AHST 4342-001 (88513)

New Media Art Histories
Fall 2023
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Arts & Humanities
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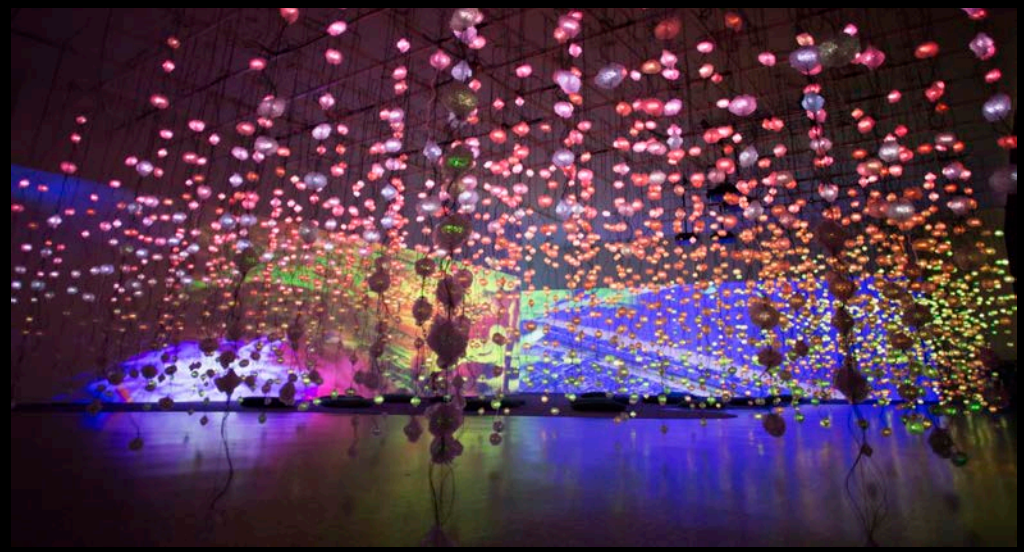
09/26/2023

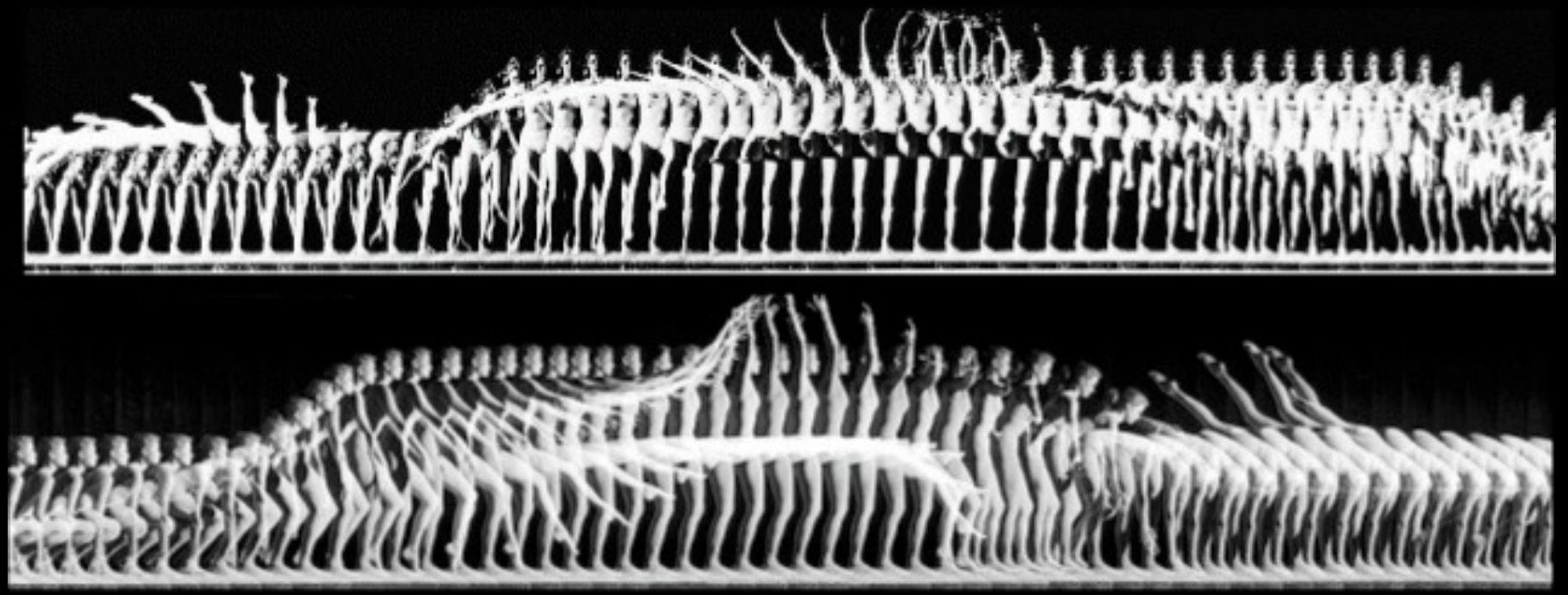
Chronophotography: Capturing Time and Movement in Image



Views of *Pixel Forest* (2016) and *Worry Will Vanish* (2014), an immersive experience by Swiss artist Pipilotti Rist at the Museum of Fine Arts, Houston, 2023

Chronophotography

Chronophotography originated as a Victorian application of science (the study of movement), and art (photography).



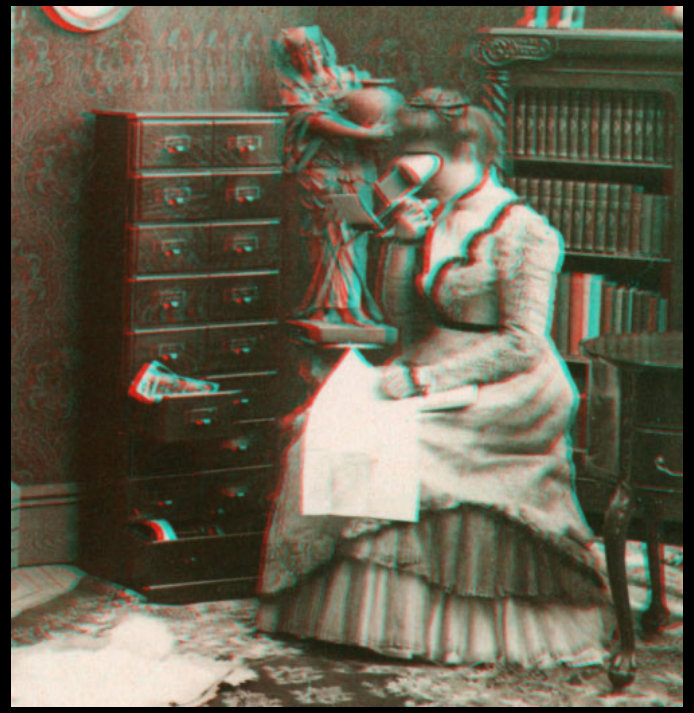
Photographs by Andrew Davidhazy

pictures of time

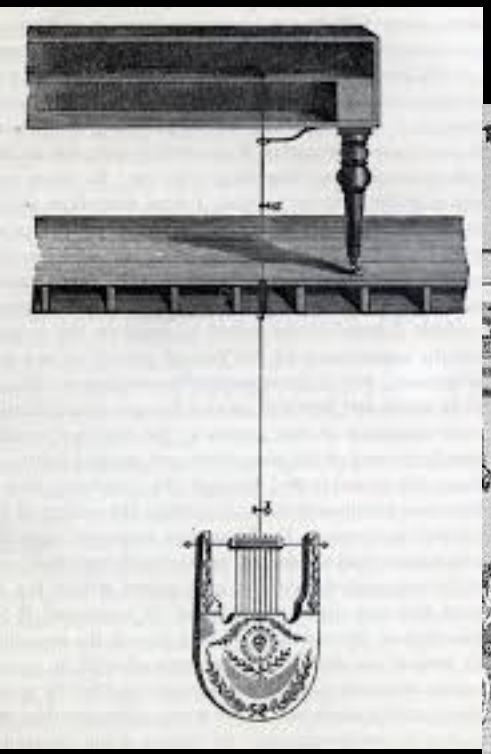
abstraction of vision

Sir Charles Wheatstone, stereoscope, 1840

Tthe stereoscope was invented by Sir Charles Wheatstone (1802-75) in 1840. Stereoscopy is any technique capable of recording three-dimensional visual information or creating the illusion of depth in an image. The illusion of depth in a photograph, movie, or other two-dimensional image is created by presenting a slightly different image to each eye. Traditional stereoscopic photography consists of creating a 3-D illusion starting from a pair of 2-D images.



Legerdemain (sleight of hand) and the senses

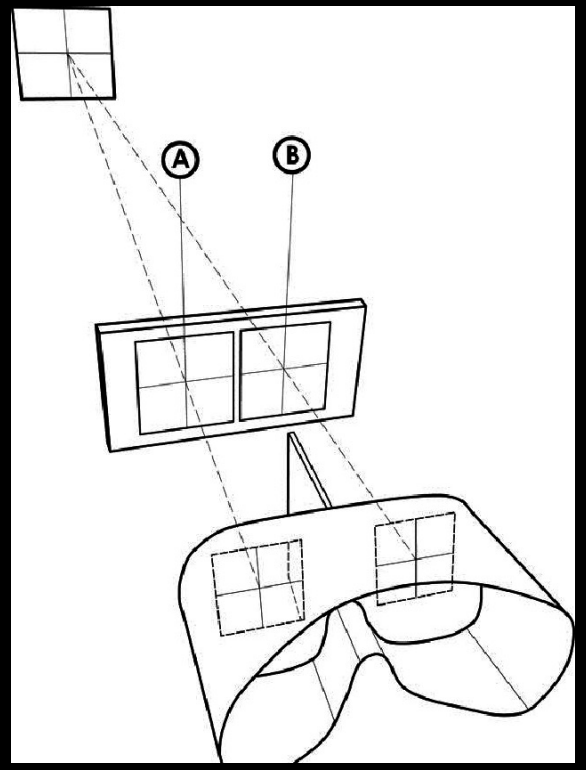


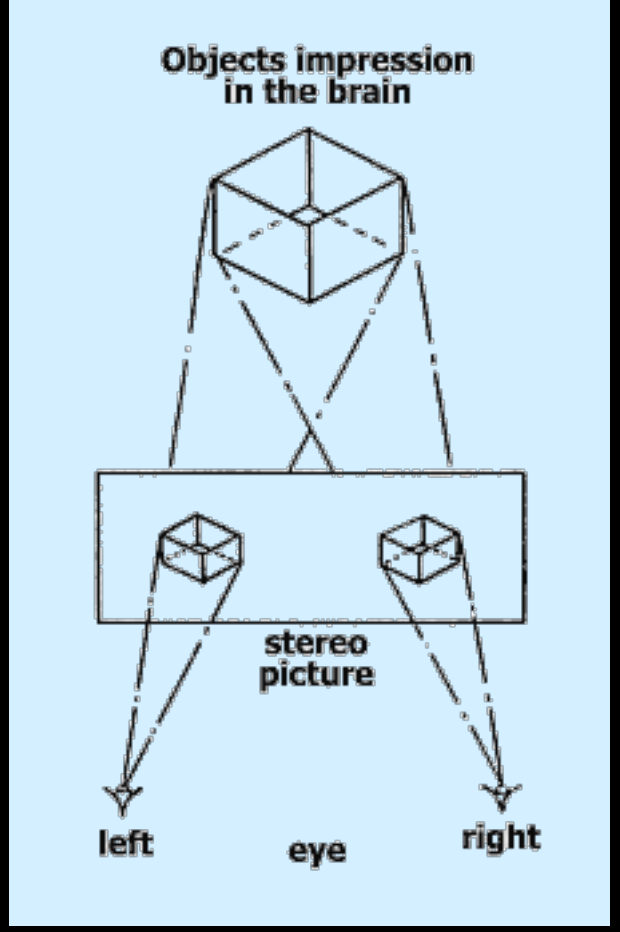
1821: ENCHANTED LYRE

In September of 1821, Charles Wheatstone exhibited his Enchanted Lyre or Aeoncryptophone at a gallery in a music store. The Enchanted Lyre was not a real instrument, it was a sounding box disguised as a lyre that hung from the ceiling by a steel rod, and emitted the sounds of several instruments: piano, harp, and dulcimer. It appeared as if the Enchanted Lyre was playing itself. However, the steel rod conveyed the vibrations of the music from real instruments which were played out of view by real musicians.

Sir Charles Wheatstone, stereoscope, 1840

Legerdemain (sleight of hand) and the senses





The easiest way to create depth perception in the brain is to provide the eyes of the viewer with two different images, representing two perspectives of the same object, with a minor deviation similar to the perspectives that both eyes naturally receive in binocular vision.

time

mobile and kinetic images

transportable pictures

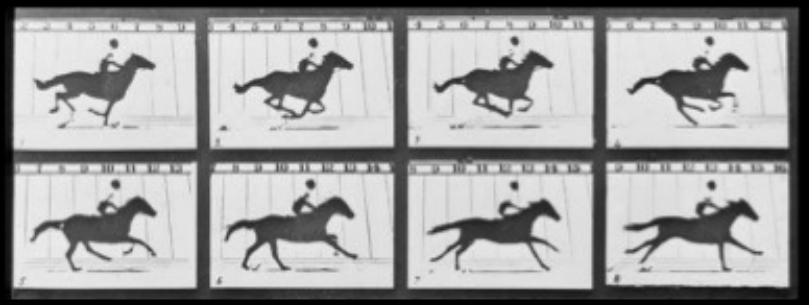
moving images

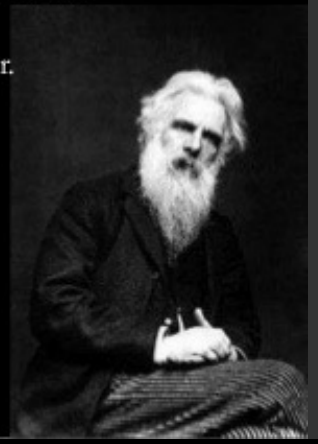
http://www.britannica.com/EBchecked/topic/399928/Eadweard-Muybridge

http://www.eadweardmuybridge.co.uk/includes/img/homepage/horses.jpg

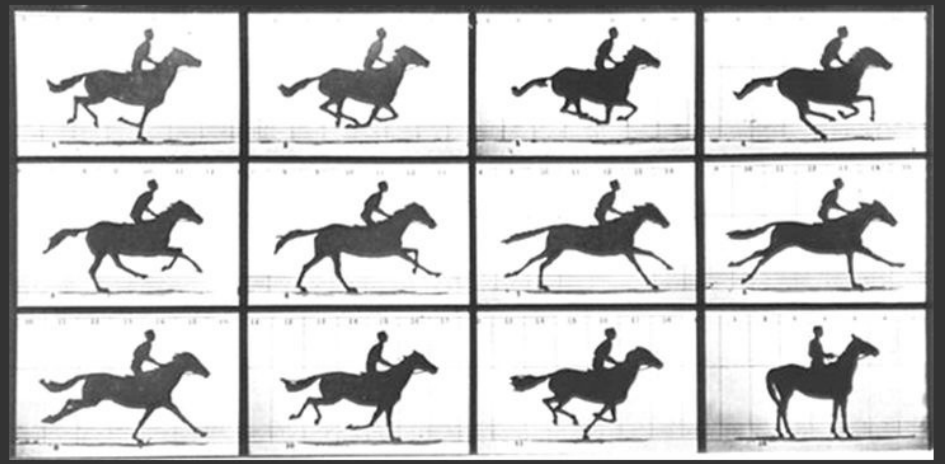
OVERVIEW OF EADWEARD

- Eadweard Muybridge, born in Kingston, Surrey was an English photographer important for his groundbreaking work in photographic studies of motion and in motion-picture projection.
- Eadweard was known as the 'Grandfather of Motion Pictures'
- Muybridge's experiments began in 1872 of photographic gatherings of animals.
- His first efforts were unsuccessful due to his camera lacking a fast shutter.





Eadweard Muybridge (Edward James Muggeridge, British 1830-1904), *Galloping Horse, Motion Study*: Sallie Gardner, owned by Leland Stanford, running at 1.40 gait over the Palo Alto track, June 19, 1879, wet plate collotype, a sequence of photographs with 12 cameras



Muybridge began the project in 1872. In 1878, he succeeded in taking a sequence of photographs with 12 cameras that captured the moment when the animal's hooves were tucked under its belly. Publication of these photographs made Muybridge an international celebrity.

In his efforts to capture duration – what Henri Bergson called *durée* and Alfred North Whitehead “a dynamisation or temporalization of space” – Muybridge set the foundations of an “imaging revolution” and would engender a range of applications for the persistence of vision, including in what we have come to know as motion pictures. Muybridge’s complex but single-minded pursuit of motion found its ideall subject and catalyst in the western expanses of a country in perpetual motion. His entire career was aimed at assembling ‘a visual primer in the human perception of time,’ and this primer started in the vast landscape of what during his time was still considered the primordial wilderness of the West. (Latsis, 2)

…Muybridge’s trajectory as a chronophotographic experimenter did not start, as has been traditionally assumed, with the analysis of time through space (what Henri Bergson would later call the “spatialization of time”), but instead with the contraction of time *in* space (the “temporalization of space”). (Latsis, 17)

Sir Charles Wheatstone, stereoscope, 1840

Sir Charles Wheatstone, stereoscope, 1840

The stereoscope generated a new kind of traffic of images. Fundamentally, this traffic concerned bringing, importing knowledge of far away places to the seated observer who looks at them in the comfort of her own home.

TECHNICS OF VISION – TRAINING PEOPLE HOW TO SEE IN CERTAIN WAYS USING CERTAIN DEVICES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Indoctrinating Looking and Teaching how to Look

Dévastation du Musée du Louvre,

Louis-Léopold Boilly, The Public in the Salon of the Louvre, Viewing the Painting of the "Sacre" begun 1808

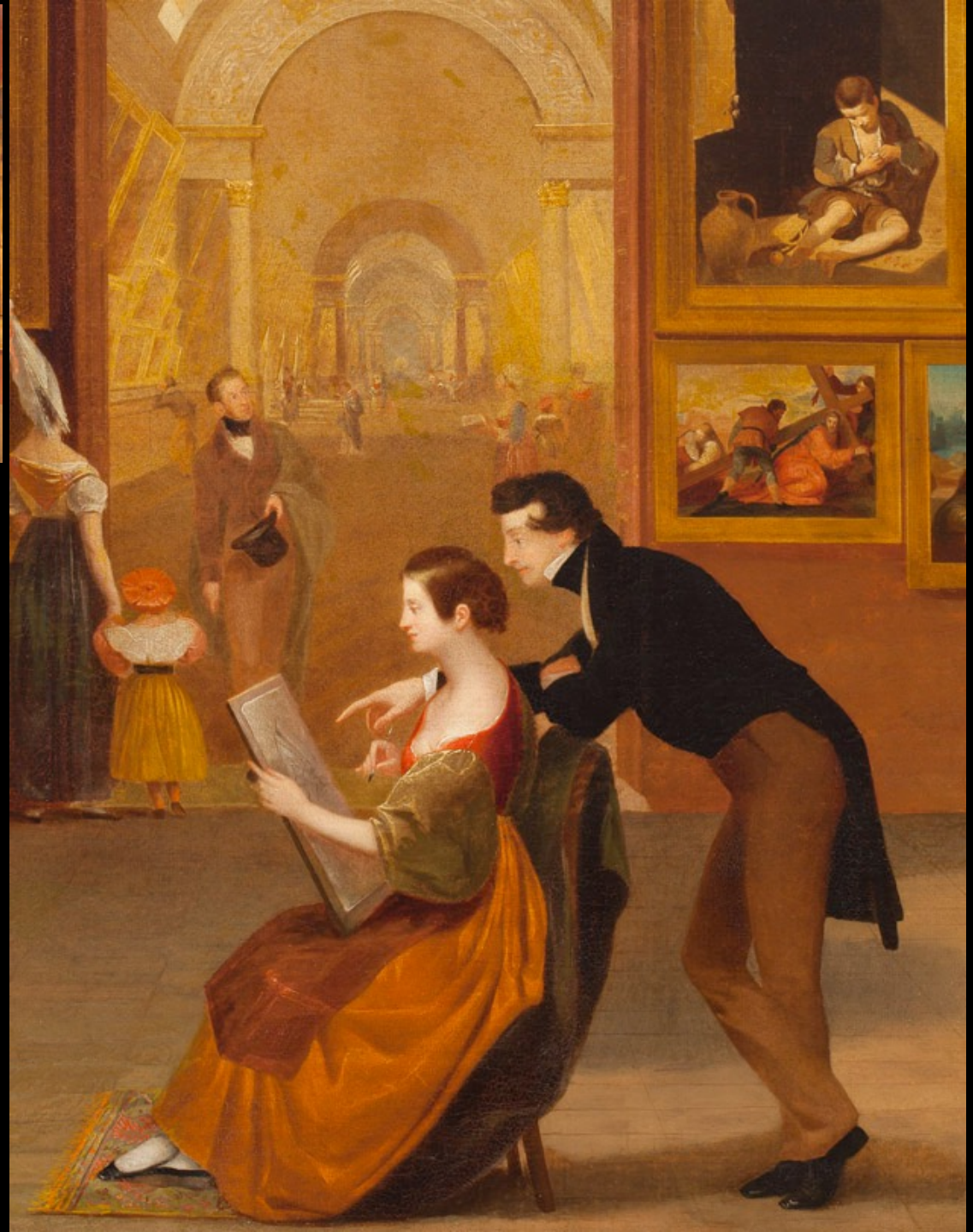
Camille Lassalle, 1839-?, Le Salon de 1874, 1874

Morse, Gallery of the Louvre, 1831-33– a painting about teaching how to see, how to look, knowledge about the Great Masters, and ranking America among Europe's finest institutions

- mechanical imitation
- intellectual imitation

Lectures on the Affinity of Painting with Other Fine Arts first delivered at the New York Athenaeum in the spring of 1826

"There is then an Imitation which copies exactly what it sees, makes no selections, no combinations, and there is an Imitation which perceives principles, and arranges its materials according to these principles, so as to produce a desired effect. The first may be called *Mechanical* and the last *Intellectual Imitation*."

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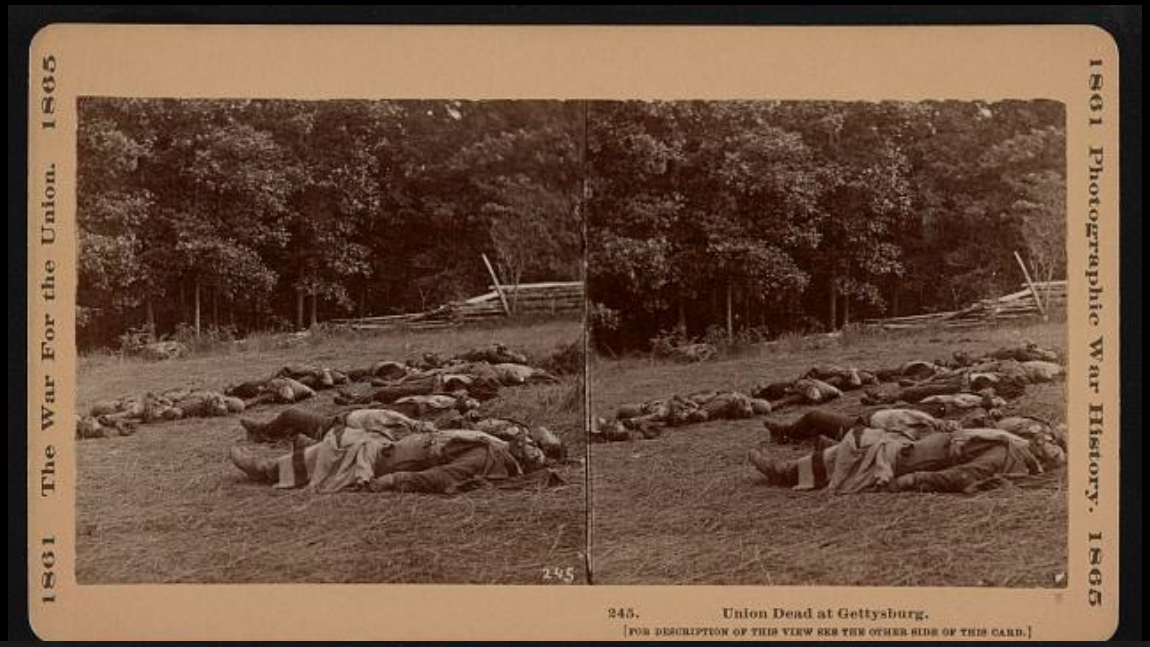
The Viewmaster was introduced at Chicago World's Fair 1939.

The stereoscope generated a new kind of traffic of images. Fundamentally, this traffic concerned bringing, importing knowledge of far away places to the seated observer who looks at them in the comfort of her own home.

The stereoscope is instrumental in the emergence of tourism – creating the romance and desire of far away otherness and exotic places.

Anonymous, The Great pyramid of Gizeh, a tomb of 5,000 years ago, from S.E. Egypt, 1908

During the Civil War, the camera went along for the ride, often in the hands of one of Mathew B. Brady's and Alexander Gardner's well-trained field photographers such as Timothy H. O'Sullivan.



LEFT: Above - Union (i.e. Confederate) dead at Gettysburg, 1865; Below - War effect of a shell on a Confederate soldier at battle of Gettysburg, 1865

RIGHT: Above - View at Losser's (i.e. Trostle's) barn, where the 9th Massachusetts Battery was cut up, 1865; Below - Meadow over which the 2d Mass. and 27th Indiana charged on morning of July 3d, 1865

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Mathew Brady's Daguerreotype Gallery and Storefront, New York City, c. 1865-66

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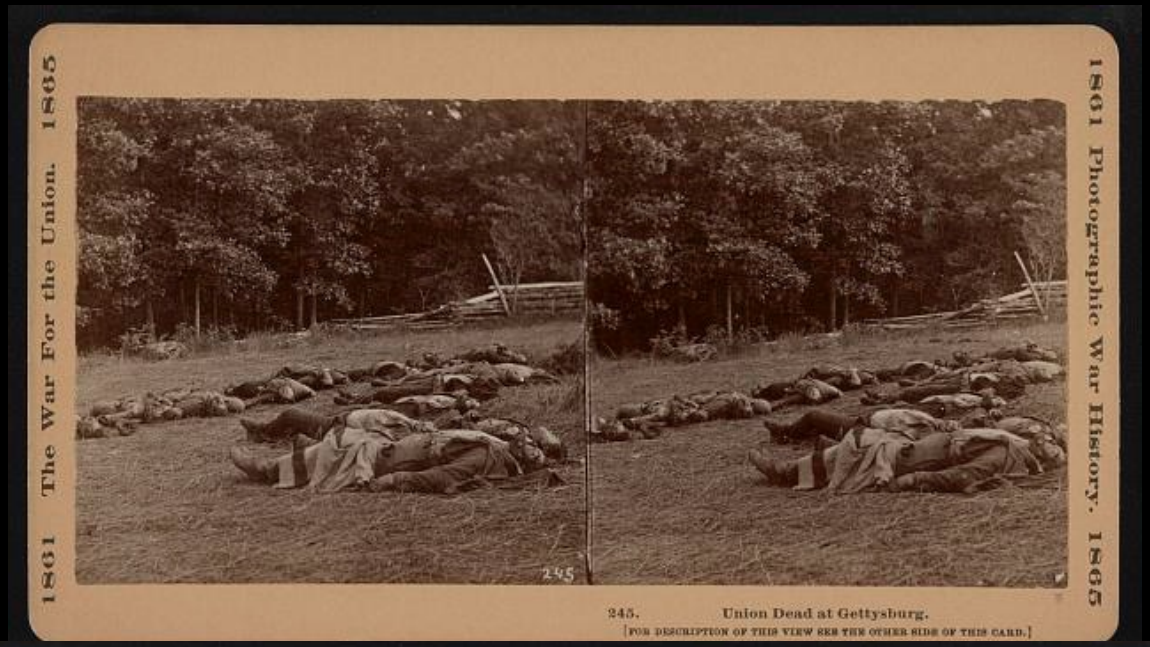

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Timothy O’Sullivan, American (b. Ireland, 1842-1882). *Camp at Shoshone Falls, Idaho*, 1868. Albumen print, 7 3/4 x 10 5/8 inche

By the close of the Civil War, twenty-five-year-old O’Sullivan had had seven years’ experience in wet plate photography, five of them working from a van on or near the battlefield. His technical proficiency under adverse conditions and his strong constitution recommended him as a photographer for the Geological Exploration of the Fortieth Parallel, the first of several exploratory surveys of the American West. Clarence King, an enterprising geologist from Yale, had convinced the government to implement a study of the geological structure and natural resources of the region west of the Great Plains and east of California, the so-called Great American Desert. From 1867 to 1872, King and his corps of young scientists and photographers mapped and described a band 100 miles wide by 300 miles long lying roughly along the route of the railroad that would link the east and west coasts in 1869.

Timothy H. O'Sullivan, Walls of the Grand Canon about 1200 Feet in Height, 1873

SUBLIME

INCOMMENSURABLE

THE AMERICAN WEST

Carleton E. Watkins, Mariposa Trail, Yosemite Valley, Mariposa County, Cal, From the "Best General View," 1865-66

Carleton E. Watkins, Mariposa Trail, Yosemite Valley, Mariposa County, Cal, From the "Best General View," 1865-66

Carleton Watkins (1829–1916) had absolutely no field training during the Civil War. In 1851, when he was twenty-one, Watkins left Oneonta, New York, for California, following the example of Collis P. Huntington, another Oneonta native who had moved to California to make his fortune. After a stint in Huntington's store in Sacramento, Watkins moved to San Francisco, where he chanced into an apprenticeship with the daggueretypist Robert Vance. By 1858, Watkins had established an independent practice, photographing mining operations and land claims for financiers who were building their careers in the lap of the new state. In 1861, Watkins traveled with one of his patrons, Trenor Park, entrepreneur of the Mariposa gold mine, on a family excursion to Yosemite, an extraordinarily beautiful valley surrounded by cliffs 3,000 feet in height. Unknown to white settlers until 1849, the valley was twenty hours by stage and mule from San Francisco. But word spread fast at the Mariposa mine, and by 1858 there were land claims, a better road, and tourists enough to support a hotel.

Carleton E. Watkins, Mariposa Trail, Yosemite Valley, Mariposa County, Cal, From the "Best General View," 1865-66

Carleton Watkins, Stereoview of Cathedral Rocks at Yosemite, 1967

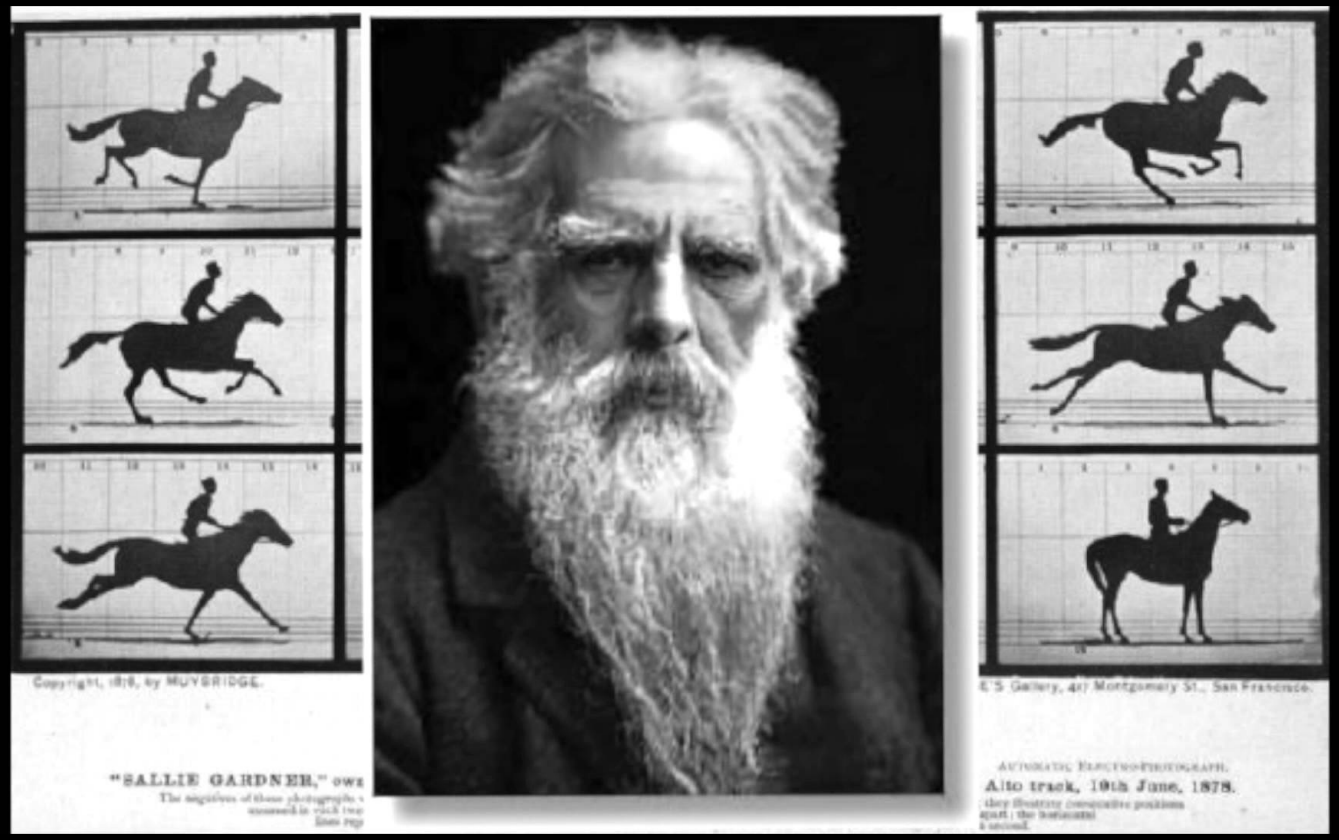
"The controlled grandeur of his views of the sublime is encoded not only with classical ideals of simplicity, geometry, and measure but also with a perception of the West as the **primordial theatre** of an authentically American place" (The Waking Dream, Gilman Paper Company Collection, p. 124). These photographs helped clinch the notion that Yosemite was a relic of Eden in North America.

https://www.donaldheald.com/pages/books/27829/carleton-e-watkins-photographer/collection-of-56-stereoscopic-photographic-views-from-watkins-pacific-coast-series-principally

Carleton Watkins, Piwyac, or the Vernal Fall and Mt. Broderick, 300 feet, Yosemite Valley, Mariposa County, Cal. 1861

cataract

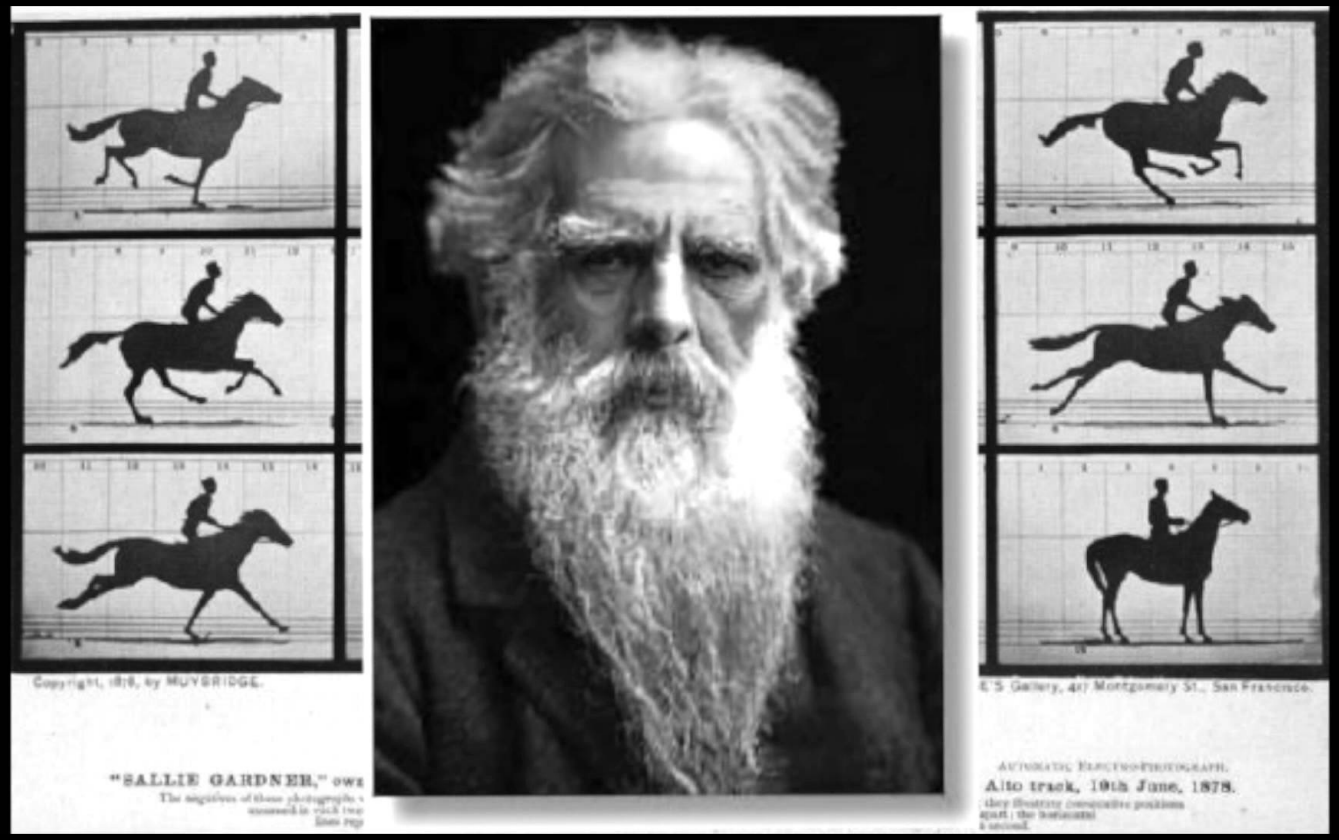
Muybridge was hardly the first person to recognize the aesthetic potential and the marketability of the American West of the imagination. Nor was he the first to be fascinated by the immensity and grandeur of the valley of Yosemite that had become, in the midst of the Civil War, the first public land set aside for future generations, a site brought to this status in part because of the photography of Charles L. Weed and Carleton Watkins. Indeed, it is still in Watkins's sublime renditions of peaks, valleys, rivers, and lakes that Yosemite survives in the popular imagination more than a century and a half after it was first imprinted on a photographic plate. (Latsis, 3)



Eadweard Muybridge (1830-1904), born Edward James Muggeridge in Kingston on Thames in county of Surrey

aka “Helios”

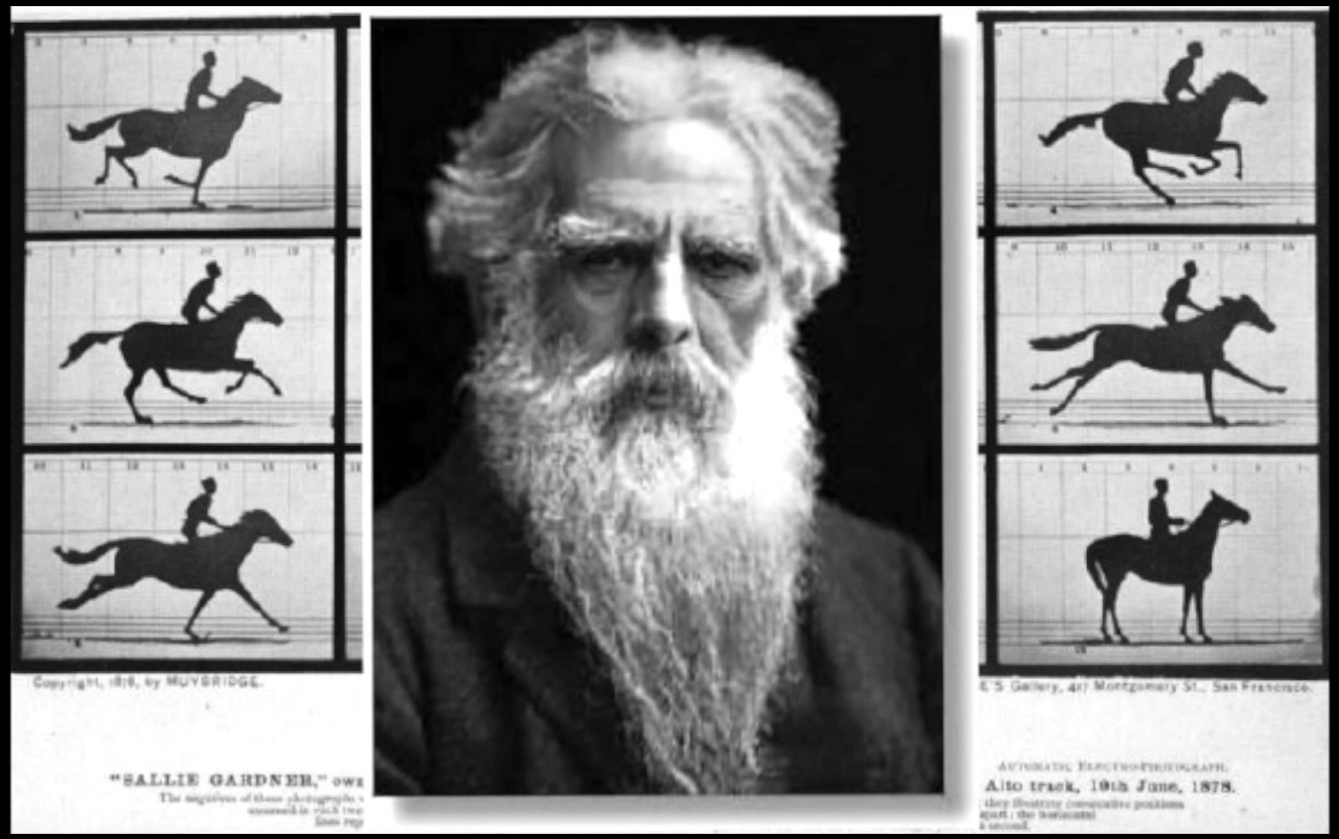
Eadweard Muybridge (1830-1904), born Edward James Muggeridge, lived many lives under many names, rose and fell, appeared and disappeared, invented and re-invented himself. The son of a corn merchant, a corn handler, named Edward James Muggeridge could christen himself “Eadward,” after two English kings, Eadward the Elder, Eadweard the Martyr, and “Muybridge,” acknowledging the fact that “muy,” as Hollis Frampton reminds us, was a measure of dry grain. But this charming an homage to one’s English town of origins, Kingston (king’s town), site of the Coronation Stone for Saxon kings, the elaborate name change was a mere prelude for a photographer, who got away with murder, because one could do that sort of thing then .



Eadweard Muybridge (1830-1904), born Edward James Muggeridge in Kingston on Thames in county of Surrey

aka “Helios”

By 1860, Muybridge was a successful bookseller. He left his bookshop in care of his brother, and prepared to sail to England to buy more antiquarian books. However, Muybridge missed the boat and instead left San Francisco in July 1860 to travel by stagecoach over the southern route to Saint Louis, by rail to New York City, then by ship to England. In central Texas, Muybridge suffered severe head injuries in a violent runaway stagecoach crash which injured every passenger on board, and killed one of them. Muybridge was bodily ejected from the vehicle, and hit his head on a rock or other hard object. He was taken 150 miles (240 km) to Arkansas, for treatment (his earliest memories post-accident were there), where he stayed three months, trying to recover from symptoms of double vision, confused thinking, impaired sense of taste and smell, and other problems.



Eadweard Muybridge (1830-1904), born Edward James Muggeridge in Kingston on Thames in county of Surrey

aka “Helios”

Prior to his accident Muybridge was a good businessman, genial and pleasant in nature; but after the accident he was irritable, eccentric, a risk-taker and subject to emotional outbursts. The emotional changes that followed Muybridge’s head injury are familiar to neurologists. Damage to the anterior part of the frontal lobe, known as the orbitofrontal cortex, disrupts the control and regulation of emotions. In modern times, damage to this region is a common consequence of severe automobile accidents.

-- Arthur P. Shimamura, *Muybridge in Motion: Travels in Art, Psychology and Neurology*

Eadweard Muybridge, Yowiye, 'Nevada Fall,' 600 feet high, c.1872

It is at this point in time when the final reincarnation of the photographer took place: Muggeridge became Muggridge, which became Muygridge, finally wrestled itself into its final spelling “Muybtidge.” But the name change did not end there, for “Edward Muybridge,” after painstaking tryouts, also had an alter ego, because as a professional photographer, he practiced under the name, “Helios.” By 1867, he was in Yosemite, conscious of his precursors, and photographing some of the same sites. What is not known is how he developed him unique style, for the vantage point favored by Muybridge often allowed the composition to be divided horizontally in the middle.

Eadweard Muybridge, Yowiye, 'Nevada Fall,' 600 feet high, c.1872

NATIONAL GALLERIES SCOTLAND

Landscape with Apollo and the Muses, 1652, Claude Lorrain (Claude Gellée)
Photography by Antonia Reeve

Eadweard Muybridge, Yowiye, 'Nevada Fall,' 600 feet high, c.1872

At first glance, it seems that the photographs were simple Claudian structures, adapting the classical paintings of Claude Lorraine, a sliver of a foreground, a generous middle ground and an open Baroque expanse into the open background which melted into the sky. But Muybridge had a penchant for reflections and turned Claude's seascapes into mirrored landscapes that bifolded themselves and then reflected themselves and then doubled themselves, as if for emphasis.

Muybridge signaled a desire to stretch the medium to the edge of its capacity as a recorder of time and space. The operative question in the waterfall series thus seems to be whether one can provide an index of time *indirectly* through its effects on space, in this case the accumulation of a volume of water over a certain period. If so, Muybridge's trajectory as a chronophotographic experimenter did not start, as has been traditionally assumed, with the analysis of time through space (what Henri Bergson would later call the "spatialization of time"), but instead with the contraction of time *in* space (the "temporalization of space"). (Latsis, 17)

Carleton Watkins, Piwyac, or the Vernal Fall and Mt. Broderick, 300 feet, Yosemite Valley, Mariposa County, Cal. 1861

Eadweard Muybridge, Yowiye, 'Nevada Fall,' 600 feet high, c.1872

How, according to Latsis, are they distinct?

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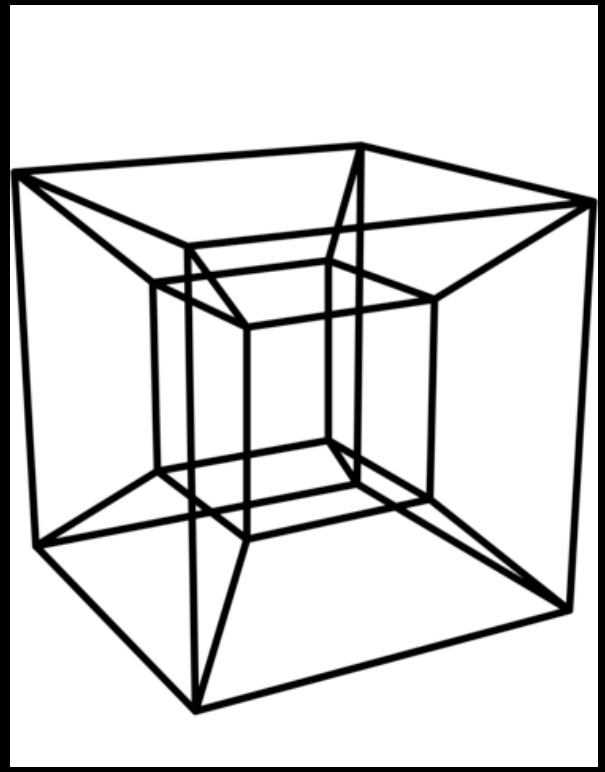
Landscape, however, was not Muybridge's sole or even primary focus; rather, a peculiar mix of profiteering and civic mindedness, artistry and technical curiosity, guided him. Nevertheless, his earliest images of Yosemite, made in 1867, are at the root of his fixation with temporality. His pictures marked a departure from the style of the previous photographers of Yosemite while also launching a series of photographic experiments that would culminate with the chronophotographic record of a galloping horse and the projection of moving, living images. (Latsis, 3)

cataract versus tesseract

Eadweard Muybridge, Base at Yosemite Lower Falls, Yosemite Valley, California, 1868

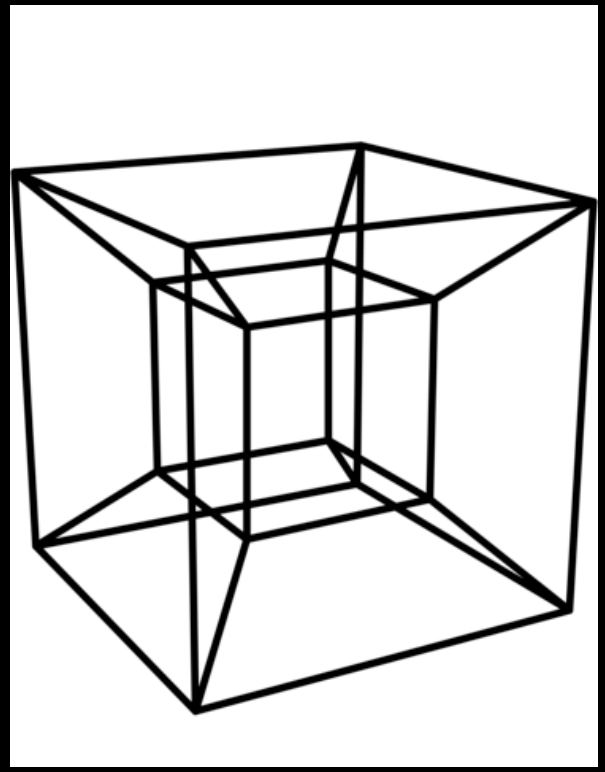


The tesseract is the hypercube also called the 8-cell or octachoron. It is is the four-dimensional analog of the cube; the tesseract is to the cube as the cube is to the square. In Madeleine L'Engle's novel *A Wrinkle in Time*, the characters in the story travel through time and space using tesseracts. The book actually uses the idea of a tesseract to represent a fifth dimension rather than a four-dimensional object (and also uses the word "tesser" to refer to movement from one three dimensional space/world to another).

He concerns himself not with how exposure times can help with photographic accuracy, sharpness, and picturesque value but with conveying as direct an image as possible of the passage of time, even if that means including indistinct volumes of white matter in his otherwise stunningly composed pictures. He therefore accepted the structural limitations of his medium (the extent of exposure times, the sensitivity of the collodion plate, and so on) and used them to suggest something that lies (just) beyond the impression that the photographic image can capture: a *continuum* of time in which the arrested moment is but a single instant. In this sense, the waterfalls in his images can be characterized as *condensed chronophotographs*, that is to say time-lapse images of water falling that have been compressed into a single image rather than a succession of exposures, leaving an overexposed area on the emulsion as a trace of that mobility, which other photographers would be keen to dismiss as an imperfection. This is what Frampton means when he substitutes the spatial *cata*-ract with the temporal *tesse*-ract, the four-dimensional model of a cube that is often used to represent time alongside the three dimensions. (Latsis, 16-17)

cataract versus tesseract

Eadweard Muybridge, Base at Yosemite Lower Falls, Yosemite Valley, California, 1868



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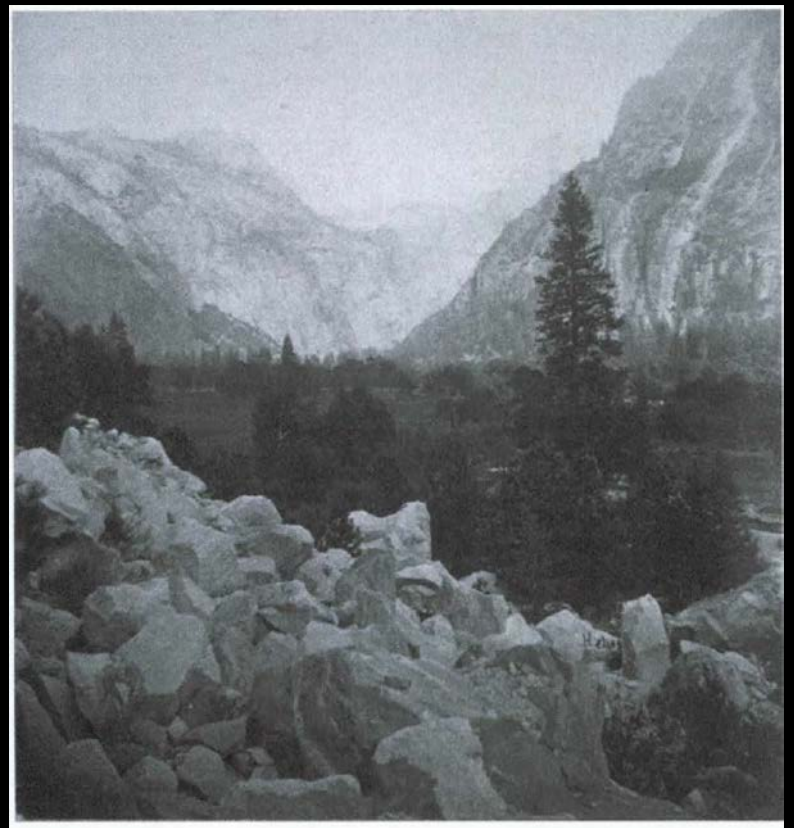


Fig. 5: Muybridge, *The Valley from the Base of Pompomparos* (one half of a stereograph), 1872. (Lone Mountain College Collection of Stereographs by Eadweard Muybridge, 1867–1880, Bancroft Library, UC Berkeley)

Muybridge, Contemplation Rock, Glacier Point, 1872

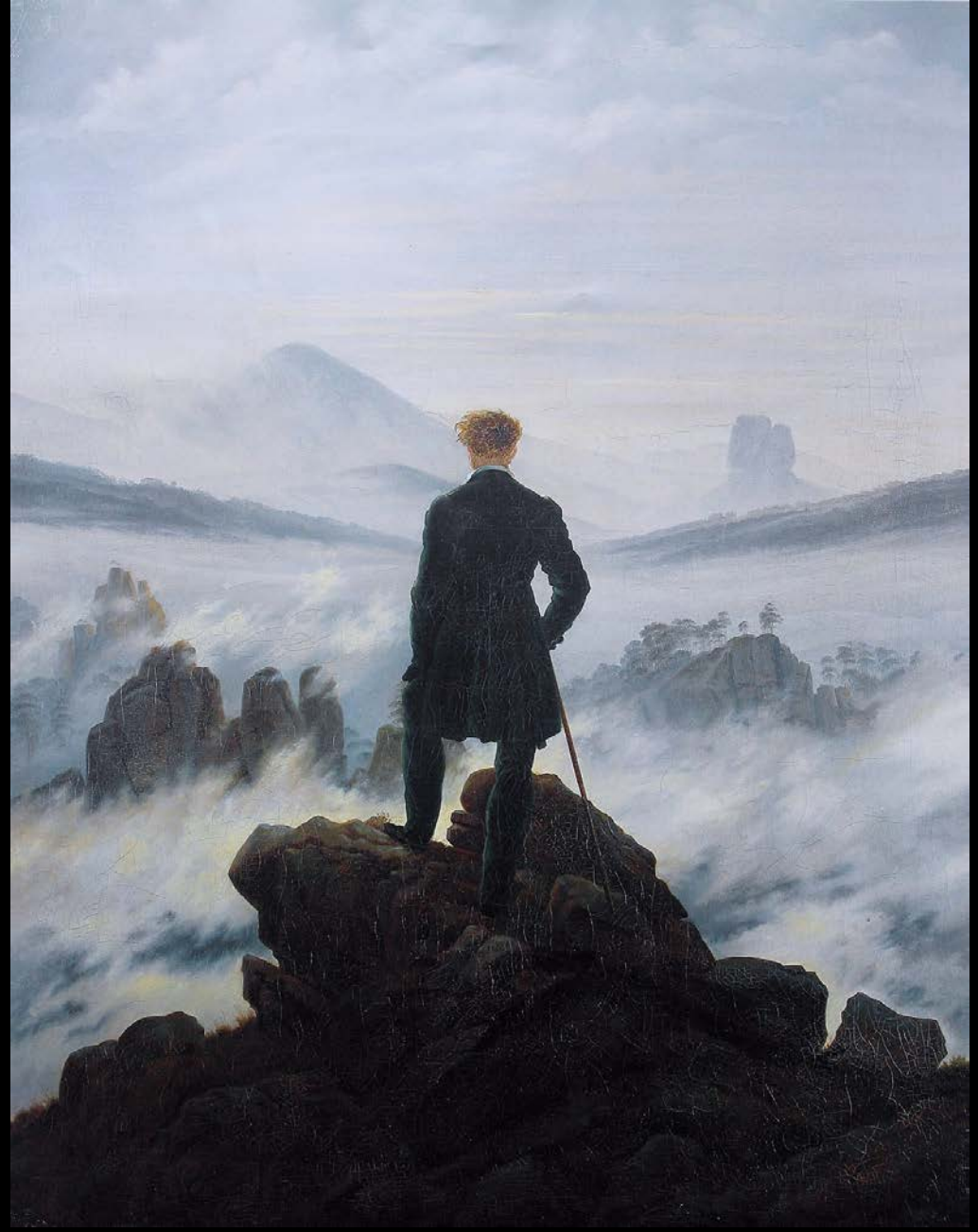
Muybridge, Granitic fissure in Eagle Rock, 1000 feet deep, Yosemite Valley, California, 1868

Muybridge, Beacon Rocks, Near Castle Rock Station, Echo Canyon, After A Snow Storm, 1868

Caspar David Friedrich, The Abbey in the Oakwood, 1809-10

Caspar David Friedrich, The Sea of Ice, 1823–24

- Romanticism
- Sublime
- Incommensurable nature



Caspar David Friedrich, Wanderer Above the Sea of Fog, 1818

Thomas Cole, Desolation, The Course of Empire, 1833-36

The Course of Empire – The Savage State; ***The Arcadian or Pastoral State***; ***The Consummation of Empire***; ***Destruction***; and ***Desolation***.

Thomas Cole, Desolation, The Course of Empire, 1833-36

A Modoc warrior is pictured in a stereoscopic series of photographs titled "The Modoc War" by Muybridge, 1870

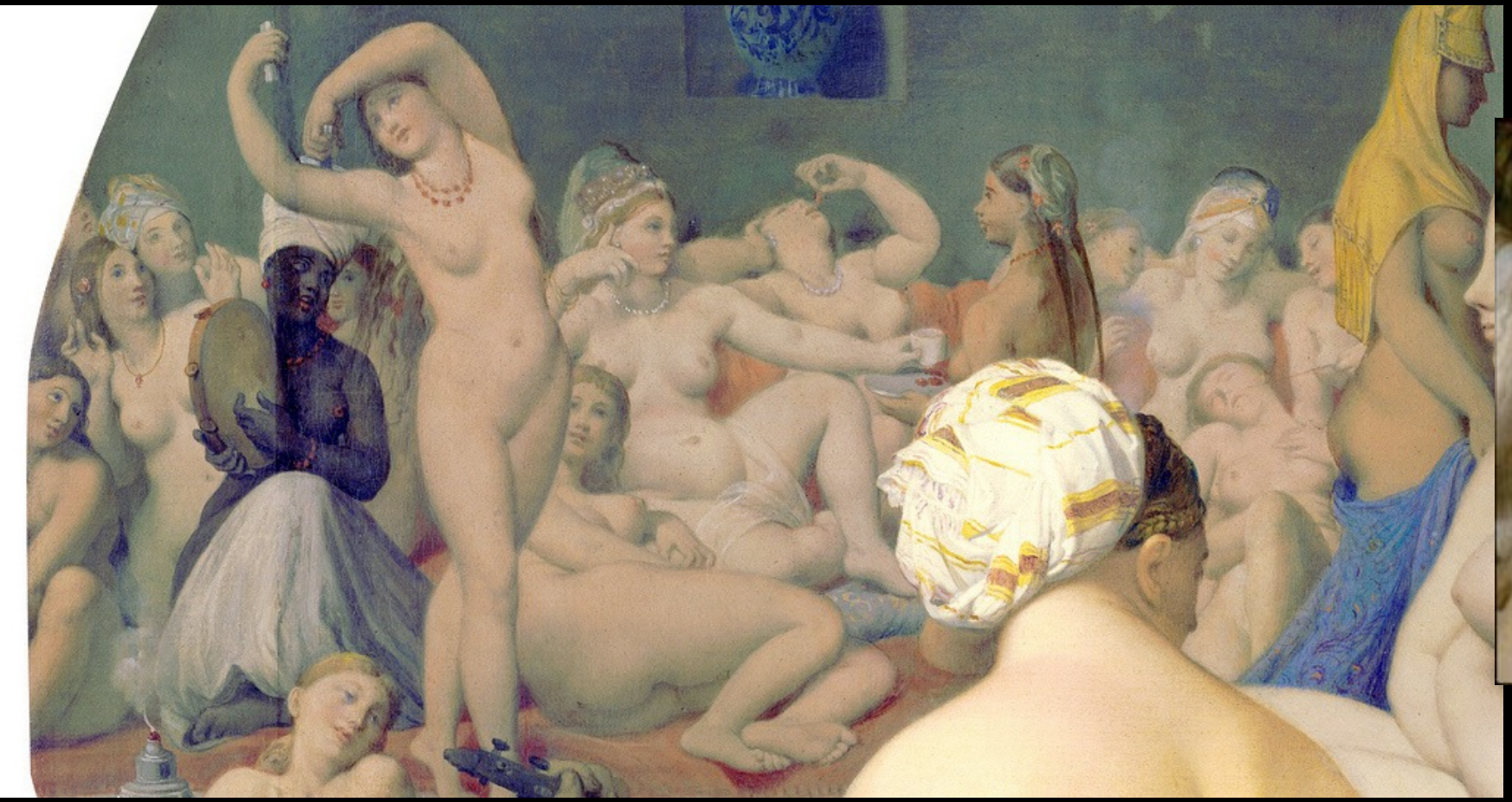
A Modoc people are pictured in the same stereoscopic series of photographs titled "The Modoc War" by Muybridge, 1870

Muybridge, Bath House in the Yosemite, 1870

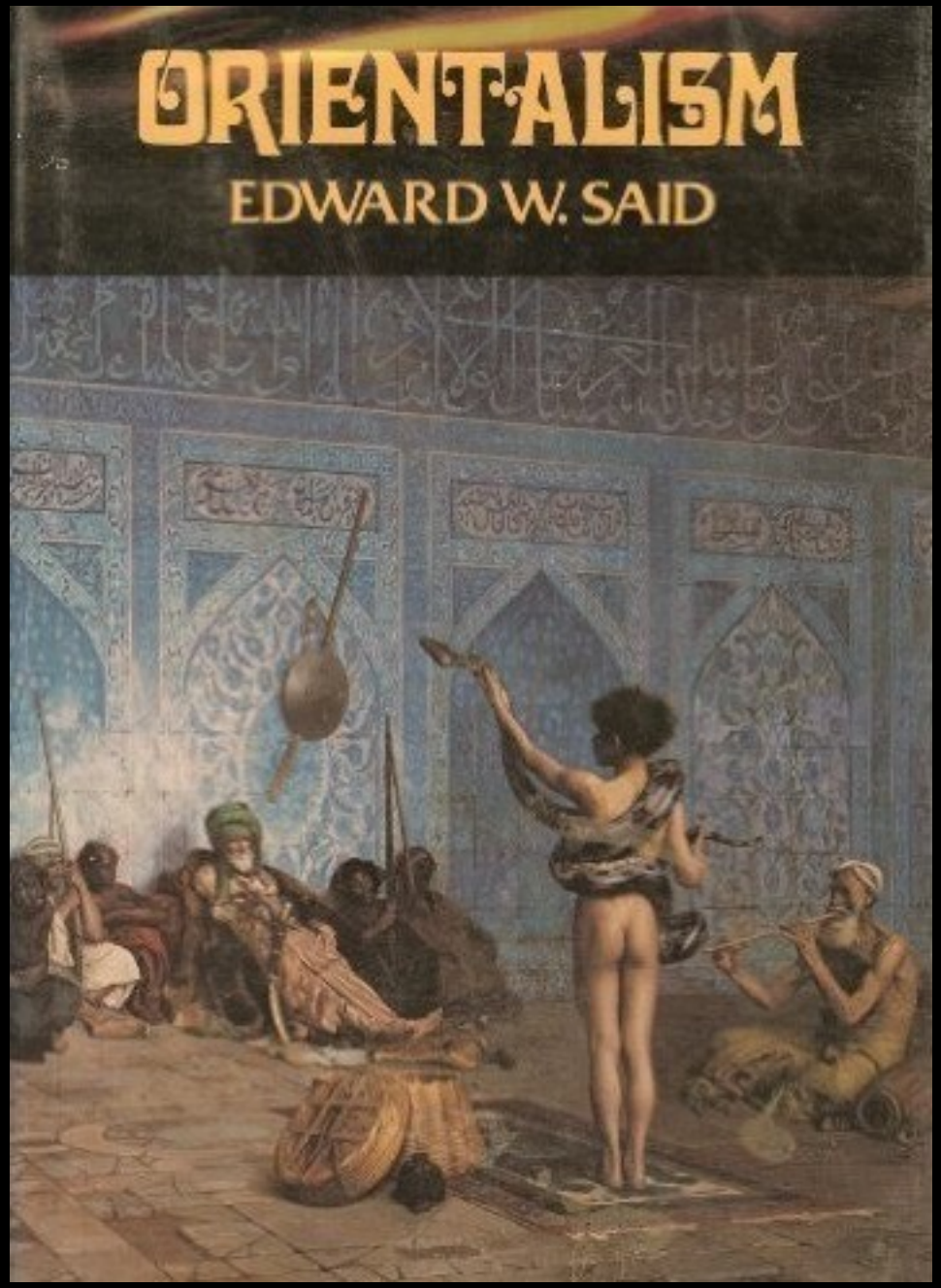
Are Muybridge’s photographs of Native Americans ‘othering’? Do they exoticize -- make humans into spectacles of aesthetic delectation? Is it a form of ‘Orientalism’?

Orientalist painting, representing "the Middle East ", was a genre of Academic art in the 19th century.

Jean-Auguste-Dominique **Ingres,** The Turkish Bath (Le Bain Turc), 1863



Orientalism
Stereotypes



Orientalism

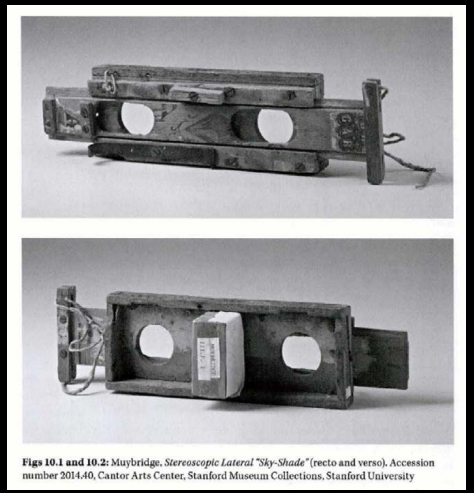
- In particular, Orientalist painting, representing "the Middle East ", was a genre of Academic art in the 19th century.
- ***Orientalism*** is a 1978 book by Edward W. Said which studies the cultural representations that are the bases of Orientalism, which Said defined as the West’s patronizing representations of ”The East" — the societies and peoples who inhabit the places of Asia, North Africa, and the Middle East. According to Said, orientalism (the Western scholarship about the Eastern World) is inextricably tied to the imperialist societies who produced it, which makes much Orientalist work inherently political and servile to power

Eadweard Muybridge, Lake Atitlan, Guatemala, 1875, published 1877

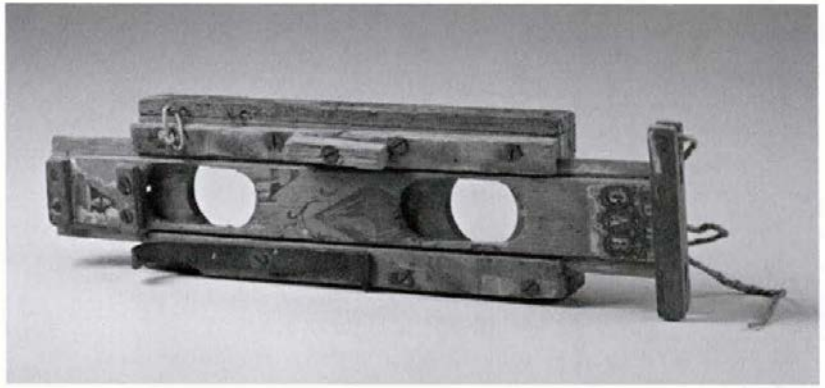
Eadweard Muybridge, Lake Amatitlán, Guatemala, 1875, published 1877

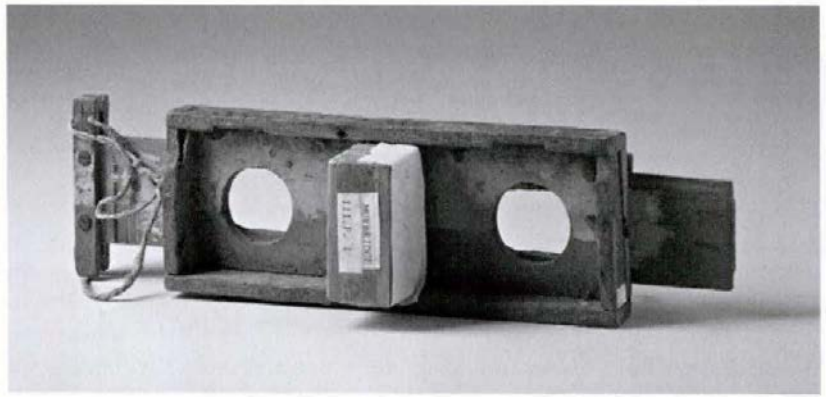
Frustrated by “the medium’s limitations, in 1869 [Muybridge] patented a camera sky shade so that he could expose his film separately for the sky and the subject below” gaining the definition between land and sky.

https://www.theguardian.com/artanddesign/2010/sep/04/eadweard-muybridge-exhibition-rebecca-solnit



Figs 10.1 and 10.2: Muybridge, *Stereoscopic Lateral "Sky-Shade"* (recto and verso). Accession number 2014.40, Cantor Arts Center, Stanford Museum Collections, Stanford University

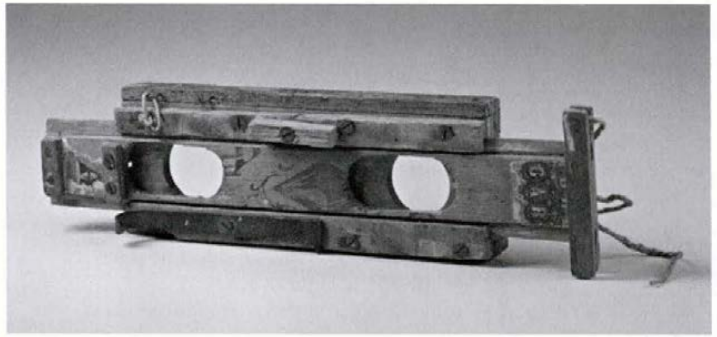


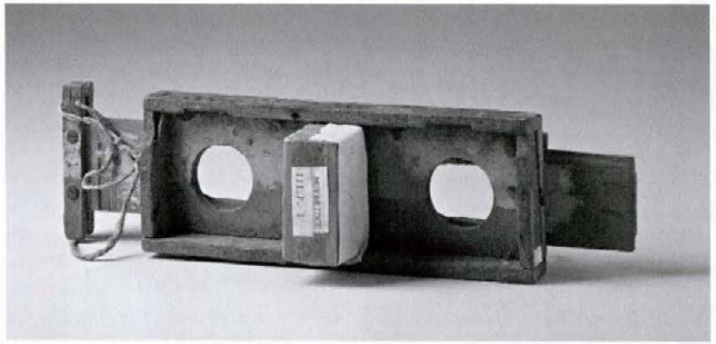


Figs 10.1 and 10.2: Muybridge, *Stereoscopic Lateral "Sky-Shade"* (recto and verso). Accession number 2014.40, Cantor Arts Center, Stanford Museum Collections, Stanford University

Sky-shade (1869)
chrono-collages (Latsis, 19)

The same picture from different albums, with varying cloud combinations. Eadweard Muybridge, *San Benito, Mexico, from the Steamer Honduras*. Triptych by Byron Wolfe, 2010. [Department of Special Collections, Stanford University Libraries; Niagara University Special Collections; Boston Athenaeum]

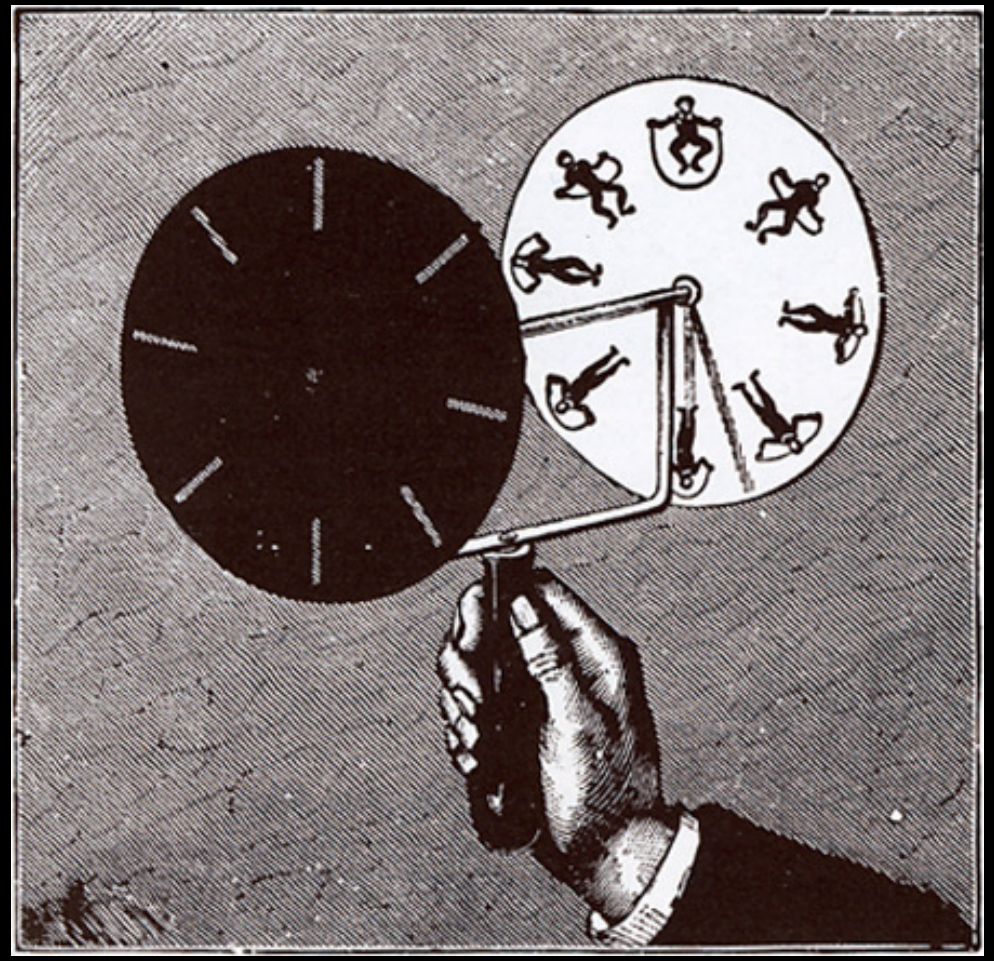


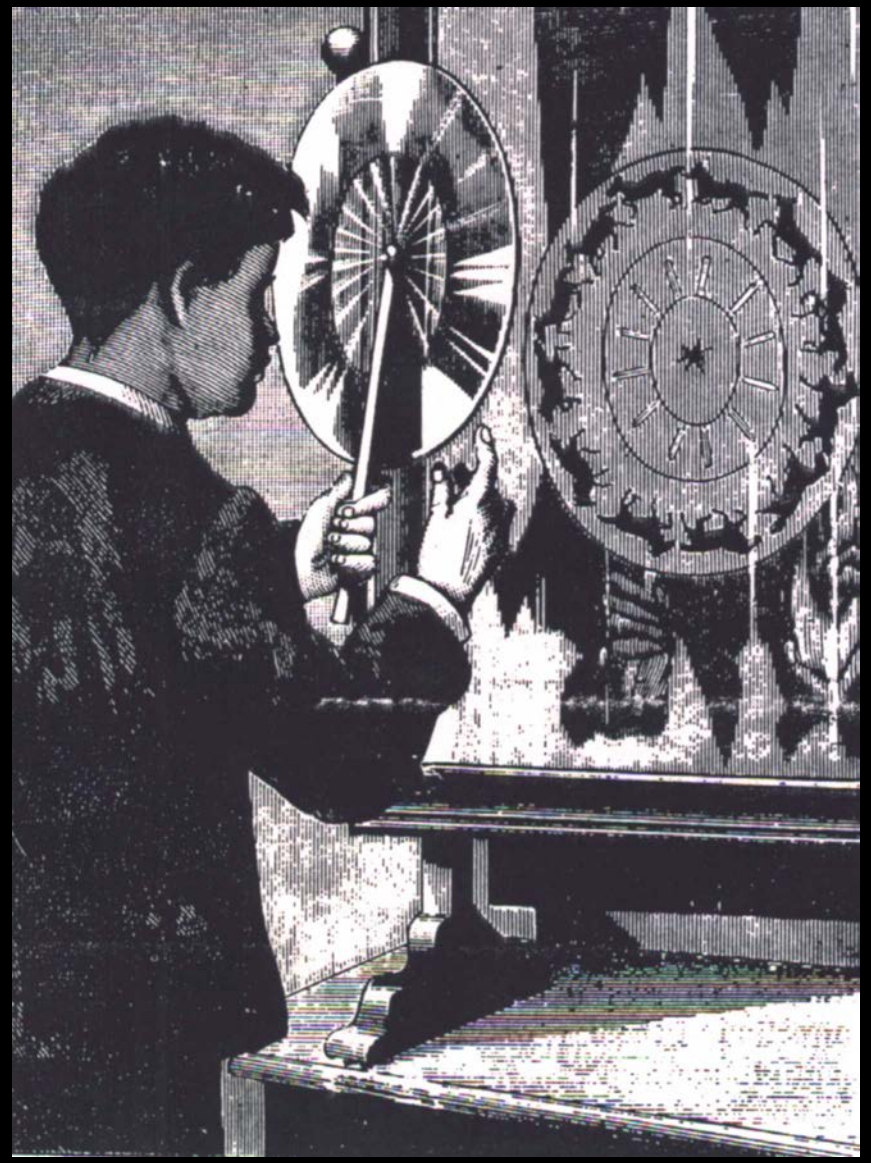


Figs 10.1 and 10.2: Muybridge, *Stereoscopic Lateral "Sky-Shade"* (recto and verso). Accession number 2014.40, Cantor Arts Center, Stanford Museum Collections, Stanford University

Muybridge was **restless with the medium's limitations**, in 1869 patenting the camera sky shade so that he could expose his film separately for the sky and the subject below (film in that era was so sensitive to blue light it routinely overexposed skies into blank whiteness). He added clouds and even the moon to many early landscapes, using the darkroom equivalent of Photoshop to doctor them. His images were themselves restless, seeking the chaotic, the startling, the moody, and the unsettling in his most personal work, the landscapes.

The same picture from different albums, with varying cloud combinations. Eadweard Muybridge, *San Benito, Mexico, from the Steamer Honduras*. Triptych by Byron Wolfe, 2010. [Department of Special Collections, Stanford University Libraries; Niagara University Special Collections; Boston Athenaeum]





Joseph Plateau and Simon von Stampfer,
Phenakistoscope, 1832

The word "phenakistoscope" comes from Greek roots meaning "optical deceiver" or "to cheat", as it deceives the eye by making the pictures look like an animation.


PATENT APPLIED FOR.
BY EADWEARD MUYBRIDGE.
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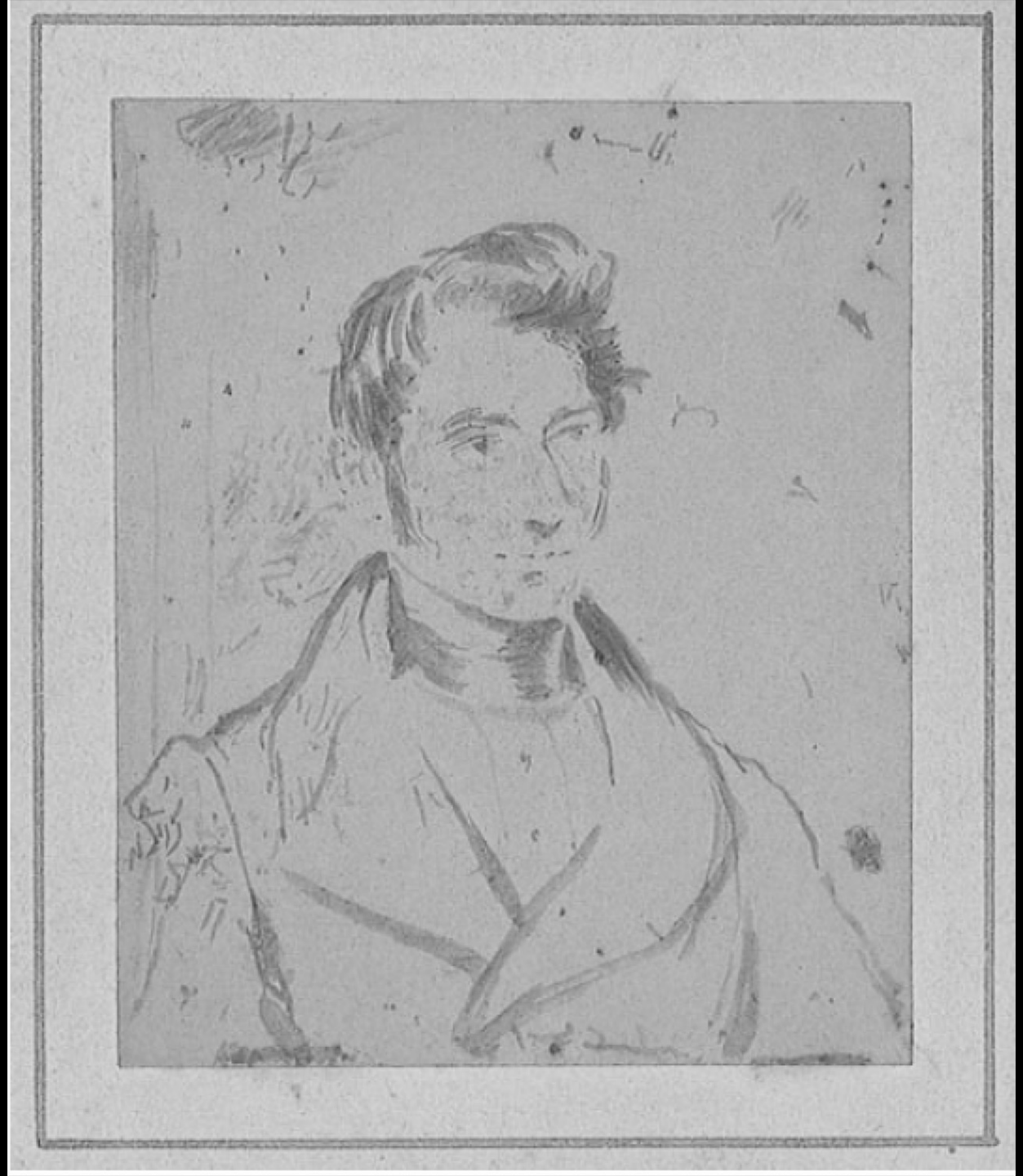
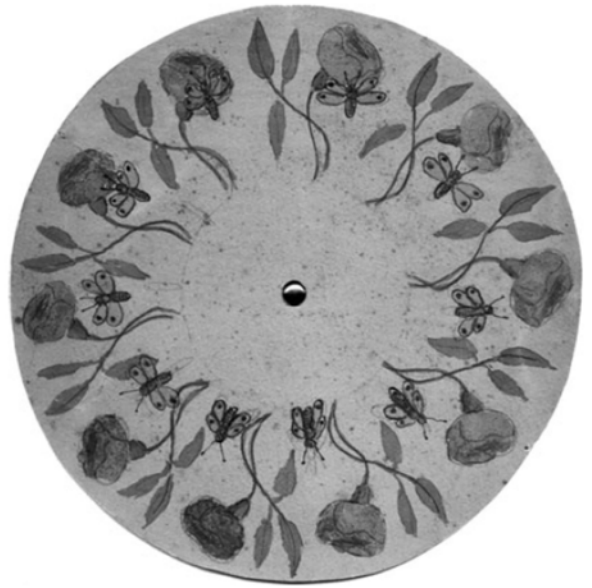
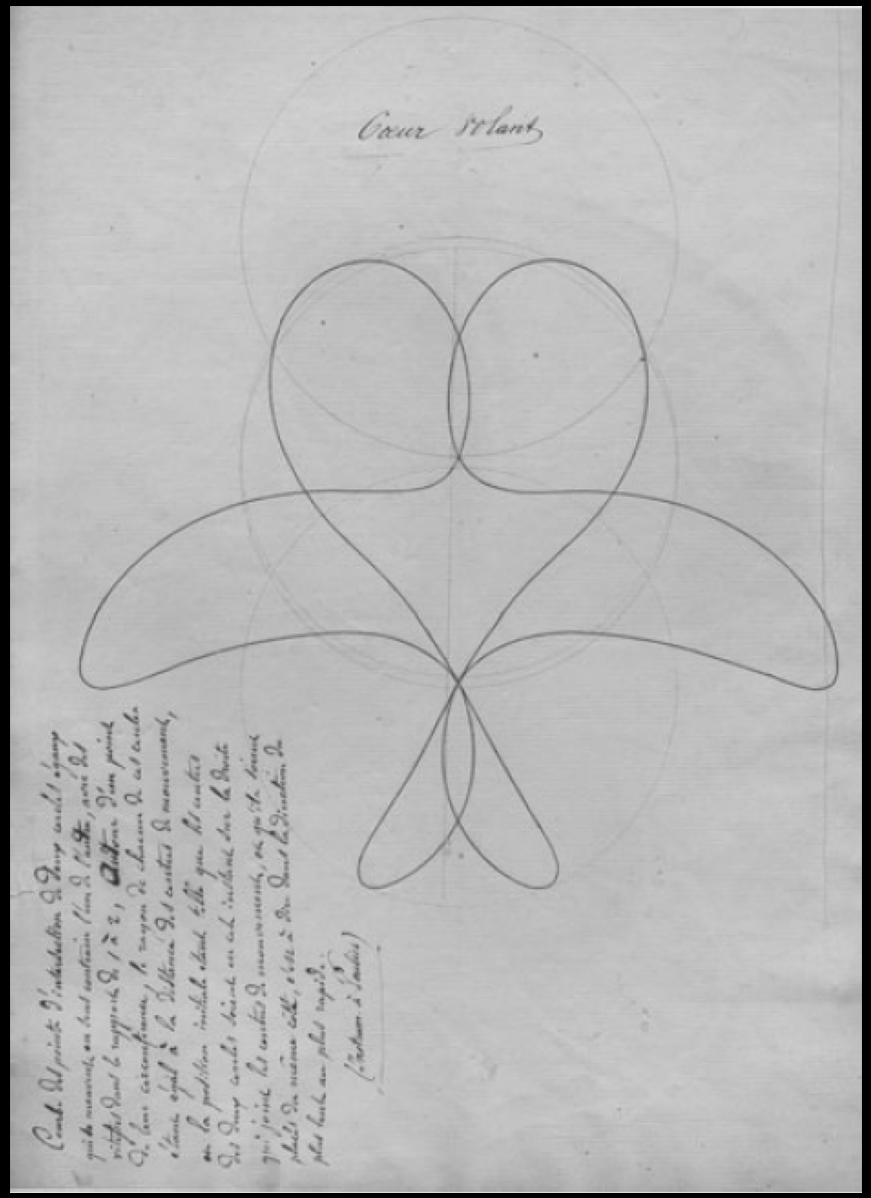
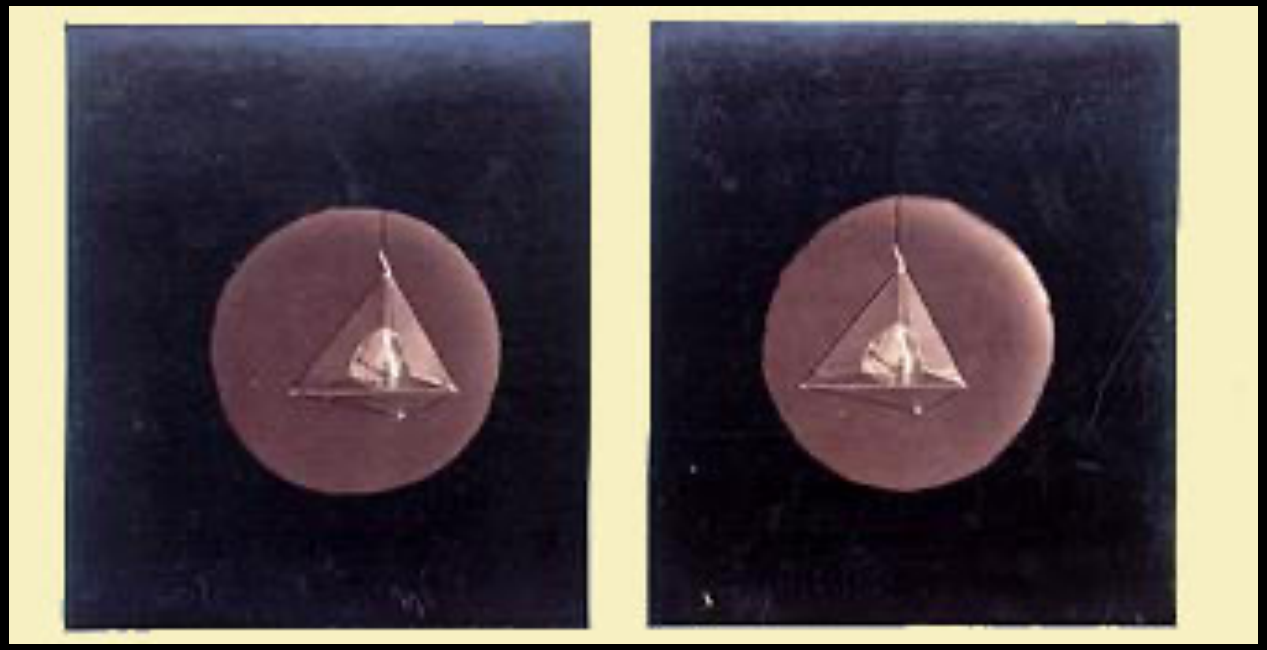
35
THE ZOOPRAXISCOPE

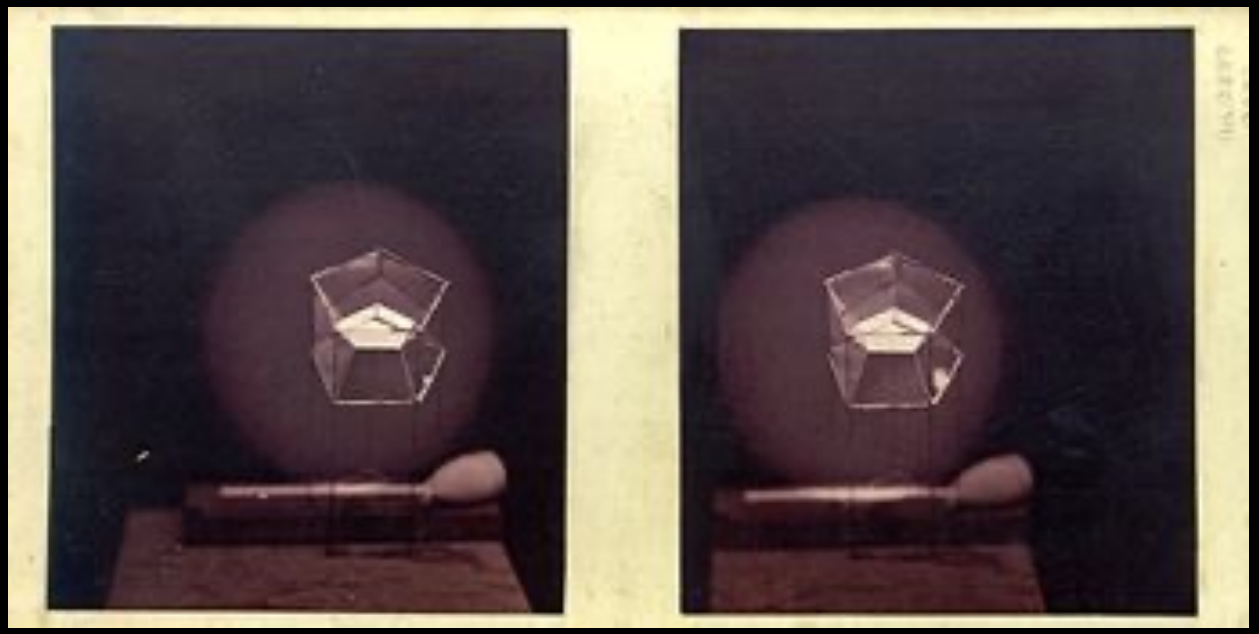


Left: Plateau, Portrait of mentor Adolphe Quetelet [1796-1874]
Center: Plateau, Anorthoscopic disks, c. 1830
Right: Plateau, Phenakistoscope disk, c. 1829



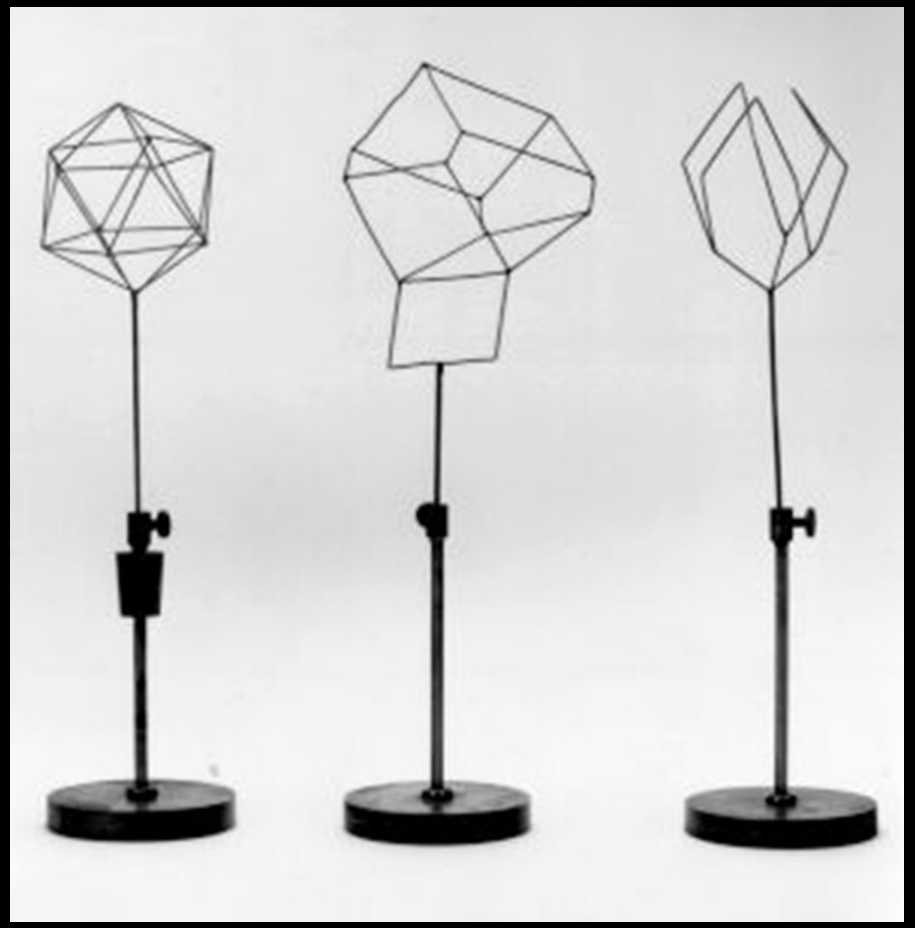


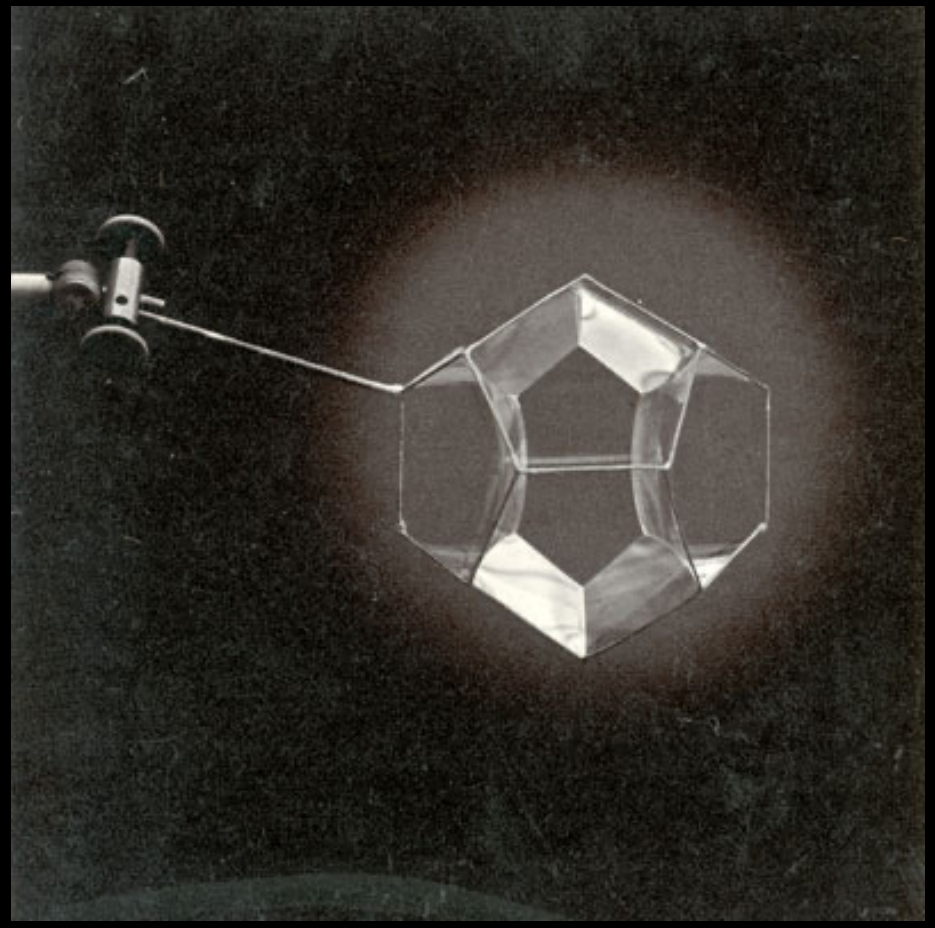




Left: Plateau, Flying Heart (Coeur volant), the locus of two identical circles rotating in opposite directions about a certain point on their circumference, determined by Plateau solely through mathematical analysis in 1828
Right: Stereo pictures of laminar soap films formed on the wire shapes by Plateau, Photo A.L. Neyt, Ghent, about 1880. Collection J.Plateau, Ghent

After submersion in "liquide glycérique", the figures in the stereoscopic images at top show a shape reminiscent of the calyx of a tulip.



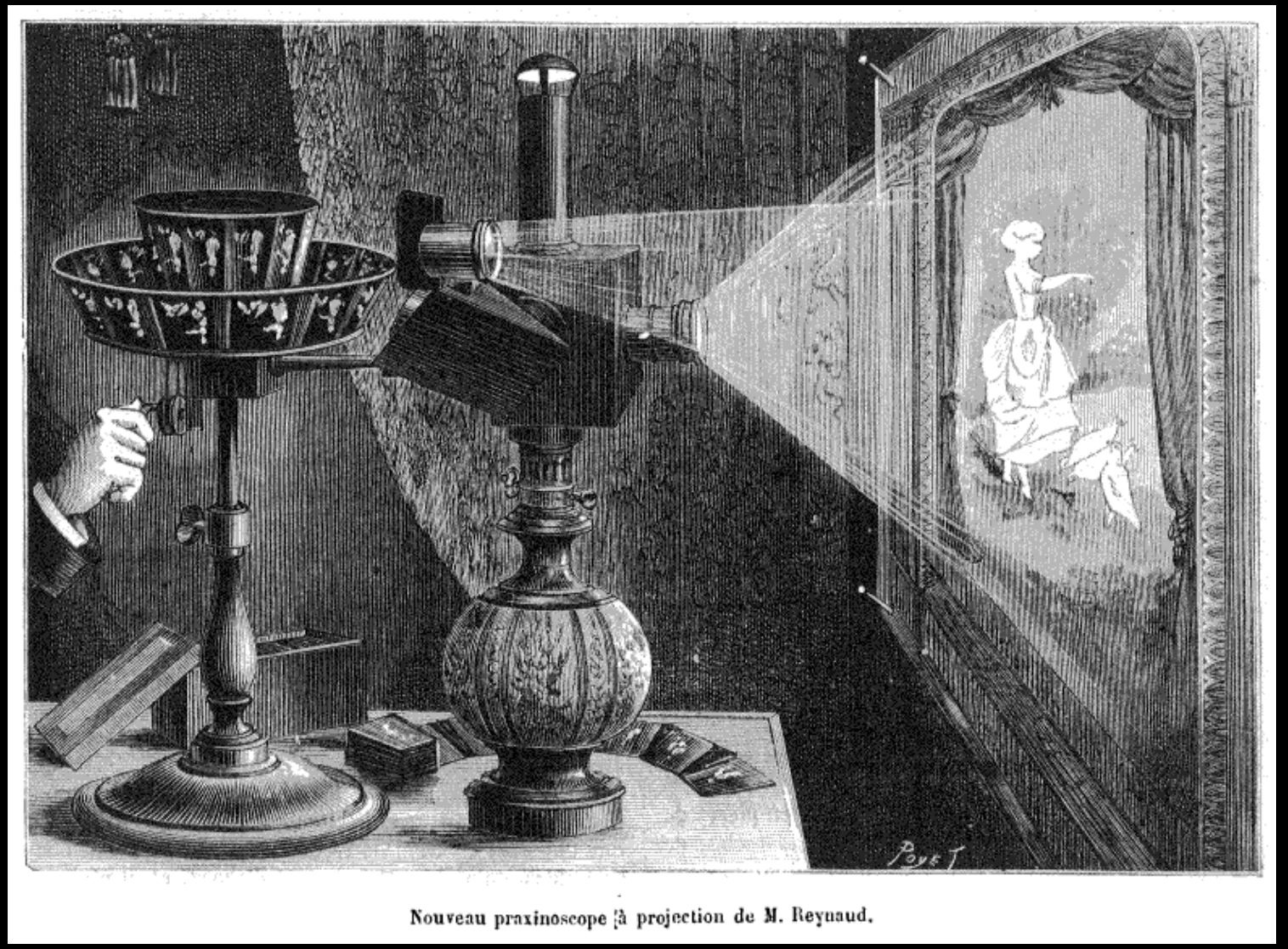


Wire figures for the study of soap films; Museum for the History of Sciences, Ghent
For his research concerning the laws governing the formation of laminar soap films Plateau has some 80 wire figures made.

The term zoetrope is from the Greek words zoe, "life" and trope, "turn". It may be taken to mean "wheel of life" or "living wheel."

William George Horner, Zoetrope (aka Daedaleum), 1833

Charles-Emile Reynaud, Praxinoscope, 1877



Nouveau praxinoscope à projection de M. Reynaud.

Charles Emile Raynaud, Praxinoscope, 1877 -- THEATRE OPTIQUE

Evolution of the Nickelodeon

Hermann Casler, Mutoscope, 1890-95

Flipped pictures while cranked

Persistence of Vision

A metaphor used to describe our ability to see continuously while blinking. Whenever light strikes the retina, the brain retains the impression of that light for about a 10th to a 15th of a second (depending on the brightness of the image, retinal field of view, and color) after the source of that light is removed from sight. This is due to a prolonged chemical reaction. As a result, the eye cannot clearly distinguish changes in light that occur faster than this retention period. The changes either go unnoticed or they appear to be one continuous picture to the human observer.

When we go to the movies, we know that a motion picture creates an illusion of a constantly lit screen by flashing individual photographs in rapid succession. Even though the movie screen appears to be constantly lit, it is in fact dark part of the time. It was the flickering image on the screen that gave rise to the term *flicks* in the early days of movies. Today's motion pictures flash images on the screen at 24 frames per second (or 48, in that each frame is flashed twice) for a flicker-free picture. You may remember making little "flipbooks" as a child. They worked on this same principle: the more images per second, the smoother the picture.

https://www.vision.org/visionmedia/philosophy-and-ideas/persistence-of-vision/136.aspx

As Thom Andersen asserts without naming it, for the principle of persistence of vision to be in operation, there needs to be a mechanism for the segmentation of an action into a series of images that are discreet yet close enough visually to (re)create the illusion of motion. This in turn can be translated into the problem of *intermittency*: the precise regulation of the intervals of light and (imperceptible) darkness that characterize every projection. (Latsis, 21)

How do we understand vision with respect to sound, smell, touch, and taste?

How is it anthropocentric to give primacy to vision?

PHYSIOLOGIE MÉDICALE

DE LA

CIRCULATION DU SANG

BASÉE

SUR L'ÉTUDE GRAPHIQUE DES MOUVEMENTS DU CŒUR

ET DU POULS ARTÉRIEL

AVEC

APPLICATION AUX MALADIES DE L'APPAREIL CIRCULATOIRE

PAR

LE Dr E. J. MAREY

Ancien interne des hôpitaux de Paris, lauréat de l'Institut et de la Faculté de médecine,
Membre des Sociétés anatomique, de biologie, philomathique, etc.

Avec 235 figures.

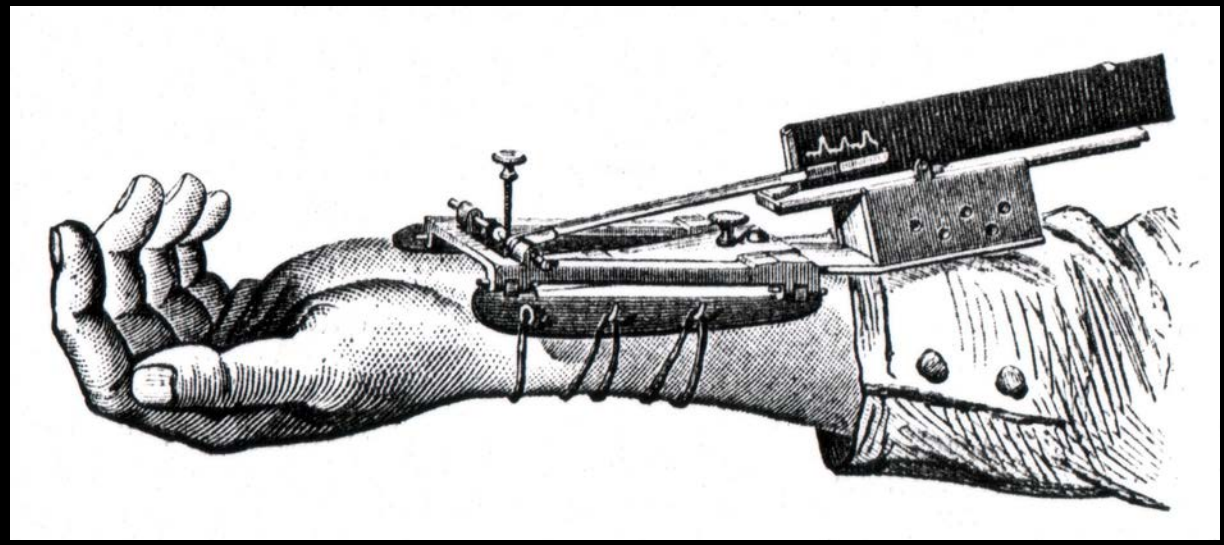
PARIS

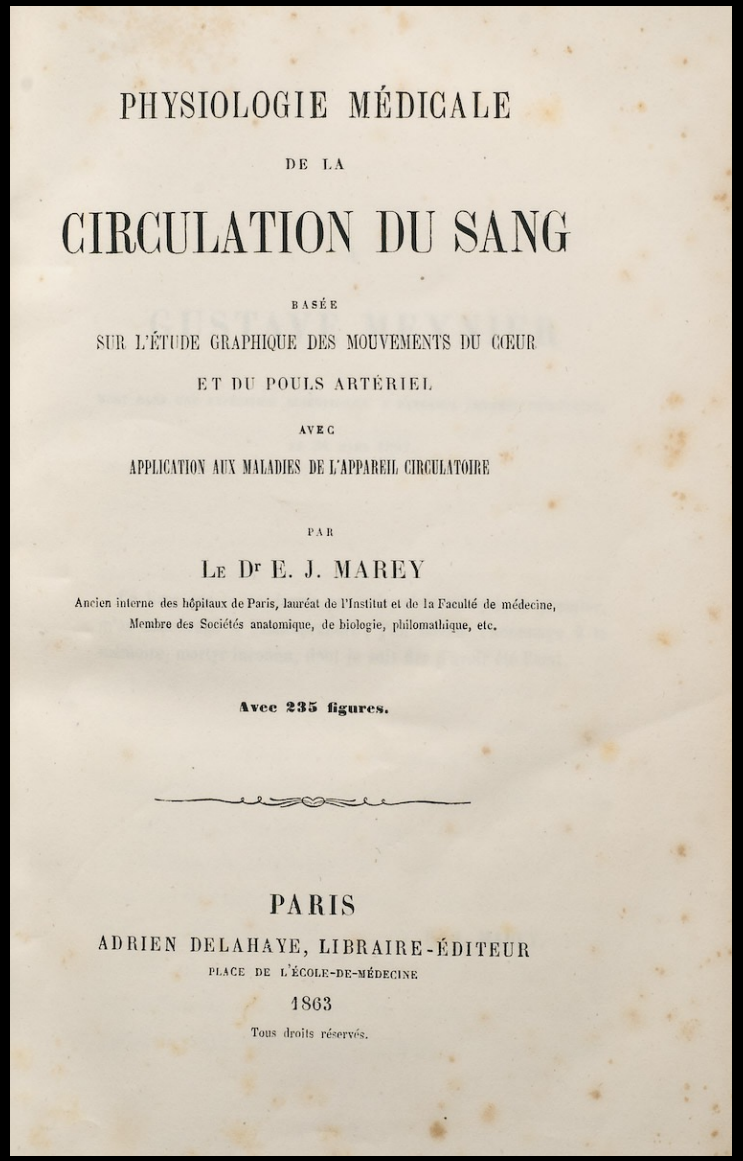
ADRIEN DELAHAYE, LIBRAIRE-ÉDITEUR

PLACE DE L'ÉCOLE-DE-MÉDECINE

1863

Left: Étienne-Jules Marey, *Medical Physiology of Blood Circulation*, 1863
Below: Étienne-Jules Marey, Marey Sphygmograph, 1860





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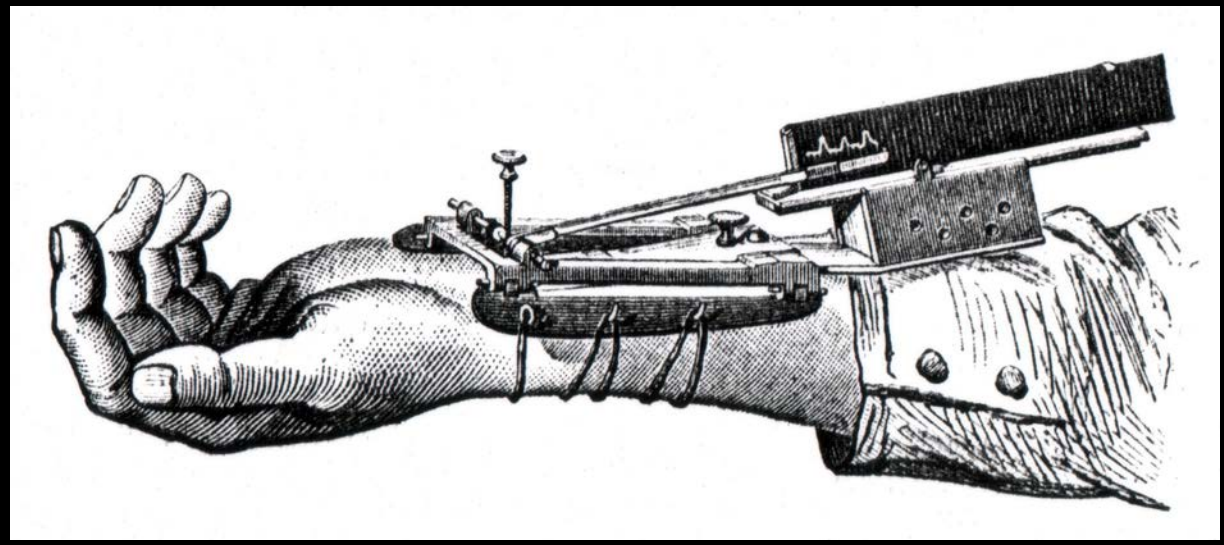
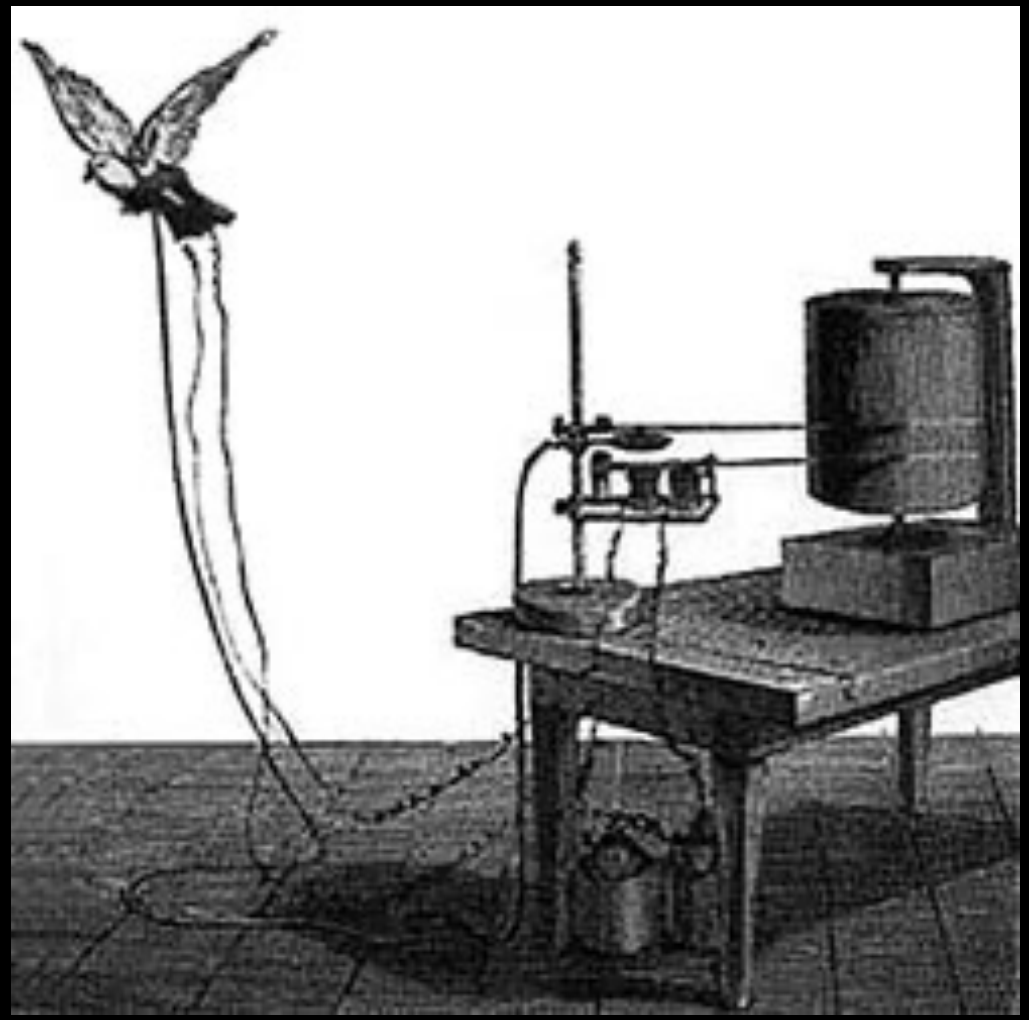
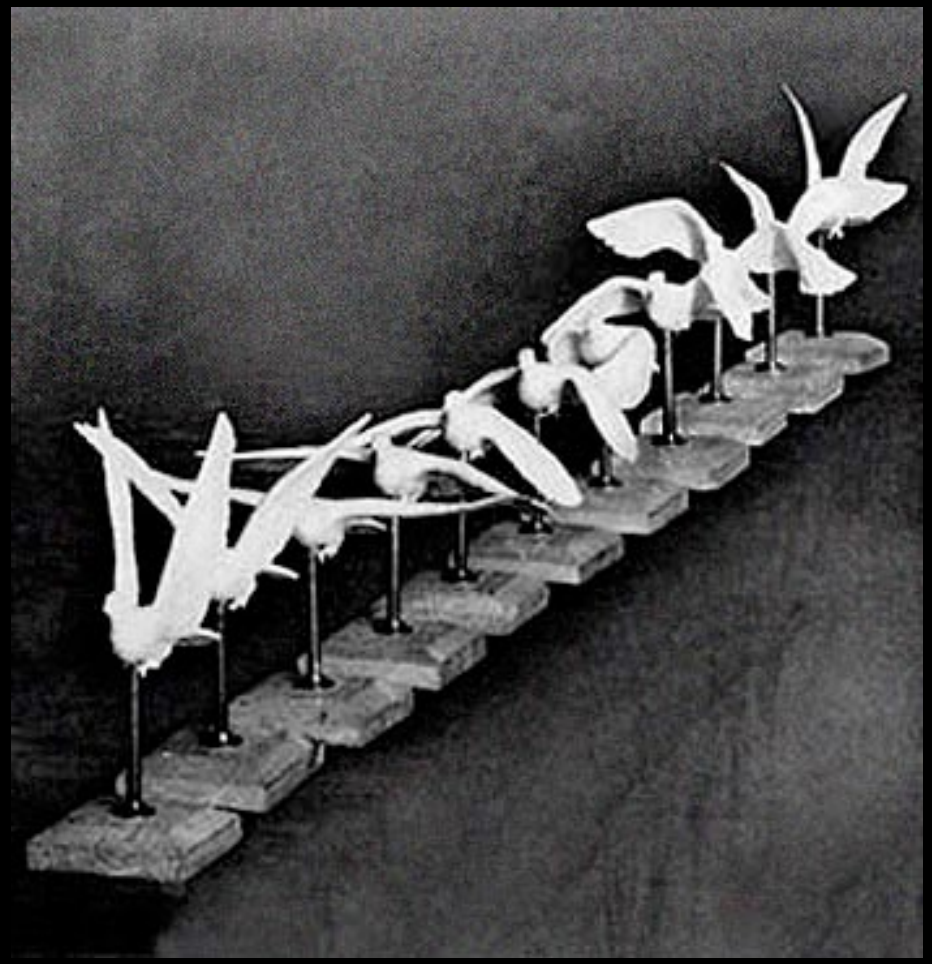
Marey's (1830-1904) interests within the burgeoning world of photography cast a wide net in terms of "mobility." Dr. Marey was a pioneer of blood pressure measurement and other physiological studies. He started by studying how blood moves in the body. Then he shifted to analyzing heartbeats, respiration, muscles (myography), and movement of the body. The first machine that could produce a paper record of blood pressure was introduced in 1847. Many other "sphygmographs" soon followed. In 1860, Marey described his own sphygmograph.





Left: Étienne-Jules Marey, insect flight machine, 1869
Right: Étienne-Jules Marey, air pantographe, 1870

During the 1860s Marey threw himself into the study of flight, first of insects and then birds. His aim was to understand how a wing interacted with the air to cause the animal to move. In 1869, Marey constructed a special machine to demonstrate the flight of an insect and the figure-eight shape produced by its wings during flight. It featured an artificial insect, with a body formed by a drum containing compressed air, that could move up, down, and diagonally. Marey next developed the "air pantographe," a device used to study a live bird in flight. The device consisted of a large rotating arm on which he could a live, instrumented bird. The bird was fitted with a small corset and carried a small piece of wood on its back, which in turn was attached to the actual "pantographe."



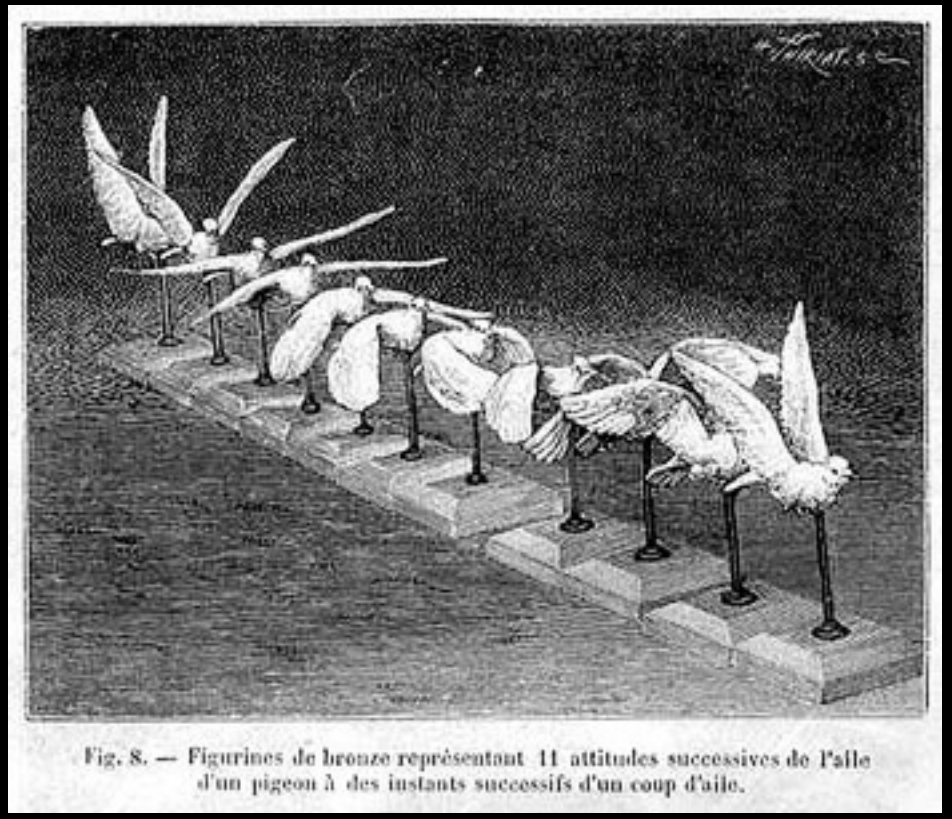
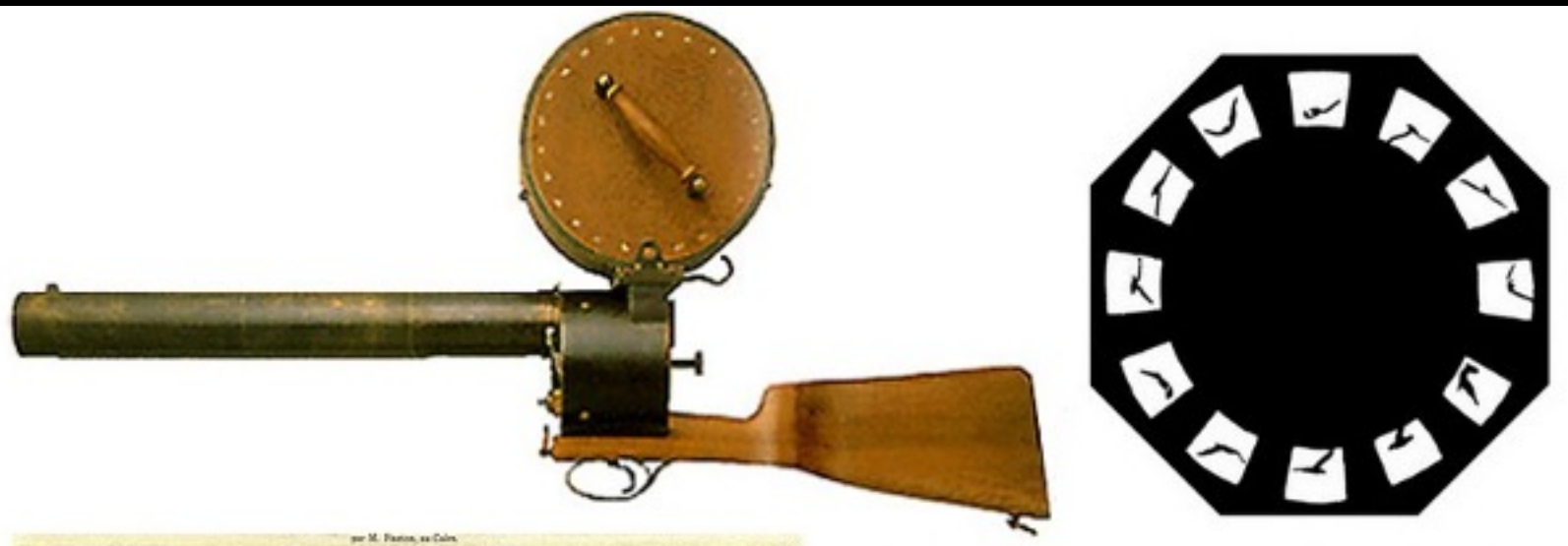
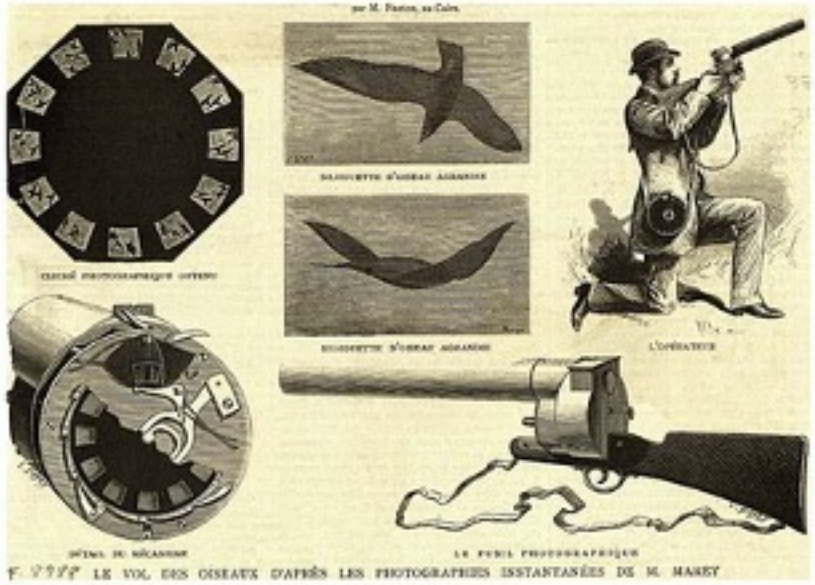


Fig. 8. — Figurines de bronze représentant 11 attitudes successives de l'aile d'un pigeon à des instants successifs d'un coup d'aile.

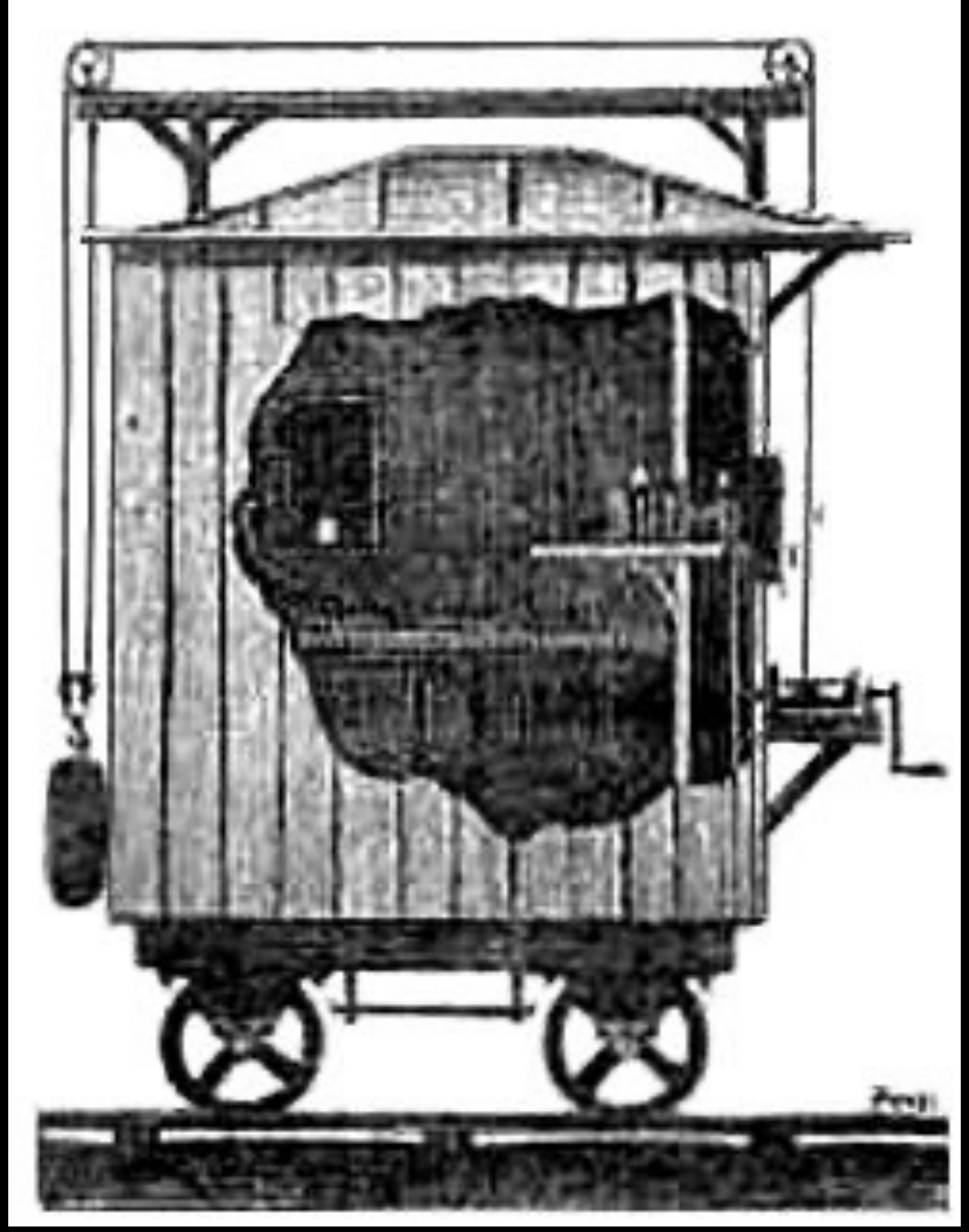
Étienne-Jules Marey, Sculptures of birds in flight, 1887-1890



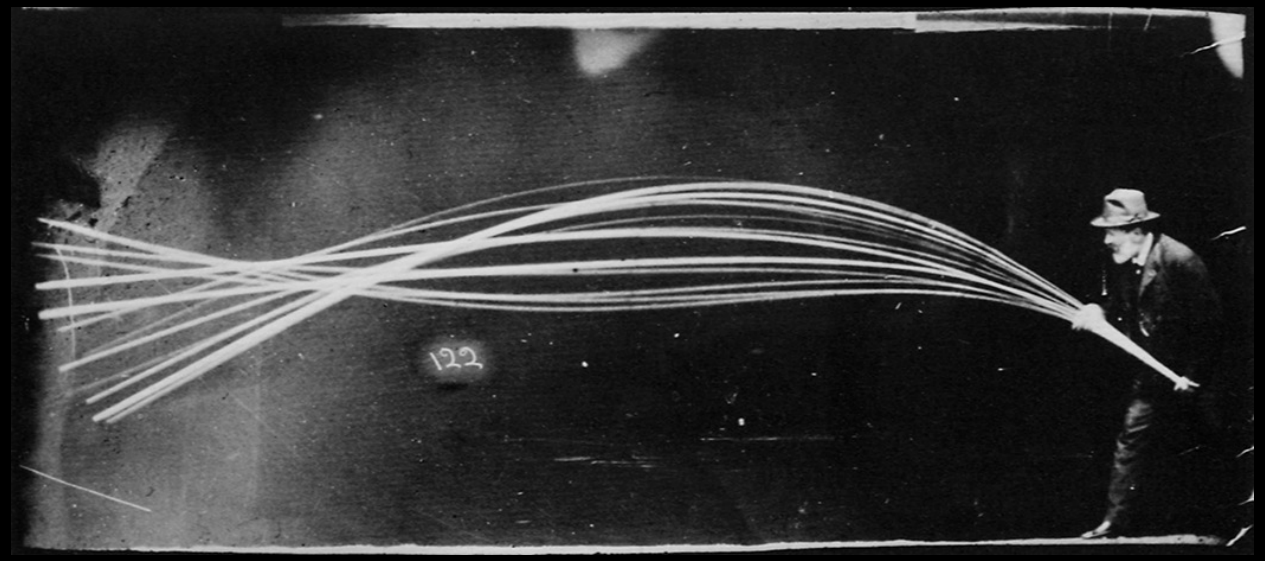


Étienne-Jules Marey, Chronophotographic Camera Gun, 1882

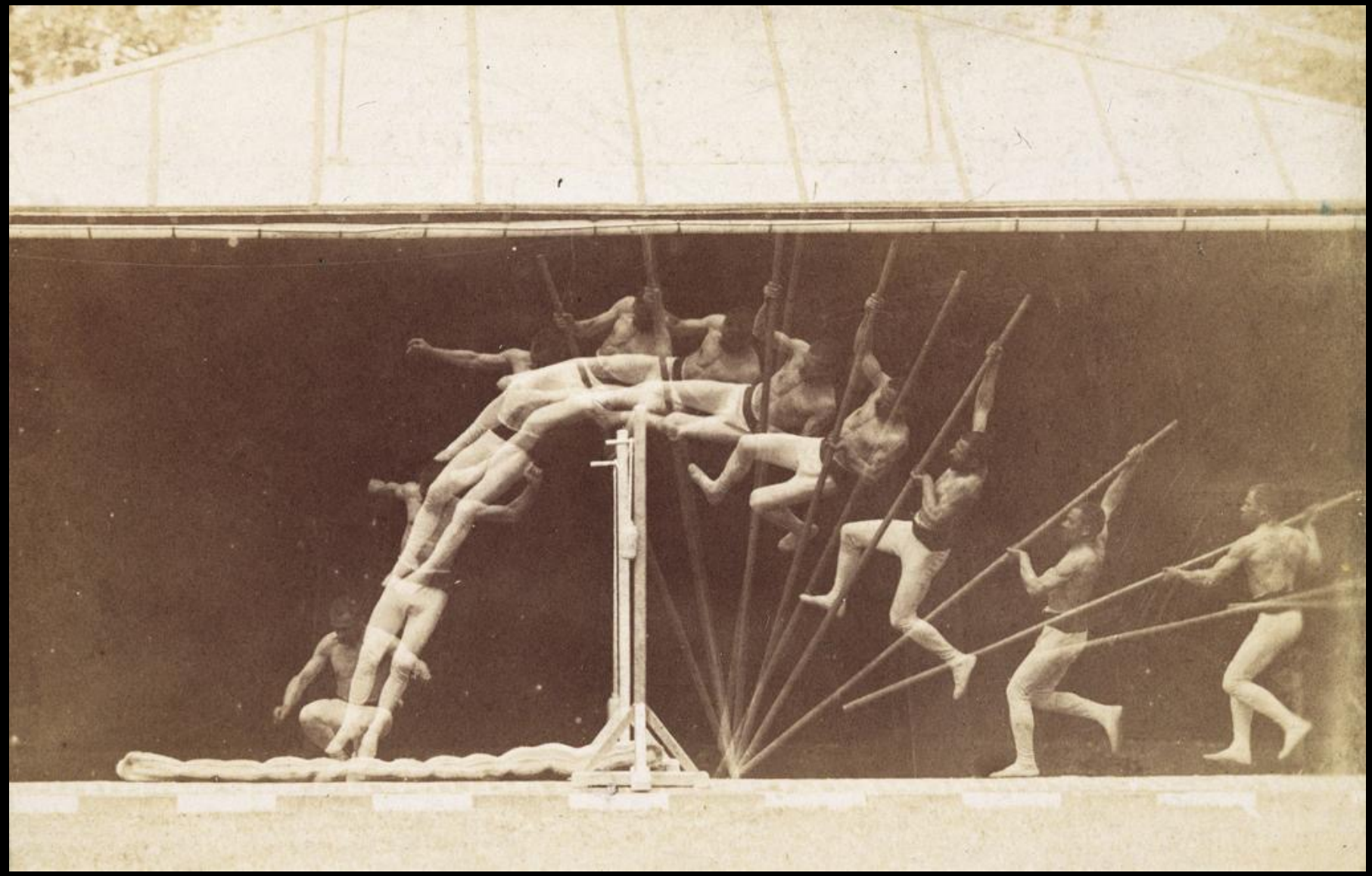
The "fusil photographique" ("photographic gun"), which was capable of taking twelve exposures per second. The images, each about the size of a postage stamp, were arranged around the edge of a revolving circular photographic plate. Equipped with a sight and clock mechanism, he was able to use the device to photograph live birds in free flight.



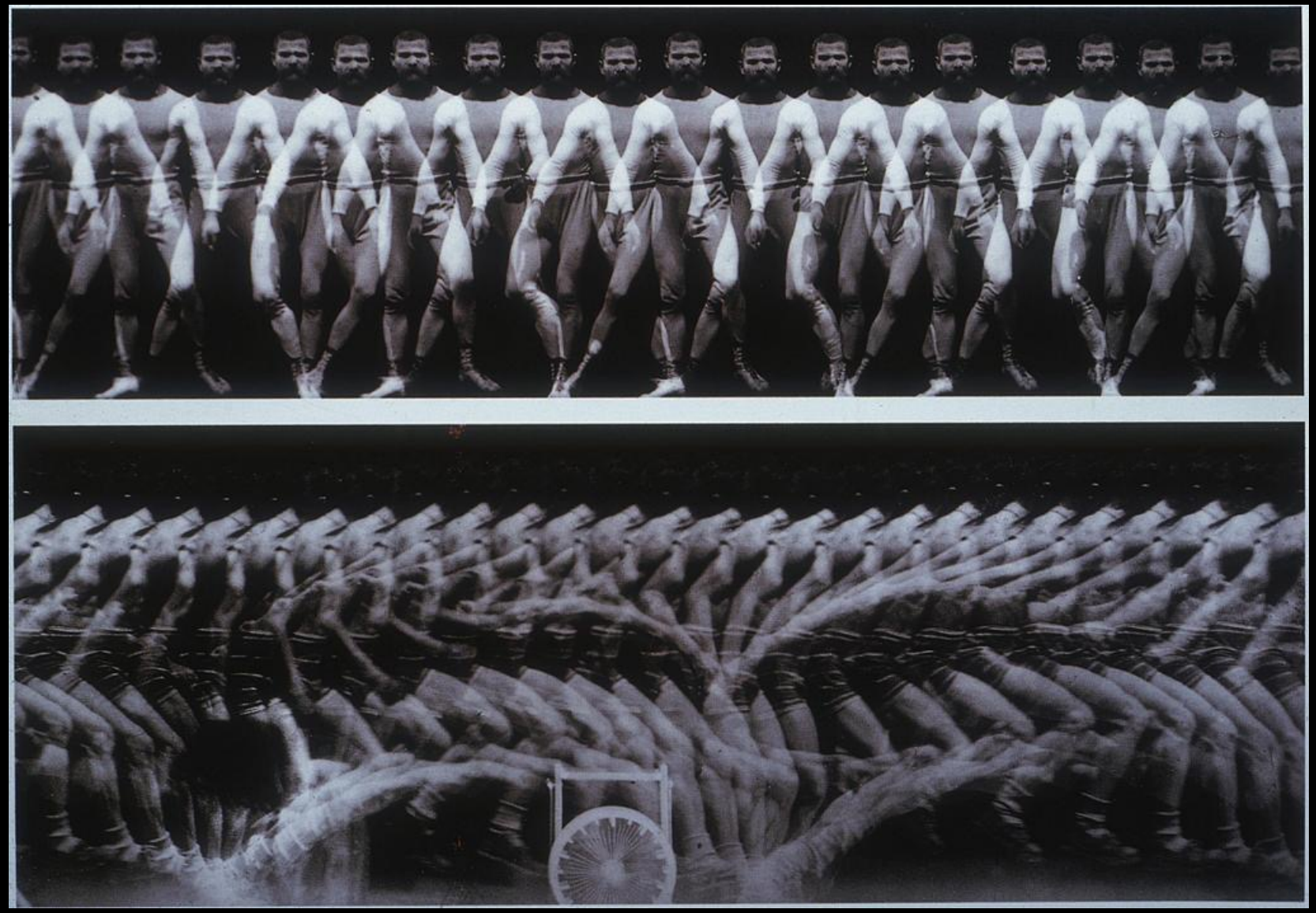
Étienne-Jules Marey, camera for chronophotography in box on wheels, c. 1885



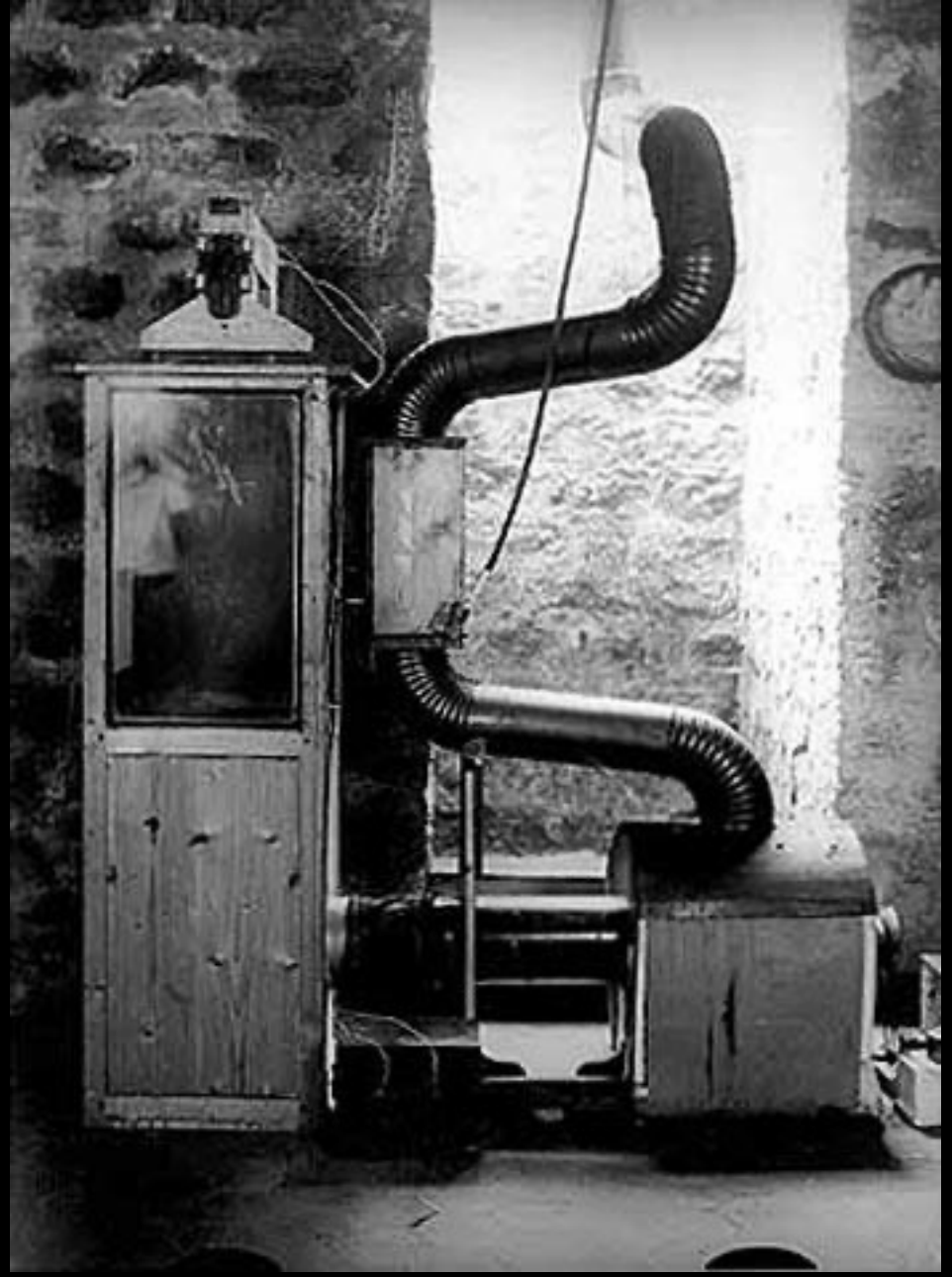
Marey shaking a flexible rod (1886)



Etienne Jules Marey, Chronophotographic Study of Man Vaulting, 1890-91

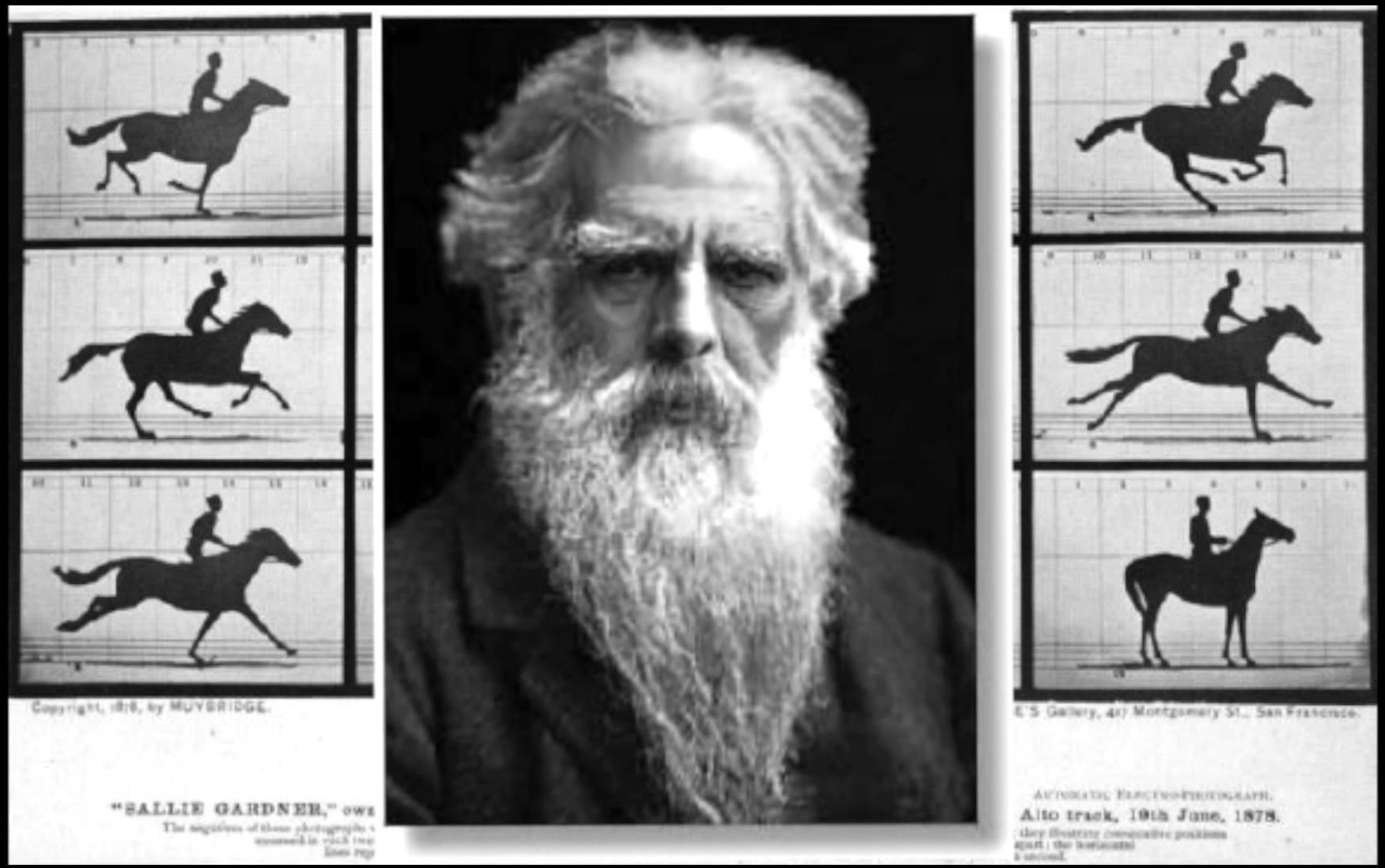


Etienne Jules Marey, Study of Lateral Walking and Running, 1886



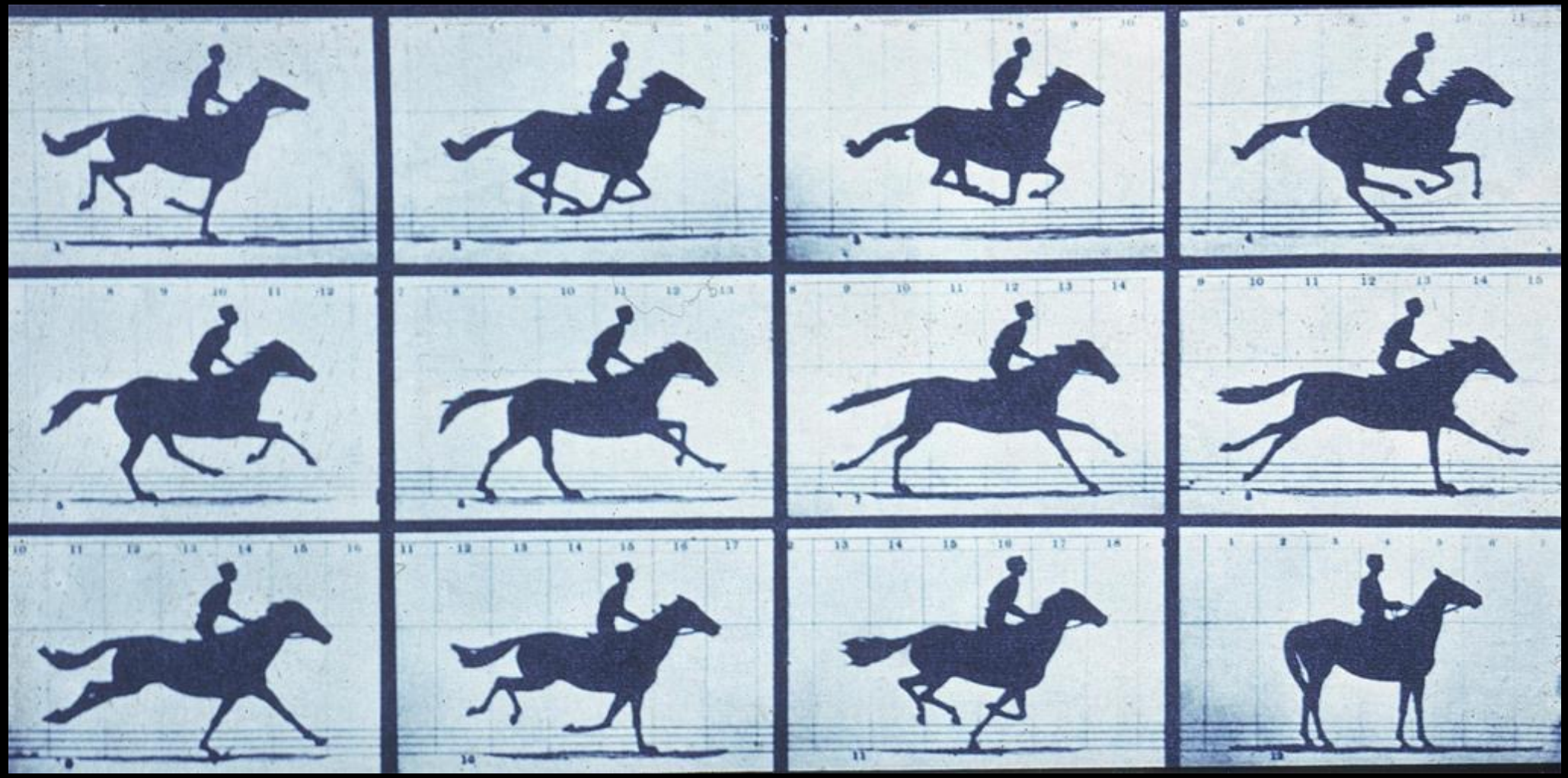
In 1901, Marey built a machine capable of producing 58 separate smoke trails. A chronographic camera was placed in front of a box closed by a transparent glass sheet. The smoke trails passed in front of a black velvet background, and were illuminated by a magnesium flash while instantaneous images were taken of the smoke trails. An obstacle could be placed in the middle of the trails, allowing the viewer to observe how different shapes affected the air flow.

Étienne-Jules Marey, machine for studying smoke trails and image of smoke trails, 1901

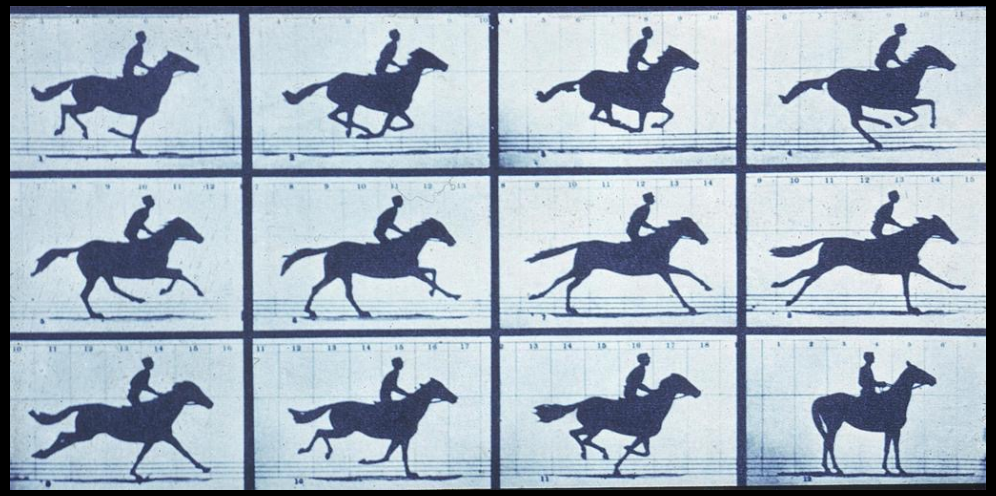


Eadweard Muybridge (1830-1904), born Edward James Muggeridge

aka “Helios”

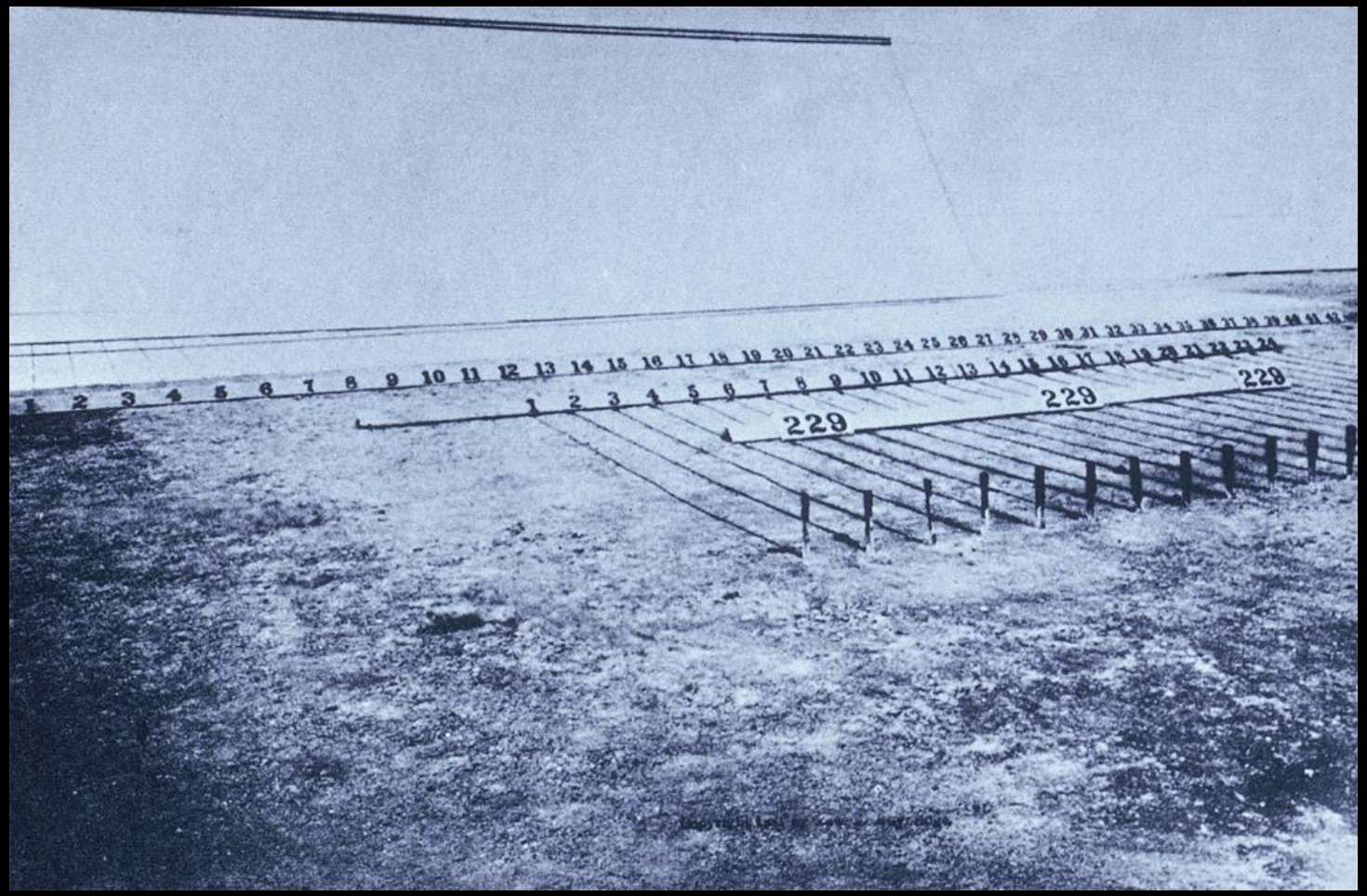


Eadweard J. Muybridge, Galloping horse (Sallie Gardner running), 1878



Eadweard J. Muybridge, Galloping horse (Sallie Gardner running), 1878

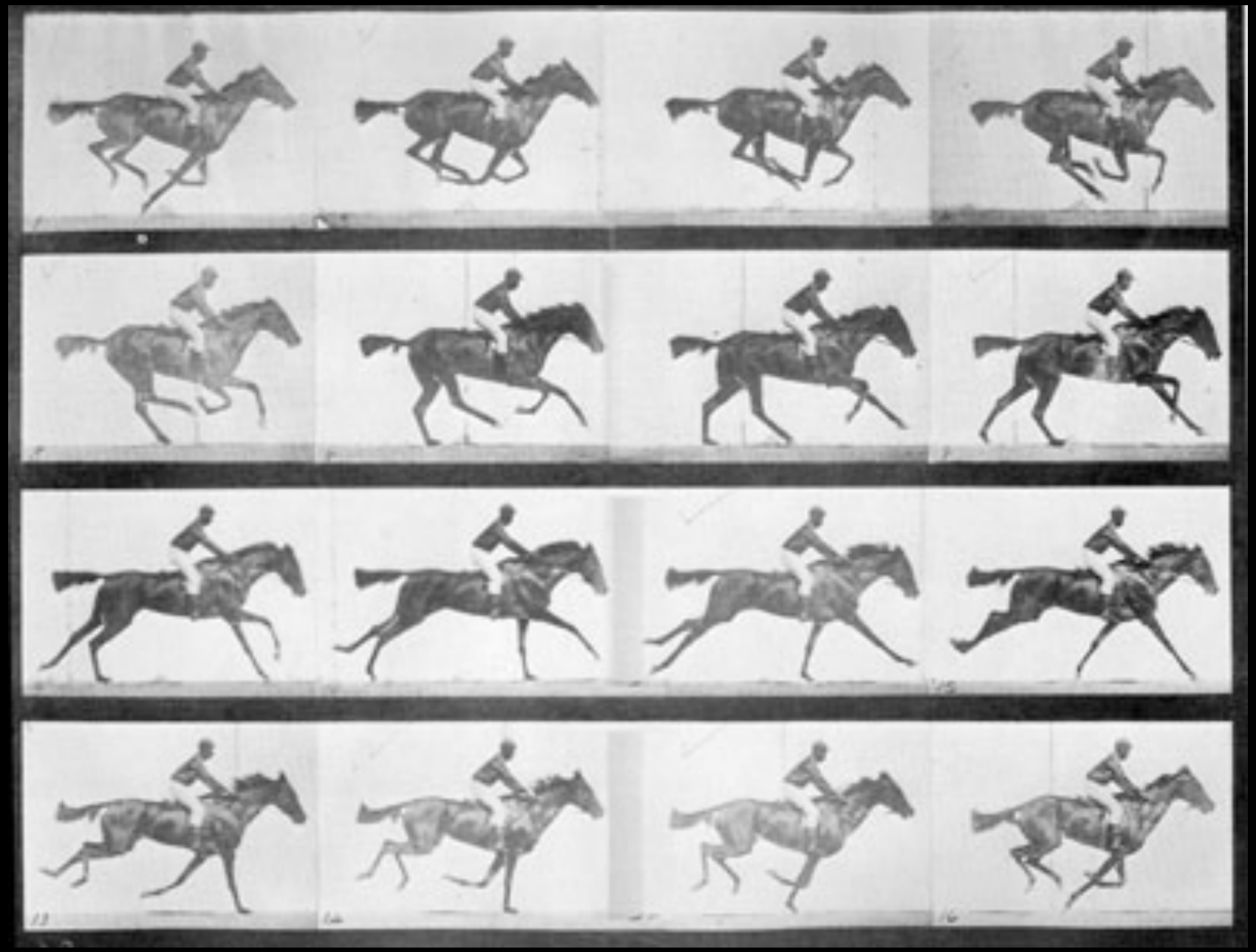
In 1872, former Governor of California Leland Stanford, a businessman and race-horse owner, had taken a position on a popularly-debated question of the day: whether all four of a horse's hooves left the ground at the same time during a gallop. Stanford sided with this assertion, called "unsupported transit", and took it upon himself to prove it scientifically. (Though legend also includes a wager of up to $25,000, there is no evidence of this.) Stanford sought out Muybridge and hired him to settle the question. To prove Stanford's claim, Muybridge developed a scheme for instantaneous motion picture capture.

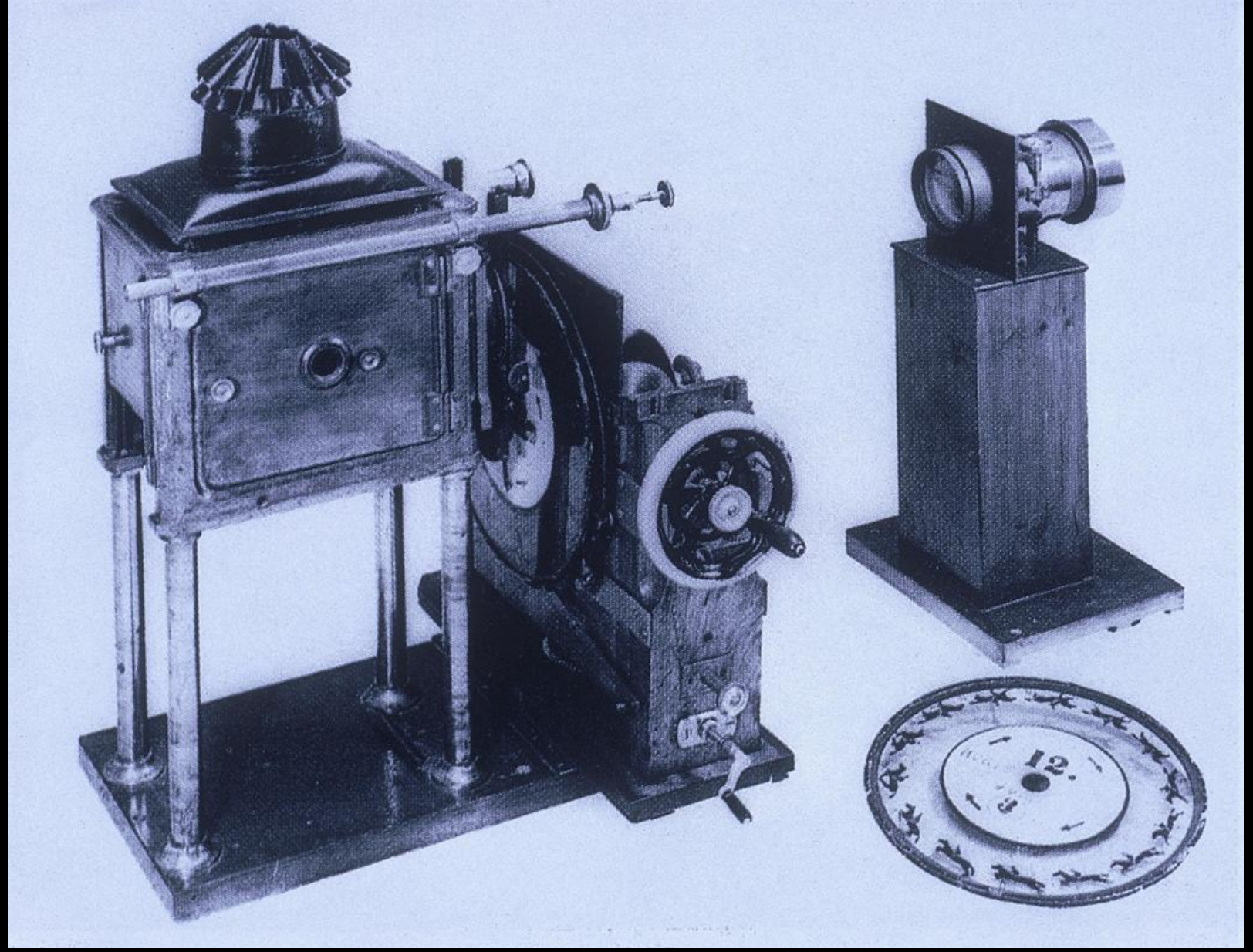


Muybridge's Stanford photographic facility, 1863

Locomotion of a horse and
“unsupported transit”

Muybridge's technology involved chemical formulas for photographic processing and an electrical trigger created by the chief engineer for the Southern Pacific Railroad, John D. Isaacs. In 1877, Muybridge settled Stanford's question with a single photographic negative showing Stanford's racehorse Occident airborne in the midst of a gallop. This negative was lost, but it survives through woodcuts made at the time. By 1878, spurred on by Stanford to expand the experiment, Muybridge had successfully photographed a horse in fast motion using a series of twenty-four cameras. The first experience successfully took place on June 11 with the press present. Muybridge used a series of 12 stereoscopic cameras, 21 inches apart to cover the 20 feet taken by one horse stride, taking pictures at one thousandth of a second. The cameras were arranged parallel to the track, with trip-wires attached to each camera shutter triggered by the horse's hooves.



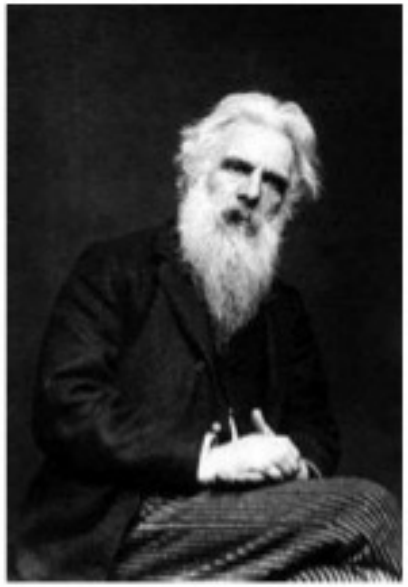


Eadweard J. Muybridge, Zoopraxiscope, c. 1870 – first movie projector
The zoopraxiscope projected images from rotating glass disks in rapid succession to give the impression of motion.

Who was Eadweard Muybridge?

Born in April 1830, Eadweard Muybridge was an English photographer important for his pioneering work in photographic studies of motion, and early work in motion-picture projection.

Today, Muybridge is known for his pioneering work on animal locomotion in 1877 and 1878, which used multiple cameras to capture motion in stop-motion photographs, and his zoopraxiscope, a device for projecting motion pictures that pre-dated the flexible perforated film strip used in cinematography.



Why is he important in Animation?

The zoopraxiscope is an early device for displaying motion pictures; it may be considered the first movie projector. The zoopraxiscope projected images from rotating glass disks in rapid succession to give the impression of motion. The stop-motion images were initially painted onto the glass, as silhouettes. A second series of discs, made in 1892–94, used outline drawings printed onto the discs photographically, then coloured by hand.

The device appears to have been one of the primary inspirations for Thomas Edison and William Kennedy Dickson's Kinetoscope.

As Thom Andersen asserts without naming it, for the principle of persistence of vision to be in operation, there needs to be a mechanism for the segmentation of an action into a series of images that are discreet yet close enough visually to (re)create the illusion of motion. This in turn can be translated into the problem of *intermittency*: the precise regulation of the intervals of light and (imperceptible) darkness that characterize every projection. It is for the purposes of regulating these intervals that Muybridge added the second disc [to his zoopraxiscope] in front of the original one that Étienne-Jules Marey had already been using, so that when the two move at the precise speed relative to each other (albeit in opposite directions), there is a stable interval of time for each successive frame to be projected onto the wall. The zoopraxiscope is thus the synthetic counterpart to the contemporaneous analytical experiments in motion imaging and thus continues the dialectical synthesis and analysis that…was already present in the treatment of the movementn of water and the delineation of space in the Yosemite photographs and stereographs. (Latsis, 21-22)

"SALLIE GARDNER," owned by LELAND STANFORD; running at a 1.40 gait over the Palo Alto track, 19th June, 1878.

DIAGRAM OF FOOT MOVEMENTS.

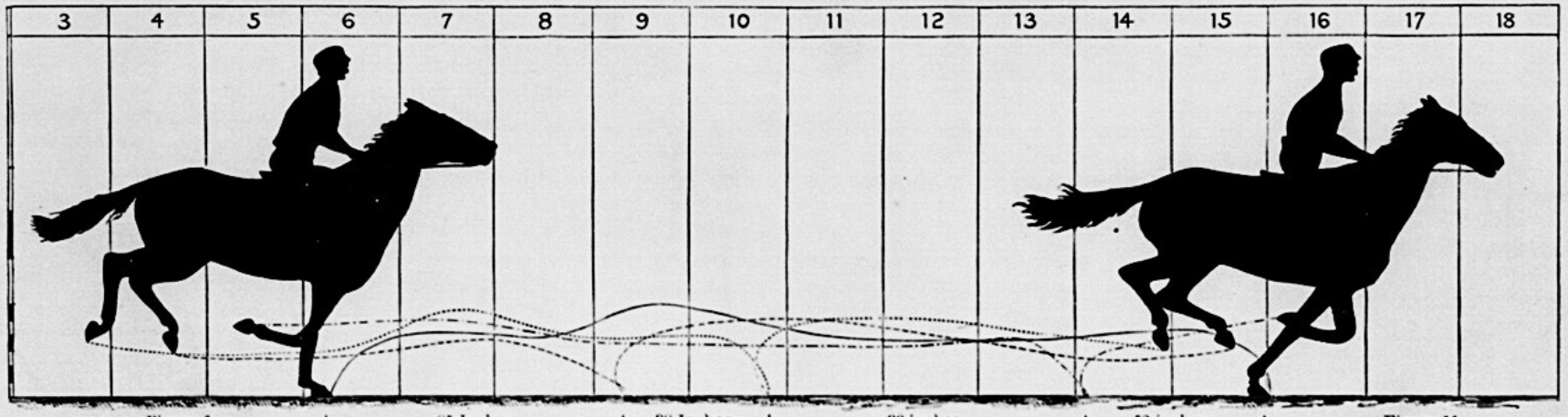


Figure 1 — 85 Inches. — 38 Inches. — 90 inches. — 52 inches. — Figure 11.

Left fore foot. Right hind foot. Left hind foot. Right fore foot. Left fore foot.

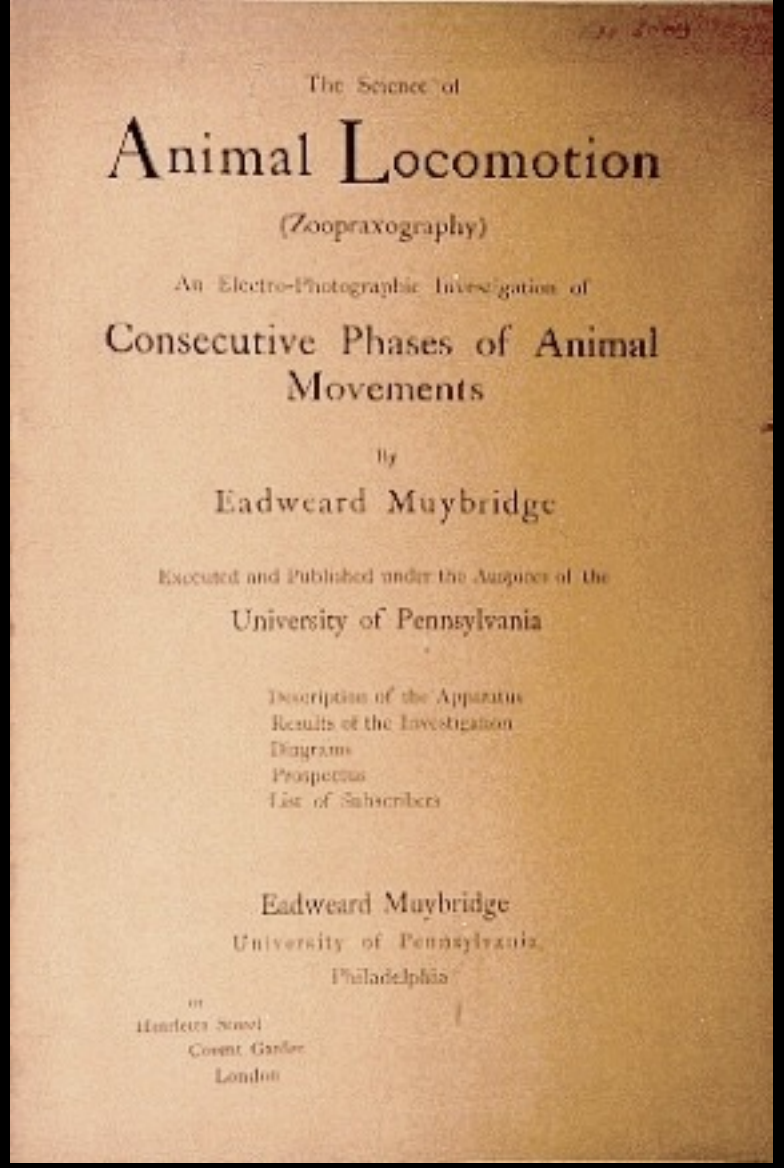
Vertical lines 27 inches apart. Total length of stride, 265 inches.

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.

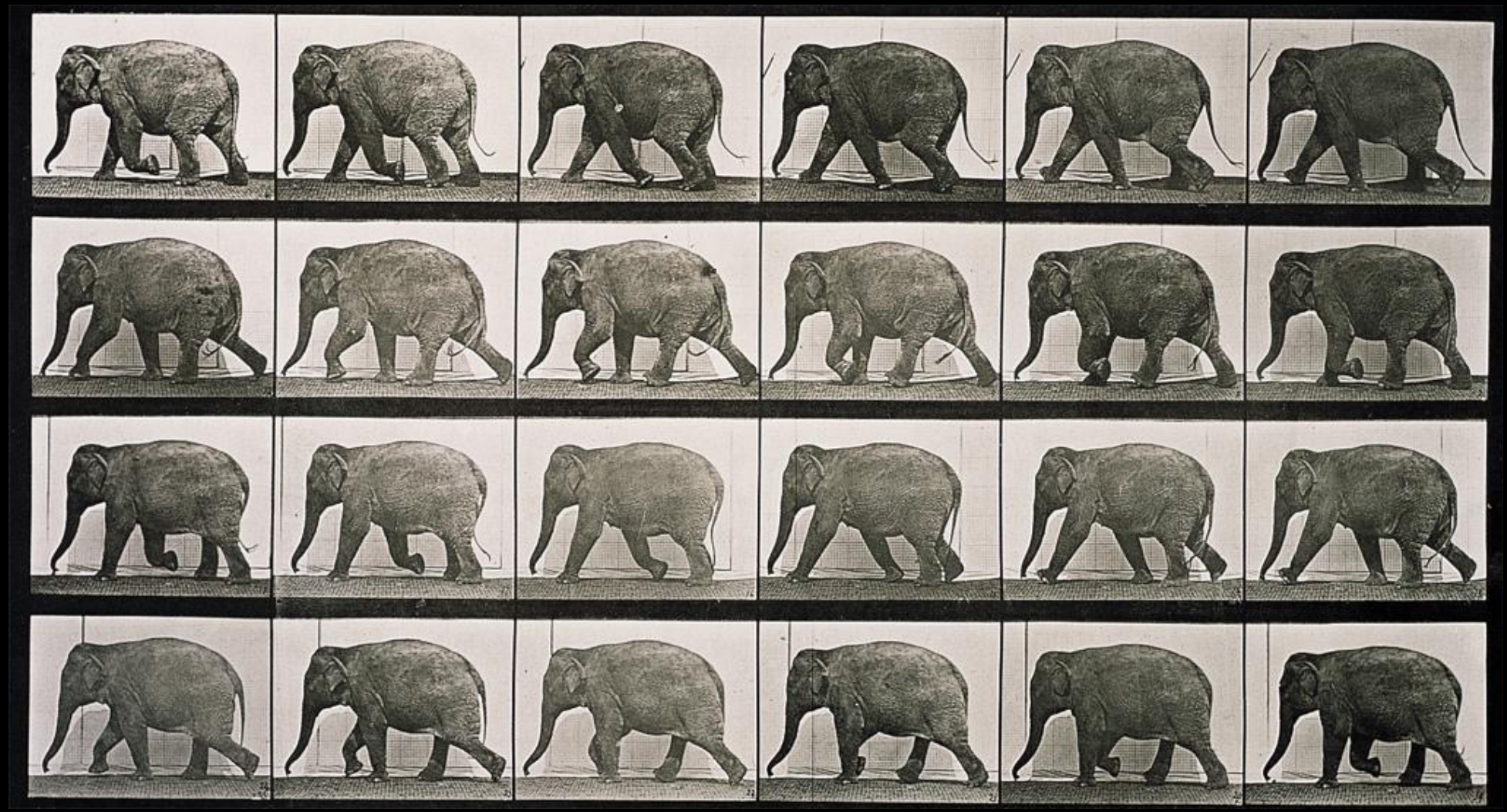
During certain portions of this stride, the feet of the mare were moving with a velocity equivalent to more than 100 lineal feet in a second of time, or nearly three-fourths of an inch, during an exposure of the two-thousandth part of a second. To enhance the usefulness of the photographs, the indistinctness 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.



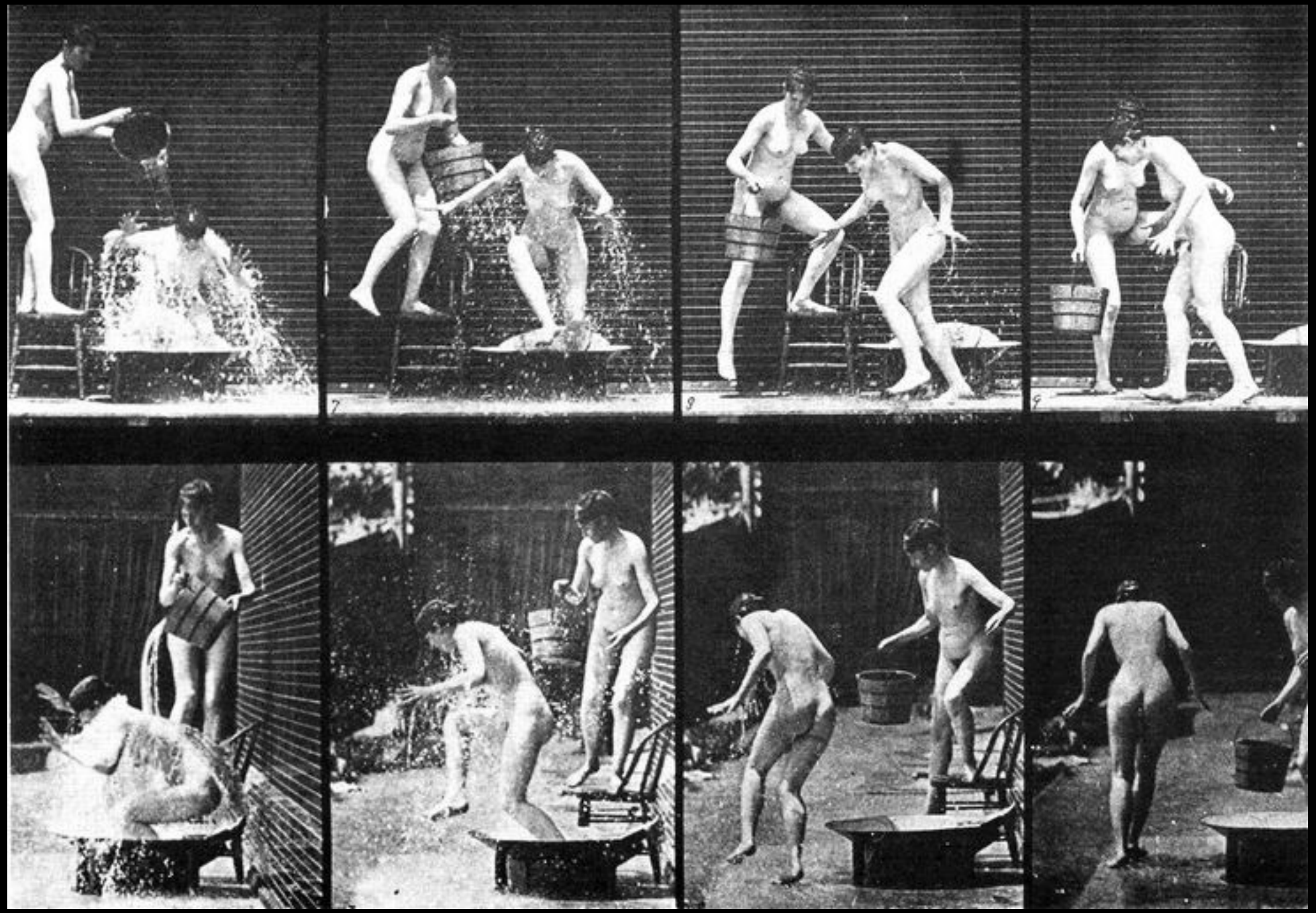
Muybridge lectures at World's Columbian Exposition (World's Fair, Chicago) in Zoopraxographical-Athenaeum Hall, 1893

At the Chicago 1893 World's Columbian Exposition, Muybridge gave a series of lectures on the Science of Animal Locomotion in the Zoopraxographical Hall, built specially for that purpose in the "Midway Plaisance" arm of the exposition. He used his zoopraxiscope to show his moving pictures to a paying public making the Hall the very first commercial movie theater.



Eadweard J. Muybridge, Elephant Walking, 1884-87

Eadweard J. Muybridge, Two Models, 8 Drinking from Water-Jar on the Shoulder of 1, 1885

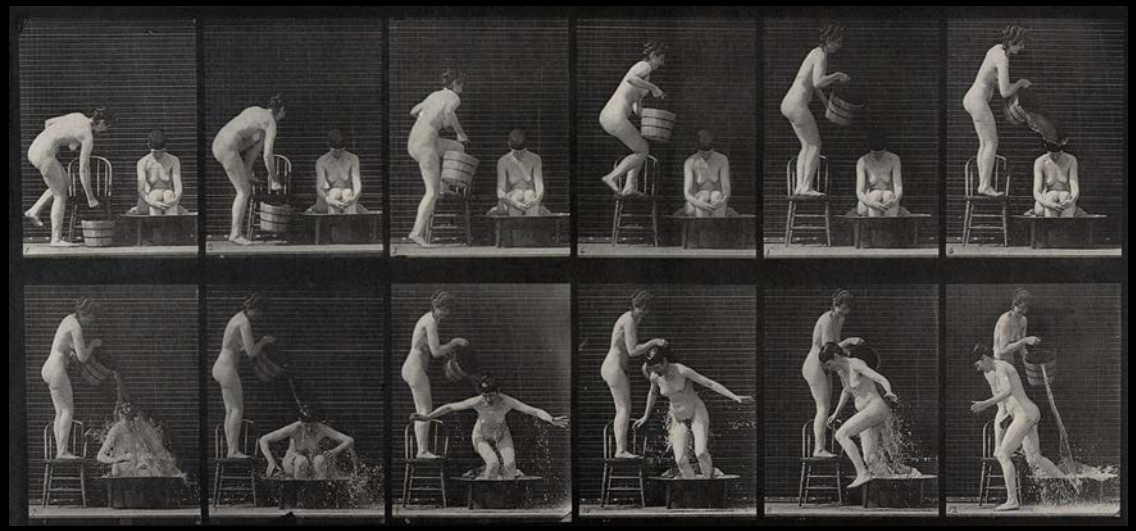


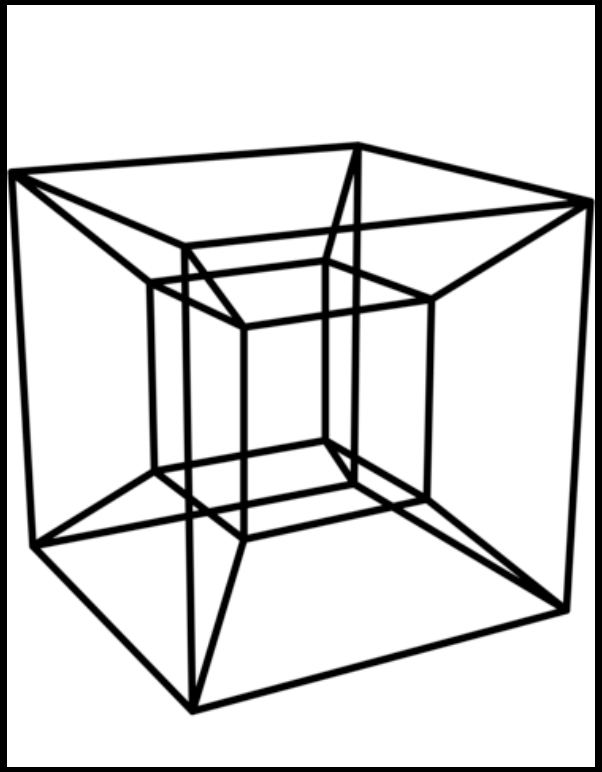
Eadward Muybridge, Woman pouring a bucket of water over another woman, 1884-85

cataract versus tesseract

Eadweard Muybridge, Base at Yosemite Lower Falls, Yosemite Valley, California, 1868

Eadward Muybridge, Woman pouring a bucket of water over another woman, 1884-85





The tesseract is the hypercube also called the 8-cell or octachoron. It is is the four-dimensional analog of the cube; the tesseract is to the cube as the cube is to the square. In Madeleine L'Engle's novel *A Wrinkle in Time*, the characters in the story travel through time and space using tesseracts. The book actually uses the idea of a tesseract to represent a fifth dimension rather than a four-dimensional object (and also uses the word "tesser" to refer to movement from one three dimensional space/world to another).