



THE EVOLUTION OF PHOTOGRAPHY IN MOTION

Radomskyi Oleksandr

ORCID: <https://orcid.org/0009-0007-8306-1384>

Photography, Radomskyi LLC, 474 Warren Str, USA

Abstract. *The article focuses on the evolution of motion photography. The aim of the study is to explore the unique techniques and styles used to capture the dynamics of moments in photography. General scientific methods of cognition, such as analysis, synthesis, comparison, and generalization, were employed in the research. The results indicate that motion photography exhibits several unique techniques. Panoramic blur emphasizes the moving subject with a blurred background, creating a sense of speed and energy. Motion blur allows the depiction of movement in all elements of the photograph, whereas frozen motion captures details of fast actions, providing clarity and revealing usually invisible aspects. Visual flow guides the viewer's gaze through the composition, creating a sense of effortless motion. The first motion photographs appeared in the 19th century thanks to the works of Eadweard Muybridge and other pioneers who used the latest technologies of their time, producing photos in the "frozen motion" style. The second type of photography from that era includes the works of Étienne-Jules Marey, who showcased motion blur. The peak of popularity for this type of photography came in the 1920s when it became an integral part of sports photography, especially during the Olympic Games, where photographers managed to capture the drama and dynamics of sports events. Modern motion photography technologies have significantly expanded photographers' capabilities. Contemporary cameras allow for the use of high shutter speeds, various autofocus modes, and specialized lenses to freeze or blur motion. Additional devices, such as drones and motion capture systems, push creative boundaries, enabling image capture from different perspectives and in highly dynamic conditions. The practical significance of the study lies in the potential use of the acquired knowledge to improve motion photography techniques, which can be useful for both amateur and professional photographers.*

Keywords: *photography, motion, panoramic blur, modern technologies, dynamics.*

Introduction

Motion photography, as a specialized genre, emerged in the 19th century and over time became a significant aspect of visual art and commercial culture. Starting with early experiments in sports event photography, such as Eadweard Muybridge's 1878 capture of a horse in motion, this genre has played a key role in documenting dynamic events. These early works not only opened new possibilities for scientific research but also inspired artists to use photography as a means of artistic expression [9]. Throughout the 20th century, with the advancement of technology and the popularization of sports, motion photography became an integral part of sports competitions, allowing not only the capture of movement but also the conveyance of the emotional intensity of the moment. Later, in the second half of the 20th century, with the rise of the advertising industry, motion photography found its place in marketing, where dynamic images are used to attract consumers' attention and boost product sales. Today, in the era of digital media and global communications, motion photography continues to evolve. It is used not only in sports and advertising but also in documentary photography, fashion, dance, and other forms of contemporary art. Photography schools in the USA and other countries actively include courses on motion photography, emphasizing its importance for the technical and creative development of future photographers.



Literature review

The issue of the evolution of motion photography is well-researched in foreign scientific literature; however, most studies focus more on the development of cinema than photography. Significant contributions to the development of this topic have been made by authors such as R. E. Christensen [3], who developed a method for cinematographic filming of the inner part of the eye, allowing the recording of color images of the fundus and anterior chamber using specialized equipment. This technique has various applications in research and education, including recording the pulsations of intraocular vessels and assessing retinal coagulation. L. Ni [13] analyzes the application of motion tracking technology in cinema, television production, and photography, highlighting the use of big data to enhance the quality of the visual experience. She notes that although motion control technology is widely used abroad, its implementation in China is limited due to technical and financial barriers. This study is useful for understanding the role of big data and motion control technology in motion photography. T. W. Hope [6] provides an overview of cinematographic photography, focusing on its historical aspects and technical details. He describes the basic principles of cinematography, such as "persistence of vision," and discusses various types of film and projectors used in the cinematic industry. This information is important for understanding the technical aspects of motion photography. S. P. Hill and G. Minghelli [4] examine the complex relationships between Italian culture and photography, exploring how photography has influenced Italian literature, cinema, mass culture, and politics. Their analysis shows how motion photography has been used to reflect cultural changes and social trends. P. M. Hillier [5] analyzes the work of Thomas Eakins with cinematography, emphasizing its scientific significance. He notes that Eakins' cinematographic photographs are scientific documents that testify to his desire to contribute to science and capture contemporary America without embellishments or alterations. This study demonstrates how motion photography can be used to document scientific and cultural phenomena. The research primarily utilized expert literature, including contemporary internet publications and photographers' blogs, which cover the latest aspects of motion photography. Thus, despite the sufficient amount of literature on this topic, there is a lack of systematic material on the subject of the study, and therefore, using various methods of scientific cognition, the information was analyzed, grouped, and systematized and presented in the light of the research topic.

Purpose of the article

Purpose of the article is highlighting the history of the development of motion photography as a genre that has managed to adapt to changes in technology and cultural trends. Through the analysis of historical context and contemporary practices, the research aims to identify the key moments and techniques that influenced the evolution of this genre. The main objectives of the study are to examine:

- the formation and evolution of motion photography: studying early experiments and their impact on the development of the genre;
- stylistic features of motion photography: analyzing how changes in the use of techniques have affected the visual appeal and perception of photographs;
- the peak of popularity: reviewing key periods and events that contributed to the widespread acceptance and use of motion photography;



– modern technologies for motion photography: investigating the impact of digital technologies on shooting and processing techniques in motion photography.

Research results

Before researching the history of motion photography, it is first necessary to understand what photography experts mean by this term. Bol T. [1] highlights three main motion shooting techniques that he uses during his travels to enhance visual impact and convey the dynamics of a scene.

Panoramic blur with sharp objects. This method involves capturing moving objects, such as cyclists, cars, rickshaws, or horses, while blurring the background. It is achieved using a panning technique with a shutter speed of about 1/30 of a second, allowing the object to remain in focus while the camera follows its movement. Adjusting the shutter speed depending on the object's speed and using a tripod can increase the number of successful shots [1].

General blur. This method of creating abstract images involves slightly blurring all elements in the photograph. Blur can be applied to moving objects, such as dancers, pedestrians, or birds. Using a shutter speed of about 1/20 of a second and a slight shake of the camera help achieve creative results. Additional experiments with settings may include changing the zoom during a one-second exposure [1].

Stationary object with movement nearby. This type of image is similar to panoramic blur, but the main object remains stationary while movement occurs around it. For example, capturing an image where a high-speed train passes by a businessman at a metro station. Such scenarios require observing potential compositions and quick reactions to create impressive images [1].

Wilkerson S. [16] also describes three main approaches to depicting movement in photography, which are somewhat different from Bol T.'s methods of creating motion photos.

Frozen motion. This method showcases one of the camera's most remarkable abilities – freezing a moment usually invisible to the human eye. Frozen motion conveys details of actions, such as the flight of hair, the movement of hands, the rising of dust, or the breaking of waves. This approach is used to illustrate the moment of action and provide a clear sense of events that might occur after the scene's "pause" [16].

Motion blur. Despite associations with poor technique or insufficient lighting, motion blur can effectively convey dynamic energy when used intentionally. Blur can be created either by the movement of the camera or by the movement of objects in the frame. This can include scenes where the object moves within a stationary environment or, conversely, where the photographer introduces movement into a static environment (e.g., using panning technique) [16].

Visual flow. Visual flow is described as the ability to guide the viewer's gaze on a smooth and often curved visual journey through the composition of the photograph. It is dynamic and effortless, and can include lines that lead the eye through or across the frame, repeated elements that create rhythm, and progressive gradations of color, size, light, or shape. Visual flow engages the viewer with the image, creating a sense of movement even when nothing is actually moving [16].

To summarize the types of motion photography, these two studies can be grouped



and systematized, resulting in a summary table 1.

Table 1 – Types of motion photography

Type of Photography	Description	Researchers
Panoramic blur	Technique where the photographer moves the camera along with the moving object to keep it sharp against a blurred background, creating a sense of speed and dynamics.	Bol, T. (2014) [1], Wilkerson, S. (2000) [16]
Motion blur	All elements of the image are slightly blurred using a slow shutter speed, creating dynamic energy and a dreamy look, suitable for abstractions and expressing movement.	Bol, T. (2014) [1], Wilkerson, S. (2000) [16]
Frozen motion	Capturing a moment in motion with a high shutter speed, which allows the details of the action that are usually invisible to be seen, conveying a sense of subsequent events after the scene's "pause."	Wilkerson, S. (2000) [16]
Visual flow	Smoothly guiding the viewer's gaze through the visual composition using lines, repeating elements, and progressive gradations that create dynamics and a sense of movement in a static image.	Wilkerson, S. (2000) [16]

Note: systematized by the author [7]

Overall, four types of motion photography used in the history of cinema can be distinguished. These are: panning blur, where the photographer moves along with the main subject, such as a cyclist, keeping the subject in focus while blurring the background; motion blur, a technique that uses a slow shutter speed to blur all elements of the image, creating a dreamy and dynamic look, ideal for abstractions and expressive depictions of motion; frozen motion, which captures a moment in motion with a high shutter speed, allowing detailed action shots that typically go unnoticed, conveying the sense of impending action after the "pause" in the scene, like the movement of a waterfall; and visual flow, used to smoothly guide the viewer's eye through the visual composition using lines, repeating elements, and progressive gradations, creating a sense of movement in a static image.

History of the first motion photos. Photography, as an art form that stops time, began to develop from its invention in 1839. However, the ability to capture motion was initially limited due to the technical shortcomings of early photographic materials and shutter mechanisms, resulting in blurred dynamic objects. The first pioneers who worked on capturing motion were David Octavius Hill and Robert Adamson, who in 1843 made some of the first sports photographs, documenting a badminton player [15]. A breakthrough in this field came with Eadweard Muybridge, who in the 1870s conducted experiments with multi-camera photography to analyze the motion of horses. His work demonstrated that horses lift all four hooves off the ground during a gallop, a key moment in understanding motion dynamics [9]. Muybridge used the "frozen motion" technique, setting up a series of cameras along a track, each with a high shutter speed activated as the horse passed by. This allowed him to freeze motion and obtain clear images of the horse in various phases of its gallop, including moments when all hooves were off the ground. This technique allowed detailed capture of each phase of movement, important for studying kinematics.



Unlike Muybridge, Étienne-Jules Marey used the "motion blur" technique. He developed chronophotography, which captured sequences of movement in a single photograph. Marey applied longer exposures, blending all the movements of the horse into a single dynamic image, allowing the entire range of motion to be seen within one frame, creating an effect of continuous motion flow. This approach made it possible to study not only individual phases of movement but also their interaction and sequence. Both approaches significantly influenced the development of photography and the study of dynamism, offering different ways to see and capture motion that remain relevant today.

By the 1930s, Harold Edgerton in the United States had refined the use of stroboscopic light for photographing motion in extremely short time intervals, visualizing moments invisible to the human eye [11]. This became an innovative approach to creating motion photography using the "visual flow" technique. In artistic photography, motion also became an important element of aesthetic expression. Photographers like Alexey Brodovitch used blur, particularly "panning blur," to convey dynamics and emotions, significantly expanding the language of visual art [11].

The technological development of the 20th century allowed photographers to capture motion more accurately and vividly, making photography an indispensable tool in art, science, sports, and advertising [16].

Motion photography became especially popular in the 1920s when sports and sports photography began to reinforce each other. This was particularly evident during the 1936 Olympic Games in Berlin, where Leni Riefenstahl captured the dynamics of athletes with incredible precision, reflecting not only the moments of competition but also the emotions and tension accompanying sports achievements. These photos did not just capture events; they told stories, making them extremely valuable for both sports history and the art of photography [15]. Eadweard Muybridge's innovations in the late 19th century laid the groundwork for this rapid development. His work, initiated by Leland Stanford and conducted in collaboration with the University of Pennsylvania, introduced a new way of thinking about photography and motion. The use of photography for scientific studies of movement made it an important tool for studying the dynamics of human and animal bodies, ultimately increasing its popularity in both scientific and artistic circles [2].

In subsequent years, with the advancement of technology and the growing influence of media, motion photography became even more important. This allowed photographers to not only capture moments but also delve deeper into and express the emotional context, highly valued in the modern world of visual arts and mass media.

Modern technologies for motion photography. Techniques for freezing and blurring motion in photography include specific camera settings and shooting methods that allow the photographer to effectively control the image of moving objects. From choosing shutter speeds to panning techniques, each technology has its own characteristics that need to be understood to achieve the desired visual effect. The technical characteristics of these technologies are presented in Table 2.

The development of motion capture (mocap) technologies has shown significant growth and innovation, transforming not only the entertainment landscape but also various other industries such as healthcare, sports, product development, and military



research. The use of advanced cameras, analytical software, and autonomous lightweight vehicles has contributed to this progress [10]. Experts predict that by 2050, photography will likely undergo a radical transformation, integrating advanced artificial intelligence (AI) technologies that will enhance both the functional and creative aspects of media. Cameras are expected to become highly autonomous, equipped with AI capable of analyzing scenes in real time, predicting potential outcomes, and even automating complex tasks. This means that cameras will not only capture moments but also actively assist photographers by suggesting optimal settings, anticipating spontaneous facial expressions or movements for perfect timing, and analyzing lighting conditions to recommend exposure adjustments [14].

Table 2 – Technical characteristics of motion photography technologies

Technology	Essence	Technical features
Shutter speed	Using high shutter speeds to freeze the motion of objects	Speeds from 1/500 to 1/8000 seconds allow the capture of instant movements without blur
Shutter priority	A camera mode that lets you choose the shutter speed while the camera automatically adjusts the aperture	Allows quick adaptation to changing shooting conditions, ideal for sports events or dynamic scenes
Manual mode	Full control over all camera parameters	The photographer manually adjusts the shutter speed, aperture, and ISO, allowing precise adaptation of the shot to lighting conditions
Flash use	Using flash to freeze motion in low-light conditions	Flashes with short firing times (up to 1/20000 seconds) can freeze even very fast movements
Fast lenses	Using lenses with large maximum apertures for better light collection	Lenses with f/1.4 or f/1.8 apertures allow shooting in low light without increasing ISO
ISO	Adjusting the camera sensor's sensitivity	Higher ISO settings allow shooting in the dark but increase image noise. It's essential to find a balance between shutter speed and acceptable noise levels
Focusing	Using continuous autofocus to keep the subject in focus	Continuous AF settings ensure image sharpness even with fast-moving subjects
Panning	A technique that involves moving the camera in sync with the subject's motion to create a sense of speed	Camera movement helps freeze the subject against a moving background, creating a dynamic and aesthetically pleasing image

Note: systematized by the author

Regarding the technological development of motion photography using external devices, future technologies include the use of drones, which can extend the focus of photography over long distances [10]; deepfake technologies that can capture and create more realistic images [10]; the use of AI and mocap [10], which can monitor the biomechanics of movements; LED volumetric technologies that allow objects to move in space [10]; motion synthesis technology using 3D technology [12]; and animation photography technologies [8].

Conclusions

Motion photography showcases unique techniques and styles that capture the dynamics of moments. Among them, panning blur highlights the moving subject



against a blurred background, creating a sense of speed and energy. Motion blur depicts the movement of all elements in the photo, while frozen motion captures the details of fast actions, providing clarity and revealing usually unseen aspects. Visual flow guides the viewer's eye through the composition, creating a sense of effortless movement.

The first motion photos appeared in the 19th century thanks to the works of Eadweard Muybridge and other pioneers who applied the latest technologies of their time. The peak of popularity for this type of photography came in the 1920s, when it became an integral part of sports photography, especially during the Olympic Games, where photographers managed to convey the drama and dynamics of sports events.

Modern motion photography technologies have significantly expanded photographers' capabilities. Contemporary cameras allow the use of high shutter speeds, various autofocus modes, and specialized lenses for freezing or blurring motion. Additional devices such as drones and motion capture systems expand creative boundaries, enabling the capture of images from different perspectives and in extremely dynamic conditions.

References:

1. Bol, T. (2014). Three kinds of motion. Tom Bol Photo. URL: <https://www.tombolphoto.com/three-kinds-of-motion/#:~:text=One%20aspect%20I%20try%20to,%20static%20subject%2Fmotion%20nearby>
2. Brockmeier, E. K. (2020). A new way of thinking about motion, movement, and the concept of time. Penn Today. URL: <https://penntoday.upenn.edu/news/new-way-thinking-about-motion-movement-eadweard-muybridge>
3. Christensen, R. E. (1963). Motion picture photography of the inner eye. Archives of Ophthalmology, 70(4), 540. DOI: 10.1001/archophth.1963.00960050542019
4. Hill, S. P., & Minghelli, G. (2015). Stillness in motion: Italy, photography, and the meanings of modernity. DOI: 10.3138/9781442619975. ISBN: 9781442619975
5. Hillier, P. M. (2007). Men and horses in motion: Thomas Eakins and motion photography. Early Popular Visual Culture, 5(1), 25-40. DOI: 10.1080/17460650701267741
6. Hope, T. W. (2002). Motion picture photography. In Encyclopedia of Imaging Science and Technology. DOI: 10.1002/0471443395.img070
7. How to Successfully Freeze Action in Photography, With or Without Flash! (2023). Photography skool. URL: <https://photographyskool.com/how-to-successfully-freeze-action-in-photography-with-or-without-flash/>
8. La Source (2016). What is the future of motion capture? URL: <https://www.lasource.io/news/what-is-the-future-of-motion-capture>
9. Martinelli, O. G. (2023). Movement in photography: From the horse to the human figure. Artmajeur. URL: <https://www.artmajeur.com/en/magazine/5-art-history/movement-in-photography-from-the-horse-to-the-human-figure/332671>
10. Motion Analysis (2023). Ones to watch: The leading motion capture trends to follow in 2023. URL: <https://www.motionanalysis.com/animation/ones-to-watch-the-leading-motion-capture-trends-to-follow-in-2023/>



11. National Gallery of Art (2016). Movement. URL: <https://www.nga.gov/features/intersections/movement.html>
12. Neurog (2024). The future of motion: Animating people from single photographs. LinkedIn. URL: <https://www.linkedin.com/pulse/future-motion-animating-people-from-single-photographs-aineurog-cnkkf/>
13. Ni, L. (2023). Application of motion tracking technology in movies, television production and photography using big data. *Soft Computing*, 27(17), 1-20. DOI: 10.1007/s00500-023-08963-7
14. Roy, M. (2024). Photography in 2050: A glimpse into the future. LinkedIn. URL: <https://www.linkedin.com/pulse/photography-2050-glimpse-future-manik-roy-swhoc/>
15. Sport in Art (2023). Sport and the body in motion as a photographer's object from history to the present. URL: <https://www.sportin.art/en/article-detail/sport-and-the-body-in-motion-as-a-photographers-object-from-history-to-the-present>
16. Wilkerson, S. (2000). 3 types of movement in photography. The Click Community. URL: <https://www.theclickcommunity.com/blog/3-types-of-movement-in-photography/>