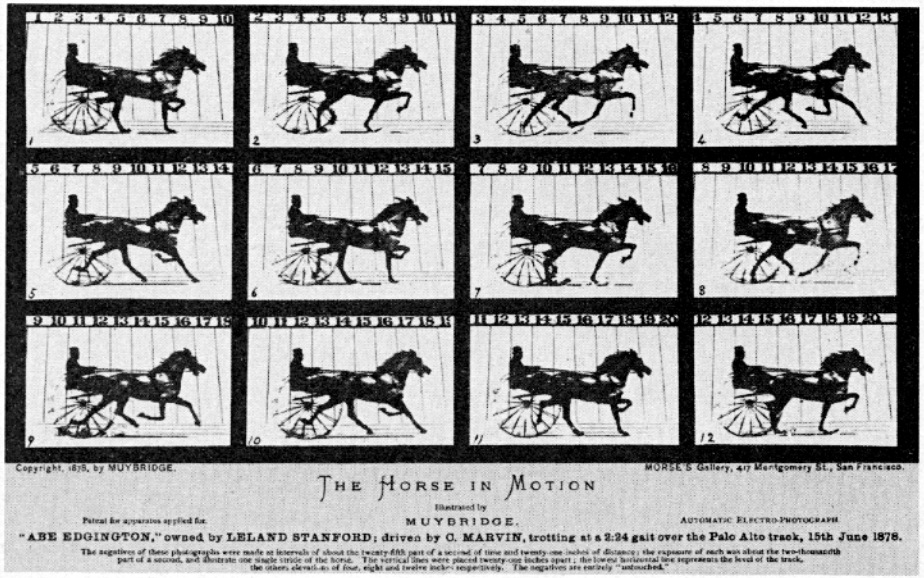
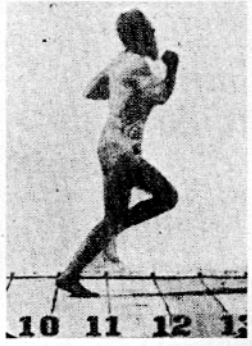
THE ANNIHILATION OF TIME AND SPACE



In the spring of 1872 a man photographed a horse. The resulting photograph does not survive, but from this first encounter of a camera-bearing man with a fast-moving horse sprang a series of increasingly successful experiments that produced thousands of extant images. The photographs are well known, but they are most significant as the bridge to a new art that would transform the world. By the end of the 1870s, these experiments had led to the photographer's invention of the essentials of motion-picture technology. He had captured aspects of motion whose speed had made them as invisible as the moons of Jupiter before the telescope, and he had found a way to set them back in motion. It was as though he had grasped time itself, made it stand still, and then made it run again, over and over. Time was at his command as it had never been at anyone's before. A new world had opened up for science, for art, for entertainment, for consciousness, and an old world had retreated farther.

The man was Edward James Muybridge of San Francisco, already renowned for his photographs of the West. In the eight years of his motion-study experiments in California, he also became a father, a murderer, and a widower, invented a clock, patented two photographic innovations, achieved international renown as an artist and a scientist, and completed four other major photographic projects. These other projects are also about time: about the seasonal and geological time of landscape, about the difference between the time that the camera sees and the eye sees, about a war between two societies with radically different beliefs about time and space, about the passage of a midsummer day's sunlight across a city in turmoil. The experience of time was itself changing dramatically during



Muybridge's seventy-four years, hardly ever more dramatically than in the 1870s. In that decade the newly invented telephone and phonograph were added to photography, telegraphy, and the railroad as instruments for "annihilating time and space." The big corporations were spreading their grasp across wider spaces and into more subtle interstices of everyday life. The Indian wars were reaching their climax and their turning point. The modern world, the world we live in, began then, and Muybridge helped launch it.

Muybridge produced more successful high-speed photographs than anyone had before. His 1878 camera shutters were a triumph of engineering that made reliable exposures of a fraction of a second for the first time, a speed at which extremely rapid motion could be captured in focus rather than recorded as blurs. The photographs were also a triumph of chemistry, which made the film "fast" enough to record so brief an instant. They froze motion so that the legs of a trotting or galloping horse, then a leaping man, and eventually the movements of lions, doves, dancing women, water spilling, artists drawing, could be depicted as a sequence of still images. At the same time, Muybridge improved upon the zootrope, a small device invented in 1834 that makes a series of spinning images seen through a slot appear to be a single image in motion. His zoopraxiscope, as he called it, projected versions of his motion studies on a screen: moving pictures, pictures of motion. It was the first time photographs had dissected and reanimated actual motion, and it was the foundation of cinema, which emerged tentatively in 1889, in full force in France and the United States by 1895. Motion pictures proper were invented by others, but no matter which way the medium's genealogy is traced, it comes straight back to Muybridge. And motion pictures changed the relationship to time farther; they made it possible to step in the same river twice, to see not just images but events that had happened in other times and other places, almost to stop living where you were and start living in other places or other times. Movies became a huge industry, became how people envisioned themselves and the world, defined what they desired and what was desirable. The Russian film director Andrei Tarkovsky thought that time itself, "time lost or spent or not yet had," was what people desired and fed upon in the films that became a collective dreamworld inhabited by multitudes. It all began with photographs of a horse in California.

Occident, the horse that Muybridge photographed in 1872, was one of

the fastest trotting horses in the country. At that time trotting races were a national passion, and the great trotters were more celebrated than horses that ran their races. Occident belonged to Leland Stanford, who had brought speed to the country in a far more dramatic way, as one of the four masterminds of the transcontinental railroad completed three years earlier. Once, the North American continent had taken months to cross, and the passage was arduous and perilous. In the decade before the railroad the time had been whittled down to six or seven grueling weeks, barring accidents. With the completion of the railroad those three thousand miles of desert, mountain, prairie, and forest could be comfortably crossed in under a week. No space so vast had ever been shrunk so dramatically. The transcontinental railroad changed the scale of the earth itself, diminishing the time it took to circumnavigate the globe. Walt Whitman hailed it as the long-dreamed-of "Passage to India."

The railroad had utterly transformed its builders too, into multimillionaires, buyers of estates, commissioners of paintings and photographs, corrupters of politicians, controllers of much of California, managers of one of the most powerful monopolies this country has ever seen. Stanford was the president of their company, the Central Pacific Railroad, and its most visible figure. Governor, senator, thief on a grand scale, he also became a philanthropist on a grand scale with the establishment of Stanford University on the grounds of his vast country estate forty miles south of San Francisco, the site where Muybridge perfected his motion-study technology in the late 1870s. His sponsorship of Muybridge was his first venture into scientific research for its own sake. Stanford University carried and carries on this venture with a hybrid of commercial and pure research that continues to change the world. Like other immensely powerful men, Stanford affected the world indirectly. In person he seems to have been ponderous and a little dull, a respectable effect he may have cultivated, but his impact was, to use a term of the time, electrifying. Spatial changes on a continental scale, technological innovations, influences on national policy and the national economy, the thousands of men who worked for him, the vast edifices and institutions that arose under his direction, and the countless lives he affected are his real expression. His support and encouragement of Muybridge is not the least of these impersonal effects.

In the spring of 1872, a man photographed a horse. Stanford commissioned the photographs in the hope that they would solve a debate about whether a trotting horse ever has all four feet off the ground at a time. Muybridge's first photographs gave an affirmative answer to that minor scientific question, but by later in the decade he realized that the project had broader possibilities and got Stanford to underwrite his development of them. He told an associate he was going to "revolutionize photography" with the technique he developed, and he did. The story of what Muybridge accomplished with Stanford's support is a peculiarly California story. Much has been written about the artistic and literary modernism that was born in Paris, but only high culture was born there, though that high culture was a response to the pervasive alienations and liberations brought by industrialization. Another part of the modern world came from California, and this part was and is an amalgamation of technology, entertainment, and what gets called lifestyle that became part of everyday life for more and more people around the world and a form of industrialization itself. Perhaps because California has no past—no past, at least, that it is willing to remember—it has always been peculiarly adept at trailblazing the future. We live in the future launched there.

If one wanted to find an absolute beginning point, a creation story, for California's two greatest transformations of the world, these experiments with horse and camera would be it. Out of these first lost snapshots eventually came a world-changing industry, and out of the many places where movies are made, one particular place: Hollywood. The man who owned the horse and sponsored the project believed in the union of science and business and founded the university that much later generated another industry identified, like Hollywood, by its central place: Silicon Valley. Hollywood and Silicon Valley became, long after these men died, the two industries California is most identified with, the two that changed the world. They changed it, are changing it, from a world of places and materials to a world of representations and information, a world of vastly greater reach and less solid grounding. Muybridge's life before those eight years of the California motion studies was a preparation for that phenomenal productivity; his life afterward only polished, promoted, and enlarged upon what he had accomplished in those years. This book is about those years that followed upon that encounter between photographer and racehorse and about that man who seems in retrospect like a bullet shot through a book.

His trajectory ripped through all the central stories of his time—the relationship to the natural world and the industrialization of the human world, the Indian wars, the new technologies and their impact on perception and consciousness. He is the man who split the second, as dramatic and far-reaching an action as the splitting of the atom.

Muybridge was forty-two when he began the motion studies, and he had been traveling toward this achievement down a circuitous path. He had been born Edward James Muggeridge on a street in Kingston-upon-Thames paralleling the banks of the Thames, not far upriver from London, on April 9, 1830. An ancient market town, Kingston had a millennium earlier been the place where seven Saxon kings of England were crowned. The lump of sandstone said to be their coronation stone was, with great ceremony, rescued from its long role as a mounting block and raised on a pedestal in the center of town in 1850. On the pedestal below this molar-shaped stone were carved the names of those kings, including two Eadweards. Though Muybridge wouldn't change his first name to Eadweard until his visit to England in 1882, he likely derived it from this monument (he changed his surname twice, to Muygridge in the 1850s and to Muybridge in the 1860s).

His own birthplace and childhood home was a row house only a few dozen feet away from the coronation stone, on the other side of one of the oldest surviving road bridges in Britain, a twelfth-century bridge across a small tributary of the Thames on which locals liked to idle and gossip. At the time, the town's buildings and pace of life seemed hardly changed over centuries: the mayor walked to church amid a procession every Sunday, the market square bustled, a night watchman patrolled the streets, locals got their water from the town pump and their beer from the many public houses. Muybridge's father, John Muggeridge, was a merchant dealing in grain and coal, and the ground floor of the family home had a wide entrance for horses and wagons to come through with their loads. John and Susan Muggeridge and their four sons lived above, in compact rooms whose back windows looked out onto the broad Thames itself, and some of the family business must have been conducted by barge. Like Stanford, Muybridge was born into a quiet commercial family in a

provincial town, and like Stanford had he stayed where he was he might have lived and died having made hardly a ripple in history. It was California that set them free to become more influential than they could have imagined. Or California and the changing world around them, for their fame was achieved by taking hold of those changes and pushing them farther. The year of Muybridge's birth and the years of his childhood saw a set of inventions and discoveries that set the stage for his own.

John Muggeridge died in 1843, and like her mother before her Susan Muggeridge took over her husband's business and seems to have run it successfully, for in 1845 the corn and coal business was listed in her name. Muybridge's grandfather Edward Smith had died when his wife, Susannah Norman Smith, was pregnant with her ninth child. She assumed command of his flourishing barge business and ran it successfully until she passed it on to her older sons, and she presided regally over her large family and larger workforce for decades afterward. When Susannah Smith died at a great age in 1870, she owned more than a dozen houses and considerable other property, though the barge business with its stables of powerful horses seems to have unraveled. Barges had transformed the transport of goods in England before railroads arrived, and the manmade canals built in the late eighteenth and early nineteenth century to accommodate them had transformed the English landscape. Before, most communities had relied largely on local materials for building supplies, provisions, and other materials. Roads were bad and sometimes dangerous, horses were expensive, and each village and town lived in a kind of isolation hard to imagine now. Most people who wanted to get somewhere walked, and many lived and died having never gone farther than a day's walk from home. By the early nineteenth century a carefully coordinated stagecoach system with horses changed every dozen miles or so brought traveling speeds up to ten miles an hour for those who could afford its exorbitant charges, and the coaches seemed reckless and godlike in their swiftness.

Goods moved on barges along canals dug into the landscape, and the barges themselves were a slow-moving business. Muybridge's cousin Maybanke Susannah Anderson recalled that when their grandfather Edward Smith "drove in his gig to London, to buy wheat or coal, he took under the seat of his gig, a carrier pigeon, and in his pocket a quill or two, and when he bought a cargo, he wrote on a small piece of paper the number of barges he needed, put the paper in the quill, tied it under the wing of the pigeon

and set it free. Someone watching for the bird's arrival unfastened the quill, took the message to the barges, and they started." Pigeons were the fastest communications technology; horses were the fastest transportation technology; the barges moved at the speed of the river or the pace of the horses that pulled them along the canals. Nature itself was the limit of speed: humans could only harness water, wind, birds, beasts. Born into this almost medievally slow world, the impatient, ambitious, inventive Muybridge would leave it and link himself instead to the fastest and newest technologies of the day. But that world was already being transformed profoundly.

On September 15, 1830, less than six months after Muybridge's birth, the first passenger railroad opened. The celebrated young actress Fanny Kemble had been given a preview of the Manchester and Liverpool Railroad that August. In a letter to a friend she exclaimed, "The engine . . . set off at its utmost speed, thirty-five miles an hour, swifter than a bird flies (for they tried the experiment with a snipe). You cannot conceive what that sensation of cutting the air was; the motion is as smooth as possible too. I could have either read or written; and as it was, I stood up, and with my bonnet off 'drank the air before me.' . . . When I closed my eyes this sensation of flying was quite delightful, and strange beyond description." Thirty-five miles an hour was nearly as fast as the fastest horse, and unlike a gallop, it could be sustained almost indefinitely. It was a dizzying speed. Passengers found the landscape out the train windows was blurred, impossible to contemplate, erased by speeds that would now seem a slow crawl to us. Those who watched the trains approach sometimes thought they were physically getting larger, because the perceptual change in a large object approaching at that speed was an unprecedented phenomenon. Ulysses S. Grant remembered riding on one of the early railroads in Pennsylvania in 1839 with the same amazement that most early travelers recorded: "We traveled at least eighteen miles an hour when at full speed, and made the whole distance averaging as much as twelve miles an hour. This seemed like annihilating space." If distance was measured in time, then the world had suddenly begun to shrink; places connected by railroads were, for all practical purposes, several times closer to each other than they ever had been.

At the railroad's official opening, Kemble returned to ride with her mother, who was "frightened to death"

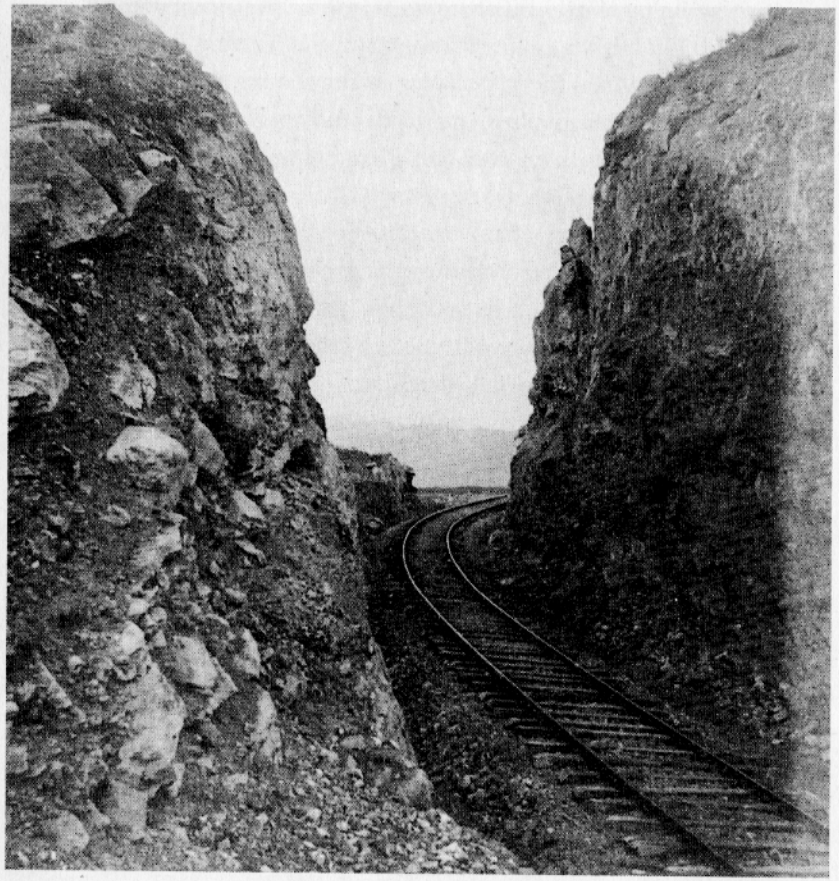
of "a situation which appeared to her to threaten with instant annihilation herself and all her traveling companions." That celebration of a thousand passengers and almost a million onlookers along the route was interrupted by an actual annihilation, the death of the progressive Tory politician William Huskisson. At a stop to take on water for the steam engines, Huskisson got out to stretch and was hit by an oncoming train. It is hard to imagine today the reflexes and responses that made it impossible to step away from a noisy locomotive going perhaps thirty miles an hour, but Huskisson could not. His leg was run over and crushed. Though the duke of Wellington applied a tourniquet to prevent him from bleeding to death on the spot, he died that evening. In Manchester the duke, who had been the hero of the battle of Waterloo and was now the prime minister preventing the democratization of voting, was greeted with angry cries of "Remember Peterloo." The railroad cars had to retreat hastily. It was no coincidence that the first railroad linked two of the Industrial Revolution's primary sites or that the Manchester workers linked the duke and the new technology to the 1819 Peterloo massacre of workers demanding reform. Industrial workers saw the new market economy as bleak and brutal, and they launched a powerful reform movement in the 1830s to gain a voice in it. The agricultural economy was as grim: the Captain Swing riots in the south of England that season of the first passenger railroad's opening protested starvation wages and wrecked reaping machines. An old order had vanished, to be replaced not by a new one but by turbulence and continual change.

Long afterward, Kemble called this railroad "the first mesh of that amazing iron net which now covers the whole surface of England and all the civilized portions of the earth." The Industrial Revolution preceded railroads, but railroads magnified its effects and possibilities unfathomably, and these roaring, puffing machines came to seem that revolution incarnate. Often compared to dragons, they devoured coal and iron in unprecedented quantities, spreading mines and mills wherever they went. In the United States, they ran on wood, and whole forests were fed into their boilers, as though the landscape itself were being devoured by speed. Railroads made possible the consolidation of industries and the industrialization of traditional activities. The fast, cheap transport of goods meant that a town could be given over to shoe-making or beer-making, a whole region to cattle raising or wheatgrowing, and people grew used to depending upon commodities that seemed to come from nowhere. The New England

philosopher Ralph Waldo Emerson opined in 1844, "Not only is distance annihilated, but when, as now, the locomotive and the steamboat, like enormous shuttles, shoot every day across the thousand various threads of national descent and employment, and bind them fast in one web, an hourly assimilation goes forward and there is no danger that local peculiarities and hostilities should be preserved." He saw the network of railroads undoing the local character of every place and approved of the erasure. People were being drawn out of their small familiar worlds into one more free, less personal, in which the associations that once attached to each person, place, and object came undone. It was a leap forward of extraordinary liberation and equal alienation.

Grant and Emerson were sounding variations on one of the stock phrases of the day, "the annihilation of time and space," which was applied over and over to railroads and other new technologies. "Annihilating time and space" is what most new technologies aspire to do: technology regards the very terms of our bodily existence as burdensome. Annihilating time and space most directly means accelerating communications and transportation. The domestication of the horse and the invention of the wheel sped up the rate and volume of transit; the invention of writing made it possible for stories to reach farther across time and space than their tellers and stay more stable than memory; and new communications, reproduction, and transportation technologies only continue the process. What distinguishes a technological world is that the terms of nature are obscured; one need not live quite in the present or the local.

Between the time of the Roman Empire and the dawn of the industrial age, wheel-drawn transportation, roads, and ships were improved, but only the printing press made a major alteration in means. Afterward, the devices for such annihilation poured forth faster and faster, as though inventiveness and impatience had sped and multiplied too. Nothing annihilated more dramatically than railroads. As people and goods traveled more frequently and farther, experience was standardized. Distance had always been roughly measurable in time, the stable time of human or equine locomotion, but the railroad transformed those equations, shortening the time and thereby seeming to decrease the distance. The world began to shrink, and local differences to dissipate. People could go much



Rock Cut Between Promontory and Blue Creek, from the series *The Central Pacific Railroad*, ca. 1869 (one frame of stereo).

farther because places were not, in terms of time, so far apart, nor was travel so expensive. Distance was relative; a technological infrastructure could shrink it spectacularly. Early in the twentieth century, when Albert Einstein reached for metaphors to explain his theory of relativity, he repeatedly seized upon the image of a train running across the landscape, a train whose passengers were experiencing time differently than those on the ground.

Railroads transformed the experience of nature, and they transformed the landscape itself. Kemble had been amazed by the cuttings, tunnels and viaducts that leveled the route of the Manchester and Liverpool Railroad,

raising the train far above and dropping it below the surface of the earth. "I felt as if no fairy tale was ever half so wonderful as what I saw," she said. Amateur geologists found a rich resource in the railroad cuttings that laid bare Britain's rock and fossils. Geology was the key science of the Victorian era, as physics was of the modern era and perhaps genetics is today, and in that era geology texts sometimes outsold popular novels. One such book was Charles Lyell's *Principles of Geology*, whose first volume was published the year of Muybridge's birth and Kemble's ride. Geologists had begun to debate the age of the earth. Bible scholars asserted that the earth was only about six thousand years old. Its rocks suggested a far greater age to those who studied them, but they did not agree among themselves how old. Catastrophists argued for a comparatively young earth in which forces far more violent than those presently at work had wrenched and welded its topography, and some still claimed Noah's flood had placed aquatic fossils in the heights. The uniformitarians believed that earthquakes, volcanoes, erosion, and other forces still at work must have gradually shaped the earth, and it must be far more ancient than had ever been imagined. Lyell had gone to Sicily to study Mount Etna and concluded that its massive cone was the result of aeons of small eruptions, and that cone sat atop relatively young rocks. His uniformitarian *Principles* portrayed an earth whose age was in the millions of years.

The railroad shrank space through the speed of its motion. Geology expanded time through the slowness of its processes and the profundity of its changes. When they subcribed to the old biblical scale of time, human beings seem to have marched as confidently as elephants, sure they were center stage in a drama whose beginning and end were near at hand and whose set changes were slight. In the new industrial and scientific sense of time, they swarmed and darted like insects, quick but uncertain of their place in a cavalcade of unimaginable length. Expelled from the cozy millenia of biblical time, Lyell's wide audience found itself on a vast plateau of millions of years of geological time. As his colleague George Poulette Scrope put it in 1829, "The periods which to our narrow apprehension . . . appear of incalculable duration, are in all probability but trifles in the calendar of Nature. It is Geology that, above all other sciences, makes us acquainted with this important though humiliating fact. . . . The leading

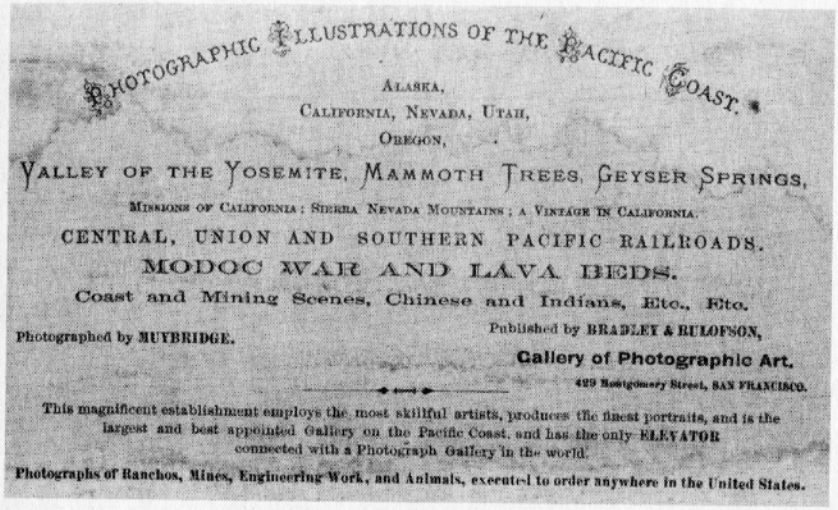
idea which is present in all our researches, and which accompanies every fresh observation, the sound to which the student of Nature seems continually echoed from every part of her works, is—Time! Time! Time!" It was geology, specifically Lyell's book that he took with him on the *Beagle*'s sail around the world from 1831 to 1836, that would lead Charles Darwin to his theory of evolution, and that theory would further transform the place of human beings on the stage of life, more distant from God and closer to the other species. Muybridge, by photographing human beings as "animals in motion" among other animals, took a Darwinian stance.

At the far end of the decade of the railroad's arrival came a third great transformer of time: photography. The Industrial Revolution is most often represented by the bleak textile mills of the British Midlands. But the same steam engines that drove the factories drove the railroads, and though railroads required mines and manufactories, they themselves produced exhilarating effects. Photography is equally a technology of its time, but it generated few such impositions on the landscape or on workers; it was an artisan's technology (though photographic factories came into existence by the late nineteenth century, and every version of the medium has involved toxic chemicals, starting with mercury and cyanide). It did not impose itself on the world but interpreted it, transporting appearance as the railroad transported matter. As a technology, it requires a very different argument about effects and merits than the heavy-duty icons of the Industrial Revolution. For if railroads and photography had one thing in common, it is that they brought the world closer for those who rode or looked. While the dull, repetitive toil of the factories seemed like slavery, these technologies often seemed liberatory.

The brothers Nicéphore and Claude Niepce had begun working on the chemistry of photography in the teens, as had Louis-Jacques-Mandé Daguerre in the 1820s, while the Englishman William Henry Fox Talbot took up the challenge in 1833. Just as the date that counts for the railroad is not that of the invention of the steam engine or the railroad track or the locomotives hauling coal in remote mines, but the date that railroads began to transform public experience, so photography was nothing but a desire, a few premature announcements, and a few faint images before January 7, 1839. That day, Daguerre publicly announced his invention of the photographic method he called daguerreotypy, prompting Talbot to rush to announce his own breakthrough later that January. (In much the same way, the American painter Samuel F. B. Morse and the Englishmen William Fothergill Cooke and Charles Wheatstone invented electric telegraphy at virtually the same time in the early 1840s, and Darwin overcame his long reluctance to announce his conclusions about evolution when Alfred Russel Wallace announced similar conclusions in 1858.)

Photography was in the air. The hope of making images mechanically rather than manually was widespread, and so was the knowledge of the light-sensitive chemicals and the basic principles of the camera obscura, or dark chamber, whose small aperture casts an image of the outside view within its walls. Photography arose out of the desire to fix the two-dimensional image that the camera obscura created from the visible world, to hold onto light and shadow. That desire was compounded of many elements. There was the enormous value placed on realistic images and accurate representations as part of the European embrace of the empirical and the expansion of knowledge and power (a society whose art was abstract or symbolic and whose goal was stasis might never crave this verisimilitude). There was the tendency to replace the activities of the hand by machines, just as the railroad replaced the actions of the traveling foot. And there was the restlessness that characterized modern European and then American society, always willing to overturn what is for what might be, that restlessness of exploration, colonialism, science, and invention, of originality and individualism, the restlessness that regarded the unknown as a challenge rather than a danger, time as something to speed up or speed through. Photography may have been its most paradoxical invention: a technological breakthrough for holding onto the past, a technology always rushing forward, always looking backward.

Photography did not appear all at once as we know it now. Talbot's process, the almost-universal method of photography since the 1850s, produced a negative image and the possibility of printing multiple positives from that negative. But it was Daguerre's process that dominated the first decade of photography. Daguerre had found a way to make direct positive images on polished plates. Each daguerreotype was unique, since there was no negative and no printing, and the images were small and elusive. The mirrored surface that at one angle showed the image at


PHOTOGRAPHIC ILLUSTRATIONS OF THE PACIFIC COAST.

ALASKA,
CALIFORNIA, NEVADA, UTAH,
OREGON,

VALLEY OF THE YOSEMITE, MAMMOTH TREES, GEYSER SPRINGS,

MISSIONS OF CALIFORNIA; SIERRA NEVADA MOUNTAINS; A VINTAGE IN CALIFORNIA.

CENTRAL, UNION AND SOUTHERN PACIFIC RAILROADS.

MODOC WAR AND LAVA BEDS.

Coast and Mining Scenes, Chinese and Indians, Etc., Etc.

Photographed by MUYBRIDGE.

Published by BRADLEY & RULOFSON,

Gallery of Photographic Art.

429 Montgomery Street, SAN FRANCISCO.

This magnificent establishment employs the most skillful artists, produces the finest portraits, and is the largest and best appointed Gallery on the Pacific Coast, and has the only ELEVATOR connected with a Photograph Gallery in the world.

Photographs of Ranchos, Mines, Engineering Work, and Animals, executed to order anywhere in the United States.

Verso of one of Muybridge's stereo cards, ca. 1873–74.

another showed the viewer looking at the image; it seemed phantasmagorical in a way paper prints would not. Compared to painting, early photography was astonishingly fast, but it required exposures from dozens of seconds to several minutes. Morse, who was in Paris the spring of Daguerre's announcement, wrote back to New York of the new invention, "Objects moving are not impressed. The Boulevard, so constantly filled with a moving throng of pedestrians and carriages, was perfectly solitary, except for an individual who was having his boots brushed. His feet were compelled, of course, to be stationary for some time, one being on the box of the boot-black and the other on the ground. Consequently his boots and legs were well defined, but he is without body or head, because these were in motion." This man having his shoes polished and the blurry bootblack were the first human beings photographed, and it is eerie to look at them apparently alone, but really surrounded by scores who vanished into speed. Photography was faster than painting, but it could only portray the slow world or the still world. People sat for their portraits with braces to hold their heads steady, and in those old portraits fidgeting children are often a blur. Landscapes were photographed on windless days when the leaves wouldn't move and the water was smooth. The bustling nineteenth century had to come to a halt for the camera, until Muybridge and his motion studies.

Even so, photography was a profound transformation of the world it entered. Before, every face, every place, every event, had been unique, seen only once and then lost forever among the changes of age, light, time. The past existed only in memory and interpretation, and the world beyond one's own experience was mostly stories. The rich could commission paintings, the less rich could buy prints, but a photograph reproduced its subject with an immediacy and accuracy art made by hand lacked, and by the 1850s it offered the possibility of mass reproductions, images for everyone. Every photograph was a moment snatched from the river of time. Every photograph was a piece of evidence from the event itself, a material witness. The youthful face of a beloved could be looked at decades after age or death or separation had removed that face, could be possessed like an object. Daguerreotypes, which were soon sold in elaborately molded cases with cut-velvet linings facing the image that sat within, were alluring objects. Soon countless thousands were lining up to possess images of themselves, their families, their dead children, to own the past. Most daguerreotypes reached out in time to make familiar faces permanent possessions; it was only when the later photographic processes arrived on the scene that photography extended its grasp in space as it had in time. The images piled up, and photography became an industry too. The world was growing larger and more complicated, and photography was both an agent of this enlargement and a device for trying to sort it all out, to own it, to make it manageable. Photography had frozen the river of time, but a torrent of photographs began to pour from the photography studios into homes, pockets, albums, photographs of pyramids, empresses, streets, poets, cathedrals, trees, actors.

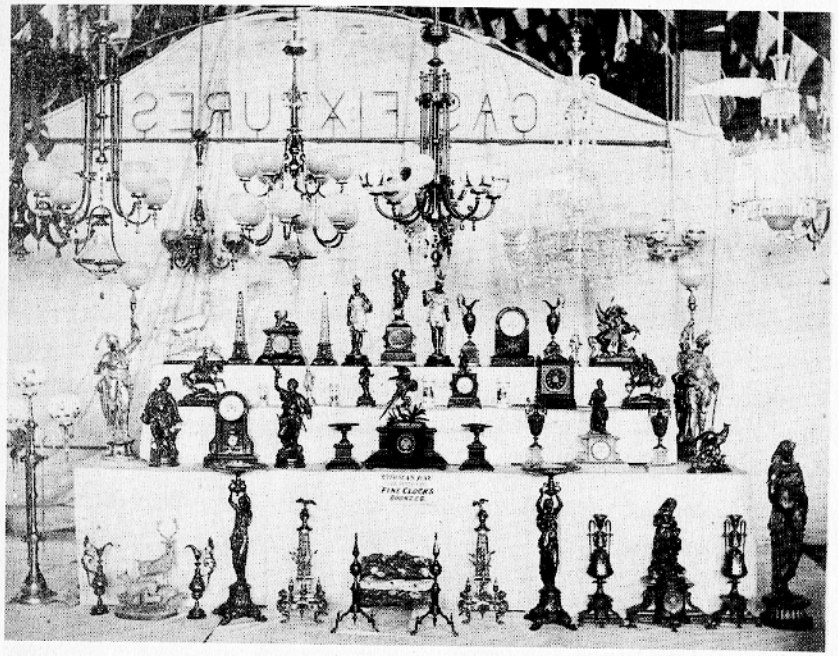
Five years after photography, one more technology, telegraphy, arrived to transform time. Telegraph messages traveled almost instantly as electrical impulses over the wires, a technology that telephones and the Internet would only elaborate. "This is indeed the annihilation of space," the *Philadelphia Ledger* exclaimed over the first long-distance telegram in the United States. Many of the early telegraphic lines followed the railroad tracks, and they replaced the railroad as the fastest communications technology. News, words, data, were dematerialized and almost instantaneous wherever the telegraph wires were strung. The distance between places that

had once been measured at ten miles an hour or less was wavering, drawing closer, almost dissolving. Karl Marx took up that catchphrase of the day when he wrote, "Capital must on the one side strive to tear down every spatial barrier to intercourse, i.e., to exchange, and conquer the whole earth for its market. It strives on the other hand to annihilate this space with time, i.e., to reduce to a minimum the time spent in motion from one place to another." In other words, the more capitalism shrinks space and speeds up time, the more it can profit. In Marx's view, capitalism itself was the engine of the annihilation of time and space, the locomotive its tangible form, and time and space were being annihilated to increase profits. This led to the formation of ever-vaster fortunes and the first modern corporations, even the stock markets whose first major stocks were railroad shares. Capitalism, stocks, corporations, transformed the labor of workers and the materials of the world into that abstraction profit. Labor and materials were themselves abstracted as the one went into the factory to become a series of simple repetitive gestures rather than an authorship of objects, and the objects themselves came to be bought and used by people more and more remote from the process of their making. But these changes also transformed the way everyone touched by the technologies perceived time and space. To use railroad terms, the engine of this cultural and perceptual change was economic.

Before the new technologies and ideas, time was a river in which human beings were immersed, moving steadily on the current, never faster than the speeds of nature—of currents, of wind, of muscles. Trains liberated them from the flow of the river, or isolated them from it. Photography appears on this scene as though someone had found a way to freeze the water of passing time; appearances that were once as fluid as water running through one's fingers became solid objects. Through the nineteenth century, as Darwin worked out his theories about literal evolution, it is as though consciousness evolved from something utterly immersed in this river to something that clambered onto land. There the atmosphere was thinner, the view was farther, and no current forced these mutating Victorians to move at a set pace—but no water bore them up and carried them along either. And there was no going back. The art of the hand had been replaced by the machinery of the camera; the travel of the foot, human or equine, had been replaced by the pistons of the locomotive; bodies themselves were becoming insulated from nature by machinery and manufactured goods; and memory had been augmented and partly replaced by photography, that freezing eye whose gaze soon reached the corners of the world. Appearances were permanent, information was instantaneous, travel exceeded the fastest speed of bird, beast, and man. It was no longer a natural world in the sense it always had been, and human beings were no longer contained within nature.

Time itself had been of a different texture, a different pace, in the world Muybridge was born into. It had not yet become a scarce commodity to be measured out in ever smaller increments as clocks acquired second hands, as watches became more affordable mass-market commodities, as exacting schedules began to intrude into more and more activities. Only prayer had been precisely scheduled in the old society, and church bells had been the primary source of time measurement. In the preindustrial world, most work was agricultural, and the time of the year mattered more, the time of day less. Work was done according to task and available light, and tasks varied from season to season. People worked for themselves or worked with masters who were, for better or worse, more than employers. The new age, with its factories and mobilities, its industrial scale, was to be impersonal as nothing had been before. Tightly enforced schedules came in with the factories whose owners sought to calibrate human labor to machine labor, the machine labor that was speeding up the production of goods, thereby speeding up the raking in of profits, the consumption of raw materials, and on and on—a runaway train of consumption driving production driving consumption. It was these factories and railroads that made knowing the exact time important, that launched the modern world of schedules and bustle. Goods increased in abundance as, for example, Manchester mills generated cheap cotton fabric, but time was becoming scarcer—literally so for workers putting in fourteen-hour days at the mills and slaves growing cotton on the other side of the Atlantic, apparently so for those in the rush of the growing cities, the greater variety of experiences, publications, images, the hectic greed of that era.

The railroad, the photograph, the telegraph, were technologies for being elsewhere in time and space, for pushing away the here and now. They made the vast expanses not so vast, the passage of time not quite so un-



Thomas Day, Importer of Gas Fixtures, French Clocks, Fine Bronzes, etc., San Francisco. A fine example of Muybridge's commercial work.

relenting. They were celebrated for the very real powers and pleasures they supplied, the real isolations and inconveniences they undid. But there were doubts too about what Thomas Carlyle in 1829 called the Mechanical Age, and the literature of the time is full of it. Hans Christian Andersen's 1844 tale "The Nightingale" compared the drab, independent-minded real nightingale with its bejeweled mechanical imitation, which sang the same waltz over and over. The court music master approved of the machine's predictability: "For you must perceive, my chief lord and emperor, that with a real nightingale we can never tell what is going to be sung, but with this bird everything is settled. It can be opened and explained, so that people may understand how the waltzes are formed, and why one note follows upon another." But it is the mechanical nightingale that grinds to a halt and finally fails the dying emperor because there is no one to wind it up. The live nightingale returns to sing the emperor back to life, out of an affection beyond the abilities of a machine. In a similar vein, Nathaniel Hawthorne's grimly comic short story of 1846, "The Celestial Railroad," sent a group of

pilgrims by railroad across the landscape of the great spiritual allegory *The Pilgrim's Progress.* The harsh terrain John Bunyan's Pilgrim had trod on foot sped by pleasantly, but the train ended up in hell rather than paradise. The old world, Hawthorne seemed to argue, was arduous, but it knew where it was going, and it went the slow, sure way. Machines made life easier, faster, more predictable, but they led away from an integrity that people missed from the beginning. It is said that on the first day of fighting in Paris's July Revolution of 1830, the clocks in the towers were fired on simultaneously and independently from several points. The destruction of machinery would be a hallmark of resistance to industrial regimentation and industrial time up through the nationwide railroad riots of 1877, which involved Stanford and, less directly, Muybridge.

Each event and thought itself must have been experienced at a radically different pace—what was slow then was slower than we could now tolerate, slower than we could pay attention to; while the speed of our own lives would have gone by them like the blur of speed before Muybridge's images or been as invisible as the passersby in that first photograph of the Parisian boulevard Morse described. Distance had a profundity that cannot be imagined now: a relative who had moved a hundred or a thousand miles away often seemed to have dropped over the horizon, never to be seen again, and travel for its own sake was rare. In some psychological and spiritual way, we became a different species operating at a different pace, as though tortoises became mayflies. We see much they did not, and can never see as they did. In 1860, George Eliot mourned the transformation of time with an aside in a novel: "Ingenious philosophers tell you, perhaps, that the great work of the steam-engine is to create leisure for mankind. Do not believe them; it only creates a vacuum for eager thought to rush in. Even idleness is eager now—eager for amusement, prone to excursion-trains, art-museums, periodical literature, and exciting novels; prone even to scientific theorizing and cursory peeps through microscopes."

Out the train window, the landscape disappeared into a blur; traveling was no longer an encounter, however awkward and dangerous, but a transport. It was as though the world itself was growing less substantial, and though some doubted the value of the change, many celebrated it. The year before Eliot mourned

leisure, the essayist and judge Oliver Wendell Holmes exulted over the way photographs of the material world seemed to eclipse their subjects: "Form is henceforth divorced from matter. In fact, matter as a visible object is of no great use any longer, except as the mould on which form is shaped. Give us a few negatives of a thing worth seeing, taken from different points of view, and that is all we want of it. Pull it down or burn it up, if you please. . . . Matter in large masses must always be fixed and dear; form is cheap and transportable. We have got the fruit of creation now, and need not trouble ourselves with the core." In Holmes's account, this dematerialization was liberatory. "Everything that is solid dissolves into air," said Marx of that uncertain era, and Holmes thought that dissolving into air was wonderful, that his generation would rise up like birds into that thinner medium, with a new freedom to see the whole glorious nineteenth-century world as a bird in flight might see it, as small pictures of things far away.

Photographic reproduction would make the world's images and experiences as available as the Manchester mills made cotton fabric. It's not hard to see ahead from Holmes's vision of the photographic revolution to cable television with its torrents of nature documentaries and news reports, comedies and advertisements, but behind it lay the hunger and ignorance of a world where images and information were scarce. One way to describe this transformation of the world whose great accelerations came in the 1830s, the 1870s, and the age of the computer is as increasing abstraction. Those carried along on technology's currents were less connected to local places, to the earth itself, to the limitations of the body and biology, to the malleability of memory and imagination. They were moving into a world where places were being homogenized, where a network of machines and the corporations behind them were dispelling the independence of wilderness, of remoteness, of local culture, a world that was experienced more and more as information and images. It was as though they sacrificed the near to gain the far.

There was no simple dichotomy, however, between nature's pace and the railroad, between images and the natural realm of the senses. It was not long before railroad lines were being built to take people into the landscape for scenic excursions and cameras were being used to make landscape photographs. It is as though the Victorians were striving to recover the sense of place they had lost when their lives accelerated, when they became disembodied. They craved landscape and nature with an anxious intensity no one has had before or since, though they pursued it in new ways: with microscopes and rock hammers, with guidebooks and cameras, with railroad excursions and collections of specimens. They filled their houses with pictures of places, but even the close-ups were often as not of places far away. The ideal landscape seemed formed of a wholeness that was no longer theirs. They looked for this wholeness as a place, and so mostly do we. These histories suggest nature was equally a kind of time or a pace, the pace of a person walking, of water flowing in a river, of seasons, of time told from the sky rather than electrical signals. Natural meant not where you were but how you moved through it, and a woman drifting across London on foot could attain certain harmonies not available to those speeding across the prairie on the express train. But the Victorian age had launched a juggernaut, and slowing down was the single thing hardest to do.

This is the paradox of Muybridge's work. He was using his state-of-the-art equipment to feed that ravenous appetite for place, for time, for bodies. He had turned his back on the slow world of his grandfather's barges and pigeons to embrace the new railroad and photographic technology, and with electricity and chemistry he made the latter faster than ever before. But his work is largely a collection of striking still images of the settlements and wilderness of the West through the mid-1870s, then an avalanche of images of bodies, the bodies of horses, then men, then women, children, camels, lions, vultures, reenacting their most familiar gestures. His inventive technology was depicting the place and the bodies that seemed ever more alienated by technological change, as though what had been lost as direct experience could be, just as Holmes dreamed, recovered as imagery. The speed of Muybridge's invention allowed real motions to be recovered at their own pace, though watching them meant stepping out of one's own time. If the experience that was vanishing can be summed up as a person standing alone in a landscape, then photography and, subsequently, film would offer images of that experience. The very essence of that solitary experience in the landscape, however, was its immediacy, its situation in a resonant here and now, while representations are always about there and then, a substitute, a reminder. Yet Muybridge spent much of his

adulthood in some version of that experience, photographing the landscape for the market.

In the spring of 1872 a man photographed a horse. With the motion studies that resulted it was as though he were returning bodies themselves to those who craved them—not bodies as they might daily be experienced, bodies as sensations of gravity, fatigue, strength, pleasure, but bodies become weightless images, bodies dissected and reconstructed by light and machine and fantasy. The movements of horses dismayed artists and amused members of the public when Muybridge's instantaneous photographs revealed them as much more complex and ungainly than the rocking-horse gallopers in paintings. Then he offered his audience of scientists, artists, dignitaries, and connoisseurs the whole world of everyday gesture back. Those gestures—a gymnast turning a somersault in midair, a nude pouring water—were unfamiliar and eerie stopped because they showed what had always been present but never seen. Set into motion, they were uncanny another way when they undid the familiar distinction between representations, which did not move, and life that did. Through the new technologies—the train to the landscape, the camera to the spectacle—the Victorians were trying to find their way back, but where they had lost the old familiar things they recovered exotic new ones. What they had lost was solid; what they gained was made out of air. That exotic new world of images speeding by would become the true home of those who spent their Saturdays watching images beamed across the darkness of the movie theater, then their evenings watching images beamed through the atmosphere and brought home into a box like a camera obscura or a crystal ball, then their waking hours surfing the Internet wired like the old telegraph system. Muybridge was a doorway, a pivot between that old world and ours, and to follow him is to follow the choices that got us here.