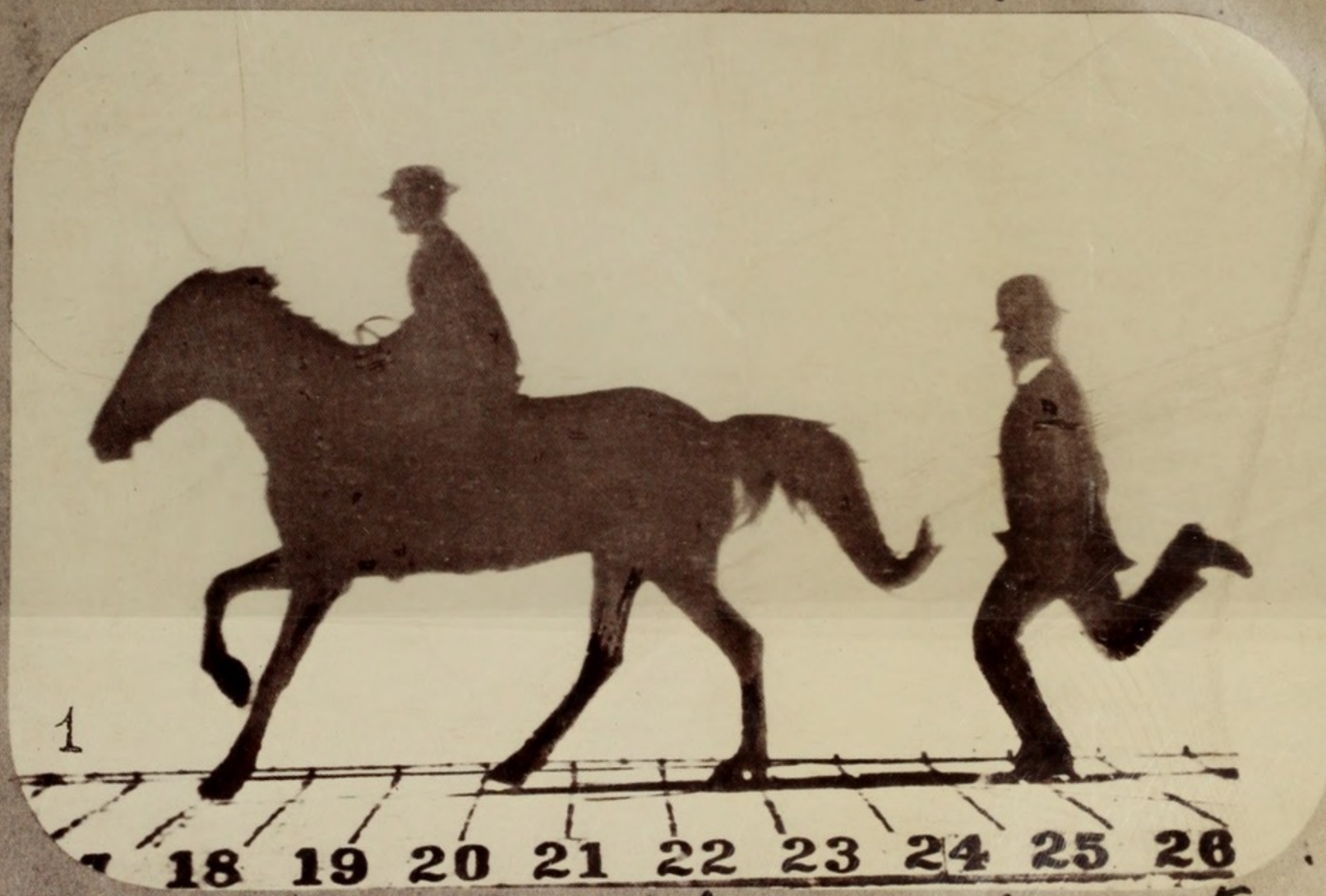
Leland Stanford Jr. on his pony
Palo Alto. May 1879



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A series of 8 phases of a stride by a pony while cantering. Photographed on wet collodion plate.

photographed. May 1879
by Eadweard Muybridge

E.M.

Eadweard Muybridge

The Stanford Years, 1872-1882

This is the fourteenth
in a series of books
published by the
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Stanford University
Lorenz Eitner, Chairman

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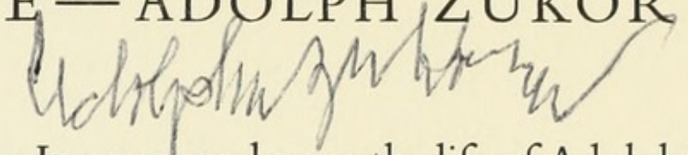
EADWEARD MUYBRIDGE — ADOLPH ZUKOR



THIS exhibition, designed to honor the pioneer work of *Eadweard Muybridge*, would have little meaning had not his experiments in instantaneous photography led to the invention of the most pervasive art form of the twentieth century, the motion picture.

There is something at once awesome and symbolic in the fact that at the very time that Muybridge was conducting his experiments in Palo Alto, California, a hundred years ago, in Ricse, Hungary, Adolph Zukor was born–another kind of pioneer, a man with the imagination to see the possibilities of an art in the crude, flickering images of the early movies, and with the energy and ability to create out of them the art-industry that we know today.

In a very real sense, the life of Adolph Zukor has spanned the entire development of motion pictures. And it is no less realistic to observe that, without the leadership of men like Zukor, we would not be celebrating today these early achievements of *Eadweard Muybridge*. The annals of history must be filled with bold pioneers whose inventions are wholly forgotten because no one had the imagination to find an audience for them.

It is, therefore, more than appropriate that in honoring the centennial of *Eadweard Muybridge's* achievements we also recognize the centennial of Adolph Zukor's birth. The creative artist and the creative entrepreneur–the one could never exist without the other.

ARTHUR KNIGHT

Eadweard Muybridge

The Stanford Years, 1872-1882

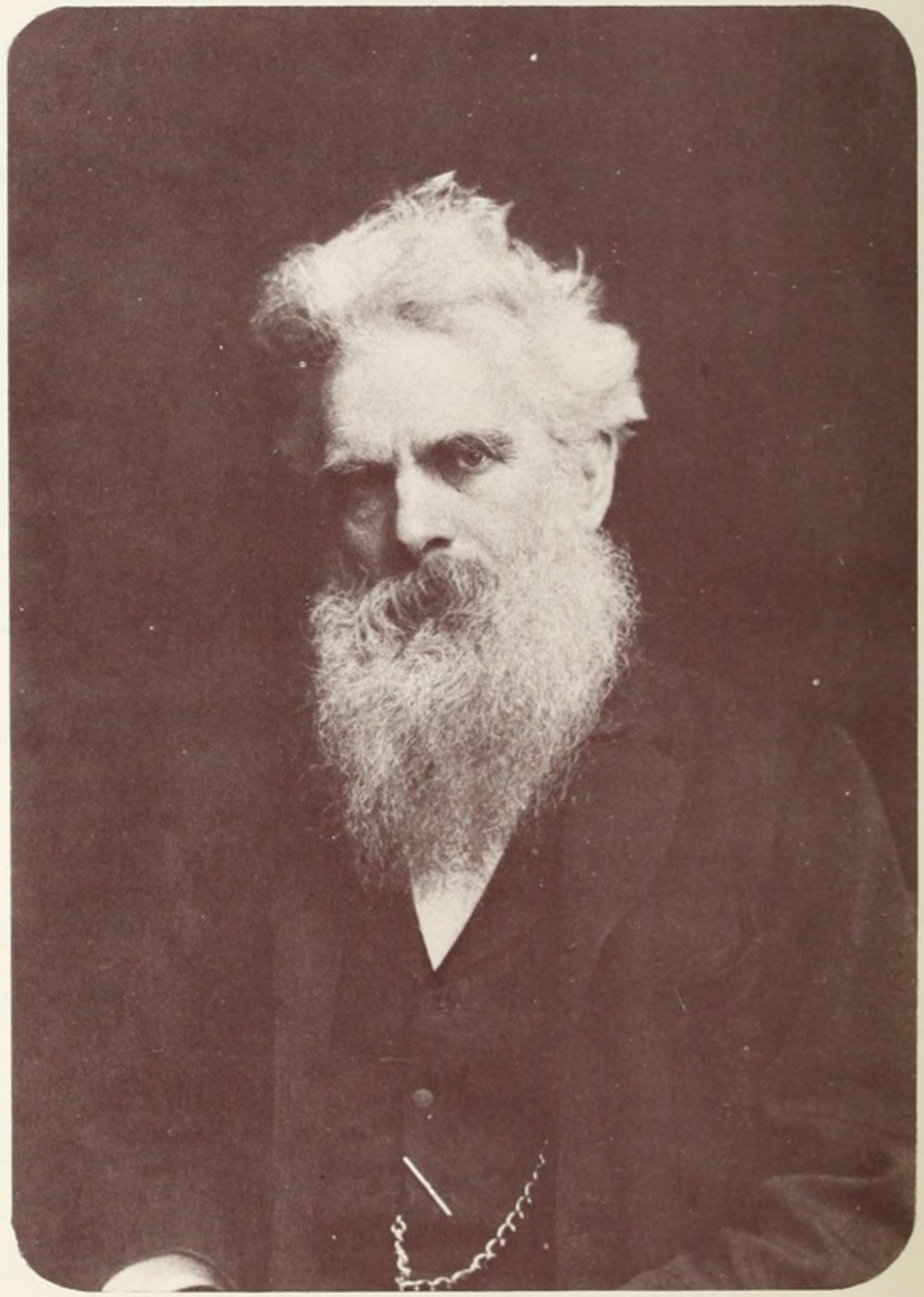
Stanford University Museum of Art 7 October - 4 December 1972
E. B. Crocker Art Gallery, Sacramento 16 December - 14 January 1973
University Galleries, University of Southern California, Los Angeles 8 February - 11 March 1973

This catalogue and the exhibition it accompanies are dedicated to
the painter Susan Weil, of New York, who introduced me to the work of Eadweard Muybridge in 1953

Anita Ventura Mozley, Registrar and Curator of Photography
Stanford University Museum of Art

Eadweard Muybridge: The Stanford Years, 1872-1882

Jean-Louis-Ernest Meissonier (1815-1891)
Leland Stanford "1881"
oil on canvas, 15 x 20 in.
Stanford University Museum of Art
Stanford Collection



Photograph by Wm. Vick Studio, Ipswich
Eadweard Muybridge c. 1881
Courtesy of Robert B. Haas

Introduction

"The circumstances must have been exceptionally felicitous that made co-laborateurs of the man that no practical impediment could halt, and of the artist who, to keep pace with the demands of the railroad builder hurried his art to a marvel of perfection that it is fair to believe it would not else have reached in another century."

—E.J. Muybridge, 1881

That the Stanford/Muybridge collaboration was a felicitous one was widely acknowledged in its own time. The outcome of the photographic experiments they made at Palo Alto Farm in 1878 and 1879 was reported in journals in this country and in Europe. By 1879, the year in which Thomas Eakins based his painting, *The Fairman Rogers Four-in-Hand*, on a serial photograph from Muybridge's *The Horse in Motion*, representation of the horse in art was changed to conform with photographic evidence, and in 1881, the year of Muybridge's triumph in France, the physiologist Etienne-Jules Marey of the Collège de France abandoned the method of graphic notation of animal locomotion that he had been using and turned, under the influence of Muybridge's results, to making photographic records of motion. Muybridge's zoöpraxiscope, which he devised in 1879, was the first instrument to synthesize motion that had been analytically photographed from life. Thus, as a result of the experiments at Palo Alto Farm, the forerunner of the motion picture was introduced to astonished nineteenth-century audiences, of whom the first was the Leland Stanford family in their Palo Alto home. "All that was wanting," said one San Francisco reporter, "was the clatter of hoofs." Muybridge himself forecast the day when entire operas would be presented through the combined effects of his zoöpraxiscope and the phonograph.

The successful outcome of the Stanford/Muybridge collaboration has called forth twentieth-century celebrations: in 1929, a three-day colloquium was held at Stanford University, and in 1930, the Royal Borough of Kingston-upon-Thames, Muybridge's birthplace, struck a medal marking the centenary of his birth. Forty-two years later, the Stanford University Museum of Art celebrates the hundredth anniversary of the beginning of Stanford's and Muybridge's work together with the presentation of an exhibition and catalogue that differs from these previous events in this respect: we hope now to present Muybridge whole, as it were, and to make it clear that the "man who took the pictures of the running horses," as he is most often described, came to the task quite prepared for it, through some ten years of experience as a photographer. And we want to answer to his often-repeated description of himself as "a photographic artist" with a display of his work of the 1870s upon which such a description is based. The art of photography is dependent upon its science; this was especially true when Muybridge practised it, for there were then no packaged goods, and every photographer was his own chemist. We will also see, in Muybridge's work of the 1870s, how technically proficient he was before he undertook the studies of animal locomotion. In our change of emphasis, or rather extension of interest in the work of Muybridge, we will follow him as he "hurried his art to a marvel of perfection," and finally produced for Stanford the synthesized motion that had been so avidly sought in the nineteenth century. Here now is given not only the accomplishment for which Muybridge is internationally known, but also the work basic to it, which we believe deserves equal attention. This is, so far as we know, the first time that the Muybridge studies of animal locomotion have been seen in relation to the photographs that preceded them.

In focusing on Muybridge's work during these years of his and Stanford's collaboration, we have learned some strange things. Through documents recently made available by the George Arents Research Library of Syracuse University, we learn that Muybridge was early a writer, a talent often congenial to photographers. The quotation given above is from an unsigned history of the Palo Alto experiments that appeared in the San Francisco *Examiner* for 6 February 1881 under the heading "Leland Stanford's Gift to Science and to Art." According to Muybridge's history, Stanford's gift was Muybridge. His article on the collaboration is rich in praise of Stanford and himself, and the dates he gives for some circumstances of the experiments are questionable. We are not sure, for instance, having no photographic proof, that Muybridge really did take a

photograph in 1872 of a horse at that point in its stride when all four feet are off the ground. Marey published experimental proof of this unsupported transit in 1873. While we celebrate a centennial date, we must also question it: did both Stanford and Muybridge thus claim priority for their work? Still, Muybridge always said that his experiments "commenced in 1872," and Stanford never disallowed the statement.

As a writer, Muybridge's subject was most often himself: in 1868 he had written, as publisher, about his own photographs, which he then issued under the pseudonym "Helios." Muybridge was also his own best historian: the most valuable source of information we have about his career is the scrapbook, now in the Kingston-upon-Thames Library, that he made of press clippings he had gathered throughout his life.

It is also strange to learn that it was doctors' orders, of all things, that started each of them on the courses that would eventually bring them together. From Scrapbook 6 of the Stanford Family Scrapbooks in the University Archives, an article of the early 1890s, under the heading "Senator Stanford's Great Palo Alto Breeding Ranch," we find that Stanford "became interested in thoroughbred horses . . . through ill health. My doctor had ordered a vacation for me and had told me that I must go away on a tour. I could not leave at that time, and he advised me to leave as soon as possible. I bought a little horse, that turned out to be remarkably fast, and it was in the using of it that I became interested in the study of the horse and its actions. . . ." And, according to Robert B. Haas, Muybridge's biographer, Muybridge was ordered by his physician to take up an "outdoor" activity to repair his health after a nearly disastrous stagecoach accident. Stanford determined to breed and train fast horses; Muybridge to become a professional photographer.

They were both men who strove to be at the top of their chosen fields. H.C. Nash, tutor to Leland Stanford, Jr., from 1881 until the boy's death in 1884, remarked in 1889 to the historian H.H. Bancroft, who was preparing his *Chronicles of the Builders*, that "anything in which Stanford is interested, he can go at." Stanford went at the breeding and training of trotting horses in such a way as to make the Palo Alto Farm famous throughout the world. He invented the so-called "brush system" of training, a system in which young horses were trained early for speed rather than endurance. According to Charles Marvin, the well-known trainer Stanford hired in 1878, Stanford instituted what we now consider progressive notions, even in relation to the education of children. In his *Training the Trotting Horse*, Marvin tells that no employee was kept on who used an angry tone or a foul word in the presence of the horses, and the daily custom of the stable included every comfort for the physical well-being and emotional security of the animals, including hot meals from a recipe of Stanford's own devising. The young horses were guided through steps in their education according to their abilities, and Stanford carefully observed their progress, when he was at the farm, from his revolving chair in the center of the "kindergarten track." (Muybridge's *Attitudes of Animals in Motion* of 1881 reflects this personal interest in the animals; we know the names of Stanford's horses from the index to the photographs, but the athletes of the Olympic Club of San Francisco, the first men to enter a motion-picture stage, are unnamed.) Stanford's personalized system of training and breeding was ultimately widely adopted; in its own sphere, it was a "revolution."

Muybridge was equally thorough. After a successful career in San Francisco as a seller of imported books, he plunged into the profession of photography to become the most sought-after photographic artist on the West Coast. From his correspondence with such journals as *The Philadelphia Photographer* and *Anthony's Bulletin*, we learn that he followed closely advances in the technique of photography, and early contributed ideas that furthered progress in its practice. He was ambitious for preëminence: if the photographer Carleton E. Watkins could make 18 x 22 in. negatives of the Valley of the Yosemite in 1861, Muybridge would eventually go him better, in 1872, and take larger and more comprehensive views than had ever been made of it, or any other Western scenery, for that matter. For this work he won the gold medal for landscape at the Vienna Exposition of 1873, in a competition that included fifty photographers from all over the world. At this time he was associated with the Bradley & Rulofson Gallery of San Francisco, which boasted "the only elevator connected with photography in the world," among other superiorities of men and equipment. The Bradley & Rulofson publication, *Catalogue of Photographic Views Illustrating The Yosemite, Mammoth Trees, Geyser Springs, and other remarkable and Interesting Scenery of the Far West, by Muybridge* tells us that by 1873, Muybridge had photographed in both stereo and large views the remarkable range of subjects that the catalogue indicates. There was probably hardly a parlor in the West that did not have some stereo views by Muybridge, which, when placed in the

stereoscope, would delight the viewer with a three-dimensional vision of spectacular scenery which he might never otherwise see. We also know, from the almost comprehensive collection of Muybridge's work of these years which is now held by The Bancroft Library that also he had made studies of moonlight effects, light and shadow, reflected images, of clouds and of trees. *The Philadelphia Photographer* called him "indefatiguable and untiring"; one term alone would not do justice to the amount and variety of his photographic production.

When Stanford and Muybridge met, Stanford, ex-Governor of California and President of the Central Pacific Railroad, was one of the state's leading citizens; Muybridge was at the top of his profession. They met, therefore, as equals in terms of the business at hand, in which each developed a consuming interest. During the time of their collaboration, what must have been immense personal differences were put aside. It is interesting to picture the railroad builder and the artist in conversation at Palo Alto or in Stanford's offices in the city and to recognize their temperamental differences as we can gather them from styles of expression and dress. In 1881, Meissonier painted the carefully groomed business man in his proper garb of the period, with his ivory-headed, gold-inlaid cane. Here is the man who could utter: "The machine cannot lie." Shortly thereafter Olive Logan reported from London to the Philadelphia *Times* that Muybridge "bears the traces of genius in his face and general get-up. As to the latter, it is *artistique au possible;* the loosely tied neck ribbon, the velvet coat, the gray felt sombrero—these might be called Californian, were they not the true artistic style of the London and Paris ateliers. With gray hair carelessly tossed back from an intellectual forehead, bright flashing eyes and a pleasant mouth, Mr. Muybridge must make himself an interesting subject for a photograph, whether in motion or at rest. . ."

Each of them, as the work came to an end, saw in its successful conclusion the realization of their separate aspirations, and a claim to glory. For Stanford, it was the crowning achievement of his interest in the scientific training and breeding of horses. For Muybridge, it summarized his superiority in the science and art of photography. Each of them believed his role to be the important one. It was the end of felicity. Stanford published his own book on the experiments, giving the photographer little credit, and Muybridge, after registering his objections to this by suing his former patron, found some one else to support more extensive, accurate and elaborate experiments.

Underlying the eventual falling out between them was, it appears, the difference between the interests that had brought them together. A theory of animal locomotion was what Stanford was after, and photographs were useful to it as proof only. They were the raw material of the investigation, and once they provided him with information, they could be thrown out the window. To be finally acceptable, to Stanford, photographs had to be translated into a more traditional graphic medium. (He would take the photographs of the Olympic Club athletes to Europe, a San Francisco newspaper reports in 1879, "to have them worked up into large paintings.") He published line copies of Muybridge's photographs in his book, *The Horse in Motion*, which was written by Dr. J.D.B. Stillman. (Who, Muybridge later said, "never was present at an experiment in motion.") By translating Muybridge's photographs into line drawings, Stanford destroyed the very exact "witness of the sun," as the nineteenth century called photography, a witness he himself had so unhesitatingly sought from Muybridge. The photographer of motion was furious. Stanford, the wealthy collector of certified American and European art, did not have a photographic vision. Muybridge did, and it is his vision that convinces us today.

Muybridge worked at a time when the canons of his art were being invented; he was one of the inventors. He began his work rooted in a nineteenth-century idea of illustration. As did other photographers of his time, he turned to painting as a model. So powerful were his photographs, that painters came to use them as studies for their own work. He manipulated his negatives, touching them out where it seemed effective, or combining them for heightened drama, a practice that is being taken up again today among photographers. As he progressed in his profession the science of his art took over; he soon pushed the capabilities of his medium as far as his wet-plate collodion equipment would permit. His pride, as a photographic artist, was that he "advanced photography." This present review of his work of the 1870s gives us the photographs upon which his claim to superiority was based. It reveals the justification of this claim. What Muybridge finally came to, under Stanford's patronage, was the previously unknown photographic analysis of motion, the negatives "taken in the 1/2000 part of a second," and the synthesis of this stopped motion. In 1972, when his achievement is our daily reality, we celebrate it.—A.V.M.

Muybridge, Bradley & Rulofson advertising card 1873
Bancroft Library, University of California, Berkeley

Eadweard Muybridge, 1830–1904

Robert Bartlett Haas

No more fascinating and mysterious a figure flickers through the scientific and artistic literature of the late nineteenth century than that of Eadweard Muybridge. The fascination arises from his work in photography (particularly his photography of motion), which, despite its undeniable influence on subsequent researchers and artists, remains today largely unexplored, unstudied or unestimated. The mystery arises from Muybridge's personality as well as from the curious absence of much of the biographical data which is required for an objective assessment of the man in relation to his work and his accomplishments. How appropriate it is, then, since Leland Stanford was Eadweard Muybridge's first great patron, that the Stanford University Museum of Art should seek a new evaluation of Eadweard Muybridge in 1972, the hundredth anniversary of his first commission for Leland Stanford.

Opinions have differed, over the years, as to the real value and meaning of Muybridge's work:

Was Muybridge truly a master-photographer of the nineteenth century, or was he only a *retardataire* worker and self-appointed genius? Was Muybridge the chief architect for Stanford's plan to investigate animal locomotion, or was he merely a technician employed by Stanford as an instrumentality to realize a project which Stanford had independently conceived? Was Muybridge the inventor of the modern motion picture, or was he only a minor figure in the history of cinematic progress?

This centenary exhibition will begin to answer such questions. And if, in the process of digesting the facts and reducing the ambiguities, the Muybridge legend should somewhat alter, Eadweard Muybridge will at least, or at last, in simple justice, be accorded his rightful and considered place.

1830-1872: From Muggeridge to Muybridge

Eadweard Muybridge was born Edward James Muggeridge on 9 April 1830 in Kingston-upon-Thames. His father, a well-established corn and small-coal chandler, died in 1843, leaving a widow and four sons. Eadweard attended Queen Elizabeth's Free Grammar School in Kingston and subsequently sought practical training and work in London, where Muggeridges had been stationers and papermakers since the eighteenth century. Muybridge's first American employment, as a commission merchant for the London Printing & Publishing Company, and his early interest in developing patents for a "plate-printing apparatus," strongly suggest a family-related apprenticeship. In 1851 he also became agent for Johnson, Fry & Company, serving their offices in Boston, New York and Philadelphia. He traveled between New York and the principal ports of the southern states, overseeing the importing, sale and distribution of books.

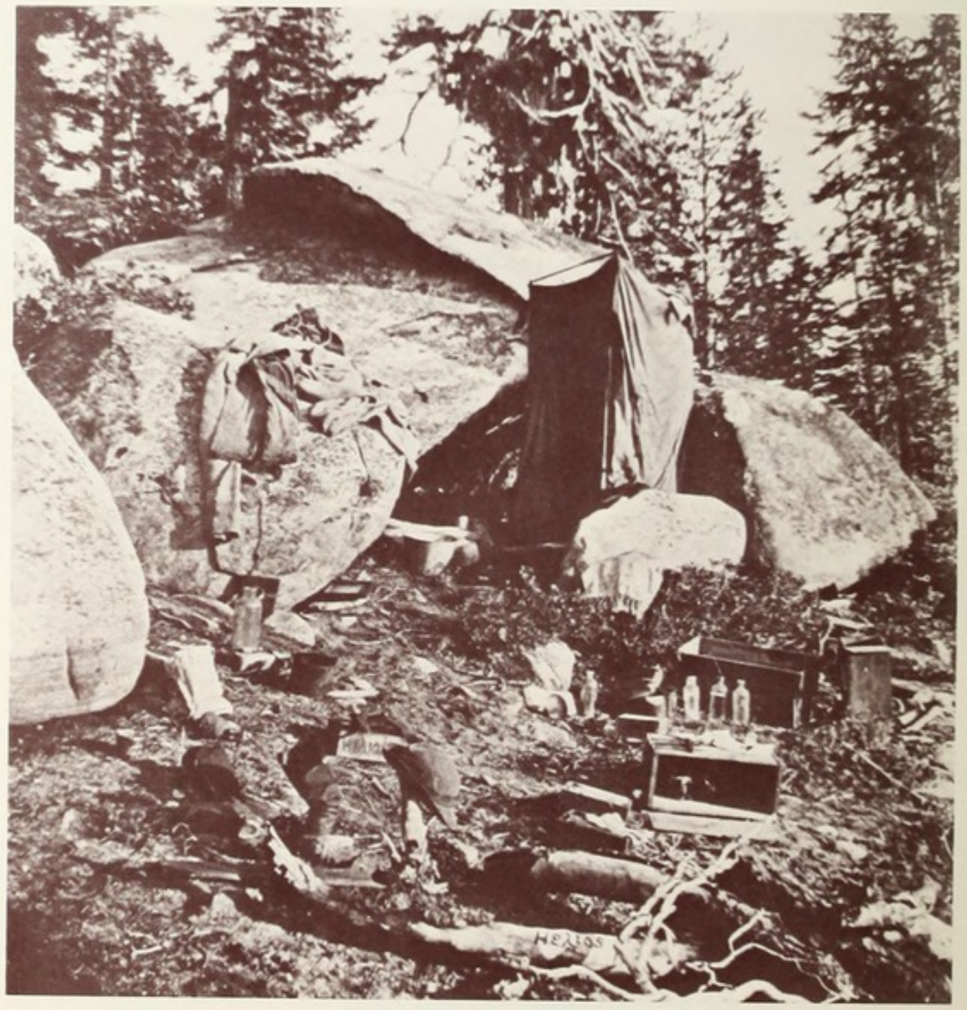
During these years, Muybridge met Silas Selleck, a New York daguerreotypist whose family was engaged in the business of book printing and bookbinding. In letters written home at this time, Muybridge said that he, too, was "working at photography," no doubt under Selleck's tutelage. When Selleck struck out for California in the early 1850s and established a successful photographic gallery in San Francisco, Muybridge resolved to settle on the West Coast and manage a bookstore of his own.

At the age of twenty-five, Eadweard Muybridge (first as Muggeridge, then as Muygridge) established a bookstore and general salesroom at 113 Montgomery Street, San Francisco. Here he claimed to have "a larger assortment of handsomely gotten up Illustrated Works than any other house in California."[1] He was soon well-known and well-patronized by the local literary and Bohemian crowds. He served on the board of the Mercantile Library. He was soon successful enough financially to bring his brother George and his brother Tom to California to tend shop for him while he himself traveled throughout the state in order to contact "gentlemen furnishing libraries" in this culture-hungry period of California's development. On these sightseeing jaunts, Muybridge developed his acquaintance with the varied resources and natural beauties

PHOTOGRAPHIC ILLUSTRATIONS OF THE PACIFIC COAST.

HELIOS
FLYING STUDIO.

Muybridge, "Helios's" Flying Studio in San Francisco 1868
B&R 340; stereo, 3¼ x 3 in. Bancroft Library



Muybridge, "Helios's" Flying Studio in Yosemite 1867
B&R 114; stereo, 3¼ x 3 in. Bancroft Library

of California and the West Coast which he was subsequently to make known to the world through the medium of photography.

In the summer of 1860, Muybridge returned to England to prepare himself for a serious second professional career as a photographer. Traveling by the Butterfield Overland Mail route through Texas to Missouri, he suffered severe injury when the stagecoach was overturned and wrecked. American medical treatment proved unsatisfactory; he traveled on to England, where he put himself under the extended care of one of the greatest physicians of the day, Sir William Gull. Gull's predilection for "natural therapy" encouraged Muybridge to plan only an outdoor career for himself. The public's passion for collecting stereoscopic views illustrating remote and exotic parts of the world suggested a lucrative field to him. He returned to California with new photographic skills, a new sense of energy and purpose, and a new dream of photographing the Far West for the world to see.

The San Francisco to which Eadweard Muybridge returned in the mid-1860s, as Clarence King described it, ". . . stood on the threshold of greatness." Ambitions were growing more refined. The completion of the transcontinental railroad, achieved in 1869, was about to make the old sea and land routes to the Gold Coast obsolete. Eadweard Muybridge plunged immediately into the five years of strenuous and productive photography during which he produced some two-thousand photographs that systematically portrayed the Far West. The photographs fall into a number of "series," identifiable today in the Bradley & Rulofson *Catalogue of Photographic Views Illustrating the Yosemite, Mammoth Trees, Geyser Springs, and other remarkable and Interesting Scenery of the Far West, by Muybridge*, a summary of all of his "outdoor" work done to 1873.[2] This included San Francisco views, Yosemite and Calaveras views, Vancouver Island and Alaska views, Lighthouses of the Pacific Coast, Farallone Island views, Railroads, (Central Pacific, Union Pacific and California Pacific), Geyser Springs, Woodward's Gardens (in San Francisco), and Scenery of the Yosemite Valley and the Mariposa Grove. Until 1872, these photographs were signed with the pseudonym "Helios"; after that, Muybridge used his own name.

Through his photographs Muybridge achieved considerable fame and fortune. They were internationally distributed and did much to make the West Coast known abroad. Muybridge's great

Muybridge
North Point Dock c.1868
B&R 301; stereo, 3¼ x 3 in.
(Muybridge is seated on the dock)
Bancroft Library

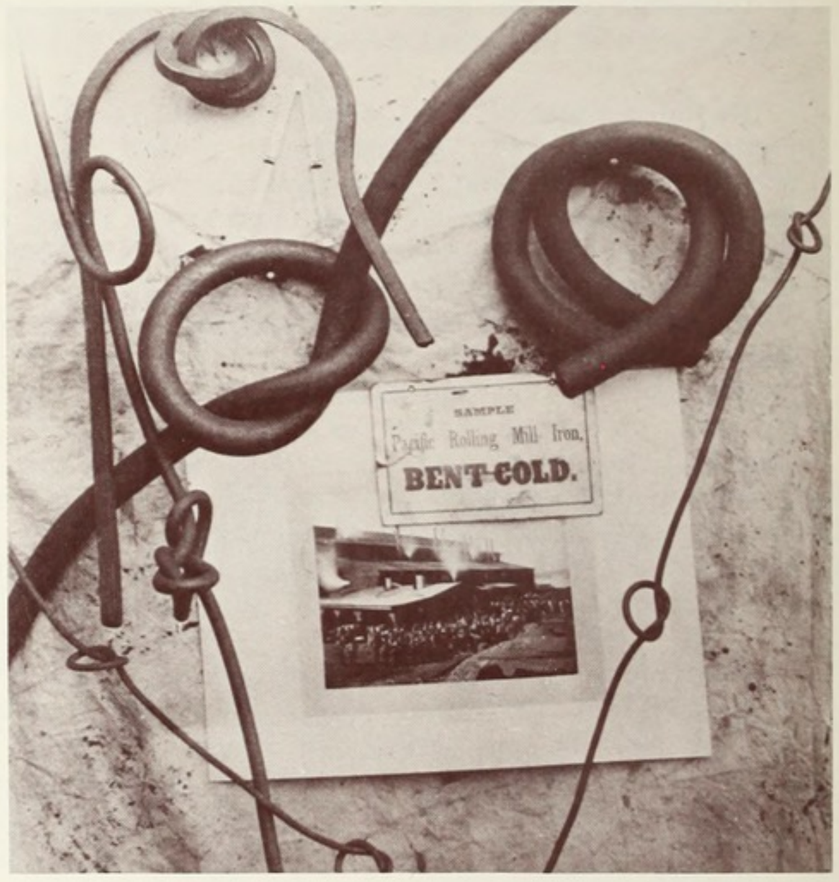
photographic cataloguing of the West is being rediscovered today. There is something so forceful, so intensive and so athletic in his coverage that it is difficult to comprehend it as the work of one man. In its day Muybridge's landscape photography was accorded professional recognition for its excellence, and Helen Hunt Jackson called Muybridge not only a photographer, but an artist. "I am not sure, after all," she wrote, "that there is anything so good to do in San Francisco as to spend a forenoon in Mr. Muybridge's little upper chamber, looking over those marvellous pictures." [3]

1872-1877: Early Experiments in California

In the spring of 1872, according to Muybridge, an unexpected summons from Leland Stanford, former governor of the State of California and powerful president of the Central Pacific Railroad Company, suddenly gave another direction to the course of Muybridge's professional life. In brief, Stanford telegraphed Muybridge from his residence in Sacramento, requesting that he secure photographic evidence for him that a horse trotting at top speed has all four feet off the ground at one point in his stride.

Although subsequent events and misunderstandings have tended to cloud the exact nature of the Stanford/Muybridge collaboration, Muybridge himself recorded, during the Stanford years, that he was "perfectly amazed at the boldness and originality of the proposition," and wondered at first whether it could be accomplished.[4] He accepted the commission, however, and in May of 1872 made several negatives of Stanford's fast horse Occident at the Union Park Race Course in Sacramento. Occident was "trotting, laterally, in front of his camera, at rates of speed varying from two minutes and twenty-five seconds to two minutes and eighteen seconds per mile." [5] Muybridge then returned to the Yosemite Valley, where he was making the wet-plate glass negatives, in sizes ranging from 20 x 24 inches to stereos, that he printed for publication by Bradley & Rulofson in 1873.

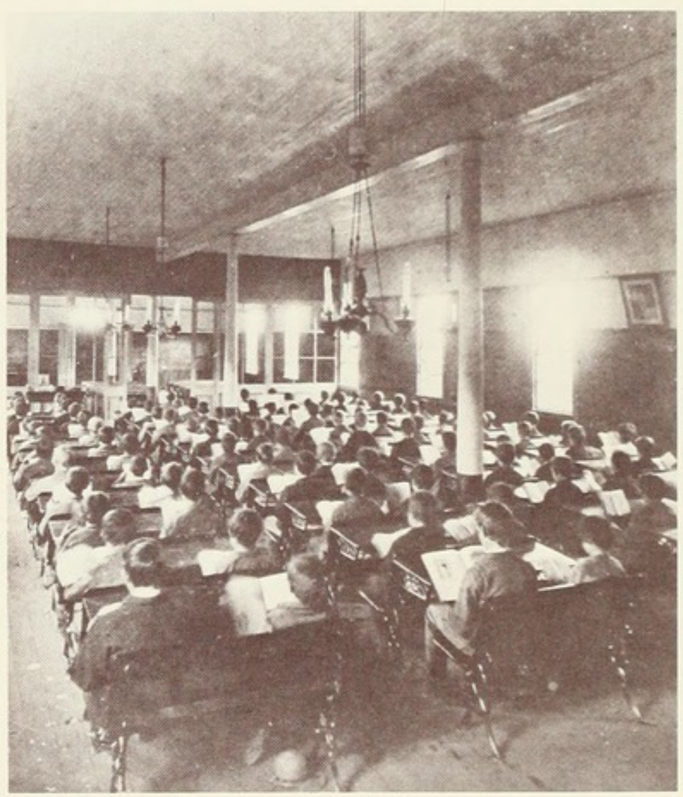
The photographs of Occident made at this time were not intended for commercial distribution and have not, to date, been located. Nor have been the photographs made in April, 1873, when Muybridge returned to Sacramento for a second try, although the *Alta California* referred to them as "a great triumph as a curiosity in photography—a horse's picture taken

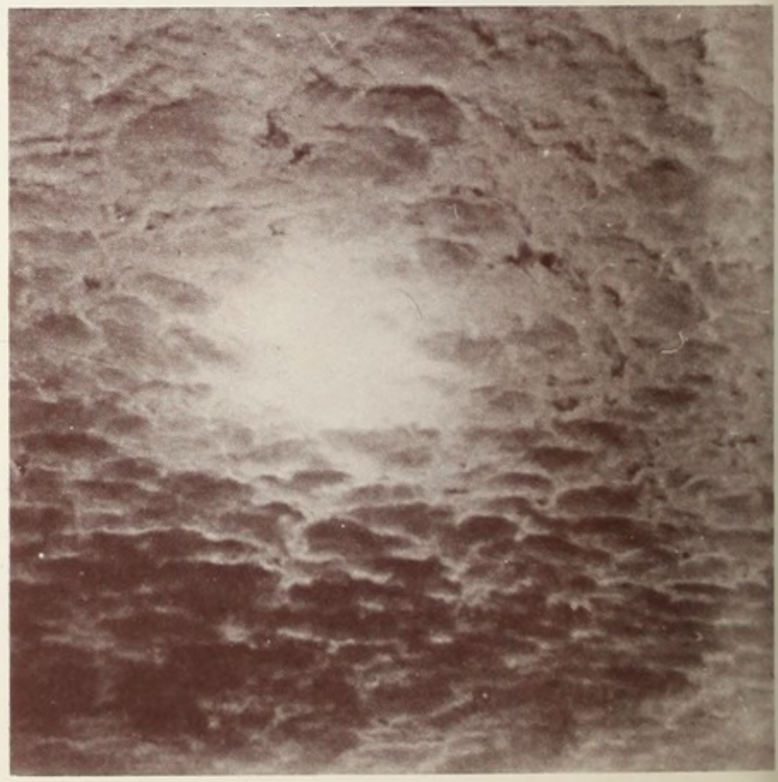


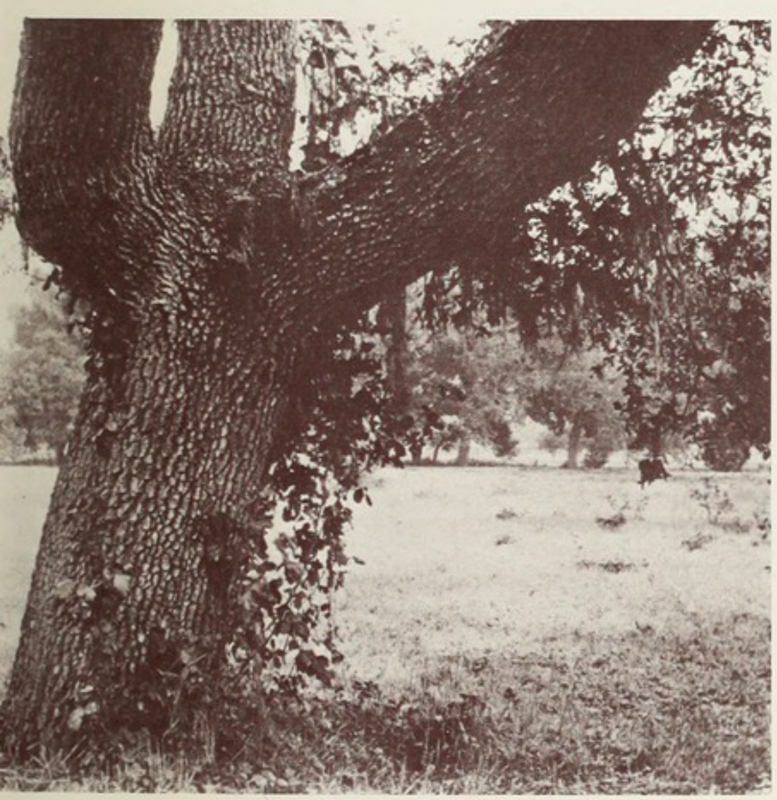
Muybridge, advertising card c.1869
Pacific Rolling Mills
stereo, 3¼ x 3 in.
Bancroft Library

Opposite:
Muybridge, stereo views 1868-1874
Bancroft Library

Indian Pow-Wow House, Nanaimo B&R 508, c. 1868
Chinese Joss House, Astrological Priest B&R 845, c. 1870
California Standard Sack Co.
View in Woodward's Gardens B&R 555, c. 1869
At the Velocipe Training School B&R 444, c. 1868
Classroom, San Vincent's Orphan Asylum, c. 1874







Muybridge
Studies of Clouds c. 1869
B&R 535, 541, 537, 536, 544, 548
stereos, 3 x 3¼ in.
Bancroft Library

Muybridge
Studies of Trees c. 1869
B&R 518-19, 521, 523-24
stereos, 3 x 3½ in.
Bancroft Library

while going thirty-eight feet in a second!" [6] Muybridge always claimed that the photographs resulting from these experiments "were sufficiently sharp to give a recognizable silhouette portrait of the driver, and some of them exhibited the horse with all four of his feet clearly lifted, at the same time, above the surface of the ground." Although Muybridge never claimed more quality for either the 1872 or 1873 pictures than to say they were "photographic impressions," Stanford found them entirely satisfactory for his immediate purpose. Because the original photographs were never circulated, photographic historians have found it easy to assert that they were "inconclusive" and mere silhouettes."

It is likely that the Currier & Ives print, *The California Wonder OCCIDENT, owned by Gov. L. Stanford*, entered for copyright in 1873, was intended to make both the photographs and the results of the experiments visual. As translated to the lithographic stone by the equestrian artist, J. Cameron, Occident displays himself in harness, at the private trial of speed, with all four feet free of the ground.

Further experiments in the photography of rapid motion under Stanford's aegis were unfortunately suspended during the years 1874 to 1876 because of the unhappy turn of events in Muybridge's private life. His young wife, Flora, became infatuated with the soldier of fortune Major Henry Larkyns, a dashing and mysterious figure who for a few brief months enlivened San Francisco's Bohemian society. After warning Larkyns away from his wife, Muybridge told Larkyns that he would not hesitate to destroy him if it were necessary to do so. Some months later Flora bore a son. Inadvertantly, Muybridge learned that the love affair between Larkyns and Flora had continued, so that the child might well be Larkyns's rather than his own. With a shockingly cool sense of justice, Muybridge then sought out Harry Larkyns on 17 October 1874 and deliberately shot him. [See Documents, B]. The trial that ensued was one of the most dramatic that the state had ever seen. No doubt Leland Stanford stood behind Muybridge throughout the case, for Stanford's great friend, Wirt W. Pendegast, served as lawyer for the defense and won an acquittal on the ground of justifiable homicide.[7] Following the trial, a way was found for Muybridge to leave the country until the unpleasantness had blown over. He traveled to Central America, arriving at Panama by Pacific Mail steamer in March, 1875. During his stay there, Flora Shallcross Stone Muybridge died.

The year before the murder, Muybridge had completed his documentation of the Modoc War; during his stay in Central America he produced a series of Central America and Isthmus of Panama views; and upon his return he executed the various panoramas of San Francisco "from the California Street Hill" that remain among the real wonders of West Coast photography. During Muybridge's long periods on shipboard, he had experimented with new chemicals and a new shutter intended for the instantaneous photography of motion.[8] Thus, despite the tragic character of this period of his life, Muybridge was professionally very productive.

By 1876 Muybridge claimed to be prepared to take photographs at 1/1000 of a second. Experiments for Stanford were, as Muybridge later said, "desultorily continued." It is probable that a Muybridge photograph of 1876 (as yet undiscovered) also supplied the image for another lithograph of Currier & Ives: *Occident/(Formerly 'Wonder') brown gelding, by pacing stallion St. Clair, dam's pedigree unknown. Owned by Ex-Gov. Leland Stanford of California/Record 2:16 3/4, Sept. 17th, 1876/Thos. Worth on stone.*

The last of the Sacramento photographs was taken in July, 1877. The now world-famous Occident was again the subject. A picture was circulated among newsmen in August and created a proper furore. Muybridge described it as a photograph of Occident made while "trotting past me at the rate of 2:27, accurately timed, or 36 feet in a second, about 40 feet distant, the exposure of the negative being less than the one-thousandth part of a second. The length of exposure can be pretty accurately determined by the fact that the whip in the driver's hand did not move the distance of its diameter. The picture has been retouched, as is customary at this time with all first class photographic work, for the purpose of giving a better effect to the details. In every other respect, the photograph is exactly as it was made in the camera." [9]

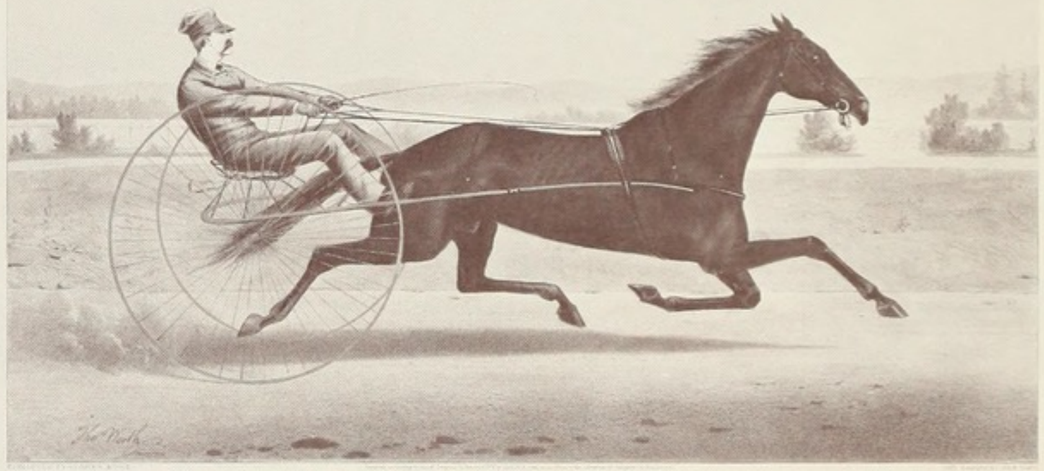
McCrellish, editor of the *Alta*, called the picture "a novelty in photographic art, and a delineation of speed which the eye cannot catch."[10] *Resources of California* reported, "Progress in Photography—an Astonishing Result." The San Francisco *Bulletin* called the picture, "A Triumph of Photographic Art." Only the *Post* took a dim view of the matter, questioning the attitudes of the horse and the driver: "Either the camera did lie," the writer asserted, "or Stanford has got the most extraordinary horse in the world."[11] Again, the photograph was

not distributed commercially, but the curious who went to Muybridge's studio were shown the negative along with a sworn statement by the driver, Mr. Tennant, as to the speed the horse had been traveling. Prints purporting to be from the negative were copyrighted by Muybridge in 1877 and distributed as "Occident Photographed at Full Speed," an "Automatic-Electro-Photograph."

Fortunately (or unfortunately), the Stanford Museum still possesses an almost totally hand-painted picture by the artist John Koch, the high-paid retoucher for Morse, who was then Muybridge's publisher. It is this painting that was apparently photographed by Muybridge and published as "Occident Photographed at Full Speed." Only the face of the driver is a photographic print; it is carefully cut and pasted to the surface of the canvas. X-ray and infra-red examination of the picture show no photographic base for the rest.[12] One is inclined to believe that Muybridge has been caught out in a gigantic hoax until one realizes that neither Stanford nor Muybridge was primarily concerned with either the quality or the distribution of the Muybridge photographs at the time. It was only required that they serve as incontrovertible data for building a general theory of locomotion on which Stanford could base a scientific theory of animal training. Once the equine image was arrested by instantaneous photography, the proof was in. Presentation of the data was entrusted to the more familiar graphic media——the drawing, the lithograph, the woodcut or the painting——as being more capable than the print of an instantaneous photograph of rendering details. An outline drawing on canvas of Abe Edgington, another of Stanford's horses, exists in the Museum; it is an exact preliminary sketch for a subsequent painting, also there.[13] This suggests that the images might have been traced onto the canvas by an artist working from lantern-slide projections of Muybridge photographs. These drawings could then have been submitted to Stanford for approval of the image before the final painting was undertaken. One is inclined to forget that reproductive printing processes in the 1870s were highly limited, and that great latitude was given to the artist to make up for this. "Retouching" photographs was thought of not only as a positive way to improve over the "accidents" of the camera, but also as an elegant embellishment, an artistic additive to photography. "Composite" photography, "moonlight" effects, "cloud" effects and manipulative studio tricks of all kinds were in common use, and were certainly practiced by Muybridge, as we can see in some of his more dramatic landscape work.

Currier & Ives, *Occident* 1873
color lithograph, composition, 7¾ x 14¾ in.

Currier & Ives, *Occident* 1876
color lithograph, composition, 16½ x 25 in.



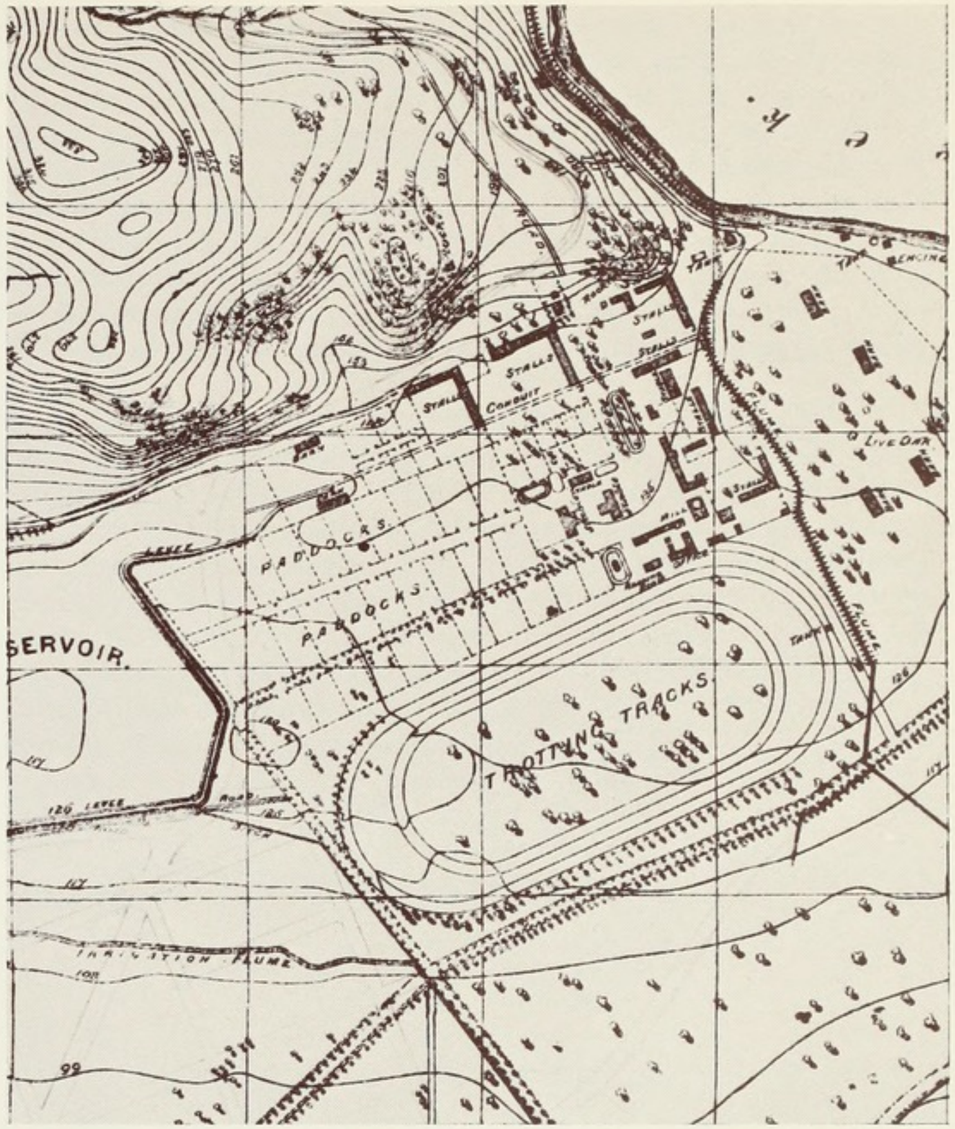
Thomas Hill (1829-1908)
Palo Alto Spring 1878; oil on canvas, 86½ x 138 in.
Stanford University Museum of Art, Stanford Collection

But of far more moment is the fact that, whatever others thought of the Muybridge/Koch picture, Stanford himself was satisfied with it. Again, it served his immediate purpose and suggested other possibilities. In fact, we learn in 1877 that the Stanford/Muybridge experiments are to be further extended: "Mr. Muybridge intends to take a series of pictures, showing the step of "Occident" at all the stages, and in this manner, for the first time, the precise differences in the motions of different horses can be clearly represented . . . a matter of much interest to horsemen, for trotters vary in their action, one having his fore-leg straight when it touches the ground, another crooked, and so on."[14]

1878-1879: Analysis and Synthesis

By 1878, the Leland Stanford family had lived in their Nob Hill mansion in San Francisco for at least a year, but much of their time was spent at their country estate, Palo Alto, where Stanford was developing his world-famous stock farm. It was here, then, in the farmland thirty-five miles south of the city, that Stanford and Muybridge projected a new full-scale photographic study of the horse in motion. The method adopted for the serial photographs at the Palo Alto Farm was a practical elaboration of Rejlander's scheme of 1872/3, which envisioned the use of a battery of cameras to illustrate the varied positions of the animal's feet in a sequential series of photographs.[15] Twelve Scoville cameras had been ordered from New York, and stereoscopic lenses for them were ordered from Dallmeyer of London. [Muybridge's "testimonials" to the quality of this equipment are given in Documents, A.]

Muybridge then prepared a "crude model" of his scheme for photographing objects in motion and took it, at Stanford's suggestion, to the chief engineer of the Central Pacific Railroad Company, Mr. S. Montague, for help in converting the idea into a workable mechanism. Mr. Montague then called in Mr. Arthur Brown, who "had in his immediate supply skilled mechanics and artisans of various kinds" at the car shops in Oakland, requesting him to take charge of the matter in accordance with Mr. Stanford's desires. Mr. Brown proposed to build the required fast shutter mechanism with "some mechanical contrivance to work automatically, as the horse passes along, by levers or some means to set them off as it went along." Mr. Brown then called in his assistant, Mr. John Isaacs, who proposed electricity and "took an active part in getting up this



Topographical map showing Stanford's Stock Farm 1886
(the lower right corner of the detail is approximate north)
From a survey map prepared for Frederick Law Olmsted,
whose drawing for the campus of the proposed university
is seen in the lower left
Stanford University Museum of Art
Gift of the Committee for Art at Stanford

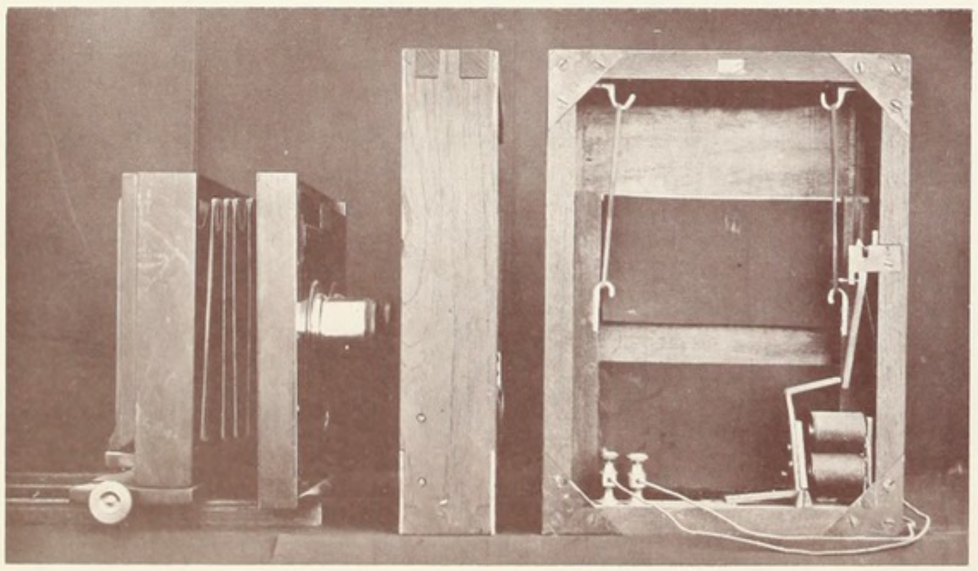
new apparatus." Isaacs made the working drawings, but the practical electrical work, which was adapted to Muybridge's crude model and built into the final working model, was done by Mr. Paul Seiler of the California Electric Works in San Francisco. Mr. Tiffany, of the San Francisco Telegraph Supply Company, supplied the electromagnets. Thus, in a manner comparable to scientific experimentation today, Muybridge's idea was worked out on a practical level through the cooperation of a group of specialists. Muybridge originated the idea, and Isaacs suggested the application of electricity to carry it out.[16]

By June the "motion-picture studio," constructed along the south side of the Palo Alto Farm's one-mile training track, was in full swing. In order to forestall the charge that the new pictures were in any way "got up," several groups of interested sportsmen and news reporters were invited, from time to time, to view the proceedings. What they saw, on 15 June 1878, the day of the initial demonstration, was a series of twelve photographs that were taken in less than half a second while Stanford's horse Abe Edgington was traveling in front of the cameras at forty feet a second. The animal was photographed against a wooden backdrop fifteen feet high and somewhat wider than the studio's length. This was marked off, as Muybridge wrote, "by vertical lines into spaces of twenty-one inches, each space being consecutively numbered" for the purpose of later analyzing the photographs and placing them in series. Muybridge prepared and developed his plates on the spot, and only a few minutes elapsed between each "take" and the exhibition of his negatives. Visitors were fascinated by the ingenuity of the electrical mechanism whereby the camera shutters were released. In photographing the running horse, threads were stretched across the track and connected so that armatures would release the shutters when each thread was broken as the horse went by. In photographing the trotting horse, the wheels of the sulky traveled over wires laid across the track to break the contact. This was the mechanism which was suggested by Isaacs.[17]

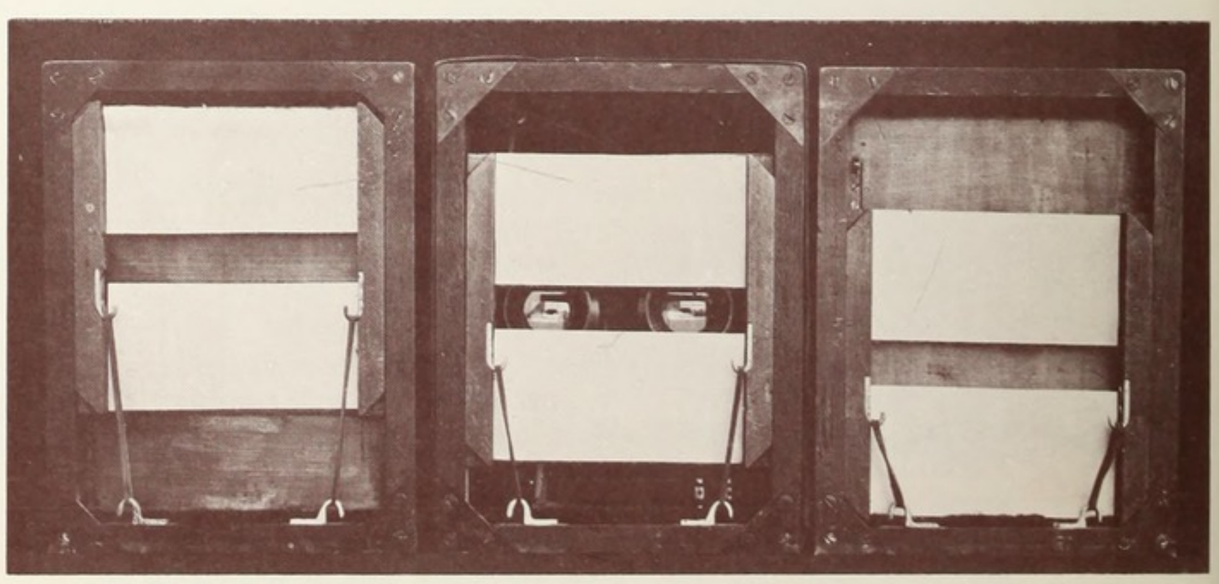
In June, 1878, Muybridge filed application for letters patent on a "Method and Apparatus for Photographing Objects in Motion"; and in July for letters patent on an "Improvement in the Method and Apparatus for Photographing Objects in Motion." The patents, No. 212864 and No. 212865, were granted to Muybridge on 4 March 1879, apparently with the full knowledge and approval of Leland Stanford. [See Documents, A, for diagrams that accompanied the patents.]

During the summer and fall of 1878, the principal equine

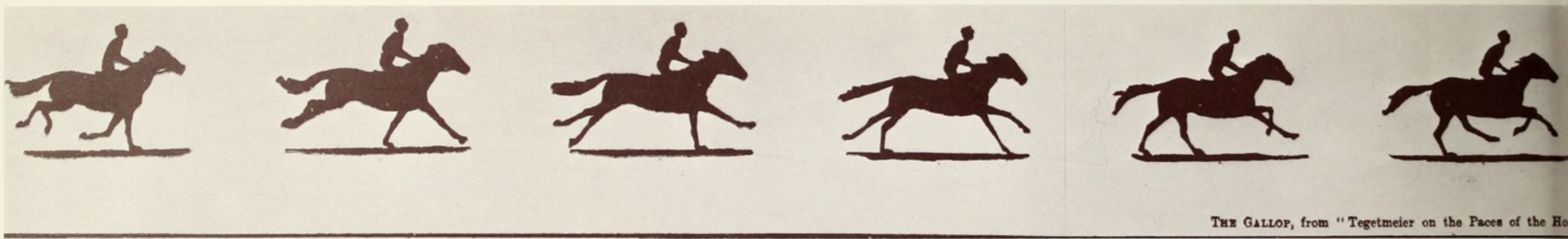
Camera and back of an electro-shutter 1878
Photograph B, *Attitudes of Animals in Motion*, 1881
Stanford University Museum of Art



Front of electro-shutters, with positions
of panels before, during and after exposure 1878
Photograph C, *Attitudes of Animals in Motion*, 1881



Muybridge, *The Palo Alto Stock Farm* c. 1880
Photograph A, *The Attitudes of Animals in Motion,* 1881



THE GALLOP, from "Tegetmeier on the Paces of the Ho

stars photographed were Stanford's Occident, Sallie Gardner, Mahomet and Abe Edgington. Six photographic cards illustrating these animals (in either six, eight or twelve positions) were copyrighted and published by Muybridge in 1878 as *The Horse in Motion.* They achieved world-wide distribution and world-wide fame. Popular consensus was that the method now employed by Muybridge "precluded all suspicion of mistakes, and ensured accuracy which could not be questioned." Popular fancy was caught by "something so complicated yet so simple and wonderful in the plan by which the horse took his own picture!"[18]

During the year 1879, Muybridge increased to twenty-four (with Stanford's full support) the number of cameras in the studio. Other horses which were then photographed were Nelson, Clyde, Dandee, Sharon, Gypsy (Leland Stanford Jr.'s pony), Albany, Nimrod, Oakland Maid, Eros, Mohawk, Elaine, Clay, Hattie, Florence, Phryne, Frankie, Maggie, Gilberta, Vaquero, Riata, Electioneer and Lancaster. In addition, studies were made of the locomotion of the ox, dog, bull, cow, deer, goat and boar. In summary, animals were represented in the actions of walking, ambling, cantering, pacing, trotting, running, leaping, standing and hauling, and the result was a utilitarian compendium of analytical, sequential photographs directly fulfilling Stanford's request for new data on the nature of animal locomotion.

In August, 1879, several athletes from the Olympic Club in San Francisco came to Menlo Park at Stanford's invitation and were photographed by Muybridge fencing, jumping, tumbling and in "various classical groupings." By the end of 1879, Muybridge had taken literally hundreds of instantaneous pictures for Stanford, and Stanford had spent around $50,000 on the project. But he was not yet finished.

On 18 December 1878, Professor Etienne-Jules Marey of the Collège de France, author of *La Machine Animale*, 1873 (translated and published in English under the title *Animal Mechanism*, 1874), which had spurred Stanford on to undertake advanced photographic projects with Muybridge at the Palo Alto Farm, sent a message to Muybridge.[19] He begged Muybridge's help in solving certain problems concerning the flight of birds on which he was working. He also suggested that Muybridge might utilize his photographs for the preparation of zoetropes: "It would be animated zoology. So far as artists are concerned, it would create a revolution." [For a discussion of the exchange of information between Marey and Muybridge, see "Marey, Muybridge and Meissonier". For the text of the letter, see Documents, C.]

Marey was only one of the many who had seen in the sequential photographs of Muybridge the possibilitity of their use in the zoetrope, the "philosophical toy" that adapted a sequence of drawings to a paper band which was placed in a rotating drum for viewing. When the drum was whirled, the drawings, seen through slits in its upper edge, gave the illusion of continuous, lifelike motion. By January, 1879, Emile Duhousset wrote from Paris that he had adapted the Muybridge photographs in an old phenakistoscope to good effect. The journal *L'Illustration*, in which Duhousset's article was published, was soon offering bands for the zoetrope of silhouettes made from the Muybridge photographs, for 10 francs. In June, W.B. Tegetmeier of London wrote in *The Field* that he had mounted the Muybridge pictures in a zoetrope with satisfactory effect. Somewhat later, he offered bands for the praxinoscope for sale under his own copyright. In July, Fairman Rogers, of Philadelphia, writing in *The Art Interchange*, stated that the painter Thomas Eakins "had plotted . . . the successive positions of the photographs and constructed, most ingeniously,

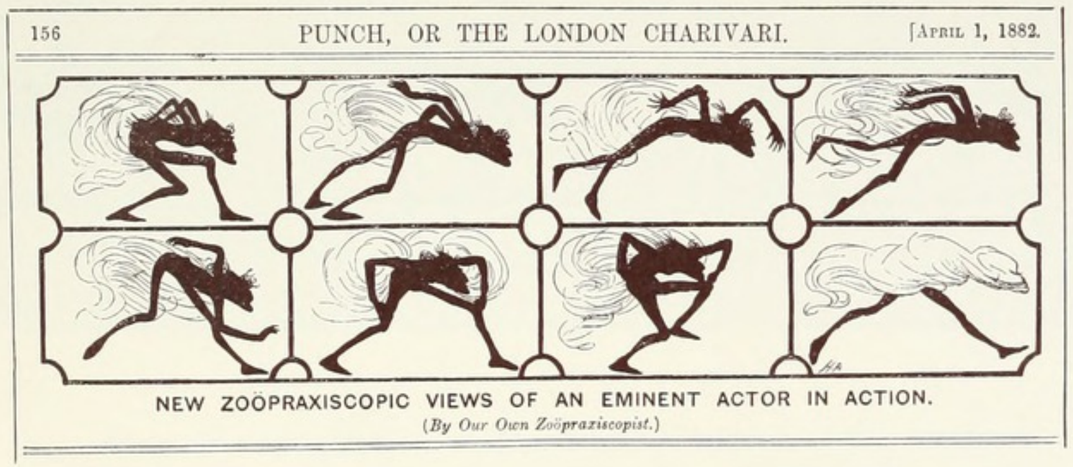
Price Sixpence.

the trajectories" which were then adapted to bands for the zoetrope. [20]

1879: The Zoöpraxiscope

We learn from Fairman Rogers's communication that Stanford and Muybridge had utilized the zoetrope for the same purpose early in 1879. Stanford had become interested in recreating the illusion of movement for others when he riffled through a stack of the Muybridge motion photographs and discovered the stroboscopic effect for himself. At this time, Leland Stanford, Jr., had an array of optical toys of different kinds, many of which are still in existence, which could have suggested the next steps—a magic lantern, a stereoscope, several chromotropes, a phenakistoscope and a zoetrope. Muybridge, again working at Stanford's suggestion and with his blessing, now developed his first viewer, a stereoscopic zoetrope based on the Wheatstone principle, which he claimed to have adapted from a model found in J.H. Pepper's *Boy's Playbook of Science*, published in London in 1854. This instrument has vanished without a trace, but it was soon succeeded by an ingenious second instrument, which Muybridge first called the zoögyroscope, later, the zoöpraxiscope, on which his fame as an early exhibitor of motion pictures came to rest.

The zoöpraxiscope combined a projecting lantern, rotating glass disks on which a limited number of hand-painted silhouettes (or, later, colored images), adapted from Muybridge's sequential photographs, were drawn, and a counter-rotating, slotted disk, geared to operate at equal speed, which acted as a kind of shutter and gave the effect of intermittent movement, as in the phenakistoscope.



The zoöpraxiscope made its official debut at the Stanfords' Palo Alto residence during a private party in the fall of 1879.[21] According to Muybridge, the images it projected were accurate enough for Stanford to identify each horse photographed from the rhythm of the gait. [See Documents, E.] Public showings throughout the next years justified the *Alta's* statement: "Mr. Muybridge has laid the foundation of a new method of entertaining the people, and we predict that his instantaneous, photographic, magic-lantern zoetrope will make the rounds of the civilized world."[22] Today one may still see Muybridge's improved zoöpraxiscope in Kingston-upon-Thames, Muybridge's birthplace. It stands in lonely splendor, somber and regal, in its glass case at the Borough Library. Of it, the British film historian Will Day once said, "One looks upon it with reverential awe!"

Muybridge was apparently not able to patent the zoöpraxiscope either in America, France or England. Thus he was careful not to claim to be its inventor. He did claim it to be the prototype for "synthetically demonstrating movement analytically photographed from life."[23] Certainly, it remained the only commercially demonstrated motion-picture projector in America for over a decade, or until Thomas Edison exhibited his projecting apparatus, the Vitascope, in 1895.

1880—1882: Fame Abroad and its Consequences

Stanford had two further projects in mind in 1880. The first was to sponsor the preparation of a substantial book on animal locomotion based on the data of Muybridge's photographs. The second was to sponsor exhibitions "before scientific bodies of the East, England and Europe" utilizing the Muybridge photographs and zoöpraxiscope. To this end, Muybridge prepared the pictures for publication, binding up sets of original prints into a number of albums, which he titled *The Attitudes of Animals in Motion*, and copyrighting them under his own name in 1881. Albums were presented to Leland Stanford, and some were later offered for sale abroad. Muybridge also worked on his zoöpraxiscope lectures in preparation for his appearances before the various "art and scientific societies" Stanford would select. Stanford had prepared the way for this in 1879, when he visited Europe with his family to commission family portraits from the French painters Bonnat and Meissonier. Meissonier's interest in the Palo Alto experiments had encouraged Stanford to invite Muybridge abroad, and to think of bringing "the entire equipment of electro-photographic apparatus to Europe and continue the experiments there. . ."[24]

Eadweard Muybridge arrived in Paris in August, 1881. On September 26th, Etienne-Jules Marey honored him at a reception in his home, where the guests were both foreign and French savants "whose names ranked high in the sciences."[25] During the following months, Muybridge worked with Marey at the "Physiological Station," sharing information about his photographic procedures and experimenting for the first time with the rapid gelatine dry-plate photography which he was then to adopt. On 26 November 1881, the art world of Paris was rallied to meet Muybridge, for Meissonier (who had recently completed Stanford's portrait, into which he had painted the Muybridge photographs) played host to two-hundred guests representing "the most eminent artists, scientists and literati of the day. . ."[26]

Stanford's name is nowhere mentioned in the guest lists. When the Stanford family left Paris for America on the day of the Meissonier reception, Muybridge "saw them off on the cars," and expressed the utmost concern over the Governor's poor health. [See Documents, F.] At first, Stanford's name had been mentioned regularly in the press as the enlightened patron who had made Muybridge's work possible, but as time went on, Muybridge himself became the popular and dominant figure, and was lionized on his own account. This was particularly true in England in 1882, where his lectures before the Royal Institution and the Royal Academy, and the publicity attending them, made him the most talked-about entertainer on two continents.[27]

Stanford's collaborative relationship with Eadweard Muybridge now underwent a decided change, and a series of misunderstandings began between the two men which led to an unreconcilable breach after almost a decade of productive work together.

The Horse in Motion, the book in which Stanford expected his findings on animal locomotion to be presented to the public, appeared in 1882, while Muybridge was lecturing in England. It was a handsome and richly illustrated quarto volume, described on the title page as being by "J.D.B. Stillman, A.M., M.D." Muybridge's name did not appear on the title page. A portion of Stanford's Preface was intended "to show the exact part taken by each of those concerned in the investigation." Here Muybridge found himself described as having been "employed" by Leland Stanford. Furthermore, the statement that he had written on the "method adopted" for the Palo Alto experiments was relegated to the Appendix, and was heavily edited by Stillman. Still worse must have been the fact that only five of the over one-hundred illustrations were direct reproductions of his photographs. The vast majority had been reduced to silhouettes by pen and ink, then transferred for printing to the lithographic stone.[28]

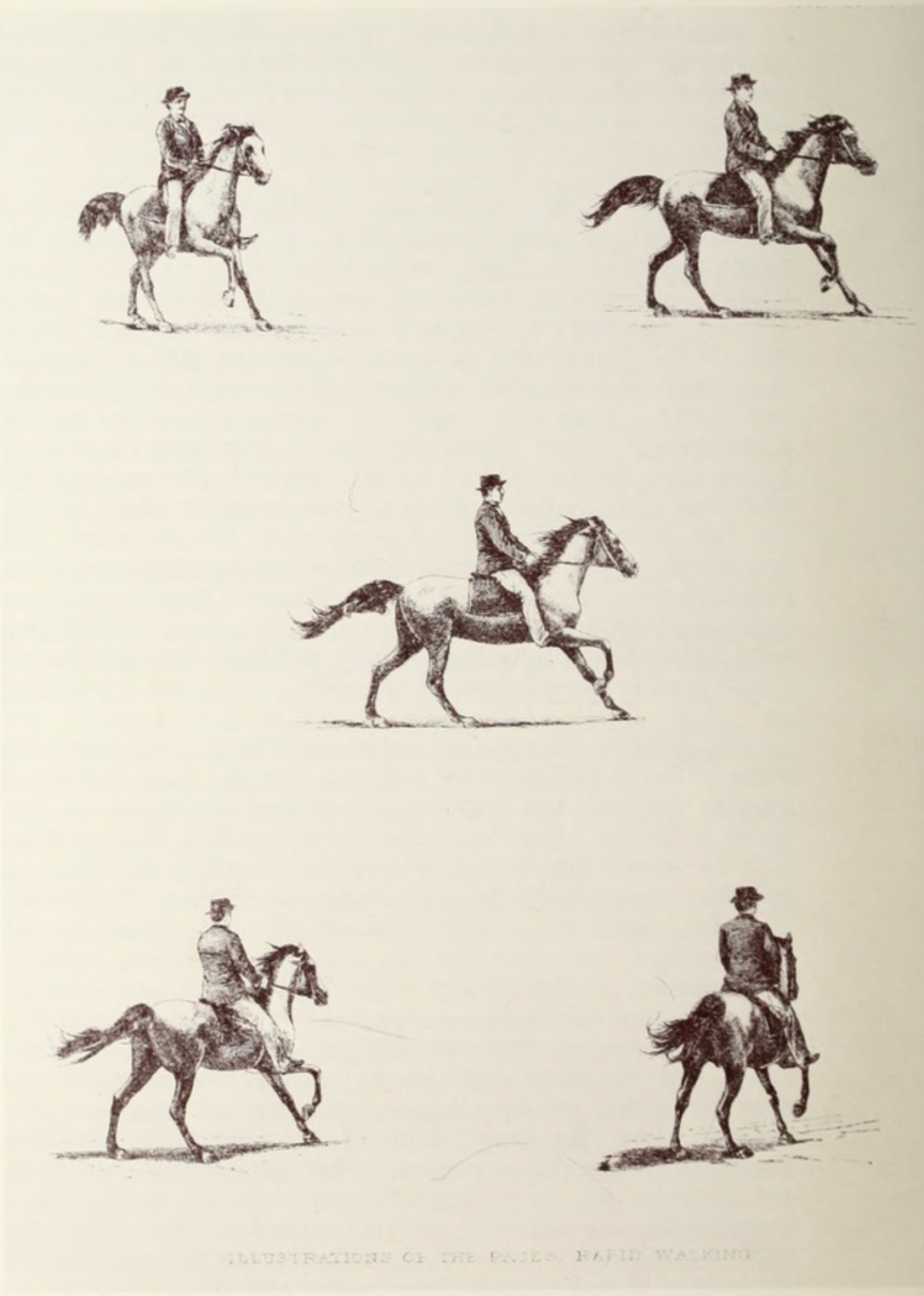
The blow to Muybridge's pride must have been enormous when he found that Stanford had seen him as a mere technician for the project, and that his personal contributions to *The Horse in Motion* had consequently been distorted. He responded with an open letter to *Nature* (London), in which he sought to put the matter straight from his own point of view: "I invented the means employed, submitted the result to Mr. Stanford, and accomplished the work for his private publication, without remuneration. I subsequently suggested, invented and patented the more elaborate system of investigation, Mr. Stanford paying the actual necessary disbursements, exclusive of the value of my time, or my personal expenses. I patented the apparatus and copyrighted the resulting photographs for my own exclusive benefit. Upon the completion of the work, Mr. Stanford presented me with the apparatus. Never having asked or received any payment for the photographs, other than as mentioned, I accepted this as a voluntary gift; the apparatus under my patents being worthless to anyone but myself. These are the facts; and on the basis of these I am preparing to assert my rights." [29]

The opposite point of view was expressed by Dr. J.D.B. Stillman (pioneer physician of California, and an early friend of Stanford in Sacramento), who prepared the text for publication: "With regard to the claims of Muybridge that the illustrations in silhouette are an infringement of his copyright. I have this to say that I can swear that they were all taken at the order of Gov. Stanford who paid all the expenses, furnished all the apparatus and material and Muybridge furnished me with all the copies from which the plates were executed knowing that they were to be used for the purpose to which they were to be applied. He also furnished him with magic lanterns and apparatus which he is now using to amuse the audiences in England and the money he used to travel and exhibit the movements of animals, and he imposed upon the Governor the idea that he possessed the most delicate chemicals enabled to produce the results when in fact he was far behind the times and processes were in use for years far more delicate and which he did not know of until he went to Europe." [30]

A troublesome legal suit, *Osgood vs. Muybridge* (Stanford's Boston publisher) was begun in the United States Circuit Court, Massachusettes District, on 14 September 1882. It was never brought to trial and was dismissed without prejudice or costs. Muybridge then immediately commenced a suit by attachment against Stanford, claiming $50,000 in damages. Stanford then claimed that, being interested in the study of animal locomotion, he had "solicited and employed" Muybridge as an expert photographer; that he had, further, employed "expert engineers, electricians, mechanics, assistants and laborers to assist in the project; that to him personally belonged "all the cameras, plates, paper, chemicals, machinery, apparatus, appliances, models, subjects, skill and labor," including the skill and labor of Eadweard Muybridge. Muybridge lost his second case. It was nonsuited by judgment in a motion rendered on 13 February 1885. By this time, Stanford's only son, Leland Jr., had died, and his and Mrs. Stanford's abiding concern was to establish a university in his memory. Muybridge was occupied with his work at the University of Pennsylvania.

Stanford's last thoughts about Muybridge were written to Stillman as follows: "I think the fame we have given him has turned his head..."[31] Stanford's last thoughts about *The Horse in Motion*, which had a singularly bad time of it on the market, were these, written to Stillman: "Don't allow the matters to worry you. If the people don't buy the book it is their misfortune as well as ours. As a money matter, if I am not

Muybridge, *"Studies of Foreshortenings,"* Mahomet running 1879
print from wet-plate collodion glass negative
Photograph 145, *Attitudes of Animals in Motion,* 1881
Stanford University Museum of Art



"Illustrations of the Paces"
lithograph from Muybridge photograph
Plate LXXV, J.D.B. Stillman, *The Horse in Motion,* 1882
Rare Books and Special Collections, Stanford University Libraries

called upon to pay more, it is of the past. . ."[32]

The history of the Stanford/Muybridge falling out is a subtle one, largely disclosed by the depositions which were gathered in 1883 by Stanford's lawyers in preparation for contesting the suit of attachment brought against Stanford by Muybridge. The depositions and letters of Muybridge and others which will be cited below, have recently been made available by the George Arents Research Library of Syracuse University, where they form part of the Collis P. Huntington Collection; they provide many of the heretofore missing links in the history.

We know from the Huntington papers that in the 1870s, Stanford and Muybridge grew to be close friends. Muybridge used to call at Stanford's Palo Alto house in the evenings, "and they would sit together sometimes for several hours talking and discussing. . .even when he would come to town [Muybridge] would call at the office and see Governor Stanford at any time."[33] Business arrangements between them were quite loose. Muybridge lived at the Farm and had all his personal and professional expenses paid there without question. In fact, under the superintendency of Mr. Dibblee Poett, Muybridge had *carte blanche.* Muybridge never set a definite fee for his professional services, expecting that Stanford would reward him handsomely if he was pleased with the final results of the work. Stanford, in turn, allowed Muybridge to copyright the photographs in his own name and to take out patents in his own name, saying that what he could earn from them was his. At one point, Muybridge offered to turn all those copyrights and patents over to Stanford, but the gesture was refused.

Perhaps the first upset in the relationship came when Stanford announced that he had invited Dr. J.D.B. Stillman to write *The Horse in Motion.* From the start, Muybridge had difficulties with Stillman. The thirty-five page account of his work at Palo Alto which Stillman had requested of him for inclusion in the book was set aside as "ungrammatical, redundant and full of hyperbole, which would make the whole thing ridiculous just like that newspaper article published in the *Examiner*. . ."[34] Muybridge wrote a short statement in place of it, and even this Stillman subsequently altered to suit his purposes without Muybridge's knowledge or approval. In this matter Frank Shay took sides with Stillman rather than with Muybridge. Shay had replaced Poett as superintendent of Palo Alto Farm, and under his regime things began to tighten up a bit for Muybridge. For example, on Muybridge's departure for Europe, Frank Shay and Ariel Lathrop fixed upon $2,000 as a suitable amount to pay him for his several years of work for Leland Stanford. This Muybridge accepted, but the amount must have seemed shockingly little to him.

That Stanford and Muybridge remained friends even after this incident we know from Muybridge's letter to Frank Shay of November 28, 1881, cited above. We also know that Muybridge had been unsuccessfully trying to interest Stanford in supporting new photographic experiments abroad: "I have been waiting the disposition of the Governor since the 1st Octr. . . .I believe he proposes to return next spring; by that time I shall hope to be in full operation experimenting with new subjects. . ."[35]

As it became apparent that Stanford was not picking up his option to finance further experiments abroad, Muybridge overplayed his hand, first by indicating to Shay that he would shortly visit England "for the purpose of inducing some wealthy gentleman (to whom I have letters of introduction) to provide the necessary funds for pursuing and indeed completing the investigation of animal motion. . ."[36] then by announcing on December 23rd that "important events have transpired which will render an extended residence in Paris necessary; and at the same time relieve me of the anxiety under which, as you well know, I have for a long time been existing."[37]

The project as outlined by Muybridge (but never completed) was for Meissonier, Marey, a "capitalist" friend of Meissonier's and Muybridge to collaborate on "a new series of investigations which I intend shall throw all those executed at Palo Alto altogether in the shade."[38] Governor Stanford was asked to join in this project, but he evidently declined. Why join in a project that would throw his Palo Alto project "altogether in the shade"? The unfortunate wording of Muybridge's letter shows that he was, on the one hand, angry with Leland Stanford for undervaluing him; and, on the other hand, that he was painfully reluctant to lose him as a patron: "one of the conditions of the agreement is, that Meissonier is to have control of the results, and that I shall assign to him my present American and European copyrights and also those I make next season. In consideration of which I shall receive payment for the times I was working in connection with their production, and at my ordinary rate of payment for work in California, this will of course be quite a sum. M. Meissonier himself is not activated by any selfish motives, neither do I suppose is his friend (who the

"friend" is I do not know) for he assures me he is very rich; but I really believe and so does M. Meissonier it will be an investment that will pay for itself, and very probably a profitable one."[39]

This playing off of Stanford against the competition of an unknown "capitalist" brought only negative results. These Muybridge felt in England in 1882 when *The Horse In Motion* came out without his name on the title page as he had expected. The suit of attachment which followed closed the door on further Stanford/Muybridge collaboration.

The cruelest blow dealt Muybridge during the trial was dealt by Stillman in a letter to Alfred Cohen, Stanford's lawyer: ". . . I believe Muybridge to be a very unsafe and unscrupulous man. If he does not wear hay on his horn he does carry a pistol in his pocket and he did shoot a friend in the back and plead insanity."[40]

One little-known fact about Dr. J.D.B. Stillman serves to put his critical ability in perspective. In a careful reading of *The Horse in Motion* made in November, 1882, by Wm. R. French, brother of the American sculptor, Daniel Chester French, twenty-seven errors were found in the plates; forty-nine errors were found in the first four chapters alone. He thought that "A person entirely unacquainted with anatomy could hardly hope to find his way through the entaglements. . ."[41] *Sartor Resartus.*

1882-1904: Further Studies and Retirement

While the Stanford years were Muybridge's years of creative expansion, the years which followed were his years of greatest acclaim, both here and abroad. From 1882 to 1884, he was heavily occupied as a public speaker in America. His topics were: "The Attitudes of Animals in Motion," and "The Romance and Reality of Animal Locomotion." Now came his invitation to carry out an exacting program of camera research at the University of Pennsylvania, where he worked during 1884 and 1885 with elaborate batteries of cameras to produce the some 100,000 photographs of animals and the human figure in motion which were published in the fall of 1887 as *Animal Locomotion.*

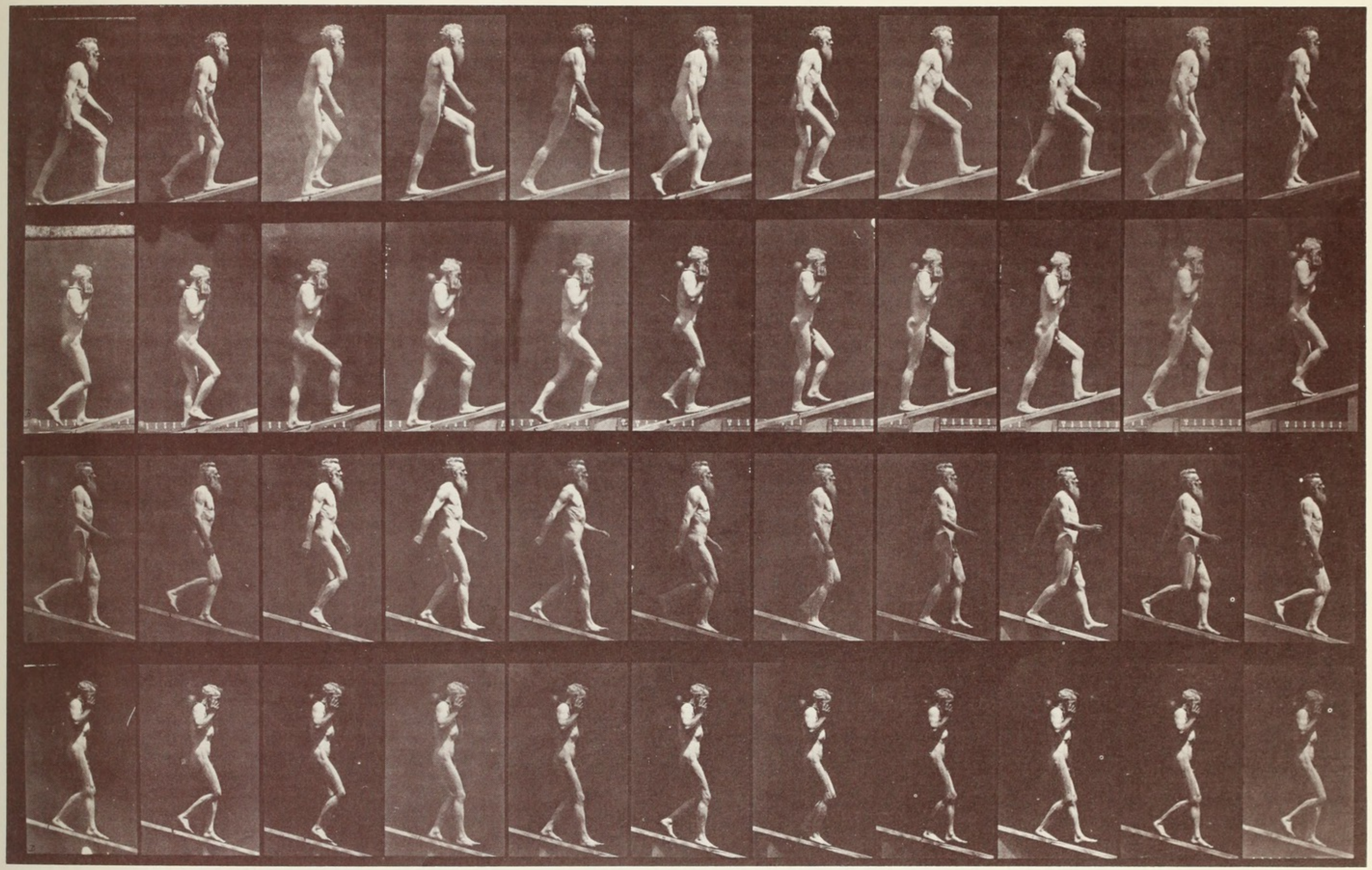
This gigantic work, which is known today as his magnum opus, led to subsequent lecture tours in America, Great Britain, Germany, France, Italy and Switzerland. HIs lecture topic was "The Science of Animal Locomotion in its Relation to Design in Art." In 1893 Muybridge projected his pictures at the World's Columbian Exposition in Chicago, and in a "motion picture theatre" expressly built for that purpose. His *Descriptive Zoöpraxography, or the Science of Animal Locomotion Made Popular*, was published by the University of Pennsylvania at this time.

Around 1894, Eadweard Muybridge returned to England and settled again in his birthplace, Kingston-upon-Thames. Between 1894 and 1896, he carried out busy lecture schedules in the British Isles. In the fall of 1897, he completed negotiations with the London firm of Chapman & Hall for the proper publication of the two volumes in which he planned to summarize his life's work: *Animals in Motion* (1899) and *The Human Figure in Motion* (1901). His satisfaction in seeing these two volumes of photographs in print, financially rewarding, and within reach of students, scholars and artists, carried him along for the next years in the glow of pride and comfortable retirement. He prepared an enormous scrapbook of his press

Muybridge, *Animals in Motion,* 1899, p. 159

1 2 3 4 5 6 7 8 9

SILHOUETTES SELECTED FROM THE RESULTS OF THE PALO ALTO INVESTIGATION, 1872–79, ALL OF WHICH RESEMBLE PHASES THAT HAVE BEEN, AT VARIOU
TIMES, ADOPTED BY ARTISTS AS THEIR INTERPRETATION OF THE GALLOP OF THE HORSE.



Muybridge, Plate 489, *Animal Locomotion* 1887
Model No. 95, "an ex-athlete, aged about sixty. . . A, ascending incline;
B, ascending incline with 50-lb. dumb-bell; C, descending incline
D, descending incline with 50-lb. dumb-bell."
gravure print, 17 5/8 x 25 3/8 in., Stanford University Museum of Art

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Die Räder eines leichten Sulkys gerathen im scharfen Tempo in eine flatternde Bewegung, welche die Schärfe des Bildes natürlich beeinträchtigen mußten. Am Boden stehen sie fest, daher der scharfe Abdruck. Die feste Stellung theilt sich dem oberen Rand, wenn auch geschwächt mit, daher oben deutlicher, wie an beiden Seiten.

Das ist der einfache und natürliche Grund der Erscheinung, wozu es kaum nöthig erscheint, die Gesetze der Natur über den Haufen zu werfen. Wenn die Erfindung auch einen riesigen Fortschritt der Photographie bekundet, so muß man mit weiteren Schlüssen für das praktische Leben doch sehr vorsichtig sein. — Soll für die Hippologie und die Malerei hieraus ein Nutzen gestiftet werden, so wäre es vor Allem erforderlich, die einzelnen Momente der Stellungen durch einen geschickten und denkenden Künstler vergrößert und verdeutlichert dem Studium zugänglich zu machen. Eine solche Initiative läge aber ebenso sehr im Interesse des Ministeriums des Krieges, wie in dem der Landwirthschaft. —sp.—

Illustrirte Sport-Zeitung
(Berlin) 20 April 1879

(Augenblicks-Photographien.) Eine für jeden Reiter und Pferdekundigen höchst interessante Verwerthung der Photographie ist einem Photographen in San Francisco, Mr. Muybridge, damit gelungen, dass er das Pferd — sowohl das eingespannte wie das geritten — während der Bewegung in mehreren Augenblicks-Bildern aufgenommen hat. Je nach der Schnelligkeit der Gangart, also je nach der minder oder mehr energischen Thätigkeit der Glieder bei der Bewegung, sind weniger oder mehr Augenblicksbilder der einzelnen Momente für Einen Pas aufgenommen, z. B. 6 Bilder für Ausführung eines Schrittes bei einer Schnelligkeit von 107 Meter in der Minute, dagegen 12 Bilder für eine Bewegung mit 965 Meter in der Minute. Im Ganzen sind 6 Gangarten dargestellt auf 6 Tafeln mit 42 Bildern. Diese Photographien geben uns eine vollständig neue Anschauung von all' den Stellungen, welche das Pferd während jeder Bewegung annehmen muss, und können also auch über die richtige Einwirkung, die der Reiter gleichzeitig auf das Pferd auszuüben hat, belehren. Die Bilder sind für 24 Mark durch die königliche Hofbuchhandlung von E. S. Mittler und Sohn in Berlin, Kochstrasse 69, zu beziehen.

Photographic Times. July

FAST HORSES AND WELL-MADE APPARATUS.

WHAT possible connection can there be between a fast horse and a camera-box? one would naturally ask upon reading the above. We answer, much, very much; and, in the language of the famed conqueror of nations, Ulysses, add

. . . "Shall I say to you
Somewhat, or shall I keep it back? My heart
Moves me to say it."

It is this. Our American Optical Co.'s apparatus, Ulysses like, is always making conquests, and it has recently made another, though on a field where victory has often been obtained by it before.

Journal Amusant (Paris) 7 June 79

« Le Colonel Duhousset, qui joint l'habileté du dessinateur à une parfaite connaissance de l'extérieur du cheval, a tenté un travail des plus intéressants. Dans une récente publication, il a montré les qualités et les défauts de certaines œuvres artistiques

Fig. 73. — Mouvements progressifs du cheval entraînant le galop.

modernes. Ce résumé se trouve à la suite d'une brochure dans laquelle il explique, avec autant de précision que de concision, tout ce qu'il faut connaître de l'extérieur pour dessiner l'animal qui nous occupe... » La brochure se trouve dans les bureaux de *l'Illustration*, 22, rue de Verneuil.

Our readers are all familiar with the triumphs of Mr. Edward J. Muybridge, of San Francisco, in making his marvellous photographs of trotting horses while in motion. No one has approached him in such work, and yet he is free to express the advantages given him by the apparatus he used, as will be seen by the letter from him below, and which will clear up the mystery of the title hereof, viz.:

417 Montgomery Street,
San Francisco, May 23d, 1879.

Scovill Manufacturing Co.,
419 and 421 Broome Street, New York.

The Camera duly arrived. In reference to it I scarce know which emotion to express most emphatically, delight or astonishment; probably the former, as the thirty Cameras of your manufacture which I have now in use afforded me ample right to expect your skilful assistants would have abundant genius to accomplish most successfully the task imposed upon them. In simplicity of design, adaptability to any possible purpose, facility of use, strength of construction, suitability of material selected, extreme lightness, and elegance of finish, this Camera affords abundant evidence of the remarkable skill of your operatives, and the comprehensive resources of your manufactory. I very much question whether ever before was there constructed an 8 x 10 Camera equally well adapted for the studio or the field, and so convenient for any required purposes, whether with one or a pair of lenses of focal length ranging from 2½ to 26 inches,

and weighing 5½ lbs only
permit me to congratulate you
Muybridge

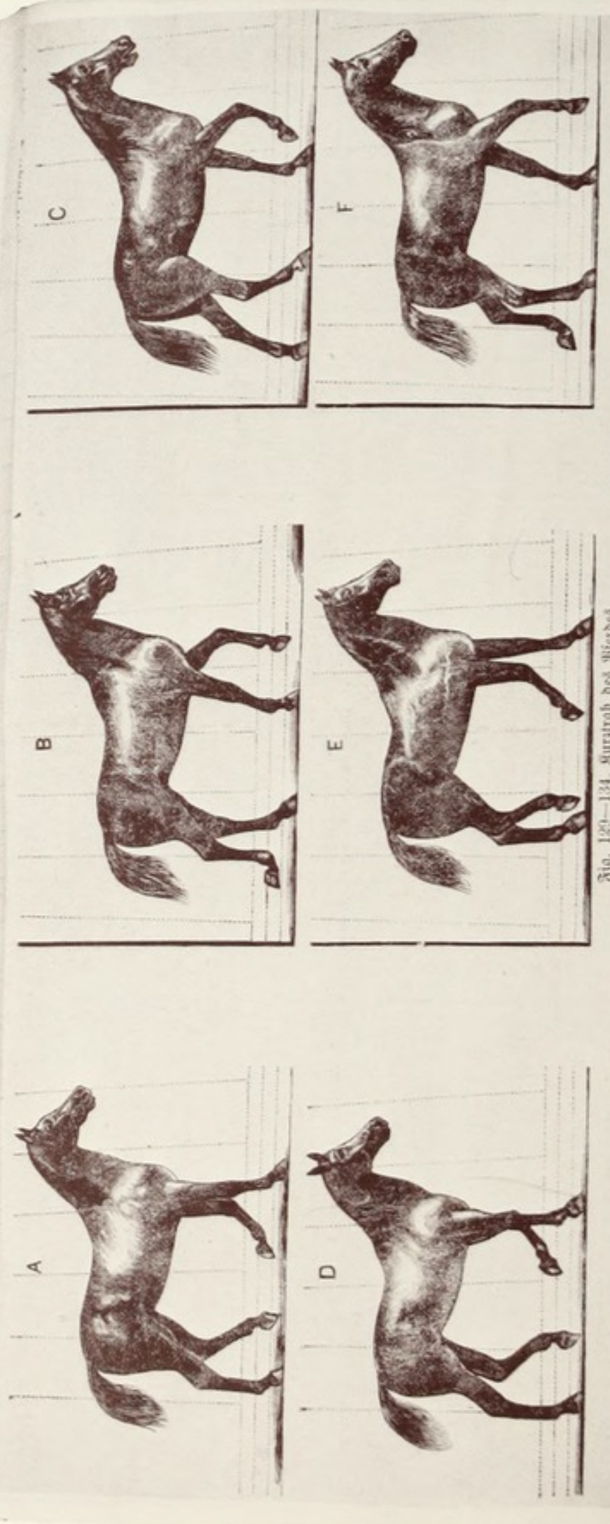

Fig. 129—134. Kurztrab des Pferdes.

Wiener Landwirthschaftliche Zeitung 26 April 1879

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Der Kurztrab des Pferdes, wissenschaftlich hergeleitet.

In der Nummer 1 des gegenwärtigen Jahrganges d. Bl. wurde unter der Ueberschrift: „Die Gangart des Pferdes, wissenschaftlich hergeleitet" die neueste Thatsache mitgetheilt, daß es dem Nordamerikaner Muybridge aus San Francisco gelungen, einen automatischen elektro-photographischen Apparat so zu vervollkommnen, daß er mit dessen Hilfe die Bewegungen des Pferdes in einer Reihe von Augenblicksphotographien fixiren konnte, und es wurde eine Reihe von solchen Augenblicksbildern vorgeführt, welche das Pferd „Abe Edgington" im Schnelllaufe mit dem Tempo von 2 Minuten 24 Secunden pr. englische Meile darstellten. Die große Beachtung, welche diese Mittheilung in allen betheiligten Kreisen gefunden hat, ist der Anlaß, daß in den beifolgenden sechs Abbildungen, Fig. 129—134, dasselbe Pferd nochmals wiedergegeben wird, wie es im Kurztrabe in fünfzehn Minuten eine englische Meile (nicht voll ein Fünftel geographische Meile) zurücklegt. Es ist auch bei diesen Bildern der Lenker und das Gefährte als überflüssig weggelassen worden und es wird zur Erläuterung nochmals hervorgehoben, daß die Negative eines jeden einzelnen Augenblicksbildes den zweitausendsten Theil einer Secunde der Einwirkung des Lichtes exponirt gewesen ist, und daß ferner die zum besseren Verständniß auf den Bildern gezogenen Verticallinien im Hintergrunde 28 engl. Zoll (0·71 Meter) von einander entfernt sind, sowie daß die dicken Horizontallinien die ebene Erde darstellen, worauf das Pferd sich bewegt, während die darüber gezogenen punktirten Horizontallinien die Erhebungen über dem Erdboden von vier, acht und zwölf Zoll (10, 20, bez. 30 Centim.) markiren. Es sind diese Linien, wie gesagt, für die Analyse der Bewegung des Pferdes unerläßlich.

Nun ist es bei diesen Bildern sehr interessant zu beobachten, daß das Pferd im Kurztrabe, der dem Schnellschritt ziemlich nahe steht, immer zwei Beine und während eines kurzen Augenblickes bei jedem Ausschreiten (Fig. 131, C) drei Beine auf dem Boden hat. Die Stellungen der Beine, wie sie die Fig. 129, A und 133, E anschaulich machen, weisen ferner ein Ausschreiten des Pferdes von vier Fuß vier Zoll (1·23 Meter) nach, während dasselbe Pferd im Schnellauf, bei dem Tempo von zwei Minuten 24 Secunden pr. englische Meile, über achtzehn Fuß (5·49 Meter) macht. Bemerkenswerth ist, daß das Pferd bei diesem langsamen Gange die Beine in der Regel nicht über vier Zoll (10 Centim.) vom Boden aufhebt und daß nur in einem Momente das linke Vorderbein (Fig. 132, D) sich acht Zoll (20 Centim.) hoch erhebt, während das linke (Fig. 134, F), wie rechte (Fig. 130, B) Hinterbein nur ein wenig über, bez. letzteres genau vier Zoll (10 Centim.) hinten ausgeworfen wird.

Auch hierbei möchte sich wieder empfehlen zur Erzielung des leichteren Verständnisses diese sechs Bilder auf Streifen zu kleben und in ein Zootrop einzufügen, weil auf diese Weise es am besten ermöglicht wird, die verschiedenen Positionen des Pferdes im Kurztrab oder Schnellschritt durch die einzelnen Phasen dieser Bewegung genau und klar zu beobachten.

Da der Entdecker dieser wissenschaftlichen Herleitung der Gangart des Pferdes auch Abbildungen vom Carrière und Galopp des Pferdes hergestellt hat, ist es Allen, die sich speciell dafür interessiren, anheimgegeben, sich direct an Mr. Muybridge, Photograph, 417 Montgomery Str., San Francisco, California, zu wenden. P. Smith.

A page from the scrapbook of clippings and leaflets that
Muybridge assembled during his retirement in Kingston-upon-Thames
256 numbered pages, 10¾ x 8¼ in., and many inserted pages
Central Library, Kingston-upon-Thames

clippings, which he bequeathed, along with his accumulation of negatives, lantern slides, technical books and instruments, to the Kingston Borough Library. He lived to see the advent of the commercial motion picture, and with it, the rise of the numerous claimants who said that they had "invented" the cinema. Only once did he involve himself in this controversy. In 1897 he reminded the editor of the *Camera Club Journal* of the fact that he had himself accomplished the synthesis of instantaneously taken analytical photographs in the zoöpraxiscope as early as 1879; that Marey's "successful obtainment of consecutive phases of motion with a single lens upon a strip of sensitized material" (in 1882) represented, in his opinion, the next stage of improvements; and that Edison's "first application of a strip or ribbon containing a number of. . . figures in a straight line (instead of being arranged on a large glass disk), for lantern projection" (in 1893) was the final bridge to the modern cinema. [42]

He later made similar statements in the Prefaces to *The Horse in Motion* and *The Human Figure in Motion.* With these statements clearly made, and his own position in the development of the study of motion put on record, Muybridge withdrew from professional concerns entirely. He relinquished his work with dignity and serenity, clear about the future: "Science advances." He foresaw the story film, but wanted no part in its commercial development. His aims had been artistic and scientific. His means had been sufficient to them.

He took up the homely life of family, friends, reading and gardening. At the time of his death in 1904, he was constructing a scale model of the Great Lakes in his garden.

Muybridge's work remains one of the great monuments of nineteenth-century artistic and scientific endeavor. Its prophetic character still influences artists and scientists today. How prophetic it was may perhaps best be seen in the prediction which he made in *Animals in Motion:* in the not too distant future, he wrote, "instruments will be constructed that will not only reproduce visible actions simultaneously with audible words, but an entire opera, with the gestures, facial expressions, and songs of the performers, with all the accompanying music, will be recorded and reproduced by an apparatus combining the principles of the zoöpraxiscope and the phonograph, for the instruction and entertainment of an audience long after the original participants have passed away. . ." [43]

Notes

1. Business advertisement for "E. J. Muygridge, 113 Montgomery Street and 163 Clay Street, San Francisco," c. 1858. The California Historical Society, San Francisco.
2. The Bancroft Library, University of California, Berkeley. The Bradley & Rulofson firm first published Muybridge's work in 1873. After his return from Central America in 1875, Muybridge's publisher was Morse.
3. Helen Hunt Jackson, *Bits of Travel at Home*, Boston, 1886, p. 86. This is an anthology of the author's articles on travel in the United States, which were serialized in Boston newspapers in the 1870s. Portions published in 1872 are found in Muybridge's Scrapbook at the Borough Library, Kingston-upon-Thames, p. 9. For a description of the scrapbook that he assembled toward the end of his life, see illustration, p. 32.
4. *Alta California* (San Francisco), 30 August 1877. Kingston Scrapbook, p. 19. Muybridge always gave Stanford full credit for the idea of applying photography to the study of the horse in motion, but not for the procedures developed to do it. The so-called "bet" as a motivation for the experiments has, in the writer's estimation, no bearing on the experimental work, and, as a consequence, has been left out of the present discussion.
5. E. J. Muybridge, *Animals in Motion*, London, 1899. All following brief Muybridge quotations whose source is not given are from his Preface to this publication.
6. *Alta California*, 7 April 1873.
7. This episode in Muybridge's life has also, in the writer's opinion, been overemphasized, in relation to his work, particularly by Terry Ramsaye, in *A Million and One Nights*, New York, 1926.

8. San Francisco *Bulletin*, 3 August 1877. Kingston Scrapbook, p. 19. This evidence that Muybridge had an inventive and independently theoretical turn of mind is borne out also by a series of mechanisms that he developed and often sought to patent: 1) a plate-printing apparatus, 2) a washing machine, 3) a sky-shade for landscape photography, 4) a method for photographing objects in motion, 5) the zoöpraxiscope, 6) a pneumatic clock, 7) a picture-feeding device for magic lanterns. He was apparently well-qualified to oversee and coordinate the technical aspects of the Stanford/Muybridge research. [See Documents, A.]
9. *Alta California*, 30 August 1877. Kingston Scrapbook, p. 19. Quoted from Muybridge's letter of 24 August to MacCrellish, editor of the *Alta*.
10. *Ibid*. Quoted from MacCrellish's comments.
11. San Francisco *Evening Post*, September 1877. Kingston Scrapbook, p. 12.
12. For further discussion of this curious recent find at the Stanford Museum, see "Catalogue and Notes on the Work." There was certainly a photographic plate of Occident, quite apart from Muybridge's copy negative of the painting based on that plate.
13. The Stanford Museum holds two canvases by P.R. Van Zandt of Albany, New York: 1) a sketch of Abe Edgington, "September 13, 1876 " (and on the stretcher, in pencil, "Oct. 3, 1876," which may have been the day of its receipt by Stanford); 2) an oil painting of Edgington based on the sketch, but with minor correction of position, "Feb. 1877."
14. San Francisco *Evening Post*, 3 August 1877. Kingston Scrapbook, p. 17.
15. *British Journal Photographic Almanac, 1872/1873*, p. 115. Rejlander's proposal was theoretical.
16. Depositions of Arthur Brown (18 July 1883), John D. Isaacs (18 July 1883), and Frank Shay (23 July 1883) in the case *Stanford vs. Muybridge*. The Collis P. Huntington Collection, George Arents Research Library, Syracuse University. See also *Resources of California*, August 1878. Kingston Scrapbook, p. 28. The name of John D. Isaacs, who was later said to have "devised the electrical equipment" for the project, was never publicly mentioned in contemporary sources. In the writer's opinion, Isaacs's status was overestimated in the "Semi-Centennial" celebration held at Stanford University in 1929.
17. Letter, John D. Isaacs to H. C. Peterson, curator of the Stanford Museum, 15 February 1916. Stanford University Archives. In his deposition, Isaacs had previously credited Mr. Paul Seiler with an alteration in the mechanism, which changed it to "operate the release by making instead of breaking contact. . ." Contemporary accounts are apt to connect the use of electricity in the Stanford/Muybridge project to Stanford's earlier experience with it when he drove the final spike for the transcontinental railroad in 1869, and simultaneously telegraphed the news to the world.
18. San Francisco *Morning Call*, 8 June 1878.
19. Marey's letter to *La Nature* is dated 18 December 1878. It was printed in the December 28th issue and appeared in English translation as well in the San Francisco *Morning Call*, 23 February 1879. Muybridge responded to Marey in *La Nature*, 22 March 1879. [See Documents, C, for texts of the exchange.]
20. *The Art Interchange* (Philadelphia), 9 July 1879. [See Documents, D, for the full text.] Eakins' s use of Muybridge's *The Horse in Motion* photographs in teaching at the Pennsylvania Academy led to his later supporting the University of Pennsylvania's invitation to Muybridge to undertake further research there. Eakins and Muybridge worked together for a brief period.
21. Cited in George T. Clark, *Leland Stanford, War Governor of California, Railroad Builder and Founder of Stanford University*, Stanford University Press, 1931, pp. 367-68. Mr. Frank Shay dated the first private showing as July 1878, "with quite a number of private exhibitions in Governor Stanford's house in San Francisco following. . ." (Deposition of Frank Shay, 23 July 1883). Shay, however, gave a wrong date for another important event, and may also be inaccurate in this case. [See introduction to Documents, E.] Another private showing was held at the Stanfords' San Francisco residence on 20 January 1880 (Kingston Scrapbook, p. 57), nine days after Muybridge photographed the solar eclipse at Palo Alto for Leland Stanford. The first public performance, recorded in several San Francisco newspapers, was on 4 May 1880 at the chambers of the San Francisco Art Association. Kingston Scrapbook, p. 58.
22. *Alta California*, 5 May 1880. Kingston Scrapbook, p. 58. Muybridge successfully exhibited his motion pictures before paying audiences from 1880 to 1897, when he retired from photography to prepare *Animals in Motion* and *The Human Figure in Motion* for publication.
23. *Animals in Motion*, p. 4. The zoöpraxiscope was preceded by various projecting machines,even projecting phenakistoscopes, which were developed in both Europe and America. None of these, however, used images "analytically photographed from life," but only pre-posed sequences that did not require instantaneous photography as a component.
24. San Francisco *Examiner*, 6 February 1881. [See Documents, E.] Many San Francisco newspapers reported Stanford's intention of carrying the results of the experiments abroad. Kingston Scrapbook, p. 65.
25. *Alta California*, 16 November 1881. Kingston Scrapbook, p. 71.

26. The Marey reception: *Le Globe*, 27 September 1881. The Meissonier reception: *Figaro*, 27 November 1881. [For an excerpt from *Le Globe*, see Documents, I.] Kingston Scrapbook, pp. 68, 71.

27. *The British Journal of Photography* for 17 March 1882 reports: "On Monday evening, at the Royal Institution, Albemarle-street, the first public exhibition in this country was given [by Muybridge] in the presence of the Prince and Princess of Wales, the Princesses Louise, Victoria and Maud, the Duke of Edinburgh and suite, whilst among the leaders of the scientific and literary world we recognized Professors Tyndall, Huxley, Owen, and Gladstone, the Poet Laureate, and many others.

    "On Tuesday evening last, again, in the lecture room of the Royal Academy, in the presence of Sir Frederick Leighton and most of the Academicians and Associates and a large number of guests, the exhibition was repeated, to the evident satisfaction of all, as the hearty applause which greeted most of the pictures testified." Kingston Scrapbook, p. 75.

28. J.D.B. Stillman, *The Horse in Motion*, Boston, 1882. Muybridge claimed that before he left America, he had approved a different title page, which included his name, and that Stillman had assured him that the book was to be "photographically illustrated." [For Stanford's Preface, see Documents, F. For Muybridge's claim, see Documents, H.]

29. *Nature* (London), 27 April 1882. Kingston Scrapbook, p. 83. [For full text, see Documents, F.] Muybridge maintained the position that he stated here throughout his lifetime. Always an independent, he did not relish being called an employee. The issue was resolved after Stanford's death in 1893, when Muybridge assumed full rights to the pictures and reestablished his public image by reproducing them *photographically* as part of his *Animals in Motion* and *The Human Figure in Motion.*

30. Letter, Stillman to the publisher, James Osgood & Co., 10 April 1882. Stanford University Archives. Stillman may have been referring to the faster gelatine process, which was not available when the Stanford/Muybridge experiments were going on.

31. Letter, Stanford to Stillman, 23 October 1882. Stanford University Archives. [For the full text, see Documents, F.]

32. Letter, Stanford to Stillman, 5 January 1883. Stanford University Archives.

33. Deposition of Frank Shay, 23 July, 1883, in *Stanford vs. Muybridge*. This deposition and depositions and letters cited below are in the Huntington Collection, George Arents Research Library, Syracuse University.

34. Deposition of J.D.B. Stillman, 7 August 1883. [See Documents, E.]

35. Letter, Muybridge to Frank Shay, 28 November 1881. [The matter can be followed in the material reprinted in Documents, F.]

36. *Ibid.*

37. Letter, Muybridge to Frank Shay, 23 December 1881.

38. *Ibid.*

39. *Ibid.*

40. Letter, Stillman to Alfred A. Cohen, 25 July 1883.

41. William R. French, *The Horse in Motion, Notes and Criticisms*, November, 1882. Manuscript, University of Pennsylvania Library.

42. *The Journal of the Camera Club*, London, p. 190 ff. Kingston Scrapbook, p. 196, ff. [For Muybridge's letter, dated 9 November 1897, see Documents, I.] Photography of motion was not Muybridge's only interest after 1882. He continued his landscape photography until the late 1890s. Many views taken during this later period exist only in the form of lantern slides at the Science Museum, London.

43. E. Muybridge, *Animals in Motion*, London, 1899, p. 5.

Robert Bartlett Haas is Director of Arts and Humanities Extension, University of California at Los Angeles.
His biography, Muybridge, Man in Motion,
is forthcoming from the University of California Press

Uncut stereo view of the Stanford residence in Sacramento

Photographs by Muybridge, 1872–1880
Catalogue and Notes on the Work

Anita Ventura Mozley

1872

The Stanford Sacramento Home
twenty-three glass negatives, 6 x 10 in.

The negatives are in the collection of Stanford University Archives. Prints from them have been made for the exhibition by the photographer Ralph E. Talbert

In May, 1868, Muybridge announced that "Helios" was prepared to accept commissions to photograph "Private Residences, Views, Animals, Ships, etc., anywhere in the city, or any portion of the Pacific Coast." The photographs of the Leland Stanford home at Eighth and N Streets in Sacramento are fairly typical of the work he did for the owners of large homes or estates in Northern California: the exterior of the house is shown, in views from varying distances; the entranceway next; the foyer; then the rest of the interior, room by room. Often members of the family sit for a portrait; the grouping is an informal one, taken as it is among the subjects' familiar surroundings. The really exceptional scene in this series is that of Jane L. Stanford and her sister playing billiards, while her son Leland sits watching. This photograph suggests a greater intimacy between Muybridge and the family whose home he was photographing than was usually the case.

Even in his "straight" coverage of the residence's interior, Muybridge produces views more dramatic than the heavily furnished rooms would seem to afford, for he often shoots straight into the sunlit windows, and is obviously not bothered by the effect this produces, as a more conventional photographer would be.

Jane L. Stanford, Leland Stanford, Jr., and Mary Lathrop in the Stanfords' billiard room

Leland Stanford bought the Sacramento residence shortly after being nominated in 1861 as the Republican (and pro-Union) candidate for Governor. In 1871, he had the house raised, a basement constructed and additions made, of which the front entrance's grand stairway is the most notable. Muybridge's 1872 photographs of it are presently being studied by the Sacramento Landmarks Commission, which is restoring the Stanford Home to the condition it was in when the Stanford family occupied it.

Valley of the Yosemite, Early Morning from Moonlight Rock B&R 2
Yosemite National Park Museum

1872

Views of the Valley of the Yosemite, The Sierra Nevada Mountains and The Mariposa Grove of Mammoth Trees

Albumen prints from wet-plate collodion glass negatives

Fifty-one 18 x 22 in. views (Bradley & Rulofson catalogue numbers 1-51).[1] Titled and mounted on 22 x 26 in. tinted boards

Thirty-six 5½ x 8½ in. views (B&R 4173-4208). Mounted on boards 11 x 14 in.

Three-hundred and seventy-nine stereos, each frame 3 x 3¼ in. (B&R 1131-1509). Mounted on cards for the steroscope

Published by Bradley & Rulofson, San Francisco, 1873

Prints from this series selected for the exhibition are from the collections of the Yosemite National Park Museum, the Oakland Museum and the Stanford University Museum of Art

The 1872 series of Yosemite views was Muybridge's first major photographic work. He realized this himself: for the first time he issued photographs under his own name, rather than under the pseudonym "Helios." His publisher, Bradley & Rulofson, advertised them as "the most perfect photographs ever offered for public inspection," and were more justified in the boast than is usually the case. The superiority of the 1872 series was acknowledged by the judges of landscape photography at the Vienna Exhibition of 1873, who awarded the Muybridge views the International Gold Medal for Landscape. (Bradley & Rulofson was quick to capitalize upon their prize-winning photographic artist; they thereafter added to their stamp, which already carried medals for preëminence in "San Francisco" and "The United States," the legend, "The World.") And another example of high critical acclaim from abroad is found in the regular monthly letter to the journal *The Philadelphia Photographer* from Dr. Hermann Wilhelm Vogel, a photographer himself, professor at the Berlin Technische Hochschule, inventor, author and, later, teacher of Alfred Stieglitz.[2] The following remarks on Muybridge's Yosemite photographs appeared in *The Photographer* for February, 1874, under the heading "German Correspondence":

"Two American novelties have recently attracted a good deal of attention here; one of them, landscapes by Mr. Muybridge of San Francisco. To the visitors of the Vienna Exhibition these pictures were no novelties, but in Berlin, they were not generally known, and the excellence and large size of the plates, the brilliancy of tone, the happy selection of the objects, excited general admiration.

"Landscapes of this size are the exception here, and the thought that Muybridge, with his mammoth camera for plates of twenty-two inches, climbed mountains, fills many a one with admiration and respect. . . ."

Muybridge had made his first trip to photograph Yosemite Valley in 1867; he was the fourth photographer we know of who ventured there.[3] On his 1867 trip he had produced seventy-two 6 x 8 in. views and one-hundred and fourteen stereos. These are presently largely unknown and unstudied; twenty of them are used as illustrations for the first guidebook to the Valley, *Yosemite: Its Wonders and Its Beauties*, "by John S. Hittlell, illustrated with Twenty Photographic Views Taken by 'Helios' and a map of the Valley," San Francisco, H.H. Bancroft, 1868.[4] But the Hittell book is rare, and actually affords little idea of the quality of Muybridge's photographs, for the illustrations are copy reductions from the original 6 x 8 in. prints. Muybridge, as publisher of the mounted series of contact prints from his 1867 negatives, had announced them as the work of "Helios," and had declared that: "For artistic effect, and careful manipulation, they are pronounced by all the best landscape painters and photographers in the city to be the most exquisite photographic views ever produced on this coast." As with his 1872 series, contemporary comment then bore him out. The *Alta California* for 17 February 1868 said:

"The views surpass in artistic excellence, anything that has yet been published in San Francisco. . . .In some of the series, we have just such cloud effects as we see in nature or oil-painting, but almost never in a photograph."[5]

This was a comment also on the earlier cloudless Yosemite photographs of Carleton E. Watkins, as well as a suggestion that by 1867 Muybridge had in use a device of his invention called "The Sky Shade" [see Documents, A], a shutter which allowed for varying exposures on a single plate, both vertically and horizontally, to compensate for the plate's difference in sensitivity to different colors in the landscape. The sky's being so particularly remarked in the *Alta* review indicates that it was particularly effective; one can hardly imagine being in full grasp of the splendor of Yosemite Valley under a cloudless sky. Particularly, the "cloud effects" recommended Muybridge's

work as "more artistic" than that of his predecessors in the Valley.

The Philadelphia Photographer for November, 1869, carried an article on the results of Muybridge's first Yosemite trip along with a print from one of the many negatives he sent to the journal's editor, Edward L. Wilson. The description of the difficulties of a photographic expedition to Yosemite Valley should be kept in mind in considering all of Muybridge's later expeditions with wet-plate gear; it is particularly relevant to the 1872 series, for which he used much large and heavier equipment:[6]

"Through the kindness of Mr. Edward [sic] J. Muybridge, San Francisco, California, who has loaned us the negatives, we are enabled to present our readers with a view in the great Yosemite Valley, California. . . . [The series of views] were taken by the indefatigable and untiring 'Helios,' before the great railroad belt that binds the Atlantic with the Pacific was completed. They were also made by one with a true artist's eye and feeling, and are therefore, precious, and as fine as precious. To photograph in such a place is not ordinary work. It differs somewhat from spending a few hours with the camera in Fairmount [Philadelphia] or Central Park [New York City]. All the traps, and appliances, and chemicals, and stores, and provender, have to be got together, and then pack-mules secured to carry the load, and drivers to have charge of them. Thus accoutred, the photographer starts out, say, from San Francisco, through hill and vale, across deep fords, over rugged rocks, down steep inclines, and up gorgeous heights, for a journey of one-hundred and fifty miles. Several days are thus occupied, and several nights of rest are needed along the road.[7]

"'Helios' has outdone all competitors. His views are grand, and, as a photographer, he might vie with the great Wilson, of Scotland. . . .

"'Helios' hopes to go to the Valley again some time soon, when he promises to secure us some more splendid subjects."

Muybridge's 1872 trip to the Valley and the surrounding high country was far more ambitious, in size and variety of equipment and in the number and range of views taken, than that of 1867 had been. In a prospectus issued from Thomas Houseworth's San Francisco studio in May, 1872, he made public his plan for the series, which was already under way, and sought further subscriptions:

"I am encouraged in this undertaking from the generally expressed opinion, especially of our best Art Critics, that although many carefully executed large-size photographs of our scenery have already been published, yet the wonderful improvement in the science of photographic manipulation, and a judicious selection of points of view, with an aim at the highest artistic treatment the subject affords, will result in a more complete realization than has hitherto been accomplished of the vast grandeur and pictorial beauty for which our State and Coast have so worldwide a reputation. To those gentlemen who are acquainted with my works, or with me personally, it will be merely necessary for me to refer to the numerous smaller photographs of my execution as an earnest of what may be expected as the result of my anticipated labors, and to remark that I have now an outfit of lenses and apparatus superior to any other in the United States. . . .

"The size of my proposed negatives will be 20 x 24 inches, and the prints about 18 x 22, of which subscribers for each *one hundred dollars* subscribed will be entitled to select FORTY from the whole series, to be printed and mounted upon India tinted boards. . . .Receive the assurance that all my energies shall be directed toward rendering this proposed series the most acceptable photographic publication ever issued in the United States, with the object of attracting attention to the magnificent scenery of our own State and Coast in a manner worthy of the theme."[8]

When the prospectus was issued, it carried in set type the names of a number of outstanding businessmen, artists, and photographers of San Francisco. On his own copy of the prospectus, Muybridge added, in his own hand, the names of additional subscribers, including the Pacific Mail Steamship Company, and the Central Pacific and Union Pacific Railroads, each of which subscribed $1,000, or the equivalent of ten sets each. Although Leland Stanford is not listed as an individual subscriber, he was then president of the Central Pacific, and must have authorized the subscription.[9]

Although the prospectus was not issued until May, by late April, Muybridge had already produced a number of large views, which he showed in Sacramento, in what must have been an interlude of rest and subscription seeking. The Sacramento *Union* for 26 April 1872 reports that:

"We had an opportunity of looking last evening at some very fine large-sized photographic negatives representing some of the most picturesque views of Yosemite Valley. . . . They are the production of Edward [sic] Muybridge. . .[10]

Pi-Wi-Ack (Shower of Stars), "Vernal Fall" B&R 23
Oakland Museum

Yosemite Creek, Summit of the Falls at Low Water B&R 44
Oakland Museum

Ancient Glacier Channel, at Lake Tenaya B&R 47
Yosemite National Park Museum

The High Sierra, from Glacier Rock B&R 38
Yosemite National Park Museum

Muybridge stayed in Sacramento briefly; by July, he was back in Yosemite. It was during this brief stay that he may have been in touch with Leland Stanford, and made the first attempt to photograph Occident in motion.

Throughout the spring and summer, Muybridge took pictures of Yosemite's meadows and waterfalls and the granite walls that surround them. News of his photographic feats reached the San Francisco newspapers. The *Alta California* for 7 April 1872 reported:

". . .he has waited several days in a neighborhood to get the proper conditions of atmosphere for some of his views; he has cut down trees by the score that interfered with the cameras from the best point of sight;[11] he had himself lowered by ropes down precipices to establish his instruments in places where the full beauty of the object to be photographed could be transferred to the negative; he has gone to points where his packers refused to follow him, and he has carried the apparatus himself rather than to forego the picture on which he has set his mind."

Muybridge returned to San Francisco from the Valley by way of the High Sierra and the Mariposa Grove of Mammoth Trees in the late fall of 1872. He spent the next five months printing his negatives for Bradley & Rulofson, who had by this time lured him away from Houseworth (the publisher from whose studio he has issued his prospectus) with their superior printing and mounting apparatus. [see Documents, A]. The series was ready for publication in April, 1873; it brought Muybridge over $20,000 in income, and the popular and critical acclaim quoted above. From then onward, he was the acknowledged leader of his profession in San Francisco.

What is there in the work produced on this great photographic expedition that recommends it above that of Muybridge's predecessors? Taken individually, the prints are richer in color and more varied in tone than the work of Watkins, to whom Muybridge is most often compared. The composition is more dramatic, and the view more extensive. The first aspect was governed by Muybridge's formulas, those for the collodion that formed the light-sensitive coating for his glass plates, and for his developer. In the days of wet-plate negatives, these formulas were the personal equipment of every photographer; they varied to suit the indivudal's purpose. There were no packaged goods. *The Philadelphia Photographer* carries many different recipes during these years for variations of individually worked-out formulas that were suited to the various practices of the photographers who submitted them. The second aspect, the drama of composition, is an attribute of Muybridge's own vision as a photographer. It is governed, of course, by the wide-angle lens that he chose to use, which made the backgrounds recede and the angle of vision expand to heighten the view of the Valley of the Yosemite, a view that is dramatic enough, just as the eye sees it.

As a series, seen most clearly in the large views, the Muybridge photographs offer a coverage of the Valley, its upper rim and the high glacial country surrounding it that had not before been presented. Many of the new points of view from which Muybridge took his photographs were available to him because new trails had been built by 1872; earlier photographers could not reach these viewpoints. Also, Muybridge dared more, and pushed himself farther than anyone before him had done. He was more ambitious; as Robert Haas says in his preceding biography, he was "athletic." He moved around the Valley's floor systematically, then covered the high ground with unprecedented thoroughness. In following Muybridge's work in the large views, the viewer moves with him, and has recreated for him the motion of a trip around and above the Yosemite Valley; it is a thorough photographic tour, as well as a surpassingly beautiful one.

Muybridge carried all three of his different sized cameras on this tour, making 5½ x 8½ views and stereos as well as the large views. As for the smaller views, and especially the numerous stereos, they complement the large ones, and are often taken from the same standpoint. One group of stereos, however, offers a more intimate sense of the photographer's vision. They are called "Yosemite Studies" (B&R 1408-1479), and in them Muybridge concentrates on light and shadow, on reflections in the Merced, the river that runs through the Valley, and on individual trees and rock formations. These are comparable to his earlier "Studies of Trees" and "Studies of Clouds" in their focus on one feature of the whole landscape. In them, as in the earlier "Studies," Muybridge made sketches, and identified through his camera the smaller views that he used in the composition of this major landscape work, the 18 x 22 in. views of the Valley of the Yosemite, the High Sierra and the Mariposa Grove of Mammoth Trees.

1873

The Modoc War

albumen prints from wet-plate collodion glass negatives

Thirty-one stereos, each frame 3 1/8 x 3 in. (B&R 1601-1631.)
Mounted on cards for the stereoscope

Published by Bradley & Rulofson, San Francisco, 1873

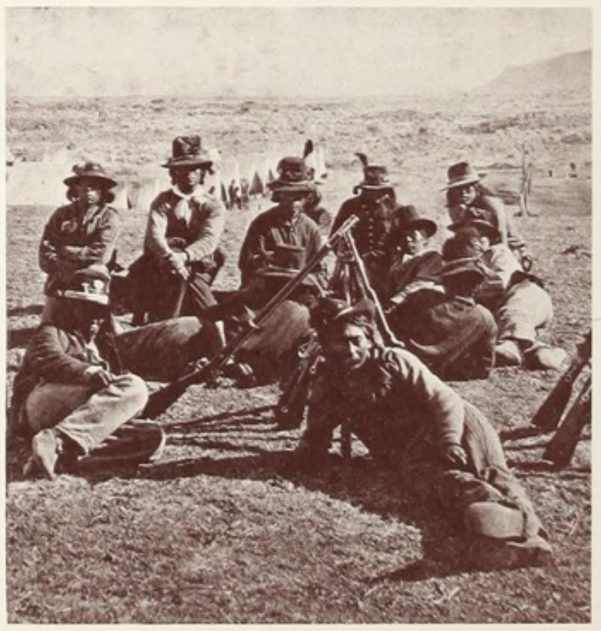
Stereos from the series selected for the exhibition are from the collections of Robert B. Haas, Nancy and Beaumont Newhall and the California Historical Society, San Francisco

From November, 1872, when a small group of Modoc Indians moved, at gunpoint, from their settlement at Lost River, Oregon, to the natural fortifications of the Lava Beds, until June, 1873, fifty-two Modoc warriors held out against one-thousand Army troops, seventy-eight Warm Spring Indian Scouts, and a company of Oregon Volunteers. The band of Modocs, under the leadership of Captain Jack, defied the Government's telegraphed orders to the Oregon Indian Agent to remove them to the reservation in Oregon, where a large number of Modocs had lived since 1864 in submissive proximity to their ancient enemies, the Klamath Indians. The defeat of the rebellious Modocs was hastened by the defection of four of their warriors to the Army; the history of the war is one of betrayal and close-range murder on both sides. For the Indians, the result of it was reprisal and submission to the Government's demands.

Muybridge, in 1881 [see Documents, E], described his coverage of this war, which was fought in the rocky caverns and fissures of the Lava Beds, south of Tule Lake, near the California border with Oregon:
". . . Mr. Muybridge was dispatched to the front during the Modoc war, and the wide spread and accurate knowledge of the topography of the memorable Lava Beds and the country round-about, and of the personnel of he few Indians who, with the bravery at least of the classic three hundred, defied and fought the army of the Union, is due chiefly to the innumerable and valuable photographs taken by him."

Muybridge's coverage of the war included photographs of Army regulars, Warm Spring Indian Scouts, the wounded being brought in after an engagement, panoramas of the Army camp on the shores of Tule Lake, Modoc women who were taken prisoner, and views of the Lava Beds after the removal of the Indian. A photograph by him published as "A Modoc Brave" was later identified as the Warm Spring Scout Loa-Kum Ar-nuk. He claimed that he went as a Government photographer, and copies of his photographs of the series are available from U.S. National Archives. But he was accompanied by a correspondent of the San Francisco *Bulletin*, and published his views through Bradley & Rulofson, so it is possible that he went on an independent commercial venture, as the English photographer Robert Fenton, for instance, had gone to the Crimean War as a pioneer photographer of war in 1855.[12]

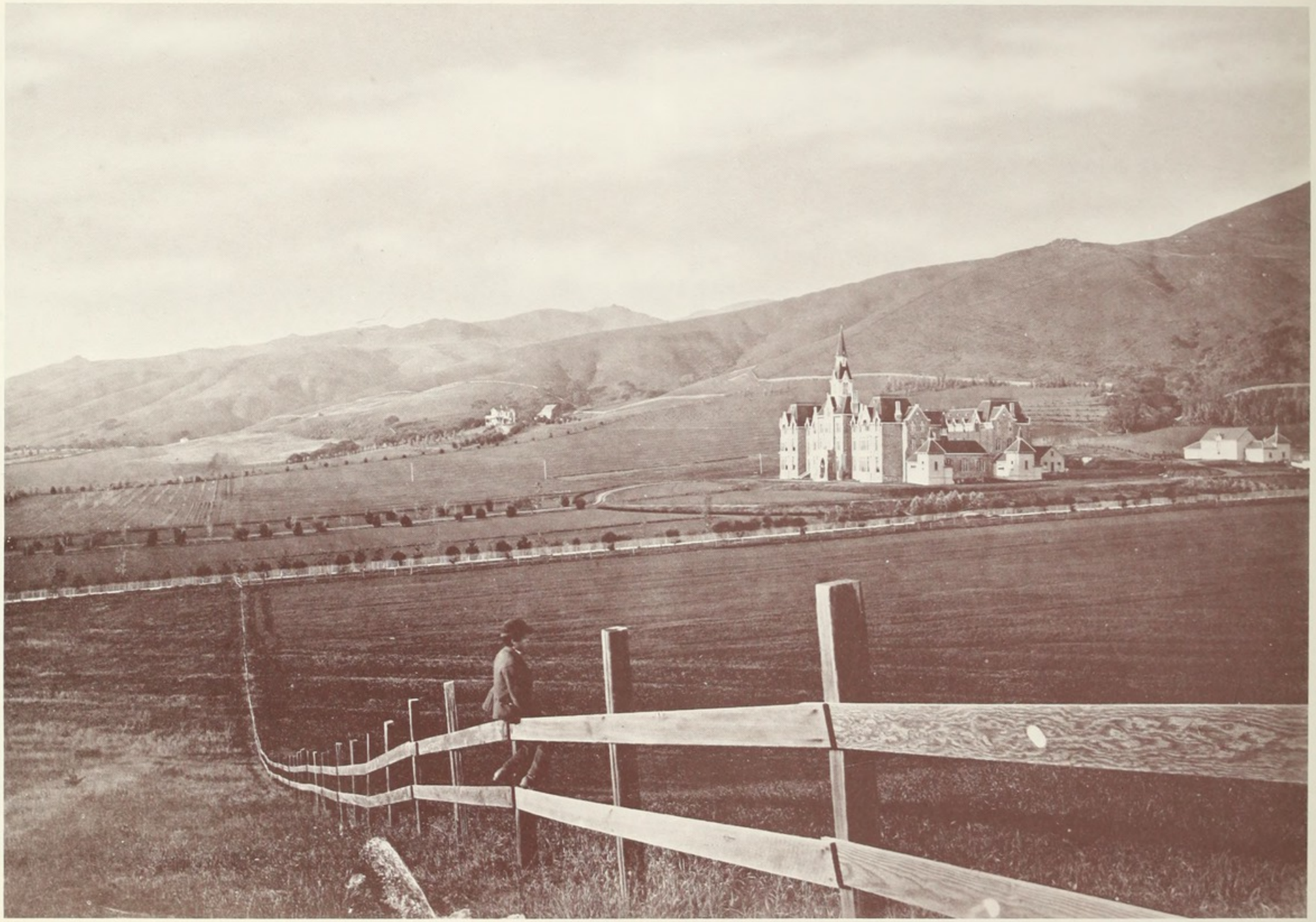
At least one other photographer was present at Tule Lake, judging from scenes of the war reproduced as engravings in *Harper's Weekly* and the *Illustrated London News* in June, 1873. Fifteen of the thirty-one Muybridge photographs were reproduced in halftone in a book published in 1914 by the son of Tobey (Modoc name, Wi-ne-ma) and Frank Riddle, who served as interpreters at the ill-fated Peace Council of 11 April 1873. It is from this extraordinary volume, *The Indian History of the Modoc War*, with its illustrations from the Muybridge stereographs, that the bitter story of the Indians' months of suicidal defiance of the vastly more powerful and numerous Army forces can be fully gathered.



Opposite:
Warm Spring Indian Scouts in Camp B&R 1628
Collection Beaumont Newhall

"A Modoc Warrior on the War Path" B&R 1626
Collection Robert B. Haas

Above:
Tule Lake, Camp South, from the Signal Station
B&R 1608-09
California Historical Society



The School for the Deaf and Blind, Berkeley. Built in 1868, destroyed by fire in 1875.
Brandenburg Album, p. 65; 5½ x 7 7/8 in.

A West Coast Anthology: The Brandenburg Album of Bradley & Rulofson "Celebrities" and Muybridge Photographs

Albumen prints from wet-plate collodion glass negatives of portraits taken in Bradley & Rulofson's San Francisco studios, and of copy photographs and views taken by Muybridge between 1867 and 1873; 128 pp., 13 x 10½ in.

84 studio portraits, 6 x 4 in. and full page

328 Muybridge photographs, from plates ranging from full stereo (3½ x 8½ in.) to 20 x 24 in. (cut to fit the album page) [13]

Original album, Collection Stanford University Museum of Art; copy negatives and study prints, Collection California Historical Society, San Francisco. Selections from the original album are on view in the exhibition

This album is named in honor of Mr. Melford F. Brandenburg, of Sebastopol, California, who rescued it from a second-hand shop some twenty years ago. It contains engravings, chromolitho prints and photographs—studio portraits of actors and actresses, singers and acrobats, taken by the various photographic artists of Bradley & Rulofson's Gallery, and views taken by Muybridge in and near San Francisco, on the Pacific Coast, in Alaska, Utah, the Yosemite Valley, the High Sierra and the Mariposa Grove between 1867 and 1873. There are fifteen copy photographs of drawings, lithographs and architectural plans also made by Muybridge.

This is, possibly, an album kept by Muybridge's wife, Flora Stone Muybridge (d. 1875). This is conjecture, but the inclusion of studio portraits of theater people, for whom she is known to have had an affinity, along with the Muybridge views, suggests the possibility. They were married in 1870 or 1871; she is said by Robert Haas to have made the floral arrangements for Bradley & Rulofson,[14] so the prints would have been readily available to her. In the spring of 1874, she bore a son whose paternity was questioned. Muybridge murdered Major Henry Larkyns, theater critic and man about town,[15] in October, 1874;

Point Reyes, to the lighthouse
Brandenburg Album, p. 56

this separated him and his wife forever. The circumstances of their lives correspond to those dates we can gather from the photographs in the album.

The early date for the album is from a photograph on p. 147, C,[16] which is a vignette of the same negative that appears as photographs No. VI in J.S. Hittell's early guidebook [see entry above on Muybridge's Yosemite photographs]. The date of the latest photograph in the album is arrived at by comparing Muybridge numbers, scratched in pen in the center of a stereo negative, with the subjects. The set of stereo views on p. 57, of the *SS Costa Rica* aground (numbers 1659, 1661 and 1657) were taken on or after 18 September 1873, when the steamer foundered at the entrance to San Francisco Bay.[17]

Stereo views, Brandenburg Album, p.104:

U.C. Berkeley;

"Falls of the Yosemite"	B&R 1488
Temple Peaks, Monastery Valley	B&R 1511
Yosemite Studies	B&R 1456
A Bradley & Rulofson "Celebrity"	
Uniform Peak, Monastery Valley	B&R 1520
Tuolumne River	B&R 1528
Yosemite Studies	B&R 1408
Mount Dana from Tuolumne Meadows	B&R 1524

Brandenburg Album, p. 67; 5¼ x 8 1/8 in.

Brandenburg Album, p. 63; 5½ x 8¼ in.

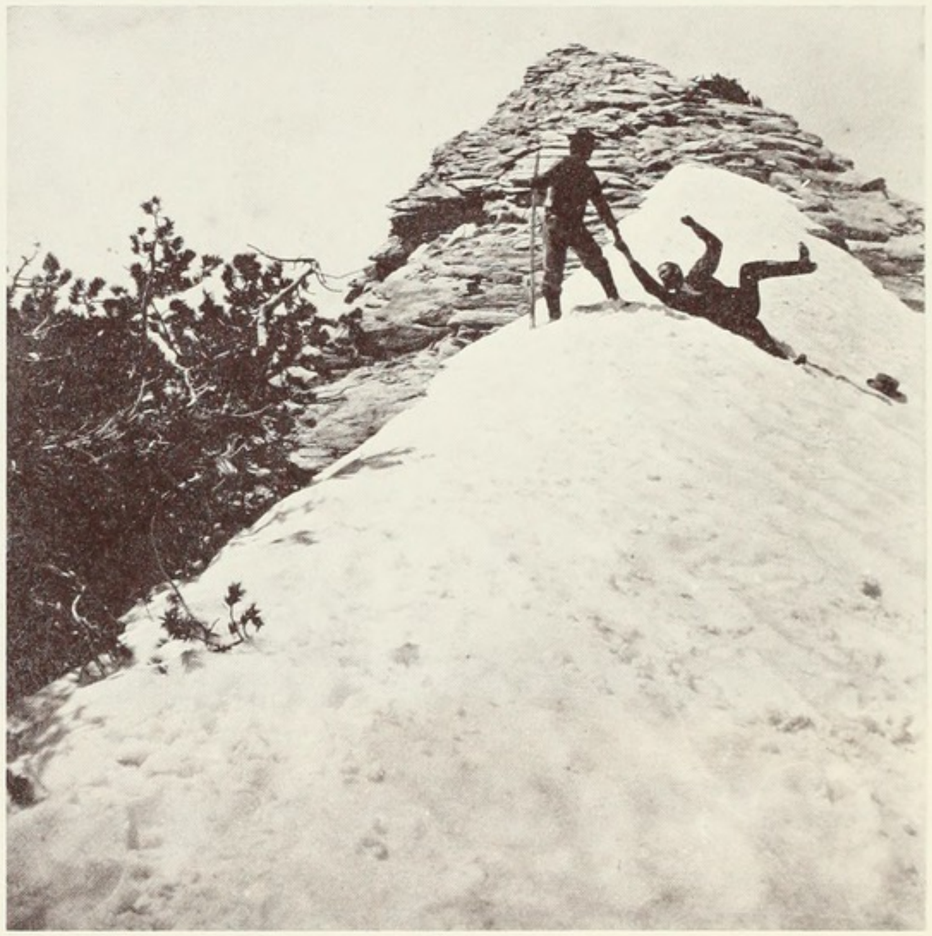
But these dates may be eventually superceded by a search of the trade of the *Vasco de Gama*, which appears alongside a wharf in photograph A, p. 129. The ship was built in Scotland in 1873, and chartered by the Pacific Mail Steamship Company in 1875. If she did not call at San Francisco before her charter, then we must throw the above conjecture about the album's maker overboard. Even so, another tantalizing question is raised: Was this the ship that took Muybridge to Panama in March of 1875?

Whatever the personal history of the album may be, it contains most of the work in all sizes that Muybridge did during these years. Of his documentary work, it is lacking "The Missions of California," "The Modoc War" series, of spring 1873, and "The State Prison at San Quentin," which, according to Muybridge's numbering system, was produced immediately after the views of the *Costa Rica* wreck.

The portraits are given the central positions on the pages, while the Muybridge prints are pasted in around them, out of chronological order, not consistently related in subject, stereo views cut in half and appearing on separate pages, and so on. The large Yosemite views, which would not fit on the pages of this "Scrapbook" are cut into details that would fit. The Muybridge views also include single stereos, cut to 3¼ in. square, uncut stereos, 3½ x 8½ in. (varying in both dimensions), and single views 6 x 9 in. (also varying slightly in both dimensions). The prints are a warm, rich brown, which can only be approximated today by toning. The paper is thin, with a smooth, slightly gloss surface.

The studio portraits must correspond to those listed in *Bradley & Rulofson's Celebrity Catalogue*, San Francisco, 1878,[18] in which the Gallery boasted that it held photographic negatives of "everyone of any note that has visited California since 1849." The list of notables appeared under the headings: "The Federal Government, Hayes, Grant, Lincoln, Governors, Congressmen, Mayors, Nobility, His Royal Majesty the King Kalakaua, Hawaii, His Grace the Duke of Manchester, Italy, India, Germany, France, Army & Navy, The Law, Clergy, Masonic, Newspaper Fraternity, Scientists, Authors, Poets & Lecturers, Mark Twain, Prof. Agassiz. . . Charles Dickens," etc. But the maker of the Brandenburg Album omitted these dignitaries, and chose to include only theater people, the "Theatrical Managers & Agents, Actors & Actresses. . . Acrobats, Magicians, Phrenologists, Spiritualists, Musicians."

The album, with its strange joining of the chosen celebrities and the Muybridge landscape and other views (a grimacing actor cheek-by-jowl with a Yosemite meadow), is a forceful portrait of Northern California of the period: men gathering guano on the Farallone Island rocks; Miss Ella Chapman posing for the portrait that will be published on the cover of the latest song hit, "*Eureka*" *Clog Dance;* a yacht race on San Francisco Bay; the stuffed tigers and the conservatories at Woodward's Gardens; an actor garbed for the role of Hercules; views of the Point Bonita and Point Reyes lighthouses, of the "Eureka Cut Between Shady Run and Alta, Looking West," and many of the Yosemite series, including one of Muybridge himself, romping in the snow on "The Ascent to Cloud's Rest."[19] The album is, as well, an extraordinary record of the work that Muybridge did on the West Coast with both stereo and large-view cameras up to his departure for Panama in March of 1875.



The Ascent to Cloud's Rest B&R 1346

"Volcan Queszaltenango," Guatemala
Rare Books and Special Collections, Stanford University Libraries

1875

The Pacific Coast of Central America and Mexico, The Isthmus of Panama; Guatamala; and the Cultivation and Shipment of Coffee, Illustrated by Muybridge, San Francisco, 1876

Albumen prints from wet-plate collodion glass negatives

"Over two-hundred views," 6 x 9 in. (varying in both dimensions), including twenty views of the coffee industry, a "panorama of Guatamala; taken from Carmen Hill and consisting of 11 views," and others[20]

Over one-hundred and twenty-five stereos

Stereographs published in Panama, 1877

Rare Books and Special Collections, Stanford University Libraries, holds two bound albums of 6 x 9 in. views, mounted on tinted boards 9 ¾ x 13¼ in. Copy negatiyes and prints have been made from selected prints in the albums by the photographer Leo Holub. Stereographs from the Panama series in the exhibition are from the collection of the Stanford University Museum of Art

The Panama *Star* for 10 March 1875 is "pleased to welcome to this city Mr. Muybridge," and further notes:

"We have no doubt Mr. Muybridge will find around Panama many views worthy of his peculiar photographic talent, and which will command a prominent place among the extra-tropical landscapes with which he has already enriched art galleries and expensive illustrated publications in the United States.[21]

The views that Muybridge made of the ruined churches of Old Panama, of the city's harbor, of landscapes near the coffee plantations of Antiqua, and the half-clad workers bathing in tropical streams, extend his reputation as an "artist-photographer," already confirmed in his earlier series of Yosemite and the High Sierra. Muybridge says in his prospectus that the phtographs were "executed by instruction from the Pacific Mail Steamship Company." While he bows to the stated necessity of producing a series of views that would satisfy the company's requirements, he clearly had his own goal:

"The object of the Company in having these views executed, was to stimulate commercial intercourse, by exhibiting to the Merchant and Capitalist in a convenient and popular manner the ports, and facilities of commerce of a country which presents such vast fields of profitable enterprize; and the principal industries of a people with whom until recently we have had comparatively little intercourse. And at the same time to gratify the tourist and lovers of the picturesque with a glimpse of the wonderfully beautiful scenes that have hitherto remained unexplored."[22]

Muybridge offered subscribers one-hundred and twenty photographs from the series for $100. Whether he had been commissioned by the Pacific Mail was disputed in 1920 by Mr. H.C. Peterson, Curator of the Stanford Museum,[23] who also gave then the following information about the dispersal of the series:

". . .Muybridge had made up five bound sets of selected views. One he gave to Mrs. Stanford, one to Frank Shay, for many years [1879-1882] Sen. Stanford's private secretary, one to Mr. Schrewin, Pres. of the P.M.S.S. Co., one to Prendergast [W.W. Pendegast], and one to Mr. Johnston, the latter two being the attorneys who defended him in the Larkyns affair.

"Mrs. Stanford's copy was destroyed in the S.F. Fire of 1906 [the earthquake of 18 April 1906 was followed by a fire that destroyed the Stanford San Francisco home]—the Prendergast [Pendegast] copy has disappeared [now in the California State Library at Sacramento], Mr. Schrewin's copy is still in his possession [this may be the copy now in the Museum of Modern Art, New York], as is also the Johnston copy in possession of Mr. Johnston [this is one of the copies at Stanford].

"This copy was presented, at my suggestion, to Stanford University by Mr. Frank Shay in 1915.

"The original negatives were destroyed by a fire a few weeks after these albums were made. As a consequence, there exists today but these four bound volumes . . .

The Johnston copy, inscribed to him by Muybridge, contains fifty-nine mounted photographs; the Shay copy, from which this inscription is quoted, contains one-hundred and forty-four, including a photographic title page similar to the composite of Muybridge views Bradley & Rulofson put out as an advertising card in 1873. In both copies, the views are identified by

Ruins of "Church of Conception," Antiqua
Rare Books and Special Collections, Stanford University Libraries

Baranca at Las Nubes, Guatamala
Rare Books and Special Collections, Stanford University Libraries

Cemetary, City of Guatamala
Rare Books and Special Collections, Stanford University Libraries

Muybridge's handwritten titles beneath them.[24]

The Central America series won Muybridge the gold medal at the Eleventh Industrial Exhibition, San Francisco, 1876. The jurors cited his previously known "judicious selection of subjects, artistic taste and skillful manipulation" and said of the photographs: "These last productions of his camera surpass all his previous efforts, and their examination renders it difficult to believe, that with our present knowledge and taste, photography can make much further progress toward absolute perfection.[25]

The tropical landscape of Central America had not, by 1875, been unexplored, as Muybridge claimed. Among the painters of California landscape who had worked in the tropics by that time was Norton Bush (1834-1894), an artist well-known to Muybridge (Bush had subscribed to his early Yosemite series), who was, in fact, in Peru by the fall of 1875, before Muybridge's return to San Francisco in late November or December of that year.[26] Bush had visited Panama in the fall of 1868, sketching the lakes and rivers of the country, and making other studies which he developed into larger paintings when he returned to California. HIs work in the tropics was so well-known that when he returned in 1870 to New York, his native state, and opened a studio in New York City, he was known as "California' Tropical Painter."[27]

The point that Muybridge was making, though, was that there had been little photographic representation of the tropics available in San Francisco. In that tropical landscape, to which he traveled immediately after his acquittal, Muybridge produced photographs intensely romantic in mood; even those in the so-called documentary series of the coffee industry convey the strength of this strangeness of feeling; it is more than a response to a landscape that was strange to the English-born photographer. The inclusion of figures in the foreground is more stated than in the Yosemite photographs, and the manipulation of cloud effects and moonlight effects, especially in the 6 x 9 in. views, more theatrical (more effective) than that seen in his earlier work.

1877

Panoramas of San Francisco from the California Street Hill

albumen prints from wet-plate collodion glass negatives

Two panoramas of eleven panels, each approximately 7 3/8 x 8 1/4 in., mounted on cloth and accordian-bound between covers, the whole panorama 7 ft. 6 in. long.

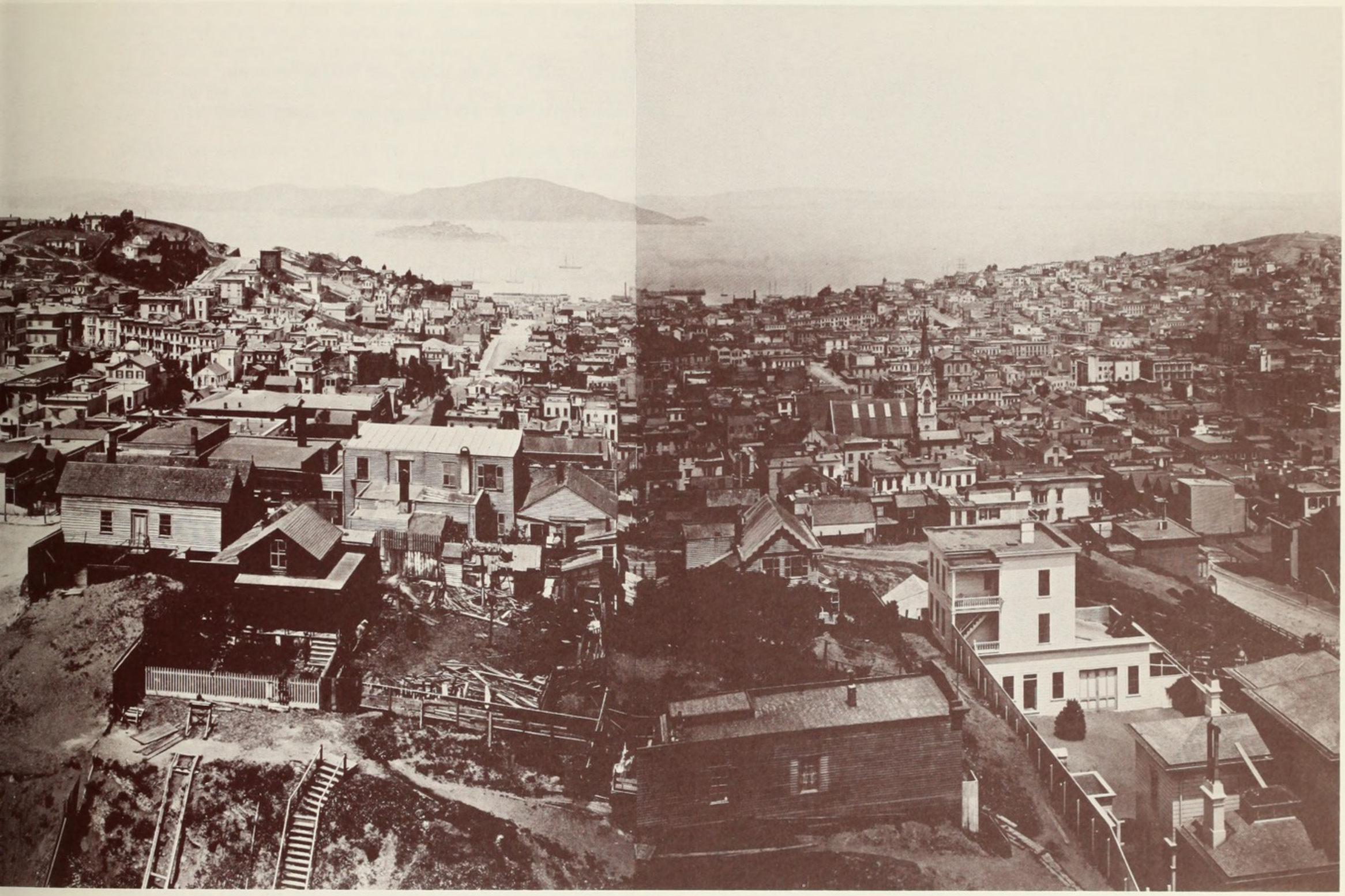
One panorama of thirteen panels, each 20 1/2 x 16 in., mounted on cloth and accordian-bound between covers, the whole panorama 17 ft. 4 in.

Copyright 1877 by Muybridge; published by Morse's Gallery, San Francisco

The thirteen-panel panorama in Rare Books and Special Collections, Stanford University Libraries, was presented to "Mrs. Leland Stanford, with compliments of the Artist, 1878." It has been copied on 8 x 10 in. negatives by the photographer Leo Holub and printed in its original size for the exhibition by General Graphic Services of San Francisco

Early in January of 1877, Muybridge set up his camera on the tower roof of the residence that Mark Hopkins was building at the corner of California and Mason Streets in San Francisco to record the city, its sweep of Bay and surrounding hills in a 360 degree view, the most complete panorama of San Francisco that had ever been made. This was Muybridge's first published work after his Panama series. In carrying it out, he again claimed San Francisco as his photographic territory.

Muybridge had been interested in taking panoramic views from the beginning of his photographic career.[29] A number of his less ambitious San Francisco panoramas from the late 1860s and early 1870s are found in the collection of Bancroft Library, and a simple north, east, south and west series from the roof of a three-story building is in the Collection of the Wells Fargo History Room, San Francisco. He even made panoramic views during the Modoc War, of the Army camp on the shores of Tule Lake, "from the Signal Station." His Panama



Panels three though six of the thirteen-part panorama of San Francisco
Rare Books and Special Collections, Stanford University Libraries

photographs had included an eleven-panel panorama of Guatamala, "taken from Carmen Hill."

The city offered a perfect site for a panoramic view. Daguerreotypists had found it so in the days of the Gold Rush; there are at least eight daguerreotype panoramas, of from two to six panels, dating from 1850 to 1853.[30] The first view from Nob Hill, Muybridge's vantage point, was taken in early 1851, and the view from that point, as it was settled, soon became favored over Rincon Point, which earlier daguerreotypists had chosen. The *Alta California*, attempting to convey the enormity of the scope of Muybridge's 1877 panorama used the analogy of "a small ant wishing to get a comprehensive view of a painted Japanese dinner plate," and climbing on a thimble to do so. A sort of census report underscored the Alta's appreciation of the Muybridge panorama ". . . it may safely be said that the homes of more than quarter of a million people within this saucer-like panorama, 50 miles long and 15 wide, are distinctly visible from the corner of California and Mason Streets, 381 feet above ordinary high tide."[31]

The thirteen-panel panorama was taken in the spring or early summer of the year. Muybridge started at about 11 a.m., and, probably with the help of an assistant, made each section in a matter of fifteen minutes. The seventh panel from the left was taken last; it is a second shot of a section that was not successful on the first try. He used a 40-in., or near telephoto, lens, which determined the number of 20 in.-wide glass negatives needed to make the complete circle. He had chosen the day for the execution of the panorama carefully; the shadows are sharp, and the atmosphere clear.

A key, which names buildings worthy of particular note, was published by Muybridge for the second eleven-part panorama. Muybridge thus provided, by photographic and literal documentation, the most comprehensive physical record that exists of San Francisco in its "Golden Era," giving us a knowledge of it as it would never be again after the earthquake and fire of 18 April 1906.

1877

Copy photographs of paintings by Norton Bush

albumen prints from wet-plate collodion glass negatives

Twenty-one prints, 11 1/2 x 19 3/4 in., mounted on boards 18 x 26 in.

Published by Morse's Gallery, San Francisco, and exhibited at the San Francisco Art Association Galleries, 1877

Copy Photograph of a painting of Occident by John Koch

albumen print from wet-plate collodion glass negative

4 x 8-1/2 in., mounted on a 5-1/4 x 8-1/2 in. card.

Copyright, 1877, as an "automatic electro-photograph" by Muybridge; published by Morse's Gallery, San Francisco

The example in the exhibition of the series of copy photographs of Norton Bush's paintings of Peru, *Mount Meiggs, Andes of Peru* (1876) is from the collection of Robert B. Haas. The copy photograph of the Koch painting and the painting itself are in the collection of the Stanford University Museum of Art.

A substantial part of Muybridge's professional work was given over to photographic copying—of architectural plans, documents, drawings and paintings. There are fifteen copy photographs in the Brandenburg Album from the years 1867 to 1873. Muybridge's advertising card for Bradley & Rulofson of 1873 was a copy of a collage of his own photographs combined with studio portraits and type proofs, as was his introductory page to the Central America album. (In his advertising card for Pacific Rolling Mills, he had created a really photographic collage, combining a photograph of the mill workers with an arrangement of their product.)

In 1876 and early 1877 Muybridge put his skill in this line at the service of the painter Norton Bush, copying the twenty-one paintings Bush had produced from sketches made in

Peru in 1875.[32] When the paintings were exhibited at the galleries of the San Francisco Art Association in February of 1877, the Muybridge photographic copies were hung with them. Bush made presentations of the copies of his paintings; *Mount Meiggs*, in the exhibition, is inscribed by him to "W. C. Bartlett, Esq., With compliments of the Artist."

The photographic copy of the painting of Occident by Morse's retoucher John Koch[33] is another sort of work. Muybridge passed it off as an "automatic electro-photograph." Upon its publication, he announced in a letter to the *Alta California* that it was "slightly retouched, in accordance with the best photographic practice." The press received it, with one exception (see "Eadweard Muybridge, 1830-1904"), as a wonder in photography, and the judges of the Twelfth Industrial Exhibition of 1877 awarded it a medal:

"E. J. Muybridge—Instantaneous Photograph of the Race-horse "Occident." The negative of this photograph was executed for Hon. Leland Stanford, the owner, while the horse was trotting at the rate of 2:40 [2:30 on the published card] or about thirty-six feet in a second. As an illustration of the marvelous resources of photography, this is a wonderful production, the duration of the exposure having been less than the one-thousandth part of a second [Muybridge claimed the two-thousandth part of a second]. This can be determined with tolerable accuracy by the fact that the whip in the hand of the driver is as sharp as if photographed while motionless."[34]

The Stanford Museum holds the painting from which the published photograph was copied. Examination of it by X-ray and infra-red photography reveals no underlying photograph. Only the face of the driver is a photograph, carefully trimmed and affixed to the surface of the painting.

The copy photograph of the Koch painting, which we assume to have been made from a lantern-slide projection of an indistinct photograph by Muybridge, tells us several things about the state of the Stanford/Muybridge study of animal locomotion in 1877. The first, and most important, is that Muybridge did not yet have lenses fast enough to take a photograph that would satisfactorily record the horse in motion. He was able at this time to catch an image that would be accurate enough for Stanford to interpret, but would not be acceptable to the public. He and Stanford were shortly to order the lenses they needed for their work from the famous

Muybridge's published photograph

The Koch painting of Occident

lensmaker John Henry Dallmeyer (1830-1883), of London. We also know that in publishing this copy print as an original photograph for some reason Muybridge at this time abandoned his often-stated demands upon himself as a technically superior photographer. But most important, I believe, is that in 1877, judging from the copyright of an "automatic electro-photograph," Muybridge had in mind an electrically triggered system for making successive instantaneous photographs of Stanford's horses.

The year 1877 was evidently one in which Muybridge tried to sustain himself by offering his skill as a copyist. In November he offered to the Board of Supervisors of Santa Clara County, in which some of Stanford's Palo Alto Farm was located, his plan for copying the county records [See Documents, A]. He had a precedent for this, in the copying by Vance's studio of the documents in the 1858 land case, *U.S. vs. Limantour*, but his suggestion that photographic duplicates be made in several copies of more-or-less routine documents seems, ninety-five years later, an advanced notion.

Muybridge's copy of Norton Bush's painting

1878

The Stanford San Francisco Home Album

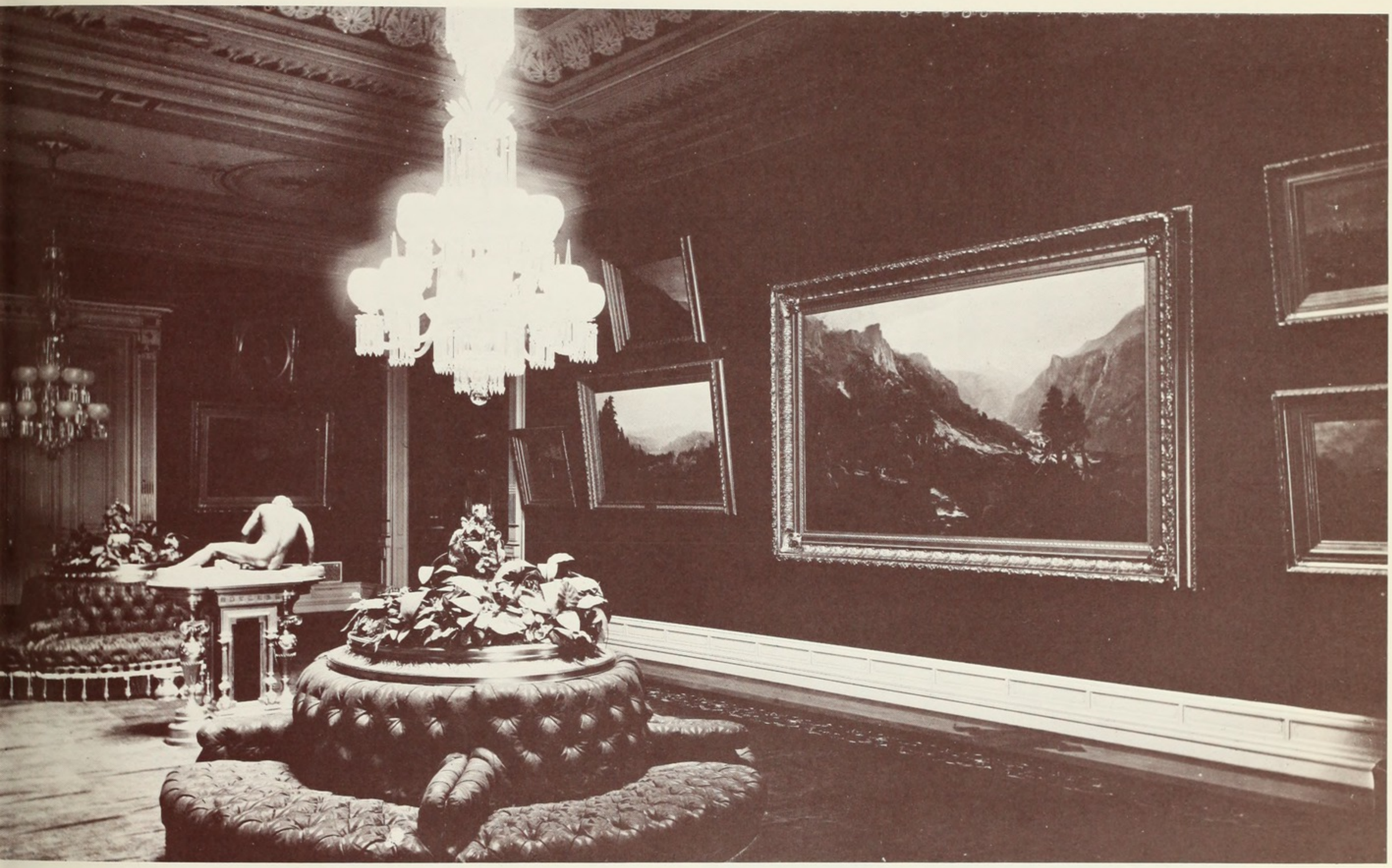
albumen prints from wet-plate collodion glass negatives

Forty-one 5 1/2 x 9 in. views, including a seven-part panorama of San Francisco, mounted on boards 7 x 10 1/2 in., bound in leather and stamped "Mrs. Leland Stanford"

Rare Books and Special Collections, Stanford University Libraries, holds the bound album of prints. Stanford University Archives holds sixty-five 6 x 10 in. negatives from which the photographer Leo Holub made the prints selected for the exhibition.

The offices of the Central Pacific Railroad had been moved from Sacramento to San Francisco in 1873, but the Stanfords' Italianate residence on Nob Hill was not completed until 1876. Presumably the photographs were taken late in that year for Mrs. Stanford's personal use. The house was built on a lot shared with Mark Hopkins, on the summit of the California Street Hill, 381 feet above the level of the Bay, a pinnacle for the wealthy. Leland Stanford, in an interview given to the San Francisco *Chronicle* for 19 May 1875, "pointed in the direction of his mansion, now being erected upon the heights of California street, and said . . .'I shall hope to live to sit upon yonder balcony and look down upon a city embracing in itself and its suburbs a million of people . . . I shall see cars from the city of Mexico, and trains laden with the gold and silver bullion and grain that comes from Sonora and Chihuahua on the south and from Washington Territory and Oregon on the north . . . I shall look out through the Golden Gate and I shall see fleets of ocean steamers bearing the trade of India, the commerce of Asia, the traffic of the islands of the ocean. . .'"

The architecture and the furnishings of the residence were appropriate to such a commanding view. The photographs in the Stanford album, like those in the similar album in Rare Books and Special Collections of the San Francisco Public Library, are titled in Mrs. Stanford's hand, and so we know that her sitting room was "furnished in purple and gold satin," and that it contained "a Statue of Mercury in bronze."



Stanford residence in San Francisco, the Painting Gallery

None of the Stanford family appears in either formal or informal groupings, as they did in the earlier Sacramento home photographs. Instead, the Stanford's growing collection of painting and sculpture is emphasized, and the views are taken to record their increasingly realized taste in decorative and fine art, a taste that was later to be expressed in the building of Stanford University, especially in its Museum and Memorial Church. There is the rotunda, with its amber glass skylight, from which mosaics of Asia, America, Africa and Europe peer down from their semicircles to the second floor hall; the Pompeian Room; the large circular mosaic of the signs of the zodiac in the entrance hall, with the marble statues of *Morning* and *Evening* beyond; and particularly, there is the "Picture Gallery," with one of the Stanfords' recent purchases, a large landscape by William Keith, *Upper Kern River* (1876), on prominent display. (This painting, now in the collection of the Stanford University Museum, was removed to the Museum in 1891, and so was not destroyed in the fire that followed the earthquake of 18 April 1906.)

Muybridge made a seven-part panorama of the city front from an upper balcony of the home, which commanded a view of the Bay of about 180 degrees. Mrs. Stanford's inscription under one of the views taken from her hilltop vantage point personalizes the photograph: "Western view, the Pacific Ocean beyond the mountains, with Fog coming in."

Stanford residence, the Pompeian Room

1878–79

The Horse in Motion

albumen prints from wet-plate collodion negatives

"Automatic Electro-Photograph, copyright 1878,
by Muybridge"

"Each series is mounted on a card,
and illustrates a single stride."

$2.50 for the series of six cards.
Each photograph, 4 x 8 1/4 in. mounted on titled cards, with analysis of the stride on the reverse of each

Published by Morse's Gallery, San Francisco

The set includes:

Abe Edgington trotting at 8 minute gait, 11 June 1878
8 positions. Intervals: 1/25 sec., 21 in. Exposure not known

Abe Edgington trotting at 2:24 gait, 15 June 1878
12 positions. Intervals: 1/25 sec., 21 in. Exposure "about 1/2000 of a second"

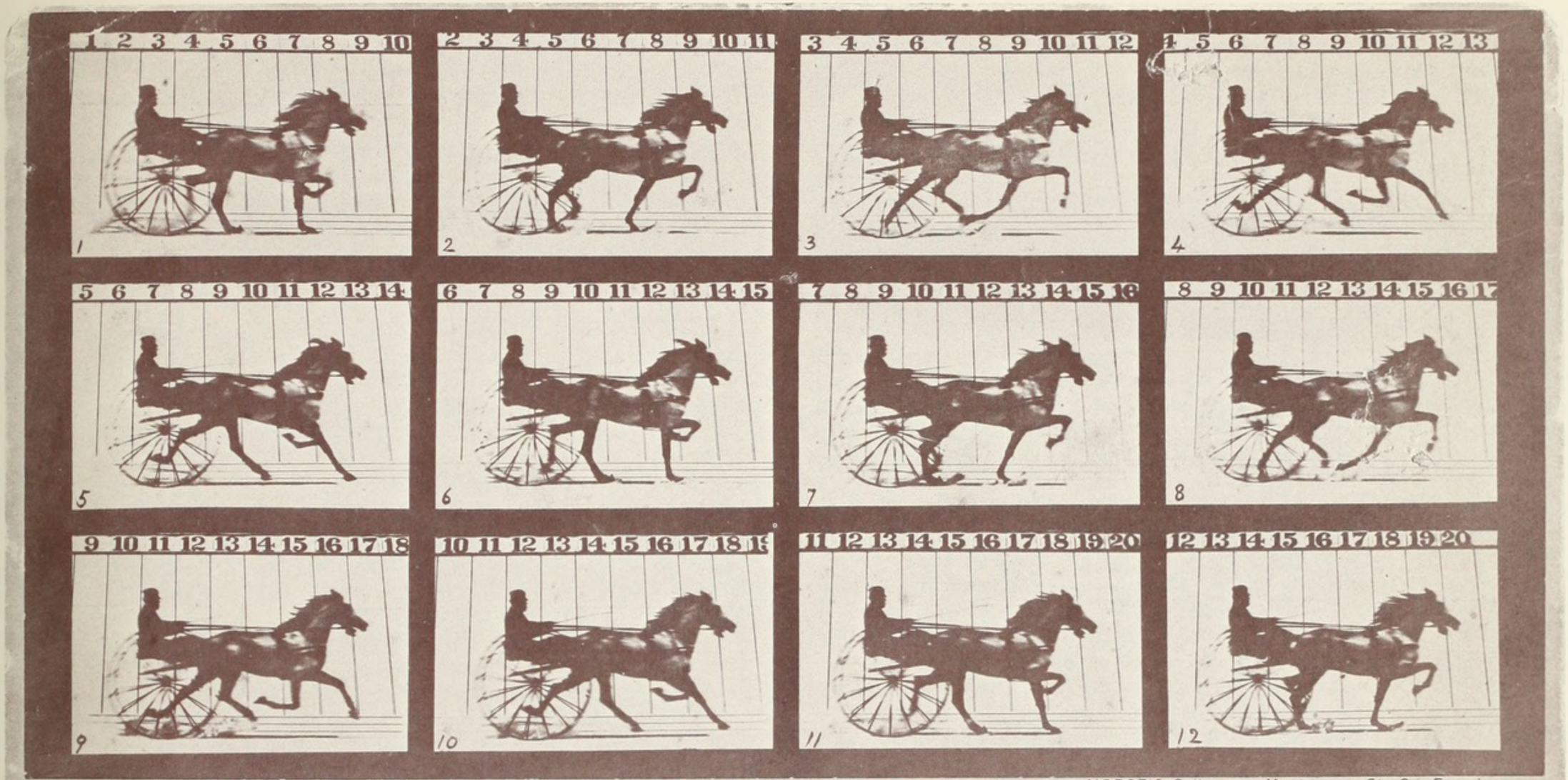
Mahomet cantering at 8 min. gait, 18 June 1878
6 positions. Intervals: 1/25 sec., 21 in. Exposure "about 1/2000 of a second"

Sallie Gardner running at 1:40 gait, 19 June 1878
11 positions. Intervals 1/25 sec., 27 in. Exposure "minus 1/2000 of a second." Retouched

Occident trotting at 2:20 gait, 20 June 1878
12 positions. Intervals: 1/25 sec., 21 in. Exposure "about 1/2000 of a second."

Abe Edgington walking at 15 min. gait, n.d.
6 positions. Intervals: 1/25 sec., 21 in.

Four of the cards in the set are in the collection of the Stanford University Museum of Art, and are shown in the exhibition. The Museum also holds lantern slides made from the negatives of these and other motion studies Muybridge made in 1878 and 1879



MORSE'S Gallery, 417 Montgomery St., San Francisco.

THE HORSE IN MOTION.

Illustrated by

MUYBRIDGE.

Patent for apparatus applied for.

AUTOMATIC ELECTRO-PHOTOGRAPH.

"ABE EDGINGTON," owned by LELAND STANFORD; driven by C. MARVIN, trotting at a 2:24 gait over the Palo Alto track, 15th June 1878.

The negatives of these photographs were made at intervals of about the twenty-fifth part of a second of time and twenty-one inches of distance; the exposure of each was about the two-thousandth part of a second, and illustrate one single stride of the horse. The vertical lines were placed twenty-one inches apart; the lowest horizontal line represents the level of the track, the others elevations of four, eight and twelve inches respectively. The negatives are entirely "untouched."

6 1-Col.

"ABE EDGINGTON," owned by LELAND STANFORD; driven by C. MARVIN, trotting at a 2:24 gait over the Palo Alto track, 15th June 1878.

In any series of photographs from life, illustrating the progressive action of a horse, the first position must necessarily be entirely accidental; the others, if in regular sequence, are contingent thereto.

FIG. **1**.—In the present series "*ABE EDGINGTON*" happened to be opposite the first Camera, as represented in Fig 1, with his left fore leg in Space 7, and right hind leg in Space 5, in nearly vertical positions, both pasterns are much bent, being nearly parallel with the ground. This position of the pasterns seems necessary to enable the horse to carry his body at an uniform height from the ground, and thus to attain the greatest possible speed, without any loss of power or time by upward and downward motions. The right fore and left hind legs are well bent, and in the act of being thrust forward.

FIG. **2**.—The horse is exerting his greatest propulsive force, by the action of the muscles of the right hind leg, and the straightening of the pastern of the left fore leg; the right fore arm is horizontal, and the knee well bent, to enable him to reach out and strike the ground at the greatest possible distance.

FIG. **3**.—The left fore foot has left the ground, and the last impulse is being given by the straightening of the pastern of the right hind leg.

FIG. **4**.—The right fore foot is reaching out, and the left, which had left the ground, in Space 7, Fig. 3, is now well doubled up, in Space 9. The right hind foot, which seems to have left the ground, in Space 5, simultaneously with the exposure of the last picture, is now elevated 16 inches, and the horse is literally flying in mid-air.

FIG. **5**.—The ærial flight is continued. The pastern of the right hind leg continues much bent, at the same elevation as in Fig. 4. The left fore foot nearly strikes the breast, while the right leg is perfectly straight, with the foot stretched out to strike the ground as far forward as possible.

FIG. **6**.—The right fore foot and left hind foot are now upon the ground, and in nearly the same position as were the left fore foot and right hind foot in Fig. 1. This completes about one-half of the stride. The right fore foot and left hind foot remain on the ground as long as the horse can swing himself forward on their leverage, as shown in Figs. 1 and 2, 6 and 7.

FIG. **7**.—The horse, with a reversal of the position of his legs, repeats the same movements, as shown in Fig. 2; the left fore foot is now raised some 24 inches above the ground, and the horse is repeating his motion of the straightening of the pastern of the right fore leg, while the left hind pastern is nearly horizontal.

FIG. **8**.—The right fore foot has now left the ground, and the left hind leg is repeating the movement of the right, as seen in Fig. 3.

FIG. **9**.—The horse is again in mid-air, and continues so in Fig. 10.

FIG. **11**.—The left fore foot, which left the ground in Space 7, at a time intervening between Figs. 2 and 3, has now again struck the ground in Space 18, but the leg has scarcely resumed its original vertical position. The right fore foot, which is just visible in Space 7, Fig. 1, is shaded by the left fore leg in Space 17. The right hind foot, which left the ground, in Space 5, in the interval of Figs. 3 and 4, now touches in Space 16, both pasterns, as before, are much bent.

FIG. **12**.—The horse has moved slightly beyond the position shown in Fig. 1. The right fore leg is thrust more forward, and the left has passed beyond the vertical. The dark spot in front of the left fore foot is the shadow of the right fore leg. It is now seen the horse has completed something more than one full stride.

By an analysis of this stride, it will be seen that the left fore foot which left the ground at Space 7, in the interval of Figs. 2 and 3, again strikes in Space 18, between Figs. 10 and 11; and the right hind foot almost immediately following, in Space 5, Fig. 3, again strikes in Space 16, Fig. 11. As the two feet, which move in unison, seem to strike the ground at the same instant, (see Figs. 5 and 10,) the fore leg being the shorter, must necessarily be raised first, and is off the ground for a longer time and distance than the hind leg, as shown in Figs. 3 and 8, where both fore feet and one hind foot is lifted, and the final propulsive force being exercised by the straightening of the pastern of one of the hind legs. The left fore foot was therefore entirely clear of the ground for a distance of about 8 spaces of 21 inches, or 14 feet, and the right hind foot, nearly as far. The right fore foot and left hind foot corresponding in their action, were, of course, clear, for a similar distance. The eye of the horse which, in Fig. 1, is intersected by the line between Spaces 8 and 9 is, in Fig. 11, where the stride is nearly completed, intersected by the line between spaces 18 and 19, at a distance of 10 spaces, of 21 inches each. Allow 12 inches for the horse to attain the same position as when he started, and we have 18½ feet, the length of the stride, by actual measurement. As each two fore feet were in the air while the horse was making a progress of 14 feet, and rested only during the remaining 4½ feet, completing the stride; and the two hind feet were each, for a very brief interval, on the ground alone, it would appear that a horse with this stride, moving at this speed, is entirely in the air about one-half of the distance; and for a brief interval of the other half, he has one foot alone upon the ground. The relative time that a horse is on and off the ground is probably dependent upon his length of limb and stride, and rate of speed.

MUYBRIDGE,

LANDSCAPE AND ANIMAL PHOTOGRAPHER,

MORSE'S GALLERY, 417 Montgomery Street, San Francisco, California.

OFFICIAL PHOTOGRAPHER U. S. GOV'T. GRAND PRIZE MEDALIST, VIENNA, 1873.

INVENTOR AND PATENTEE IN THE UNITED STATES, ENGLAND, FRANCE, ETC.

OF THE

Automatic Electro-Photographic Apparatus.

The following photographs are now published: "*Occident*" trotting at a 2:20 gait, 12 positions. "*Edgington*" trotting at a 2:24 gait, 12 positions. "*Edgington*" trotting at an 8 minute gait, 8 positions. "*Edgington*" walking at a 15 minute gait, 6 positions. "*Mahomet*" cantering, 6 positions. "*Sallie Gardner*" running at a 1:40 gait, 11 positions. Each series is mounted on a card, and illustrates a single stride. They will be sent to any part of the world in registered letter, free of postage, upon receipt of $2.50 for each series.

Arrangements made for Photographing and Recording the Action of Horses in motion, in any part of the World.

The reverse of the Edgington card

In June of 1878, the Stanford/Muybridge photographic study of animal locomotion really got off the ground. In 1877 faster lenses had been ordered from Dallmeyer of London, and twelve Scoville cameras from the manufacturer in New York. Muybridge had, he said, achieved faster chemical solutions. His earlier attempts to regulate the camera shutter mechanically were not successful, and a set-up that used electricity to trip the shutters had been devised. The following quotation from an article in the San Francisco *Morning Call*, a piece of writing which sounds very much like Muybridge's own [compare the style with Documents, E], gives the history:

"His [Muybridge's] first endeavor was to open the slide of the camera by hand as the horse went by, but this was too slow to give a clear picture; and then a machine was made which would run at a regular rate, and which could be graded to the speed of the horse. This was a very ingenious contrivance, in appearance between a clock and a music box, but the difficulty was to regulate the horse with the machine. . .This machine had to be started by hand, so that there were two uncertain elements to interfere. Could electricity be used, and the current be controlled exactly at the right moment, the difficulty would be overcome. When Governor Stanford drove the last spike which connected the Union and Central Pacific Railways, and in a figurative sense united the Atlantic and Pacific Oceans, though the broadest part of the continent intervened, the blow of the hammer was echoed by a salvo of artillery from the shores of the bay. The act itself was the herald which announced the completion of the great design; and, surely, if it could thus be drove across mountains and valleys, the same agency would solve this portion of the problem. But it required a large outlay to perfect the machinery, and involved the sending for a portion of the work from England. It also required time; but the idea, once entertained, could not be abandoned, and the delay only intensined [sic] the purpose to carry it to A Successful Termination." [35]

By June, the electrical apparatus was ready. On June 15th, representatives of newspapers and journals, of the world of art and of sports were invited to Palo Alto Farm to witness successive exposures being made of Abe Edginton trotting and Sallie Gardner running, and to see the results, developed on the spot. The *California Rural Press* for 22 June described the setup:

"On one side of the track a large screen is placed, and set at an angle of about 20 degrees from the perpendicular, the screen being covered with white cloth and having vertical lines formed across it 21 inches apart, which show black against the white cloth. The spaces between these lines are numbered from one to twenty in conspicuous black figures at the top. At the bottom is another low white screen with horizontal lines four inches apart, to show the height of the horse's feet above the ground. Powdered lime was sifted over the track in front of the screen so as to make a perfectly smooth white surface, over which the horse was driven. On the opposite side of the track from the screen a low shed was erected, open in front, and on a bench or table were placed 12 cameras, numbered in order, so as to take 12 views 21 inches apart. These cameras were ... constructed with an improved double slide, so that exposure could be cut off instantly, one slide moving each way across the lens. The slides were held open by a catch connected with an armature in the side of the camera. A battery of eight jars was placed in the shed and each camera had an independent set of wires. These wires were led across the track under the ground until within two feet of the background or screen, where they were raised so that one of the sulky wheels would pass over and strike them. The wires corresponded with the vertical lines on the background, and as the sulky wheel passed over the wires the armature holding the catch of each separate instrument released the catch and the slides cut off the exposure of the camera at the instant, so that the photograph was taken without any blur. As the wheel passed over the different wires the different pictures were taken, each 21 inches apart, illustrating perfectly the stride of the horse. . . . In photographing a running horse, the wires could not be used in the same way for manifest reasons. Fine black threads were placed across the track, 21 inches apart, and connected so that the armatures would release the slides as before."[36]

As for the success of the photographs, the *Press* reporter added: "They show . . . the gait of the horse exactly, and in a manner before impossible. A long description even would be unintelligible, while the photographs show the whole stride at a glance."

The eyewitness accounts were carried in the local press, and on 27 July 1878, copied in a brief note in *Scientific American.* By October, this journal had received prints of the photographs, and reproduced them on the cover of its 19 October issue. The spread of their fame can be followed thereafter in "Marey, Muybridge and Meissonier," p.85.

Within two weeks after the initial public demonstration, Muybridge applied for his patent on the apparatus, and by July was already on the lecture circuit with lantern slides of the horse in motion, showing his photographs of the horse with his earlier ones of Yosemite and Central America. In Sacramento, in September, J.M. Hutchings accompanied him, describing the views of Yosemite. At these lectures, in which he projected sixty illuminated photographs, life-size, showing the action of the horse's various gaits, "Mr. Muybridge showed himself to be a clever and lucid lecturer on a very difficult subject. . ."[37] At the Mechanics' Fair, in San Francisco, in August, he explained "briefly the various pictures as they pass in quick succession before the gaze of the observer. . . . Many of the theories concerning rapid motion are dispelled into very thin air by these photographs. The action of the trotter in motion as caught by the camera is very different to what the artist usually makes him appear on canvas. Not since the time of the Egyptians, as Mr. Muybridge remarks, has the animal been delineated as he appeared in these negatives. . ."[38]

In the interval between the high summer experiments of 1878 and those of 1879, Muybridge and Stanford ordered twelve more cameras, and expanded the experimental setup to accommodate them. In November of 1878, the *Alta California* had reported that the instantaneous pictures had "called out a number of letters from artists, anatomists, horse-fanciers and others, all expressing the hope that other pictures of a similar character will be taken. A lecturer on anatomy in an art school wants a series showing the changes in the position of the muscles while running, thus supplying a great want of art students. The movements of the muscles while boxing, or in any violent exertion, can thus be obtained with precision, and in no other method."[39]

The experiments of summer 1879 included animals other than the horse, and, in August, man entered Muybridge's motion-picture stage. Stanford invited members of the Olympic Club of San Francisco to perform before Muybridge's cameras, and among the successful results was a series of fourteen photographs of Mr. Lawton turning a back somersault. The *Chronicle* for 9 August 1879 also reported the use Stanford intended to make of some of the photographs of athletes:

"After the athletic performances several photographs were taken of the athletes in various classic groupings. Governor Stanford will have each negative worked up to a cabinet-size photograph, and take one of each with him to Europe, where he will have two life-size oil paintings made of each. . ."[40]

By the end of the experimental period of 1879, Muybridge had also expanded his method to take synchronized views of both men and horses from four and five different camera positions, a technique that was basic to his later work at the University of Pennsylvania.

"General View of the Experiment Track"
Photograph F, *Attitudes of Animals in Motion*, 1881
Stanford University Museum of Art

1879

The Zoöpraxiscope

Muybridge's original machine for projecting in motion his instantaneous photographs is in the Central Library, Kingston-upon-Thames. A replica of it is in the Science Museum, London, and a working zoöpraxiscope, in which the mechanics, but not the finishing materials, were copied, is in the International Museum of Photography, George Eastman House, Rochester, New York.

The copy in the exhibition, from the collection of the Stanford University Museum of Art, was made by the design engineer David Beach from Muybridge's description of his machine, quoted below, and from photographs of the original zoöpraxiscope at Kingston-upon-Thames.[41]

It is probable that Stanford and Muybridge intended to synthesize the analytical photographs even before an experimental method for taking them had been devised. In 1877, they ordered twelve cameras for the study; a zoetrope with thirteen slots uses twelve images to convey forward motion.[42] The use of drawings of the correct successive positions of human locomotion for zoetrope bands had been suggested by Etienne-Jules Marey in 1873:

"Every one knows the ingenious optical instrument invented by Plateau, and called by him 'Phenakistoscope.' This instrument, which is also known by the name of Zootrope,[43] presents to the eye a series of successive images of persons or animals represented in various attitudes. When these attitudes are co-ordinated so as to bring before the eye all the phases of a movement, the illusion is complete; we seem to see living persons moving in different ways. This instrument, usually constructed for the amusement of children, generally represents grotesque or fantastic figures moving in a ridiculous manner. But it has occurred to us that, by depicting on the apparatus figures constructed with care, and representing faithfully the successive attitudes of the body during walking, running, etc., we might reproduce the appearance of the different kinds of progression employed by man."[44]

Stanford, according to Muybridge, had read Marey's *Animal Mechanism* closely [see "Marey, Muybridge and Meissonier"]. If Stanford could think of making instantaneous photographs of the horse in motion, the next step, of making a synthesis of the motion for an existing instrument, was certainly a readily available idea. As soon as *The Horse in Motion* series was published, the suggestion of using the photographs on bands for the zoetrope was advanced on all sides [see "Eadweard Muybridge, 1830-1904"].

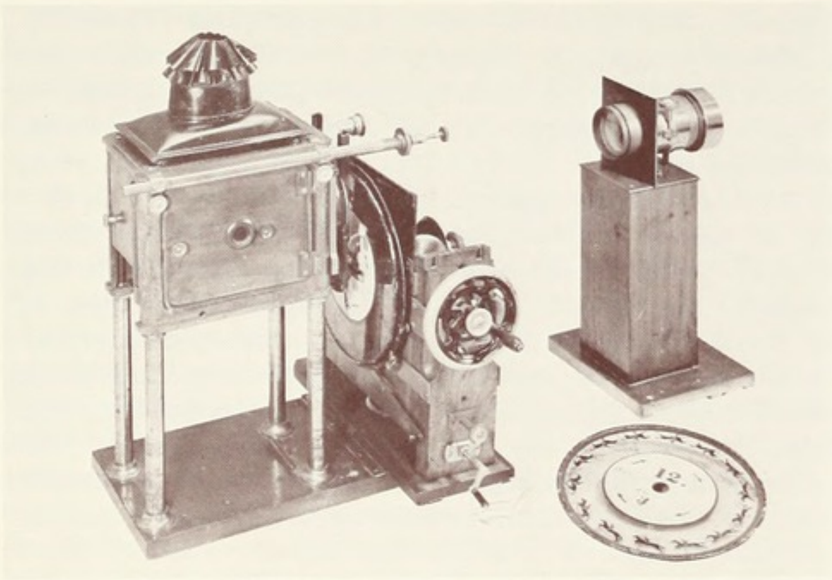
Within a month of his success in taking the series photographs of the horse in motion, Muybridge was projecting them life-size, "in quick succession" before audiences in California.[45] The near-synthetic effect of one slide quickly succeeding the other must have made him determine to devise a way to project them in quick enough succession to correctly reconstitute the motion his instantaneous photographs had stopped. The synthesis would be absolute proof of his accurate analysis, as well as an instructive entertainment for the public.

Muybridge's first attempt to devise a machine that would accomplish this was based on Wheatstone's reflecting stereoscope. This was abandoned, however, and he developed the instrument that he finally called the zoöpraxiscope. His description of the process leading to it appears in his Preface to *Animals in Motion:*

". . . the author arranged, in . . . consecutive order, on some glass discs, a number of equidistant phases of certain movements; each series. . . illustrated one or more complete and recurring acts of motion, or a combination of them: for example, an athlete turning a somersault on horseback, while the animal was cantering; a horse making a few strides of the gallop, a leap over a hurdle, another few strides, another leap, and so on; or a group of galloping horses.

"Suitable gearing of an apparatus constructed for the purpose caused one of these glass discs, when attached to a central shaft, to revolve in front of the condensing lens of a projecting lantern, parallel with, and close to another disc fixed to a tubular shaft which encircled the other, and around which it rotated in the contrary direction. The latter disc was of sheet-metal, in which, near its periphery, radiating from its center, were long narrow perforations, the number of which had a definite relation to the number of phases in the one or more lines of motion on the glass disc—the same number, one or two more, or one or two less—according to the sequence of phases, the intended direction of the movement, or the variations desired in the apparent rate of speed.[46]

"The discs being of large size, small portions only of their surfaces—showing one phase of each of the circles of moving animals—were in front of the condenser at the same instant.



Muybridge's Zoöpraxiscope, Kingston-upon-Thames

"To correct the apparent vertical extension of the animals when seen through the narrow openings of the metal disc on its revolution in such close proximity to, and in the reverse direction of the glass disc, the photographs on the latter, after numerous experiments, were ultimately prepared as follows:—

"A flexible positive was conically bent inwards, and inclined at the necessary angle from the lens of the copying camera to ensure the required horizontal elongation of the animal while the straight line of ground corresponded with the curvature of the intended ground-line of the glass disc, towards the periphery of which the feet of the animals were always pointed.

"A negative was then made of this phase, and negatives of the other phases, in the same manner. All the negatives required for that particular subject were then consecutively arranged, equidistantly, in a circle, on a large sheet of glass; if the disc was to include more than one subject, the phases thereof were arranged in the same manner, and a transparent positive made of them collectively. The glass support of the resulting positive was subsequently cut into the form of a circle, and a hole bored through the centre, for the purpose of attaching it to the inner shaft of the apparatus. . . .Much time and care were required in the preparation of the discs, each figure having to be photographed three times, independently, before being photographed collectively.

"For many of the discs it was found advisable to fill up the outlines with opaque paint, as a more convenient and satisfactory method of obtaining greater brilliancy and stronger contrasts on the screen than was possible with chemical manipulation only. In the "retouching" great care was invariably taken to preserve the photographic outline intact.

"To this instrument the author gave the name of Zoöpraxiscope; it is the first apparatus ever used, or constructed, for synthetically demonstrating movements analytically photographed from life, and in its resulting effects is the prototype of all the various instruments which, under a variety of names, are used for a similar purpose at the present day. . ."

The first audience for the first motion pictures was Leland Stanford and his family, who saw them in their Palo Alto home in the autumn of 1879. [See Documents, E.]

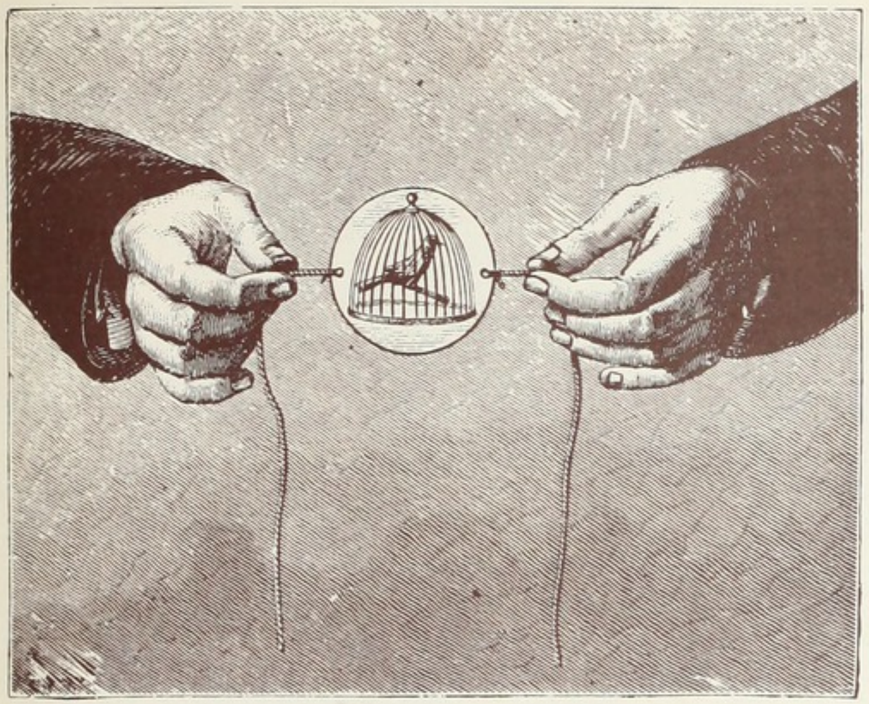
Several Nineteenth-century "Philosophical Toys," Forerunners of the Zoöpraxiscope

The nineteenth-century was avid for the synthesis of motion, and a number of so-called "philosophical toys" were created to present it. These precursors of Muybridge's zoöpraxiscope depended upon successive poses that could be observed with the eye, or psoed for the camera. They were available, as Marey had noted in 1873, for scientific use, and had, in fact, been used by M. Mathais Duval, professor of anatomy at the Ecole des Beaux-Arts with subjects drawn after graphic notations of human locomotion.

The principle underlying all of these nineteenth-century devices, as William I. Homer noted in his discussion of them in an address to the College Art Association in 1963, is the phenomenon of persistence of vision. When the retina of the eye is stimulated by images faster than 1/10 of a second, the illusion of continuous motion will result. The following illustrations and descriptive captions cite some of these nineteenth-century toys.

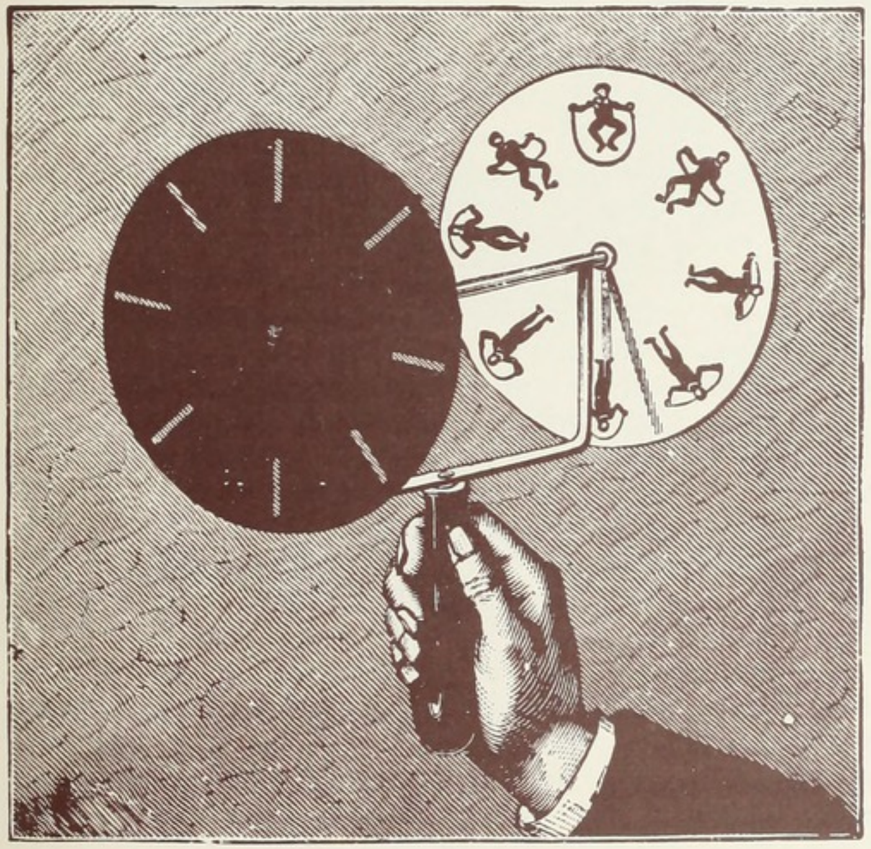
Thaumatrope 1826

Bird in a Cage. A circle of carboard has related images on both sides. When it is rapidly twirled, by means of attached strings, both images are simultaneously received by the viewer. In this



Thaumatrope 1826

Phenakistoscope 1832



case, the bird appears to be inside the cage.

Stroboscope or *Phenakistoscope* 1832

Simon Ritter von Stampfer, an Austrian, invented the *Stroboscope*, and independently, in the same year, the Belgian philospher and scientist Joseph Plateau invented the *Phenakistoscope*. In these two toys, a disk with perforated slots, on one side of which are drawings of successive movement, is rapidly rotated. To observe motion, the viewer looks through the slots toward a mirror which reflects the drawings on the other side in simulated motion. The devices were improved to eliminate the mirror by placing two counter-rotating disks on one shaft.

Daedelum, or *Wheel of Life*, later called the *Zoetrope* 1834

Although a toy called the Daedelum, or Wheel of Life, was invented in 1834 by W.G. Horner of Bristol, it did not gain wide popularity until 1867, when the same device was brought out in the United States under the name of zoetrope. The zoetrope turns the phenakistoscope to the horizontal; it is a slotted revolving drum through which the viewer peers to see apparent movement

Praxinoscope 1877

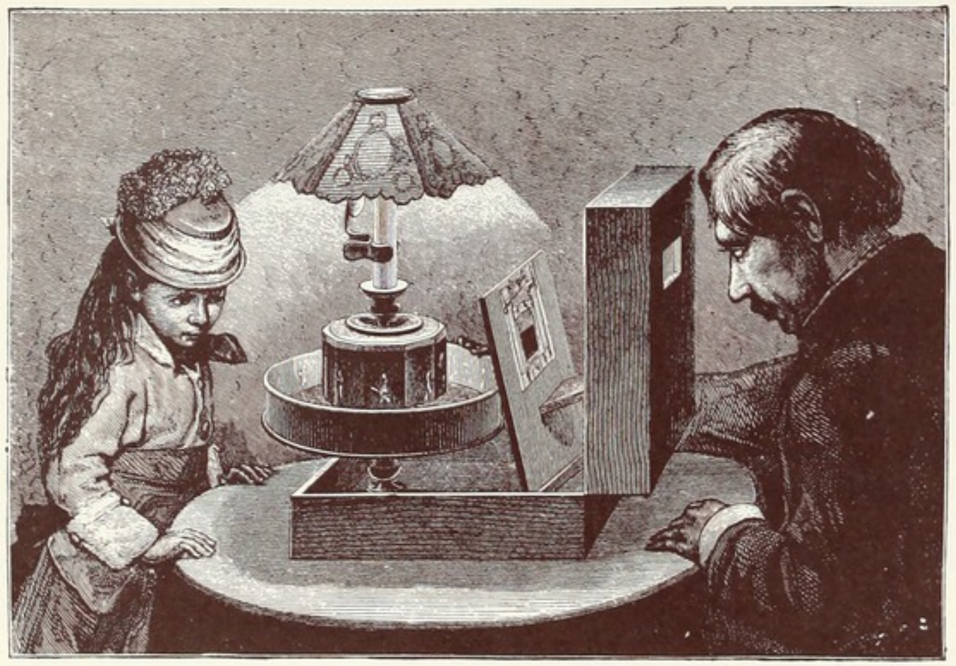
Emile Reynaud patented this device in Paris in 1877. It was an advance over the zoetrope, for Reynaud placed mirrors in the center of the drum, which reflected the images from its interior rim. Thus, the viewer looked over the outer rim, and saw a smoother motion than that interrupted by the slots of the zoetrope.

The Praxinoscope Theater 1878

Reynaud improved on his *Praxinoscope* in this delightful toy. Between the viewpoint and the turntable is a place for a scenic effect, which remains still, while the figures in the drum appear to move. The theater came equipped with a variety of scenic effects, from a circus ring for acrobats to a snow scene for skaters.

The Magic Lantern

Basic to Muybridge's zoöpraxiscope, of course, was the



The Praxinoscope Theater 1878

projection, or magic lantern, which had been in use since the 16th century. Slides for lantern projection also conveyed movement:

Chromotropes and Comic Slides

The chromotrope gives a kaleidoscopic effect when two counter-rotating circles of glass, with different designs on them, are moved by a simple string and tackle mechanism. The comic slides operate either by a lever, which moves a partially painted slide quickly to block out and then reveal portions of a painted image in a frame (a man doffs his hat, the devil pops in and out of a bundle of straw), or by a more complicated lever and rack-and-pinion method, in which two motions are apparent: a man snores as he sleeps (his jaw moved by a lever), while a rat circles from under his bed to jump into his mouth (operated by the circular motion of the rack and pinion). These slides were also used to educate: "The Earth's Rotundity" shows two ships circling the globe.

1880

Phases of the Eclipse of the Sun, 11 January 1880

albumen print from wet-plate collodion negative

3 1/4 x 4 1/4 in., mounted on a printed card 6 1/2 x 4 1/4 in.

"Photographed for Hon. Leland Stanford, at Palo Alto, California, by Muybridge"

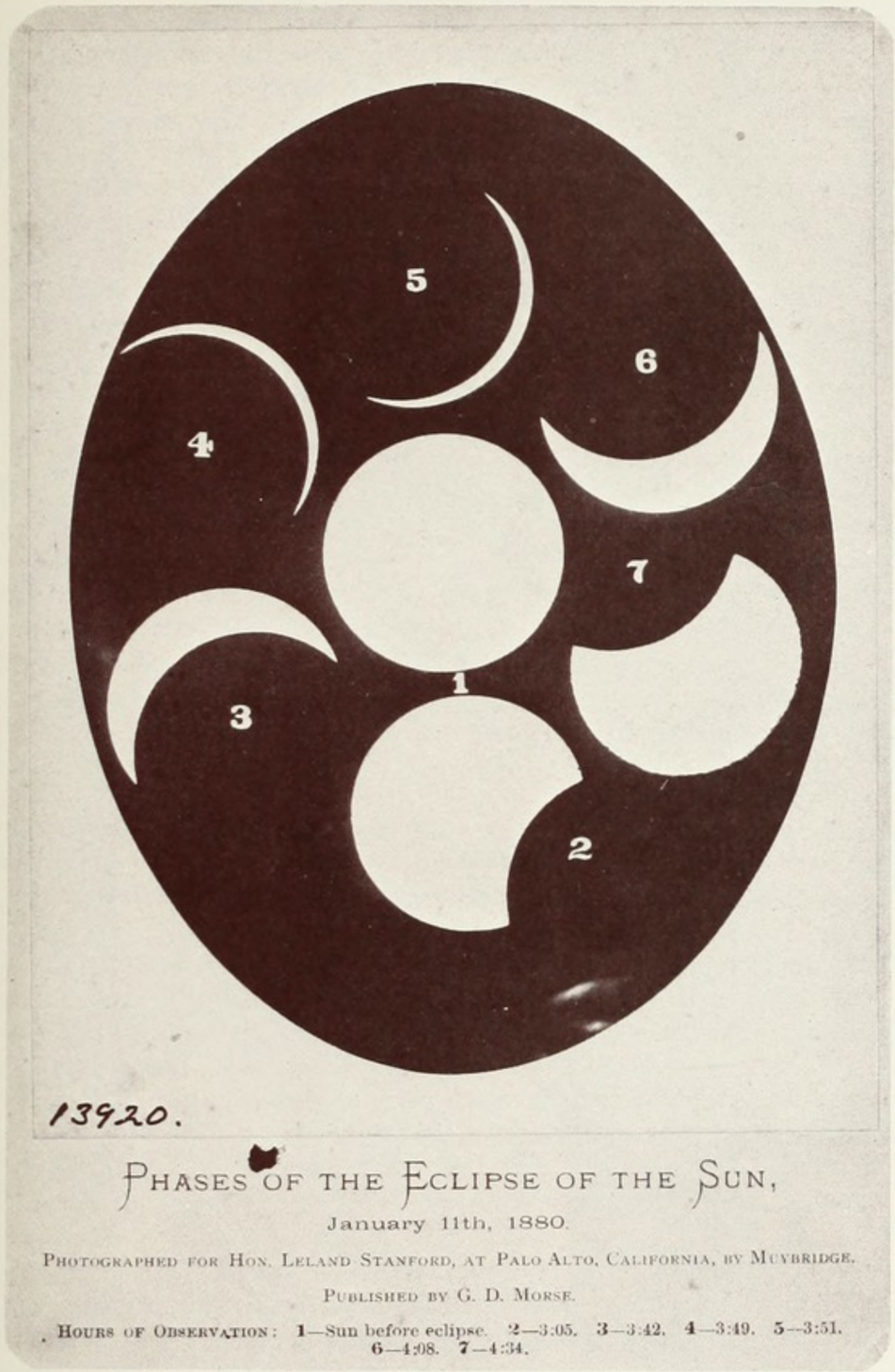
Published by G.D. Morse, San Francisco

Fifteen collodion negatives, 2 3/4 x 3 1/2 in., with time notations in Muybridge's hand

Collection Stanford University Museum of Art. The exhibition prints were made by the photographer Ralph E. Talbert from the Muybridge negatives

By the time Muybridge made his negatives of the total eclipse of 11 January 1880, photography had long served astronomy, particularly with regard to studies of the sun. Daguerreotypes had been made of the sun as early as 1842, under the direction of François Arago, the French astronomer who had announced Daguerre's invention to the Acadèmie des Sciences on 7 January 1839. Wet-plate collodion, a faster process, was introduced in 1851. Photographs taken with wet-plates by the German photographer Berkowski during the eclipse of 28 July 1851 made visible some prominences, as well as the inner corona of the sun, and from the accurately timed photographs taken in Paris during the eclipse of 15 March 1858, the apparent diameter of the sun was established.[48] Muybridge was among the last photographers of an eclipse to use the wet-plate method, for by 1880 the modern silver-bromide gelatin emulsion had appeared. With this faster film, photography became an indispensable tool of astronomical discovery.

The Stanford Museum's set of negatives of the 1880 eclipse is not complete; according to Museum records, five are missing. This may account for the inequality of the time intervals between exposures. The most complete eclipse of the sun occurred at 3:50 p.m., as reported in San Francisco. In Palo



Stanford University Museum of Art

Alto, Muybridge took three successive photographs around that time at intervals of three, three and two minutes: by his own notation, at 3:46 p.m., 3:49 p.m. and 3:51 p.m.

Immediately after 3:50, according to a newspaper account,[49] "the most singular phenomenon of the eclipse occurred, as observed in San Francisco. It consisted of the rapid changes of the crescent of light as the moon passed over the sun's disk. [In] the first phase. . . the horns of the crescent pointed horizontally to the south, but in the course of the half minute which this extreme obscuration lasted, the horns of the crescent rapidly changed position until they pointed to the zenith. When the sun set in the west the left hand side of the upper limb was notched. . . by the moon's outline."

Seven of the twenty-one phases Muybridge recorded are represented in the published photograph, which appears to be a photograph copy of drawings made after the original photographs, and lacks any suggestion of photographic quality. It may have been made with scissors and paper.

The total eclipse of the sun of 11 January 1880 was the last one of the nineteenth century. Significantly, his photographs of it were the last ones "Helios" was took for Leland Stanford.[50]

1881

The Attitudes of Animals in Motion. A Series of Photographs Illustrating the Consecutive Positions Assumed by Animals in Performing Various Movements

"Executed at Palo Alto, California, in 1878 and 1879, "Copyright 1881, by Muybridge"

In Stanford's presentation copy:
"Hon. Leland Stanford: Sir—Herewith please find the photographs illustrating *The Attitudes of Animals in Motion*, executed by me according to your instructions, at Palo Alto in 1878 and 1879. Muybridge, Menlo Park, 15th May, 1881."

Two-hundred and three albumen prints from wet-plate collodion negatives, 6 3/4 x 9 3/4 in.

Rare Books and Special Collections, Stanford University Libraries, holds a copy of *Attitudes* in which the photographs are mounted. The Stanford University Museum of Art's copy,

shown in the exhibition, is unmounted; the prints are trial proofs on print-out paper

In this summation of Muybridge's work for Stanford, the individual pages are untitled, and bear only his copyright stamp. Preceding the "Index to Illustrations" is Muybridge's introduction:

"The accompanying photographs, illustrating the attitudes of animals in motion, were executed in 1878 and 1879, at the Palo Alto Stock Farm, by instructions of Governor Leland Stanford.

"The following is a brief description of the introductory illustrations:

"A. General view of the Palo Alto Stock Rancho.

"B. A photographing Camera and back of Electro-shutter. Two light panels of wood, each with an opening in the center are adjusted to move up and down, freely in their framework. These panels are arranged to exclude light from the lens and are held in position by a latch. At the proper time, a current of electricity charges a magnet attached to the shutter frame, an armature is thereby attracted and caused to strike the latch which holds the panels; they, being released, are drawn respectively upwards and downwards with great rapidity, by rubber springs, and light is admitted to the photographing plate while the openings in the panels are passing each other.

"C. Front of Electro-shutters, with positions of panels before, during, and after exposure.

"D. Front of operating room in which are arranged parallel with the track, 24 Cameras, at a distance of 12 inches from the center of each Lens, and an Electro-shutter in front of each.

"E. Operating track, covered with rubber flooring, and crossed with lines 12 inches apart, over which the animals are caused to move. On one side of the track a white background is arranged at a suitable angle. The cross lines on the track are distinguished by the upper line of figures. The particular Camera in which any negative of a series is made, is designated by the parallel direction of the vertical stake, with the horizontal line extending to the corresponding number of the Camera immediately opposite. The discriminating number of each series of exposures is recorded on each negative by the large figures [229 for example] which is changed for each movement illustrated.

"F. General view of the experiment track, background and Cameras. Threads are being stretched across the track, 12 inches apart, and at a suitable height for photographing the action of a running horse. One end of each of the threads is secured in front of the Cameras, hauled taut, and fastened to a metal spring, which is drawn almost to the point of contact with a metal plate. In its progress over the track, the animal strikes these threads in succession, and as each spring touches its metal plate, a current of electricity is sent through a connecting wire to the magnet in the shutter opposite, and exposures of the plates in the line of Cameras is successively made, each exposure recording the position of the animal at the instant of his pressing against its corresponding thread; this accomplished, the thread immediately breaks. For horses driven in vehicles the exposure is made by steering one of the wheels over wires, slightly elevated from the ground, the successive depression of each one completing an electric circuit, and making its corresponding exposure.

"For recording the movements of animals not under direct control, clock-work apparatus is arranged to cause successive exposures at regulated intervals of Time instead of at uniform distances. The boxes, arranged in a semi-circle contain Electro-shutters and Cameras, for obtaining simultaneous exposures of the same position of the animal from different points of view. —Muybridge"

It is not known how many copies of this book Muybridge printed. There must have been at least five: the one that appears in the Meissonier painting of *Leland Stanford*, 1881 (now in the Stanford Museum), and the four that Muybridge sold in London before his return to the United States in 1882 [see Documents, H]. There is a copy in the Library of the Academy of Arts and Sciences, which may be one of the five accounted for above. The book was, at any rate, handmade. No reproductive process was used for the photographs. There was no factory setup at Palo Alto, and there is no publisher named. Muybridge printed the five (at least) sets of 203 photographs himself. It was a prodigious work.

The photographs in *Attitudes of Animals in Motion* have an archetypal quality, a tense awkwardness that is apparent in any art before the finesse that accompanies foreseeable results sets in. Muybridge was experimenting in 1878-79; he was at the height of his interest in the doing of the work.

Running high leap, Photograph 103,
Attitudes of Animals in Motion


1
12 13 14 15 16


2
12 13 14 15 16


3
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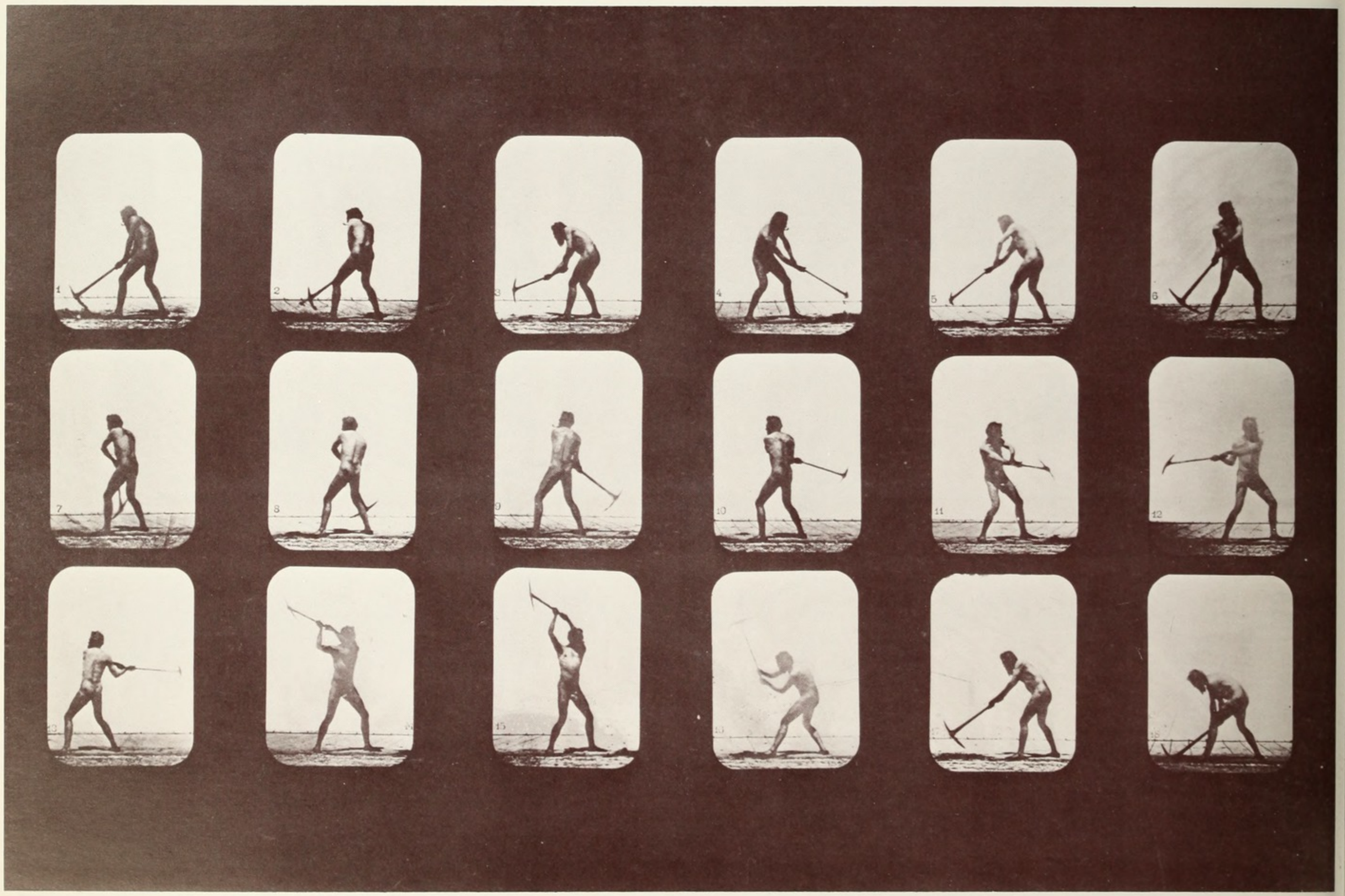
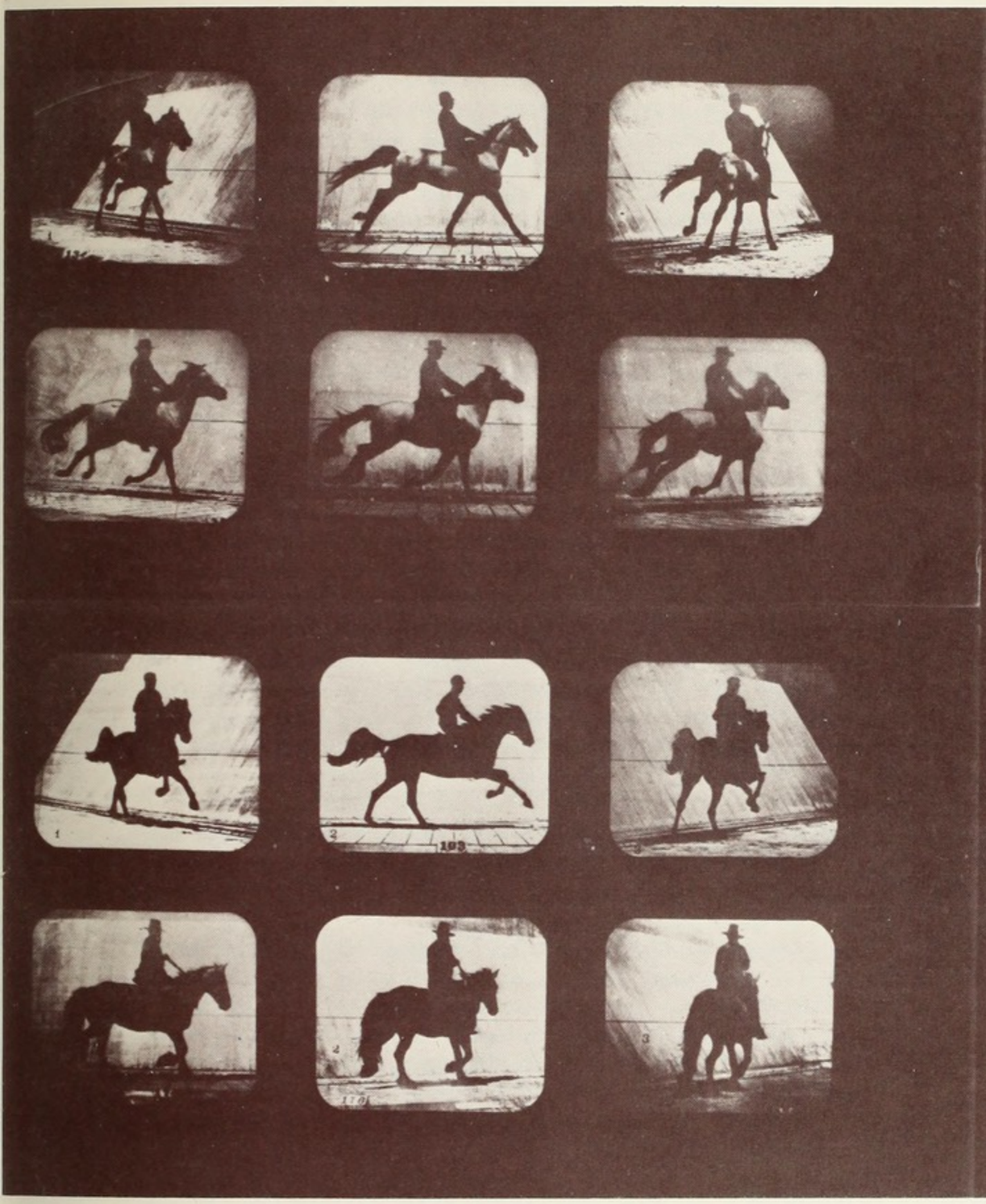
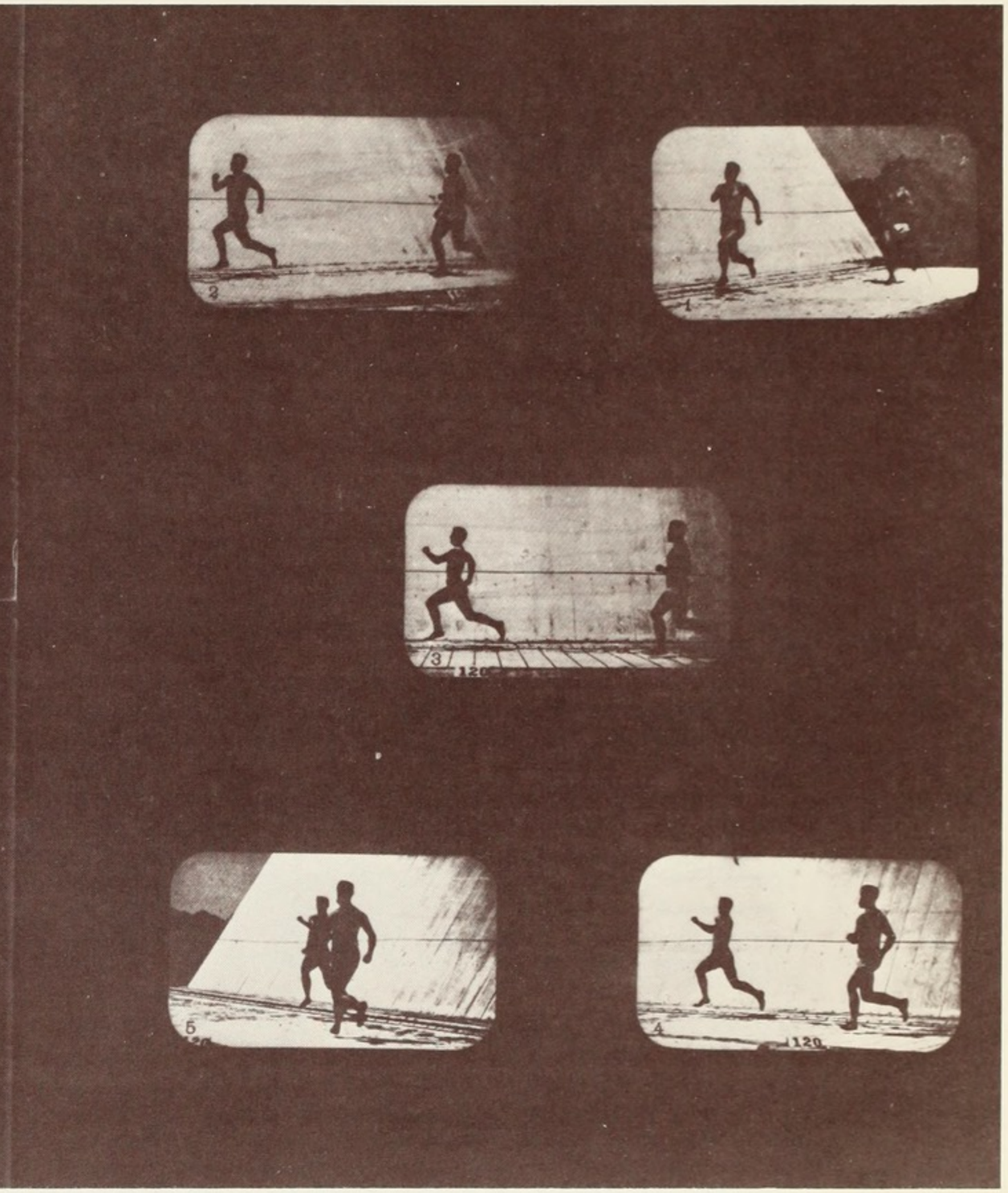




Opposite:
Athlete swinging a pick
Photograph 110, *Attitudes of Animals in Motion*
Two cameras have been used; the photographs are not consecutive



Above:
Studies of foreshortenings
Photographs 187-191, *Attitudes of Animals in Motion*

1882 *The Horse in Motion*

The Horse in Motion, As Shown by Instantaneous Photography, With a Study on Animal Mechanics, Founded on Anatomy and the Revelations of the Camera, in which is Demonstrated the Theory of Quadrupedal Locomotion, by J.D.B. Stillman, A.M., M.D.

"Executed and Published under the Auspices of Leland Stanford"

Boston, James R. Osgood and Company, 1882

Printed by the University Press, Cambridge

"One Volume, Royal Quarto, Fully Illustrated, $10" [51]

Five heliotype reproductions of Muybridge photographs, nine color plates of anatomical drawings, ninety-one photo-lithographs of drawings made from Muybridge's photographs, 127 pages of text

Rare Books and Special Collections, Stanford University Libraries

The publication of this book in February 1882 ended the Stanford/Muybridge collaboration. It reached England in April, 1882, when Muybridge was famous for his demonstrations before learned societies of the analysis and synthesis of animal motion, of which he claimed to be the originator. Because his name did not appear on the title page, and because Stanford named him only as a "skilled photographer," his word was questioned; he started a suit against Stanford and returned to America. [See "Eadweard Muybridge, 1830-1904," and Documents F and H for a history of the suit.]

The history of the book has an equally sad conclusion. Although long reviews of it were placed by the publisher in the leading newspapers throughout the country and abroad, it did not sell. Stanford wrote the following note to Dr. Stillman, who was to remain his lifelong friend, on July 28, 1882:

"I have not your last letter before me, but I remember that the business portion of it was in regard to the price of the book. I think a low price is best for I would like to hear of some sales and possibly someone may want it if the price is low enough. I have never heard of anybody's buying the book nor have I heard of the book's being sold." [53]

Comparison of the lithographic plates in Stillman's volume with the Muybridge photographs the drawings were made from suggests one reason for the failure of this expensive publication [see p. 28]. The Muybridge photographs catch the vivacity of motion of the subjects; the lithographs appear posed, lifeless renderings of motion extracted from its actual setting. Stillman had guided the book through the press, but no doubt it was understood by Stanford that drawings after the photographs rather than reproductions of them were to be used. In making this decision Stillman and Stanford underestimated the convincing power of the photographs, underexposed as some of them might have been. The decision to use line copies of them was consistent with Stanford's customary acceptance of photography as a medium that gave information, rather than as a visual medium, with an inherent message.

Stillman's text is heavily written, and according to W.M.R. French, who sent Stanford a thirteen-page manuscript of corrections, in case there should be a second edition, was full of errors, which even included the misspelling of the name of Stanford's star horse, Abe Edgington. The thought of a second edition was put aside, although Stillman had ordered $2,000 worth of corrected plates for it in advance, so confident was he of its success.[54] As for the first edition, those volumes that were not sold are believed to have been burned along with everything else in the fire that destroyed the Stanford San Francisco home in April, 1906.

Although Muybridge did not win his suit, he had the last word. In his *Prospectus and Catalogue* for *Animal Locomotion*, 1887, he wrote:[55]

"In conclusion, it may not be irrelevant for the author to remark that a number of his early experimental photographs of animal movements, and his original Title, "The Horse in Motion," were copied, and published a few years ago, in a book which is referred to in the following paragraph, reprinted from *Nature* (London), June 29, 1882. After the full Title of the book is quoted, the reviewer says, 'The above is the somewhat long title of a large and important work issuing from the well-known Cambridge (U.S.) University Press.

" 'Long as is the title, the name of the principal contributor to the volume is left unrecorded there; though, indeed, even a cursory glance over its contents shows how much indebted is the whole question of the mode of motion in the horse to the elaborate series of investigations of Mr. Muybridge.' "

Notes

1. *Catalogue of Photographic Views Illustrating the Yosemite, Mammoth Trees, Geyser Springs, and other remarkable and Interesting Scenery of the Far West, by Muybridge*, Bradley & Rulofson, San Francisco, 1873. Original in The Bancroft Library, University of California, Berkeley. The catalogue has been thoroughly studied by Mary V. Jessup Hood and Robert B. Haas. Their article, "Eadweard Muybridge's Yosemite Valley Photographs, 1867-1872," *California Historical Society Quarterly*, Vol. XLII, San Francisco, March 1963, pp. 5-26, gives the results of the study. Much of the information in the present discussion depends upon it.
2. Beaumont Newhall provided this article by H.W. Vogel, as well as the information about him.
3. Three other photographers had preceded him. The pre-1872 history of the graphic representation of the Valley, whose existence became generally known in 1851, when the Mariposa Battalion chased a group of Indians into it, is, in brief, as follows: In the summer of 1855, the young English artist Thomas Ayres accompanied a party of tourists led by James M. Hutchings, the first "developer" of the Valley. There he made wash drawings of views,.two of which were published in San Francisco in 1855 (Emil Ernst, "Yosemite's First Tourists," *Yosemite Nature Notes*, Vol. XXIV, No. 6, June 1955). In 1859, Charles L. Weed, for whom Hutchings also served as guide, took twenty 10 x 14 in. plates and forty stereos, which were published in San Francisco by Vance's Gallery (Mary V. Hood, "Charles L. Weed, Yosemite's First Photographer," *Yosemite Nature Notes*, Vol. XXXVIII, No. 6, June 1959). In 1861, Carleton E. Watkins took photographs on the Valley floor and the first photographs from above the Valley. He made subsequent trips during the mid-sixties; his photographs were published in the U.S. Government Survey, *Geology*, Vol. I, 1865, and *The Yosemite Book*, 1868 (Hood and Haas, *op. cit.*, p. 8). In 1866, W. Harris completed a series of views taken in and around Tuolumne Meadows (the high country) for J.D. Whitney, director of the Geological Survey, and these were published in *The Yosemite Book (ibid.)*. Then Muybridge entered the scene.
4. For his titles in the Hittell volume, Muybridge used the Indian names favored by Hutchings, e.g.: "Tissayac, or Half Dome," "Piwyac, or Vernal Fall," "Yowiye, or Nevada Fall." He continued this practice after others had abandoned it.
   The following passage in Hittell's guidebook describes the landscape:
   "The great attraction of Yosemite is the crowding of a multitude of romantic, peculiar and grand scenes within a very small space. One of these waterfalls, one of these vertical cliffs, half a mile high, one of these dome or egg-shaped mountains, or the chasm itself, as a geological curiosity, would be worthy of world-wide fame; but at Yosemite there are eight cataracts, five domes, a dozen cliffs, several lakes and caverns, and numberless minor wonders, besides the biggest groves near by, and scores of mountains. . . ." (Hittell, *op. cit.*, p. 9.)
5. Kingston Scrapbook, p. 8.
6. I am also grateful to Beaumont Newhall for this quotation.
7. By 1872, there were other possibilities for easier travel: by rail or boat and rail from San Francisco to a stage point; by stage to several points from which horses and pack mules then descended into the Valley.
8. Kingston Scrapbook, p. 15.
9. Artists listed as subscribers include: "A. Bierstadt, Charles C. Nahl, Norton Bush, S.M. Brookes."
10. Kingston Scrapbook, p. 8.
11. According to Mary and William Hood, who have studied early photographs of Yosemite from a geological and botanical point of view, the Indians who summered in the Valley before the white settlers arrived had periodically burned off growth on the floor. The earliest tourists, therefore, had much more complete views of the surrounding rock formations and the waterfalls than are available today, when the growth of trees and shrubs has gone unchecked.
12. For the history of photographic war reporting, see Helmut Gernsheim, *The History of Photography from the Camera Obscura to the Beginning of the Modern Era*, New York, 1969, pp. 267-74, 453-4. Also, Beaumont Newhall, *The History of Photography from 1839 to the Present Day*, second edition, New York, 1964, pp. 67-74.
13. Some are identical views; a stereo cut to 3¼ in. square and separately entered, has been counted as one.
14. Conversation, January 1972.
15. R.B. Haas, manuscript of *Muybridge, Man in Motion.*
16. This page numbering does not represent the original order of the album, which cannot be known, since the pages were loose and had been regrouped. The letters signify the position of the prints on each page.
17. The information about the *SS Costa Rica* and, following, about the *Vasco da Gama* was given by Karl Kortum, Director, and the late Albert Harmon, Librarian, of the San Francisco Maritime Museum.
18. The Bancroft Library, University of California, Berkeley.
19. Identified by Mary V. Jessup Hood.
20. From the subscription offer written in Panama by Muybridge on 1 October 1875. The offer is signed "Eduardo Santiago Muybridge." Kingston Scrapbook, p. 15, insert.

21. Kingston Scrapbook, p. 14.
22. *Ibid.*
23. On the flyleaf of one of the Stanford albums, H.C. Peterson wrote: ". . .Upon his return he attempted to coerce the Pacific Mail SS. Co. to buy the lot from him on the basis of a purported contract with him. In the endeavor to realize money from the P.M. SS. Co., he threatened suit—but the proof was too conclusive that there was no contract."
24. A set of unidentified views will shortly be published in a biography of Muybridge by Kevin MacDonnell of England. These may be the views that are mentioned in a letter of Walter R. Miles, a former professor at Stanford University, to Mrs. Helen Cross, Associate Director of the Stanford Museum, on 19 December 1955. Miles, writing from Istanbul, asks for a microfilm of the two albums with Muybridge's handwritten titles in them so that he can identify his set of seventy unmounted views given to him by Mr. Timothy Hopkins (the son of Stanford's partner, Mark Hopkins), in 1929, when Miles was "chairman of the committee that arranged the Stanford-Muybridge Celebration." He asks that the microfilm be sent to Mrs. E.B. Ginsburg of Clinton, South Carolina, who "is studying the Muybridge photographs, on a project of mutual interest." Letter in the files of the Stanford Museum.
25. Report of the Jurors, Eleventh Industrial Exhibition, San Francisco, 1876. Kingston Scrapbook.
26. Kingston Scrapbook.
27. From notes made by Kent Seavey, Stanford University, from the Norton Bush scrapbooks in the Oakland Museum Library.
28. Cited in George T. Clark, *Leland Stanford, War Governor of California, Railroad Builder and Founder of Stanford University*, Stanford University Press, 1931, p. 310.
29. For the history of the painted diorama (also called panorama), see Helmut and Alison Gernsheim, *L.J.M. Daguerre*, second edition, New York, 1968, and Olive Cook, *Movement in Two Dimensions*, London, 1963, especially Chapter 2. For photographic panoramas, see H. Gernsheim, *The History of Photography, op. cit.*, pp. 119, 126-7, 142, 291, 136-7.
30. For reproductions of panoramic views of San Francisco made by daguerreotypists between 1850 and 1853, see *Sea Letter*, San Francisco Maritime Museum, Vol. II, Nos. 2 and 3, October 1964.
31. *Alta California*, 22 July 1877. Quoted on Muybridge's advertisement for the panorama. California Historical Society, San Francisco.
32. From notes made by Kent Seavey, Stanford University, from the Norton Bush Scrapbooks in the Oakland Museum Library.
33. The author of "Bohemian Bubbles" in the San Francisco *Post* thus criticized Koch's work on Occident:
"It is not an unusual error with artists to paint one limb out of proportion with another, and it might be excused in photography, only that the apparatus can't lie. I don't know, though I could excuse Koch if he had painted those legs in Indian ink instead of simply retouching the negative to give a better effect. He should know anatomy, but it is strange how little artists study nature. One artist receiving a commission to paint a picture of a shipwreck painted some red lobsters among the rocks on shore, and another, not being able to get on without a bit of red somewhere in the foreground of a river scene, painted a bunch of carrots floating down the stream. Now, lobsters are not red until after they are boiled, and as a matter of fact, carrots don't float." Kingston Scrapbook, p. 12.
34. The judges used the same wording Muybridge had used in a letter to the editor of the *Alta California* dated 2 August 1877:
". . .I herewith enclose you a photograph made from a negative, which I believe to have been more rapidly executed than any ever made hitherto.
"The exposure was made while "Occident" was trotting past me at the rate of 2:27, accurately timed, or 36 feet in a second, about 40 feet distant, the exposure of the negative being less than the one-thousandth part of a second. The length of exposure can be pretty accurately determined by the fact that the whip in the driver's hand did not move the distance of its diameter. . . ." Kingston Scrapbook, p. 19.
35. San Francisco *Morning Call*, 16 June 1878. Kingston Scrapbook, p. 21.
36. Kingston Scrapbook, p. 20.
37. San Francisco *Chronicle*, 9 July 1878. Kingston Scrapbook, p. 30.
38. San Francisco *Bulletin*, 28 August 1878. Kingston Scrapbook, p. 30.
39. *Alta California*, 20 November 1878. Kingston Scrapbook, p. 32.
40. Kingston Scrapbook, p. 57.
41. The differences between the Stanford zoöpraxiscope and Muybridge's original are optical and mechanical. Muybridge used a lens of longer focal length for projection up to life-size. The lens had to be mounted on its own pedestal, apart from the machine. The Stanford copy has a lens of shorter focal length, mounted in front of the gear frame. The Stanford copy uses a tungsten filament light instead of oxyhydrogen. It does not have the attachments Muybridge used to project still slides as well as moving pictures. Like the original, the copy is operated by hand. David Beach, who designed and built the Stanford zoöpraxiscope, believes that the modified magic lantern in the Stanford Museum

Collection is the prototype of the light housing that Muybridge used, and has incorporated it into his copy of the original.

42. For a history of the zoetrope and other nineteenth-century "philosophical toys," see Gaston Tissandier, *Popular Scientific Recreations*, New York, c. 1879; O. Cook, *Movement in Two Dimensions*, London, 1963; and D.B. Thomas, *The Origins of the Motion Picture*, London, Science Museum, 1964.
43. The phenakistoscope was also called "zootrope" at this time; after 1867, when the Daedelum was introduced to the United States under the name zoetrope, the name was usually reserved for this slotted revolving-drum device. See the descriptions and illustrations below for some of the many nineteenth-century scopes and tropes.
44. Etienne-Jules Marey, *Animal Mechanism*, New York, 1874, p. 137.
45. The "quick succession" of one image after another was noted in reports on the lectures by several San Francisco and Sacramento newspapers. Kingston Scrapbook, p. 30.
46. Compare the counter-rotation of the disks with the improved phenakistoscope, below.
47. Marey, *Ibid.*
48. The full history is given in Gerard de Vaucoulerurs, *Astronomical Photography, from the Daguerreotype to the Electron Camera*, translated by R. Wright, New York, 1961.
49. San Francisco *Evening Bulletin*, 12 January 1880.
50. In his Preface to *Animals in Motion*, 1899, Muybridge remarks: "With the exception of a series of phases of a solar eclipse, made in January, 1880, the Palo Alto researches were concluded in 1879."
51. From the advertisement for the book published by H.H. Bancroft, San Francisco, 1882. The Bancroft Library.
52. Dr. Stillman was a Gold Rush pioneer. He had earlier published his account of the voyage from New York in 1849 and of life in California: *Seeking the Golden Fleece*, San Francisco and New York, 1877.
53. Stanford University Archives
54. Letter, Osgood to Stillman, 30 December 1881. Stanford University Archives.
55. Muybridge, *Animal Locomotion, Prospectus and Catalogue*, University of Pennsylvania, 1887, pp. 17-18.

Jean-Louis-Ernest Meissonier
Self-Portrait in the Studio
from Gustave Larroumet, *Meissonier*, n.d., p. 8

131, Boulevard Malesherbes

Mon cher ami
M^r Muybridge d'Amérique
m'a fait voir une série de projections
photographiques mettant en mouve-
-ment les hommes & les animaux
Cela m'a paru d'un si haut intérêt
que j'ai pensé qu'il vous serait désa-
gréable de vous et qu'il vous en
plairait peut-être avec d'autres amis, j'ai
prié M^r Muybridge de recommencer
cette expérience
Venez donc samedi prochain 26 de
mois à cinq heures, nous causerons quelques
instants ensemble et vous verrez
une scène un peu curieuse
Venez sans cérémonie, je vous invite
j'ai invité par le Dames
à venir bien cordialement
E Meissonier

Muybridge's copy of Meissonier's invitation for
the demonstration of 26 November 1881
Kingston Scrapbook, p. 72, insert
Muybridge Collection, Central Library, Kingston-upon-Thames

Marey, Muybridge and Meissonier

The Study of Movement in Science and Art

Françoise Forster-Hahn

Ever since Leonardo's efforts to analyze "phenomena of short duration," such as the flight of birds or the waves of water, artists and scientists have attempted to visualize and make visible what lies beyond the limits of human perception. But only with the help of modern technology and through the conjunction of science and art did the century-long searches come to a successful conclusion in the latter part of the nineteenth century. One of the central issues in the nineteenth century was the analysis of the horse's movements during its various gaits. The history, the results and the impact of these crucial experiments will be investigated in the following essay.

I. Crystallation of Scientific, Photographic and Artistic Investigations, 1870-1881

Paris 1881

On 26 November 1881 the French painter Jean-Louis-Ernest Meissonier (1815-1891) gave Eadweard Muybridge a spectacular reception in his elegant Paris residence, which was not only chronicled in many newspapers of the day, but became a much-discussed topic in artistic and scientific circles interested in the analysis and representation of movement. An article in the *American Register* of 3 December 1881, under the title "Mr. Muybridge's Photographs of Animals in Motion," described Muybridge's demonstration in enthusiastic terms and named the many illustrious guests gathered by Meissonier for this extraordinary occasion:

"One of the latest topics of Parisian conversation has been the magnificent entertainment at the residence of M. Meissonier, where we had the pleasure of meeting a large number of the most eminent artists, scientists and literati of Paris. The object of the renowned artist was to introduce to his friends Mr. Muybridge, of California, and afford them an opportunity of witnessing a very remarkable exhibition. . . . At last the Gordian knot is solved, and from the far-off land of California comes a man who is welcomed by the most eminent of living painters, accorded his friendship, and introduced by him, with a generosity equaled only by the greatness of his renown, to an assemblage of eminent men, such as is seldom found within the walls of one room . . . . The pictures consisted of a large number of photographs projected with the aid of the oxyhydrogen light, the size of life, upon a screen, illustrating the attitudes assumed by a horse during each twelve inches of progress, while performing the various movements of hauling, walking, ambling, cantering, galloping, trotting, leaping . . . Other pictures illustrated the actions of the dog, the ox, the deer, etc., and the attitudes of men in the act of wrestling, running, jumping, and other athletic exercises. . . . With the aid of an instrument called the zoopraxiscope many of the subjects were exhibited in actual motion, and the shadows traversed the screen, apparently to the eye as if the living animal itself were moving, and the various positions of the horse and the dog, many of which, when viewed singly, are singular in the extreme, were at once resolved into the graceful, undulating movements we are accustomed to associate with the action of those animals. The most remarkable and beautiful pictures were probably those of birds on the wing. . ." [1]

Among the guests were the artists Eugène Guillaume, then director of the Ecole des Beaux-Arts, Jean Léon Gérôme, Alexandre Cabanel, Léon Bonnat, Jean-Baptiste Edouard Détaille, the critics Jules Claretie and Albert Wolff and the poet Alexandre Dumas fils. Meissonier had assembled some of the most famous and influential painters and critics of the official art establishment of the day. They all witnessed the photographic proof that the horse had, indeed, all four legs off the ground during one phase of the gallop; not in the traditional "hobby-horse" position, however, but in a rather odd way, with all four legs bunched together under its body. The author of the article in the *American Register* singled out three aspects of Muybridge's demonstration that had been noted earlier in the American press. These aspects were to become the main issues in all future discussions: the extreme oddity of the individual attitudes as they were caught in single

photographs; their synthesis by the zoöpraxiscope into "graceful undulating movements"; and, thus, the reconciliation of the odd and unexpected stills with the accustomed perception of the human eye.

Two months before this reception, Muybridge had given an "exhibition" at the home of the physiologist Etienne-Jules Marey (1830-1904) "in the presence of a large number of scientists from various parts of the world, then attending the Electrical Congress at Paris."[2] The first public record of Muybridge's appearance in Paris is an article in *Le Globe* of 27 September 1881.[3] Both demonstrations, the first one given before an audience of internationally renowned scientists, and the second before artists, literati and critics, had far-reaching consequences, particularly for the two men who had been Muybridge's hosts.

The demonstration in Meissonier's residence represented for his guests the culmination of a long and arduous search by artists to establish the phases of the horse's gaits, for it presented to them the conclusion of photographic experiments in "synthetically demonstrating movements analytically photographed from life."[4] For Muybridge, the reception at Meissonier's and its publicity was the stepping stone for his triumphant European lecture tour and his future career. In two letters that he wrote immediately after these events, he clearly realized the impetus they would give to his professional life:

"I have happily obtained a recognition among the artists and scientists of Paris which is extremely gratifying, and were honor all that I am seeking, I need have no apprehension."

"M. Meissonier exhibits the greatest interest in my work, and through his commanding influence I have obtained a recognition here which is extremely gratifying and advantageous."[5]

Muybridge continued his work in the "Electro-Photo studio in the Bois de Boulogne" and his ambitious plans included a joint publication with Meissonier and Marey.[6]

Marey's Research and Duhoussets's Investigations

The first news of Muybridge's successful experiments at Leland Stanford's Palo Alto Farm had reached Europe three years earlier, when Gaston Tissandier (1843-1899) had published copies of some of his instantaneous photographs in the journal

lancé au trot avec une vitesse de 727 mètres à la minute. La figure 5 enfin est un véritable tour de force photagraphique; elle reproduit la succession des temps de l'allure de *Sallie Gardner*, au grand galop de course, fendant l'espace avec une vitesse de 1142 mètres à la minute.

Nous recommandons à nos lecteurs de bien étudier chacune des positions du cheval dans ce mou-

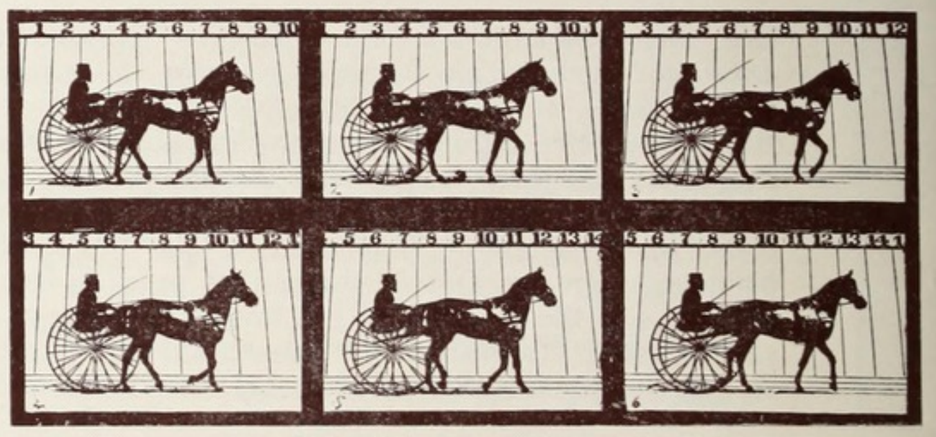


Fig. 1. — Cheval au pas. — 105 mètres à la minute.

vement vertigineux. Dans le n° 1 (fig. 5) une seule jambe, celle de devant droite touche terre, tandis que les trois autres sont suspendues par une énergique contraction des muscles. Dans le n° 5 (fig. 5) on voit le cheval entièrement isolé, aucune de ses jambes ne touche le sol, elles sont ramassées sous le ventre, au moment où elles vont être lancées, comme sous l'action d'un ressort qui se détend.

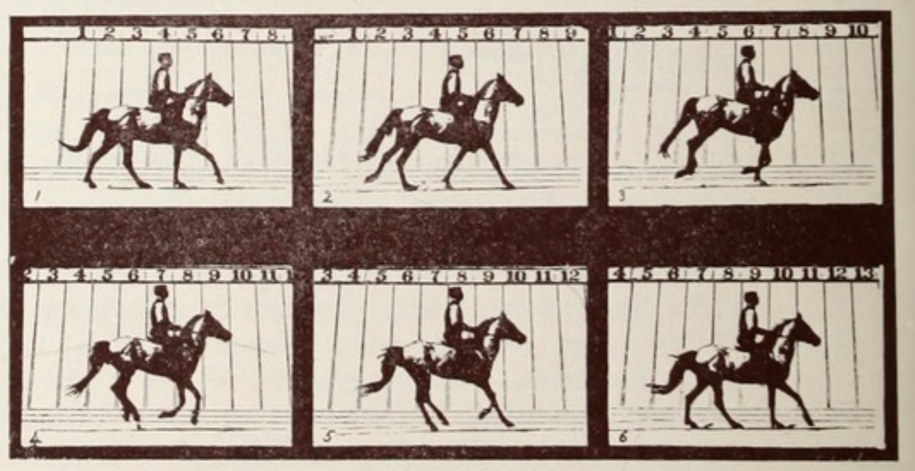


Fig. 2. — Petit galop. — 200 mètres à la minute. (Reproduction par l'héliogravure de photographies instantanées.)

On remarquera dans les n°s 8 et 9, comme une des jambes de devant est singulièrement tendue, dans une position qui n'aurait jamais été soupçonnée sans le secours de la photographie instantanée.

Nous devons ajouter que l'écartement des lignes verticales sur les photographies de M. Muybridge est de 21 pouces anglais, soit de 0m,582 millimètres et celui des lignes horizontales de 0m,102 millimètres. — Les numéros indiqués au-dessus de chaque figure ont été ajoutés après coup sur le cliché, et servent à l'étude de chacune des images.

Ces différentes gravures héliographiques forment

La Nature, 14 December 1878
The first European publication of the Stanford-Muybridge experiments

La Nature of 14 December 1878. Tissandier, a chemist and aeronaut, had founded *La Nature* in 1873 and acted as its versatile and inspiring editor. It was from this publication that Marey first learned about Muybridge's and Stanford's investigations into animal locomotion. Tissandier had immediately sensed the value of Muybridge's photographs for both physiologists and artists and publicly recognized Muybridge's results as an important complement to Marey's studies,[7] which he had published in *La Nature* for 28 September and 5 October 1878. Marey, who had been professor of natural history at the College de France since 1869, devoted his entire scholarly work to the study of movement. Since the early 1860s he had recorded his analytical experiments with graphic notations and had published his researches in a number of books and articles. Marey later acknowledged that the possibility of applying photography to the study of animal and human locomotion marked a decisive turning point in his work.[8] Thus he grasped immediately the potential of Muybridge's photographic investigations, which to some extent paralleled his own researches at the time. In a letter printed in *La Nature* of 28 December 1878, the issue immediately following the first European publication of Muybridge's photographs, Marey welcomed them as both a superior means of physiological studies and a "revolution" for artists because they furnished "the true attitudes of movement," and "positions of the body in instable balance in which a model would find it impossible to pose."[9]

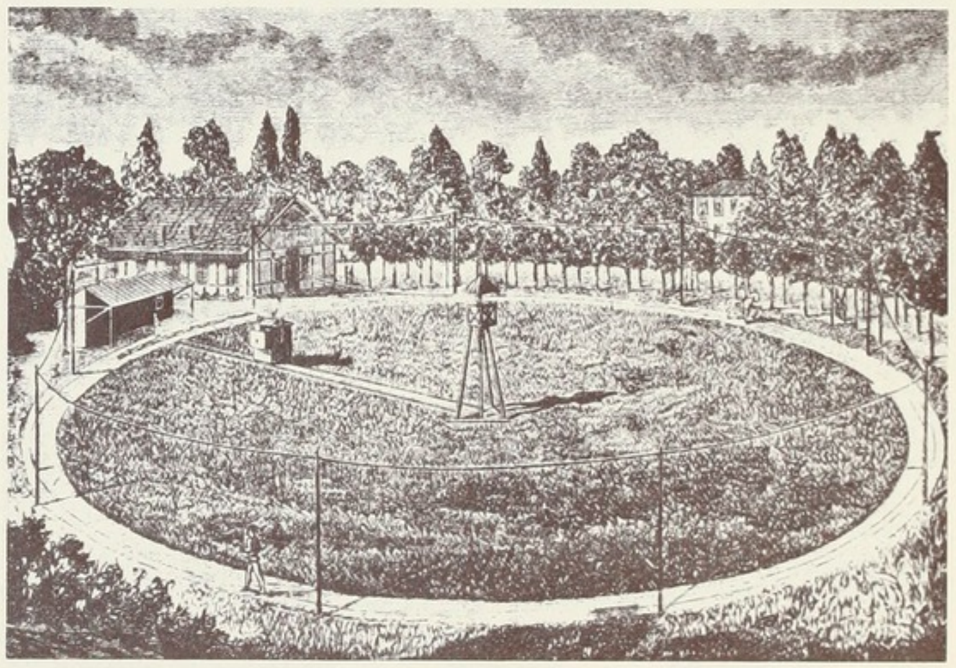
"There is scarcely any branch of animal mechanics which has given rise to more labor and greater controversy than the question of the paces of the horse," Marey had written in *Animal Mechanism*, first published in 1873. He himself had tried to analyze the movements of the horse, and had described his experiments in great detail in *Animal Mechanism:*

"For the experimental shoe employed in the experiments made on man has been substituted, on the horse, a ball of India-rubber filled with horsehair, and attached to the horse's hoof by a contrivance which adapts it to the shoe. . . . When the foot strikes the ground, the India-rubber ball is compressed, and drives a part of the confined air into the registering instruments."[10]

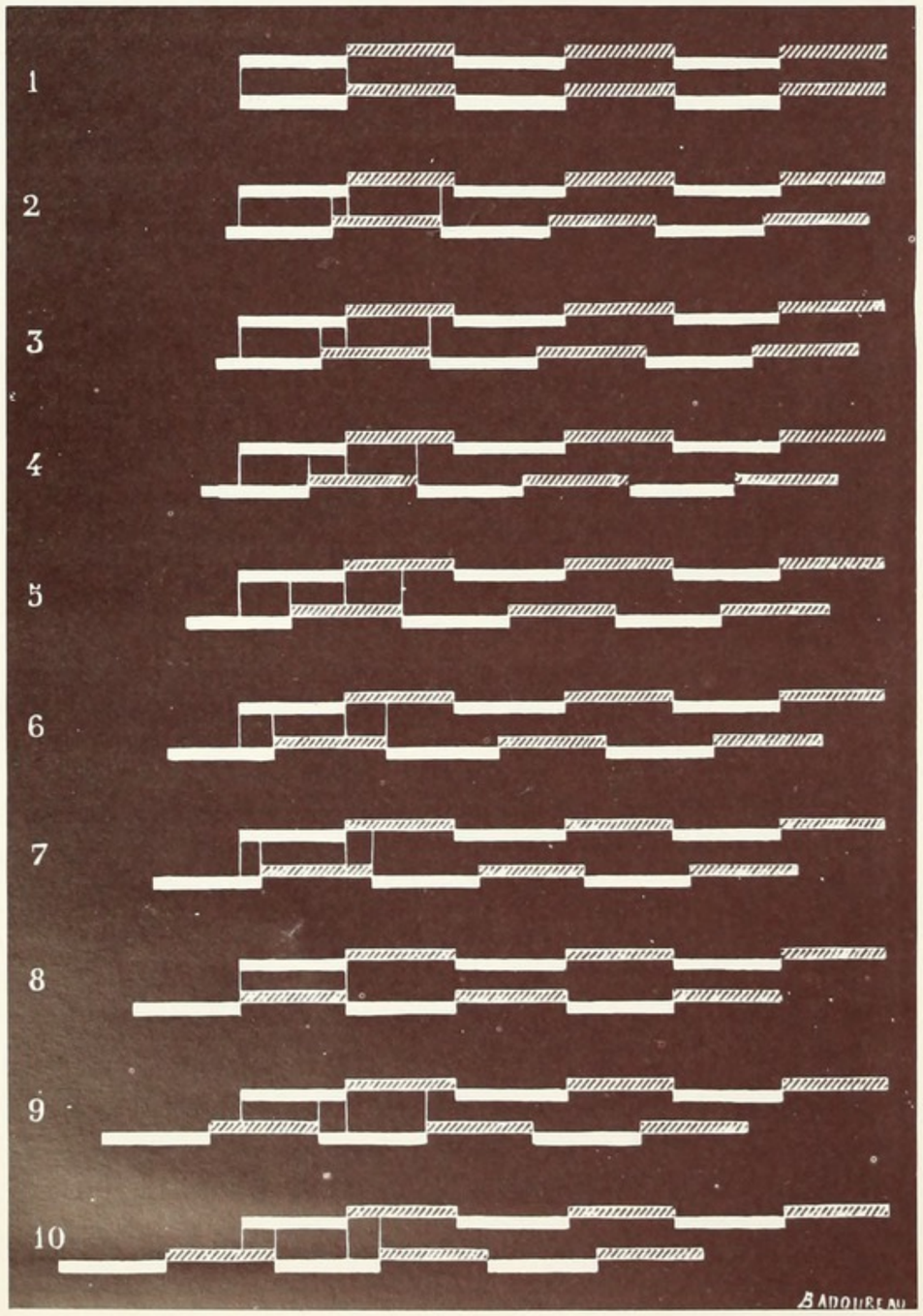
By measuring the distance between the traces of the hoofs and recording the interval, Marey derived his "synoptical notations." Some of these were transcribed by Emile Duhousset into drawings showing the horse's attitudes in various gaits.

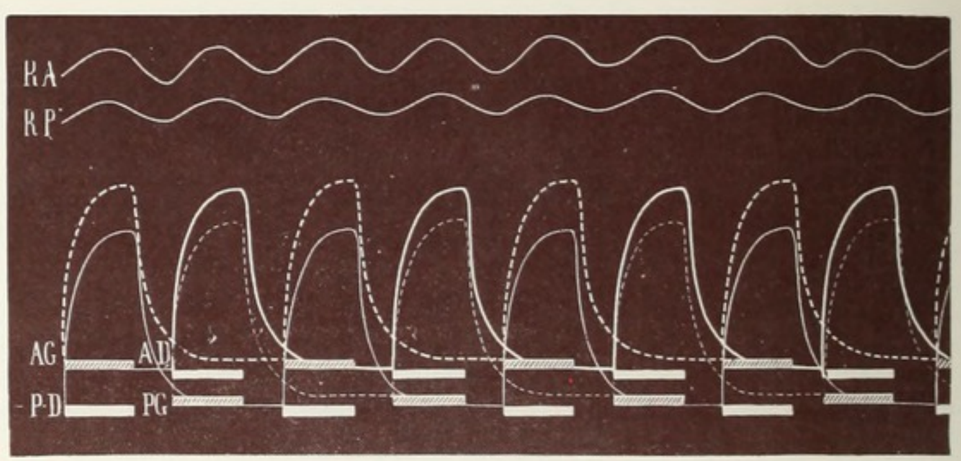
Duhousset was a Lieutenant-Colonel in the French Army and an experienced horseman. A year after Marey's publication, he published his own investigations, which he had begun as a prisoner of war in Germany, in *Le Cheval*, a book he dedicated to artists, and one in which he discussed erroneous representations of the horse in art.[11] Prior to the publication of his investigations, he had been in close contact with Gerome, Meissonier, and Eugene Guillaume, among others, and all had urged him to publish his results, which they believed would be of great value to artists. Duhousset based his analytical drawings on Marey's chronographic notations and his own experience, and thus was able to discover very nearly the correct attitudes of the horse during its various gaits. In fact, his drawings nearly correspond to Muybridge's photographs, an achievement made possible through the close collaboration between Marey and Duhousset.[12]

In *Le Cheval*, Duhousset contrasted his drawings with examples of erroneous representations in art, which he treated in an abbreviated historical survey. Using examples by Vernet, Gericault, Rosa Bonheur, Meissonier and others, and specifically pointing to Meissonier's most truthful representations, Duhousset confronted his nearly correct drawings with the traditional poses of galloping horses in art. Muybridge was later to adopt this method with extraordinary success.



Marey's Physiological Station



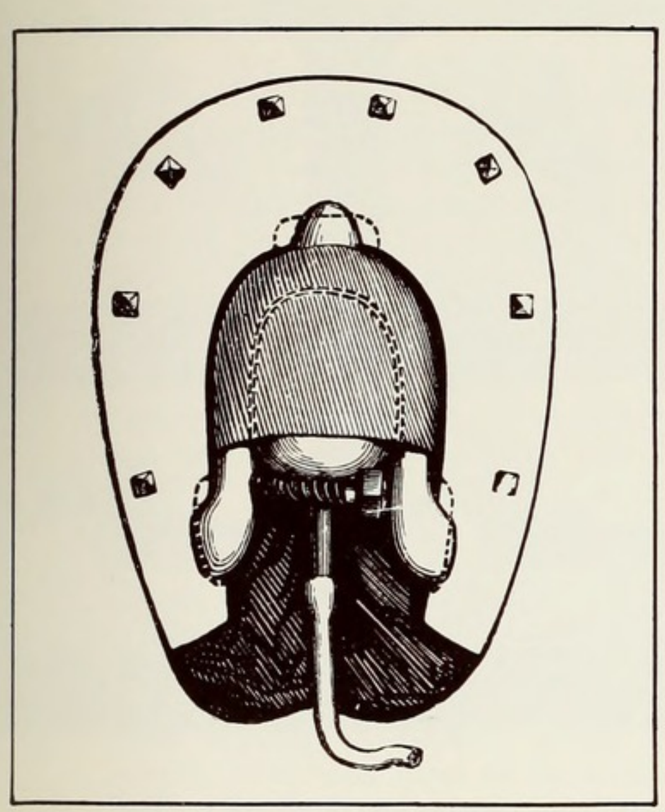


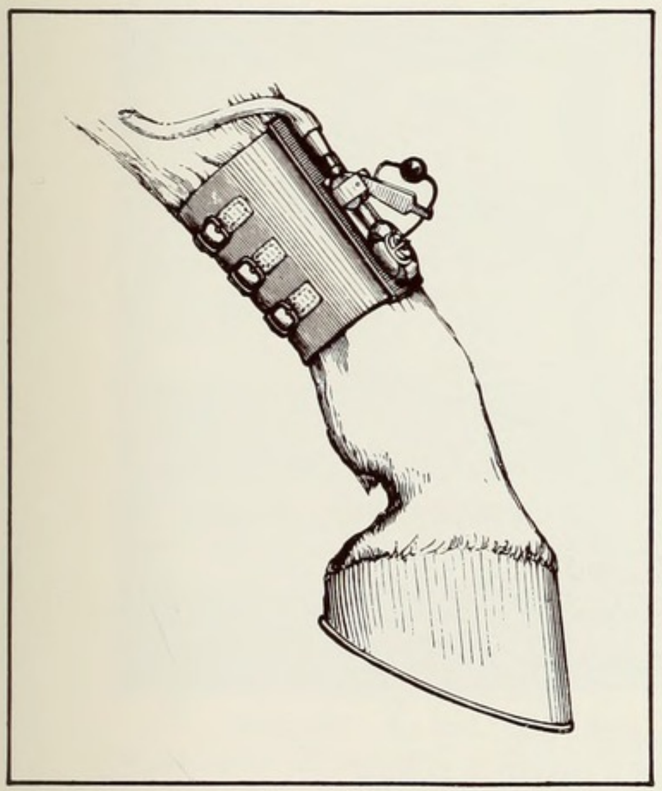
E.-J. Marey, *La Machine animale*, 1873:

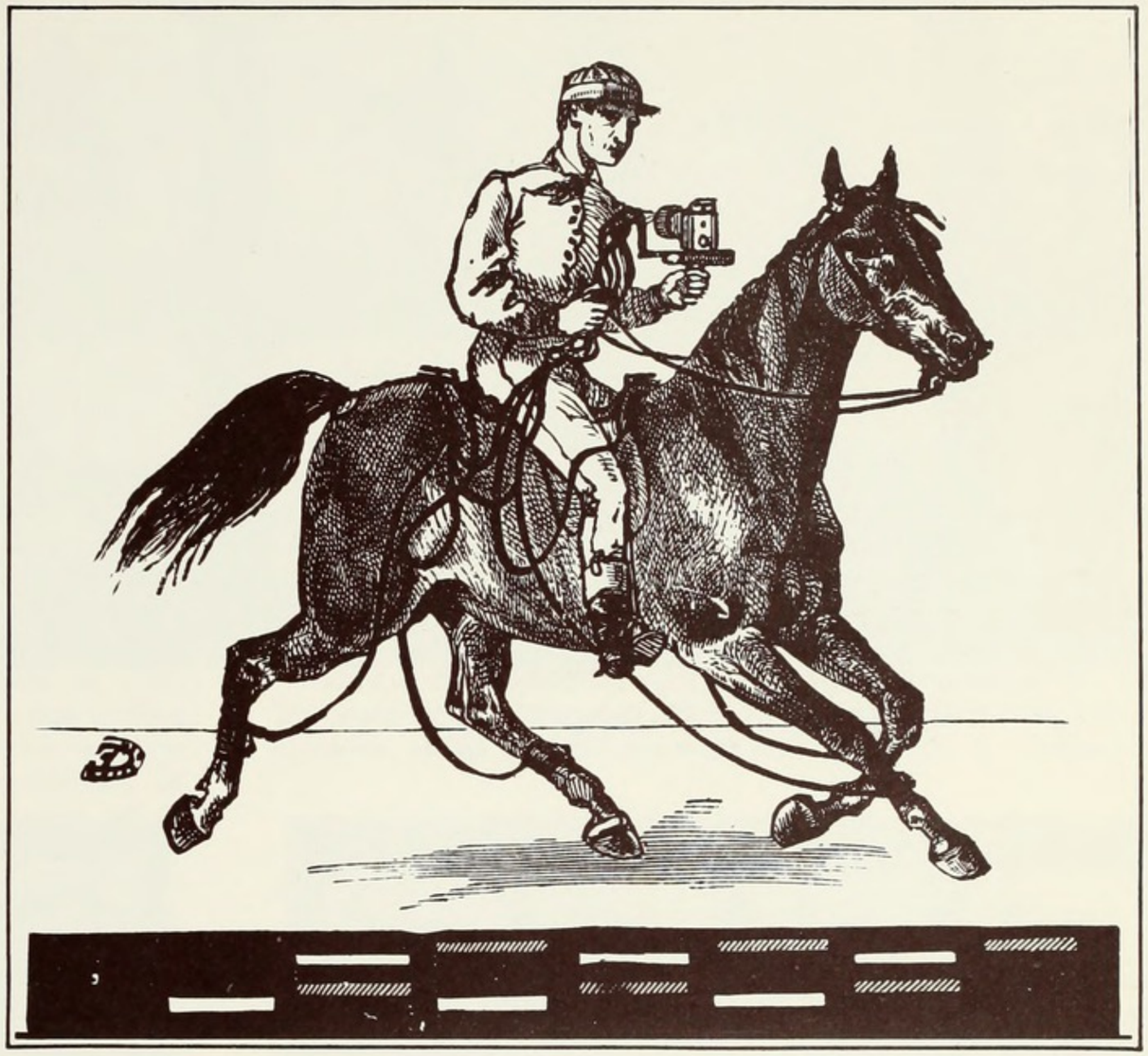
"Graphic curves and notations of the horse's trot. RA, reactions of the fore-limbs. RP, reactions of the hind limbs. AG and AD [anterior left and right], curves and notations of fore-limbs. PD and PG [posterior right and left], curves and notations of hind-limbs"

"Synoptical notations of the paces of the horse, according to various writers"

1. Amble, according to all writers.
2. Broken amble, according to Merche.
   High step, according to Bouley.
3. Ordinary step of a pacing horse, according to Mazure.
   Broken amble, according to Bouley.
   Traquenade, according to Lecoq.
4. Normal walking pace, according to Lecoq.
5. Normal walking pace (Bouley, Vincent and Goiffon, Solleysel, Colin).
6. Normal walking pace, according to Raabe.
7. Irregular trot.
8. Ordinary trot (In the figure, it is supposed that the animal trots without leaving the ground, which occurs but rarely. The notation only takes into account the rhythm of the impacts of the feet.
9. Normal pace, from Lecoq.
10. Traquenade, from Merche.



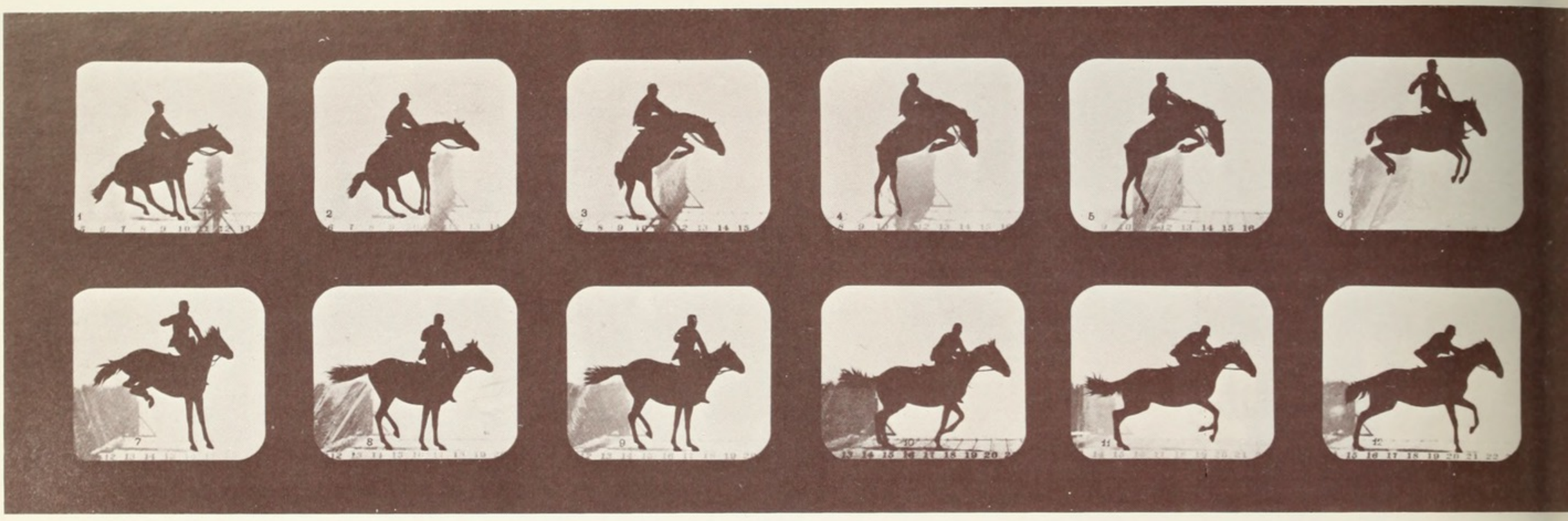




Emile Duhousset, drawing from Marey's notations for
"Horse at full trot. The dot placed in the
notation correspondends with the attitude represented."
The horse is shown in the point of its stride when
it is entirely free of the ground. (Duhousset has
also indicated this in drawing the shadow.)
E.-J. Marey, *Animal Mechanism*, 1874, p. 158

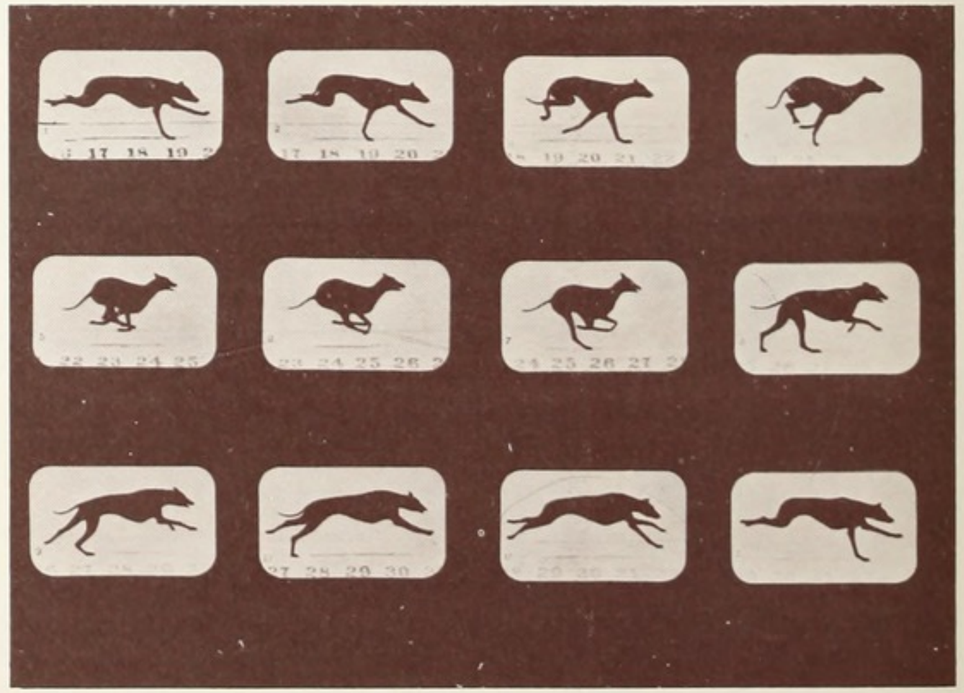
"Experimental apparatus to show the pressure
of the horse's hoof on the ground."
E.-J. Marey, *Animal Mechanism*, 1874, p. 148

"Apparatus to give the signals of the
pressure and rise of the horse's hoof."
E.-J. Marey, *Animal Mechanism*, 1874, p. 194



Muybridge, *Frankie leaping* (12 of 24 exposures) 1879
Photograph 53, *Attitudes of Animals in Motion*, 1881

Muybridge, *Deer running* 1879
Photograph 86, *Attitudes of Animals in Motion*



Muybridge, *Greyhound running* 1879
Photograph 76, *Attitudes of Animals in Motion*

Jean-Louis-Ernest Meissonier

Meissonier familiar with these researches, had not only ventured into lengthy experiments to analyze the horse's gaits, but had also been interested in photography and its practical application for some time. As early as the 1860s he used photographs to record his work. Not a single painting left his studio without having been photographed for the purpose of establishing a modern *liber veritatis.* [13] An experienced horseman, Meissonier spent a great deal of time watching and sketching horses at the parade grounds of Saint-Germain.[14] He also made wax models of horses, which he placed in his studio, and according to one of his later remarks, he seems to have used photographs as well.[15]

When the German painter Adolf von Menzel (1815-1905) came to Paris for the world exhibition of 1867, he and his friend Paul Meyerheim visited several French artists, Meissonier among them. Meyerheim later gave a lively account of their visit: when they arrived at Meissonier's residence, they found the artist in his park, sketching one of his horses. Meissonier first showed his German guests around his stable of eight horses, then took them to the harness room, which was stuffed with historical equipment, and then to the colorful costume room, in which there was an equally varied collection of uniforms and costumes. Only thereafter were the guests led to his studio, a long, narrow garden building, lit its full length by a skylight, with red and white striped wallpaper all around. It was here that Meissonier showed them numerous small sketches of horses, all done on tiny unprepared wooden boards, which he would fix to the right bottom corner of his palette, sketching the horses, as he explained, while walking along with them in order to catch their positions through all phases of movement.[16] The sketches being inconclusive, Meissonier went to greater lengths:

". . .he had a miniature railway made in his park at Poissy, running parallel with a track; and seated on a trolly, the speed of which he was able to control or accelerate at will, he watched the movements of a horse ridden by a servant. By these means he had succeeded in decomposing and noting 'in a flash' the most rapid and complex actions. Reflection completed what observation had begun." [17]

But despite these efforts, Meissonier's results were not completely satisfactory to him:

"I managed at last, by dint of sheer hard work, to thoroughly understand a horse's walk (which is a very difficult matter), and its trot, which is easier. But my studies of the gallop, though I watched it with all the attention I could bestow, never satisfied me. I had even broken down one horse, all to no purpose." [18]

It was at this deadlock in his investigations that Meissonier became acquainted with Muybridge's instantaneous photographs, which he first saw in Marey's laboratory. Some time after their first publication in *La Nature*, Demeny, one of Marey's assistants, described the painter's shocked reaction to those photographs that contradicted all traditional representations in art:

"The great painter Meissonier . . . used to visit our laboratory. He was interested in the gaits of the horse, which he sought to represent exactly. When he saw the first photographic analyses . . . he was utterly astounded and accused our apparatus of seeing wrongly. 'If you give me a horse galloping like this one' ——and he showed us one of his sketches—— 'then I will be satisfied with your invention.' " [19]

Very soon thereafter, however, Meissonier became the first European artist to be completely convinced by photographic evidence, and a great advocate of Muybridge.

Leland Stanford at Meissonier's

When Leland Stanford first visited Meissonier in 1879,[20] he brought with him prints that Muybridge had made of his experiments at the Palo Alto Farm. Stanford, whose own attempts to analyze the motion of the horse went back to 1870, hoped to persuade the artist to paint his portrait. Meissonier himself gave an account of Stanford's visit:

"Meanwhile, towards the autumn, some American dealer, I have forgotten which, brought a certain Mr. Leland Stanford, a former governor of California, and his wife to my studio. He asked me to paint his portrait.[21] My first impulse, of course, was to refuse, but he began to talk about the photographs of horses in motion, and said they were his. He had even spent $100,000 on the work,[22] so a friend who was with him said, and the proofs which had reached Europe were a mere nothing. He had hundreds of others, far more interesting, not merely of horses in motion, but of oxen, stags, dogs and men. He had proofs of these last fighting, wrestling, jumping from the trapeze, etc."[23]

According to the author of an article in the Sacramento *Daily Record-Union* for 26 June 1881, Stanford visited the painter again in June 1881. The somewhat exaggerated and dramatic account of this eye-witness emphasized again the great astonishment of the artist. Meissonier reacted to the photographs with utter disbelief, which the California businessman brushed aside with the simple statement: "The machine cannot lie." When Meissonier brought out various wax models of horses, Stanford produced the instantaneous photographs of the bound volume, *The Attitudes of Animals in Motion:* [24]

". . .the Governor succeeded in convincing him of his error. It was almost pitiful to see the old man sorrowfully relinquish his convictions of so many years, and the tears filled his eyes as he exclaimed that he was too old to unlearn and begin anew."[25]

When Meissonier portrayed the California businessman and politician in the late summer or autumn of 1881, he was no doubt asked to represent him with two characteristic attributes: the cane with the little gold nugget, as a tribute to the venture that had laid the foundations for his later fortune, and the bound volume of the Muybridge photographs, "executed according to [his] instructions at Palo Alto," [26] a testimony to the greatest preoccupation of Stanford's private life, the scientific training and breeding of his beloved horses. [27]

The Photographic Experiments of Muybridge and Stanford

The sensational result of the photographic experiments in California had been obtained through the combined efforts and the collaboration of an accomplished photographer, a wealthy horseman who was also knowledgeable and curious, and experienced engineers and electricians. Stanford himself had first conducted experiments on the sandy race track at Sacramento in the summer of 1870, when he and a friend tried to measure the depth of the impressions left by the horse's hoofs on the soft ground of the track.[28] These first experiments were, however, not initiated to satisfy scientific or artistic curiosity, but for very practical reasons, namely, to gain accurate knowledge of the horse's locomotion for purposes of training. Two years later Stanford — believing as he did in technical progress and the practical application of technology — decided to try photography in order to determine whether a trotting horse had all four feet off the ground at some point in its stride. In May of 1872 he engaged Muybridge to take photographs of his horse Occident at the Sacramento race track. After the interruption of these first attempts Muybridge returned to new experiments in July 1877. His letter of 17 February 1879 to the editor of *La Nature*, in answer to Marey's earlier letter of December 1878, leaves no doubt about Marey's responsibility for Stanford's continuing experiments:

"Would you kindly tell Professor Marey," he wrote to Tissandier, "that the study of his famous work on animal mechanism inspired Governor Stanford with the first idea of the possibility of solving the problem of locomotion with the help of photography." [See Documents, C.]

As an expert on horses, Stanford certainly knew not only Marey's scientific publication that appeared in an English edition in 1874, but also Duhousset's book, *Le Cheval*, published that same year.[29] This time Muybridge had achieved the controversial result, "Occident trotting at a 2:27 gait." The first reports of this were published on 3 August 1877 in the *Alta California* and the San Francisco *Bulletin*. In 1878 Muybridge expanded the investigations, at Stanford's request, at Palo Alto Farm, to which Stanford's horses had by then been moved. He published six serial photographs and copyrighted the set under the title *The Horse in Motion*. In the autumn of that same year the news of his successful experiments reached a national paper and thus a much wider public. *The Scientific American* on 19 October 1878 printed a report under the title "The Science of the Horse's Motion," which was illustrated with 18 line drawings after Muybridge's photographs, thus focusing international attention on the experiments in the Far West. Meanwhile, Muybridge kept improving his experiments and systematically developed the apparatus which he later refined in his work at the University of Pennsylvania. During these years he also developed the zoopraxiscope. He demonstrated it in the Stanford home during an autumn evening in 1879, again at the Stanford San Francisco home in January 1880 and gave a first public showing of the "Magic Lantern Zoetrope" in San Francisco to a small circle of artists and critics in May 1880. At the same time he completed the printing of his negatives and arranged them in elegantly bound albums for presentation to Stanford in May 1881. The album shown in Meissonier's portrait testifies to Stanford's pride in having actively initiated, participated in and supported these photographic experiments which led to the first instantaneous pictures of the running horse.

The overwhelming response Muybridge received in Paris, however, was perhaps less due to the photographs themselves than to their demonstration with the zoopraxiscope. While the individual stills tended to "freeze" single attitudes in isolation, the zoetrope offered the possibility of creating an illusion of coherent motion based on the persistance of vision. It is not quite clear who first suggested to Muybridge the use of the zoetrope in order to simulate the synthesis of movements which he had been able to analyze in successive phases. *The Scientific American* of 19 October 1878 had actually proposed this step, and similar references were made in the San Francisco papers of May 1880.[30] Emile Duhousset in Paris and W. B. Tegetmeier in London were the first to use Muybridge's photographs in a phenakostiscope and in Reynaud's praxiniscope. But Marey may have given the decisive incentive, since the French scientist could point to his own expertise and previous experiments. In *Animal Mechanism*, the book Muybridge specifically mentioned as the force inspiring and encouraging Stanford, Marey had written:

"But it has occurred to us that, by depicting on the apparatus figures constructed with care, and representing faithfully the successive attitudes of the body . . . we might reproduce the appearance of the different kinds of progression employed by man." [31]

Later, in *Le Mouvement*, Marey described his own experiments, which he had made as early as 1867. In order to demonstrate the horse's movements the physiologist still had to use analytical drawings as a means of achieving the synthesis of individual successive attitudes. Twelve images were drawn on a long strip of paper which, when placed in the zoetrope and rotated, afforded a "concrete demonstration of the relations as expressed in the chronographic notations."[32] Thus, the French scientist immediately visualized the use of instantaneous photographs in a zoetrope and expressed his idea of an "animated zoology" in his letter to *La Nature*. Speaking of Muybridge's instantaneous photographs he wrote:

"And then what beautiful zoetropes he will be able to give us; one will see all imaginable animals in their true gaits; this will be animated zoology." [See Documents, C.]

Instead of drawings which were merely transcriptions of chronographic notations, Muybridge was now able to go a step farther and substitute for these inconclusive images painted copies of his correct analytical photographs. With his complicated zoopraxiscope and instantaneous photographs Muybridge was capable of achieving a far more convincing illusion of coherent "moving pictures" projected in life-size than anyone before him had been able to devise.

"Mr. Muybridge Showing His Instantaneous Photographs of Animal Motion at The Royal Society"
The Illustrated London News, 25 May 1889, cover

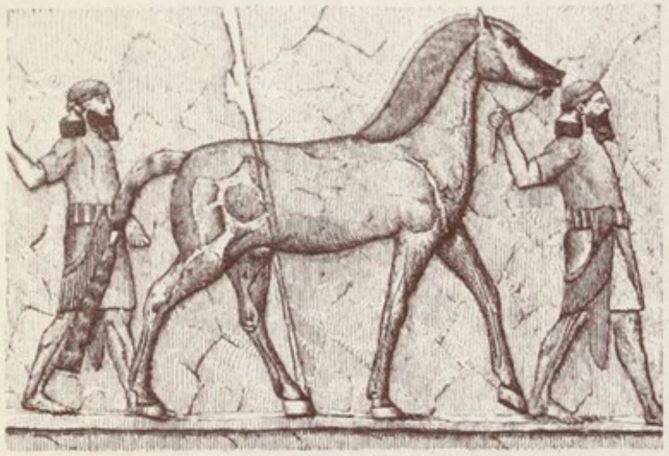


Fig. 13. — Bas-relief Assyrien (British Muséum). Un cheval à l'amble.

Fig. 14. — Bas-relief égyptien (Medynet-Abou). Deux chevaux attelés marchant l'amble.

Fig. 16. — Statue de Henri IV sur le Pont-Neuf. — Type du trot correct.

Fig. 15. — Le Cavalier et la Mort, par Albert Dürer. Cheval au trot légèrement désuni.

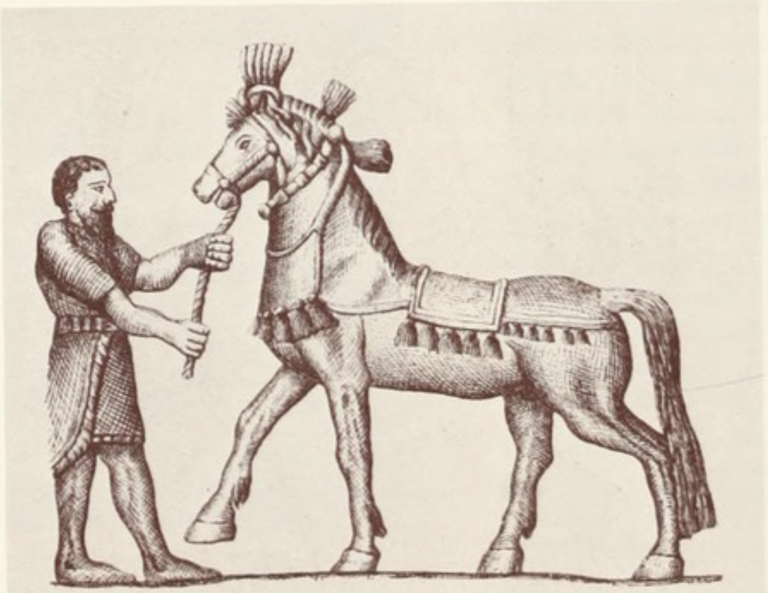


Fig. 17. — Bas-relief assyrien (Ninive). Cheval au pas.

Fig. 18. — Bas-relief en terre cuite de l'époque Volsque (Velletri). Trois chevaux attelés marchant au pas.

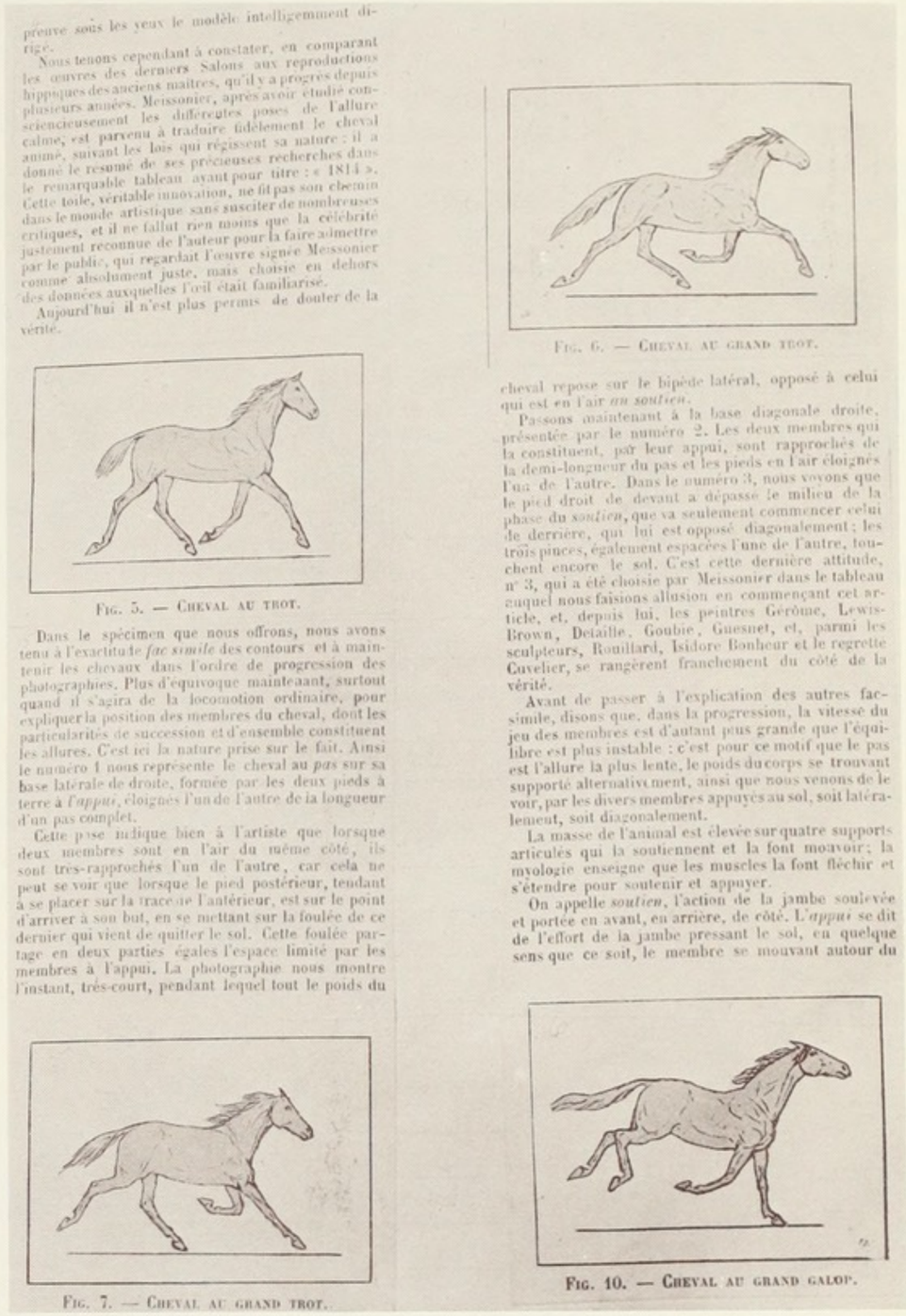
Illustrations of the representation of the horse in art that accompanied Marey's article *La Nature*, 5 October 1878

Muybridge's Lecture Demonstrations and Publications

Stanford's and Muybridge's experiments in California were not carried out in isolation, but in close reciprocity with Marey's and Duhousset's work in Paris. During the decade of 1870-1880 both the Americans and the French had been intensely involved in the study of animal locomotion. Before Marey contacted Muybridge through *La Nature* in December 1878, their individual efforts exactly paralleled each other in time as well as in their objective. While the first national publication of Muybridge's instantaneous photographs appeared in *The Scientific American* of 19 October 1878, Tissandier published almost simultaneously Marey's latest experiments and attempts to represent animal locomotion, richly illustrated with Duhousset's drawings in the 28 September and 5 October issues of *La Nature.* Just as Marey's work influenced Stanford's and Muybridge's photographic investigations, so did Duhousset inspire the idea and design of Muybridge's lecture demonstrations. Muybridge must have known not only Duhousset's book *Le Cheval*, but also Marey's article in *La Nature* with Duhousset's illustrations. In the second installment Marey referred to precisely this book which had so evidently shown the mistaken representations of the horse's gaits, and he emphasized this point with Duhousset's illustrations, confronting the correct drawings with erroneous examples, which ranged from Assyrian reliefs to modern art. In January of the following year Duhousset wrote about Muybridge's achievements in *L'Illustration*, where he pointed out again the possibility of applying the results of instantaneous photography to the field of art. [33]

Muybridge's "exhibitions" also reflect plans that he, Marey and Meissonier had pursued in November and December of 1881 in Paris, to prepare "a work upon the Attitudes of Animals in Motion as illustrated by the Assyrians, Egyptians, Romans, Greeks, and the great masters of modern times." [See Documents, F.]

It had been Stanford's pioneering mind and insistence on using the camera to analyze the horse's movements that had given new direction to Muybridge's work. Once confirmed in his own success by the acclaim of their synthesis in the zoopraxiscope, Muybridge sensed the relevance of his work for art and began to build lectures around this aspect. Following Marey, Duhousset and Meissonier, he developed his concept in greater depth, and presented the subject of animal locomotion



preuve sous les yeux le modèle intelligemment dirigé.

Nous tenons cependant à constater, en comparant les œuvres des derniers Salons aux reproductions hippiques des anciens maîtres, qu'il y a progrès depuis plusieurs années. Meissonier, après avoir étudié consciencieusement les différentes poses de l'allure calme, est parvenu à traduire fidèlement le cheval animé, suivant les lois qui régissent sa nature : il a donné le résumé de ses précieuses recherches dans le remarquable tableau ayant pour titre : « 1814 ». Cette toile, véritable innovation, ne fit pas son chemin dans le monde artistique sans susciter de nombreuses critiques, et il ne fallut rien moins que la célébrité justement reconnue de l'auteur pour la faire admettre par le public, qui regardait l'œuvre signée Meissonier comme absolument juste, mais choisie en dehors des données auxquelles l'œil était familiarisé.

Aujourd'hui il n'est plus permis de douter de la vérité.

Fig. 5. — Cheval au trot.

Dans le spécimen que nous offrons, nous avons tenu à l'exactitude *fac simile* des contours et à maintenir les chevaux dans l'ordre de progression des photographies. Plus d'équivoque maintenant, surtout quand il s'agira de la locomotion ordinaire, pour expliquer la position des membres du cheval, dont les particularités de succession et d'ensemble constituent les allures. C'est ici la nature prise sur le fait. Ainsi le numéro 1 nous représente le cheval au *pas* sur sa base latérale de droite, formée par les deux pieds à terre à *l'appui*, éloignés l'un de l'autre de la longueur d'un pas complet.

Cette pose indique bien à l'artiste que lorsque deux membres sont en l'air du même côté, ils sont très-rapprochés l'un de l'autre, car cela ne peut se voir que lorsque le pied postérieur, tendant à se placer sur la trace de l'antérieur, est sur le point d'arriver à son but, en se mettant sur la foulée de ce dernier qui vient de quitter le sol. Cette foulée partage en deux parties égales l'espace limité par les membres à l'appui. La photographie nous montre l'instant, très-court, pendant lequel tout le poids du

Fig. 7. — Cheval au grand trot.

Fig. 6. — Cheval au grand trot.

cheval repose sur le bipède latéral, opposé à celui qui est en l'air *au soutien*.

Passons maintenant à la base diagonale droite, présentée par le numéro 2. Les deux membres qui la constituent, par leur appui, sont rapprochés de la demi-longueur du pas et les pieds en l'air éloignés l'un de l'autre. Dans le numéro 3, nous voyons que le pied droit de devant a dépassé le milieu de la phase du *soutien*, que va seulement commencer celui de derrière, qui lui est opposé diagonalement ; les trois pinces, également espacées l'une de l'autre, touchent encore le sol. C'est cette dernière attitude, n° 3, qui a été choisie par Meissonier dans le tableau auquel nous faisions allusion en commençant cet article, et, depuis lui, les peintres Gérôme, Lewis-Brown, Detaille, Goubie, Guesnet, et, parmi les sculpteurs, Rouillard, Isidore Bonheur et le regrette Cuvelier, se rangèrent franchement du côté de la vérité.

Avant de passer à l'explication des autres fac-simile, disons que, dans la progression, la vitesse du jeu des membres est d'autant plus grande que l'équilibre est plus instable : c'est pour ce motif que le pas est l'allure la plus lente, le poids du corps se trouvant supporté alternativement, ainsi que nous venons de le voir, par les divers membres appuyés au sol, soit latéralement, soit diagonalement.

La masse de l'animal est élevée sur quatre supports articulés qui la soutiennent et la font mouvoir ; la myologie enseigne que les muscles la font fléchir et s'étendre pour soutenir et appuyer.

On appelle *soutien*, l'action de la jambe soulevée et portée en avant, en arrière, de côté. L'*appui* se dit de l'effort de la jambe pressant le sol, en quelque sens que ce soit, le membre se mouvant autour du

Fig. 10. — Cheval au grand galop.

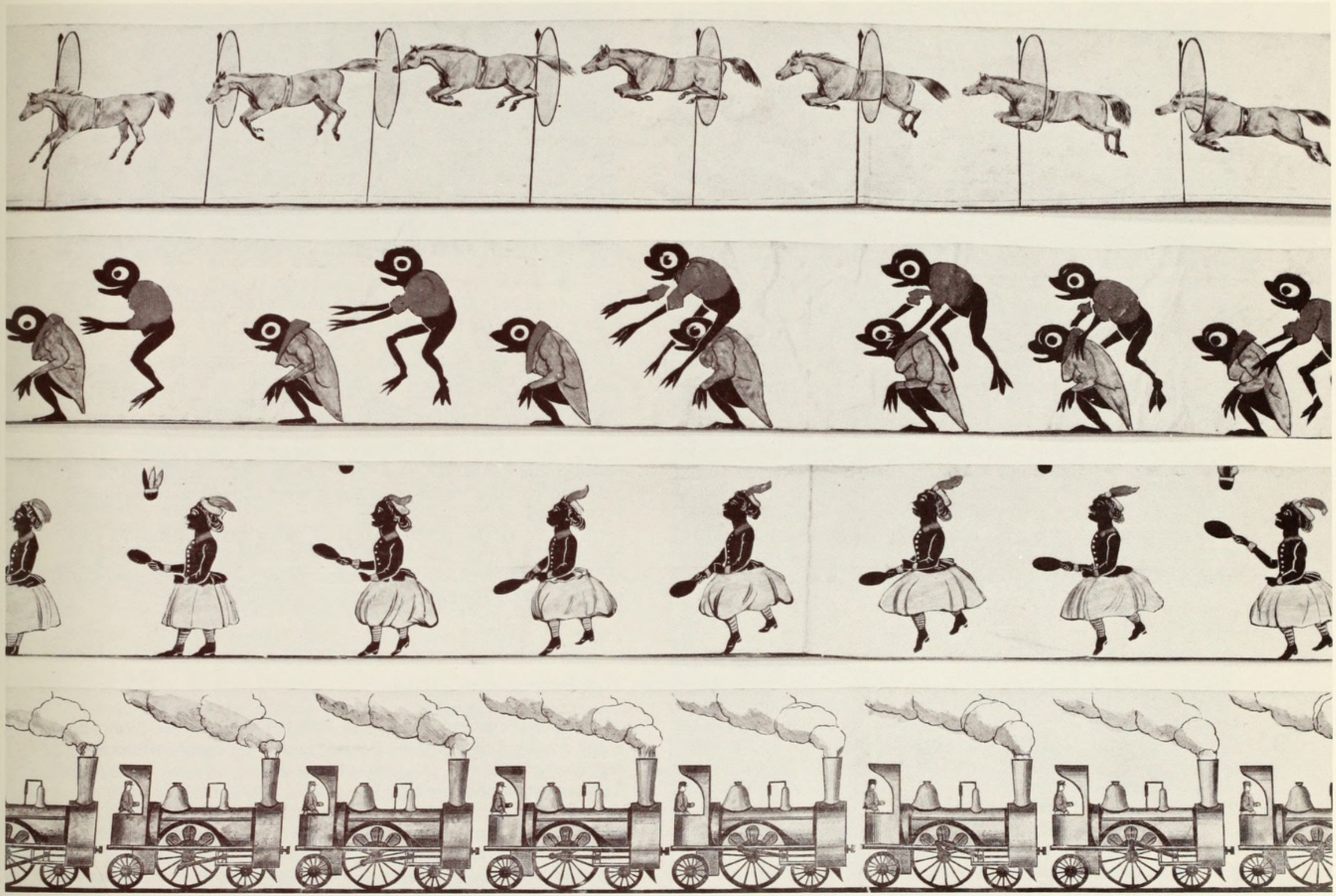
An excerpt from Duhousset's article, *L'Illustration*, 25 January 1879

in historical perspective and with regard to art. Contrasting earlier error and "evidences of its absurdity" with the correct analysis, he became convinced of the "acknowledgment by the Artist of the necessity of reformation." The syllabus that he printed later in *Zoöpraxography*,[34] complemented by his slides and disks, allows a fairly coherent reconstruction of the demonstrations on "Zoöpraxography or the Science of Animal Locomotion in its Relation to Design in Art." After a description of the camera equipment and his experiments, he presented slides of sculptures, paintings and prints, all showing the horse in each of its gaits, from "pre-historic, ancient, medieval and modern times." He surveyed Assyrian reliefs, examples of the Parthenon frieze, the Bayeux tapestry, medieval manuscripts, monuments of rulers on horseback, followed by paintings and prints by Vernet, Géricault, Delacroix, Meissonier and other contemporaries, and he contrasted these traditional and erroneous representations with his own "moving pictures" of animals in motion.

He had built the zoöpraxiscope so that he could both show slides and insert the disks to which painted copies of his photographs had been transferred. The subjects he selected for the disks are often taken from the stock images popular with the zoetrope: jumping or speeding horses, athletes, dancers and animals in motion. The effect he achieved with his "exhibitions" is well documented in the newspapers of the 1880s, which he meticulously collected. Later, he appended long excerpts from this collection to *Zoöpraxography*. Although there was sceptical, polemical and critical reaction, too, the over-all response was as favorable in London, Vienna, Berlin, Munich, New York, Boston and Philadelphia, as it had been in Paris.[35]

One of Muybridge's illustrations of an "absurd" representation
Science Museum, London

While Muybridge worked in Paris, Stanford returned to America in December 1881 and went ahead with his own publication of a scientific documentation of *The Horse in Motion, as Shown by Instantaneous Photography with a Study on Animal Mechanics* by Dr. J.D.B. Stillman (1882), in which Muybridge is merely mentioned in Stanford's preface as the photographer "employed." [see Documents, F]. Ironically, the book did not ellicit the desired and expected response and led to great disappointment for its author and sponsor. It was, in fact, of no more lasting consequence than Duhousset's earlier publication. The consecutive phases of the horse's gaits were analytically presented in line drawings, but this alone created no sensation. Only a combination of these results with the "moving pictures" of Muybridge's zoöpraxiscope, or the sequential arrangement of the photographs reproduced in his later Philadelphia publication, achieved success with a wider public. *Animal Locomotion* (1887) appeared five years after Stanford's unsuccessful effort. This elaborate *opus* offered 781 plates with more than 20,000 figures of "men, women, and children, animals and birds, all actively engaged in walking, galloping, flying, working, playing, fighting, dancing, or other actions incidental to everyday life, which illustrate motion and the play of muscles." This very expensive publication was followed by two smaller volumes, *Animals in Motion* in 1899, and *The Human Figure in Motion* two years later. For *Animal Locomotion* Muybridge had designed a system of arranging the individual photographs in linear sequence with several rows filling one page, so that they overcame, at least to a degree, the impression of single isolated positions. Read horizontally, the instantaneous photographs strongly suggest the visual effect of movement in time and space, although nothing in print could, of course, compare with the continuum achieved by the zoöpraxiscope. It was precisely this time-space factor of representing movement that was to stimulate developments in the sciences and arts.



Zoetrope strips, England, c. 1870
each strip is 6'' deep
Oakland Museum

II. The Impact of Muybridge's Work on Science and Art

Marey's mention of "phenomena of short duration," namely, "the movement of waves or of the attitudes of men and animals in their most rapid motions" refers to problems that Leonardo had studied with intense effort centuries earlier. The *Codex Huygens*, once attributed to Leonardo, contains some drawings in the second book on human movement illustrating successive phases in "cinematographic" fashion, as Panofsky described them.[36] Folio 22 illustrates the various stages of a man rising, and folio 29 represents a figure, inscribed within a circle, bending forward and backward. The consecutive stages are not spread over the sheet, but are superimposed in one image. Thus, a pictorial effect is achieved similar to Marey's chronophotographs. In regard to the flight of birds, Paul Valéry thought that instantaneous photography had "corroborated" the images of Leonardo's sketches,[37] and it is most fascinating to compare Leonardo's studies and drawings of his *Codice sul volo degli uccelli* (1505) with Marey's researches and photographs in *Le Vol des oiseaux* (1890). In his attempts to comprehend the formation of waves and turbulances in water and the flight of birds, Leonardo had clearly reached the limits of visibility. Without the help of instruments the very speed of these natural phenomena eluded his grasp. Centuries of eye-straining observation did not permit painters to capture what an instantaneous photograph recorded at Palo Alto Farm.

Marey and Photography

When Muybridge arrived in Paris in August 1881,[38] he brought along a series of instantaneous photographs of the flight of pigeons which he had expressly made on the request of the French scientist.[39] Now Muybridge guided Marey's work into a direction which determined the further course of his studies. From this time on, the French physiologist applied photography to his research, using the camera to record and represent movement in all its phases. In 1882 Marey designed the "photographic gun," which took twelve exposures on one plate. Supported by the French government, he continued his experiments in this direction on a large scale. With his multiple exposures, he created a synthesis of movement in time and space, rather than an analysis in sequential rows of images, as Muybridge had done. The novel visual effect of his chronophotographs produced a striking illusion of motion, although individual phases were not clearly visible, since their contours were blurred by superimposed exposures. While Muybridge's photographs arrested movement to serve correct analysis, Marey's chronophotographs suggested spatio-temporal continuity in a new pictorial manner. Both Muybridge and Thomas Eakins were to later use adaptations of the "Marey-Wheel" during the production of Muybridge's *Animal Locomotion* at the University of Pennsylvania in 1884 and 1885.[40] Marey's multiple images inspired Seurat, e.g., in his painting *Le Chahut* (1889-90),[41] as well as the Futurist concept, of which Giacomo Balla's *Bambina che corre sul balcone* (1912) and Marcel Duchamp's *Nude Descending a Staircase* (1912) are the examples most often quoted.[42] In 1888 Marey turned to moveable film, and after first using rolls of paper, he then replaced them with celluloid film, thus constructing the immediate predecessor of the film camera; Muybridge, with his zoopraxiscope, had developed a forerunner of the film projector. [See Documents, I.]

In the same year, 1888, Muybridge envisioned, in a consultation with Thomas A. Edison, the combination of "moving pictures" with sound as a form of mass entertainment. He speculated:

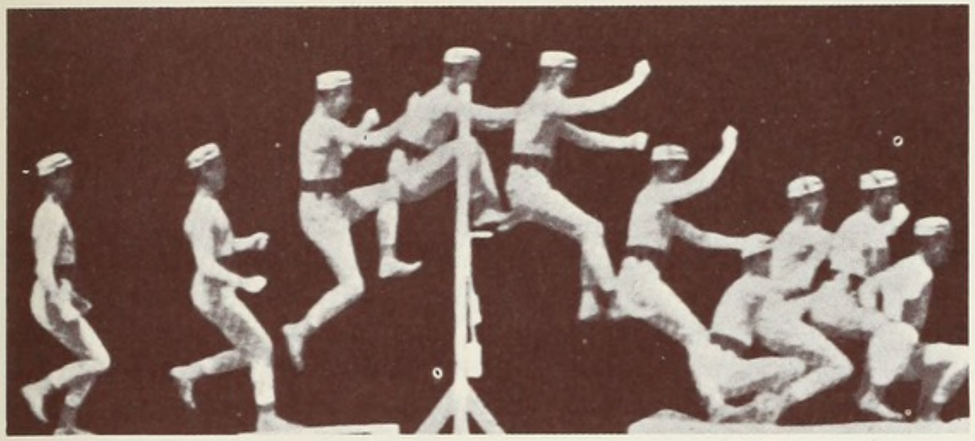
". . .as to the practicability of using that instrument (the zoöpraxiscope) in association with the phonograph, so as to combine, and reproduce simultaneously, in the presence of an audience, visible actions and audible words.[43]

The Response of Artists

While Muybridge continued and elaborated upon his Palo Alto work at the University of Pennsylvania, the early influence of his photographs was felt everywhere, and Marey was among the first to recognize their significance:

"It is instantaneous photography in particular that has exercised a noticeable influence upon the arts, because it allows to fix in one authentic image phenomena of short duration, like the movements of waves or of the attitudes of men and animals in their most rapid motions."[44]

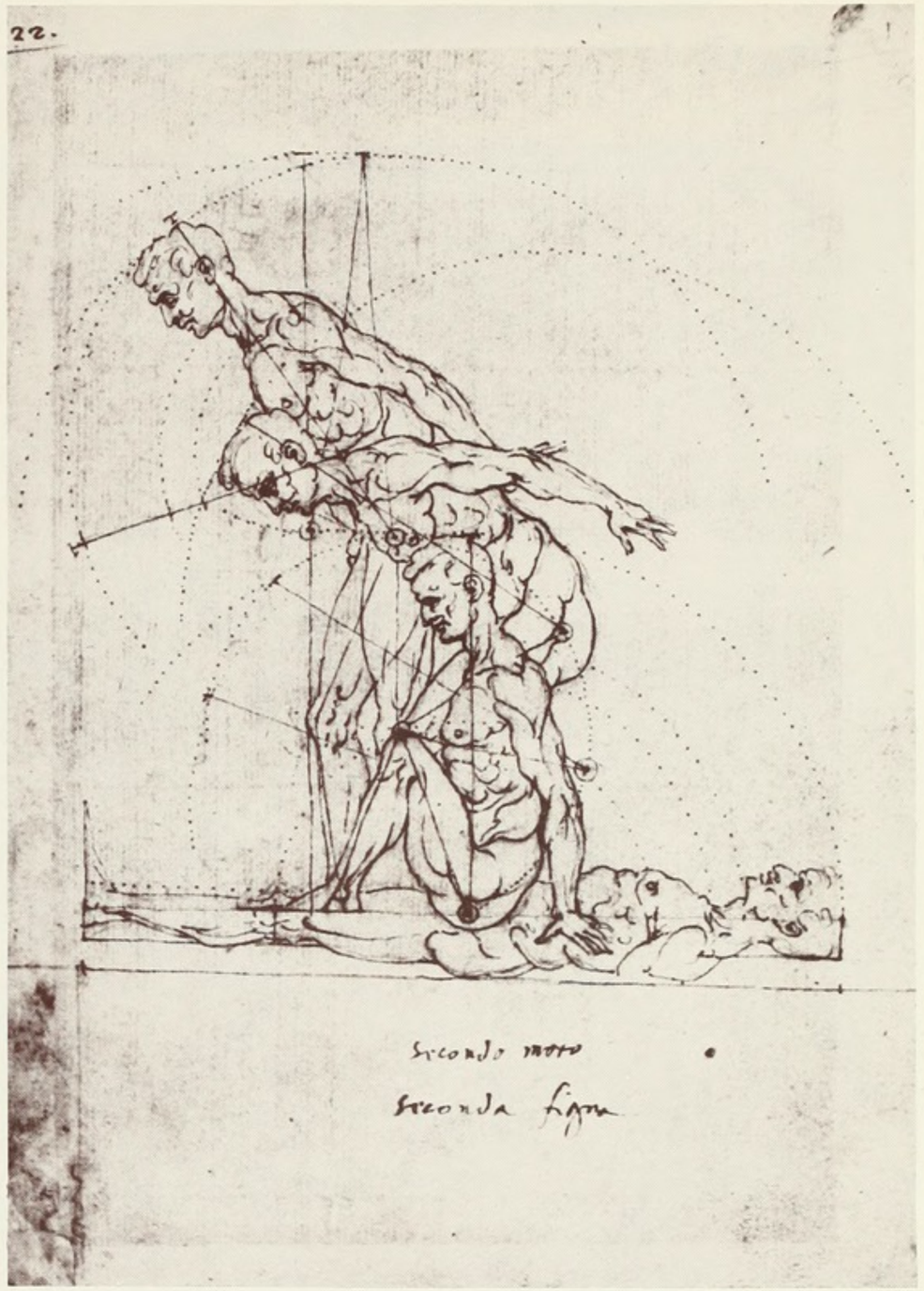
Meissonier, Muybridge's ardent supporter and promoter, was the first to admit this, and in all of his later paintings of horses,



E.-J. Marey, chronophotograph, 1882

he applied the new knowledge provided by the analytical photographs. Before the publication of the Stanford/Muybridge experiments, Meissonier had labored on one of the major paintings of his Napoleon cycle, *Friedland, 1807* (1875), now in the Metropolitan Museum. This large canvas depicts Napoleon at the height of his fame, in Friedland, during the battle. "The idea was to show the Emperor Impassible, in the midst of movement and struggle." The galloping curiassiers in the foreground were much-admired and discussed among artists and connoisseurs at the time. Thousands had crowded to see the painting, "the happy apogee" of the cycle, as Meissonier had himself described it, when it was exhibited for a few days at the Cercle de la Place Vendome before being shipped to America. When Meissonier later copied this painting in water color in 1888, he made some changes as a result of Muybridge's photographs.[45]

Cabanel and Gérome, both present at Meissonier's reception, also made use of Muybridge's work, and so did most of the battle and horse painters in Europe as well as in America. The impact of the photographs was far-reaching, for publications of them were numerous, and there was hardly an art academy that did not take up the subject in one way or another. Many of the famous institutions had invited Muybridge for a presentation, and were later among the subscribers to his *Animal Locomotion*. So were many internationally known artists, as we gather from the illustration of signatures and lists of subscribers that Muybridge, always a tireless promoter of his own work, published in a detailed appendix to his *Zoöpraxography*. Among the artists, academic painters outnumbered the



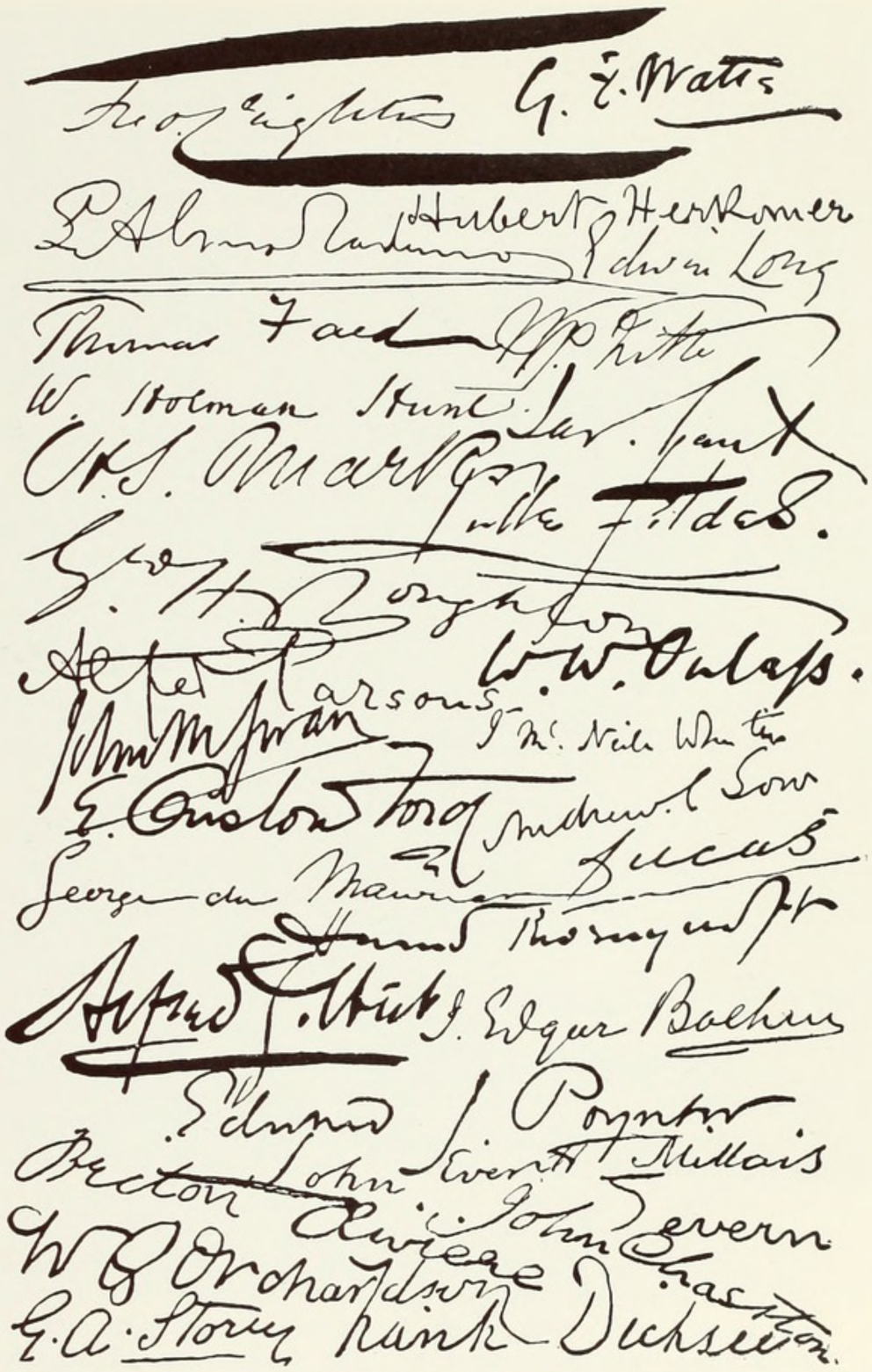
Codex Huygens, folio 22
Pierpont Morgan Library

J.-L.-E. Meissonier
Friedland, 1807 "1875"
oil on canvas 53½ x 95½ in.
The Metropolitan Museum of Art
Gift of Henry Hilton, 1887

avant-garde, but the wide range of names gathered there reflects the enormous response that Muybridge finally drew from the art world: Alma-Tadema, Bonnat, Meissonier, Marks, Menzel, Millais, Bouguereau, Carolus-Duran, Defregger, Gerome, Herkomer, Kaulbach, Lenbach, Puvis de Chavannes, Rodin, Whistler, to name a few.

Although not a subscriber to the later work, Edgar Degas (1834-1917) saw the publication of the instantaneous photographs in *La Nature* in 1878, and thereafter followed Muybridge's work closely. While most of the contemporary artists made a purely literal use of the analytical studies, Degas's involvement with them, and with photography in general, is much more complex.[46] He was an ardent admirer of the medium and a fine photographer himself, and he had a perceptive eye for the unconventional pictorial elements which photography offered. The numerous sketches Degas made of horses and of dancers attest to his preoccupation with the correct analysis of movement. He did not only use the new photographic analysis in a general way, but he studied it intently, making drawings and sculpture after some of the plates in *Animal Locomotion* (the drawing of "Annie G. in canter," after plate 620, and the sculpture of a *Draught Horse* after "Johnson Hauling," plate 571).[47]

The passionate study of movement in science and art can be followed throughout the nineteenth century. During the first half of the nineteenth century the caricatural picture story, unfettered by the conventions of academic art, had made its point with a sequence of rapid movements following each other in strips. At the end of the century, when scientific, photographic and artistic searches had explored movement and its representation to the threshold of the cinema, Edouard Vuillard (1868-1940) made a number of drawings of his model in cinematographic sequence. Degas and Vuillard were enthusiastic photographers who did not hesitate to use the new medium for their work. In the early 1890s, Vuillard made two lithographs depicting young women in various poses, *L'Interieur aux cinq poses* and *L'Atelier.* At about the same time, the artist also attempted to render successive movements of a model and began to arrange individual studies in a sequential row so that they strongly convey the idea of cinematographic progression. The Stanford Museum recently acquired a drawing of a young woman sewing and apparently in the process of trying on her garment. At least two similar drawings are known, all done at the same time.[48] In Germany, Franz von Lenbach



Subscribers to *Animal Locomotion*
From *Descriptive Zoöpraxography,* 1893
Rare Books and Special Collections, Stanford University Libraries

Thomas Eakins (1844-1916)
The Fairman Rogers Four-in-Hand "1879"
oil on canvas, 24 x 36 in., Philadelphia Museum of Art
Gift of William A. Dick

(1836-1904), the famous Munich portrait painter and a subscriber to the Muybridge Philadelphia publication, was fascinated by the new medium, and made extensive use of it for his portraits from the 1890s. The painter used a sequence of individual stills showing the sitter from different angles and in slightly varied poses as well as enlargements. Such a series of individual photographic studies does not render continuous motion, but as multiple images arranged in a sequence, they remind one strongly of a Muybridge page with which Lenbach was very familiar.[49]

In America, too, artists grasped immediately the novelty and the potential of instantaneous photographs. Like Meissonier, Thomas Eakins (1844-1916) applied the new knowledge in a large painting, his first important Philadelphia commission, *The Fairman Rogers Four-in-Hand*, 1879, now in the Philadelphia Museum.[50] For this painting, originally called *A May Morning in the Park*, he made drawings and even sculptures after Muybridge's series of twelve photographs of Abe Edgington trotting, taken in June 1878. At that time a set of six mounted photographs of Muybridge's *The Horse in Motion* were for sale; Eakins obtained a set. He certainly was aware of the ambivalent reaction such an unconventional representation would arouse, for he made use of the correct positions of the trot, but abstained from applying the same analytical findings for the turning wheels of the carriage, a fact that was severely criticized by the American artist Joseph Pennell, Whistler's friend and biographer, when he delivered a lecture at the London Camera Club Conference in 1891 and vehemently denied any pretension to regard photography as an art or to upgrade its value for artists: "If you photograph an object in motion, all feeling of motion is lost, and the object at once stands still."[51] In contrast to Marey, he believed that instantaneous photographs could serve as mere suggestions "for hints of swift action," but not more. Like Marey, Fairman Rogers, "the intelligent art patron" and director of the Philadelphia Academy, who had commissioned the painting eleven years earlier, had no doubt at that time about the value of Muybridge's photographs. [See Documents, D.] Other American artists, like Frederick Remington, made ample use of the analytical photographs of horses, but the connection remained a rather superficial one, restricted as it was to the exact rendering of the horse's gaits. Like the European academic and battle painters, they were unable to see in any other elements of Muybridge's pictures a stepping stone for their art.

Muybridge and the Artists of the Twentieth Century

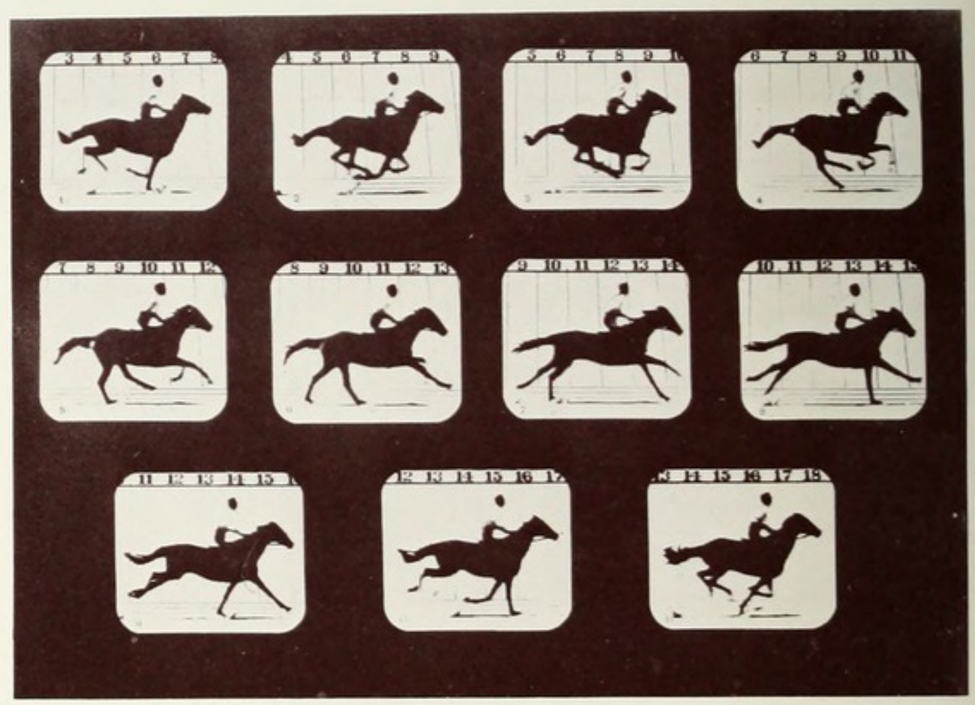
With the Futurist concern for the representation of movement such narrow, literal interest in Muybridge was gradually abandoned. While Frantisek Kupka's drawing *Les Cavaliers* echoes the simulation of moving horses in a cinematographic fashion,[52] it was, above all, the sequential arrangement of successive stills in *Animal Locomotion*, and the "extreme" positions they revealed, that were to have a lasting impact after the photographer was long dead and his once-sensational zoopraxiscope had become a forgotten relic in the small collection of the Central Library in his home town, Kingston-upon-Thames. Twentieth-century artists grew increasingly responsive to the pictorial potential of Muybridge's serial pictures. It was the oddity and awkwardness of certain stills, the apparent distortion and unexpected foreshortening of moving bodies that attracted Francis Bacon.[53] Bacon became so engrossed by Muybridge's photographs that he acquired an intimate knowledge of hundreds of his images, especially of subjects that went almost unnoticed in the nineteenth century, like Muybridge's series *Paralytic Child Walking on all Fours.* The stimulus that Muybridge's work radiated was manifold and often indirect, such as we find it in the program and teaching of the Bauhaus. But the new concepts proposed in Lazlo Moholy-Nagy's book *Malerei Fotografie Film* (1925)[54] could only evolve from the innovations of Muybridge and his contemporaries. Andy Warhol was inspired by the sequential arrangement of slightly varied images, as in his paintings of 1963; Warhol eventually turned to making motion pictures.

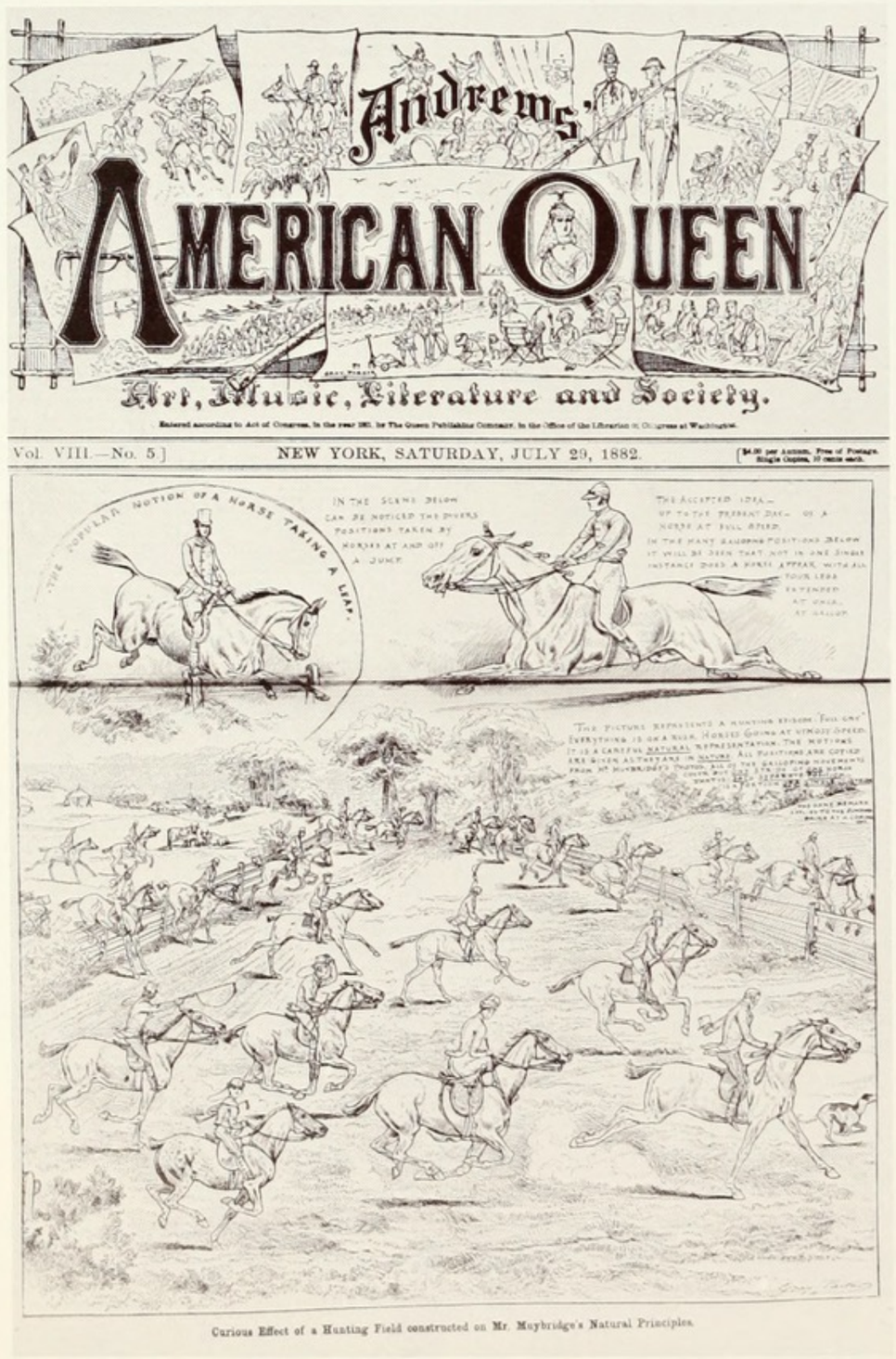
A Controversy of Aesthetics

Muybridge had become aware of the aesthetic problems of his innovative photography by the utter shock and disbelief that his truthful, but "ungraceful" and "extreme" images had caused, and by the sceptical or ambivalent reaction among artists and critics who questioned their value for art. For centuries, the credo of artists had required the study of nature and the truthful rendering of observation. How could this principle be reconciled with pictures that contradicted all conventional perception, but still were correct beyond all doubt?

Georges Guéroult, in his article "Formes, Couleurs et

Right, Muybridge, *Sallie Gardner Running* 1878
Zoöpraxiscope disk
Central Library, Kingston-upon-Thames
Below, the "accepted idea" vs. photographic evidence





Curious Effect of a Hunting Field constructed on Mr. Muybridge's Natural Principles

Mouvements," in the *Gazette des Beaux-Arts* of 1882, criticized precisely this extreme oddity of Muybridge's analytical photographs:

"The attitudes are, for the most part, not only ungraceful, but have a false and impossible appearance. The Americans, great realists, . . .did not fail to prove Géricault and Vernet wrong; they pretended that the photographs of Muybridge were a sort of revelation which was to overthrow all accepted notions of drawing the horse."

The author even declared that the Muybridge photographs were "wrong," visually speaking, because they showed the galloping horse as the human eye can never see it, and therefore, at the end of his essay, he urged artists "to speak in their own language. [55] Rodin, whose signature appears in the subscription list to *Animal Locomotion*, emphasized this point when questioned about how he would reconcile the truth revealed in Muybridge's photographs with the traditional claim to copy nature sincerely:

". . .it is the artist who is truthful and it is photography which lies, for in reality time does not stop, and if the artist succeeds in producing the impression of a movement which takes several moments for accomplishment, his work is certainly much less conventional than the scientific image, where time is abruptly suspended. [56]

Rodin criticized contemporary French battle painters for the literal application of Muybridge's findings. Eakins had been reprimanded for the same, not because of the oddity of individual positions, but because the single isolated still he used did not convey the feeling of motion. Although Marey had explicitly stated that he did not want to deal with the problems of aesthetics, a field that was not his own, he repeatedly pointed to the value of his and Muybridge's photographic results for artists. Aware of the unexpected and odd attitudes such photographic evidence revealed, he was convinced that among the numerous positions of successive movement caught by the camera, there surely would be one which the artist could employ without offending the laws of traditional aesthetics. Thus the artist would be able to achieve not only a greater variety, but also a new representation of movement.[57]

Muybridge himself recognized clearly why the reaction of artists was bound to be so ambivalent:

"If it is impressed on our minds in infancy that a certain arbitrary symbol indicates an existing fact; if this same association of emblem and reality is reiterated at the preparatory school, insisted upon at college, and pronounced correct at the university; symbol and fact—or supposed fact—become so intimately blended that it is extremely difficult to disassociate them, even when reason and personal observation teaches us that they have no true relationship." [58]

Once the human mind has made the association of an image with reality, even scientific proof has difficulties overcoming the convention of such traditionally accepted "signs."

Paul Valéry, who first wrote about Degas's fascination with Muybridge's instantaneous photographs of horses, speculated about the intricate connection between conventional perception and the technical innovation:

"Muybridge's photographs laid bare all the mistakes that sculptors and painters had made in their renderings of the various postures of the horse. They showed how inventive the eye is, or rather how much the sight elaborates on the data it gives us as the positive and impersonal result of observation. Between the state of vision as mere *patches of color* and as *things* or *objects*, a whole series of mysterious operations takes place, reducing to order as best it can the incoherence of raw perceptions, resolving contradictions, bringing to bear judgments formed since early infancy, imposing continuity, connection, and the systems of change which we group under the labels of *space*, *time*, *matter*, and *movement*. This was why the horse was imagined to move in the way the eye seemed to see it; and it might be that, if these old-style representations were examined with sufficient subtlety, the *law* of unconscious falsification might be discovered by which it seemed possible to picture the positions of a bird in flight, or a horse galloping, as if they could be studied at leisure; but these interpolated pauses are imaginary. Only *probable* positions could be assigned to movement so rapid, and it might be worthwhile to try to define, by means of documentary comparison, this kind of creative seeing by which the understanding filled the gaps in sense perception" [59]

The "issue over which the battle broke," as E.H. Gombrich put it, was the galloping horse. [60] Many modern artists were well aware of the scientific basis of instantaneous and of chronophotographs. In their novelty these photographs carried conviction and pictorial potential: they provided the artist with both truthful observation of nature and unprecedented images, conveying and stimulating the very idea of movement. The time

dimension visually caught in single or in serial images created totally new compositional formulae to represent movement in time and space. Finally, the painter's fascination with movement acquired not only a scientific basis, but a great variety of pictorial models from the multiple and sequential exposures of the camera.

Unaware of the far-reaching developments that the photographic venture at Palo Alto Farm would engender, Stanford had initiated a series of experiments which influenced many fields: the accurate analysis of successive movements by instantaneous photography and their synthesis with the zoopraxiscope stimulated physiological and other scientific research, inspired artists and, at the end of the century, led to the creation of an entirely new medium, the one that has come to dominate twentieth-century vision: the motion picture.

Notes

1. This article was reprinted in *Scientific American*, Supplement, 28 January 1882.
2. E. Muybridge, *Animals in Motion*, London, 1899, p. 4.
3. *Le Globe*, Paris, 27 September 1881: The article refers to the applicability of Muybridge's work for artists and to a remark by Marey, who first drew a parallel between instantaneous photographs and Japanese prints: "Ils [the artists] s'habitueront, comme le disait M. Marey, à peindre le vrai aussi bien que les Japonais (pour les oiseaux), et à le faire accepter au public." [For another excerpt from the article, see Documents, I.]
4. Muybridge in his description of the zoöpraxiscope, *op. cit.*, p. 4.
5. Muybridge to Frank Shay, Leland Stanford's private secretary. [See Documents F, for full texts of the two letters, which are in the Collis P. Huntington Collection of the George Arents Research Library, Syracuse University.]
6. This project, announced in the letter of 23 December 1881, and the question of the copyright of Muybridge's photographs certainly contributed to the change in Stanford's attitude toward Muybridge. The ambitious plan for the French publication never materialized. [See Robert Haas's biography for a discussion of the change in the relationship between Muybridge and his patron.]
7. Gaston Tissandier, "Les Allures du cheval. Représentées par la photographie instantanée," *La Nature*, 14 December 1878, pp. 23-26, with heliogravure illustrations.
8. Marey began his research with a study of blood circulation, *Physiologie médicale de la circulation du sang*, Paris, 1863. In all of his publications after 1881 he emphasized the great value of the photographic method for his work. In several of his books he described the Muybridge system and also gave credit to Stanford for his pioneering application of photography to problems of animal locomotion. Cf. particularly, *Développement de la méthode graphique par l'emploi de la photographie. Supplement à la méthode graphique*, Paris, 1885, pp. 7-12. Marey's own works provide the best source for any study of his physiological research and the development of his photographic methods and the cameras he constructed for his investigations.
9. Marey's letter, dated 18 December 1878, was published in *La Nature* for 28 December 1878, p. 54, and Muybridge's answer, dated 17 February 1879, appeared in the issue of 22 March, 1879, p. 246. [For the texts of the two letters, see Documents, C.]
10. E. J. Marey, *Animal Mechanism, a Treatise on Terrestrial and Aerial Locomotion*, London and New York, 2nd ed., 1874, The International Scientific Series, vol. XI, p. 138 and pp. 147-148. The first French edition appeared in 1873 under the title *La Machine animale, locomotion terrestre et aerienne*.

    Other physiological research was carried out at the same time, cf. J. Bell Pettigrew, *Animal Locomotion*, London, International Scientific Series, vol. VII, 1872. Earlier investigations include the analytical attempts made by the Weber brothers; by Wachter, who published in 1862 a series of drawings illustrating the gallop; and by Raabe. Helmut and Alison Gernsheim, in *The History of Photography*, London, 1969, pp. 435-436, even refer to earlier suggestions, which went in the same direction as the Stanford/Muybridge experiments: "In 1860 Thomas Rose, an amateur photographer, suggested using 100 stereoscopic cameras in a

row, giving exposures of 1/6 second at intervals of the same duration. The positive prints were to be mounted in pairs on a large phenakistiscope disk, which, when revolving, would reproduce the action of life in stereoscopic relief — i.e. a three-dimensional "moving picture". (From *The Photographic News*, 18 May 1860, p. 33.) Cf. also: Beaumont Newhall, *The History of Photography*, Museum of Modern Art, New York, 1949, chapter 7, "The Conquest of Action," pp. 103-118.

11. Emile Duhousset, *Le Cheval*, Paris, 1874. Another book devoted to the study of the horse and its gaits had appeared the year before: Emile Debost, *Cinésie Equestre*, Paris, 1873, but the author did not consider representations of the horse in art.
12. Duhousset not only provided illustrations for Marey's *Animal Mechanism*, but also for the long article which Marey had published in two installments in *La Nature* two months before Tissandier broke the news of Muybridge's successful experiments, cf. Marey, "Moteurs animés. Expériences de physiologie graphique," *La Nature*, 28 September and 5 October 1878. In these articles, Marey published a lecture he had given at the French Association for the Advancement of Science in August. In *Animal Mechanism*, p. 152, Marey specifically acknowledged his indebtedness to Duhousset's experiments and to his faithful translations of the graphic notations. Later, in *La Chronophotographie*, Paris, 1899, Marey again noted how close these drawings came to the positions of the horse as revealed in Muybridge's photographs (p. 8).
13. Philippe Burty, "L'Oeuvre de M. Meissonier et les photographies de M. Bingham," *Gazette des Beaux-Arts*, Vol. XX, January 1866, pp. 78-89.
14. All references and quotations after the English translation: Vallery K.O. Gréard, *Meissonier, His Life and His Art*, 2 Vols., London, 1897; this reference, Vol. I, p. 78.
15. "In the days before photography it was very difficult to work from actual data." Gréard, *op. cit.*, Vol. II, p. 326.
16. Paul Meyerheim, *Adolf von Menzel, Erinnerungen*, Berlin, 1906, pp. 97-102.
17. Gréard, *op. cit.*, Vol. I, p. 78.
18. *Ibid.*, Vol. II p. 266.
19. G. Potonnié, *Cent ans de photographie, 1839-1939*, Paris, *Société d'histoire générale et d'histoire diplomatique, classe de l'histoire des sciences*, I, 1940, p. 158. No source is given for this episode.
20. Date given by Muybridge in his article published in the San Francisco *Examiner*, 6 February 1881. [See Documents, E.]
21. In the English translation the text reads: "He asked me to paint her portrait." The reference to "her" certainly is a mistranslation of the French text, *Meissonier, ses souvenirs—ses entretiens. Précédés d'une étude sur sa vie et son oeuvre par M.O. Gréard*, Paris, 1897, pp. 194-195. It is not clear from the sentence if Meissonier meant Mrs. or Mrs. Stanford's portrait, but he did paint only one portrait, that of *Leland Stanford*, now in the Stanford Museum. Historical fact and the context of the whole paragraph make it quite clear that the translation should read; "He asked me to paint his portrait." This has caused some confusion in the literature.
22. The usual estimate of the costs of these experiments is around $40,000. Exaggerated rumors about Stanford's expenses circulated in America as well as in Europe, and, if this account is correct, were evidently not disallowed by Stanford.
23. Gréard, *op. cit.*, Vol. II, p. 267.
24. *The Attitudes of Animals in Motion: A Series of Photographs Illustrating the Consecutive Positions Assumed by Animals in Performing Various Movements.* "Executed at Palo Alto, California, in 1878 and 1879, Copyright 1881, by Muybridge."
25. This article, signed VAL and dated "Paris, June 26, 1881," appeared in the Sacramento *Daily Record-Union*, 23 July 1881 under the title: "How Governor Stanford Converted Meissonier. The Great Horse Painter Finds that He Has Been in Error as to the Horse all His Life." The author must refer to Stanford's second visit to Meissonier's studio in June 1881, when he brought along a bound volume of Muybridge's photographs. At this time the French painter knew of Muybridge's work through Marey and the prints which Stanford must have shown him in 1879, during his first visit.
26. Muybridge, dedication page of *The Attitudes of Animals in Motion*.
27. Gréard, *op. cit.*, II, p. 289: "Leland Stanford, Governor of California, asked me to paint his portrait in 1881. I had it engraved for him by Jules Jacquet. His cane was introduced for a special reason. It was the one he always used. He prized it greatly, for on the handle was a little gold plate, made from the first nugget he found, the foundation of his fortune.—On the table by the side of the famous cane lies an open album. It contains the first horses and animals in motion photographed by the American Muridge." (With the wrong spelling of Muybridge's name in the English translation). According to Muybridge, Stanford paid $10,000 for his portrait. [Letter of 28 November 1881, see Documents, F].
28. G.T. Clark, *Leland Stanford, War Governor of California, Railroad Builder and Founder of Stanford University*, Stanford University Press, 1931, p. 343.
29. Potonnié, *op. cit.*, p. 125, without source. *Cf.* also Marey, *La Chronphotographie*, pp. 6-8.

30. Robert Taft, *Photography and the American Scene*, New York, 1938; new edition, New York, Dover, 1964, p. XIII, n. 8. Tegetmeier reported his presentation in the *Field*, London, 28 June 1879. Other references in: San Francisco *Bulletin*, 5 May 1880 and *Alta California* of the same date.
31. Marey, *Animal Mechanism*, p. 137. Marey adds that Carlet and Mathias Duval, professor of anatomy at the Ecole des Beaux-Arts, carried out this plan.
32. Marey, *Le Mouvement*, Paris, 1894, pp. 300-301.
33. Duhousset, "Reproduction instantanée des allures du cheval, au moyen de l'électricité appliquée à la photographie," *L'Illustration*, 25 January 1879. Muybridge's collection of newspaper clippings also includes an advertisement of Duhousset's book from *Journal Amusant*, 7 June 1879.
34. E. Muybridge, *Zoöpraxography, or the Science of Animal Locomotion Made Popular*, University of Pennsylvania, 1893. His Appendix A, pp. 1-2 gives a detailed syllabus of the lectures and an abbreviated list of the subjects on some of his disks. "Abbreviated Criticism," Appendix A, pp. 4-34. Appendix B, pp. 8-14, lists the subscribers to the Philadelphia publication. The original glass positives that Muybridge used for his lectures are now in the Museum and Art Gallery at Kingston-upon-Thames and in the Science Museum, London.
35. For the enthusiastic as well as the critical response, see also Aaron Scharf, *Art and Photography*, London, 1968, in his chapter "The Representation of Movement in Photography and Art", pp. 162-178.
36. Erwin Panofsky, *The Codex Huygens and Leonardo da Vinci's Art Theory*, Studies of the Warburg Institute, vol. 13, London, 1940, see particularly fols. 22 and 29, pp. 27-29 with figs. 10 and 13.
37. Paul Valéry, *Degas Danse Dessin*, Paris, Vollard, 1936, p. 60.
38. In *Le Mouvement*, p. 108, Marey gives August as the month of Muybridge's arrival in Paris.
39. *Le Mouvement*, p. 108. In *Physiologie du mouvement. Le Vol des oiseaux*, Paris, 1890, p. 131, after describing Muybridge's method of taking instantaneous photographs, Marey again mentions the photographs of pigeons which he had brought along to Paris, and points to the differences of Muybridge's method and his own, which he had developed in the meantime. Whereas the Muybridge method did not produce successive photographs of flying birds which could be arranged, like those of galloping horses, in a series, Marey's photographic gun enabled him to take such pictures; he published them in this book.
40 In an excellent study, "Eakins, Muybridge and the Motion Picture Process", *Art Quarterly*, Vol. XXVI, Summer 1963, pp. 194-216, W.I. Homer, with J. Talbot, stressed the fact that Eakins's contribution to the development of the motion picture consisted in the perfection of methods and devices constructed and used earlier by Marey and Muybridge, rather than in an innovative mechanism of his own. Homer and Talbot also pointed out that Muybridge worked with a modification of the "Marey-Wheel" in 1884. Eakins made analytical drawings of the Muybridge photographs based on Marey's diagrams as well as sketches and sculpture from the Edgington series for his painting *The Fairman Rogers Four-in-Hand*.
41. In a letter to the *Burlington Magazine*, "Concerning Muybridge, Marey and Seurat," Vol. 104, September 1962, pp. 391-392, W.I. Homer contested this connection that Scharf had made earlier in "Painting, Photography and the Image of Movement," *ibid.*, Vol. CIV, 1962, pp. 186-195. Even if there was no direct influence, it seems unlikely that Seurat was unaware of Marey's researches. For further discussion, cf. A. Scharf, *Art and Photography*, pp. 177-178.
42. For the impact of Marey's chronophotographs, see also A. Scharf, *op. cit.*, and, more general, O. Stelzer, *Kunst und Photographie*, Munich, 1966. Balla's and Duchamp's paintings were also exhibited in *Malerei nach Fotografie, von der Camera Obscura bis zur Pop Art*, Munich, Stadtmuseum, 1970, cat. nos. 982 and 987. The well-documented catalogue is by J.A. Schmoll gen. Eisenwerth.
43. Muybridge, *Animals in Motion*, p.4
44. Marey, *Le Mouvement*, p. 165.
45. Gréard, *op. cit.*, II, pp. 306-306, quotes the letter which Meissonier wrote about the painting to Mr. Stewart of New York, the purchaser. [See also Documents, G.] Meissonier had worked on the painting over a period of ten years. About the galloping cuirassiers, p. 307; the watercolor, p. 309; about the concept of the entire Napoleon cycle, pp. 298-299. Like every other figure in the painting, each horse had its own dossier of studies.

    According to E. Duhousset, *Le Cheval dans la nature at dans L'art*, Paris, 1902, Meissonier copied the painting in a watercolor larger than the original oil for the Exposition universelle, 1889 (now in the Huntington Hartford Collection) and he made only minor modifications. Duhousset states that it was painful for Meissonier to accept the positions of galloping horses as they were revealed in instantaneous photographs. But whereas Meissonier made only slight modifications for the watercolor *1807*, in later years he modeled in wax a rider after a Muybridge photograph for the painting *Le matin de la bataille de Castiglione*, which was shown with the wax model in a small exhibition at the Ecole des Beaux-Arts in 1892.
46. For Degas's attitude toward, and use of photography, see A. Scharf, "Painting, Photography, and the Image of Movement," *Burlington Magazine*, CIV, 1962, pp. 186-195, and in *Art and Photography*, chapters eight and nine, an

extremely detailed, well-documented and well-illustrated discussion.

47. Van Deren Coke, *The Painter and the Photograph*, New Mexico University Press, 1964, p. 15.
48. A very closely related drawing of probably the same model is reproduced in *Art News Annual*, XXIII, 1954, p. 55, titled *Studies of a Japanese Model* and dated ca. 1900. Another sketchbook drawing which depicts a woman sewing in seven successive individual studies is reproduced in: E. Vuillard, *Cahiers de dessins*, note by J. Salomon and preface by A. Vaillant, Paris, 1950 (no pagination). For Vuillard's own photography and use of it for his work, see the catalogue of the exhibition *Vuillard et son Kodak*, London, Lefèvre Gallery, March 1964.
49. *Malerei nach Fotografie, op. cit.*, pp. 75-90 with illustrations.
50. Eakins entered into correspondence with Muybridge in 1879; he suggested a new system of marking the background against which the horses were photographed for more accurate measurement. He had lantern slides made from the series, and used them for instruction at the Philadelphia Academy. Gordon Hendricks has discussed *A May Morning in the Park* in great detail: *Bulletin of the Philadelphia Museum of Art*, Spring, 1965, pp. 49-64, and also the correspondence between Eakins and Muybridge, and between Fairman Rogers and Muybridge. The article is a detailed documentation of the connection between Eakins' work on the painting and Muybridge's photographic analysis of the horse's trot. See also: L. Goodrich, *Thomas Eakins*, New York, 1933; and B. Newhall, "Photography and the Development of Kinetic Visualization," *Journal of the Warburg and Courtauld Institutes*, VII, London, 1944, pp. 40-45.
The exhibition catalogue by Gordon Hendricks, *Thomas Eakins: His Photographic Works*, Pennsylvania Academy of the Fine Arts, Philadelphia, 1969, documented in several instances how often Eakins used his own photographs for paintings, and further, how much he regarded photography as a part of his work.
51. Joseph Pennell, "Photography as a Hindrance and Help to Art," *British Journal of Photography*, London, 8 May 1891, Vol. 38, pp. 294-296.
52. Exhibited in *Malerei nach Fotografie*, cat. no. 980.
53. J. Rothenstein and R. Alley, *Francis Bacon*, London 1964, deal extensively with the relationship between Muybridge's photographs and Bacon's paintings. More general: J. Russell, *Francis Bacon*, London, 1971, pp. 109-113.
54. *Bauhausbucher 8, Munich*, 1925. The first English edition: *Painting, Photography, Film*, with a note by H. Wingler and a postscript by O. Stelzer, London, 1969.
55. G. Guéroult, "Formes, Couleurs et Mouvements," *Gazette des Beaux-Arts*, 2nd period, Vol. 25, Paris, 1882, p. 178 and 179.
56. Quoted after the English translation, Paul Gsell, *On Art and Artists*, London, 1958, p. 91. The original French edition appeared in 1911.
57. Marey, *Photographie du mouvement*, Paris, 1892, particularly p. 56 and pp. 62-64.
58. Muybridge, *Animals in Motion*, p. 164.
59. Quoted after the English translation by D. Paul, Paul Valéry, *Degas, Manet, Morisot*, introduction by D. Cooper, Vol. XII of the collected works, New York, 1960, p. 41. First published in 1936.
60. E.H. Gombrich, "Moment and Movement in Art," *Journal of the Warburg and Courtauld Institutes*, XXVII, 1964, pp. 296-297 in regard to Muybridge.

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Documents

Selected and annotated by Anita Ventura Mozley and J. Sue Porter

A. Technical Matters

"A New Sky Shade"

Under this title, Muybridge published details of a device that made it possible to vary exposure times on a single plate, thus compensating for the difference in sensitivity of his plates to different colors in the landscape. The article appeared in the prestigious journal of photography, The Philadelphia Photographer, *edited by Edward L. Wilson, Vol. V., May, 1869, and is reprinted here through the kind help of Beaumont Newhall. It is signed "Helios," the pseudonym Muybridge used for his photographic work until he published his Yosemite series of 1872.*

I have been reading with some interest M. Carey Lea's article "On New Diaphragms," in the February number of the *Photographer*, and foreseeing certain disadvantages and inconveniences by the use of the diaphragms therein proposed, I submit to your notice a sky-shade, which I have had in use some time, with the exception of a minor arrangement included here, and which I think will be found to embrace all the advantages claimed either for the perforated metal shade of Mr. Lea, or the inclined diaphragm of Mr. Sutton, with the addition of greater adaptability and simplicity in use.

A, is the camera front supporting the lenses *a a*. B is a frame of wood of a suitable size, and extending outward from the camera-front as far as convenient, without obstructing any portion of the view it is desirable to include in the negative. C, C, are grooves in which the shutter, Fig. 2, is kept in place. D, D, D, are sections of rubber tubing, to break the force of the shutter in a rapid descent. E, E, are springs, forced inward in its descent by the projecting top of the shutter, H, and in their relaxation preventing any rebound of the shutter. M^1 and M^2 are spring-catches, the lower to hold the shutter up while focussing, the upper for the same purpose when an instantaneous exposure is desired. Fig. 2 is a rear view of the shutter (*i.e.* of the part towards the camera), made of wood, and as light as is consistent with its duties. H, is a bar of wood firmly attached to the shutter proper, G. O, O, are vertical bars attached to G, moving in the grooves, C, C, acting as guides when the shutter is elevated, and also as supports to an iron rod, I, to which they are connected by a leather hinge at the line, V; the rod, I, is of greater length than the width of the frame, and works outside, or rather in front of it. K, is a piece of black cloth, which is attached to the iron rod, I, at its upper part, and to the bottom of the frame, B, at its lower part.

The manner of using the apparatus is self-evident. The frame, B, being attached to the camera, the springs, E, E, are compressed when the shutter rises a short distance by the expansion of the rubber springs, D, D; the shutter is now elevated and supported by the spring-catch, M^2, and the focussing is performed (in my camera the frame is about two inches deep, but I have an arrangement to extend it three or four inches further from the front of the camera if necessary; a simple piece of board cut into steps on either side, and the focussing-cloth does duty as a shade for the space left open at the top). This done, the shutter is released from the

Fig 1.

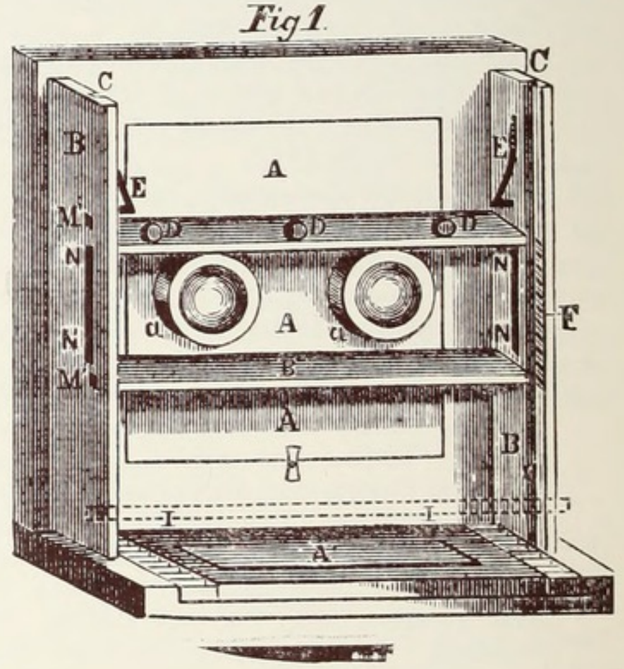


Fig. 2.

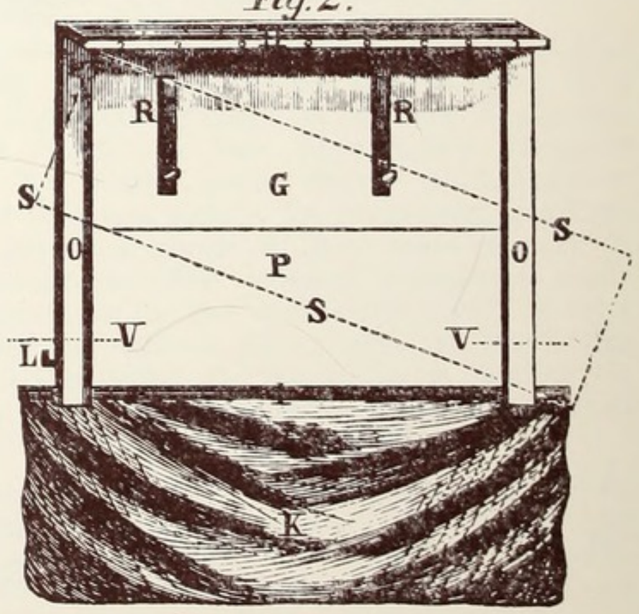
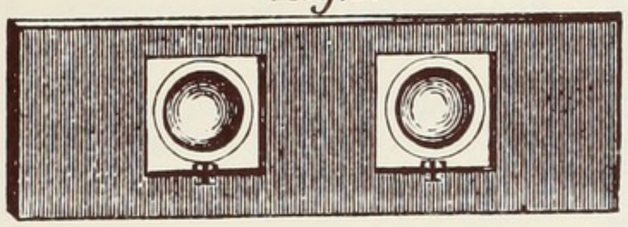
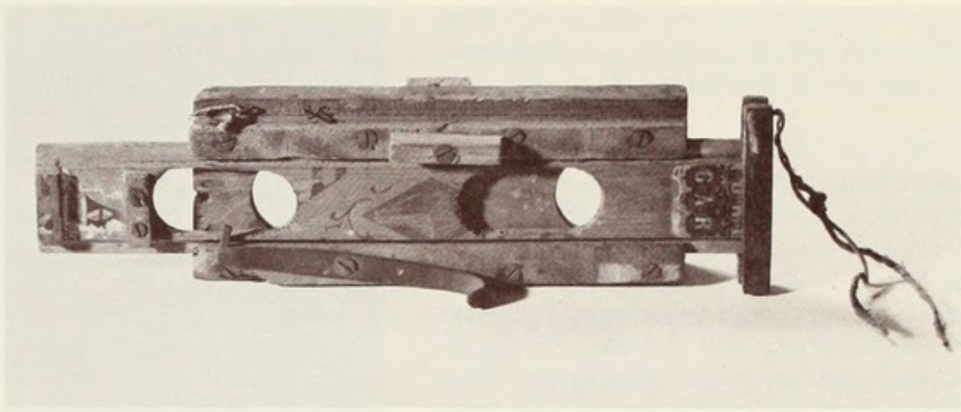


Fig.3.





Muybridge's lateral sky-shade, 1879
Stanford University Museum of Art

spring-catch, M^2, and allowed to fall to the sky-line, which is carefully noted by means of the scale, F, Fig. 1, and the pin, L, Fig. 2. It is convenient to divide the scale into one-eighth inches; this will be found near enough for practical purposes. A correspondingly adapted scale may be drawn on the focussing-screen; this, however, will perhaps lead to confusion, as each lens will require a different scale. I content myself by fixing the shutter in place when the sky-line is reached, and then examining the indicating-pin in front. The middle distances are now noted, and the shutter drawn up and fastened by the catch, M^1; when the sky is sufficiently bright, or the lenses sufficiently rapid for an "instantaneous" exposure, the shutter is released, and the time occupied by the exposure is regulated by the size of the opening, P, Fig. 2. If a more lengthened exposure is desired, it is best first to raise the shutter to the height required, and give the necessary exposure to the sky, then lower it and give the middle distances what additional time is requisite, and finally complete the exposure of the foreground; it, of course, being understood that the required exposure of the foreground is longer than that for objects at greater distance; should that not be the case, the shutter can readily be moved or adapted to give middle or distant objects any comparative exposure necessary, by having a false front attached by thumbscrews or other contrivances at R, R; in this event either side may be made to drop lower than the other if required, as indicated by the dotted line, S, Fig. 2. When, however, as is sometimes the case, *one side* of a picture requires a longer exposure to obtain detail than the other, openings, N, N, Fig. 1, can be made in the sides of the frame, and a shutter, Fig. 3, with openings of suitable size, T, T, made therein, and, if accurately made, and the lenses are exact (I have presumably written for stereoscopic work all through), the portion of the image resulting from each lens will be correspondingly shaded by moving the shutter in the required direction. [1]

It is highly probable this apparatus may not be new to many of your readers, but I do not recollect observing either in your or any other photographic journal, a description of anything, for the purpose intended, I find so convenient or useful. A more elaborate apparatus for the extension or contraction of the shade can be made upon the principle of the bellows, and worked by a rack and pinion if desired, but, for almost all operators, the present form will be all-sufficient.

It is just possible, a description of my focussing-cloth for field-work, may not be uninteresting to a few of your readers. I prefer, for many reasons, a draw-shutter to my plate-holder that comes entirely out, and before adopting my present cloth, was frequently troubled with light-struck plates. It is large, of course, covering the camera with about three-feet drop from the bottom all around, and covered with white cotton cloth outside. On one side (the right) I have an attachment like the sleeve to a coat, so fashioned, with an opening at the bottom large enough to insert the hand; the cloth being fastened *under* the camera, I draw out the plate-holder shutter *into* this sleeve or bag, as it may be called, and let it hang down out of the way until the exposure is complete; you will readily see the light has no chance of getting to the plate while the shutter is being withdrawn. The white covering is a great protection, keeping both the head and the camera cool.

HELIOS
San Francisco, March, 1869

A Question of Quality

Muybridge joined Bradley & Rulofson's Gallery after his Yosemite expedition of 1872; his old publisher, Houseworth, retaliated by putting a worn and badly mounted print from the Yosemite series in his window. The print carried the Bradley & Rulofson name. The following exchange was published in the Alta California *on several successive issues in 1873:*

"Messrs. Bradley and Rulofson are much obliged to Mr. Houseworth for giving their names a place in his window; but attaching them to an old, soiled print from a condemned negative of Muybridge's (neither print nor negative being made by

them), shows to what a wretched strait the poor gentleman is driven in a fruitless effort to compete in business."

Houseworth replied:

"Thomas Houseworth and Co.—To the public in general, and a reply to the card of Bradley and Rulofson—The Yosemite View exhibited by us in our window is one of a set of forty furnished to a subscriber by Bradley and Rulofson for the sum of $100 and bears their name as the publishers. The View is a fair sample of the lot which was sold to me at a heavy discount on the cost and is now in the same condition as when received by the original purchaser. We would further remark that we had tried to purchase from these gentlemen some of their views and they positively refused to sell us, for reasons which we leave others to judge."

The editor then got the following comment from Muybridge:

"Aesop in one of his fables related that a miserable little ass, stung with envy at the proud position the lion occupied in the estimation of the forest residents, seized some shadowy pretext of following and braying after him with the object of annoying and insulting him. The lion turning his head and observing from what a despicable source the noise proceeded, silenty pursued his way, intent upon his own business, without honoring the ass with the slightest motion. Silence and contempt, says Aesop, are the best acknowledgements for the insults of those whom we despise."

On Bradley & Rulofson,
Muybridge's Publishers 1874[2]

In July, 1874, the Philadelphia Photographer *announced the award of the medal in their initial prize competition to Bradley & Rulofson, who "sent us six negatives of the same subject, all equally perfect, being absolutely without spot or blemish. . . . They are among the purest specimens of photography it has ever been our good fortune is inspect." The issue carried a print of one of the negatives (reproduced in R. Taft,* Photography and the American Scene, *New York, 1964, p. 332; a print of one of the other negatives of the same subject appears on p. 98 of the Brandenberg Album, see illustration), letters from Rulofson and his operator, Mr. Taylor, and the views of the working parts of the Bradley & Rulofson establishment reproduced here. The material is reprinted through the courtesy of Beaumont Newhall and The International Museum of Photography, Rochester, New York.*

Brandenburg Album, p. 98

Rulofson to Wilson, Editor of the Philadelphia Photographer *("San Francisco, May 13th, 1874")*

Friend Wilson:

I herewith forward to you a note from Mr. Taylor, giving our formulae for working, and containing some of his views on the subject, but I must confess I would not have you understand that I indorse all he says on the subject, of the relative quality of San Francisco work, nor the causes to which he ascribes the assumed superiority, while I would be slow to detract from the industry, perseverance, and skill of our photographers. I think it but fair to admit that they possess some climatic advantages not enjoyed elsewhere in America. I don't regard the light as superior in actinic power to that of the Atlantic States; but we do possess a more even temperature, the thermometer seldom rising above 75° or falling below 60°, with a slightly humid atmosphere, presenting the most favorable conditions for delicate chemical processes involving the use of volatile substances. And a Californian's *proverbial modesty* causes us to cast about for some natural cause to which to attribute any superiority, which our friends may kindly ascribe to our productions.

I send herewith a plan of our gallery, from the street entrance to elevator, to the roof; there are in all twenty-nine rooms, reasonably adapted to their several uses. You will observe that we formerly occupied the corner building only; we then cut through into the adjoining building on Sacramento Street, and later, effected an entrance into the one on Montgomery Street. We are now giving employment to thirty-four hands all told. We employ six Chinese; they are faithful, industrious, and expert, valuable aids in the mounting and finishing department.[3]

We made several attempts to obtain an interior negative of our reception-room, of which we are proud, but failed, owing to the long exposure required, and the throng constantly interrupting. . . .
William H. Rulofson

D.B. Taylor to Wilson ("San Francisco, May 4th, 1874")

Dear Sir:

In obedience to your request, I give you my formula by which the prize negatives were made. It is an old and long-used formula, but I think there is not better when carefully used.

COLLODION.
Ether and Alcohol, ...equal parts.
Cotton, ...6 grains to ounce.
Iodide of Ammonium, ...4½ grains.
Bromide of Potassium, ... 2 grains.
Silver bath—40 grains, slightly acid.
DEVELOPER
Water, ...96 ounces
Iron, ...6 ounces
Acetic Acid, ...10 ounces
Alcohol, ...6 ounces

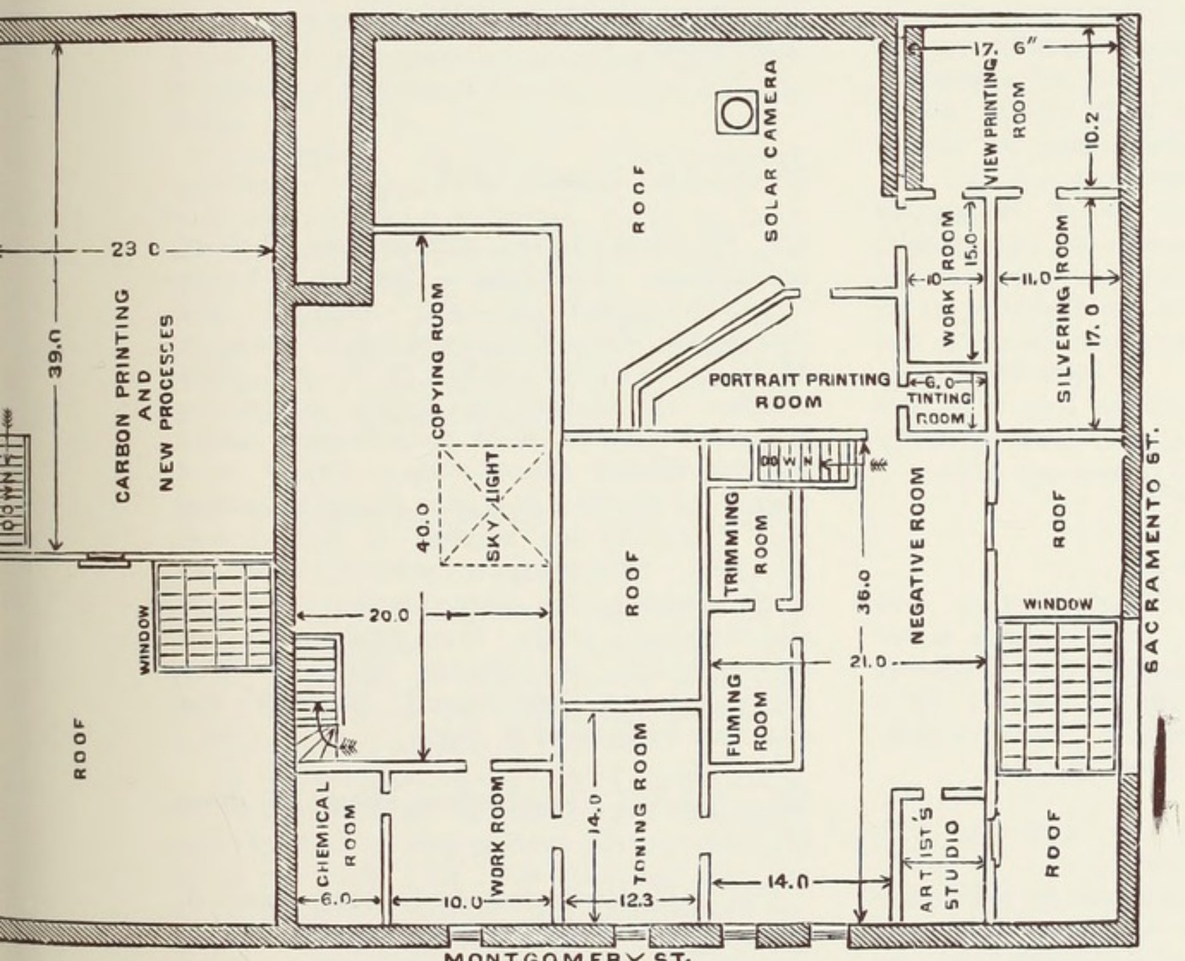
The above is the formula I have worked for the last four years, all the time I have been with Bradley & Rulofson, and our negatives, in quality, improve from year to year—not by trying every newfangled notion that comes along, but by giving our *closest attention* to the details of the process. I have worked in photography for the last sixteen years in the Eastern and Western States, and have met more thoroughbred photographers in San Francisco than I ever saw in my life before. This city has the reputation of making some of the finest photographs in the Union, and I might say the world,[4] and it is *all due* to the careful, hard workers in photography. The climate has nothing to do with it. Work, *work* does it; *work* is the word with us.

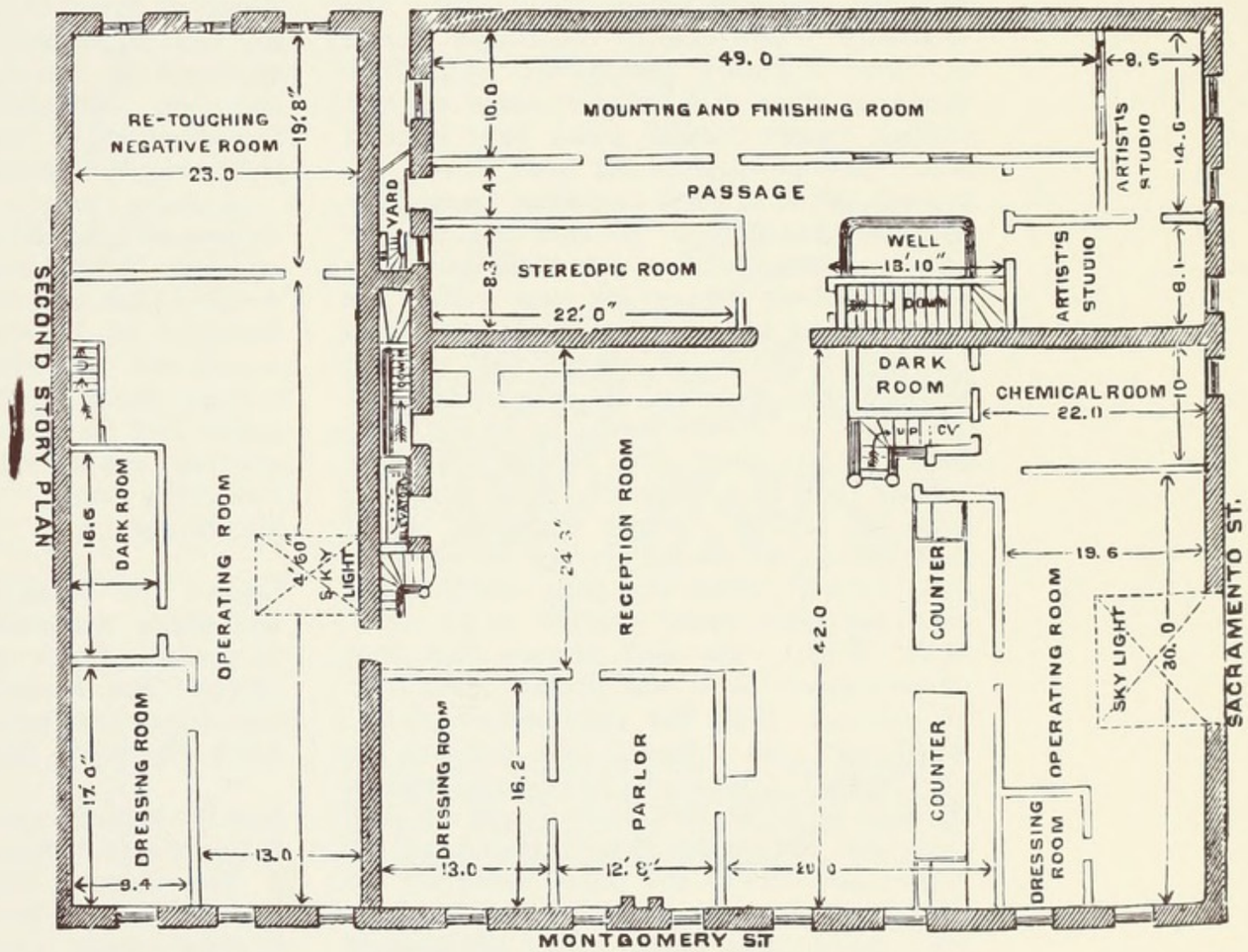
D.B. Taylor
Operator with B. & R.

Copy Photographs 1877

The following article on Muybridge's proposal of November, 1877, to photographically copy the Santa Clara County records is from the San Jose Mercury *for 9 November 1877. (Kingston Scrapbook, p. 10.) Shortly before this, Muybridge had published his photograph*

The two upper floors of Bradley & Rulofson's Gallery, 1874.





of Occident Trotting at Full Speed, *"an Automatic Electro-Photograph." The proposal to photocopy the records was turned down by the Committee of the Board of Supervisors, chiefly because the amount of money required was "more than they could secure in a lump." Photocopying machines were finally installed in the County Offices in 1949.*[5]

"The Muybridge Process"

Mr. E.J. Muybridge, the San Francisco photographer, who offers to photograph the county records, arrived in this city yesterday, and at 2 P.M. appeared before a committee from the Board of Supervisors and a number of prominent citizens for the purpose of explaining the process and answering such questions as might be propounded. He brought with him for the inspection of the committee a copy of the Mexican records made in 1858 for reference in the case of the United States vs. Jose Y. [sic] Limantour.[6] A perfect facsimile of every document was given, and though nearly twenty years have elapsed since the photographing was done, the records are in as good condition apparently as when just copied. He said that by the photographing process the copy would be more distinct where ink was yellow or faded in the original, but there would be no improvement at where the original showed signs of wear. He offered to copy 25 books, or 15,000 pages, for 35 cents per page for one book. If a second copy was desired he would furnish it for 13 cents per page. Mr. Hardy, County Recorder, stated that the books would average about three and one-half folios to a page, which at 12 cents per folio would amount to 42 cents. W.W. Wright, the well known San Jose photographer, who was present, gave it as his opinion that the proposition of Mr. Muybridge was a liberal one and that he had figured it down to the lowest notch. He felt satisfied the work would be well done. Mr. Muybridge further stated that he would also furnish the paper necessary for the work, the county to do the binding. The matter was taken under advisement and a report will be handed in at the December meeting of the Board.

Muybridge's Testimonials 1878-79

Muybridge's testimony to Dallmeyer lenses is reprinted from Anthony's Photographic Bulletin *(New York), September 1878 (letter dated "San Francisco, Aug. 17, 1878"). The London firm of Dallmeyer is often citted in* The Philadelphia Photographer *of the period as the manufacturer of superior lenses. (Kingston Scrapbook, p. 32.)*

Messrs. E. & H.T. Anthony & Co.
Dear Sirs:

I must say the partial success I have met with must be attributed to the extraordinary rapidity and wonderful depth of focus of the Dallmeyer lenses. In my next experiments I intend reducing the exposure to the 5,000 part of a second, and am confident, with some slight modification of my chemicals, to obtain better results than the present.

I have more than sixty lenses of Dallmeyer's manufacture in my equipment, and have used them exclusively, within the Arctic Circle and under the Equator, at an elevation of 10,000 feet and beneath the waters of our Bay.[7] with exposures varying from 18 hours to less than the 2,000 part of a second, and must candidly confess I cannot afford to use any other.
Faithfully yours,
Muybridge

Under the heading "Fast Horses and Well-Made Apparatus, "Muybridge's letter in praise of the manufacturer's cameras (dated "San Francisco, May 23rd, 1879") was printed in Photographic Times *for July 1879. (Kingston Scrapbook, p. 52.)*

Scovill Manufacturing Co., 419 and 421 Broome Street, New York:

The Camera duly arrived. In reference to it I scarce know which emotion to express most emphatically, delight or astonishment; probably the former, as the thirty Cameras of your manufacture which I have now in use afforded me ample right to expect your skillful assistants would have abundant genius to accomplish most successfully the task imposed upon them. In simplicity of design, adaptability to any possible purpose, facility of use, strength of construction, suitability of material selected, extreme lightness, and elegance of finish, this Camera affords abundant evidence of the remarkable skill of your operatives, and the comprehensive resources of your manufactory [sic]. I very much question whether ever before was there constructed an 8 x 10 Camera equally well adapted for the studio or the field, and so convenient for any required purposes, whether with one or a pair of lenses of focal length ranging from 2½ to 26 inches, and weighing 5½ lbs. only. Permit me to congratulate you.
Muybridge

Muybridge's Patents 1879

On 27 June 1878, Muybridge filed an application for letters patent on an "Improvement in the Method and Apparatus for Photographing Objects in Motion." On 11 July 1878, he filled another application for letters patent on the same subject. Both patents were issued by the United States Patent Office on 4 March 1879. The first was issued as Patent No. 212,865; the second as Patent No. 212,864. Muybridge's introductions to both patents are given below and are illustrated with the drawings that accompanied the issued patents. The drawings are reproduced through the courtesy of Robert B. Haas.

No. 212,865 (application filed 27 June 1878)

Be it known that I, Edward [sic] J. Muybridge, of the city and county of San Francisco, State of California, have

invented certain Improvements in Taking Instantaneous Photographs of Objects in Motion; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to certain drawings accompanying this specification, and forming a part of the same.

My invention has reference to that branch of photography which is known as "instantaneous photography," and it applies more particularly where the object to be photographed is in rapid motion.

The principal object which I have in view is to take photographic views of horses that are moving rapidly under speed, in order to determine the posture, position, and relation of their limbs in different portions of their step or stride.

My invention relates to a double-acting slide, with the means for operating the same, and to a novel background, which is graduated or marked so as to gage [sic] the position of the horse and the posture of his limbs. . . .

Referring to the accompanying drawings, Figure 1, Sheet 1, is a perspective; Fig. 2, Sheet 1, is an end section, showing camera slides, track, and background. Fig. 1, Sheet 2, is a section of slide-frame, showing trigger, lever, armature, and magnets. Fig. 2, Sheet 2, represents a photograph. Fig. 3, Sheet 2, represents a contact-plate. . . .

No. 212,864 (application filed 11 July 1878)

. . .My invention has reference to a novel arrangement for exposing the sensitive plates of photographic cameras, for the purpose of taking instantaneous impressions of objects in motion.

In a cotemporaneous [sic] application for a patent filed by me I have described and claimed an arrangment for operating a slide or slides for this purpose by an electric circuit which was established or broken by the object to be photographed as it passed in front of the camera.

2 Sheets—Sheet 1.

E. J. MUYBRIDGE.

Method and Apparatus for Photographing Objects in Motion.

No. 212,865. Patented Mar. 4, 1879.

Fig 1

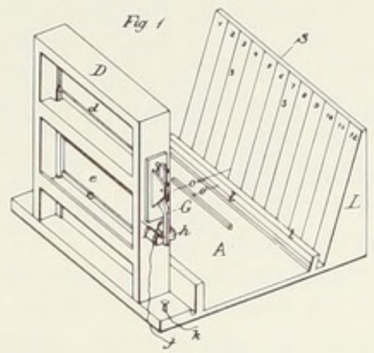
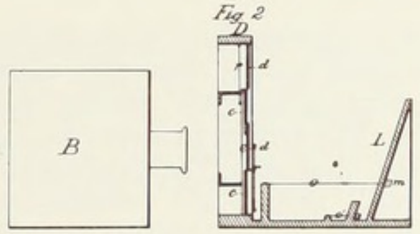


Fig 2



Witnesses
D B Lawler
W. F. Clark

Inventor
Edward J. Muybridge
per Jno L. Boone
Attorney

No. 212,865. Patented Mar. 4, 1879.

Fig 1

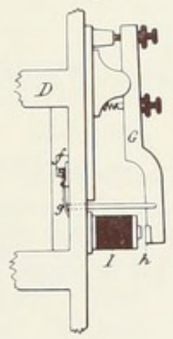


Fig 3

Fig 2

E. J. MUYBRIDGE.

Method and Apparatus for Photographing Object in Motion.

No. 212,864 Patented Mar. 4, 1879.

Fig 1

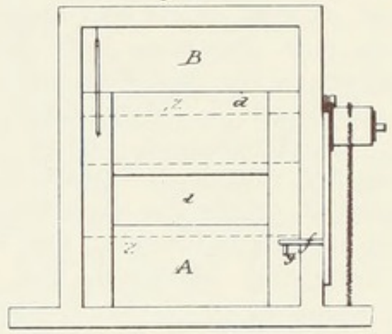
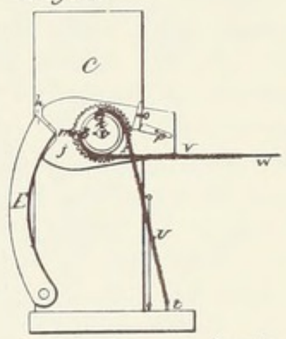


Fig 2.



Witnesses
D B Lawler
I Sam Taylor

Inventor
Edward J. Muybridge
per Jno. L. Boone
Attorney

My present invention relates to an arrangement whereby the moving object is made to operate the slide simply by mechanical means.

Referring to the accompanying drawings, Figure 1 is a back view of the frame and slides. Fig. 2 is an end view. . . .

B. The Murder 1874

From the Calistoga Free Press, *Saturday, 24 October 1874 (all spellings follow those in the transcript of the article in the Yosemite National Park Research Library)*

Early Sunday morning last, the news of a terrible tragedy, which occurred the night

previous at about 11 o'clock, at the residence of Wm. A. Stuart, near the Yellow Jacket quicksilver mine, about seven and a half miles west of Calistoga, in this county, was received here. The particulars as near as we can ascertain, are as follows: On Saturday last, just before the departure of the San Francisco boat for Vallejo, Edward J. Muybridge, a well known photographic artist in San Francisco, by means of letters which fell into his hands, made the discovery that his wife, who is now in Oregon, and to whom he was devotedly attached, had been on terms of criminal intimacy, for some time past, with Major Harry Larkyns, formerly connected with several San Francisco journals, but lately engaged in getting up a map of the mines in this and adjoining counties. Frenzied over the discovery, he immediately made his way to Calistoga, and learning here that the destroyer of his peace was at the Yellow Jacket Mine, hired a team at Connelly's stable, and employed Geo. Wolfe to drive him there. Alighting, he knocked at the door, and enquired if Major Harry Larkyns was in.The gentleman that answered the call informed him that he was, and invited him in; he very politely and calmly refused, saying he wished to see the Major only a moment on the outside. The Major, who at the time was engaged in a game of cribbage with a lady, answered the summons. As he opened the door and looked out into the dark, he called out: "Who is it? I can't see you." Mr. Muybridge says "Good evening, Major; my name is Muybridge, and here is the answer to the letter you sent my wife," and fired at the breast of Larkyns. The Major staggered back, and ran through the kitchen and sitting room, and out the front door, and fell close to a large oak tree. Mr. Stacy and others carred him in the house and laid him on a bed, where he breathed his last in about one minute and a half. After firing, Muybridge followed closely, but was at once covered by a pistol in the hands of J.M. McArthur, and surrendered—though making no attempt to escape—and was brought to Calistoga immediately and given into the hands of Constable Geo. B. Crumwell. We are informed that there was talk of lynching Muybridge at the time of the shooting, but through the influence of Mr. Stuart this act of violence was not put into effect.

The remains of Major Larkyns were brought to Calistoga Sunday morning, and thence conveyed to San Francisco, in the afternoon for interment. On Monday Muybridge was brought before Justice Palmer of this place, but waiving an examination, was taken to Napa, and there confined in the county jail, to await the action of the grand jury.

The deceased was a native of Scotland, and aged 39 years the day of his death. Mr. Muybridge is about 47 years of age [Muybridge was 44], and a native of England.

We had a conversation with Muybridge while here, and found him very calm and collected, and apparently feeling entirely justifiable in the killing of Larkyns, and we are informed that since his incarceration at Napa, he still retains his composure. He says it was not his intention to kill the Major, but to maim him for life. Hon. W.W. Pendegast, of Napa, and C.H. King, of San Francisco, have been retained as his council, and we hear that they will soon make application for his release on bail.

C. The Marey/Muybridge Letters

Gaston Tissandier, editor of La Nature, *wrote the following introduction to Marey's letter, which appeared in "Correspondence,"* La Nature, *No. 291, 28 December 1878.*[8]

On the Photographic Reproduction of the Horse's Gait:

The documents which we published on this subject in one of our recent installments (No. 289, 14 December, 1878, p. 23) have been appreciated by a large number of our readers. Many readers have requested samples of Mr. Muybridge's photographs from the address which we published on page 23, column 2 [given in Muybridge letter below]. We forwarded the following letter to Mr. Muybridge received by us from Mr. Marey, of the Institute, and we hope that the skilled physicist from San Francisco will respond completely to the interesting questions which are put to him by our learned correspondant.

Marey to Tissandier, 18 December 1878

Dear Friend,

I am impressed with Mr. Muybridge's photographs published in the issue before last of *La Nature*. Could you put me in touch with the author? I would like his assistance in the solution of certain problems of physiology too difficult to resolve by other methods. For instance, on the question of birds in flight, I have devised a gun-like kind of photography [*"fusil photographique"*] for seizing the bird in an attitude, or better, in a series of attitudes which impart the successive phases of the wing's movement.*Cailletet*[9] told me he had tried something analogous in the past with encouraging results. It would clearly be an easy experiment for Mr. Muybridge. Then what beautiful zoetropes he could make. One could see all imaginable animals during their true movements; it would be animated zoology. So far as artists are concerned, it would create revolution for them, since one could furnish them with true attitudes of movement; positions of the body during unstable balances in which a model would find it impossible to pose.

As you see, my dear friend, my enthusiasm is overflowing; please respond quickly. I'm behind you all the way.
J. Marey

Muybridge to Tissandier, 17 February 1879 (from La Nature, *No. 303, 22 March 1879)*

Dear Sir,

I read with keen interest Professor Marey's letter to you (see La Nature, No. 291, 28 December 1878 p. 54) in reference to my photographs depicting the movements of the horse (see La Nature, 14 December 1878 No. 289, p. 23) which you honored me by reproducing in your prestigious journal. Your laudatory remarks about them gave me great pleasure. Would you be so kind as to communicate the assurance of my high esteem to Professor Marey and tell him that his celebrated work on animal movement first inspired Governor Stanford with the idea of the possibility of resolving the problem of locomotion with the help of photography.[10] Mr. Stanford consulted me about this and, at his request, I resolved to assist him in his task. He charged me with following a series of more complete experiments. For this purpose we constructed 30 dark rooms with electric shutters which, in order to photograph horses, would be placed approximately 12 inches from one another. We began our experiments the next May [1878] and we intended to fix all the imaginable postures of athletes, horses, oxen, dogs and other animals in movement. In the beginning we didn't study birds in flight but Professor Marey, having suggested this idea to us, also [directed our experiments towards this.] Consequently, we modified our automatic arrangements and we made our successive attempts at intervals of regular time by means of a clock which we had constructed for this purpose.[11]

I am afraid of encountering many more difficulties in obtaining satisfactory results with birds in flight than with other animals, but we will set about it as best we can.

I would be very grateful to all breeders of racehorses in France or England if they could confirm our experiments by conducting other experiments. My agent, Mr. Brandon, Rue Laffitte, No. 1, in Paris, would be pleased to furnish them with all the necessary information about construction and handling of the equipment. Without a doubt our method would be improved considerably if scholars as distinguished as Mr. Marey would lend their attention to it.

I am sending Mr. Brandon, by this post, two collections of all the photographs made to this date on the subject in question; it would please me if you would accept one and I would be obliged to you if you would persuade Mr. Marey to accept the other with my compliments.

Your devoted, Muybridge

D. Fairman Rogers Comments 1879

The following article by Fairman Rogers, horseman, wealthy patron of the arts and Director of the Philadelphia Academy, appeared in The Art Interchange, *9 July 1879. (Kingston Scrapbook, p. 55)*

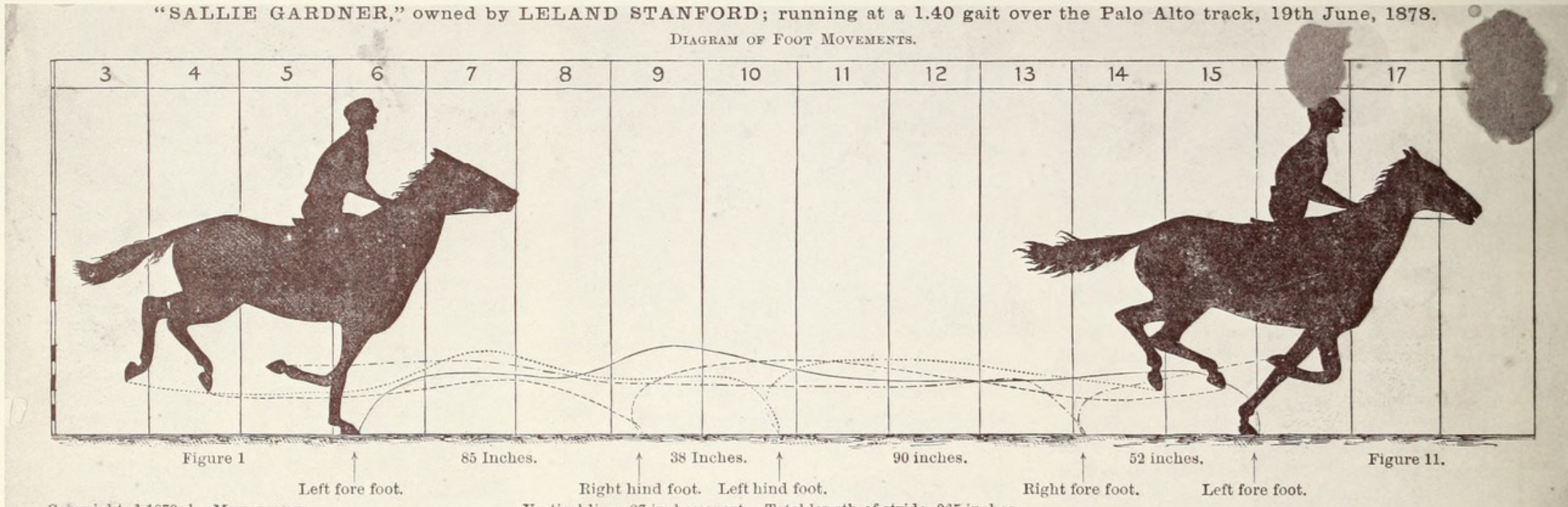
THE ZOOTROPE. Action of Animals in Motion——The Muybridge Photographs of Horses——The Instrument as a Factor in Art Studies.

When Mr. Edward Muybridge, of San Francisco, assisted by Governor Stanford, made in the spring of 1878, his first photographs of the horse in motion, it became evident to those who had been previously engaged in studying the subject of the locomotion of animals that they had never before had any such material for their investigations as that which he then presented.

His process, briefly, consists in having a number of photographic cameras on a proper support near the level of the ground, at equal distances, say twenty-seven inches apart. Opposite to the cameras and parallel to the line in which they stand, is a white screen or fence with vertical lines also twenty-seven inches apart, drawn on its surface, one directly opposite to each camera. A wire, with proper electrical connections, leads from each line to the corresponding camera. The animal whose motion is to be photographed, is driven or ridden on a line parallel to the screen in front of the cameras, and as he crosses each wire, the slide of the camera corresponding to that wire is opened, and a photograph of the animal in that position is obtained. In the experiments on a horse at racing speed, for example, the animal covers about twenty-two feet in each stride, ten cameras, therefore, twenty-seven inches apart, would record ten different portions of one stride or step. The photographs thus produced show the successive positions, the transitions from one to the other of which are altogether too rapid to be appreciated by the eye.

A number of investigators have attempted to analyse the action of man and of animals in the various gaits. The Weber brothers, as to man,[12] and Wachter, Raabe, Marey, and Lenoble de Teil, for horses. In fact, nearly all the writers on horsemanship have attempted to analyse the action of the horse, but with indifferent success. Marey's method was the most complete, but when his results are examined by the light of Muybridge's photographs, they are found to be quite unsatisfactory.

Shortly after the appearance of the photographs, Mr. Thomas Eakins of Philadelphia, Instructor in the Pennsylvania Academy of the Fine Arts, who had long been studying the horse from an artistic point of view, and whose accurate anatomical knowledge fitted him especially for the investigation, took them up for examination. Wachter, in 1862, had published a set of ten drawings illustrating the gallop, the most complicated of the gaits, which he arranged to be used in what was then called the phenakisticope [sic], an instrument which we now know in its improved American form under the name of Zootrope,[13] and his analysis was so nearly correct that the horse galloped quite satisfactorily when looked at in the



The above diagram is projected from a series of electro-photographs, executed by instructions of Governor Stanford, and illustrates the course traversed by the feet of the mare Sallie Gardner, during a single complete stride.

The mare being thorough bred, one of the fastest runners on the coast, and noted for her graceful form and superb gait, the successive positions assumed by her during the stride, may be accepted as representative in their character.

During certain portions of this stride, the feet of the mare were moving with a velocity equivalent to more than 100 lineal feet in a second of time, or nearly three-fourths of an inch, during an exposure of the two-thousandth part of a second. To enhance the usefulness of the photographs, the indistinctness of their outline resulting from this rapid motion, has been corrected, with care to preserve their actual positions. Photographs from the original untouched negatives are curious for comparison, and can be obtained at the same rate, if required. Hereafter the exposures will be reduced to the five thousandth part of a second, thus limiting any movement to one-fouth of an inch.

In future experiments it will be interesting to observe, to what extent, a knowledge of the foot movements of a colt, as illustrated by electro-photography, can be availed of to determine his probable speed at a more advanced age.

Thomas Eakins (?), diagrammatic analysis of the stride

apparatus. His ingenious drawings hardly received the notice which they merited, and he seems to have been extremely modest in his own appreciation of their value. The writer, familiar with the work which had been done in this direction, saw immediately that the zootrope would be a useful instrument in enabling the experimenter to determine whether the photographic analysis was correct, and constructed a large metal zootrope, with various appliances, for making it a scientific instrument. The idea was of course a very natural one, and had already occurred to Gov. Stanford and Mr. Muybridge, who had independently done the same thing.[14] The photographs themselves are not exactly adapted for immediate use in the zootrope. They are too small, and most of them show no interior modeling, but are mere silhouettes, in which the near and off legs cannot be readily distinguished from each other. In some of them, the running horse, for example, the intervals are not equal, owing to a pecularity of the photographic apparatus, an explanation of which would be too long for the limits of this article, in others the twenty-seven inches is not an aliquot part of the length of a whole stride. To obtain a perfectly satisfactory result, drawings must be made based upon the information given by the photographs.

To do this, Mr. Eakins plotted carefully, with due attention to all the conditions of the problem, the successive positions of the photographs and constructed, most ingeniously, the trajectories, or paths, of a number of points of the animal, such as each foot, the elbow, hock, centre of gravity, cantle of the sadlle, point of cap of the rider, & c. Having these paths, and marking the beginning of the stride and the exact point at the other end of the diagram where the beginning of the next stride occurs, the whole stride can be divided into an exactly equal number of parts; twelve has been selected as a convenient number, and the exact position of each point of the body determined for each of the twelve positions.[15]

Although [sic] familiarity with the anatomical construction of the animal enables the artist thus to draw each of the twelve positions or attitudes, and when the figures thus made are put into the zootrope, a perfect representation of the

motion is obtained. By varying the number of the slots, through which the drawings are seen, the animal can be made to move forward or to remain in one place, as he would appear if the spectator were to ride or drive alongside of him at the same rate of speed. The relation of the action to the distance passed over in each stride can be regulated with accuracy. The motion is exceedingly smooth, and such things as the waving of the tail or the mane are shown in the most natural manner. It is of course possible to reduce to the slowest speed, for the purpose of study, the action of the horse at his top speed, which is so rapid that the eye fails to catch the details of it in nature.

An addition to the zootrope is now being made by which, at the moment at which each foot appears to the eye to strike the ground, a sharp tap of a small hammer will be made by the instrument, and the cadence of the step will be made manifest to the ear, and will aid materially in the study of the motion.[16]

It is obvious that while the photographs and the drawings made from them are the analysis of the motion, the combination of them in the zootrope is the synthesis, and is a complete test of the accuracy of the analysis. Mr. Muybridge intends to continue his experiments, and will accumulate a mass of information which will be of the utmost value. At the suggestion of Mr. Marey, whose investigations in the same line, with entirely different means, have been very important, he will probably make corresponding photographs of the flight of birds.

The value of these investigations to the artist is very great. It is certain that nearly all the attempts to represent the gaits of either animals or men, in painting, are extremely unsatisfactory, and it is only by thoroughly understanding the mechanism of the motion, that the artist will be able to portray it in any satisfactory manner. A glance at the Muybridge photographs of the running horse shows that the postion of the legs, which is usually accepted as representing a full run, as drawn by the best painters of horse subjects, is not only incomplete, but absolutely incorrect, and must be universally so recognized as soon as correct information is obtained by those who criticize such works. There are many interesting speculations as to how this new information may be utilized by the painter, for which we have not space at present, but Mr. Muybridge deserves the thanks of all artists for the valuable addition that he has made to the general fund of knowledge.

E. Muybridge: "Leland Stanford's Gift. . ."

From documents now in the Collis P. Huntington Collection of the George Arents Research Library, Syracuse University, we learn that Muybridge was the author of an article on the history of the Stanford/Muybridge experiments which appeared in the San Francisco Examiner, *Sunday, 6 February 1881. According to the deposition of Frank Shay, then 27, private secretary to Leland Stanford from April 1878 until June 1882, Muybridge brought the manuscript of the article, in his own handwriting to him, and Shay made "a few verbal changes," but the article as published was "substantially" that which he had seen in manuscript. (Deposition of Frank Shay, in* Stanford vs. Muybridge, *San Francisco, 27 July 1883, pp. 38-39.) Dr. Stillman, then 65, in his deposition, compares the printed article to one brought to him by Muybridge in response to his request for a history of the experiments—one which he found "ungrammatical, redundant, full of hyperbole, which would make the whole thing ridiculous just like that newspaper article published in the* Examiner; *just the same kind of stuff." Instead of publishing Muybridge's article as an introduction to his* The Horse in Motion, *as had evidently initially been suggested, Stillman relegated it to the appendix of the book, and at that used it only as a "technical" text for his own version of it. (Deposition of J.D.B. Stillman, in* Stanford vs. Muybridge, *7 August 1883, pp. 6-11.) Muybridge's history of the experiments at Palo Alto is printed below as given, without correction of the spellings, in the* Examiner *for 6 February 1881. The article was read into the court records as "Defendant's Exhibit H," and was always wrongly dated in these records as being published on 6 February 1880.*

SAN FRANCISCO ART

Leland Stanford's Gift to Art and to Science
Mr. Muybridge's Inventions of Instant Photography and the Marvelous Zoögyroscope

The results of Mr. Muybridge's years of efforts to perfectly photograph animals of all kinds, man included, while in continuous and in the most rapid motion, may now be said to be fully and most satisfactorily complete, as is also his zoogyroscope—his marvelous invention for putting his pictures again in motion, and an invention which was evolved by the necessities of the result he had determined to achieve and has achieved. Mr. Muybridge came to California in 1855, and most of the time since and all of the time since 1860 he has been diligently, and at the same time studiously, engaged in photography. For several years after 1860 Mr. Muybridge made a specialty of landscape photography, and it is through his innumerable photographs, both in large pictures and in stereoscopic sets, that a realizing sense of the wonders of California scenery has been effected abroad. Mr. Muybridge's acknowledged precedence in this department of the art caused his appointment as the official photographer of the United States Government, and as

such he visited all parts of the Pacific coast line, photographing the light-houses along it from San Diego to Cape Flattery, and incidentally photographing also all the intervening coast scenery. Also as such Government photographer Mr. Muybridge was dispatched to the front during the Modoc war, and the wide spread and accurate knowledge of the topography of the memorable Lava Beds and the country round-about, and of the personnel of the few Indians who, with the bravery at least of the classic three hundred, defied and fought the army of the Union, is due chiefly to the innumerable and

VALUABLE PHOTOGRAPHS

Taken by him. In fact, in a swiftly progressive art each day making such rapid strides onward, and each stride more startling than the original discovery of the process that it was good work for the average photographer to keep even abreast of his art, Mr. Muybridge had obtained such undisputed pre-eminence that it was to him that Mr. Stanford appealed in June, 1872, when the latter had finally determined to essay a very remarkable discovery. Mr. Stanford had never been technically a painter, but he had always been one of those for whom technical painters paint—one of those to whom the artist whether in delineative or in word, painting merely gives back his own unconscious sentiments. He was also always a lover of horses as well as of pictures. When Mr. Stanford had been in the eternal fitness of things rewarded with fabulous wealth for the splendid and romantic daring that had built a railroad across deserts, then almost untracked, across two of the mighty mountain ranges of the world, across a lonely land that echoed only to the dull thunder of the tramp of the buffalo herds or the crack of the trackman's rifle repelling the attack of the savage red man—a railroad that forever united the civilized world with its dauntless vanguard on the Pacific slope and that put San Francisco on the beaten highway of the nations—then Mr. Stanford was enabled to gratify both his love of art and horses. Of this has come a result probably more important to art than any other of the century. Mr. Stanford purchased many fast horses; he purchased many valuable pictures; he bought the most elaborated works of the

MOST APPROVED
MODERN SCIENTISTS

Authoritatively analyzing, among other things, the motion of animals; and he became the generous patron and the valued friend of the eminent artists, not alone of his own State and nation, but of Europe. The first, and perhaps curious result of alternately watching the speeding of his flyers of the turf and of reading works descriptive of the paces of the horse and looking upon pictures of the horse at speed, was that he concluded there was a diametric difference of opinion as to such movements between the horse himself and the horse's delineators of either science or art. And he took sides with the horse. Assuming that Mr. Stanford adopted the correct opinion, that opinion might be determined to be only an attestation of the exceptional keeness of Mr. Stanford's eyesight. But when it is remembered that for thousands of years no eye had been sufficiently keen to detect the true movements of the horse in action; when it is remembered that from the first known representation of the horse in motion, and found in the mural decorations of the Egypt of the past, down to the last approved picture of the same, and which is that of "The Derby" by Herring, admitted to be almost the peer of Landseer, all artists had represented the horse at speed as stretched out in the air like a kite or a flying squirrel; it will be admitted that the unaided eye-sight which could detect the error as old as the world itself, was itself a valuable possession. But when Mr. Stanford, in the course of his readings, came at page 161 in the recent and valuable work of Professor Marey, the great French savant, to the statement that "in the natural walking pace there are never more than two feet on the ground at a time," he would stand it no longer.[17] This was in 1872, at which time Mr. Stanford was a resident of Sacramento.[18] He immediately telegraphed to Mr. Muybridge requesting the latter to visit him. This Mr. Muybridge did, when Mr. Stanford startled the photographer by stating that what Mr. Stanford desired was

A PHOTOGRAPH OF
HIS HORSE, OCCIDENT

And taken while the horse was at full speed. No wonder even the skilled Government photographer was startled, for at that date the only attempts that had ever been made to photograph objects in motion had been made only in London and in Paris, only by the most conspicuous masters of the art, and only of the most practicable street scenes. And even in these scenes in which the photograph of no objects moving faster than the ordinary walk of a man had been attempted, and in which the legs had not been essayed at all, the objects were taken as they moved towards the camera, in which action, owing to the laws of perspective, the continuous change of place was less noticeable. Occident was then admittedly the fastest trotter in the whole world, having recorded a mile in 2:16 3/4, which was faster one than even the skipping Goldsmith Maid had done. And the picture was required to be taken, not as the flyer should bear down on the camera, but as his driver should shoot him at fullest speed past the lens[19] Mr. Muybridge therefore plainly told Mr. Stanford that such a thing had never been heard of; that photography had not yet arrived at any such wonderful perfection as would enable it to depict a trotting horse at speed. The firm, quiet man who had, over mountains and deserts and through the malignant jeers of the world, built the railroad declared impossible, simply said: "I think, if you give your attention to the subject, you will be able to do it, and I want you to try." So the photographer had nothing to do but "try." He thought over the matter, skillfully made all the then known combinations of chemistry and optics for

taking an instant picture, made the trial, and succeeded in getting the first shadowy and indistinct picture of Occident at a trot.

THE PICTURE

Was extremely unsatisfactory to the artist and he was therefore surprised when upon its exhibition to Mr. Stanford, and after that gentleman had long and intently scrutinized the foggy outlines of the legs, Mr. Stanford expressed unbounded satisfaction with it. No wonder. To him the hazy outlines were the sun's written confirmation of his theory that from the time of the first graven image to that of Rosa Bonheur there had never been the true representation of an animal in motion. With the picture itself, merely as a picture, Mr. Stanford was no more satisfied than was the artist, and the latter having agreed that he would concentrate his thoughts upon the evolution of some way in which photographs might be more rapidly taken, he went away. In July, 1877, Mr. Muybridge again went to Sacramento and there took another photograph of Occident at full speed on the Agricultural Park Track. That picture was a success that satisfied not only Mr. Stanford but Mr. Muybridge also. But it satisfied no person else. No picture that had ever been produced by any process had called up so instant

A STORM OF DERISION

And opprobrium.[20] Scientists ridiculed it, anatomists scoffed at it and old turfmen jeered at it and aggressively maintained the impossibility of a horse ever getting itself into the position represented. But the self-sustained Mr. Stanford had gone unscathed through a more malignant tempest of jeers than that, and had brought the scoffers to shame at last. Mr. Stanford looked at the picture. "That is nature," he said. "I am convinced; now I will convince others." The picture was a single one, taken with a single camera, and, necessarily, the horse was represented in only that one atom of time in which he was huried past the lens. It was an impossibility to devise any way in which a horse going at full speed should at one certain instant and at one prescribed point be in any predetermined part of his stride. But at Mr. Stanford's suggestion Mr. Muybridge at once went to Mr. Stanford's country residence at Palo Alto, and there arranged twelve cameras to take that many photographs of a horse passing at full speed over the private track of the Palo Alto estate. The twelve cameras were arranged in a line and so immediately succeeding each other as to take twelve different views of the horse while passing all twelve of the cameras at a single stride of his gait. Oft-repeated and painstaking experiments were made with walking, with trotting, with cantering and with running horses. Any one picture of any one of these series of twelve each of pictures was notably more perfect than the single picture obtained at Sacramento. These pictures were published, and instantly found their way all over the known world. Everywhere they created

THE PROFOUNDEST ASTONISHMENT,

The least of such astonishment being created here, where Mr. Stanford, Mr. Muybridge and the horses were known, for there is some inexplicable and invarable rule concealed in the oft-quoted text of the Scriptures that "a prophet is not without honor save in his own country and among his own kindred." The pictures created something like consternation among the learned, the scientific, and the artistic societies of Europe. Copies of the series were published in the best illustrated papers of both America and Europe, including the *Scientific American* and the leading pictorials of Berlin, of Paris, of Vienna, and of London. The inestimable value of the revelations made by Mr. Muybridge's photographs was commented on at length in the London *Times*, the *Illustrated London News*, *Le Nature* of Paris, and other journals. Professor Marey, member of the French Academy, and author of the great work on Animal Mechanism, with the description of which of the walk of a horse, Mr. Stanford had taken issue, was not content with publishing in *Le Nature* the radical revolutions of his own views of animal mechanism effected by a view of these pictures, but he wrote Mr. Muybridge a letter couched in almost extravagant terms of compliment as to the value of the developments made by the process. As an instance of how far this astonishment at the new revelations extended, it may be stated that among the many letters from eminent men in all parts of the world, and received by Mr. Muybridge, was one written in very choice Siamese by His Most Gracious Majesty the King of Siam, and that Mr. Muybridge might have the pleasure of knowing what the King had said in his letter, the latter had very thoughtfully had

THE AMERICAN CONSUL
AT BANGKOK

Inclose under cover with the letter a translation of it into English. The King of Siam is himself, although an amateur photographer, still a skilled one, and his unstinted commendations were those of an expert as well as of a King. In front of windows of bookstores in London, in Paris and in New York, and in which the prints of the series were exposed, crowds would congregate to comment on the curious spectacle which had given to an animal so well known an absolutely new signification. A lady well known as a leader of San Francisco society was one day walking along Broadway, and was stopped by an eager crowd in front of a window near the Metropolitan Hotel. Her own curiosity being aroused, she commissioned her escort to push his way to a view of what attracted so much attention. He returned to her considerably rumpled and compressed and reported, "It's that queer picture of a horse taken by that iconoclastic photographer of your own city, and whose malign art has torn into tatters ten thousand prized paintings of horses that had hitherto been confidently supposed to be either trotting or galloping, but which this ruthless gentleman has

proved to be either swimming or flying." Mr. Stanford himself was in Paris shortly after the publishing of the photographs, and was in the studio of his friend, the great artist Meissonier, who had himself seen the prints. "Sketch me here a horse trotting," said Mr. Stanford. Meissonier smiled, stepped to his easel, and with a few dextrous touches sketched a horse trotting, as all good artists have insisted upon his trotting, since the world began.

THE ARTIST STEPPED BACK

And both he and Mr. Stanford for a moment contemplated the work. "Now," said Mr. Stanford, "make me a sketch of that same horse in that same stride when he shall have progressed twelve inches farther on." The artist looked at Mr. Stanford, stepped slowly and thoughtfully to the easel and with some hesitation made a second sketch. He stepped back, looked at it, rubbed it out, made another, stepped back and looked at that. Three times he repeated this operation. Then rubbing out the lines of the last essay he turned to Mr. Stanford and said simply, "I can't do it." And yet Meissonier many years ago drew the picture of a horse that would have irretrievably damned any other artist than himself and for which he was jeered by the critics without mercy. Meissonier maintained the position was correct and in 1877 California sent to Paris the certificate of the sun that Meissonier had been correct, for one picture of the series[21] represents a horse in very nearly the attitude represented by the greatest living painter. But as Mr. Stanford had been the only one to express satisfaction with the initial picture of 1872, so he was now the one, when everybody else said "success," to exact success far more complete. Therefore, he gave Mr. Muybridge *carte blanche*, with instruction to provide himself with entirely new electric and photographic apparatus the most perfect that could be made in the world, and arrange the Palo Alto track for the taking of a new and more perfect series of pictures. Mr. Muybridge then had new lenses made by the celebrated optician Dallemeyer of London. One hundred feet of the race track

AT PALO ALTO

And in front of the camera was covered with India rubber. On one side of this track a commodious shed was erected for no less than twenty-four cameras. Opposite the shed, on the other side of the track, was erected a background, fifteen feet high, of white canvas, and which slanted away from the track at an angle of thirty degrees. In the shed, back of the camera, was a powerful electric battery. The twenty-four cameras were arranged in line, and in front of the lens of each was secured a stout, wooden shutter about twelve inches square, with slides secured in place by a spring, the release of which would cause them to be snapped past each other by powerful India-rubber bands. On the farther side of the surface of the track was secured two lines of wooden rails an inch in height and eighteen inches apart, and across these rails and twelve inches apart were stretched wires. Between these rails the driver steered a wheel of the sulky, and as the wheel passed over each wire an electric circle was completed which tripped the spring in the lens shutter, its slides were shot past each other, and in passing each other they exposed for a very razor-edge of time the photographic plate to the action of the intense light, and in that hairbreadth of time the photograph was secured forever. Instead of the wires, and in the case of ridden horses, the electric currents were completed by the contact of the breast of the passing horse with threads of silk, which had been stretched taut across the track at the proper height from the grounds and distances from each other. In what an inconceivable atom of time any one picture of this new series of twenty-four to the stride of a racehorse at his fullest speed was taken is a matter of calculation. The running

ONE-MILE RACEHORSE,

Which when photographed, was going at the rate of one mile in 1:40. This is at the rate of fifty-two feet per second. But this is the rate of the aggregate body and limbs of the horse. The feet, considered separately, travel not only as fast as the body of the horse, but are likewise alternately thrown forwards and backwards, and the result of a series of careful calculations is that the foot of the racehorse, during certain parts of the stride, travels more than two and a half times as fast as the body, or that the foot of the horse in this instance, during such times, was going at the rate of 130 feet in a second at the time the picture was taken. All thoroughly-studied and experienced photographers can tell by the scrutiny of any photograph what change of position was made by the object photographed during the time of such photography. A comparison of the opinions passed upon the picture of "Sallie Gardiner" shows that her foot was photographed while it was moving only one-quarter of an inch. As 130 feet is to one-quarter of an inch, so is one second to the time in which the photograph was taken. This was the inconceivable portion of time that is less than the six thousandth part of a second. A recent reprint, in a San Francisco paper, of the achievement of a New York photographer who had secured a photograph in the one hundredth part of a second, must have been published as a mock compliment to an artist progressing backwards at such fearful strides. Artists abandon the legendary position of the horse only slowly. One reason is the difficulty Meissonier himself experienced of reasoning from one position of a horse known to be correct, to his position a second later, or seen from any other point. Mr. Muybridge, once in the studio of Mr. Perry watched with interest the artist endeavoring to outline the picture of

A CALIFORNIA COACH AND FOUR[22]

He had Mr. Muybridge's pictures as a guide. But these were broad side views, and he wanted a quartering view. Mr. Muybridge hastened back to Palo Alto, arranged five cameras in a semi-circle and concentrating

upon one point, galloped a horse over the point where the electric current was completed and produced a perfect picture of a horse at fullest speed, as seen from five different points of view all at the same instant of time and while, of course, the horse was in one and the same position.[23] Now an artist with these pictures as guides can draw a horse in any position desired. Mr. Stanford was now just half satisfied. He had the picture of animals going at the rate of a mile in 1:40 and at any six thousandth part of a second of the gait that he might select to view them at. Now he bade the artist to put the pictures themselves in motion. Again the artist urged that science had found no way of doing such a thing. It was of no avail, and for two years and a half the railroad builder and the photographer toiled with a child's toy—the zootrope—as the initial point, and finally emerged with the zoögyroscope, signifying generally animals in motion.[24] A disc of zinc about eighteen inches in diameter has slots radiating around its outer verge. On the outer verge of a similarly-sized disc of glass are the silhouettes of any one series of the photographs.[25] The discs are placed on the pivot of a delicately-constructed machine, which revolves them in opposite directions. A very perfect magic lantern, constructed for the purpose, casts the pictures the size of life on a prepared screen and across which the horses walk or trot, canter or gallop, even as they do in life. This device may be said to be already perfect. By it wisdom was at last justified of her children. There across the canvas trots or gallops forever

THE THOROUGHBRED RACER

Even as in life he is seen on the fiercely contested track. Into the surprising attitudes of the horse in the photographs is at last breathed the breath of life, and the scoffs and the jeers do not cease, indeed, but they have found other victims, and the bas reliefs of the Egyptians and the "spirited picture" of the Derby by Herring; even the lauded canvases of Rosa Bonheur are found to have no more truth to nature and consequently no more real artistic value than if they had all been representations of the mythical Unicorn. The exactness with which the motion is reproduced may be inferred by the following: When Mr. Muybridge had achieved success with the zoogyroscope he had one series of photographs done in silhouette on the outer rim of one glass disc, and with the apparatus hastened to Palo Alto to show the result to Mr. Stanford. Across the great screen again and again galloped at full speed a delicate-limbed race mare. Mr. Stanford looked at it. "That is Phryne Lewis," said Mr. Muybridge. "You are mistaken," said Mr. Stanford; "I know the gait too well. That is Florence Anderson." The artist was certain it was Phryne Lewis. Mr. Stanford was equally certain it was Florence Anderson, and it was only after investigation and the discovery that by a misunderstanding it was the pictures of Florence Anderson that had been done in silhouette that the artist was convinced of his error. The series of pictures taken are perfect and numerous, and include those of athletes running, wrestling and turning somersaults, as well as of

A HORSE'S COMPLETE SKELETON

Imported from New York and carefully photographed in each of the positions of a horse in trotting.[26] The zoogryoscope is complete in every detail. The three magic lanterns are the most perfect that can be made. The series of discs already prepared are thirty, and include representations of all kinds of motions of horses, horned cattle and men. In Europe, far more than even in America, the desire of the artists and the scientific to see these illustrations is intense. Under these circumstances, the rumor that Mr. Stanford and Mr. Muybridge will some time in the near future take the pictures to Europe, there to exhibit them in acceptance of urgent entreaties so to do, appears to have a probability of truth. The inestimable value of the joint labors of Mr. Stanford and Mr. Muybridge to the scientist in the demonstration of animal movements and their still greater value to artists in elevating the portraiture of life in motion into an entirely new plane, sustains the hope that the completed works will soon be put on exhibition. The circumstances must have been exceptionally felicitous that made co-laborateurs of the man that no practical impediment could balk, and of the artist who, to keep pace with the demands of the railroad builder hurried his art to a marvel of perfection that it is fair to believe it would not else have reached in another century.

F: Stanford vs. Muybridge

Muybridge to Frank Shay, Paris, 28 November 1881 ("Address American Exchange, 449 Strand, London")

Dear Mr. Shay.

You have probably been informed at the time of writing this, that the Governor and Mrs. Stanford left Paris on Saturday,[27] with the intention of sailing from Liverpool 1st Decr. I saw them off on the cars, and much regret the state of the Govs. health left so much to be desired; however, for the last week he has been rapidly improving, and we have every hope he will have a comfortable voyage, and land in New York, if not entirely well, at least with every prospect of immediate restoration. His residence in Paris has been entirely devoid of pleasure, both to himself and Mrs. Stanford, but if the C.P. and S.P. can spare him, I believe he proposes to return next spring; by that time I shall hope to be in full operation, experimenting with new subjects, that will practically exhaust the scope of the investigations. Whether these will take place in France or England is yet in the hidden arcana of the future.

I have happily obtained a recognition among the artists and scientists of Paris which is extremely gratifying, and were honor all that I am seeking, I need have no apprehension. I sent you a paper with an account of my reception at an entertainment at the residence of Professor Marey, who occupies the chair of natural history at the "Institut;" with this I forward a notice of a reception at the residence of Meissonier to whom the Gov. paid $10,000 for a portrait of size about 10 x 12 inches.[28] Many of the most eminent men in art and science and letters in Europe were present at the exhibition; and men like Dumas, Gerome and Millet requested the pleasure of an introduction to me. Happily I have strong nerves, or I should have blushed with the lavishness of their praises. You will probably read some other notices which will be copied from other French and English papers.

I am not unmindful of your promise to do me any little favor. I might during my absence ask of you, and I will now ask you to devote about a half hour of your valuable time.

I shall shortly visit England for the purpose of inducing some wealthy gentlemen (to whom I have letters of introduction) to provide the necessary funds for pursuing and indeed *completing* the investigations of animal motion; and in framing an estimate of the probable cost, can have no better basis than the cost of the work already accomplished.

Will you therefore at *your very earliest convenience* favor me with the total amount of money paid to me, or on my account; segregated if convenient under the following headings.

1. Cash paid for apparatus and material which will include amts. paid me by you when the Gov. was sick.

2. Cash paid to Muybridge for personal use *not including* the $2000 the Gov. gave me.

3. Cash paid for wages of assistants.

4. Estimated cost of buildings and making the track at Palo Alto.

This will be valuable to me for laying before these gentlemen the actual cost of work already done and I have no doubt you will be kind enough to furnish me with the particulars. I am writing this with the pen you gave me, I think the slight irregularities you may observe, may be attributed to the "Mackinnon ink" which is falsely stated to "flow freely."

I have not written to Gov. S. before, because I had accomplished nothing; I have been waiting the disposition of the Governor[29] since the 1st Octr.; not absolutely idle for I have been collecting materials for a work upon the attitudes of animals in motion as illustrated by the Assyrians, Egyptians, Romans, Greeks, and the great masters of modern times. Will you please kindly remember me to Mrs. Shay, Mr. Taine to whom please say I will take the earliest opportunity of writing. Mr. Lathrop; Capt. Smith; Mr. Severann, and others too numerous to mention.

Yours Faithfully, Muybridge
Please don't delay sending statement.

Muybridge to Frank Shay, Paris, 23 December 1881 ("Hotel de l'lle de France, 26 Rue St. Augustin")[30]

Dear Mr. Shay:

On the 28 Nov last I wrote requesting the favor of your furnishing me with a statement arranged under the separate heading of "Wages to operatives," "Advances to me personally," and "Material" of the cost of the experiments at Palo Alto.

This statement I wished to place before some gentlemen, in my application to them for providing the means for another series of investigations into the attitudes of animals in motion. With that courtesy which you have invariably exhibited in your intercourse with me I have no doubt you have furnished me with all the particulars.

I suggested addressing your reply to London, but since then some very important events have transpired which will render an extended residence in Paris necessary; and at the same time relieve me of the anxiety under which, as you well know, I have for a long time been existing.

Some time ago I [presented] you a paper with an account of my reception among the scientists at the residence of Professor Marey; and later one with an account of an exhibition at the studio of M. Meissonier.

M. Meissonier exhibits the greatest interest in the work, and through his commanding influence I have obtained a recognition here which is extremely gratifying and advantageous.

Notwithstanding the large prices obtained for his pictures, unfortunately M. Meissonier is far from rich; but his influence with wealthy people is immense; and one of his friends has expressed a desire to associate himself with M. Meissonier, Professor Marey and myself in the instituting of a new series of investigations which I intend shall throw all those executed at Palo Alto altogether in the shade. I have been experimenting a great deal and have no doubt of its successful accomplishment.

You know that upon the completion of the work at Palo Alto, after so embarrassing [six] a time,[31] I hoped to be in a position to devote my attention to the development of the ideas which have created so great a sensation, and been received with so much warmth in Paris. This was my intention; and I am happy to say, thanks to the friendship of M. Meissonier there is now an opportunity of its realization.

Using the photographs I propose to make next year as his text, M. Meissonier intends to edit and publish a book upon the attitudes of animals in motion as illustrated by both ancient and modern artists. He proposes it shall be a most elaborate work, and exhaustive of the subject. It is to be the joint production of Meissonier, Professor Marey, "the

capitalist," and myself, and be a standard work on art which as Meissonier says will hand the names of all four of us down to posterity.

Both he and I considered it appropriate to invite the Governor to join us if he is so disposed, which we have done by letters, we shall be pleased to welcome him if he is inclined to come in, if he declines we will avail ourselves of the desire of M. Meissonier's friend.[32]

One of the conditions of the agreement is, that Meissonier is to have control of the results, and that I shall assign to him my present American and European copyrights and also those I make next season. In consideration of which I shall receive payment for the times I was working in connection with their production, and at my ordinary rate of payment for work in California, this will of course be quite a sum.[33] M. Meissonier himself is not actuated by any selfish motives, neither do I suppose is his friend (who the "friend" is I do not know) for he assures me he is very rich; but I really believe and so does M. Meissonier it will be an investment that will pay for itself, and very probably a profitable one.

I have had several other propositions made me, among others one from Goupil, the fine art publisher, and perhaps I might make more money if I treat with each country separately but I am desirous of being free from any financial management or operations, and devote my time unreservedly to work.

I hope your mine has turned out enough rich paying ore to satisfy the reasonable requirements of any moderate man, and that its results will enable you to retire from speculation, and seek enjoyment for a time in Europe; and if in the course of your travels you should next summer find yourself in Paris; make me a visit to my Electro-Photo studio in the Bois de Boulogne and I will give you a welcome. Respects of the kindest description to Mrs. Shay.

Yours Faithfully, Muybridge

Muybridge to J.D.B. Stillman, 7 March 1882 ("American Exchange, 449 Strand, London")

Dear Doctor:

When I last wrote you a few months ago, I offered to assist you in the production of the work on the theory of animal movements. I have become possessed of a great deal of information on the subject which I am willing to place at your disposal to work up for our joint benefit. It was contemplated at one time to make use of my photographs for illustration, but having heard nothing further in relation to it, and from conversation with Mr. Stanford last Fall I suppose the idea of making arrangements for pictorial illustration has been abandoned. In December last, Mr. Meissonier and I wrote to Mr. Stanford that we in association with Professor Marey contemplated the publication of a very elaborate illustrated work on the attitudes of animals in motion and the prosecution of new investigations into the subject one of the conditions being that Mr. Meissonier should acquire control of the copyrights. As I had all the time been under the impression Mr. Stanford would like to acquire the copyrights of the photographs, if not for Europe, at least for America, we deemed it the correct thing to write him to join us in preference to making other arrangements, but to neither of our letters have we been favored with a reply.

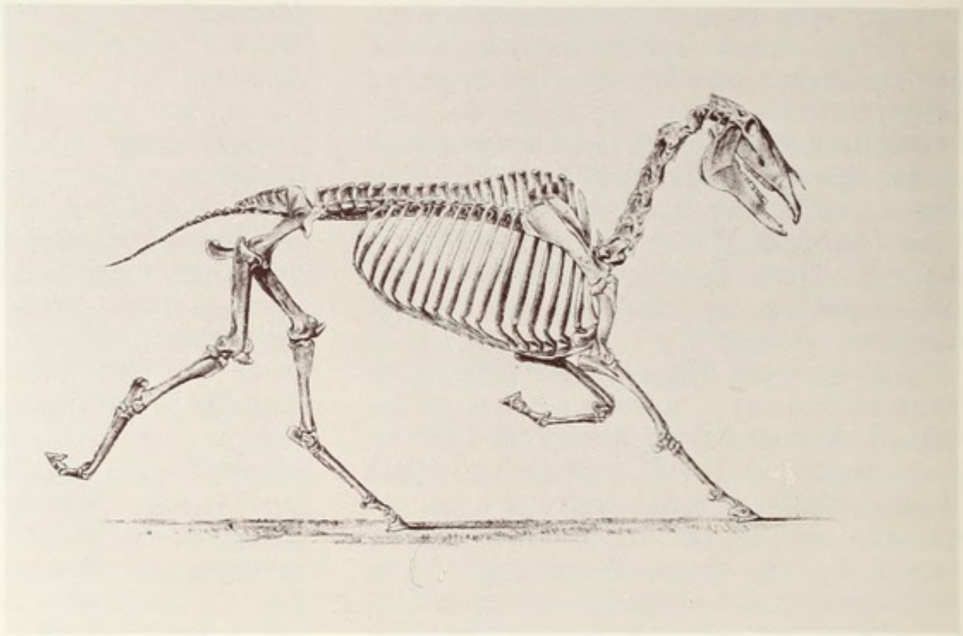
You are I suppose still writting [sic] away: you perhaps recollect what I originally told you about the time it would take; and, if you succeed in getting the work in the market before 1883 I shall consider you very fortunate. Who have you arranged with to publish it?

I am in England at the invitation of the Royal Institution. Drs. Tyndall, Huxley, Bowman, Carpenter, Crookes, and a number of other eminent men have taken a great interest in my photographs, and last evening we had a rehearsal in the lecture room of the institution preparatory to an exhibition before the members on Monday night when we shall have a very brilliant audience. Sir Fredk. Leighton, president of the Royal Academy was present last evening and after it was over he expressed himself anxious to arrange for an exhibition before the members of the Academy, and I meet a number of R.A.'s this evening at the house of Alma-Tadema to talk the matter over. I have had a very agreeable interview with Lord Roseberry and quite a number other distinguished and wealthy men. I anticipate no difficulty in pursuing the investigation on a large and more comprehensive scale than has yet been done and to an exhaustive conclusion, (and I think it probable my anxiety, and financial embarrassment, now of some years duration, is over). I suggested waiting the publication of any theories founded on my work, until this was done as I was anxious all criticism should await the completion of the new experiments. I am promised every facility for work in Paris, but whether I shall commence there or in England I have not yet fully determined. The Prince of Wales takes a great interest in the matter and I am promised an introduction to him on Monday. Hoping you are in your usual robust health, I am Yours Faithfully, Muybridge[34]

Stillman's Book Reaches London (from Nature, *20 April 1882)*[35]

We have received from Messrs. Trubner and Co. a handsome and richly illustrated quarto, "The Horse in Motion, as shown by Instantaneous Photography, with a Study in Animal Mechanics, founded on Anatomy and the Revelations of the Camera, in which is demonstrated the Theory of Quadrupedal Motion," by J.D.B. Stillman, A.M., M.D. The investigations are executed and published under the auspices of Mr. Leland Stanford, of Palo Alto Farm, California. We hope shortly to notice this work at some length, and meanwhile make the following extract from Mr. Leland Stanford's preface, which shows the exact part taken by each of those concerned in

the investigation:—"I have for a long time entertained the opinion that the accepted theory of the relative positions of the feet of horses in rapid motion was erroneous. I also believed that the camera could be utilized to demonstrate that fact, and, by instantaneous pictures, show the actual position of the limbs at each instant of the stride; under this conviction I employed Mr. Muybridge, a very skillful photographer, to institute a series of experiments to that end. . . . When these experiments were made, it was not contemplated to publish the results; the the facts revealed seemed so important, that I determined to have a careful analysis made of them. For this purpose it was necessary to review the whole subject of the locomotive machinery of the horse. I employed Dr. J.D.B. Stillman, whom I believed to be capable of the undertaking. The result has been, that much instructive information on the mechanism of the horse has been revealed, which is believed to be new, and of sufficient importance to be preserved and published."

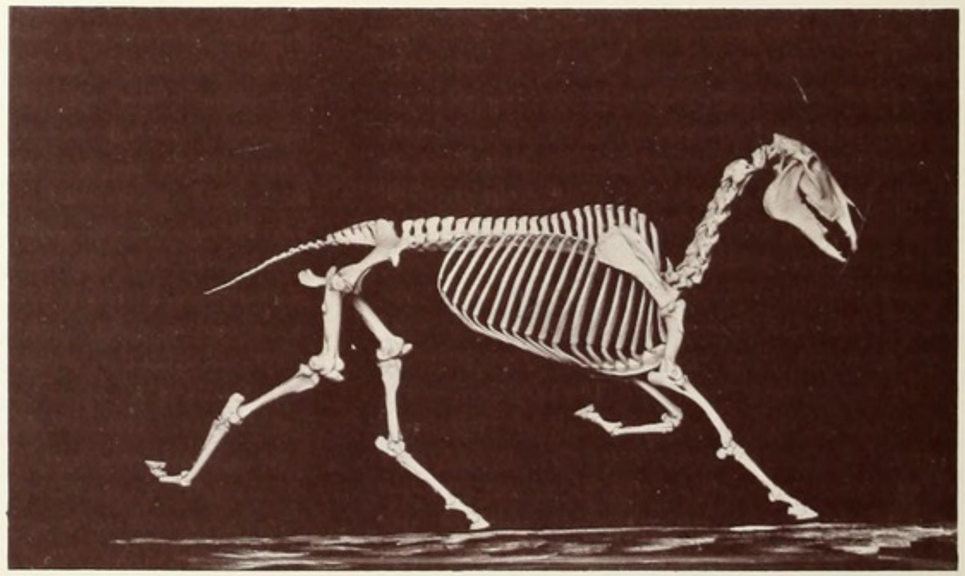


Lithograph from J.D.B. Stillman's *The Horse in Motion*

Muybridge Responds (Nature, *27 April 1882)*

In *Nature*, vol. xxv. p. 591, you notice the publication of a work entitled "The Horse in Motion," by Dr. Stillman, and remark: "the following extract from Mr. Stanford's preface shows the exact part taken by each of those concerned in the investigations." Will you permit me to say, if the subsequently quoted "extract" from Mr. Stanford's preface is suffered to pass uncontradicted, it will do me a great injustice and irreparable injury. At the suggestion of a gentlemen, now residing in San Francisco, Mr. Stanford asked me if it was possible to photograph a favourite horse of his at full speed. I invented the means employed, submitted the result to Mr. Stanford, and accomplished the work for his private gratification, without remuneration. I subsequently suggested, invented, and patented the more elaborate

Muybridge's original photograph,
from *Attitudes of Animals in Motion*



system of investigation, Mr. Stanford paying the actual necessary disbursements, *exclusive* of the value of my time, or my personal expenses. I patented the apparatus and copyrighted the resulting photographs for my own exclusive benefit. Upon the completion of the work Mr. Stanford presented me with the apparatus. Never having asked or received any payment for the photographs, other than as mentioned, I accepted this as a voluntary gift; the apparatus under my patents being worthless for use to any one but myself. These are the facts; and on the bases of these I am preparing to assert my rights.[36]
J. Muybridge [the E. is omitted]

Stanford's Preface to "The Horse in Motion"

I have for a long time entertained the opinion that the accepted theory of the relative positions of the feet of horses in rapid motion was erroneous. I also believed that the camera could be utilized to demonstrate that fact, and by instantaneous pictures show the actual position of the limbs at each instant of the stride. Under this conviction I employed Mr. Muybridge, a very skillful photographer, to institute a series of experiments to that end. Beginning with one, the number of cameras was afterwards increased to twenty-four, by which means as many views were taken of the progressive movements of the horse. The time occupied in taking each of these views is calculated to be not more than the five-thousandth part of a second. The method adopted is described in the Appendix to this volume.

When these experiments were made it was not contemplated to publish the results; but the facts revealed seemed so important that I determined to have a careful analysis made of them. For this purpose it was necessary to review the whole subject of the locomotive machinery of the horse. I employed Dr. J.D.B. Stillman, whom I believed to be capable of the undertaking. The result has been that much instructive information on the mechanism of the horse has been revealed, which is believed to be new and of sufficient importance to be preserved and published.

The Horse in Motion is the title chosen for the book; for the reason that it was the interest felt in the action of that animal that led to the experiments, the results of which are here published, though the interest wakened led to similar investigations on the paces and movements of other animals. It will be seen that the same law governs the movements of most other quadrupeds, and it must be determined by their anatomical structure.

The facts demonstrated cannot fail, it would seem, to modify the opinions generally entertained by many, and, as they become more generally known, to have their influence on art.
LELAND STANFORD
Palo Alto Farm, California, 1881

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Stanford to Stillman, 23 October 1882 ("Office of the Central Pacific Railroad, President's Department")

Dear Doctor:

I enclose you Osgood's report, and also a letter from Mr. Reid. Muybridge has commenced a suit by attachment in Boston, levying on all the books, and charging that I have, by the publication of the book, injured his professional reputation. He wants damages to the extent of $50,000 and claims that the idea of taking photographs of horses in motion originated with him, and not with me, and that I set up that claim in the book.

When I first spoke to Muybridge about the matter, he said it could not be done. I insisted, and he made his trials. He has often stated this to others, and I think there will be no difficulty in defeating his suit, and showing that his merit such as it is, was in carrying out my suggestions. You will probably remember his having said so to you, as he was in the habit of saying so often to others. I think it was completely set forth in the sketch that he gave at one time to put into the book as an appendix.[37] I think the fame we have given him has turned his head. I think of going East about the first of next month. If you have any suggestions to make in regard to the book or other matters please let me know and I will endeavor to attend to them promptly.
Hoping yourself and family are all well. I am with kind regards,
Your friend, Leland Stanford

G. Meissonier's New "1887"

From the New York Evening Post, *Saturday, 26 March 1887 (Kingston Scrapbook, p. 171)*

Sir: A cablegram from London, published in one of this morning's papers, announces the fact that Meissonier is painting a new "Friedland" picture, which is to be a revised and improved copy of the work in the Stewart collection now being sold at public auction in this city.[38] The implication being conveyed by the article is that Meissonier is guilty of a dishonest action in thus reproducing his famous picture.

A letter which I have seen this morning, written by Meissonier to Mr. Muybridge of the University of Pennyslvania, and certain facts which have come to my notice, explain why the artist has decided to reproduce the work upon which so much of his fame in this country has seemed to depend.

A few years ago, when Mr. Muybridge first went to Paris with a collection of his photographs of animals in motion, a reception was tendered him by Meissonier, to which were invited many of the most distinguished artists in France. At this reception Meissonier exhibited and highly commended the wonderful revelations made by Mr. Muybridge's investigations, stating frankly, in the presence of his

brother artists, that he had been mistaken in his past observations of horses in motion. He acknowledged that the picture "Friedland" contained what he now knew to be gross errors, and he expressed his regret that he could obtain no opportunity to correct them, as he would gladly do.

Feeling that his reputation as an artist might in time be compromised by this picture, Meissonier, it is believed, has begun the new picture with the intention of correcting such faults as he recognizes in the work in the Stewart sale.

No artist is more conscientious and none more jealously guards his good reputation than does Meissonier. He is a man who never allows to go out of his studio a work which, at the time, he deems unworthy of his reputation or unsatisfactory to his highest artistic knowledge.
Very respectfully yours,
Charles M. Kurtz, New York, March 25

H. Restatement 1892

Draft of a letter, Muybridge to Stanford, 2 May 1892. "San Francisco Art Association, 430 Pine Street, San Francisco." (The original, in Muybridge's hand, is in The Bancroft Library, University of California, Berkeley, and is published here, with Muybridge's deletions indicated in brackets, by the permission of the Director.) The letter is addressed "To The Hon. Leland Stanford, United States Senate." There is no signature. [39]

My dear Sir.

In the spring of the year 1872 in Sacramento, you asked me if it was possible to photograph from a lateral point of view, your horse Occident while trotting at full speed; as you wished to confirm a theory that a horse trotting at full speed must necessarily be clear of the ground for a portion of his stride.

I need not remind you that in a few days I established the truth of this theory to your and my own satisfaction, if not to the satisfaction of the world.

On the 7 August 1877 in a letter (a copy of which I have before me)[40] I suggested to you a plan for making a series of electro-photographs, automatically, by which the consecutive phases of a single stride could be successfully photographed.

Being [~~I became~~] much interested in this subject, [~~and in seeking your co-operation in the work~~.] I offered to supply you with what copies of the results you required for your personal use, if you would pay the actual expenses of obtaining them—omitting any payment in money for my time.

You accepted my proposition, and from a few days after the date of my letter, until the spring of 1881, or for more than three years, my time was devoted almost exclusively to superintending the construction of the apparatus or the execution of the work.[41]

In the summer of 1878 I published and copyrighted under the title of

> The Horse in Motion
> by
> Muybridge

six photographs of your horses, each illustrating [12] consecutive phases of the Trot, Gallop, etc.

I delivered to you a large number of these photographs with the above title printed on the mounts thereof, but very few were sold.

In [~~consideration~~] consequence of the interest which you and [~~Mrs. Stanford~~] manifested in the work, [~~and her desire to extend the investigation~~] it was then arranged that I should continue my work, with 24 cameras instead of 12 the results of which, as you state in the preface to the book, published under your auspices—were not originally intended for publication by you.

Finding, however that my system of investigating Animal Locomotion began to attract some attention, it was agreed and arranged that my photographs should be reproduced and published in book form.

It was your professed, and I believed your sincere desire to recognize my devotion to the work by extending a knowledge of it to the world, and by that means to bring me not only fame, but something more substantial, in the shape of [~~something~~] that which too often fails to accompany fame, these or words to that effect, were frequently used by you.

During the winter of 1880-81 "J D B Stillman MD" (who was not present at a single experiment of motion) — at your request commenced to examine and write a description of my photographs. While engaged in this work, Stillman submitted to me the title page of the proposed book, which, taking my original copyrighted title as his key, was substantially as follows:

> The Horse in Motion
> as demonstrated by a series of photographs
> by Muybridge
> With an attempt to elucidate the theory
> of Animal Locmotion
> by J.D.B. Stillman MD
> Published under the auspices of
> Leland Stanford

This title page was satisfactory to me and had this book been published it might have been of some assistance in obtaining for me the reward which you expressed your belief and desire I should have.

Early in the year 1882 I gave a Lecture at the Royal Institution of Great Britain, when I took the opportunity of giving you, what I think you will consider was full and generous acknowledgment for your co-operation and assistance in my work.

This lecture brought me into contact with many persons distinguished in Science or Art or holding the highest rank in Society.

Mr. Spottiswoode—the President of the Royal Society of London invited me to prepare a monograph on Animal Locomotion to be published in the "Proceedings" of the Society, and promised to provide the funds for an exhaustive investigation of the subject to be made under the auspices of the Society.

I was invited to give several public and private repetitions of the Lecture given at the Royal Institution. And altogether a brilliant and profitable career seemed opened to me in London.

In response to the invitation by the President I wrote a monograph on Animal Locomotion, and submitted it to the Council of the Royal Society.

This monograph was examined, accepted and a day appointed for its presentation to the Fellows, and for its being placed in the records of the Society.

I have in my possession a proof sheet of my monograph, printed by the Society, (as is its custom) before [it is] being place on the record of its "Proceedings."

About three days before the time appointed for the reception of my monograph by the Fellows, I received a note requesting my presence at the Rooms of the Society.

Upon my arrival I was conducted to the Council Chamber, and was asked by the President in the presence of the assembled Council, if I knew anything about a book then on the table having on its title page, the following

The Horse in Motion
by
JDB Stillman MD
Published under the auspices of
Leland Stanford

[and] there being no reference thereon to Muybridge.

I was asked whether this book contained the results of the photographic investigation of which I had *professed* to be the author. That being admitted I was invited to explain to the Council how it was that my name did not appear on the Title page, in accordance with my professions.

No explanation of mine could avail in the face of the evidence on the title page, and in the book before the Council, I had no proof to support my assertions.

My monograph was refused a place on the records of the Royal Society until I could prove to the satisfaction of the Council my claim to be considered its original author, and until this day it remains unrecorded from the lack of evidence which would be acceptable to the Council, which evidence is at your command.

The doors of the Royal Society were thus closed against me, and in consequence of this action, the invitations which had been extended to me were immediately cancelled, and my promising career in London was thus brought to a disastrous close.

My available funds being exhausted I was compelled to sell the four original photographic copies of

"The Horse in Motion"

which I had printed at your request and for your purposes, and with the proceeds of their sale I returned to America.[42]

I will not now trouble you with any details of other and subsequent happenings more than to say that in consequence of this publication of

"The Horse in Motion"
by
J.D.B. Stillman MD

I for two years vainly sought assistance to pursue my researches until at last through the influence of Dr. William Pepper, and other gentlemen (who had made due enquiries as to my position in the matter) I was instructed by the University of Pennsylvania to make a comprehensive investigation of the subject of Animal Locomotion. A few of the results of this investigation, you have seen.

I have patiently waited during eleven years without bringing this matter to your attention, but I think that the time has arrived when in justice both to you and to myself I ought to do so.

With many of the facts which I have related you are already familiar, and I do not believe you will question the accuracy of my statements in regard to the others, they are however all susceptible of [~~being readily and~~] conclusive[~~ly proved~~] proof. I am, Dear Sir, Yours Faithfully

I. Muybridge: His Summation 1892

"Correspondence," The Journal of the Camera Club (London), 9 November 1897, pp. 190-192 (Kingston Scrapbook, p. 196)

Sir,—

If a recent lecture at the Camera Club was correctly reported in the *Standard*, of 5th Nov., I have no doubt of one of the statements made by the lecturer causing you and some of the other members of your Club considerable astonishment.

The paragraph reads as follows:—"The reconstruction of that movement—that was to say the synthesis—was then considered a very distant problem. Towards 1893 appeared the Edison Kinetoscope, which realized that synthesis."

The "then" presumably, refers to a date previously mentioned—1874—at which time a photographic investigation of animal movements had been commenced in California.

During the last few years, numerous gentlemen in Europe and America have put forth claims to have been the first to demonstrate by synthesis the results of photographic analysis.

Having, many years ago, practically retired from the field of photographic investigation, I have taken no part in this controversy. Since, however, the statement is gravely made to a body of scientific men assembled in your rooms, that an apparatus for showing "Animated Photographs"—so called—was not "invented" until about five years since, I thought it a not inappropriate occasion to send you, for the information of such members of your Club as care to take the trouble to read them, a few quotations in regard to some demonstrations of a similar character which were made so long ago that one may reasonably be excused for having forgotten all about them.

As dates are the all important feature in this matter, it is as well to direct attention to the fact that Mr. Richard A. Proctor,

writing in 1881, alludes to his having seen, "about two years" before that time, the projecting apparatus called the Zoopraxiscope, which was then in practical use to reproduce apparent motion from analytical photographs.

Whether the Zoöpraxiscope or any of the instruments more recently constructed for this purpose can be correctly called an "invention" may be open to question, for it is well known that the same principle was employed by the Belgian physicist, Plateau, in the early part of this century, and, perhaps, before that time by the Weber Brothers; so whatever honour may be considered as belonging to the "inventor" of this system of demonstration must be awarded to one long since passed away.

I am not aware whether Plateau, or the Webers, used a modification of the apparatus for lantern projection. I think it very likely the former did, anyway an instrument was used for that purpose nearly fifty years ago by Pepper.[43]

Now, in regard to the Kinetoscope.

I think Mr. Edison himself would no more claim to be the inventor of the first apparatus, constructed and used for the purpose of demonstrating by synthesis movements originally analytically photographed from life, than he would claim to be the originator of the phonograph, the telephone, or the electric lamp.

The Kinetoscope is undoubtedly an improvement on the Zoöpraxiscope, even as that instrument was an improvement on the Zoetrope.

Several years before the appearance of the Kinetoscope, Mr. Edison was made perfectly familiar with the construction and contemplated improvements of the Zoöpraxiscope during a conversation held with him about the possibility of combining that apparatus in a modified form with the phonograph, and thus to synchronously reproduce actions and words an article in respect to which was published in the *Nation*, of New York 19th January 1888.

At that time, however, the phases of any one or a series of actions was limited in number to thirty-six——the number of lenses used for photographing. In this way was illustrated two strides of a horse, a jump over a hurdle, another two strides, another jump and so on, uninterruptedly repeated during a period limited only by the patience of the audience.

All of the more recent instruments are, naturally, a great improvement on their prototype. Science advances.

To Mr. Marey must be attributed the first successful obtainment of consecutive phases of motion with a single lens upon a strip of sensitized material. The results of some of his experiments in this direction were published by him at a meeting of the Académie des Sciences, 3rd July, 1882, and are reported in *Comptes rendus des seances de l'academie des Sciences*, t. xcv.

You will perhaps see that the first demonostration given in Europe of projected syntheses of analytical photography was at the house of M. Marey, in Paris, September 1881. Your Club has, I think, in its library, one of the series of photographs exhibited on that occasion, which was made in 1878, and seen by Mr. Proctor——synthetically——I think, the following year.

Permit me, in conclusion, to direct your attention, and through you, that of your colleagues, to a paragraph of page 20 of a little book, called "Descriptive Zoöpraxography," which, I believe, is in your library. It refers to the flight of insects.[44] Marey has demonstrated many interesting facts on this subject, but I much question if it is possible with his system to solve the problem. I am confident that a thorough investigation of insect flight will result in information of very great practical value to the physicist and the mechanician, and therefore were worthy the attention of any of your members who have the time, the facilities, and the disposition to pursue that line of research.

I am, Sir,
Yours faithfully, E. Muybridge

Reports referred to in the above Letter:

[The first "report" in Muybridge's Appendix to his letter is Marey's letter, preceded by Tissandier's introduction to it, both of which are reprinted as Document B, above.]

Gentleman's Magazine, vol. 251. Article appearing December, 1881, signed "Richard A. Proctor." "About two years ago I heard, for the first time, of a photographic achievement which seemed to me at the time scarce credible, and which I was presently assured by one of our ablest English photographers was absolutely outside the bounds of possibility. . . .

"Yet it is found that so soon as the pictures, instead of being studied separately and with steady gaze, are submitted in rapid succession to the eye . . . .by arranging them uniformly round the outside of a rather large disc, only a small portion of the upper part of which can be seen at a single view, and setting this disc in rapid rotation, so that picture after picture comes into view . . . . we are able to see the horse galloping as in nature——stride succeeding stride——every circumstance of the motion, even to the waving of the tail and mane being truthfully, and therefore naturally, presented."

Le Globe (of Paris), September 27th, 1881. (M. Vilbort)——"M. Marey, professeur au Collège de France, réunissait hier quelques savants, étrangers et français, dans la maison nouvelle qu'il habite au Trocadero . . . . Parmi les invités de M. Marey on remarquait M. Von Helmholtz . . . M. Govi . . . MM. Bjerknes, Brown-Sequard, Mascart, Lippmann, Nadar, Gaston Tissandier. . . Crookes, etc. . . . Les mouvements sont décomposés et reproduits, y compris les mouvements transitoires entre les diverses allures . . . par le procédé *zootropique*. C'est la reproduction——mais projetée, c'est-a-dire agrandie et visible pour un plus grand nombre——de la curieuse expérience qu'on

fait au zootrope sur les tables des salons. . .Nous voyons ainsi passer devant nos yeux de longues files de chevauz au galop s'assemblant, s'étalant avec la plus surprenante souplesse. Puis des chiens les suivent, courant entre leurs jambes la queue au vent.

"Dans ce défilé diabolique, dans cette chasse infernale, les cerfs courents après les chiens, les boeufs poursuivent les cerfs, et les porcs eux-mêmes montrent dans leur galop de folles prétentions à la grâce et à la vitesse.

"La photographie surprend aussi le vol des oiseaux dan les mille combinasions de leurs ailes qui tantôt relevées planent au-dessus de leur corps, tantôt se repliant les enveloppent tout entiers."

The Standard (London), November 28th, 1881.—"M. Meissonier has just gathered in his studio all the most celebrated French artists and sculptors to witness some curious experiments. . . .When these twenty-four photographs, placed in a kind of wheel, were turned rapidly, and made to pass before the lens of the magic lantern, their truthfullness was demonstrated most successfully."

Illustrated London News, March 18th, 1882 (Geo. A. Sala).—"By the aid of an astonishing apparatus called a 'Zoopraxiscope,' which the lecturer described as an improvement on the old 'Zoetrope,' but which may be briefly defined as a Magic Lantern Run Mad (with method in the madness), the ugly animals suddenly became mobile and beautiful, and walked, cantered, ambled, galloped and leaped over hurdles in the field of vision in a perfectly natural manner. . . .After the horses, dogs, oxen, wild bulls and deer, were shown under analogous conditions of varied movement, and finally Man appeared (in instantaneous photography) on the scene and walked, ran, leaped, and turned back-somersaults to admiration."

The Nation, New York, January 19th, 1888 (W.E. Garrison).—"Now it is evident . . . an imperishable record of the figure, height, dress, carriage and gait of any eminent man . . . could be had. Posterity at the bidding of our photographic necromancers could call up any of these worthies at any future date, and see him move across the stage with a startling verisimilitude. Nay, we would have his very 'walk and conversation.' . . . The phonograph, at the same time, as we may anticipate from its ultimate perfection, might repeat audibly. . . ."

Notes

1. This shutter, made partially of a cigar-box top, is in the Stanford Museum Collection. It is illustrated on p.111. The sky-shade was a forerunner of the appratus Muybridge devised for taking instantaneous photographs of Stanford's horses.
2. Muybridge had gone to Yosemite with his equipment in a box marked "Houseworth." But upon his return, he deserted his old publisher, and moved to Bradley & Rulofson.
3. Rulofson thus proclaims that, for a Californian of the period, he was an Equal Opportunity Employer.
4. Muybridge had won the Gold Medal at Vienna in 1873 for his large 1872 views of Yosemite.
5. Helen Arbuckle, "Muybridge Made Pictures of Motion," San Jose *Mercury and News*, 2 April 1972.
6. Copy in Rare Books and Special Collections, San Francisco Public Library. The photographic copies of the documents were made at Vance's Gallery, whose premises in San Francisco Bradley & Rulofson eventually occupied.
7. Muybridge, in the first three of the locations, refers to Alaska, 1868; Panama, 1875; Yosemite, 1872. Photographs taken "beneath the waters of our Bay" have yet to be found.
8. Translations by J. Sue Porter, Stanford University Museum of Art. Tissandier had published an article by Marey on the graphic notation of movement ("Moteurs animés, Expériences de physiologie graphique," a paper given at the French Association for the Advancement of Science, 29 August 1878) in two installments preceding his publication of the Stanford/Muybridge experiments: *La Nature*, No. 278, 28 September 1878, and No. 279, 5 October 1878.
9. Louis Cailletet (1832-1913), a French physicist.

10. Muybridge's dating is confusing. See his statement that Stanford had read *Animal Mechanism*, especially p. 161, before 1872 in his unsigned article, Document E. Marey's *La Machine Animale* was published in Paris in 1873; in New York, under the title *Animal Mechanism*, in 1874. In fact, in a later letter [reprinted as Document I], Muybridge gives the date as 1874. By thus blurring the two dates, Muybridge condenses the two phases of the Stanford/Muybridge experiments into one. The distinction is that in 1872 they were attempting to prove by a single instantaneous photograph that a horse at some point in his stride has all four feet off the ground; by 1874, the experimental idea had expanded, and what they now sought to obtain through a series of instantaneous photographs was a record of all the phases of a horse's stride. This was accomplished at Palo Alto in 1878, after Muybridge's return from Central America.
11. For the clock, see *Proceedings of the Royal Institution of Great Britain*, for 13 March 1882.
12. The eldest of the three brothers, Ernst Heinrich Weber (1795-1878), was an anatomist and physiologist. Another researcher was the American physician and author, Oliver Wendell Holmes (1809-94), Holmes studied the instantaneous stereoscopic views of the streets of London, Paris and New York, which were first published in 1859, and found that the walking figures in them showed entirely different attitudes from those depicted by artists. "We thought we could add something to what is known about it [the mechanism of walking] from a new source, accessible only within the last few years and never, so far as we know, employed for its elucidation, namely the *instantaneous photograph*." He employed the artist F.O.C. Darley to make drawings from the photographs; these were published with his article, "The Human Wheel, its Spokes and Felloes," in *Atlantic Monthly*, Vol II, May 1863, pp. 567-80. (For a fuller discussion of Holmes's inquiry, see B. Newhall, "Photography and the Development of Kinetic Visualization," *Journal of the Warburg and Courtauld Institutes*, Vol. VII, Nos. 1 and 2, 1944, pp. 40-45.)
13. Olive Cook, in *Movement in Two Dimensions*, London, 1963, p. 127, gives 1867 as the year in which the Daedelum or Wheel of Life was brought out in the United States under the name of Zoetrope.
14. By this time Muybridge was working on his first zoöpraxiscope, which he demonstrated at Leland Stanford's Palo Alto home in the autumn.
15. For an example of Eakins's diagrammatic representation, see illustration above.
16. The first mention of combining sound with photographically analyzed motion. Cf. remark in The S.F. *Call* for 5 May 1880, "All that was missing was the clatter of hoofs!" (Kingston Scrapbook, p. 58).
17. E.J. Marey, *Animal Mechanism*, New York, 1874. On this page Marey also remarks: "All [the necessary researches into animal locomotion] can only be effected by men especially interested in these inquiries, and placed in favorable circumstances to undertake them." This certainly is a description that suits Leland Stanford. Stanford immediately accepted the challenge.
18. But see the date of *Animal Mechanism*, above.
19. For a discussion of the difference between recording photographically the motion of a subject who moves along the line of vision and one that moves across it, or laterally, see B. Newhall, *op. cit.*
20. For a discussion of the published picture, see catalogue.
21. An error in date. There were no series pictures until 1878.
22. Enoch Wood Perry, Jr. (1831-1915), was an internationally famous portrait painter. He is listed in Muybridge's promotion piece for *Animal Locomotion* as a subscriber.
"A California Coach and Four" is probably an oblique reference to Thomas Eakins's use of the photographs of Edgington for the painting *The Fairman Rogers Four-in-Hand*, 1879. Muybridge never refers to Eakins by name, although he corresponded with him.
23. See illustrations.
24. Again, Muybridge's time calculations appear to be off. The first serial photographs were taken in the spring of 1878; the zoögyroscope (later called the zoöpraxiscope) was operated in 1879, a matter of a year and several months. But it must be remembered that in 1877, Muybridge and Stanford ordered twelve cameras for the experiments; a strip of an object in motion for a zoetrop with thirteen slots has twelve images. It seems likely that Stanford and Muybridge followed Marey's suggestion in 1874 of producing an "animated zoology," and from then onward directed the experiments toward the synthesis as well as the analysis of motion.
25. Muybridge later reduced the size of the disk to twelve inches.
26. Stillman, in his deposition, cited in the introduction, says: "The first thing done was, we sent to Chicago for the skeleton of a horse—or the Governor did. We had no basis, no anatomical knowledge relating to horses, and no way by which we could get it; and it was evident to me that we had got to begin on the anatomy. . . . We therefore sent for the skeleton. (Stillman deposition, pp. 4-5.) The skeleton is shown in six different phases of motion in the drawings made from Muybridge's photographs for Stillman's book (Plates XII, XXXV and XLVIII). Photographs of it appear on the last ten pages of Muybridge's *The Attitudes of Animals in Motion*, Palo Alto, May 1881.
27. The letter was written two days after

Meissonier's reception, which was held on Saturday, 26 November, the day on which Stanford left.

28. See p. 6 for a reproduction of the painting.

29. By "disposition" Muybridge means further financial support.

30. Stanford had returned to Palo Alto by now, and when the letter was received there by Shay, in early 1882, had already written his Preface to J.D.B. Stillman's *The Horse in Motion.*

31. By "embarrassing" does Muybridge refer to his enforced travel to Central America in 1875-76 after the scandal of the Larkyns murder of 1874? The serial trials were probably envisioned in 1874, the year Marey's book was published in English, but could not be taken up until after Muybridge had returned and had finished printing his Central America photographs; that is, not until 1877.

32. The letters to Stanford have not been found by the authors of this catalogue.

33. His Yosemite series of 1872, which occupied him for almost a year, brought Muybridge over $20,000. On 30 May 1881, Stanford paid Muybridge $2,000 for his work at the Palo Alto Farm, which had occupied him intermittantly from 1877 to 1881. (The record of payment is in the Collis P. Huntington Collection of the George Arents Research Library, Syracuse University.) The payment was made to Muybridge in New York, and is marked on Stanford's account as "chargeable to Photograph a/c." This strange letter designation may be deciphered as "automatic-electro," which is Muybridge's description of his first published "photograph" of Occident in 1877.

34. The letter is not in Muybridge's hand. The two printed above, to Shay, are.

35. The two following items are paired in the Kingston Scrapbook.

36. Muybridge instituted his first suit *Osgood vs. Muybridge* in the Circuit Court of Massachusetts on 14 September 1882. It was immediately non-suited; Muybridge then initiated *Stanford vs. Muybridge.*

37. See Documents, E.

38. The original painting is now in the Metropolitan Museum of Art, New York, and the watercolor in the Huntington Hartford Collection.

39. Muybridge was in San Francisco preparing to embark upon A Zoöpraxigraphical tour of the Orient. During his visit to the city, he also wrote two notes to Stanford, (5 August 1892, originals in The Bancroft Library), asking that he deliver two boxes of equipment to friends of his in the area, the Doyles. It is these two wooden boxes, we believe, which were recently found in San Francisco by Marilyn Blaisdell, a San Francisco dealer in Californiana, and purchased by the Stanford Museum. The lamp housing for the Stanford copy of the zoöpraxiscope, a chromotrope, the lateral sliding shutter of 1869, and the glass positives of animals in motion illustrated in the catalogue were in them. The Doyle family of Menlo Park for years held the collection of Muybridge stereographs and larger views that is now in The Bancroft Library.

Instead of touring the Orient, Muybridge accepted an invitation to lecture at the World's Columbian Exposition in Chicago, 1893.

40. The letter has not been found by the authors of this catalogue.

41. From August of 1879 until May of 1881, Muybridge worked on the improvement of his zoöpraxiscope and on printing *The Attitudes of Animals in Motion.* He also gave lectures throughout California during this period.

42. Muybridge must be referring to *The Attitudes of Animals in Motion.* An advertisement for *Attitudes* appeared in *The British Journal of Photography* for 19 August 1881: "THE ATTITUDES OF ANIMALS IN MOTION. A series of 209 PHOTOGRAPHS, illustrating 2,000 attitudes of Men, Horses, Dogs, and other Animals, while executing their various movements from life, by MUYBRIDGE. Price £20 for the entire series. Published by the Author, and for sale at the Office of *The British Journal of Photography*, 2, York St., Covent Garden, London, W.C." Then it was Leland Stanford's name that was missing. This and the letters to Shay reprinted above probably made Stanford hurry home to produce his own book.

43. Muybridge refers to John Henry Pepper, author of *The Boy's Playbook of Science*, London and New York, second edition, 1860.

44. Muybridge is referring to the following passage, p. 26 of his *Descriptive Zoopraxography (1893):*

"Although the one six-thousandth part of a second was the duration of the most rapid exposure made in this investigation, it is by no means the limit of mechanically effected photographic exposures. Marey, in his remarkable physiological investigations, has recently made successive exposures with far less intervals of time; and the author has devised, and when a relaxation of the demands upon his time permit, will use an apparatus which will photograph twenty consecutive phases of a single vibration of the wing of an insect; even assuming as correct a quotation from *Nicholson's Journal* by Pettigrew in his work on Animal Locomotion that a common house fly will make during flight seven hundred and fifty vibrations of its wings in a second of time, a number probably far in excess of the reality.

The ingenious gentlemen who are persistently endeavoring to overcome the obstacles in the construction of an apparatus for aerial navigation, will perhaps some day be awakened by the fact that the only successful method of propulsion will be found in the action of the wing of an insect."

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[see catalogue entry]

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Thom Andersen, *Eadweard Muybridge, Zoöpraxographer*
A sixty-minute film in 16 mm.color. Made at UCLA

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The photographer Leo Holub of Stanford University made it possible to include Muybridge's Central America work and the San Francisco panorama in the exhibition by making copy negatives and prints from the bound originals. He also made exhibition prints from the Muybridge negatives of the San Francisco home. Ralph E. Talbert, professor of photography in the Department of Journalism, Sacramento State College, made exhibition prints from Muybridge negatives of the Stanford Sacramento home and the eclipse of the sun. Thomas Waskevich of Stanford University Reprographic Services photographed the Muybridge equipment for the catalogue.

Timothy Vitale and Donald Glaister prepared the photographs and the optical toys for the exhibition.

David Beach, Stanford University Mechanical Design Department, brought a zoöpraxiscope once again to Palo Alto Farm.

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In the name of Muybridge, sincere thanks is extended to them all. —A.V. Mozley

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