

Muybridge, the Galloping Horse and revealed Errors in Art

Pangratos Papacosta¹ Ph.D.,

"The horse. Here is nobility without conceit, friendship without envy, beauty without vanity. A willing servant, yet never a slave." Ronald Duncan

"When I bestride him, I soar, I am a hawk: he trots the air; the earth sings when he touches it; the basest horn of his hoof is more musical than the pipe of Hermes." William Shakespeare, Henry V.

Introduction

The horse has been an intimate part of human history, going back even before the use of writing, found in prehistoric cave paintings that are more than 35,000 years old. The horse has been a symbol of power, nobility and grace. After their domestication around 3,000 BC horses were ridden to battle, used in transportation and hunting, they ploughed fields, raced for trophies and were displayed on royal arms. They were prized for their speed or their pulling power. The scientific term *horsepower* (hp) is based on the ability of a draft horse to pull up a certain weight to a specific height in one second. Horses in pairs ploughed the fields and when placed in front of a box with wheels, horses went to battle, ran in competitive races or transported heavy loads. Their performance was significantly enhanced in the 9th century with the introduction of the harness and the horseshoe. In mythology, the horse was often associated with deities such as Apollo, the Greek god of music riding his chariot as the Sun did over the sky above. In Apocalypse, the last book of the Bible, disasters come in the form of four horsemen. Horses have always had a special relationship with royalty. History attests that the great art masters painted portraits of their patrons who often chose to pose sitting gracefully on a beautiful horse. In some cultures, like the British, the horse is regarded as a noble creature well integrated in cultural traditions like horse racing, fox hunting and the game of polo.

Artists have often used horses in their paintings to celebrate a moment of history^{(1) (2)} like Napoleon Crossing the Alps (1800) by Jacques – Louis David (1748 – 1825) or seasons like in the Book of hours or Très Riches Heures du duc de Berry by the Limbourg brothers (1370 -1416). Royalty riding or posing on horses was part of the work of artists like Diego Velasquez, Anthony Van Dyck, Charles le Brun, Benozzo Gozzoli, Edwin Landseer, Georg Christoph Grooth, Lukas Konrad Pfandzelt and Johann Gotfried Tannauer. Horses fascinated scholars not only for their graceful posture and symbolism but also for their graceful stride. Animal locomotion was studied by great men of art and science like Aristotle of Stagira (384 -322 B.C), Galen of Pergamum (129 –216 AD), Albertus Magnus (1193/1206 -1280), Leonardo Da Vinci (1452-1519) and Giovanni Borelli (1608 – 1679). Horses in a standing position as portrayed in paintings or sculptures, have been depicted correctly throughout history. Their graceful gallop, although highly admired, remained a mystery to both scientists and artists, specifically on the accurate depiction of their legs' orientations during galloping. Our eyes have no difficulty in capturing accurately the image of a standing horse in multiple poses. But the human eye is unable to capture the exact sequence and correct leg orientation of a horse while galloping. This was not possible till the invention of the camera in the late of 19th century.

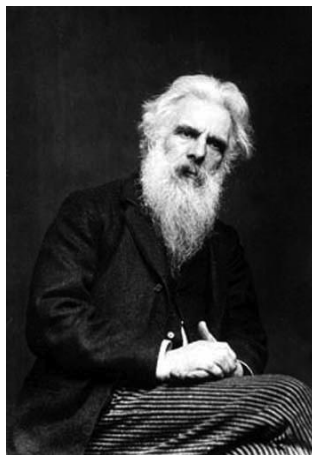
The Photographic study of Motion

At the end of the 19th century two photographers French Etienne Marey and Anglo-American Eadweard Muybridge became pioneers in the camera study of animal and human locomotion. Etienne Marey (1830–1904) was fascinated with the motion study of many different animals and humans.

¹ Professor of Physics Emeritus, Columbia College Chicago E-mail: ppapacosta@colum.edu

As a medical scientist of animal and human physiology he pursued the photographic study of locomotion, using his knowledge of anatomy and physiology and his love of photography. In 1882, he designed a photographic gun that could shoot 12 consecutive frames per second, all recorded on a single film. This moment-by-moment study of locomotion using the camera became known as Chronophotography, a precursor of cinematography. (Chronos the Greek word for time). In 1873 Marey published *La Machine Animale* (Animal Mechanism). His book *Le Vol des Oiseaux* (The Flight of Birds), was published in 1890 and was enriched with photographs, drawings and diagrams. Using Chronophotography Marey studied the motion of horses, birds, dogs, sheep, donkeys, elephants, fish, insects, reptiles, etc. Some call Marey's work "animated zoo". Marey also studied how cats always are landing on their feet. His work is an unusual blend of an intense interest in science and artistic ingenuity. His new form of photography not only helped boost the new science of Biomechanics but made also a significant contribution to the new art form of cinematography. One of the readers of Marey's book on animal locomotion was Leland Stanford, a former California governor and senator who made his fortune as an industrialist, as president of the Southern Pacific Railroad and who later founded Stanford University. Stanford also loved and bred horses. Marey's book provided data that suggested that there is a moment during gallop when all four legs of the animal are off the ground. Stanford was intrigued by this and wanted to seek a reliable proof of the "unsupported transit" of the horse with "a machine that could not lie," the camera. For that task, he recruited one of the best-known rising star photographers in California at the time, Eadward Muybridge.

A young cousin remembers Eadward Muybridge as "an eccentric boy, rather mischievous, always doing something or saying something unusual, or inventing a new toy or a fresh trick".⁽³⁾Hollywood would have loved Muybridge's life story and novelists would have wished they had invented his character. He was an eccentric inventor who just before a historic and revolutionary discovery killed his wife's lover, a premeditated murder punishable by hanging. Defense witnesses suggested that the brain injury he suffered in a stagecoach accident in 1860 marked a change in his behavior. The jury rejected an insanity plea but found him not guilty of murder on the grounds of "justifiable homicide".



Johnston, Frances Benjamin, photographer 1910. Library of Congress

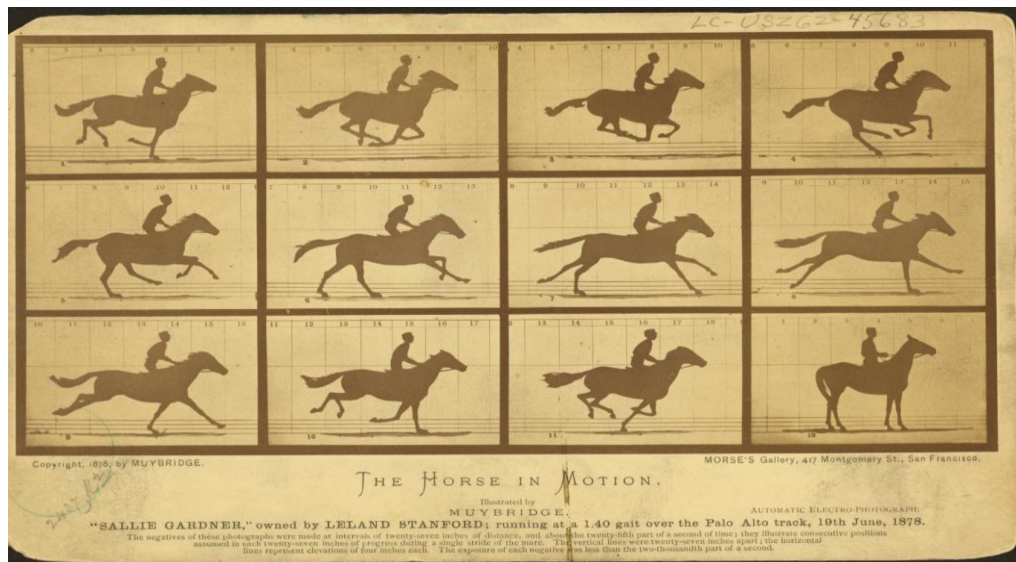
A visionary genius he left his mark in science and art yet his behavior was a paradox. He could erupt in violent outburst yet in social situations he was polite and gentle and often charming. He was a pioneer in photographic studies of motion but also a showman, entertainer, a charismatic lecturer, inventor and a venture capitalist.

Eadward Muybridge was born at Kingston-upon-Thames in England on 9 April 1830. He is also known as Muggeridge, Mugridge, Muygridge and as Helios, a pseudonym he invented for himself and his portable photo lab. At age 20 he immigrated to America working in New York selling books and prints and later in San Francisco that was known then as "capital of the Gold Rush". He returned to England to recuperate after the stagecoach accident and worked as the director of a Turkish investment bank. While in England he was successful in obtaining two patents, one for a washing machine and another for a printing process. He returned to San Francisco and devoted much of his energy and time to learning photography. His fame suddenly grew worldwide thanks to his large panoramic landscape photographs of Yosemite Valley in California.

His photographic exploration took him to Alaska, to the Lava Beds in northern California where he photographed the Modoc Indians and US soldiers, to plantations in Guatemala, to Panama and to the American west coast to photograph lighthouses. He is also known for his large panoramic photographs of San Francisco.

In 1872 Leland Stanford hired Muybridge to prove via a photograph that indeed there is a moment in the gallop of a horse when all four hoofs are off the ground. At the time, the question had been developed into an intense public debate and legend has it that Stanford had a \$ 25,000wager in favor of the “unsupported transit” moment. Muybridge’s photo investigation of the galloping horse took place in Palo Alto Stock Farm owned by Stanford. Muybridge recognized right away the mechanical difficulties of his task. Cameras and film at the time were not able to capture fast motion. Any motion that was photographically recorded appeared as a blur. Shutters were too slow to capture the motion of horse galloping at 40 feet per second. To freeze an image in motion it required a fast shutter that could take the picture in a fraction of a second. Fortunately, the technology of the times was in Muybridge’s favor. This was the era of the electrical revolution with the new inventions of the telegraph and the telephone, both of which rely on electromagnets. Carpenters and engineers that Stanford employed built the infrastructure of the Galloping Experiment. Muybridge placed twelve large glass-plate cameras in a line along the edge of the track. The high-speed electromagnetic shutters were triggered in sequence by a thread as the horse passed. All twelve cameras took the pictures in a rapid succession and all within a fraction of a second. To allow for maximum reflection of light the path was lined with white sheets or sprinkled with lime in powdered form. Muybridge also experimented with different developers that made the film more sensitive to light. In June of 1878 the photographs that Muybridge took of Stanford’s horse named “Sallie Gardner” showed that there is indeed a moment when all four legs of the horse are off the ground in a momentary state of “unsupported transit” as if the horse was flying at that brief moment. This event was witnessed by racing enthusiasts and journalists who gathered in a party like atmosphere, all eager to witness a moment of history. A few days later the Sacramento Daily Union wrote the following about the event.

“The feat performed by Muybridge, an artist of this coast...is second only to, among the marvels of the age, to the discoveries of the wonderful discoveries of the telephone and the phonograph...These pictures ...prove that the horse in trotting assumes positions never dreamed before...with legs to be in almost all conceivable positions.”⁽⁴⁾



Muybridge Eadweard, photographer.

The horse in motion, "Sallie Gardner," owned by Leland Stanford, running at a 1:40 gait over the Palo Alto track, 19 June 1878. Library of Congress. Soon after this, Muybridge added twelve more cameras for a total of 24 to capture the gallop in even greater detail. Although the images were little more than silhouettes, they were clear and sharp and were received with tremendous interest worldwide when they were published in several journals.

Later on Muybridge painted these images in silhouette form at the edge of a glass disc for a machine he invented and called **“Zoopraxiscope”**. Upon rotation, the disc produced the illusion of motion thus making it the forerunner of the movie projector. The first projection that lasted only few seconds was to Leland Stanford. Stanford was so impressed he sent Muybridge on a European lecture tour to Paris and London where he used his Zoopraxiscope to dazzle politicians, authors and royalty. It was said that the Zoopraxiscope was of high standards of reliability. One of the projectionists stated that he operated it over 60 times without a single failure. ⁽⁶⁾



The Zoopraxiscope - a Horse Back Somersault, 1893. Muybridge, Eadweard, Artist. Library of Congress

The early Muybridge-Stanford partnership was a fine example of collaboration. Unfortunately, the relation grew sour when horseman J.B. Stillman, encouraged by Stanford, published *The Horse in Motion* in 1882 in which Muybridge received only a minor credit for his photography. Historians suggested that one reason for that is that Stanford considered Muybridge as an employee rather than as a partner. It was also suggested that like many of his contemporaries, Stanford regarded photography neither as art nor as science but merely a trade. The lack of recognition that Muybridge rightly deserved in *The Horse in Motion* also cost him an offer he was about to get from Britain’s Royal Society of Arts for the study of animal movement. In August 1883 Muybridge accepted an invitation from the University of Pennsylvania to carry out a two-year massive photographic study of animal locomotion. Using a superior dry gelatin dry plate and new cameras Muybridge took over 100,000 photos of different animals (some from the local zoo) and human figures, many nude, in a wide range of daily activities including sports. He himself is seen in some of these images. His work at the University of Pennsylvania was the theme of his last two books, *Animals in Motion* (1899) and *The Human Figure in Motion* (1901) that remain in print to this date.

At the conclusion of his work at the University of Pennsylvania Muybridge traveled widely and gave a series of lectures enriched with his motion machine, including a major event at the 1893 Chicago World’s Columbian Exposition. He used his Zoopraxiscope to show his moving pictures to the public who were happy to pay an admission fee, thus making this the beginnings of the commercial movie theater. The last few years of his life were spent in tours throughout Great Britain. Muybridge died of prostate cancer in May of 1904 at his birth town of Kingston upon Thames whose museum holds many of his papers and artifacts.

The Art Connection

For thousands of years galloping horses were wrongly depicted with all four legs extended forwards and backwards like in the case of a cheetah or a cat during a chase. The artists must have assumed that this was anatomically the correct way of all four-legged animals in full speed. The examples are many and go back to ancient Mesopotamia and Egypt. Horses ridden by archers in a lion hunt or horses pulling chariots to battle are shown galloping with legs outstretched in this wrong position. Horse racing was a popular sport in the Olympics of ancient Greece. Horse racing scenes that decorated Greek pots often show horses with wrong leg orientations.

Bronze sculptures were a much rarer depiction of a racing horse. One such surviving bronze sculpture is the “Jockey of the Artemision” displayed at the Museum in Athens Greece. The back legs are thicker than normal because – as it was suggested - they were used to support the statue yet their relative orientation is wrong. Muybridge’s work not only helped to settle a popular question on what Leland Stanford referred to as the “unsupported transit” moment of a galloping horse, it also helped to correct a perpetuating misconception about galloping horses depicted in art. None of Muybridge’s images show a horse in full gallop with all legs off the ground and stretched out forwards and backwards in opposite directions. So, Muybridge’s photos also put a stop to a perpetuating error in art.

The following are examples of paintings that deal mostly with horseracing in which the galloping horses are wrongly depicted, in terms of their leg orientation.



Race horses and Jockeys cross the finishing line by Victor J. Adam, 1850, Welcome Library, London

“Those hoofbeats reverberated in art and science and are still heard today. In pursuing for Stanford the secrets of equine gait, Muybridge unwittingly set the stage for a spectacular invention a decade later – the motion picture. The racehorse experiment also taught scientists to see photos as data, launching the study of animal locomotion. And the images shook the art world by exposing postural errors in classic equine sculptures and paintings... Artists of the day were both thrilled and vexed because the pictures “laid bare all the mistakes that sculptors and painters have made in their renderings of various postures of the horse”... The most common error had been to show the running animal in a “bobbyhorse” pose with front and hind legs extended. Once Muybridge’s photos appeared, painters like Edgar Degas and Thomas Eakins began consulting them to make their work truer in life.”⁽⁵⁾



Parole: brown gelding, by Imp. Leamington, dam Maiden by Lexington.

Currier & Ives, 1879. The Library of Congress



The finish in the great match race ... at Sheepshead Bay, N.Y., June 25th, 1890 between Salvator and Tenny. 1890, by Currier & Ives. Library of Congress





An exciting finish by John Cameron, 1828, Library of Congress
A political cartoon showing three bookmakers watching a horserace,
by Tom Merry, 1889, Welcome Library, London



The derby at Epsom, 1821, by Theodore Gericault
Photo Credit: Erich Lessing/Art Resource, NY



Rebecca and Brian de Bois-Guilbert. 1828,

by Cogniet Leon. By kind permission of the trustees of the Wallace Collection, London/Art Resource, NY

Closing remarks

Both Muybridge and Marey have influenced the arts in numerous ways. Their study of motion led to the development of the motion industry. In her book *Picturing Time: the Work of Etienne-Jules Marey*, Marta Braun suggests that Marey developed the first workable motion picture projector. His study of birds in flight may have inspired the Wright brothers. The photographic study of motion by Marey and Muybridge have influenced many of 20th century new artforms like Futurism, (a celebration of speed) Dadaism and Cubism. Marcel Duchamp's painting *Nude Descending Staircase*, is one of the best examples of art that abandons the static image, celebrating instead the image as it moves through space and time. Francis Bacon (1909 – 1992) is another artist whose depictions of twisted bodies have been inspired by the works of both Muybridge and Marey.

The story of Marey and Muybridge is rich in Zeitgeist (spirit of the times) moments. These early pioneers and founders of motion pictures were born in the same year (1830) and died in the same year (1904). Both were fascinated with the human body in motion and they developed their own devices that helped them to study this with their cameras. Although Marey was more of the scientist in this pursuit and not a professional photographer, they were aware of each other's work. Marey was impressed with Muybridge's images of the galloping horse. Muybridge captured moving bodies in separate films whereas Marey captured motion in sequential exposures on the same film. They could both freeze motion down to a fraction of a second. The invention of the strobe light in 1931 by Harold Edgerton at MIT was the next generation of instruments that could now freeze time down to less than a millionth of a second. As with the work of Marey and Muybridge artists and scientists alike made great use of the strobe light in their work.

As Muybridge and Marey were freezing motion with their cameras Thomas Edison was freezing voice and sound in the mechanical recording and reproduction of sound using the phonograph, his 1877 invention. Space, time and motion have been transformed almost overnight by these technologies. Marta Braun underlines this transformative period. She writes ⁽⁴⁾

“Muybridge's instantaneous photographs of movement have taken their place with the other late nineteenth-century technological innovations that have permanently transformed our notions of time and space. The phonograph, invented in 1877 by Thomas Edison, recorded the voice and made its sound permanent, bringing the past moment of speech or song into the present and forever conflating the two.

The telephone, invented in 1876, did the same thing with space, making it possible to communicate across distance and to hear accounts of faraway events as they happened.... "A work for the Art connoisseur, the Scientist, the Artist and the Student of Art or of Nature" is Muybridge's description of Animal Locomotion...a juncture between art, science and technology. ...A technical wizard, show-business pioneer, popular scientist and artist."

References

1. "The Horse in Art" by John Baskett, Yale University Press, 2006
2. "Horses in Russian Art" State Russian Museum, Printed by Graphicart-Formia, 2001
3. "The Man who Stopped Time" by Brian Clegg, Joseph Henry Press, 2007
4. "Eadweard Muybridge" by Marta Braun, Reaktion Books, 2010
5. "The Man who stopped Time," by Mitchell Leslie, Stanford Magazine, May/June 2001
6. "Muybridge the Eye in Motion," by Stephen Barber, Solar Books, 2012

Bibliography

- "The Scientist who Took Pictures," A book review of *Picturing Time* about the works of Etienne
- Marey by Marta Braun. A New York Times Book Review by Andy Grunberg, 25 April 1993
- Eadweard Muybridge, in Encyclopedia Britannica
- "Hero in his own movie," article by Tim Adams of the New Statesman, 10 September 2010
- "Impossible Points, Erroneous Walks" by Henry Petroski, American Scientist, March-April 2014, pp 102 -105
- "Muybridge with (out) Marey." By Jan Baetens, IMAGE & NARRATIVE.
On line magazine of the Visual Narrative, July 2000.

Appendix

More relevant images (With no copyright restrictions)

In all these additional images the galloping of horses are depicted wrongly.



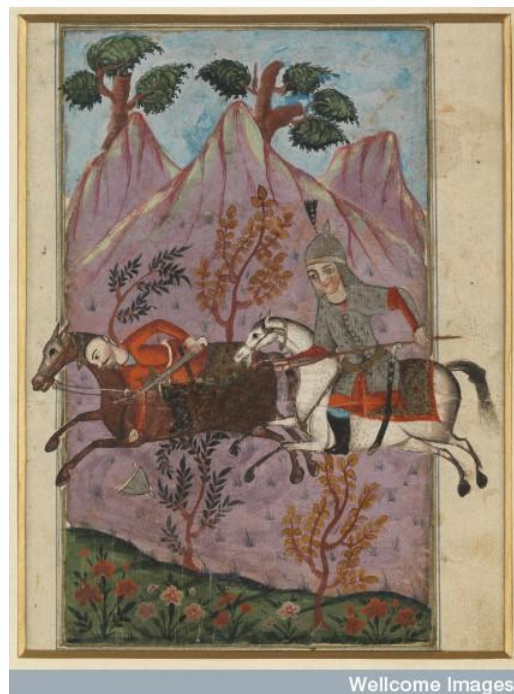
The finishing line at a horse race. (showing eight of the most famous jockeys at the time) by Liberio Prospero, 1888, Wellcome Library, London



A woman on horse-back losing her hat.
Lithograph by C. Vernet and E. Purcell.
Around 1820s. Wellcome Library, London



Horse race finish Calcutta India 1830. Artist unknown
Victoria and Albert Museum, London



Wellcome Images

One of the earliest examples of horses in wrong gallop is the painting in the *Scene from the Shahnameh*. The classic book of Shahnameh, written around 1000 AD, deals with the mythical and also the historical past of the Persian empire and its influence on that part of the world. Here two men are riding on horseback through sparse woodland.

Welcome Library, London



A fair in Andalusia with Horse Racing, by Galofre Gimenez, 1890s
Victoria & Albert Museum, London



Circus duet by Loyd R., 1831, Victoria & Albert Museum, London