

History of Photography : From Camera Obscura to the Kodak Camera

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Second Edition

Published 2 February 2020

Preface

This paper was written in order to examine the order of discovery of significant developments in the history of motion pictures. It is part of my efforts to put the study of social and cultural history and social change on a scientific basis capable of rational analysis and understanding. This has resulted in a hard copy book *How Change Happens: A Theory of Philosophy of History, Social Change and Cultural Evolution* and a website [How Change Happens Rochelle Forrester's Social Change, Cultural Evolution and Philosophy of History website](#). There are also philosophy of history papers such as [The Course of History](#), [The Scientific Study of History](#), [Guttman Scale Analysis and its use to explain Cultural Evolution and Social Change](#) and [Philosophy of History](#) and papers on [Academia.edu](#), [Figshare](#), [Humanities Commons](#), [Mendeley](#), [Open Science Framework](#), [Orcid](#), [Phil Papers](#), [SocArXiv](#), [Social Science Research Network](#), [Vixra](#) and [Zenodo](#) websites.

This paper is part of a series on the History of Science and Technology. Other papers in the series are:

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Other papers by Rochelle Forrester include works on Epistemology and the [Philosophy of Perception](#) such as [Sense Perception and Reality](#) and on quantum mechanics such as the [Quantum Measurement Problem](#) and [The Bohr and Einstein debate](#) on the meaning of quantum physics. Rochelle Forrester's work is also published on [Slideshare](#), [Issuu](#) and [Scribd](#). Rochelle Forrester is a member of the [International Network for Theory of History](#).

Abstract

The invention of photography was only possible due to the camera obscura effect which produces an upside down image of a scene on the back wall of a box when light is reflected through a tiny hole in the box. The camera obscura effect has been known since classical times. The invention of photography required that the image be fixed and reproducible and this was not achieved until the 19th century, after the discovery of the light sensitive properties of certain silver compounds, which resulted from scientific discoveries in the preceding three centuries. After photography was invented it was improved by the invention of color photography and became cheaper and easier. The order of discovery was inevitable and is an example of how social and cultural history has to follow a particular course determined by the structure of the world around us. Photography is only possible due to the existence in nature, of the camera obscura effect and of the existence of light sensitive compounds and only when they were put together, was photography invented.

The invention of photography required the understanding of two scientific ideas, one concerning physics and optics, the other involving chemistry. The optical idea was that of the camera obscura. The camera obscura (Latin for dark room) involves light reflected from an object passing through a pinhole in the side of a box or room and an upside down image of the object appearing on the far inside wall of the box or room. This effect is caused because light travels in a straight line and when some of the light rays reflected from an object go through a pinhole they cross and reform as an upside down picture of the object on the far wall of the box. The image is upside down because the light rays cross, as the light rays coming from a lower point on the object will go to a high position on the far wall of the box, and those coming from a higher point on the object will go to a lower point on the far wall of the box. The camera obscura had been known since classical times and had been used by Arab astronomers since the 9th century to look at the sun, stars and the moon. Roger Bacon in the 13th century and Leonardo da Vinci in the 15th century knew of the camera obscura and in the 16th century a lense was used in place of the pinhole. The image produced on the inside back wall of the box or room was of limited use as it could not be kept or reproduced.

It was to take a series of discoveries in chemistry before camera obscura images could be given permanence and could be reproduced. In the 18th century it was known that some compounds of silver, particularly silver nitrate and silver chloride, blackened on exposure to sunlight. In 1802 Thomas Wedgwood and Humphrey Davy took the first photographs by placing leaves on top of a piece of white paper, coated with a silver nitrate solution, in the sunlight. Where the leaves covered the paper, the paper remained white, while the rest of the paper blackened. This created the world's first negative but the photograph could not be fixed and the white areas soon darkened when exposed to light. Wedgwood and Davy also experimented with putting the treated paper in a camera obscura but were unable to find any way of making the images permanent.

It was a Frenchman Joseph Niepce who in 1827 discovered how to make an image permanent. He used a resin called bitumen of Judea to coat a glass plate and exposed it to an image in a camera obscura. Where the light hit the plate the resin hardened and turned white. The unhardened areas were darkened with iodine vapor to contrast with the white parts. Niepce produced the first permanent negative but his process has the grave limitation of an exposure time of many hours.

It was not until 1839 that a more practical method of producing a photograph with an exposure time of about 30 minutes was invented by Jacques Daguerre. Daguerre used a silver plate coated with a layer of silver iodine, a compound very sensitive to light. When the plate was exposed in the camera the picture appeared and was developed using mercury vapor and the image was fixed with sodium hyposulfite. The process soon became known as Daguerreotype.

A further photographic process was independently invented by William Talbot in 1839 and was improved in 1841. Talbot treated paper with silver nitrate, potassium iodine and gallo-nitrate of silver and exposed it to a camera obscura. He obtained a negative which he then lay in sunlight on top of paper treated with the same chemicals to produce a positive. Talbot found he could produce as many positives as he liked from a single negative and it was this advantage that resulted in his process, soon to be called Talbotype, being preferred over Daguerreotype, which produced only one photo for each exposure.

The wet collodion process was developed in 1851 by Frederick Archer and was soon to supersede both the Daguerreotype and Talbotype processes. The collodion process involved using a glass plate for the negative image, rather than paper. Liquid chemicals such as nitrocellulose and silver bromide were poured on the glass plate which was placed in the camera and exposed while the glass plate was still wet. The process was not very user friendly with photographers often getting the chemicals over their hands, arms and clothes. The process also required that photographers carry substantial equipment around in order to do their photography. However exposure times were down to about ten seconds depending on the size of the plate and intensity of the light.

Experiments began with the use of dry plates from about 1853 as dry plates did not require immediate development and reduced the equipment photographers had to carry around. Early dry plates however had very long exposure times so that they were seldom used until after 1871 when Richard Maddox invented the gelatino-bromide dry plate which soon had an exposure time of one second. Between 1874-80 a cheap and fast way of making multiple prints from a single negative was invented. The process involved using a gelatine coated paper sensitized with silver bromide, a compound very sensitive to light. The process allowed prints to be made in the dark room without having to expose the print paper to sunlight.

Popular use of photography expanded enormously, when in 1888, George Eastman introduced the Kodak camera. The camera used a flexible roll film made of paper coated with a

light sensitive emulsion. A year later celluloid film was introduced which made the processing of the film cheaper and easier. Celluloid was first produced by Parkes in Great Britain in 1862 and then independently by Hyatt in the USA by compounding cellulose nitrate and camphor. Cellulose nitrate had earlier been produced by Braconnet in 1832 by treating cotton with nitric acid.

Color photography was experimented with in the late 19th century but the first practical system of color photography was introduced by Louis and Auguste Lumiere in 1907. Their autochrome process involved photographic plates on glass coated with red, green and blue granules that acted as color filters, allowing some light rays through and reflecting others. Other color photographic processes were soon introduced and in the 1920's and 30's smaller hand held cameras were introduced. In the late 1960's electronics was introduced into photography in the form of light sensitive photocells which determine the exposure time for photographs.

Photography has had a major effect on society in a number of areas. In science photographs were taken through microscopes and telescopes to provide permanent and accurate pictures of everything from magnified insects to stars and galaxies. Photographs could show movement that could not be seen with normal vision. Photographs were taken of galloping horses to show that at times they had all four hooves off the ground and of birds in flight.

Social reform was affected by photographs when photographs of substandard living conditions and of child labor hastened efforts to improve housing and to ban child labor. Photographs of war led to greater understanding of the horrors of war which could never be shown by paintings which tended to glorify war. Photographs of the Vietnam War are often credited with undermining American public support for the war. Magazines began using photographs, both in advertising products and in news stories from around the mid-19th century. Photography also became an art form taking over the role of portrait painter and producing many other pictures previously produced by artists. This encouraged art to move towards more abstract images which could not be produced by photography until quite recently. Popular photography became widespread with the introduction of the Kodak camera. Pictures taken during holidays or of friends and family began to fill family photo albums.

Photography was only possible due to certain properties of light and of chemical compounds, such as silver nitrate and silver chloride. Light, when passing through a pinhole into a dark room or box, will produce an image of the scene outside the box or room on the far inside wall of the box or room. If this property of light did not exist there would have been no photography. The light sensitive nature of certain silver compounds was also vital to photography in order to allow the image provided by the camera obscura to be fixed and made permanent. If those light sensitive chemicals did not exist photography could not exist. The invention of photography could only take place after the discovery of the camera obscura effect and after the discovery of the light sensitive properties of the silver compounds. The camera obscura effect had been known since classical times while the light sensitive properties of the

silver compounds became known after a series of experiments by European scientists such as Georg Fabricius, Angelo Sala, Wilhelm Homberg, Johann Schultze and Carl Scheele in the 16th, 17th and 18th centuries. Their discoveries were known to Wedgwood and Davy when they created the first photograph and to Niepce, Daguerre and Talbot when they discovered ways of fixing and making photographs permanent. Both the process of creating the photograph and fixing it were dependent on prior discoveries in chemistry made in the few hundred years before photography was invented in the 19th century. The existence of the camera obscura effect and of light sensitive chemicals, which enabled an image to be fixed to produce photographs, shows how the structure of the universe has a major effect on human social and cultural history.

The process by which photography developed in the 19th century followed a logical pattern with the easier discoveries being made before the more difficult discoveries. How to create the photographs was discovered, as it had to be, before how to fix them was discovered. Black and white photography was invented before color photography as color photography involves additional complications, than there are with black and white photography. Throughout the 19th century exposure times for photography fell as new and improved techniques were developed. The whole process was improved until amateur photography became possible towards the end of the 19th century.

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