Photography – a Journey in Progress

Edited by Martin R. Christensen

Part 1: Light, shadow and chemical discoveries

"From Light Shadow Is Born..."

Shadow effects, a picture's basic ingredient, have always enjoyed an indisputable success: a source of light, some gestures evoking shadows on a screen opposite arousing the imagination of young and old – and it´s as simple as that! Various objects shaped in certain ways would produce surprising silhouettes, once their shadows were projected. Cut-outs and little shadow theatres enjoyed moments of popularity, a tradition, which seemed to thrive in especially Asia.[i]

Effects of Light and Shadow

A whole range of articles and equipment have been created down the centuries in order to highlight a picture and give it a particular rendering or even make it move.

The idea of animating shadows with the aid of connected objects is old and was quickly used in portrayals often of a religious character and then of a more widely popular nature. It probably came from China or India. Marionettes made of leather and embellished with bright colors and openwork motifs, used for entertainment, have been found in areas such as China, Java, Bali, or Turkey.

This theatre form was probably imported into Europe at the time of more frequent exchanges with the Orient during the seventeenth century. In the nineteenth century, the fashion also favored toy shadow theatres. A cardboard box decorated with lithographs became a little theatre in which one could parade various cut-out decors and characters against an illuminated background.[ii]

Precursors of Photography: the inventors

Pierre-Louis Guinand: the process of guinandage

Pierre-Louis Guinand, born to a Swiss family of watchmakers, was extremely interested in the manufacture of optical glass, and from 1784 conducted research to obtain the best possible quality of "flint" glass. This glass was used for microscopes, telescopes, glasses and other kinds of optical instruments, and later in the manufacture of lenses.

His technique of mixing raw materials produced exceptional results; subsequently called "guinandage", this process was gradually introduced into all the glass factories in the country, including suppliers to Lerebours and Secretan in Paris and Voigtländer in Braunschweig.

Johann Heinrich Schulze: light and chemical reactions

During the Middle Ages, alchemists had noticed the darkening of silver salts when exposed to the light and used them to color various materials like wood and ivory. However, it was at the time of the Renaissance that alchemists discovered silver chloride, when, in 1566, it was noticed that it turned dark blue in the light.

Johann Heinrich Schulze, a German professor of anatomy interested in chemistry, was the first to publish a scientific study on the reactions of certain chemical compounds of silver in 1727. Schulze was also the first to establish that light reacts on silver salt. Thus, he opened the way to photography.[iii]

Jean Sénebier: spectral sensitivity

Jean Sénebier, a theologian and physics enthusiast, living in Geneva in the eighteenth century, undertook a lot of research into a few very different areas. One of the things he was interested in was the sensitivity of natural substances to light.

In 1782, he wrote an important paper on spectral sensitivity – in other words about the colors – of silver chloride. He noticed then that it was blue light, which blackened this silver salt most quickly.

Jacques Charles: the solar megascope

A French professor of experimental physics, Jacques Charles studied the expansion of gases and made the first aerostatic ascension with hydrogen on August 2, 1783. He also invented the solar megascope, which was a machine used to obtain a projection of images enlarged with objects illuminated by a set of mirrors.[iv]

Charles is thought to have conducted some photochemical experiments around 1789. Unfortunately, there are no contemporary records, or any written by him, about this, and the accounts that have filtered down are incomplete and not very clear.

Humphry Davy

Humphry Davy, an English physician and chemist, is the author of several discoveries, such as laughing gas. He also taught chemistry and published various works. He was a member of the prestigious Royal Society of London, becoming its president in 1820. Throughout his career, he obtained a number of distinctions for his works. He was also the inventor of the miner's lamp, made of metal cloth, called the Davy lamp.[v]

Around 1800, he worked with Thomas Wedgwood on the light sensitivity of silver salts, and published their results.

Thomas Wedgwood: the sensitivity of silver salts

Towards 1800, Thomas Wedgwood, the third son of a famous English porcelain manufacturer, conducted a number of trials on the sensitivity of silver salts to light. Using silver nitrate to sensitize his paper, he then exposed it in a portable camera obscura, an instrument widely used by his father's factory for landscape backrounds. He did not obtain any convincing results, despite the advice of his friend, informed chemist Humphry Davy. He is still considered a pioneer and perhaps even "the first photographer".[vi]

Joseph Nicéphore Niépce: the invention of Photography

Joseph Nicéphore Niépce shared a passion for research with his brother Claude. They kept corresponding with each other about their experiences. Thanks to this exchange of letters, we know about Josephs work.

From 1816, Niépce became interested in lithography and conducted many trials. He discovered that Judean pitch has the property of hardening in the light. In 1825, while exposing a translucent drawing on a plate

coated in this substance, he succeeded in obtaining a picture. He called this process "heliography" (from the Greek word "helios", which means "Sun").[vii]

Niépce exposed these same plates in a darkened camera and thereby succeeded in obtaining the first photograph. The oldest photographs known to this day took him a day to expose.[viii]

1839: the Invention of Daguerre Unveiled to the world

The artist Louis-Jacques-Mandé Daguerre arrived in Paris in 1804 and underwent an education as a theatre stage designer. In July 1822, together with another artist, Charles Marie Bouton, he set up the "Diorama" in a building, where the large canvasses painted on both sides with different subjects changed appearance, depending on whether they were illuminated from the front or behind. The Diorama was exhibited in London a year later.[ix]

In his work, Daguerre used the camera obscura a lot and frequently went to Chevalier the opticians, where he heard about Niépce, with whom he started to work. Daguerre discovered that silver iodide changes quickly in the light. He placed a plate coated with silver in a box containing iodine crystals, whose vapors formed silver iodide on the plate's surface. After its exposure in the camera, the picture, still not yet visible on the plate, was revealed by the vapors given off by the mercury, heated to a certain temperature. On August 19 1839, François Arago, a famous physicist, astronomer, and elected politician, presented this process to the Academies of Fine Arts and Sciences.[x]

1834: the photogenic drawings of Talbot

Born in 1800 in southern England, mathematician William Henry Fox Talbot was interested in archaeology. He travelled a lot and never left without taking a darkened camera for his trip samples. Wanting to find a way of *"printing these natural pictures on paper..."*, he started conducting trials in this direction in 1834, by exposing some objects on sensitized paper, which he called "photogenic drawings", then exposing these papers in a camera obscura.

With the announcement of Daguerre's discovery in 1839, Talbot redoubled his research efforts and later developed his negative process, called the calotype process, whose great innovation was the possibility of running off as many copies as one wanted.[xi]

Hippolyte Bayard: a forgotten Inventor

As early as 1839, when France got to know of the result of the research by Talbot, Hippolyte Bayard, an employee at the Ministry of Finance without any special scientific education, but familiar with artistic circles, also managed to produce some "photogenic drawings" on paper – but above all direct positive images. He could not publish his process, due to political pressures on the part of the promoters of the daguerreotype, whose official announcement had not yet been made. His process was finally published in the Official Monitor on 13 November 1839, after an encouraging report by the Academy of Fine Arts. He tried to have it recognized in February 1840. In March the same year, Talbot, who claimed that he had developed his process before Bayard, was invited by the Academy Of Science to reveal it. Compared to Bayard, he had the advantage of the negative and the possibility of multiple printing.[xii]

Andreas Friedrich Gerber: a Swiss Forerunner

A professor of veterinary medicine at the University of Bern, Andreas Friedrich Gerber was interested in several fields, including the earliest photographs. At the same time as Niépce and Daguerre, he conducted various research and experiments which, according to his own declaration in the preface to his book titled

"Manual of the general anatomy of man and of domestic animals", 1840, were concluded by 1836. By this time, he was already able to achieve an imprint of light passing through a microscope on paper sensitized with silver chloride, using a camera.

Johann Baptist Isenring: the first Exhibition

A Swiss painter, Johann Baptist Isenring, fascinated by the discoveries of Niépce and Daguerre, acquired the equipment for "daguerreotypy" in October 1839. In August 1840, he put on an exhibition in his workshop, illustrated with a four-page catalogue. This was perhaps the first photograph exhibition in the world.[xiii]

In this catalogue, Isenring stated he had made some trials before the announcement of the Daguerre invention, and had worked according the methods of William Fox Talbot.

Isenring abandoned his painting for a time and worked as a travelling photographer for two years, in which he established himself in Munich, Germany. He made portraits, photographs of architecture, reproductions of paintings and developed a coloring method for his proofs, which he patented.

The Daguerreotype Collection

One of the problems with daguerreotypes was the time needed for posing, a major problem with capturing the human face comfortably. The earliest studios, perched high up under the roof, were real "glass cages". The photographic equipment stood in front of a specific piece of furniture: an armchair or chair equipped with a headrest, a column, a cardboard balustrade, curtains, rare plants, painted objects and background. The daguerreotype portrait enjoyed success throughout the 1840s.[xiv]

The Parisian Opticians, the Chevaliers

Vincent Chevalier, his son Charles and later his grandson Arthur, a family of opticians in Paris, were selling amongst other things in their boutique different variations of the camera obscura and counted among their regular customers Louis-Jacques-Mandé Daguerre, a huge user of this instrument for his professional needs as a painter and theatre set designer.

On the 12th of January 1826, Colonel Niépce, the cousin of Joseph Nicéphore, went to the Chevaliers and told them about his cousin's work. Charles Chevalier related the story to Daguerre who was to meet Niépce in September 1827. They produced a treatise together in 1829, which culminated in the official announcement of the discovery of photography in 1839.

From 1840, the Chevaliers started selling cameras, optics and various items related to photography.[xv]

The Calotypes of Jean Walther

Apart from cloth trading, merchant Jean Walther (1806-1866) was also interested in photography. In his professional capacity, he met the French printer-photographer Blanquart-Evrard, who specialized in the volume reproduction of landscape photographs or other works of art working from paper negatives.

Jean Walther produced a large number of calotypes (negatives on paper) from which he printed some remarkable salted papers. His pictures documented his town and the monuments and landscapes of the surrounding Lake Geneva area.

A sizeable collection of original salted papers and calotypes is preserved in the historic Museum at Vevey, and underwent restoration in 1995. This iconographic treasure of precious documents also illustrate the extremely assured eye of this photographer throughout his career.

The first photographers' equipment

From the moment François Arago presented the Daguerre process on the 19th of August 1839, it seemed that many optician shops were flooded with keen amateurs, who had just seen a daguerreotype in action. Daguerreotype demonstrations were arranged for the public, who were able buy a full set of equipment at various opticians. This type of kit cost around 300 to 400 Francs, 100 days' wages for the average working class person, if not more. Making daguerreotypes or calotypes was a preserve of well-to-do, sophisticated amateurs.

Together with other publications, the "Le Magasin pittoresque" of November 30 1839 gave a detailed description of the process, and daguerreotyping quickly broke down barriers, also achieving notable popularity in the United States.[xvi]

These three pieces of equipment for full plate, half-plate and quarter-plate formats existed thanks to Jules-Gustave Schiertz, a cabinetmaker and photographic equipment specialist based in Paris. In 1844, during an exhibition of French-made photographic equipment, this manufacturer received a bronze medal for the quality of his cameras and accessories.

The World in Relief

Around 1830-40, those who enjoyed the pleasure of viewing in relief used to look at representational drawings in perspective or geometric constructions. Relief photography enthusiasts enjoyed the foretaste of a more spontaneous photography. As those pictures were viewed through magnifying glasses, their size could become smaller, the camera was less bulky and easier to carry and exposure time shorter, as a small plate requires less light for exposure. Stereoscopic photography played a part in popularizing photography.[xvii]

At the beginning, one used a single camera that one moved laterally along a stand between two views. Soon it was considered an improvement to move the lens to save having to move the camera, with an internal divider to avoid the views overlapping.

Next, two cameras were combined into one, with the advantage of having the simultaneous exposure of the two pictures. John Benjamin Dancer, a Manchester optician, invented the first double-lens camera in 1856.[xviii]

The stereogram also became an article that one could buy and collect. In 1851, Louis-Jules Duboscq produced and marketed the first stereoscope, conceived by an Englishman, David Brewster. Opaque pictures could be seen by opening a cover fitted with a mirror to illuminate them, while transparencies, which appeared from 1855, could be viewed directly in daylight through a frosted glass placed on the front. In 1861, an American, Oliver Wendell Holmes, invented the open stereoscope, light and easier to use.

Abel Niépce de Saint-Victor and the First Negatives on Glass Plate

Claude Felix Abel Niépce de Saint-Victor, a cousin of Nicéphore, and a military man with a strong interest in chemistry, made the decisive step towards the negative on glass plate in 1848. He used albumin (egg white) as the "adhesive" in the sensitive emulsion on the glass.

The plate was coated with a light layer of liquid albumin containing a little potassium iodide, which, once dry, was perfectly homogeneous. It was then sensitized by immersion in a bath of silver iodide, exposed for

a number of minutes and developed, then finally fixed and washed. It was not necessary to develop it immediately after being exposed. The positive proof was normally printed from this negative plate.

This process – though very slow, which made it inconvenient – produced negatives of an excellent quality, which were hardly distinguishable from wet collodion negatives.

A New Process in 1850: wet collodion

The inconvenience of the negative on not very transparent paper, gave rise quickly to the search for a better basis. The use of glass was attractive, but how was one to make the sensitive emulsion stick to it?

In 1846, a French chemist, Louis Ménard, dissolved some cotton powder or guncotton – discovered that same year by Swiss chemist Christian Friedrich Schönbein – in a mixture of alcohol and ether. He obtained a viscous liquid, which hardened and became transparent as it dried. This liquid was collodion, which is used for various purposes, including in the medical field.

A French photographer, Gustave Le Gray, published in 1850, evoked the use of collodion on glass in the appendix of a page. Its method was not very easy, but seemed to produce excellent results.

In March 1851, English sculptor and calotypist, Frederick Scott Archer, perfected the so-called wet collodion method. The plate had to be prepared just before exposition, at the risk of losing its sensitivity, and then developed straight after taking the photograph. The photographer had to be equipped with a portable laboratory whenever he went out. The beautiful quality of the negatives obtained with this process assured the general introduction of this method from the 1860s at the expense of the daguerreotype and calotype systems.[xix]

Ferrotype and Ambrotype

By sensitizing a pewter plate with wet collodion, previously lacquered in black or brown, one obtained a direct negative, called a ferrotype. A French photographer, Adolphe Martin, made this discovery in 1853. The ferrotype was called a “tintype” in England, where it was known from 1856. It was known as the “melanotype” in the United States.[xx]

The ambrotype, a process patented in 1854 by American inventor James Ambrose Cutting, was a negative image on a glass plate; this was placed in front of a screen with a black rear side (made of paint or cloth), and the picture appeared as a positive.[xxi]

Both systems were mostly used for portraits, in small format – down to the size of a button or postage stamp – and were then framed or presented in richly decorated cases, or even in jewels. It was often the roving photographer, who used these inexpensive processes much in fashion in the 1860s.

1864: the Dubroni Camera Laboratory

The idea of processing the exposed picture directly inside the camera came along very quickly: already in 1839, Talbot had conceived of such a piece of equipment. On December 21 1864, Englishman Jules Bourdin applied for a patent for a camera, which he christened the Dubroni Pocket Camera (an anagram of his name), which was produced in several different sizes and models.[xxii]

This was the era of wet collodion, making it necessary to sensitize the plate just before taking photographs and developing them immediately afterwards. The body of the camera contained a bottle, whose rear side was open; a glass plate replaced the ground glass. With the aid of a pipette, the composition for sensitizing

the plate was inserted into the hole situated on the outer frame and one shook the camera to ensure an even application. After an exposure of a few seconds – with the camera on its stand and corked up – one could proceed with the development. It was possible to check one's progress through a yellow glass on the rear panel, protected by a shutter.

This number 2 model was part of a pack containing all the products needed to process the plates, in bottles bearing the trademark Dubroni, as well as various accessories, proof papers, and a user's manual.

Retouching Negatives

A negative was rarely perfect, apart from dust and other "mechanical" defects, which needed retouching. Even the subject in the picture may have had some details for correction, like smoothening the skin texture of the face in a portrait.

The retoucher worked at a desk, which was specially equipped with a mirror directing the light from under the negative, which was positioned on a frosted glass, with the sensitized surface upwards. A magnifying glass, retouching knives, brushes, poster colors, rubbers, pencils, varnish and therebentine constituted his main tools.

The basic principle was to limit the touching up to the strict minimum necessary, starting by working with the retouching knife, then continuing with pencil or brush, delicately applying color by gently hatching.

Positive Contact Printing from 1840

The nature of the negative implied a positive print. This is what Frédéric Dillaye thought about it at the beginning of the century:

"The exposure of the sensitized paper, or if you prefer, the printing of the collotype on paper, constitutes one of the most delicate operations, which some amateurs do not understand. Either through ignorance, or through laziness, some even go so far as to neglect this part of their art and entrust all of their negatives to the first photographic developer they meet (...) How naïve, really! (...) The actual artist is the only one who can do full justice to what remains, in effect, the presentation of his work".

The Printing Frame

The exposure of the sensitized paper took place in a printing frame, an apparatus whose essential function was to ensure a perfect contact between the negative and the positive.

The exposure or insolation was carried out in daylight, with the printing frame placed on a leaning stand, in order to receive the light rays as well as possible; it could take ten minutes in sunlight, or a whole day in overcast weather. The daylight paper enabled a check at any time of the intensity of the picture, by opening one of the shutters at the back of the frame. Once correctly exposed, the print was toned and fixed, then washed and dried.

Shooting outdoors during the collodion period

Taking photographs of landscapes and monuments quickly attracted photographers, even though it was not always easy to do.

Although the advent of the collodion negative brought a great improvement to the quality of the picture, a certain disadvantage persisted: the need to prepare and process the plate at the time of taking the picture.

From the 1850s, as well as the cumbersome picture-taking equipment, it was necessary to take along one's laboratory.

Many photographers continued to use it after the arrival of the dry plate, when they were working with large formats, as they could not always find mass-produced plates in these sizes, but also for reasons of economy.

The Megaletoscope of Carlo Ponti

Swiss-born Carlo Ponti set himself up in Venice as an optician and photographer. From 1860, he perfected "Aletoscopio" (from Greek "true", "exact" and "vision"), a viewing apparatus for large-sized photographs.[xxiii]

In 1862, he put the final additions to the "Megaletoscopio", an enlarged version of the Aletoscopio and entrusted its production to the cabinetmaker, Demetrio Puppolin.[xxiv]

If Carlo Ponti was actually given production exclusivity in 1862, the administrative confusion, which reigned after Venetia returned to Italy in October 1866, annulled this privilege. Thus, other Venetian photographers were able to produce and sell this camera.

The Megaletoscope was used to view photographs in two different ways with a light-dark effect. The observer viewed heavily enlarged pictures through the optical system.

With the "daylight" view, the side shutters opened to allow daylight to illuminate the face of the photograph, a print on very fine albumin paper mounted with other elements on a wooden frame with handgrips. The body of the camera could turn through 90 degrees to enable the viewing of vertical pictures.

With the "night-time" view, after re-closing the side shutters and opening the third shutter situated behind the camera in front of a light source, a colored night-time scene appeared by transparency, with a totally different atmosphere.

Part 2: Mechanical marvels and the emergence of photography

The Camera Obscura

The formation of the picture of an exterior landscape through a small hole in a darkened room is a phenomenon, which was well known before our time. Aristotle, the famous Greek philosopher of the fourth century BC, noticed it without being able to explain it.

It was in the fifteenth century that Leonardo da Vinci found a rational explanation for the phenomenon. During the sixteenth and seventeenth centuries, the idea to replace the little hole with a lens to improve the image emerged, and then to install a mirror to make it upright again, and use the camera obscura as a drawing instrument.

The camera obscura was a highly valued instrument in the eighteenth century and at the beginning of the nineteenth, some were even permanently installed in houses built in parks, gardens and holiday locations to the pleasure of many.

From the sixteenth century, the camera obscura was considered as the ideal instrument for rendering perspective and became from that time an artist's tool. In the eighteenth century, travel was the fashion, and people brought home sketches and drawings made with the aid of a camera obscura. Various models, folding or compact, were available to informed enthusiasts. Manuals explaining how to use, and even how to make a camera obscura were published, while attempts to improve the optical system continued.[xxv]

Optical Views

Optical views probably first emerged in the fifteenth century: these etchings, often colored, depicting landscapes, various scenes and interior views with vast perspectives, which could be viewed with the aid of a box equipped with magnifying glasses, enjoyed growing popularity and were very fashionable from the end of the seventeenth century. The impression of relief experienced while observing the optical views was to find a development with the appearance of stereoscopic pictures.

Travelling picture showmen roamed the towns and fairgrounds to the great delight of young and old, and many postage stamps depict the mat work. Editors were selling these pictures in Germany at first, then in France, England and Italy.

From the middle of the eighteenth century, the mass production of these pictures lowered their quality somewhat and their coloring often remained minimal. Soon, they were overtook by the fashion for the magic lantern.

Described in 1646 by Athanasius Kircher in his "Ars magna lucis et umbrae", the magic lantern comprises a box with an optical tube used to increase the size of the image and forms and various other materials. It projects onto a white surface images painted on glass plates positioned in front of the spot illuminated by a candle or an oil or paraffin lamp, sometimes fitted with a silvered reflector. A chimney evacuates smoke.

At the end of the seventeenth century, thanks to the impact of German researchers, the magic lantern became easier to handle and was used for other applications than for shows aiming to amuse or frighten, and began to assume a pedagogical and scientific vocation.[xxvi]

The Magic Lantern up Hill and down Dale

The magic lantern really took off across the world around this time. During the eighteenth century, it was essentially optical quality and the source of light, which were going to improve. Roving showmen travelled from place to place and were received by the locals; sound mixed with pictures and was enhanced by a narrative, the music (barrel organ) and different sound effects.

Mystery plays, trivial and satirical subjects were in demand. Many opticians were selling plates and lanterns from the second half of the century, when it even became "the evening pastime" at the royal court.

From 1800, the magic lantern operator was less crucial and his activity was seriously compromised by the industrialization of the lantern and the great success of the toy lanterns. If the picture pedlars tended to disappear between 1870 and 1880, the professional exhibitors were increasingly organizing quality shows up to the arrival of the cinema.

Toy Magic Lanterns

From the 1850s, opticians were producing small magic lanterns on a cottage industry scale for use by children; the huge success enjoyed by this toy soon led to its industrialization, as much in France, where Lapierre had the monopoly for it, as in Germany, at Nuremberg, where companies were producing plates printed with scenes. Home projection put the roving showman out of business.

In France, Auguste Lapierre, an ironmonger-handyman set up in Paris in 1848, began making polychrome magic lanterns painted in bright colors coated in alcohol-based varnish and operated with a paraffin lamp. In 1884, the Lapierre Company took over its competitor Aubert, the real inventor of this type of lanterns. From the end of the nineteenth century, the Lapierre factory, which had expanded, manufactured large projection lamps. Lapierre also produced series of plates, recognizable by their edge-binding tape of green paper. It was recognized as the specialist in the Tales of Perrault, narrated on panoramic plates, where small texts and images take their turns.[xxvii]

Illuminated Projection Sessions

Public conferences using projections became fashionable during the nineteenth century. Many companies of a religious or laic character offered illustrated presentations, and suppliers specialized in the production of images for such conference holders. The British enjoyed the most prestigious venue of those times, the Royal Polytechnic Institution founded in 1838 in London. It served as a center for both exhibitions and for projection shows.[xxviii]

The English were particularly distinguished in the manufacture of the lanterns enabling projection. It was Englishmen, who devised the superimposition of two or three projectors for the fade-in fade-out or the simultaneous projection of several pictures. These projectors, in general use for public meetings, were oxyhydrogen gas lamps. From the end of the nineteenth century, electric equipment arrived on the market, fitted with an arc lamp or an incandescent bulb. In 1878, a year after inventing the gramophone, Edison succeeded in manufacturing an electric bulb, by enclosing a carbon filament in a vacuum in a bulb.

Photographic Projection

The popularity of the magic lantern continued to grow during the second half of the nineteenth century with the series production of illustrated plates and the growing fashion for photographic plates.

Towards 1850, the German-born Langenheim brothers, established in Philadelphia, perfected photographic pictures designed for projection. They also appeared in Europe from the end of the century. The subjects of the photographic plates are visibly more realistic than their painted counterparts, with landscapes, current events and scientific themes.[xxix]

In France, Duboscq and Molteni remained main manufacturers of projection lamps and their accessories, and offered a vast selection of plates. However, England was the most successful market.

Projectors of photographic plates could be used in combination with a projection system of opaque documents, and its direct descendant, the epidiascope, was widely used until the 1960s.[xxx]

Phantasmagorical Shows

The earliest true illuminated projection shows go back to the second half of the eighteenth century, a period of torment, which saw a revival of interest in the Middle Ages and the Gothic period. Macabre décors, atmospheres imbued with mystery, melancholy and elements of the supernatural seeped into literature and in the shows, which enjoyed a huge success.

These portrayals, known as phantasmagorias, adeptly staged diabolical intrigues and phantoms with the aid of retro-projection, a moving lamp and two sets of semi-transparent mirrors surrounded by a macabre décor and heightened with lugubrious sounds. The compère and his assistants tried to impress the audiences – and they succeeded.[xxxi]

The Fantasmagorias of Belgian Stage Magician Étienne-Gaspard Robert, using the stage name Robertson, were shown at the Convent of the Capucins at Paris at the end of the nineteenth century, and remain the most famous example of phantasmagorical shows. Robertson patented for a lantern, which he called the "fantoscope", mounted on feet sliding along two rails and equipped with an optical tube with interchangeable lenses.[xxxii]

Preparation of Lantern Plates

The first glass plates were hand-painted, the subject applied by transfer from a paper pattern. One plate included several subjects, or a panoramic view. Later, the line drawing was applied mechanically to the plate then colored by hand. The artists generally remained anonymous, with the exception of Desch, established in Paris at the end of the nineteenth century.

From the end of the 1800s, plates became mass-produced, at first in Germany. Chromolithographs printed in transparent colors were applied to the glass plate and it became possible to buy subjects in transfer kit form, which one could apply to the glass plates oneself.

Subjects varied; landscapes, monuments, nature, mythological themes, historical or even religious, fairy tales and legends, comic strips, or children's series. Some plates were fitted with mechanisms enabling them to be animated, such as a crank or a rod, which turned a second concentric plate, or a cord, which pulled another element across in front of the background or transformed the subject.

William Charles Hughes, an English optician, manufactured a triple lantern around 1895. Producing lanterns and various projection materials, Hughes submitted a whole series of patents between 1875 and 1893. He was a pioneer of the earliest English cinematographic equipment, producing a cinematographic street viewer. Manufactured out of mahogany and brass, and usable as a double lantern, its original system used

oxhydric lighting. Held in special bags, and later in bottles, the oxygen and hydrogen under pressure fueled the lantern via a system of rubber tubing connected to brass taps, enabling the regulation of their outflow onto the incandescent lime rod, or the restriction of their inflow to reduce the light, in order to produce a fade-out effect. A second set of longer focus lenses was used for large areas. The lenses were mounted on a mobile system, making it possible to incline them slightly in order to fully blend the three images.[xxxiii]

Such a lantern was, for example, ideal for the production of the "windmill in the snow" series, where the sequence of daytime, night-time and then snowbound scenes was achieved using two projection elements, with the third being used for the moonlight effect, the arrival of the swan (animated plate), or perhaps falling snow. During the show, several people were involved around the lantern, each with a precise function, as well as the musician(s) and the narrator.

Around the Animated Image

The functioning of the equipment designed to animate the image is based on the phenomenon of the persistence of the retinal image: when the images that make up a movement follow each other rapidly and with a break between each one, our eye does not notice this and the movement appears to us to be continuous as in reality.[xxxiv]

The cinematographic magic lantern functions on the same principle as the lantern for fixed images, with, in addition, a bladed shutter in front of the lens and a system of film advancement, comprising a perforated 35mm transparent continuous band.

The Mutoscopes were marketed from 1894 by the American Mutoscope Company and distributed in Paris from 1899. By feeding a ten centimes coin into the machine, one could turn a handle and watch scenes full of life and animation. The pictures were little sheets of paper mounted on a wheel, which could hold about a thousand. When this started up, an incandescent lamp came on. The subjects of these papers were very varied, though with a decided preference for saucy scenes.[xxxv]

Slide Projection

From the end of the 1920s, the first projection equipment appeared on the market for 35mm film slides, but it was not until after the war that color slides emerged.

Slide projection really took off after the 1960s. Photography on this basis was cheaper than color printing from a film negative, storing slides in boxes was quite practical, and slide shows could be rather pleasant occasions.

A number of slide projectors appeared on the market for domestic use, and the professionals were also partial to these accessories, which were more convenient for printing applications. Some specialized in "slide shows" and developed their techniques, working with fade-ins and fade-outs using several projectors.

With the advent of video and digital equipment, slide projectors began to lose ground and could well soon become collectors' items, albeit extremely interesting in their diversity, as almost every brand had its projector, often linked with a very specific slide-viewer.

The Plate Era

Inventions at the end of the nineteenth century led to mass manufacturing of plates, which had become much more sensitive to light. This opened the way to the creation of instantaneous photographs. The recorded image brought movement to a standstill, froze a gesture, laid bare what was elusive and invisible. This completely new visual representation of movement, however, was poorly understood.

Advances in technology accelerated, and photography both went with the flow and took advantage of it. Cameras could be hand-held, and improvements were made, which saw significant increases in the quality and luminosity of lenses. Electricity made lighting the studio simpler, and offered much more stable light sources for projection and for enlargement.

In parallel to a diversification in the professional photographer's activities, the simplified practice of photography aroused an ever-growing interest from the public, with newly founded societies attracting amateurs keen to hone their techniques.

At the dawn of the twentieth century, the invention of halftone photography allowed a photographic image to be printed straight into books, magazines, and daily newspapers. This opened up an enormous market, not the least of which was press photography.

While people were still asking questions about photography's status as an art form, they were no longer in any doubt about its range of applications. Photography quite simply became indispensable.

Gelatine Bromide Plates

The complexity of the collodion wet-plate process pushed researchers to experiment with new solutions. A desire to reduce exposure time while continuing to use permanently sensitive negative plates was a driving force behind research. This led to the invention of the silver bromide process – the dry plate was born.

In 1855, French chemistry professor Jean-Marie Taupenot mixed collodion albumen, and devised a plate, which could be used dry. The Englishmen B.J. Sayce and W.B. Bolton improved the process somewhat when they made silver collodion bromide plates - which went on sale from 1867. In spite of this progress, and the advantage of having ready-to-use plates, these film bases were not very sensitive.

In 1871, the experiences of the English doctor Richard Leach Maddox brought the first solution: he coated a glass plate with a gelatine emulsion containing silver bromide, subsequently dried; even so, it still was not sensitive enough. Then in 1878, Charles Harper Bennett proposed heating the emulsion before applying it to the glass. An increase in sensitivity was then recorded, which permitted exposures of 1/25th of a second, thus opening the way to capturing the moment.

Mass-production of the dry gelatine bromide plates began, with various European and American companies embarking on their manufacture. Switzerland also had a hand in the process via the business of Dr. J.H. Smith, who invented a machine for coating emulsion onto glass plates.

Thanks to the reduced exposure time, it became possible to take a photograph without a tripod, and this would have a revolutionary effect on camera design.[xxxvi]

The Photographer's New Tools

The appearance of Richard Leach Maddox's dry plate and the progress it enabled gave birth to a flourish in the creation of hand-held cameras, equipped with a viewfinder, shutter and plate magazine. A few field camera aficionados carried on using them, fitting them with a shutter.

The camera took the form of a large box which could contain several plates and be fitted with mirror finders to suit the format in height and width, and which was simply hand-held to operate. The novel and remarkable discreteness of this type of camera brought it the nickname the "detective", and during the 1890s, it enjoyed a certain success. It could hold a dozen 9x12 cm or 13x18 cm plates with gravity-assisted reloading or via a spring-loading system. The detective's lifespan would be brief however. The introduction of flexible film made it possible to produce cameras, which performed even better.[xxxvii]

From 1890 onwards came folding bellows cameras, whose front lens moved with the bellows into spring or cheek-stoppers onto which the viewfinder and shutter were attached.[xxxviii]

Reflex-type cameras, which made visible the exact image, which was to be photographed, had been around since the 1860s. In the 1880s they turned into a more or less cube-format box with a lens board mounted at the far end of a bellows, a focal plane shutter (located in front of the surface of the sensitive plate) and a focusing head on the camera. This covered the ground glass receiving the image of the subject to be photographed via the intermediary of a mirror set at a 45° angle behind the taking lens.

Pointing the Camera

Instant photography meant changes to working practices. The camera could leave the tripod, which meant a permanent field of view was necessary, both in order to frame the subject and to bring it into focus.

The simplest solution was to place two cameras both equipped with the same lens one on top of the other, one for framing, the other for taking the picture. A slight difference between the two images persisted.

From then on, manufacturers dreamt up various viewfinders, from simple frames to more complex optical systems, even adopting the solution of a second lens, which reflected the image to a plane above the camera via a mirror set at 45°.

The culmination of this system was the reflex viewfinder, or the use of a retractable mirror placed behind the taking lens, allowing the photographer to see precisely the image that would be photographed before it was taken, because the shutter was released to allow light to expose the sensitive plate.[xxxix]

Measuring Light

From the moment plates started to be mass-produced, it became essential to quantify their sensitivity. In order to make the operator's life easier, various light measurement systems were developed. Not very practical, and frequently experimental, the photoelectric light meter would supersede them – to great effect.

Exposure tables or calculators

In around 1880, Ferdinand Hurter, born in Schaffhouse, Switzerland, and Englishman Vero Charles Driffield developed a procedure based on sensitometry linked to the introduction of a sensitivity index, which would remain in use up until today. Various types of tables made it possible to determine correct exposure time

working on the basis of parameters, such as the type of subject, light conditions, latitude, season and time of day etc.

Actinometers
The founding principle of these devices worked by measuring the time taken by a photosensitive paper to reach a specified density. Alfred Watkins around 1890 was the first to really enable this system to show its worth.

Extinction meters
A graduated filter or optical wedge was adjusted on the camera, pointing at the subject, until the moment when the brightest point on the subject just ceased to be visible. The luminosity index obtained was calculated using a scale in order to work out the exposure time. This method remained uncertain.

Photoelectric light meters
In February 1873, Willoughby Smith held a conference at the British Society of Telegraph Engineers, presenting information on the variation of the photoelectric conductivity of selenium, according to the amount of light received. This discovery led to various more or less unsuccessful research, since the electrical technology of the period was still in its infancy. It took until the 1930s to show serious results.

Mechanics took its Place in Photography
Long exposure times did not require a shutter mechanism – a lens cap sufficed. However, in order to make an exposure, lasting a fraction of a second, the use of a mechanism became essential. The first lens-mounted shutters appeared around 1860.

One of the first systems was the foreground shutter. A spring activated one or two valves. *"In the case of instant photography"* a drop shutter was recommended: a blade with a hole in it slid into the frame with the help of gravity. A double guillotine perfected this system, moved by sideways-acting sets of springs.

Early shutters, experimental at best, were progressively replaced by various mechanisms offering a choice of different speeds and shutter actions. The roller-blind shutter located in front of the lens fully met these criteria, with the advantage that it was light and did not cause vibrations: the shutter was a sort of small blind made from black cloth which wound itself around a spring-loaded axle, whose tension could be adjusted according to the desired exposure.

From the 1900s on, two types of shutters became widespread: the focal roller-blind shutter, situated in front of the sensitive surface, and the central shutter, which was made up of leaves exposing the lens from its center outwards and mounted inside it. The Compur, which came out in 1912, was the most popular of these models.[xl]

The Photosphère
In the 1880s, the growing degree of amateur interest in photography encouraged camera manufacturers to design equipment, which was easier to use and harder wearing. It was in this context that Napoleon Conti developed the Photosphère, a metal camera designed for exploration in tropical countries.

From 1886, Conti undertook to build a metal camera, which could resist any kind of weather and humidity in tropical countries, the tropicalized photographic body. Conti did not stop there. He wanted to design a new camera, easier to use and lighter. In 1888, he applied for a patent for the photosphere. This was the

same year as George Eastman launched the Kodak, the first camera designed to be used with film. The Compagnie Française de Photographie began selling the photosphère in 1889.

The photosphère, an entirely metallic camera, was equipped with a flat back, which could take a double chassis or a magazine. The hemisphere-shaped, spring-activated shutter gave this camera its unique shape.

Subsequently, Conti did not stop improving his camera, making it more and more precise, easier to use, and equipping it with various accessories, including a viewfinder, and even a mount enabling the camera to be fitted to a bicycle. Over the course of several years, the photosphère was made for four different formats, including one model in 1891 for taking stereoscopic exposures.

The photosphère was on sale for roughly a decade; some 4,000 units were made, including all the various formats. A practical piece of kit, the photosphere's compact size made it an immediate hit among both amateurs and explorers.[xli]

Two One-Thousandths of a Second

At the end of the 19th century, Guido Sigriste, a Swiss painter well known in Paris, tried to fix the attitudes of a galloping horse for the demands of his art. He specialized in representations of historic scenes and battles. Not able to find a camera fast enough, he decided to build one himself.

Sigriste started to learn about photographic science, and designed a camera equipped with a slit shutter, for which he obtained a Swiss patent on 17 November 1898, and a gold medal at the 1900 Paris Exposition Universelle World Fair. Together with two associates, he then created the Maximum Performance Camera Company (Société anonyme des appareils photographiques à rendement maximum) and set up a factory at Neuilly. The first cameras went on sale in 1902, manufactured in various formats, even including a stereo version. A lack of resources, however, meant that the business did not do well. By 1906, production had already come to a halt.

The shutter system developed by Sigriste was truly revolutionary for its time. The slit focal shutter "swept" the plate, and was held in a moving bellows joined to the front of the camera to prevent rogue light from getting in. This system worked simultaneously by adjustment of the slit width and the rate of travel, offering considerable latitude in exposure time, according to different subjects, as indicated on the table underneath the shutter control wheel.

The Telephoto

Invented by Auguste Vautier-Dufour, and patented in 1901, the Telephot made it possible to take photographs at a long distance thanks to an ingenious system, which reduced the camera's bulkiness.

An ardent photographer of the night skies and a lover of telephotography, Vautier-Dufour had been busy experimenting since the 1890s. After a series of unsuccessful trials, he finally had some good results, some of which were thanks to advice from Emile Schaer, associate astronomer at the Geneva Observatory. This allowed him to reduce the bulk of a camera equipped with a very long focal-length lens.

Two internally-mounted mirrors lengthened the distance which light has to travel by making it run the length of the camera three times, thus enabling it to be more compact in size. It was possible to retract the upper part into the body for transporting.

The patent for the Telephot, Vautier-Dufour and Schaer's system was obtained on 14 March 1901. To sell his camera, in 1904 Vautier-Dufour created the VEGA Photography and Optics Company, together with photographer Frederic Boissonnas, located in the rue Versonnex in Geneva, which produced several different models including a stereoscopic Telephot.

Magnesium Flash Photography

Capturing the image was also about capturing movement. In other words, there was still a need to address the question of making something stand still. To find a solution to this problem, people very quickly started thinking about using a powerful and rapid-acting light source, like a magnesium flash.

In 1808, Sir Humphry Davy, inventor of the arc lamp, discovered how to isolate magnesium in its pure metallic form. Nevertheless, it took until 1860 to understand its light-giving properties and to develop a process for refining it efficiently. The first time magnesium was used in photography was in 1864.

Numerous patents were lodged for lamps, which used magnesium in ribbon form, producing a bright light whose duration was linked to the length of ribbon used; but these processes remained expensive, and still did not make it possible to take a truly instantaneous photograph.

The following years were dedicated to finding ways to produce a true magnesium flash, and from 1880, powder flash was developed with the addition of an oxidant for improved lighting, as well as various mechanisms facilitating its usage, such as spirit-lamp burners, or more basic devices such as powder trays, the use of which was not without its dangers.[xlii]

Eadweard Muybridge – bringing Movement back to Life

An English photographer based in the United States, Eadweard Muybridge specialized in landscapes, monuments, ships, and horses. In order to photograph the latter while they were moving at a gallop, he developed a system, which made it possible to set off a series of cameras one after another, and obtained a patent for it in 1878.

In 1872, Muybridge met Lelan Stanford, a former Governor of California, who had a passion for horses. In order to satisfy Stanford's wish for *"a series of pictures showing every component part of the horse's gallop"*, Muybridge set up 12 cameras, which a horse would set off one by one while it was galloping, by breaking threads linked to electromagnetic shutters in the cameras. He submitted a patent for this system in July 1878, and sold his photographs as well as zootrope and praxinoscope adaptors, which he devised in his San Francisco workshop.

From 1879, the photographer extended his observations both to other animals and to humans, this time using 24 cameras. The international press published glowing accounts of his work.

From the start of 1880, Muybridge began to employ projection to present his images. He did not project his photographs directly, preferring to use images, which he painted onto a glass disc. Muybridge then organized public projection meetings, and from 1881, embarked on a tour of Europe.

From 1884, Muybridge worked at the University of Pennsylvania. There, he enjoyed much-needed support, and could devote himself wholeheartedly to his life's great work, "Animal Locomotion, an electro-photographic investigation of consecutives phases of animal movements", which came out in 1887.[xliii]

The Animated Image and Emile Reynaud

In the nineteenth century, the animated image fascinated everyone. Animation machines were built on the phenomenon of persistence of vision demonstrated at the beginning of the century – in other words the eye's ability to retain an idea of an image, which had already been seen – and then to associate it with the image that was currently being seen.

From 1840 onwards, people started to project moving images. In 1853, Jules Duboscq, a French optician, came up with a machine, which could project stroboscopic discs. In 1869, an Englishman, Thomas Ross, submitted a patent for the Wheel of Life, projecting images from a phenakistoscope with the help of a magic lantern.[xliv] However, the perfection of these systems we owe to Emile Reynaud.

In 1864, Reynaud, a precision engineer, met Catholic priest and physicist Abbé Moigno, and through him, he discovered magic lanterns. Reynaud fell in love with these devices. Noticing that the movement of the slits darkened the images and colors, he decided to improve this mechanism by replacing the slits with a series of mirrors arranged in a crown at the center of the device. On 30 August 1877, Reynaud submitted a patent for the praxinoscope (from Greek "praxis", meaning "action", and "skopein", "to examine").[xlv]

Enthralled with the process, Reynaud did not stop there. In 1879, he built his praxinoscope inside a box equipped with a slit, which made it possible to observe moving images against a background reflected onto a two-way mirror, the Praxinoscope Theatre. After this followed a combination of the praxinoscope, with a magic lantern, the Projection Praxinoscope. In 1888, the Optical Theatre, a larger model of the Projection Praxinoscope, was born. In 1892, Reynaud signed a contract with the Musée Grevin. His illuminated pantomimes were very successful for a number of years.[xlvi]

Image Animation Machines

Throughout the nineteenth century, people invented all manner of enchanting devices for animating the image, each with its peculiar characteristics, whose workings were based on the phenomenon of retinal persistence.

The Phenakistiscope (from Greek "phenax", "a cheat", and skopein, "to examine"), invented by a Belgian physician, Joseph Plateau, in 1832, was a disc perforated by a specific number of blades spinning vertically in front of a mirror. By looking through the blades at the mirror, the subject printed on the interchangeable disc appeared as a moving image.[xlvii]

The Zootrope (from Greek "zoe", "life", and "tropion", "to turn"), devised in 1833 by British mathematician William George Horner, only went on sale in 1867. When this cylinder perforated by vertical blades was rotated and watched through these blades, the image reel sprang into life. With his praxinoscope, Reynaud improved the principle of the zootrope, with mirrors reducing the shuttering. Our perception of the moving image got significantly better.[xlviii]

The interchangeable reels were often printed on both sides. The subjects displayed were very diverse, often playful, the main idea being to create the most lifelike sequence possible.

Ottomar Anschütz: perfecting the Zootrope

From the 1880s onwards, Ottomar Anschütz, a portrait painter from Lissa in Prussia (present-day Poland), became interested in analyzing movement like Muybridge and Marey before him. He developed a series of shutters, which enabled him to take exposures at 1/1000th of a second. Using a battery of cameras

equipped with these rapid-fire shutters, Anschütz photographed the locomotion of horses, and military maneuvers.

In 1886, Anschütz perfected the Zootrope, an optical toy, which had been on sale since 1867. In place of drawings, which broke down movement, he substituted his chronophotographic pictures, placing the blades between the images instead of on top of them. As a result, successive exposures became visible, printed horizontally or vertically onto cardboard strips.[xlix]

In parallel, Anschütz took an important step towards cinematographic projection. In 1887, he developed the Electrotachyscope, a disc on which transparencies were mounted, each representing different stages in a movement.[l] As the disc turned, thanks to an electrical contact mechanism, each image was briefly lit by a gas tube (the Geissler tube[li]) which lit up when an electric current was put through it, thereby bringing the movement back to life. Projection thus disappeared, as the one- or two-second animated sequence on the disc could be seen directly. This machine, which later went on sale, subsequently made it possible for a limited number of people to enjoy the spectacle.

Reproduction and Impression

From the beginning of the nineteenth century, progress in the realms both of photography and of printing finally enabled direct reproduction of a photographic image in a print. Thus, a large number of illustrated magazines were born.

From the 1880s, the phototype process made it possible to produce a large quantity of quality prints. The print had to be affixed into the pages of the book designed for this purpose. Heliogravure, a very beautiful process, which required that the image be printed onto special paper, was used for art books.[lii]

From 1890, process engraving (duotone) finally meant that the image and text could appear on a single document, opening the way to large-scale production of illustrated magazines and other publications. The original image had to be in the form of an engraved image, made up of variable-sized engraving points according to the density of the tone, which was to be reproduced. This was copied onto a metallic plate where each point was pushed into relief in order to receive the printing ink. In this way, photography integrated text, and the page could be printed in one go.[liii]

Reproduction cameras designed for photographic copying of documents up to the largest sizes were developed, with adapted lighting; the document being reproduced needed a high quality perfectly uniform light. To begin with, natural light was advocated for this operation, which would give way in due course to widespread use of arc lighting.

Legal Photography

From photography's very beginnings, portraits made in daguerreotype were used to identify individuals. Around 1860, the widespread use of reproduction proofs and the invention of the calling card intensified the practice of legal photography. These formats made it possible to distribute pictures of wanted criminals.

Following the events of the 1871 Paris Commune, suspects were photographed in surrounding prisons. In 1872, the first police photography service was created. Alphonse Bertillon developed an anthropometric system, bertillonage, in 1882, which consisted of producing signal files, containing the measurements and characteristic signs of every subject. Both a frontal and profile photo were taken of the detainee. These two

portraits completed the file. In 1888, Bertillon was named head of the photographic department of the identification service for the Paris Prefecture Police.[liv]

In the heart of the studio was a chair set a good distance away from the camera, which allowed frontal and profile photos to be taken of the detainees. Lighting and the positioning of the subject had to be strictly observed. A fast-printing machine, which was also present in the studio, could produce 20,000 small format photographs in a single night, thus enabling wide distribution of images when looking for a criminal. This system soon spread all over Europe.

In 1909, Rodolphe Archibald Reiss, a professor of photographic sciences at Lausanne University and editor of the Swiss Photography Review created the Institute of Police Science, where the Bertillon method was put into practice.

Multiple Image Cameras

With the growing appetite for photographic portraiture, the introduction of the portrait in the calling card format, and improvements to sensitive emulsions gave birth to a new type of camera, one, which gave multiple images, that would make sittings less fastidious, and more fun.

Numerous models were proposed on the market, functioning according to the three following principles:

Around 1850, a photographic body could be fitted with a sliding back, which moved to take several exposures on a single plate. Subsequently, these multiplier backs enabled even more images to be taken, as it became possible to move them horizontally and vertically.

One of the ideas was also to move the lens in front of the plate, mounting it on a sliding or rotating board.

The final solution was to fit a specific number of lenses to the camera, which would all expose the plate individually, as a group, or simultaneously. This system was deemed too expensive, and the multiplier back took over. Even so, around 1900, postage stamp format photography was very popular, and this type of camera enjoyed a renewed bout of interest for this specific application.

The Carte de visite Portrait

Thanks to the development of the wet collodion process in the 1850s, it became possible to produce better proofs, and reduce exposure times. In this context, portrait photography enjoyed a big boost in popularity. In 1854, French photographer Andre Adolphe Eugene Disderi submitted a patent for the carte de visite format portrait.

Disderi's new process consisted in taking several exposures, measuring roughly 6x9 cm, on a single plate with the help of a multiple lens body or a monocular body fitted with a multiplier back. The proofs were not all exposed at the same time, making it possible to change pose. Making the portraits into a smaller format enabled cost reductions, and from this moment on, photography became accessible to even more people.

This invention lead to a considerable increase in photographic studios in Europe and the United States. Customers had various accessories and backgrounds at their disposal for the creation of their portraits while having their photographs taken. The developed proof was mounted on a card with the photographer's name on the back, giving the latter a good bit of publicity.

The carte de visite portrait was a great success. People collected miniatures of their families, their friends, or even celebrities of the day. They made lavishly decorated albums in which to keep these portraits. During these years, formats diversified, notably including the office, bedroom or outdoor walk formats.[lv]

The Photographic Portrait

The photographic portrait was already popular in the daguerreotype era. In 1854, the invention of the carte de visite portrait immediately experienced colossal success. Portrait taking became a flourishing activity, which would lose its power in the face of photographic techniques as they became available to all. Its aesthetic would gain in stature in accordance with fashions of the day.

The photographer's studio was a world in itself, either small or large depending on the owner's means. In the waiting room, customers were free to peruse albums placed at their disposal and think about the setting, which would best suit them. The customer then moved on into the portrait studio, a large space bathed in light, thanks to an atrium window, which was also the source of uncomfortable variations in atmospheric conditions, if one believed the things people said about them.

Once the background (painted canvas), the furniture and the accessories had been chosen, the models struck their pose, helped by the headrest in order to stay still during the long seconds it took for the exposure to happen. The photographer adjusted the natural light with the help of curtains around the atrium and white reflector screens; it was not until the 1880s that it became possible to use electric light.

When all was set up, the photographer just needed to release the shutter. The camera, a studio body, stood on a tripod; it was fitted with a special lens for taking portraits, with a slightly long focal length, and above all a big aperture, which allowed for reduction in exposure times. The sensitive plates were typically 13x18 cm or 18x24 cm format.

Passport Photo Machine

From the end of the nineteenth century, procedures of automatic photography came into existence. The invention of the passport photo booth was based on a system of automated exposures followed by the development of the negative and its immediate small format printing. A Russian born immigrant to the United States, Anatol Marco Josepho, submitted a patent in 1924 in New York. This first automated Photobooth was named the "Photomaton". In 1927, Josepho was paid one million dollars for the invention.[lvi]

In 1889 in Paris, Théophile-Ernest Enjalbert, a camera-maker, presented an automatic photography system during the Exposition Universelle World Fair, which turned out not to lead anywhere in particular.[lvii]
In 1893, German Conrad Bernitt showed off the "Bosco Automatic", two cameras, which were set off by a coin being introduced and produced tintypes. It was only in 1910 that photographs start to be printed on strips of paper.

The first public automatic photo booth was installed in 1926 in New York, and the Photomaton Company founded in 1927 was active from its very beginnings in Europe, but also in China and Japan. At that time, it produced six different poses, which were delivered within eight minutes, with some models able to print out portraits in the postcard format. About 1925, Siemens & Halske developed a photographic booth. Fun and functional (for identity photographs), the photo booth soon became a big hit with artists too.

Spy and Detective Cameras

The spy camera, or a camera disguised in another form to take photographs in secret, came into being at the same time as the gelatine bromide dry plate, although some early versions were rather more ambitious.

Spy cameras, whether a serious or playful tool, took every possible shape: a revolver, a disc hidden under the waistcoat, a tie, binoculars, a hat, a book, even a handbag. It was fitted with plates, which were sometimes in a tiny format, and ingenious systems for their development. The appearance of film on a flexible base would enable other fantasies such as the pen, the watch, or the cane.

Photography measures the Landscape

Photogrammetry is the practice of taking measurements through the medium of photography, enabling an object to be fully reconstructed by comparing different views. In 1851, French colonel Aime Laussedat created the first photographic body designed for measuring. He may be regarded as the father of photogrammetry.

A future General, Guillaume-Henri Dufour, used this method to make a geometric representation of Swiss territory. From 1832, he worked with his assistants on carrying out a relief map of of Switzerland using the principle of triangulation. In 1845, they published the first of the 25 pages, which made up the 1:100.000 scale national map. Publication was completed in 1864.

In 1878, the Swiss Federal Topographical Office carried out its first photogrammetric terrestrial relief map of the Rhone glacier. Round about 1890, German teacher Carl Koppe, who had already been carrying out triangulation work on the St. Gottard railway, made a series of relief maps within the framework of a construction survey for the Jungfrau railway.

The X-ray

There had been many experiments since the invention of photography. A new decisive step was taken in 1895, when physician Wilhelm Conrad Röntgen, a professor at the Physics Institute at the University of Wurzburg in Bavaria, discovered the X-ray.

In 1842, the English physicist and doctor, John William Draper, obtained absorption rays on daguerreotype plates of ultraviolet and infrared. In so doing, he proved that the sensitive photographic plate could carry the impression of invisible luminous radiation. X-rays were a part of this invisible radiation.

On 8 November 1895, while he was working on electrical experiments with a Crooks (cathode) tube, Röntgen discovered this radiation. The tube, despite being completely darkened, still emitted a weak light, which enabled him to detect the shadow of bones in his hand, which were opaque to the X-rays just like metal, on a panel painted with fluorescent material. On December 22 1895, he photographed the skeleton of his wife's hand exposed in this way – an image, which became emblematic of the beginnings of radiography.

From this moment on, radiography made rapid progress. Initial exposure times of fifteen minutes to an hour were quickly reduced. Big photographic firms like Ilford and Eastman also manufactured special emulsions.

Röntgen's discovery allowed him to obtain the first Nobel Prize for Physics in 1901.[lviii]

Microscopic Photography

People had been thinking about the possible scientific applications of photography ever since it began, but time was invested in truly taking on photography. This turned out to be restrictive to the freedoms of an artist, who could explore a subject's three dimensions, while producing an image, which was more vivid, by blurring the unimportant structures of his or her drawing.

Very quickly, scientists wanted to try to use photography to record what the naked eye could not see, but which they already knew intimately thanks to the microscope, which had been in use since its appearance in the seventeenth century. It was only in the 1880s that the use of microphotography became widespread.

Even so, there was a mass of subjects, which needed recording, whose size was too big for a microscope, yet which at the same time, was difficult to photograph with a traditional camera. The macrophotographic picture required a particular piece of equipment to be able to get sufficiently close to the subject. Manufacturers of photographic equipment quickly made these kinds of accessories available to buy.

The Photographer's Laboratory circa 1900

The increase in the sensitivity of photographic papers from the middle of the 1880s associated to new gas or electrical light sources, particularly of those of the "Gaslight" type, finally made the practice of negative enlargement available on a mass scale.

French optician Noël Paymal Lerebours was said to be the first to have experimented with enlargement, as early as 1853. In 1855, Auguste Bertsch managed to make enlargements of a series of four images, "the white barrier" from negatives around seven cm. long on their side, in order to test a new chemical recipe. He was the designer of the small metallic camera, which had taken these pictures, as well as of the accompanying enlarger, the solar "Magnascope".

Around 1860, the Belgian photographer Desiré van Monckhoven, whose contribution to photography was considerable, designed a solar reflector enlarger (a mobile mirror which moved according to the trajectory of the sun), an improved version of the one which the American David Woodward patented in Baltimore in 1857, based on the principle of a magic lantern whose light source was sunlight. During the 1860s, Edouard Delessert, a French photographer from the Vaud, also developed his images using a solar enlarger.

The Amateur Photographer

The simplified practice of photography and the appearance of easy-to-use cameras making it possible to produce more spontaneous images would interest an entirely new public made up of "distinguished amateurs", who wanted to perfect their knowledge. It did not become a craze, until the practice of using flexible film became widespread.

From the 1880s on, numerous photographic societies sprang into life. They welcomed both amateurs and professionals into the ranks, even scientists working closely with photographic circles. Every photography society offered regular meetings to its members so that they could share their experiences, take part in conferences and demonstrations as well as in excursions. They put together exhibitions, organized competitions with prizes in the form of both medals and diplomas. Each member had access to its society laboratory and to a library, which was subscribed to various publications including foreign ones.

Access to the medium was made easier by the publicity that brands like Kodak put into operation very skillfully. Numerous works and manuals dealing with taking pictures as well as development and printing procedures were all aimed at amateurs who wanted to sharpen their eyes and perfect their techniques.

Color Photography

From the beginnings of the daguerreotype, scientists and researchers dreamt of the silver plate retaining a color imprint. Nevertheless, they had to wait for an extension in photosensitivity to include all visible colors in the spectrum for photography to satisfy this desire.

From 1859, Louis Ducos du Hauron, a French pianist with a passion for optics, threw himself into the task: *"the experience of painters taught me that a mix, in suitable proportions, of red, yellow and blue could produce more or less every color"*. Thus, he demonstrated the principle of trichromy, and on 7 May 1869, he presented his results to the French Photography Society. For his part, the poet Charles Cros became author at the same time of the work "General solution to the problem of color photography".

In 1874, Louis Ducos du Hauron patented the Melanochromoscope, a camera fitted with a single lens and semi-transparent mirrors, enabling a simultaneous exposure of three separate black-and-white plates through three filters, blue, green and red. It was possible to restore all the colors (through additive synthesis), by superposing these three pictures colored in their respective tints on top of one another. Ducos du Hauron can thus be considered the true creator of color photography, and modern processes were the product of his discovery.[lix]

With the development of color in the realm of publishing, photographers found a new sphere of activity: they did not just take pictures using trichrome bodies, with the help of processes like pinatype, they also worked on the selection of colors as a function of the future print they would make, giving subjects a test print in reference.

The Lumière Brothers' Autochrome Process

The Lumière brothers, Auguste and Louis, best known as the inventors of cinema in 1895, developed a completely original method of color photography, which they were the first to mass-produce. On December 17 1903, they obtained a patent for a process known as Autochrome – color, which derives from itself.

Having collaborated in the development of Gabriel Lippman's interference process in 1891, starting in 1892 the Lumière brothers decided to dedicate their research to improving Louis Ducos du Hauron's 1869 trichrome process.

The method developed by the Lumière brothers aimed to simplify the trichrome process by using a single plate containing a fine network of potato starch particles colored blue, green and orange-red. They published their first results in 1904, and started production in 1907. From the 1930s on, along with the advent of the small format and the arrival on the market of new color processes, the success of the autochrome plate began to decline.[lx]

Under the microscope

Looking at a fragment of an autochrome plate it was possible to see the network of orange-red, green and blue-violet microscopic potato starch grains. They acted like filters, coloring every point of the image in its true tint in relation to the black-and-white image, which was behind it.

Photographic Optics

The science of optics was considerably more ancient than that of photography. Opticians frequently built lenses destined for telescopes, microscopes and camerae obscurae. The birth of photography led to new demands for obtaining a luminous image, clean right across its surface and with no deformities.

The first lenses were built using a simple lens, known as a meniscus lens, which required the use of a "pupil" or diaphragm in order to restrict light to passing through its center, thereby limiting errors. Daguerre already used the combination designed by Charles Chevalier of two lenses made from different glass, so the faults of one compensated those of the other, improving the end result.

In 1840, Charles Chevalier introduced "photography using combined glass", which worked both as a landscape lens and as a portrait lens by the addition of a supplementary element. One year later, the Hungarian optician Joseph Petzval, who was born in present-day Slovakia, designed a lens, whose luminosity would remain unequalled for a long time, frequently used for taking portraits.

Stereoscopic Photography

British physician Charles Wheatstone established the principle of binocular vision for the first time in 1831. A fashionable phenomenon ever since the London Great Exhibition of 1851, stereoscopic photography lost its appeal after 1865. From the 1880s onwards, this quite particular form of photography enjoyed a return to popularity with the advent of the dry plate and of cameras, which were easier to handle.

In 1891, the International Congress of Photography adopted a standardized 8.5 x 17 cm format for stereogrammes. Those, which were available to buy enjoyed consistent success, the more so since the easy-to-use, open type or "American" stereoscope was widely distributed.

The first stereoscopy clubs were founded in around 1900, but the arrival of the postcard and of cinema took stereoscopic photography to task, forcing its advocates to pull together to save it.

Between 1900 and 1920, the range of stereoscopic cameras was broad, with high quality versions like those from the Jules Richard factory in Paris leading the field. Progress at the end of the century was down to his patent for the "Verascope" in January 1893, a camera, which was easy to use, but employed high quality technology, designed for taking and looking at images. The immense success of this camera, along with the range, which followed it, not counting the numerous viewers, which Richard invented like the Taxiphote, a stereo transparency viewing cabinet for the home, made a considerable contribution to renewing enthusiasm for stereoscopy circa 1900.

Military Cameras

Armies rapidly understood how they could benefit from photography, as a means of surveillance of enemy lines. These observation campaigns were undertaken on ground level by artillery regiments or from fixed balloons by balloon units, air force troops took up the baton from the start of the First World War.

At the dawn of the twentieth century, Zeiss made long-range telephotographic bodies in its Dutch branch, the Nedinsco Company. The highest performing body, with a three-meter focal length, constituted a serious strategic advantage during the 1914-18 war, as did the 1m20 and 70 cm versions, delivered into the hands of observers in fixed-line balloons who photographed enemy lines, the balloon was well lashed onto its cable at the limit of the enemy artillery's range.

The first Swiss military flights took place in autumn 1911. The highly conclusive results of this experience provided the impetus for other missions of this type in 1913, but it was not until the declaration of the First World War in August 1914 that Swiss air forces really came into life. The photographs taken from airplanes were done so using a hand-held body, which the observations officer held from on board the aircraft, pointing it as vertically as possibly, while the pilot concentrated completely just on flying. Reconnaissance flights were later systematized following serious progress both in terms of aeronautics and of photographic equipment, rendering the presence of a photographer on board unnecessary.

The photographic Jumelle

The photographic Jumelle took over from the Detective during the 1890s. Directly inspired by cameras used for stereoscopic photography, it was slightly conical in form, more compact and easier to use. Amateurs rapidly adopted the photographic Jumelle, and makers proposed various models, equipped with numerous perfections and all kinds of accessories.

Bodies for photographic Jumelles, made primitively out of wood, became metallic and were covered with a leather casing. The camera was equipped with foldable rangefinder, fixed lenses of various focal lengths, and a largely functional shutter. It took a magazine holding 6, 12, 18 or 24 plates whose formats varied from 6x6.5 cm to 9x12 cm. There was even a panoramic format, which came out of the stereoscopic binocular, with the entire stereogramme plate receiving a unique view.

Leon Gimpel, a self-taught French photographer, worked with the L'Illustration newspaper between 1897 and 1936. He produced a number of reportages on Parisian life, in black-and-white and in color (he was a great exponent of autochrome) equipped with a Spido photographic Jumelle by Gaumont. Thanks to this, photographic Jumelles were considered the first real tool for reporting.[lxi]

The Ermanox plays with the Shadows

This camera, made by Ernemann in Dresden from 1924, finally made it possible to take instant photographs in low light, thanks to the exceptional luminosity of its lens. Its design was rapidly outdated, and the Leica, a contemporary model of the Ermanox, soon supplanted it, being more compact and designed for 35mm film. Its production ceased around 1930.[lxii]

The Ernemann factory assigned the task of coming up with a lens with a larger aperture than f3.5, which was then considered superior, by the engineer Ludwig Bertele. The Ernostar was the result, opening out to f2.0, and then to f1.8, produced in several focal lengths.[lxiii]

The Ermanox, in aluminum, with a rangefinder, existed for a 4.5x6 cm plate format and for a larger 6.5x9 cm format. A foldable version was produced in 1925, allowing a size up to 13x18 cm. The Ermanox-Reflex, which went on sale in 1926, was designed for a 4.5x6 cm plate format. These various models were fitted with a focal plane shutter, which worked up to a thousandth of a second, while the lens was mounted on a tube with a spiral focusing system.

This highly successful 1920s camera was used among others by German journalist and photographer Erich Salomon, who particularly liked to take pictures without his subjects being aware, and as a result was able to take famous images of politicians talking among themselves, and of various celebrities as well. These "stolen" photographs were extraordinary at the time. In 1930, Salomon abandoned the Ermanox he had acquired in 1927, replacing it with a Leica. In 1944, his career was interrupted by his arrest and deportation.

The Compass – made by Watchmakers

The Compass, the origin of whose name remains unknown, owed its existence to an Englishman who was obsessed with technique but who had no particular relationship to photography - Noël Pemberton-Billing. Patented on 16 May 1936, the camera, built by LeCoultre & Cie in Le Sentier in the Vallée de Joux, brought with it a number of refinements, which were unheard of at the time.

The construction of the Compass was entrusted to LeCoultre & Cie, a company happy to have the chance to do something different in the midst of a crisis in watchmaking. The Compass Camera Company took over distribution once it reached England.

Extremely compact, the fully metal (aluminum) camera existed in three versions, with texts engraved on the housing in French, German or English. It was equipped with an f3.5 Kern lens and a coupled telemeter for focusing. It carried negatives on the glass plate or sheet film measuring 24x36mm; later came a 6-exposure roll film back. It also had built-in filters, an optical exposure meter, two finders including one with a right angle, a ground glass finder, a spirit level, a panoramic head and a stereoscopic system, allowing the camera to be moved laterally for taking two successive views.

LeCoultre & Cie produced 4,000 units up until 1939-40 when production of the Compass was forced to cease, due to it being impossible to source film made for the camera. The film had come from Ilford in England, but the factory stopped production because of bombardments during the war. From then on, this camera was very highly sought after among collectors.[lxiv]

The shooting studio

The model can adjust his/her attire in the area provided behind the screen in the corner of the posing lounge. In the shooting studio or posing lounge, bathed in light thanks to a glass panel facing north, the walls are treated in blue to soften the dazzling effects of the light.

The studio camera rests on one stable foot with a device that enables its height and angle of inclination to be adjusted; it is equipped with a special lens for portraits: a slightly long focal length and wide aperture to reduce the posing time. The sensitive glass plates are generally in 18x24 cm or 24x30 cm formats, or thanks to reduction frames, even smaller.

The plate sensitization and development laboratory (or dark room)

In the laboratory or dark room, lit by a filtered yellow or red light, the glass plates are sensitized just before the shooting, and subsequent development. Usually the photographer's assistant ensures that he has all the necessary products within easy reach.[lxv]

The storeroom for glass plates

In the glass plate storeroom, an adequate quantity of glasses in their correct sizes needs to be selected for the day's work. These plates will be cleaned with the greatest of care and then polished. The place can also serve as the workshop for various repairs.

The negative retouching studio

At ground floor level in the negative retouching studio, in front of a curtained window, to reduce the glare, the negative retoucher is at work; he sits at a specially equipped desk where a mirror directs the light under the negative, which lies on a frosted glass, with its sensitive surface upwards. A magnifying glass, scrapers, brushes and poster colors, rubbers and pencils, varnish and turpentine are the main tools.

The laboratory for the preparation of sensitized paper

It is in the laboratory for the preparation of sensitized paper, where the sheets of paper with paste have to be prepared, with a smooth surface. These sheets are submerged for a few minutes in salt water, dried and finally sensitized in a silver bath. Do not proceed to this process too soon, to avoid yellowing of the paper.

The exposure glass panel of the printing frame

The exposure or insolation happens in natural light in the glass display panel of the printing frame, placed on an inclining support in order to receive the rays of light most effectively. A laboratory assistant places the negative plate in a printing frame, in contact with a sheet of sensitized paper in a silver bath.

The insolation of this frame can last ten minutes in strong light, or one day in overcast conditions. Printing-out paper allows a permanent control of the intensity of the image, by opening one of the slides at the back of the frame in subdued light.

The printing laboratory

After having correctly exposed his image, the laboratory assistant moves on into the printing laboratory. The print is generously washed, then immersed around ten times in a toning bath to reinforce the sepia tint and to prolong its conservation. Washed again for 6 to 8 hours, it is fixed in thiosulphate, rinsed one last time, and hung to dry in a suitable dryer.

The finishing studio

The positives retoucher is busy retouching images or embellishing them with coloring highlights, while his colleague in charge of finishing proceeds to place them under the press to flatten the prints, and then to trim them and mount them on a stiff card or in a frame. A developed print is usually mounted on a cardboard, bearing the name of the photographer on the reverse side, providing him with good publicity.

The open-air portrait

As our studio enjoys the privilege of a garden, taking portrait photographs outside is quite possible as well as taking advantage of the good afternoon light. In order to immortalize his model, the photographer uses a more maneuverable camera, the field camera, and a darkroom tent, which enables him to prepare and treat his plate just before shooting.

The photographer's trips

For his trips, the photographer has a caravan and a horse, in order to transport all his material, without forgetting a ladder, on which he can fix his shooting camera, enabling him to be at the right height for architectural photographs. Once emptied of the cartons of materials, the interior of his caravan serves as laboratory, where he can install all the equipment he needs to prepare and develop his negative plates.

Part 3: The Picture as a Showpiece and photography as true mass media

The Century of the Film

The appearance of film on a flexible base in the 1880s was to radically transform photography. The camera underwent a veritable metamorphosis, becoming smaller and mechanical. The provision of a succession of views, with a facility that could not have been imagined with negatives on glass plates, film simplified photography so comprehensively that it introduced a real revolution in our way of observing and communicating and opened the way to the huge activity of photographers in the twentieth century.

The use of the film enabled the emergence of the cinema and 35mm cinema film, developed by Edison, led to another innovation, the famous Leica of Oskar Barnack. With this instrument, the actual concept of the modern camera came into its own. With the appearance of Rolleiflex from the end of the 1920s, it became the tool par excellence of photographic reporters and played an important role in the golden age of the illustrated press.

After 1945, the rapid economic recovery, together with easier access to leisure activities, gave a new lease of life to the photography industry. Film lent itself ideally to intensive industrialization, and photography entered the realms of mass consumption. With the general introduction of the rapid use of color in the 1960s, film and its processing became a supermarket product.

Although film first appeared only just before the twentieth century, it is today already in the process of disappearing in the face of rapid emergence of the digital image – and yet never have manufacturers offered such effective emulsions, as those coming from the latest research in the field.

Film

Film, or rather photographic film, is made of a gelatine emulsion containing silver grains, which are light-sensitive, applied to a flexible base. In black and white, it has only one layer of emulsion and three in color, respectively sensitive to blue, green and red.

From 1908, a so-called “safety” film, made of cellulose acetate, gradually replaced the first transparent bases made of highly inflammable nitrate cellulose.

This film does not “see” all the colors of the spectrum, and is insensitive the red light, which appears black in the picture. This spectral sensitivity was developed during the photographic color research conducted particularly by Adolf Miethe and Arthur Traube. In the 1920s, this gave birth to the panchromatic film, which was sensitive to the whole visible spectrum.

The silver grain size determined the sensitivity of the film to light. The bigger the grains, the more sensitive the film, or the less it needs light to be exposed, and more the photography will be granular. Sensitivity measurement scales appeared around the end of the nineteenth century, and became standardized in the 1930s with the DIN and ASA norms. Towards 1950, even greater sensitivity levels were proposed, such as the 1250 ASA, (today ISO) of the Royal X pan of Kodak, which was introduced in 1959.

The “natural” reproduction of colors has always had to come up against the highly subjective way these are perceived by everyone. Numerous surveys and studies have been conducted by manufacturers in the hope of being able to offer more suitable emulsions to everyone’s taste – even taking into account cultural and geographic aspects.[lxvi]

The First Film

Well before the appearance of the first George Eastman film, a first example of a film emerged during the Franco-German war of 1870. On this occasion, important documents were reduced photographically onto a piece of collodion and then flown by pigeon to the besieged Parisians.

Prudent René-Patrice Dagron, a chemist and photographer, invented a camera towards 1860 that could produce photographic views less than 2mm square. A moving glass plate carrying 9 lens reproduced the picture as many times as required to fill the sensitive plate.

Cut out straight from the plate, these tiny photographs could be affixed to various articles, such as jewels, penholders or other tourist items. They were applied by means of gluing with a cone acting as a magnifying glass, the Stanhope lens.

Airmail, set up after a meeting with well-known photographer and caricaturist Gaspard-Félix Tournachon, known by the pseudonym Nadar, proved very useful during the war of 1870. Dispatches and mail were reduced onto a collodion film. This light and flexible material was taken after treatment from the glass plate, which acted as its medium, then rolled into a feather tube, which was finally fixed to a homing pigeon's tail. The animal could thus carry up to 18 films the size of a quarter of a playing card, each containing the equivalent of 16 folio pages. All weighing less than a gram. The first film was born.[lxvii]

From one Spool to the other

Attempts were made to replace the glass plate by a flexible paper strip, culminating in the middle of the 1880s with the success of the roller chassis of George Eastman and William Walker, and the American Film.

The glass plate, used since the middle of the nineteenth century as the base for photographic emulsion, proved to have a number of disadvantages: its fragility, bulk and weight. A return to the use of a sensitive paper, which produced in long strips feeding from one bobbin to the other, was quickly developed.

Although the first known film to be drawn by a roller mechanism already dates back to 1854, it was not until the efforts of George Eastman that such a mechanism became popular with the public. Founder of what was to become the Kodak brand, Eastman wanted to put photography within everybody's reach. In 1884-85, he launched the negative in roll form with a bobbin chassis.

As the grain of the base paper could still be seen on the photograph, Eastman soon after produced the American Film, an advanced film that made it possible to separate the base paper from the sensitive layer after development. When printing, the sensitive surface transferred onto a glass plate, guaranteeing a better picture definition due to its transparency.[lxviii]

"You press the Button, we do the Rest"

Following the favorable reception the bobbin chassis received from the public, Eastman decided to integrate it inside a camera. He pursued his research in this direction and in 1888 created the Kodak Original – a camera that was to really popularize photography.

For this launch, Eastman devised the name of Kodak, easy to pronounce in all languages. This camera, so easy to use, brought photography within everybody's reach, despite a price of 25 dollars, which was high for the times. The most revolutionary item proposed by Eastman was a development and printing service process. Once the film was exposed, the user sent his camera to the factory and got it back a few days later

fully reloaded. It came back with the developed film and the negatives mounted on cardboard. Thus, the user did not have to worry about these delicate processes anymore. Eastman adapted the slogan: *"You press the button, we do the rest"*.

From 1889, Eastman replaced his film's base paper with celluloid, a transparent material. Although he was the first to commercialize it, Eastman was however not the first to invent celluloid film: a minister, Hannibal Goodwin, had taken out a patent for this two years earlier, but it had taken a long time to be delivered.

Eastman's work made a decisive impact on the history of photography, anticipating the popular success it was to encounter today.[lxix]

The Escopette (literally "Blunderbuss")

The success of the Kodak Original encouraged other camera makers to design cameras capable of using Eastman's film. This was the case for the Escopette, made by Albert Darier, and patented in November 1888.

The Escopette's name stems from the gun bearing the same name, because of its shape: the camera was mounted on a pistol grip, and a trigger served as the shutter release. It was easily hand-held but could also be stood up using the two movable legs located on the front of the camera. Like the Kodak Original, the camera did not have a viewfinder, but had lines of sight drawn onto the body instead.[lxx]

In 1889, Swiss photographer Frédéric Boissonnas took a series of photographs of the Vevey Winemakers' Fair using the Escopette. These were gathered together as a photograph album, which was probably published as a limited edition.

Bringing the Image to Life

Famous American inventor Thomas Alva Edison played a crucial role in the birth of the cinematographic industry. Instrumental in creating the perforated 35mm film, which then became the standard format for cinema and photography, Edison invented the first commercialized film viewer, the Kinetoscope, patented in 1891.

Having designed the phonograph, a device, which recorded and reproduced sounds, Edison was looking for a way to *"do for the eye what the phonograph did for the ear"*. In 1891, he invented the Kinetoscope, a device, which made it possible for a single spectator to view short films lasting about 30 seconds each.

At the same time, he developed the Kinetograph, a cinematographic camera. In order to shoot his films, Edison ordered 35mm format film from Eastman and Blair, half the width of the film used for the Kodak Original. He decided to perforate the film so a cogwheel could turn it. The perforated 35mm film became the standard format for cinema, and then later the standard format for photography.[lxxi]

The Birth of Cinema

In the race for the invention of cinema, brothers Auguste and Louis Lumière were the official creators of the process. In 1895, they patented a device, which could take pictures, print positives and project them onto a screen.

Inventors of several devices in the field of photography, the French Lumière brothers also invented the Cinematograph. The patent was registered in February 1895, but it was only in December that year that the Cinematograph became truly operational.

Marey's chronophotographic shots were already very close to cinematographic photograms, but only very short series were possible. Edison's invention solved that problem, using long reels of film, but it was not capable of projection. With the Cinematograph, the Lumière brothers were able to put together "long" sequences of film and project them for several spectators.

Auguste and Louis Lumière gave the cinematographic industry its true beginnings. They organized paying public projections and, as early as 1896, trained operators, who were sent all over France to shoot films.[lxxii]

Kodaks for Everyone

One of the main driving principles behind the world-famous Kodak brand was founder George Eastman's desire to simplify and popularize photography. After the launch of its first camera in 1888, the company released a large number and wide variety of products.

Conscious of the economic benefits to be derived from the growth in the amateur photography market, Eastman set up a genuine marketing project ahead of his time. Through the diversity of cameras sold and intensive advertising campaigns, he attempted to reach all potential users, and did not hesitate to target new audiences, such as women and children.

In the space of a few years, Kodak produced dozens of different models in order to meet all the amateurs' needs. As part of its drive to popularize photography, the company made its products more and more affordable, eventually selling one camera, the Brownie, for just 1 dollar.

Kodak's success enabled the company to retain a position of virtual monopoly for many years. Other giants of the photography industry such as Zeiss only began to grow much later, during the 1920s. The word "Kodak" was even used in the vernacular for a while, as a term referring to any camera.[lxxiii]

Spy Cameras

Made possible by the appearance of gelatino-bromide plates, spy cameras became very fashionable in the 1880s. Hidden within everyday objects, they made it possible to take photographs unnoticed. Emergence of film, which used a more flexible, more compact format, further stimulated the creativity of inventors.

The film reel was adapted to all kinds of everyday objects. Cameras were hidden within gentleman's attire, a watch, a cane, a hat etc., or in some cases handbags, which were used by the Soviet Union's intelligence service, the KGB.

Since it was important for discretion's sake not to take obvious aim at the subject, the main problem in terms of taking photographs with those kinds of cameras was the framing of the shot.

Vest Pocket: the Soldier's Camera?

As its name suggests, the Vest Pocket was a camera small enough to fit in a vest (or jacket) pocket. This foldable camera's reduced size was also due to the use of 127-format film, which was more compact than its predecessors. Its size, the simplicity of its use and its affordable cost made it a great success after its release in 1912.

During the First World War, Kodak launched an advertising campaign in the United States encouraging recruits to buy this camera. It was depicted as a way to relieve the boredom in the training camps where soldiers were stationed before being sent to Europe, and a way to share their everyday life with loved ones. In France, advertisements for the Vest Pocket appeared in the Photo-Plait catalogues, describing the

camera as “the soldier’s Kodak”. This would appear to suggest that everyone had their own Vest Pocket at the time. In fact, it seems to have been owned mainly by officers and a handful of soldiers from well-to-do backgrounds.

Despite an official ban on taking photographs at the front line, to protect the secrecy of military operations, countless photographs were taken. Some illustrated newspapers even took advantage of the abundance of images and organized contests rewarding the best amateur war photography.[lxxiv]

Sheet Film and Film Pack

Film came not only in rolled-up form, but also as individual sheets – sheet film. The latter appeared on the market in 1884 to replace the glass plate, and developed at the same time as the film reel. Inserted within a frame at first, it later also became available inside a cartridge, the Film Pack.

Sheet films were made of a sheet of celluloid slightly thicker and more rigid than rolled-up film. They were either set within a frame, which usually contained two sheet films back-to-back, the way glass plates were set, or within a cartridge, which had a greater capacity. In the latter case, the sheet films were thinner.

In 1884, Englishman John Carbutt was the first to sell these flat sheets of celluloid. Sheet films were seen as an excellent substitute for glass plates, which were heavy and fragile, and they made it possible to continue to use plate-based cameras, such as field cameras, whilst still enjoying the advantages of film.[lxxv]

Breaking down Movement

Following Eadweard Muybridge’s work on the representation of movement, French physiologist Etienne-Jules Marey realized how much he could benefit his own studies via the use of photography. He designed a photographic chamber using glass plates, which he then adapted to the use of film rolls.

In the course of his research, Marey first took an interest in movement inside the body, such as blood circulation and breathing. He then widened the scope of his studies to all forms of locomotion, be they human or animal.[lxxvi]

The images captured by Muybridge prompted Marey to turn to chronophotography, a series of successive frames, which broke down movement. Having obtained his first results using a photographic rifle, Marey equipped a photographic chamber with a rotating shutter with adjustable aperture, capturing 10 images per second. Every time the aperture passes in front of the lens, the subject has moved very slightly, and one obtains a succession of movements on the same sensitive plate. The drawback is that images are superimposed if the subject is not moving fast enough. This problem was solved in 1888 by Eastman’s paper film roll, and then by celluloid film in 1890. A press frame device made it possible to move the film forward, and then to stop it for each shot. The principle of the cinematographic camera was born.[lxxvii]

Leica: “small Negatives, large Photographs”

The camera, which truly launched the use of 35mm film in photography, was the Leica, which appeared on the market in 1925. It set the size of the small format with a 24x36mm negative.

Its inventor, German Oskar Barnack, was head of the Research and Development department at the Ernst Leitz Optical Institute in Wetzlar. A photography enthusiast whose health was fragile, he had long wanted to design a light, handy photographic camera he could take with him on his walks. He also designed a small device that was capable of testing the exposure of cinematographic images. Noticing that cinema negatives

produced enlargements of an excellent quality, he decided to turn what was at first only a cinematographic accessory into the pocket camera he wanted to design. Prototypes were made as early as 1913, but the First World War interrupted Barnack's research, and it was not until 1925 that Leitz launched its first series of cameras on the market.

The Leica, a contraction of Leitz Camera, defined what still today represents the small format. Barnack, taking up an idea that had already been applied to certain devices prior to the Leica, doubled the standard size of the cinema negative. He thus obtained a 24x36 mm format, which produced images that were of an even higher quality. Barnack felt that the two-thirds ratio between the sides was more harmonious.[lxxviii]

Rolleiflex

Released in 1929 by German company Franke & Heidecke, the Rolleiflex quickly became the reporting tool of choice for those who did not wish to switch to the smaller format.

This camera had two lenses, one for viewing and one for framing. The image was reflected by a mirror onto a ground glass found on the top of the camera. This system, which made clear viewing possible, had already been known for about 50 years at the time. Franke & Heidecke were the first to apply this device to a camera using film.

Made entirely out of metal, the Rolleiflex was very popular amongst reporters, who liked how it operated silently and the continuity of the viewing, while the photograph was taken, thanks to the 2-lens system, as well as its robustness. The viewing glass on the top of the camera was also an encouragement to take photographs from other points of view, rather than always at eye level. Lastly, Rolleiflex's 6x6 cm image format gave enlargements better definition than the 24x36 mm format.

Rolleiflex, the Leica and the Speed Graphic became the three main cameras used by photojournalists, with each camera offering different possibilities in terms of working methods, but also in terms of results.

Color

Color took off in the middle of the 1930s with the emergence of new emulsions designed initially for cinema and adapted afterwards for use in photography.

Several years after the Lumière autochrome plates, films began to appear using the same basic principle: a network of microscopic elements colored in the three primary colors, blue, green and red, filtered the light. Amongst these so-called geometrical screen films can be found for instance the Dufaycolor and the Finlay. Agfa put an Agfacolor film on the market in 1932, which used the same process. The difference was that it used a filter made of three strips of glass tinted in blue, red and green placed in front of the lens instead of a geometrical screen on the surface of the film. This surface, however, was covered in a framework of micro lenses.

The appearance of Kodachrome in 1935 marked the emergence of a new process based on the subtraction of colors rather than their addition. It made it possible to have an image without a geometrical screen, which therefore had a much finer grain. It was followed a year later by Agfacolor Neu. The complex development process for these two films meant that users were forced to send the films back to a lab once they were exposed. These two films, which took the form of slides once processed, paved the way for the democratization of color.

Photographer Pigeons

The first known aerial photographs were taken by Nadar in 1858 during a hot-air balloon flight. A novel idea in terms of taking photographs from the sky appeared about 40 years later: a small camera specifically designed to be carried by a pigeon, inconspicuously capturing satellite images.

Wilhelm Neubronner, a pharmacist from Kronberg in Germany, had carrier pigeons that brought him urgent prescriptions. His son Julius continued this practice. In order to verify the route taken by one of his pigeons, he designed a small device, which could be fitted to the bird's chest using elastic straps. Patented in 1903, this camera took several snapshots on film that is 4 cm along each side using a delayed-action automatic trigger.[lxxix]

Around 1910, Julius Neubronner designed a second camera: the Doppel-Sport. It took a single panoramic image on a curved 3x8 cm negative with a rotating lens, activated by a delayed-action trigger.[lxxx]

In the 1930s, Christian Adrian Michel, the Swiss owner of a watchmaking parts factory in Aargau, designed a camera adapting the Doppel-Sport to use 16 mm movie film. The camera, which was never a commercial success, was equipped with a timing mechanism, which ensured the delay of the shot being taken, the moving of the film and the interval between photographs.

Cameras in espionage

Before the spy camera business grew, crime scenes were recorded by daguerreotype photography. These cameras could capture scenes, but nothing was small enough to be carried around in the pocket or advanced enough to capture still images of motion. This was until the famous Minox subminiature camera, first devised in 1922. Nearly a century after the photograph was invented, the spy camera was conceived. Some of the first secret cameras were designed by Walter Zapp in Germany between 1937 and 1943.

During World War II, agencies were interested by the small size and macro focusing capacity of the spy cameras for inconspicuous use in surveillance and document copying.

Spy cameras became a luxury item and were commonly used as an espionage tool in the Cold War, whilst production was developing technologically, also creating a number of accessories. Spy Camera accessories such as tripod mounts and flash guns allowed users to branch out into more complex forms of photography.

Eastman Kodak, a leader in the standard photography industry, produced a camera to fit perfectly inside of a matchbox, which the U.S. Office of Strategic Services used during World War II. In the 1940s, the Steinbeck ABC Wrist Watch Camera was released, which soon became a highly sought after item. However, the face of the watch quite clearly contained a lens if you looked closely. By 1960, F21 also known as AJAX (part of Analog Museum collection) cameras were in use by KGB agents. The lightweight camera was concealed in a coat button. All the agent had to do was press a button from a release shutter in his pocket, and the front of the camera would quickly open as the camera took a photo. German Stasi agents also used the famous briefcase cameras in the 1970s and 80s, which allowed them to shoot images in infrared to expose low light condition

Tricking the masses

As the popularity of spy cameras grew, companies began making products to look as though they contained spy cameras (for instance the miniature model camera as a lighter - part of Analog Museum collection). The Kiev John Player was a pack of fake cigarettes fitted with tiny cameras, created as trick gifts for gullible tourists, passed off as used by the KGB agents. It did, however, work, if you knew how to use it.

Today, secret camera technology has progressed significantly from its roots, but some vintage models are still available to collectors, such as the Minox B, EC, MX, TLX, Lite lighter camera, Expo watch camera and DSC. With the advent of digital photography in the 20st century spy cameras have evolved to be able to digitally record still and moving images, as well as sound. Recently spy cameras have developed to use 3G spy camera technologies to allow users to record from anywhere in the world.

More people are using spy cameras every day as they become increasingly technologically advanced. Now, hidden cameras are totally unnoticeable and able to perform a variety of tasks to allow users to find out anything they need. The UK today currently is using 4.2 million CCTV cameras across the country. Covert cameras can be hidden in objects from glasses and pens to clocks, and are available for use by employers, employees, members of the police force and the general public.

1939-1945: photography in the war years

The Second World War slowed down both the production of photography equipment in Europe and its import from the United States. The manufacture of cameras for military use, on the other hand, grew. Photographers were on the front lines and took pictures, which the illustrated press eagerly published. These were sometimes also used for propaganda.

During the First World War in 1914-1918, the work of the first war photojournalists was closely monitored, even censored at times. It was only later that the profession grew in stature, and that the major magazines began publishing their work regularly. These committed photographers made Robert Capa's phrase their own: *"If your pictures aren't good enough, you're not close enough"*.

The production of cameras for military use, which already existed, grew in scale and in refinement. Some companies had already become specialized in that area of production, and large manufacturers produced military versions of their cameras in order to meet demand. The hand cameras used for aerial photography were gradually replaced by motorized cameras using film, which were operated directly by the pilot, like the weapons.

Some companies continued their production, albeit on a reduced scale, and found it difficult to obtain supplies, like the Leitz company for instance, which ran out of focal plane shutter curtain, and used red material provided by the Nagel factory in Stuttgart which Kodak had taken over in the early 1930s.

Polaroid

American physicist Edwin Land invented the first satisfactory process making it possible to develop snapshots instantaneously. Made available to the public in 1947, the Polaroid came in a wide variety of models until the company ceased to operate in 2008.

The method used by Land was to transfer the negative's silver grains that were not exposed, which were normally eliminated during development, to another layer where they were reduced to metallic silver, creating the positive image.

The first Polaroid camera, the Model 95, used a special roll of film made by Kodak. It produced black and white proofs, which took exactly one minute to develop. Land's process was later improved several times. Color appeared in 1963. The same year, the roll of film was replaced by the Film Pack, which meant that one could continue to take pictures, while the image was developing outside the camera.[lxxxi]

The Polaroid system, which was a rapid success with the general public, also attracted other users due to its immediacy. It was thus used for identity documents, medical photography or at crime scenes, and became a very popular artistic format.[lxxxii]

Since 2010, a handful of former Polaroid employees have been trying to revive production of films.

The Tools of the Professional Photographer

After the War, the professional photographer had a whole range of modern devices at his disposal, which met his various needs very well: reporting, architecture, advertisement images, fashion, portraits etc.

As early as the 1930s, the photographer had a new and very useful source of light at his disposal: the magnesium bulb flash. The bulb containing magnesium in wire form was sometimes colored blue to emulate better the hue of daylight; it was single-use only, as it burned when activated and had to be replaced before taking another photograph.

Photojournalists' favorite tools were being modernized: they had a wide variety of interchangeable optics, cameras that were getting lighter and lighter, and which were easy to use in all conditions. The improving small format reflex was rapidly becoming more popular thanks to its viewing system, which would soon replace the telemetric viewing camera.

For studio photographs or architectural shots, the photographer used an optical bench chamber, a device, which has forward and back bodies mounted on a bar along which they slide. This system, which uses large format sheet film, allows for great flexibility in terms of optical correction movements (tilt, swing and shift), and makes it possible to combine several components easily.

Another camera, which was very popular due to its versatility, was the Hasselblad, a medium-format reflex made in Sweden from 1948 and derived from an aerial photography device designed for military use. It is a modular system, in which components such as the lens, the film housing, the viewfinder and even the winding knob are interchangeable.

Artificial Light

The first instances of the use of electric lighting in photography date back to the end of the nineteenth century. The incandescent lamp would become a common sight in photographers' workshops, only to be replaced by the studio electronic flash from the 1960s.

In 1925, brothers Laurent and Augustin Seguin first presented the true invention of the electronic flash: the Stroborama, which apparently immobilizes a moving body through a series of brief flashes of light repeated at a given frequency. The flash is caused by the instantaneous discharge of an electrical spark within a tube

filled by a rare gas, krypton. An important breakthrough was made, when a capacitor was developed that could store the electrical energy needed for the discharge.

In 1936, Frenchman Paul Laporte had the idea of using xenon, which has a hue close to that of daylight when it is made a conductor of electrical current. American physicist Harold Edgerton designed the first studio electronic flash in 1939. Russian engineer Dimitri Rebikoff began working on the subject in 1943 in Paris, and in Switzerland after that, where he was represented by Pierre Bron, who decided to undertake the manufacturing and produced the first Broncolor flash in 1953.

The first portable flashes were rather unwieldy: the generator, housed in a case or satchel, included rechargeable accumulators. Technical progress gradually enabled this equipment to be made more compact.

The Reflex Camera

The principle of the reflex camera made viewing possible through the lens, in other words the exact view of what one is going to photograph. The first reflex cameras appeared around 1890. The small format reflex appeared towards the end of the 1930s, and became more and more successful.

The main advantages of reflex viewfinding, in terms of focusing in macrophotography for instance, prompted manufacturers to integrate it within small and medium format cameras of the 1930s. The Спорт (Sport), made in Russia around 1935, was allegedly the first small format reflex camera on the market. This new reflex generation still had a major drawback: the viewing was obscured, when the diaphragm was shut to take the photograph.[lxxxiii]

Around 1935 a Swiss precursor, Jacques Boolsky, designed a small format reflex camera, and entrusted Pignons S.A. of Ballaigues in the Vaud Jura region with its research and manufacturing. Combining reflex viewfinding and a telemetric viewfinder, this camera was released in different versions from 1939, and the final version was eventually presented at the Basel Sample Fair in 1944, and marketed as the Alpa Reflex I.

The Leica of Robert Frank and the Americans

Born in 1924, Robert Frank spent his youth in Switzerland and being interested in photography from a very early age, made it his profession. After a visit to Peru in 1948, he spent several years travelling extensively throughout both Europe and the United States, where he established himself as an observer of American society. In 1953, he received a grant from the Guggenheim Foundation to undertake a visual documentation of the American civilization, equipped himself with a Leica and went all around the United States from April 1955 until June 1956. The resultant book entitled “The Americans” was published by Robert Delpire in 1958 and was followed by an American edition in 1959, with a preface by famed novelist and poet Jack Kerouac.[lxxxiv]

Japanese Cameras

Camera production in Japan began in the 1930s, and grew after the Second World War until it eventually dominated the photography market from the mid-1960s onwards. In 1930 in Tokyo, three men decided to build a camera similar to the Leica, but which would be affordable for Japanese people. Goro Yoshida, Saburo Uchida and Takeo Maeda created the company, which would later become Canon, and sold their first camera in 1936.

After the war, occupied Japan was forced to convert its industry to civilian purposes. One of the activities it chose was the production of photographic cameras. One of these corporations was Nippon Kogaku, which would later become Nikon, and which released its first camera in 1948. A long line of 35mm cameras followed, whose reputation speaks for itself.

Western photographers first saw these cameras in the hands of their Japanese counterparts during the Korean War. Japanese cameras, which were innovative, of excellent quality and sold at incredibly low prices, soon exploded onto the global photography equipment market.

The Life of an Image

Photographers returned from their expeditions with rolls of exposed film, which had to be treated properly for images to be recovered. From every film, a contact sheet was obtained upon which images appeared in the negative's format. The photographer's work fed the illustrated press, which was incredibly successful during the twentieth century.

It was from the contact sheet that the photographer selected images for enlargement. For 6x6 cm, in order to avoid waste, photographers used scissors to make a first selection of negatives before placing contact sheets together on a cardboard panel. For 35mm however, the film was less easy to handle and the whole roll of film was contact printed onto a single sheet of photographic paper.

The square 6 x 6 cm format allowed the photographer to continue the framing process in the lab by selecting a height or width format, often to meet the page setting requirements of a newspaper, and refining the framing marked on the contact sheet.

The 24x36 mm negative's small size made this unfeasible, and progress in the quality of viewfinders favored taking photographs that were framed on the spot; keeping the original framing actually became a golden rule for some photographers.

Access to this raw material was a rich learning experience, showing for instance just how many pictures photographers had to take in order to get the one that worked, whether in terms of framing or lighting or the moment the photographer chose to capture.

Snapshots of Real Life

The photographic image became accessible to all, whether actor or spectator: in books and monographs, richly-illustrated manuals of all types, attractive albums, which one could fill with one's own pictures, and last but not least, as a newcomer about to enter its heyday, the postcard.

As early as the interwar period, photography enjoyed rapid growth and became an excellent vehicle for photographers to make themselves known and to spread their work, somewhat less ephemeral than appearing in the illustrated press.

The new practice of instantaneous photography became the subject of instruction manuals, which enabled the amateur to master the essential aspects such as framing, seizing the right moment, not forgetting the assessment of the proper posing time depending on the lighting. All still far from easy when using the cameras of the time.

Photography assumed its place within albums that families put together carefully, mindful of the image it was projecting. One saw not only family members carrying out everyday activities, but they could also be posing alongside their prized possessions, such as their cars.

The postcard, printed first in black and white and then in color, was a fantastic vector for the spread of the photographic image of a variety of subjects, and began to experience considerable growth from the latter part of the 1890s. Printed in extensive series on photographic paper by photographers or specialized publishers, it could also be a "home" print, sometimes even unique, printed on paper of the appropriate format, with spaces for the message and the address on the back.

Photography for All

By 1950, almost everyone had access to a wide variety of photographic equipment and services, depending on what one wanted. Photography shops sold cameras and accessories, lab equipment, films and papers. Developing films and printing enlargements for customers, their owners were often active photographers outside of business hours.

The ease with which new models of cameras with little reels of film could be used attracted a wide range of users, which the photography industry soon learned to target using advertising campaigns: women, youths, so-called enlightened amateurs, who had access to a whole array of manuals and clubs. Of course, there were also rich customers, who could find the gem to fulfil their every desire in the nearest shop.

The success of the Leica and then the Contax prompted manufacturers to offer their considerable potential market other models that were more compact and less expensive. Kodak marketed a disposable 35mm film cartridge for the Retina, manufactured by its German branch from 1934, which was compatible with all existing cameras, and contributed to the success of the small format.

Along with a camera to suit one's budget, at a photography shop anyone could find personalized advice or even lessons, all sorts of publications, and an after-sales service, which ensured that films were developed and photographs were printed. Those who wished to process the images themselves could acquire an enlarger adapted to their needs, lab material, vats for developing negatives and all sorts of paper for the prints.

Retrofocus and Zoom

A French engineer and optician named Pierre Angénieux brought about revolutionary advances in optics for photography, cinema and television: the wide-angle retrofocus in 1950, lenses with very wide aperture (f:0.95) from 1953, and the constant aperture zoom lens for cinema in 1956.

The image of a wide-angle lens forms so close to the last component, that there was not enough space left for the reflex viewfinder's mirror. In order to solve this problem, in 1950 French optician Pierre Angénieux had the brilliant idea of designing a retrofocus lens which "pushed back" the image in optical terms, freeing up the space needed for the reflex mirror.[lxxxv]

Pierre Angénieux (1907-98) created the Etablissements Angénieux in 1935 in Paris, and then settled in his birthplace of Saint-Héand in the Loire region. He produced high quality lenses for both photography and cinema. He supplied major brands such as Alpa, which did not produce optics. The Angénieux Company is now part of the Thales group.[lxxxvi]

Roger Cuvillier, a French optical engineer working for the SOM-Berthiot, in 1949, invented the zoom or variable focus lens for cinema. In 1956, Angénieux designed a constant aperture zoom lens, using a very precise cam mechanism, which made greater focal variations possible. The first zoom for small format reflex cameras was the result of a joint effort by Voigtländer and Zoomar in New York, and first appeared on the Bessamatic in 1959.

Instamatic

Kodak once again launched a hugely successful marketing campaign, when it created the Instamatic series in 1963. With its simplified film-loading system, the Instamatic range sold around 70 million units, an all-time record.

During the period of prosperity and consumption, which followed the Second World War, cameras became accessible to an ever-wider audience. However, the tiresome need to read the instruction manual, and the errors caused by faulty loading of the film in the camera remained an obstacle for a number of users. Kodak dealt with the problem by releasing the Instamatic, a camera, which was extremely easy to use and was loaded with the Kodapak, 35mm film contained within a plastic cartridge. All one needed to do was slide it into the camera, and it was ready to take pictures. Once the film was exposed, the cartridge itself could be sent to the lab for development. No more fear of failing to load the film properly. This granted the general public ever-greater ease of access to photography. The Instamatic also brought about a huge growth in industrial development labs, which produced enormous amounts of color prints to meet the demand.[lxxxvii]

In 1972, almost a decade after the Instamatic film, Kodak introduced another film system, the Pocket Film. It offered the same benefits as the Instamatic system, except that the cassette was much smaller, which enabled the design of an even more compact camera.

While the Instamatic cassette was equipped with a 35mm-wide film, the Pocket cassette was based on a 16 mm-wide film, whose negatives at 13x17mm were only a quarter of the size of a small format negative. Film cassettes with the designation of 110 were mostly color negative films, but also for black and white, and as slide films, with a sensibility in the range of 100 to 400 ISO.

About every decade, a new film system came onto the market, and none was more popular than the small format film – including the Disc-system, which was introduced in the autumn of 1982.

It was the same Kodak engineers, who had already built the Pocket-system, who set their sights on further developing this miniaturization. The now only 8x10.5mm-sized negative was not to be produced any more as a roll film. Instead, the 15 small negatives were grouped onto a film disc.

The small format had the advantage, that it enabled the development of even more compact cameras. Qualitatively, the Disc-system was not altogether convincing, so that film production had to wait seven years, before it was ready to start.[lxxxviii]

Action

The first attempts made to automate the forward movement of film and the resetting of the shutter so as to improve the speed of the shooting date back to the beginning of the twentieth Century. During the 1960s, manufacturers, Japanese included, offered motorized cameras.

The very first motorized camera was the Pascal, invented by Frenchman François Pascal, patented in 1899. This clockwork camera made it possible to take a dozen consecutive shots, 3 to 4 shots per second. The release opened the shutter and made the film move forward. Various attempts to automate the forward movement of the film were made after that.[lxxxix]

In 1934, German company Otto Berning & Co produced the Robot, which was a compact camera following a new design with a clockwork motor, which could be wound using a knurled knob. In 1936, Leica designed a first device, before making a clockwork motor, which was made electric from 1939.

During the 1960s, manufacturers made electric motors, which could be fitted underneath the reflex cameras, making it possible to take series of burst-shots, the use of which became more and more widespread.

Thus equipped, the photographer could now trigger quicker successive series of shots in order to capture the most evocative moment of a given event. Whereas a handful of images of the same subject had been the norm before, it became quite common to use an entire roll of film.

Hasselblad: destination the Moon

Put on the market after the Second World War, the Hasselblad modular camera was associated with the American conquest of space from 1962, like its competitor Nikon would be later on.

In 1940, the Swedish government asked Victor Hasselblad, a photographer who had worked for Kodak, to design an aerial reconnaissance camera for its air force. Once the war was over, Hasselblad focused on designing a camera based on his aerial model. All its components, from the lens to the film cartridge and including the viewfinding system, were interchangeable. The first model came out in 1948.

In October 1962, astronaut Walter Schirra took a Hasselblad camera with him, which NASA had modified slightly, notably to make it as light as possible. This was the beginning of a long-standing collaboration, still active today, between the agency and the Swedish manufacturer. Since that time, Hasselblad has been designing special models according to NASA's guidelines to equip manned flights. The Hasselblad was notably part of the Apollo 11 expedition, which took the first pictures of man on the Moon.[xc]

Panoramic Photography

The first panoramic cameras appeared only a few years after the official invention of photography, in 1839. The advent of flexible format film made their use considerably easier.

Panoramic images have a wide field of view, closer to the human eye's view than standard images. The desire to widen the field of view emerged very early on in the history of photography. The first panoramic images, landscapes most of the time, were made up of several images placed side by side. Specifically-designed cameras soon appeared. Two types can be distinguished for film.

They can be rotating, which means that the camera turns on itself. The rate at which the film feeds from one reel to the other is synchronized with the rate of movement of the camera. This system gives 360-degree views, or even more if the camera makes several rotations.

They can also have a swiveling lens. It sweeps the photosensitive film layer, which is set in a semi-circle in the housing, a shape to which film, unlike other formats, easily adapts. These cameras can take pictures with a maximum angle of 180 degrees.[xci]

The Industrial Laboratory

Between the 1970s and the turn of the century, industrial laboratories developing and printing images experienced their true golden age.

After the appearance of the Instamatic in 1963, color printing on paper became the standard in amateur photography. In order to cope with the massive sales of color film and the ever-growing numbers of users, industrial laboratories underwent significant growth. In the beginning, photography shop owners acted as intermediaries, sending the films to be developed and receiving the prints. Later on, some laboratories offered their services to customers directly by mail. By removing the photography shop intermediary, the work could be delivered very quickly and at much lower prices.

The advent of the digital camera dealt a fatal blow to this entire market. Only one such laboratory remains today in Europe.

The APS Format

In an attempt to breathe new life into the photography market, five leading manufacturers united their efforts to launch a new film format in 1996, the Advanced Photographic System.

At the beginning of the 1990s, Kodak, Fuji, Canon, Nikon and Minolta decided to face the challenge posed by a market, which was steadily losing momentum.

In 1996, they put the APS on the market, a new film format. Its main new feature was the addition of a magnetic tape, which recorded data relating to the image. It now became possible to indicate various parameters, such as the time at which the shot was taken or exposure data, as well as the format in which the photographs should be printed. It was also possible to add text or sound. Housed within a cartridge, the 24mm wide film just needed to be placed inside the camera. It was then automatically loaded, preventing any errors due to manipulation.

Marketed as the new standard format for silver-based photography, the APS was a moderate success at best. The absence of any decisive advantage over 35mm film, and the gradual appearance of digital cameras aimed at the general public, did not work in its favor.[xcii]

Fully Automatic

During the final decades of the twentieth century, the main changes made to photographic cameras were related to the introduction of electronics.

The various functions of cameras, which until then had been mechanical, now became automated. The beginnings of this automation date back to the 1960s, with the invention of an “electric eye”, which could measure light. Soon after, the accuracy of exposure time improved further when light could be measured directly through the lens. A little later, film could be loaded automatically. Then, around 1980, autofocus appeared, measuring the distance to the subject being photographed and adjusting focus. Finally, image stabilization arrived, making it possible to avoid blurs caused by movement.

These easy-to-use cameras removed the final technical difficulties, which amateur photographers faced, drastically reducing the number of “failed” photographs. In the professional sphere, the computer handled all functions related to the image.

All these improvements resulted in machines, which are completely dependent upon an energy source. Once the batteries are out of charge, it is often impossible to continue to use them.

Pinhole Camera Photography

Pinhole camera photography represents the return to the simplest expression of the exposure camera.

The pinhole camera operates on the principle of the camera obscura. By piercing a little hole in the dark chamber, this only "selects" a single reflected ray per point of the subject. All the rays that cross each other at this precise spot together project the inverted image of the external view onto the surface placed across their path – whether this be a film or a digital sensor.

The almost infinite depth of the field due to the absence of a lens, combined with the long exposure time, enable the taking of astonishing exposures. This particular vision, resulting from a clean image from end to end, produced by the pinhole camera. Its very simple usage quickly gave photographers the urge to use cameras, whose lens was replaced by this famous little hole.[xciii]

The pinhole camera fascinated Peter Olpe, a Swiss designer, teacher and graphic artist. He designed and produced numerous cameras, which were in total harmony with the images, they produced. These boxes, real miniature architectural models, sometimes equipped with several pinhole cameras like a building with multiple windows retaining the trace of light within the spaces thus created. He donated his collection to the Swiss Camera Museum in 2012.

The Digital Revolution

Digital photography, so recent, already has a history as readily forgotten, as its development was meteoric. Is it actually justifiable to talk about a digital revolution?

In order to produce a picture digitally, you have to be able to replace the photochemical imprint left by the light in the photographic emulsion by an electrical signal of proportionate intensity, which can be coded in numbers. After this change, the picture receives a digital code like any other kind of information with which it is going to be associated, mixed or even transformed.

In the computer, many different kinds of information can be handled simultaneously. The wish to include the picture with them arose quite naturally, whence the need to be able to not only digitize pictures, but especially to capture and digitally record *"the imprint of the flow of light"* to use the terminology of Nicéphore Niépce.

However, the most profound upheavals due to the arrival of digital photography concerned the diffusion of pictures and their remote consultation. The photographer no longer has exclusive control over his pictures, because he shares them with the whole world, perhaps not always willingly.

1965: a Picture in Numbers

On 28 November 1964, NASA placed its probe, Mariner 4, in orbit around Mars. Its video camera was programmed to take around twenty pictures on 15 July 1965. The Earth being at a distance of 216 million kilometers, the scientists opted for a digitalized transmission of these photographs. The camera's video signal recorded on a magnetic tape was converted into binary code, generating a file of 40,000 dots.

The radio transmission of the first page from Mars lasted over eight hours, and it was composed of 200 columns, each with 200 points, coded on 64 shades of grey. During the arrival of the data, as engineers

were impatient to see the result, they stuck small pieces of paper onto a board, colored according to the numerical value received for each dot of the picture. Confronted with the apparition of this exceptional photography, were they aware they were drawing history's first "pixels"?

1973: Space – an experimental ground for Digital Photography

In 1973, the Fairchild Imaging Company launched the first camera with CCD captors ("Charged Coupled Device" – a transfer charging instrument) fitted with a captor of 100x100 dots, which transformed the data transmitted by light into an electric signal. A photograph of the Moon was taken with this camera coupled to a telescope in 1974.

From the end of the 1970s, cameras with CCD captors appeared in the world of astronomy to be used freely with telescopes, enabling a much finer observation in a much shorter space of time.

The Hubble space telescope was launched in 1990. It was equipped with two cameras containing Texas Instruments captors made up of 800x800 photosensitive elements. The four CCD matrices of this system, the size of a postage stamp, are extremely sensitive to weak luminous indicators of distant galaxies, and can perceive objects invisible to the naked human eye. Each element converts the light it receives into electrical current, which is then digitally coded, thus forming a pixel. The whole of these data is then transformed into a picture with the aid of a computer.

1975: the Invention of a new kind of photography

Born in 1950, Steven J. Sasson, electrical engineer by training, at that time a young researcher with Kodak Apparatus Division Research Laboratory, was asked by his superior: *"Can one conceive a camera, which combines the technology of the CCD captor with digital picture treatment?"*

From the beginning of the 1970s, Texas Instruments and Fairchild were each developing cameras, where the film was replaced by a CCD captor and image obtained treated analogically.

From 1975, Sasson devised a system integrating several technologies already existing. He used a Kodak camera equipped with a Fairchild CCD captor, connected to a Motorola analogue-digital image converter. He took his first photograph in December, a black and white portrait of 100x100 pixels. Its recording onto a magnetic tape, a mini cassette, was made in 23 seconds, the same time required to read and transmit this picture onto a television screen. In 1977, Sasson presented a report of about forty pages to his employer, whose conclusion drafted the path to follow for this new photography to become truly functional. The patent was dated 26 December 1978.

1977: electronic Photography

In 1976, Sam Kendes, 47 years old, and his son Kenneth, 24 years old, were in New York City on Broadway. They came across a crowd of people queuing to have their computer portrait made for £3.

In 1977, after a concerted effort culminating at Christmas 1976, Sam and Ken created the CASI Computer Portrait System. A still video camera took a picture that could be viewed on a television screen and then "coded" into a frame of typographical characters. It was the only way of printing from a computer at that point in time. They offered their Computer Portrait System for family celebrations and events and were immediately highly successful. Afterwards, CASI was to specialize in the production of T-shirts and other objects decorated with photographs.

This was the technique adopted for the Computer Portraits Christmas or “electronic photography” offered to clients by a London supermarket at Christmas 1977. This document represented an important landmark in pre-computer experimentation. Its only “digital” aspect was its rendering, since the filming and filing of the pictures were still analogue.

1981: a Photograph in “Still Video”

In September 1981, Sony launched the first camera where the recording onto a magnetic disc of a still analogue video image replaced the film. The same year, Sony introduced the famous 3.5-inch floppy disc.

Computer-assisted publication developed with the arrival of personal computers and the use of home video became generally accepted.

A new relationship between photography and video emerged, with equipment enabling the conversion of photographs to video for viewing on a television screen, and even the production slideshows on video cassettes.

1982: Eikonix and the Beginning of Digital Camera Work

In 1982, Eikonix Corporation marketed the first digital filming instrument that was able to record a picture scanned by a module with 3000 CCD photoreceptors, which moved over 4000 lines across a surface of 24x36mm inside the camera itself.

Each sensor provided a signal equivalent to the light intensity at that particular point. This signal was then converted into a digital value and this matrix or collection of values became a picture. At the beginning, the picture was in black and white, then by adding three filters, red, green and blue, and by combining all three pictures, the first digital color films were obtained.

This particularly heavy equipment was most frequently used in scientific laboratories. Industrial Light and Magic, an American special cinema effects company, founded by the creator of “Star Wars”, George Lucas, was to use this apparatus to digitalize, frame by frame, his first films.

In 1985, Eikonix Cororation was taken over by Eastman Kodak for 56.5 million dollars.

1986: the First Still Video Machines

In 1986, the first still video machines appeared on the market aimed at professionals, such as the Canon RC 701, or the prototype of the reflex Nikon SCV, fitted with a CCD sensor with a capacity of 300,000 pixels, or a new Mavica from Sony.

These “still video pictures” were recorded on a magnetic tape or little discs. They were analogue just like the equipment receiving them. They could be viewed on a television screen thanks to a video player, printed via the help of a video printer, or recorded on a video recorder and transmitted in the same way as television pictures with a proven technique.

1984: digital Transmission at the Olympic Games

The idea of using electricity for the reproduction and transmission of a picture was already in the air from the middle of the nineteenth century. At the beginning of the 1890s, the electro-signature of Amstutz was launched. The French journal, L’Illustration, of 9 February 1907, reported a conference held by Professor Korn on the transmission of photographs by telephone on the Paris-Lyon-Paris circuit (1024km). Based on

this procedure, Frenchman Edouard Belin devised the belinograph, a photographic transmitter using the telephone and telegraph networks.[xciv]

In 1984, various transmission trials of digital pictures were conducted during the Olympic Games, among others by Hasselblad, who set up an effective system for this event, which created quite a stir in media circles. In 1988, this system culminated with the Dixel 2000 in collaboration with AFP ("Agence France Presse").

The invention of the World Wide Web (internet) in 1990 by Tim Berners-Lee, a computer analyst at CERN near Geneva, revolutionized data transmission methods, of all kinds, and completely transformed the working habits of the press agencies.

1986: Sinar and the Digital Picture

Sinar, an internationally renowned, large format chamber manufacturer, based in the Swiss Canton of Schaffhausen, was interested at a very early stage in the impact that digital technologies were bound to have on the development of photography. In 1978, Hans-Carl Koch, son of the founder, wrote an internal memo on this subject.

In 1986, Sinar invested in Minneapolis and created a company, Interscan, where two employees went to work, who built the first back scanner. This 4x5" laboratory prototype was fitted with a Kodak 3-RVB line bar (one line of sensors for red, one for green, one for blue) and produced a digital image of 2000x3000 pixels, so 6 million pixels towards 1987.

In 1998, Sinar became an important producer of digital backs for professional equipment and generated a series of innovations and performances with a definition of 6 million pixels in 2000, then 16 million in 2001, and over 22 million pixels one year later.

This success was significant. The year 2000 was the best year ever for the company, but while Hans-Carl Koch had the feeling that his objective was achieved and the future secured, he realized that research and development costs were getting far too high, and he approached the German group Jenoptik, who bought him out. Today, Sinar is once again an independent Swiss company.

Photoshop

Photoshop, a software for processing digital images, emerged from the work of the Americans, Thomas and John Knoll who, from 1987, were perfecting a programme destined originally to images in various shades of grey on a monochrome screen. The scanner manufacturer, Barneyscan, agreed to distribute this very first version of the "ImagePro" called afterwards "Photoshop".

The Knoll brothers also met Apple and the artistic director of Adobe, Russel Brown, who immediately appeared interested. Adobe bought the license in 1988 and Photoshop 1.0 became operational on the Macintosh February of 1992. Digital photography was still in its infancy at this moment, and this software was intended for processing scanned photographs.

The arrival of this new tool on the market caused quite a stir and specialists claimed it was a scandal in the face of photographic objectivity maltreated in this way. They were simply forgetting how and how much retouching and photomontage were practiced by photographers since the beginning of this medium. One

only has to consider the tools used with Photoshop: pencils, paintbrushes, buffers and other gums and color ranges, which are all direct references to the tool bag of the perfect retoucher.

1990: the Time of the Scanners

The limited capacity of the first digital sensors did not produce pictures of as high a quality as traditional photography. On the other hand, if a row of photo sensors were placed on a module sweeping the image from one side to the other, this considerably increases the number of recorded dots and the definition of the picture became completely acceptable.

This is the principle of the scanner invented by Russel A. Kirsch in 1957, which used photoelectric cells. The first scanners were used in printing, screening and the selection of photograph colors. In 1987, Barney Scan came out with a scanner for 35mm slides compatible with Macintosh.[xcv]

The earliest digital cameras in use for professional photography were classic large format chambers, such as Sinar, where one inserted, before shooting, a back scanner connected to a computer. Other manufacturers offered machines with integrated scanners, which met with little success.

However, the sweep of the scanner bar took quite a time, making instant photography impossible. The machines were also cumbersome and could not be taken out of the studio. To meet the expectations of their customers, asking for more and more digital photos, photographers used a hybrid method, photographing on film, which they later scanned and processed digitally.

1990: the First Digital Machines

The beginning of the last decade of the twentieth century was marked by a series of fundamental innovations, perceived as such by computer enthusiasts, but not having quite the same impact in photographic circles.

1990 saw the appearance of the first entirely digital camera, the FotoMan, launched by Logitech, a Swiss company. This revolutionary machine no longer used an intermediary facility to store the pictures, which were viewed and treated in the computer by means of the Fototouch software. In 1991, Kodak launched its DCS (“Digital Camera System”) system: an element constructed on a Nikon F3, connected to a separate storage unit containing batteries, and fitted with a small screen on which to view the pictures (with a capacity of 200 megabytes).

The first digital camera back allowing instant black and white, but not color, was offered by Leaf. It was designed for professional equipment such as the Hasselblad medium format and the Sinar large format chambers.

The year 1990 saw the birth of Photoshop, a picture processing software, initially conceived for printing. The Classic Mac with color screen came out in 1993, after which it became easier to process photographs on the computer, but their printing had not yet achieved the same degree of simplicity. Digital photography could not yet do without film or photographic paper. The pictures were most often “flashed” onto film with an image recorder such as the Polaroid Palette for 35mm film or Polaroid film or with much heavier machines for graphic art applications.

1992: the Photo CD

In 1979, Philips and Sony, with the collaboration of Hitachi, perfected the sound-CD ("Compact Disc"), whose commercial production began in August 1982.

The compact disc has a reflective surface with many cavities. These are "read" by a laser beam and produce binary variations, and so digital, which are transmitted to a sensor. In 1985, the CD-ROM, designed to be read by a computer, came onto the market.

In 1992, Kodak launched the photo CD for storing digitized photographs. This system was accessible to everybody, private individuals and professionals, and it can be considered the first "bridge" between analogue and digital, enabled the storing of around a hundred analogue pictures scanned with high resolution. It was thereafter possible to introduce these photos into a computer to process them (Photoshop came out in 1990), view them and store them.

Most of the big laboratories offered this service to their customers. They were equipped with a KODAK PCD Imaging Workstation (PIW) system, comprising a film scanner, data processor, color monitor, CD-recorder, a thermic printer for the indices and suitable software. The commercial printing of "family photo" films became digital without the user necessarily knowing.[xcvi]

The Ink Jet

The first ink jet printing began during the 1980s. Introduced in 1987, the Iris printer was intended for printing design layouts or preliminary trial runs in the field of graphic arts or to produce exhibition panels. Rapidly, artists were to commandeer a tool that enabled the printing of large dimensioned photographs, whether on paper or canvas or other materials.

Towards 1994, some color ink jet printers appeared. These were aimed at personal computers, with a definition enabling a good quality photograph print run, but which did not last long, as the inks were still not very resistant against the light or various exterior agents especially the ozone. Printers subsequently offered increasingly refined definitions, in association with the proliferation of ink colors and pigments, whose brilliance was adapted to that of the papers.

Among the many evolutions – or perhaps even revolutions – generated by the digital image, ink jet printing might be the one that contributed most to the development of photographers' freedom. These, confronted with a limited choice between conventional paper of relatively similar colors, could now do as they pleased, and use paper designed for photographic printing or adapt others, increase their number of throughputs, or manage their own personal color contents.[xcvii]

Access to digital data, stored on magnetic tapes or on laser-burned discs necessitates the use of a specific CD-player, which will certainly no longer exist in a decade or two. Furthermore, the risk that these materials will degrade is high and requires constant attention. In order to avoid this risk, Professor Rudolf Gschwind, of the Imaging and Media Lab at the University of Basel, devised a laser digital data recording system on conventional microfilms, where the information can be viewed permanently, without any special equipment.

In order to guarantee the best possible conservation, Professor Gwschwind chose a photographic process, which was known for its longevity, Ilfochrome. Contrary to chromogenous photographic processes, where the colorings are assembled during development, Ilfochrome, launched under the name of Cibachrome,

reduces a quantity of stable coloring contained in the sensitive layers to constitute the image, which ensures it exceptional longevity.

Digital Photography to the Aid of Lost Colors

The results of the work conducted in 1994 by Rudolf Gschwind, showed day by day that the work had an enormous relevance. The colors of our photographs were disappearing irrevocably.

Thanks to digitization in three distinct images, one for yellow, one for magenta and the other for cyan, this programme measured the density curves of these colors, and, through digital processing, calculated the curves of the original colors and reconstituted them.

1995: digital for everybody

From the beginnings of digital photography, manufacturers were thinking about general public applications. However, a good number of years went by, before this wish could be realized in the face of conventional photography, which also continued to evolve, offering a reproduction quality better than ever before.

From 1995, cameras with a “futuristic” design appeared which had more of a mass-market appeal and they appealed to enthusiasts of new technologies. Picture definition was still weak and they were still expensive. Like the compact conventional cameras of the same period, they were slow to release, but, unlike film cameras, they were immediately viewable on screen. Towards 1997-98, the market became saturated with cameras that were increasingly efficient and offered a better quality-price ratio.

The real revolution for shooting was the immediate visibility of the picture taken. Being able to check the result immediately enabled retakes without any extra cost and offered the photographer the opportunity for self-tuition, so that he kept improving.

From 2003-04, a technology reversal process began. The multiple functions of digital photography, its computer applications offered at an ever more accessible price, as well as the new storing tools and sharing pictures on the web attracted even the least convinced. The photographic world wavered and then digital photography took the upper hand.

Professional Digital Equipment

With the new millennium, digital reflex cameras offered adequate definition for the photographic press. The image could be immediately transmitted without needing to develop the film and then scan the photographs. Photographers remained prudent though and ensured their work by also using conventional equipment. Once back in the laboratory, pushed for time, they transmitted their digital pictures directly, and little by little, they gave up developing their films. Soon conventional cameras were no longer being used.

It was not until 2004 that the first digital reflex cameras appeared with a 24x36mm sensor similar to their shape at the time of film use. However, the smaller sensors offered advantages, which appealed to certain professionals, such as the reduction in the size of the telephoto lens.

Digital backs soon replaced the scanning systems and enabled instant photography, equipping the optical bench chambers and medium format cameras. The progression of their definition was to prove staggering, passing in less than ten years from 6 million pixels to more than 50 million for the most impressive. This was much more than required to meet the demands of advertising photography, for example.

Measuring about 6 cm across, the sensor of a digital back enables the reduction of the optical bench chamber size and its lens.

The Camphone or Photophone

In the 1980s, various telephones fitted with a camera and screen appeared, such as the Lumaphone from the company Atari.

Philippe Kahn, a French computer analyst, built the first cameraphone in 1997, and then in 1999, the Japanese J-phone network received the first camphones or photophones marketed by Sharp.

From the beginning of the new millennium, all mobile telephone manufacturers came into this promising market, even offering mini cameras, which were unfortunately based on older models. Their efficiency progressed very rapidly, moving from a few pixels to definition levels that even the most advanced digital cameras had not reached a few years earlier. Panoramic function, night shooting, nothing was left out.

In 2008, 4.8 million cameras and 19 million camphones or photophones, if you still want to call them by this name, were sold in France.

Among the equipment born of the digital revolution, the photophones were those that most overturned habits in photography, which beyond its primary role of providing memories, became a simple means of communication, destined to show and exchange pictures, which are now so short-lived.

The Digital Retina

A digital image forms thanks to the capacity of the silicon sensor to produce an electric current when it receives light. It is not yet an image, in the same way that the data sent by the retina of our eye to our brain cannot yet be seen.

Each dot of this “potential” photograph has to be coded in numbers, according to the binary system acceptable to the computer, in order to become a pixel, or the digital representation of a dot in the picture. Together, the many pixels still have to undergo a number of mathematical operations before becoming a digital photograph.

At the beginning of digital imagery, these calculations enabled the equalizing of film performance, but the digital revolution has only just begun. In the near future, digital image processing and the new optics and new sensors will certainly generate advances, which are unimaginable today.

Located at the heart of the camera, the sensor has replaced film. It is made up of many microstructures deposited on a material with a particular electric behavior, called a semi-conductor, in this case, silicon. The object manufactured is called a “wafer”, like the thin biscuit.

The twenty-first century: as long as there are Films

The digital revolution has brought about the disappearance of some huge companies, producers of world-famous films, whose brands are sinking gradually into oblivion.

The conversion to digital projection in the cinemas and the progressive abandonment of the use of film in the medical x-ray field have further accentuated the fall in film consumption, whose break-even point has often been threatened, causing numerous closures, such as that of the famous Kodachrome.

The attachment of certain photographers to the very particular performance of the large format machines remains very strong. For others, this approach leads them not only to use very large format machines, up to 50x60 cm, but also to produce their own negative plates on glass, or their own paper negatives, just like in the nineteenth century.

Contrary to this search for "hyper quality", many photographers do not see themselves as part of a kind of "over-synthetic perfection" of the digital image, and so continue using basic cameras that are even known for their bad quality.

Many applications for smartphones and iPhones are creating "old photos" or even reproducing images in the style of the Polaroid and other Instamatics. Photographers are taking over these new tools, creating some remarkable images, like the reporter Damond Winter, voted "Photographer of the Year" in 2010 for his work in Afghanistan.

Thanks to "Mission Impossible", films are once again available for our good old Polaroid cameras, but the output of these new films can prove to be unreliable and difficult to master.

Footnotes

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