full speed and whether all four feet were off the ground at the same time. Muybridge, interested in the proposition, agreed to assist Stanford. After many attempts, Muybridge succeeded in making a stop-motion photograph of Stanford's horse by exposing the negative for less than one-thousandth of a second, executing an image with a rapidity that had not been achieved before. It revealed that a horse did, indeed, have all four hooves in the air at once during a rapid trot. Another significant discovery that came of this, one particularly worthy of mention in the context of this exhibition, is that, unlike depictions in paintings created up to that point, a horse's four legs were off the ground while aiming *in* rather than *out*. Thus, in addition to stopping motion, Muybridge changed the way horses were represented in paintings.

In 1877, Stanford commissioned Muybridge to continue his experiments, yet this time the directions were more elaborate. Muybridge was to photograph a horse's movements "at all of its stages." The goal was to supply visual images documenting each phase of movement to assist in training both animals and human athletes. Muybridge photographed various animals as well as human subjects in front of a backdrop. As they moved, they tripped newly designed, electrically operated shutters on twelve cameras. The exposures, again, lasted for one thousandth of a second.

After successfully stopping sequential motion, Muybridge envisaged the next logical step, which was the possibility of reconstituting, or animating, his still photographs. To that end he developed a device called a Zoöpraxiscope. This tool consisted of a glass disk on which images were arranged equidistantly and consecutively, with the addition of a slotted counterrotating viewer. The Zoöpraxiscope was used, in Muybridge's own words, "for synthetically demonstrating movements analytically photographed from Life." These first "motion pictures" were seen by the Stanford family in 1879. Two years later, Muybridge projected them for European audiences that included artists, scientists and other intellectuals.

Late in 1883, the collaboration between Muybridge and Stanford ended. Muybridge then continued his work at the University of Pennsylvania, where he expanded the range of his subjects as well as the movements he studied. He photographed his subjects in front of a backdrop with a grid marked on it before a battery of 24 cameras about six inches apart in a line parallel with the grid; smaller groups of cameras were maneuvered into position to capture frontal, rear and foreshortened views. In a year and a half of work, Muybridge produced some 100,000 images. The university selected 781 of his motion studies for their publication *Animal Locomotion*, twelve of which are included in this exhibition.

[Muybridge] captured aspects of motion whose speed had made them as invisible as the moons of Jupiter before the telescope and he found a way to set them back in motion. Time was at his command. —Rebecca Solnit, *River of Shadows: Eadweard Muybridge and the Technological Wild West*, 2003

In the 1930s, the notion that time could appear to be stopped took another huge leap forward when Harold Edgerton, at MIT, developed an electronic stroboscope that generated brief bursts of light, allowing high-speed moving objects, such as the blades of a fan, to appear as if frozen or static. He then synchronized the flashes with the motion of the subject, such as a tennis swing, while taking a series of photographs through an open shutter at the rate of many flashes per second, resulting in ultra-high-speed, chronological stop-motion photographs. This apparatus decreased exposure times significantly—to *millionths* of a second. The resulting images captured moments that had been completely unfathomable due to their subjects' rapid speed, such as a moving bullet. Edgerton's invention allowed him to capture the very instant that a milk drop hit liquid, documenting the splash upon impact with a clarity and precision never before witnessed in photography. While Muybridge's pictures stopped time, Edgerton's seemed to slow it down to a state of temporary suspension.

Harold Edgerton (American, 1903–1990), *Bullet Through an Apple*, 1964, from *Seeing the Unseen: Twelve Photographs*, 1977
Dye transfer print

Though revolutionary, Edgerton's idea was not new; in fact, the British inventor of photography itself, William Henry Fox Talbot, envisaged it as early as 1851. Harold Edgerton, nearly eighty years later, certainly seemed to be the man of science Talbot had called for. He was not only a scientist but also a photographic artist who "depicted whatever moved across the field of view." Despite his brilliant inventions and longstanding teaching career at MIT, Edgerton's miraculous stop-motion photographs were what earned him world renown. Whether the general populous understood their scientific and engineering import or not, people around the globe were stunned and amazed by these pictures. Edgerton was indeed depicting the unseen—poetically, and with absolute regard for their aesthetics.

This is evidenced early on by the inclusion of his famous milk drop image in the first photography exhibition at The Museum of Modern Art, New York, in 1937. Due to the rapid pace of technological and scientific advancement over the last century, these photographs may not have the same impact that they did when first seen, as may also be the case with Muybridge's works. Nevertheless, they continue to astound and evoke wonder while inspiring each successive generation of photographers.