1. Photographic Printing Paper

The calotype, an improvement on William Henry Fox Talbot's photogenic drawing, is the starting point in the history of techniques for printing photographs on paper. Its inventor, Fox Talbot, was a product of the British aristocracy, a multitalented scientist interested in many fields, including astronomy, mathematics, and optics. In 1833, while traveling in Italy on his honeymoon, he tried to use a camera lucida to sketch the scenery, during which the idea of a method for recording the camera's images (photogenic drawing, or what we now call photography) occurred to him. He began serious experimentation the next year and by 1835 had succeeded in creating negatives. In 1839, when he heard of the announcement that Daguerre of France had invented a photographic process, Fox Talbot immediately presented the results of his research to date to the Royal Society. Subsequent experimentation led to his perfecting the calotype in about 1840.

The outstanding feature of the calotype is that it is a negative-positive process, an invention that is the fundamental form of analog photography, for it makes possible producing multiple positive prints from a single negative. The original calotype did not produce crisp images and was prone to fading. Fox Talbot held, moreover, several patents on the method, creating additional barriers to its adoption. Thus, its commercial success was unlikely. Controlling the gradations of light and shadow in the print and choice of paper, however, provided scope for reflecting the intentions and emotions of the photographer in the image, and the lack of clarity of the outlines could give rise to soft effects. Thus, some artists were attracted by Fox Talbot's process.

The idea of the negative-positive process then developed rather independently in two directions: methods for developing the negative, to produce a negative image, and printing techniques for creating the positive. Those printing techniques, developing handed in hand with the advances of the Industrial Revolution, did go on to achieve commercial success. The production of photographic printing paper shifted to factories, and those papers were repeatedly improved as the companies producing them sought to upgrade their industrial products. The result was the production in large quantities of stable printing papers and the development of many new materials and techniques, including salted paper, albumen paper, platinum printing paper, gelatin silver prints, pigment printing, and printing color photographs.

Photogenic Drawing

William Henry Fox Talbot published his discovery of what he termed photogenic drawing, the world's first camera-less photography process, in 1839. He placed subjects such as leaves, feathers, and lace on paper made photosensitive by soaking it in chemicals, and exposed them to sunlight. The areas that light struck turned black, producing a negative image in which black and white were reversed. That was used as a paper negative. When placed in contact with another sheet of photosensitive paper, it was possible to make a positive image. That was the prototype for the first negative-positive process: the calotype.

The Calotype

The calotype is the negative-positive process, using a paper negative, that William Henry Fox Talbot invented in 1840. Talbot named his process the "calotype," after kalos, the Greek word for beauty; it was also called the Talbotype. The paper was made photosensitive by soaking it in a solution of silver nitrate and potassium iodide, then placed in the camera while moist. After the exposure is made, the paper is developed and fixed to form the negative. Then it is placed in contact with a sheet of salted paper, which has been processed with silver nitrate and table salt, and exposed to sunlight to make a positive print. The calotype, which permitted making multiple prints from the same negative, was the first act in the development of analog photographic reproduction in the nineteenth and twentieth centuries.

The Pencil of Nature

The Pencil of Nature, the world's first photographically illustrated book, presents the vision of Fox Talbot, the first to conceive of what we now know as the photo book or photo collection, a format made possible by a photographic process that permitted reproducing multiple copies of an image.

In 1843, Fox Talbot established a photofinishing laboratory in Reading from which he published The Pencil of Nature, which consisted of twenty-four photographic plates and his text, in six installments between 1844 and 1846. In it he introduced the many possibilities of the calotype, including a variety of artistic styles, photography's documentary nature, its reproducibility, and its value as scientific illustration. Talbot sought to communicate how useful the calotype could be by including plates illustrating scenes from his own home in the country, stone structures, and facsimiles of a printed page, a lithograph, and a sketch, among other images, along with his description of the process of photographic reproduction.

A facsimile edition of The Pencil of Nature was produced in 1989 to commemorate the 150th anniversary of the invention of photography. Here we display the twenty-four plates from that edition on the gallery walls. In the showcase are the originals, printed between 1843 and 1853.

Calotype Portraits

The calotype process was rarely used for portrait photography. In Scotland, where Fox Talbot's patent on the calotype did not apply, however, David Octavius Hill and Robert Adamson used that process to create a striking body of superb portrait photographs.

Hill, an artist, had been commissioned to create an historic group portrait commemorating the founding of the Free Church of Scotland. Working with Adamson, a photographer, he produced calotype portraits of over 400 of the founding members, intending to use them as preliminary sketches for the group portrait. Hill and Adamson's use of light and placement of the subject, combined with the calotype's characteristic coarse grain and soft outlines, created beautiful effects.

Calotype Landscapes

The calotype was more often used in landscape than in portrait

photography. In contrast, the daguerreotype, another photographic process invented almost simultaneously with the calotype, was not suited for outdoor photography, and developing daguerreotypes was far from simple. The calotype was, however, convenient to use in the out of doors, and it also permitted making multiple prints of the same image, which increased its usefulness as a means for comprehending scenery.

In France, the calotype became increasingly popular from the latter half of the 1840s through the 1850s, due in part to improvements in the process made by Louis Désiré Blanquart-Evrard. The calotype was employed in a national project to create a photographic record of the monuments of the French state. That project, the Missions héliographiques, was organized in 1851 by the Historical Monuments Commission of the Ministry of the Interior to create a record of France's architectural heritage. The participating photographers included Édouard Baldus, Hippolyte Bayard, Gustave Le Gray, and Henri Le Secq. They photographed crumbling churches, forts, bridges, and chalets.

Salt Print

Scott Talbot, taking his photogenic drawing a step further, invented the world's first process for making positive prints. The salted paper he invented was also used in printing calotypes. Soaking the paper in a bath of sodium chloride (table salt) and then coating it with a silver nitrate solution creates silver chloride, which is photosensitive. When the negative is paced in contact with the salted paper and exposed to sunlight, a positive image, sepia in color, appears. It was, in effect, a photogram that did not require developing. Salted paper was produced until about 1860, but was gradually replaced by albumenized paper, which could produce a clearer image.

Egypte, Nubie, Palestine et Syrie

The world's first book of travel photographs, Egypte, Nubie, Palestine et Syrie was produced in 1851 from salted paper prints developed at the photographic printing plant Louis Désiré Blanquart-Evrard established in Lille, France. It is a pioneering example of connecting photography with print media. Maxime Du Camp travelled throughout the Middle East in 1849 to 1851, taking photographs, of which 125 are included in this book. The special interest that the people of Europe at that time expressed in the Middle East help create a market for books of photographs.

Progress in Photographic Printing

Combining the wet collodion process and albumen paper permitted capturing greater detail in photographic prints as well as greater image clarity. As photography evolved from the calotype to the processes the succeeded it, its potential expanded further.

The wet collodion process began with the introduction of the use of glass plates to photography in 1851. By mixing a silver halide with collodion, a viscous solution of potassium iodide and potassium bromide in alcohol, and applying it to the glass substrate, it was possible to produce a light-sensitive negative. A host of outstanding photographers adopted the wet collodion process, printing from those negatives onto albumen paper: portrait photographers Nadar and Julia Margaret Cameron, landscape photographers Felice Beato and Carleton E. Watkins, and combat photographers Roger Fenton and Timothy O'Sullivan, for example. The new technology also encouraged full-fledged mass production of photographic prints, and photography became popular in many forms, including photographs providing journalistic coverage of wars and the widespread adoption of the inexpensive carte de visite, a calling-card sized format used for prints of studio portrait photographs.

At the time that these techniques were becoming popular, Japan was undergoing the upheavals of the closing days of the Tokugawa shogunate and the Meiji Restoration. Professional photographers such as Ueno Hikoma and Shimooka Renjo, pioneers in portrait photography, appeared, and the "Yokohama photograph," a popular type of souvenir for foreigners, was invented. Kusakabe Kimbei and other outstanding talents produced superb work in that format.

The albumen print remained in use for a relatively long period of time. Eugène Atget, who had a huge influence on modern photography, used that process in printing his photographs of the streets of Paris in the late nineteenth and early twentieth century. But because the albumen print, like the calotype, suffered from a tendency for prints to yellow and fade, it was replaced form 1900 on by the gelatin silver print as the dominant form of black-and-white print.

Albumen Print

Invented in 1850 by the French photographer Louis-Désiré Blanquart-Évrard, albumen paper was the type of paper used for printing photographs most commonly, and for the longest period of time, throughout the nineteenth century. The paper was prepared by coating it with egg white (albumen) mixed with salt, letting it dry, and then coating it with a solution of silver nitrate to make it photosensitive. When a negative was placed in contact with it and the paper exposed to sunlight, a sepia-colored image would develop. Albumen paper, the dominant photographic printing paper for over 40 years, could be mass produced, unlike materials used earlier. The factory Blanquart-Évrard opened in Lille was the world's first large-scale manufacturing facility for photographic printing paper.

Carte de Visite

The carte de visite, a photograph mounted on paper the size of a calling card, was a popular format in the second half of the nineteenth century. Multiple copies of a single (wet-plate) negative the size of the card were shot, from which sheets of cards were printed and then the cards cut out, one by one. In 1854, André-Adolphe-Eugène Disdéri secured a patent on the carte de visite. Photography studios opened in cities and towns all over, achieving commercial success as men and women, young and old, from the bourgeois and working classes, ordered their cartes de visite.

Science and Photography

Photography was soon used as a tool of scientific research. In the age of the wet collodion process, attempts were made to use photography to create a scientific medical record of psychological responses and

psychotic states. One early adopter was Guillaume-Benjamin-Amand Duchenne de Boulogne, the French physician famed as the inventor of electrotherapy, who photographed the momentary expressions of the human face in his research into the physiology of emotion.

In the late 1870s, advances were being made in developing gelatin as a new photosensitive material to replace collodion, and photography was poised to make new leaps forward. As highly sensitive gelatin dry plates began to be widely adopted, it became possible to do without the tripod and take photographs with a hand-held camera. Eadweard Muybridge and Etienne Jules Marey, among others, utilize the more sensitive plates to conduct experiments in using photography to capture the actions of both humans and animals. For the series of photographs of actions by Muybridge displayed here, he used the wet collodion process. He switched to the more sensitive gelatin dry plates for his later photographs analyzing motion.

Photographic Technique for Pictorialists

The art photography movement known as Pictorialism spread in the late nineteenth and early twentieth centuries to Europe, the United States, and Japan.

One trigger for that movement was the rise of a class of amateur photographers who sought to create photographs as fine art, a movement spurred by the widespread adoption of the gelatin dry plate. Among them, Peter Henry Emerson advocated what he termed Naturalist Photography from about 1885. Emerson, an innovative photographer, asserted that the visual impression that the human eye received from nature could be expressed directly in a photographic print. His thinking had a great influence on the members of the Brotherhood of the Linked Ring, a British group of Pictorialists formed in 1892, and on Alfred Stieglitz, who was studying abroad in Germany. Upon his return to the United States, Stieglitz, through Camera Work, the journal of the Photo-Secession, an organization he formed to work for the establishment of photography as a fine art, brought the art photography movement to its peak.

The sharpness of the perimeters of elements in photographs, which had been greatly improved since the days of the calotype, was, in the eyes of the Pictorialists, a disadvantage, in artistic terms. To erase those strengths of photography, they manipulated their prints, added color, and aimed to create work in a painterly style. Thus, the Pictorialists actively used pigment printing methods such as the carbon, gum bichromate, and bromoil print that facilitated manipulating their images.

Platinum Print

William Willis of the UK invented the platinum printing process in 1873. Because the image in such prints is rendered in platinum, it is resistant to fading and discoloration and outstandingly stable over time. Such prints also have rich tonal gradations and clear detail; the delicate tones in the mid range are particularly beautiful. Platinum prints were frequently used until the 1920s, when the soaring price of platinum led photographers to abandon the process. Some contemporary photographers are, however, once again focusing on the potential of the platinum print.

The Carbon Print

Joseph W. Swan of the UK received a patent for the carbon print process in 1864. It was Alphonse Louis Poitevin of France who had discovered the basic principle, that gelatin or gum arabic, when mixed with potassium dichromate, becomes photosensitive. (The areas of the gelatin exposed to light will harden.) That discovery led to Swan's invention. A mixture of a pigment, usually carbon black, and the potassium bichromate-gelatin solution is applied thickly to paper, making it photosensitive. After the gelatin dries, the negative is placed in contact with the paper, which is exposed to sunlight and then developed in warm water to produce the print. In the 1860s, carbon prints were popular for their deep, rich tones and permanence, and the process was widely used in Europe. While commercial use all but ceased after the 1880s, the carbon print process continued to be employed by Pictorialist photographers and is still used by contemporary photographers who appreciate its expressive possibilities.

The Gum-bichromate Print

The gum-bichromate print is a type of pigment print. It was invented in 1855 by Alphonse Poitevin, who discovered that when a colloid such as gelatin, albumen, gluten, or gum arabic was combined with potassium bichromate, it becomes photosensitive. A photograph printing process based on that principle was introduced at an exhibition of the Photo-Club de Paris in 1894 and became widely known. The primary process utilized for printing art photographs until the 1930s, the gum-bichromate process was used by Constant Puyo, Robert Demachy, Edward Steichen, Heinrich Kühn, and other Pictorialist photogrpahers. The beautiful shading that the pigment produced and the rich tones that superimposing negatives in printing could achieve are among its distinctive characteristics.

The Bromoil Print

The bromoil printing process was a favorite of Pictorialist photographers in the first half of the twentieth century. Its principle was discovered in 1907 by J. E. Wall of the UK; C. Welborne Piper perfected the process the following year. A gelatin silver print, enlarged from the negative, was chemically bleached so that the gelatin in the areas that had been more exposed to light hardened and the other parts became absorbent to water. When oil-based ink or oil pigments are brushed on, the shadows will take up the ink, while the highlights will reject them, so that the print of the photograph will appear.

Photomechanical Printing Processes

Heliography, which Joseph-Nicéphore Niépce conceived of in 1822, represented the dawn of both photography and photomechanical printing.

After the invention of the daguerreotype, researchers experimented successfully with a method of using etching or other methods to create grooves in the image on the silver plate of the daguerreotype, apply ink, and transfer the image to paper or other

materials. That method was not developed further, since William Henry Fox Talbot's invention of the paper negative, in the same period, made reproducing photographs possible. The paper negative had, however, two major disadvantages: lack of image clarity and a long processing time. Fox Talbot, seeing photomechanical printing as a possible solution, conceived of the principles behind photogravure and half-tone printing.

Photomechanical printing methods developed in the nineteenth century include the collotype, the woodburytype, photogravure, and half-tone printing. From the latter half of the century on, their use, on an increasingly large scale, continued to expand, both to deliver images as documentary records and to serve commercial objectives, i.e., meeting the demand for advertising. Some photographers also used those printing processes for the distinctive beauty that they could produce. Among them, the technique known as "dust-grain gravure," which used fine resin dust grains, was characterized by soft, delicate tones, and was adopted by Peter Henry Emerson and other Pictorialist photographers as well as used in printing Camera Work, the journal of Alfred Stieglitz's Photo-Secession. The high artistic quality of such work clearly distinguishes it from the high-volume printing used to turn out masses of reproductions.

The Woodburytype

Walter Woodbury of the UK applied in 1864 for a patent on this photomechanical process, which was used in printing photographs. A lead mold (a letterpress plate) was formed from a relief of an image formed of hardened bichromate gelatin emulsion. The mold was filled with an ink made of a pigment (carbon black) and gelatin. The Woodburytype process was widely used in Europe and America. Goupil & Co. licensed it in France, using the Woodburytype in publishing Galerie Contemporaine, a weekly review. The portraits of famous people and literary figures in that magazine were printed using the Woodburytype process.

Photogravure

Karl Klic of Austria developed the photogravure process in 1879 by improving on the intaglio printing process that Fox Talbot had announced in 1852. A photomechanical process, it permits reproduction of photographs in large numbers. A copper plate is coated with powdered pine resin and then bichromated gelatin. A transparent positive image is placed in contact with it and the plate is exposed. The plate is then inked and the image transferred to paper. Because manipulating the copper plate can control the resulting photograph, Pictorialist photographers such as Emerson, Coburn, and Stieglitz used the photogravure process extensively.

Electricité

Man Ray created this work in 1931 as part of a project commissioned by Compagnie Parisienne de Distribution d'Electricité, a French electric power company. In the portfolio of his work that he prepared for senior officials and customers, Man Ray's photograms (Rayograms) were crisply and beautiful reproduced by means of photogravure.

The Age of the Gelatin Silver Print

The first three decades of the twentieth century were fertile years in Europe for the birth of new movements in the arts. In response to Surrealism, the Bauhaus, and the Neue Sachlichkeit (New Objectivity), for example, photographers also created new styles. It was not by imitating painting but by pursuing the beauty unique to photography that it would achieve full citizenship in the world of fine art.

From 1900 on, the gelatin silver print became the dominant type of black-and-white print, its strengths the rich gradations of grays, blacks, and whites it could produce and the clarity of the image. Surrealists such as Man Ray and Bauhaus artists such as László Moholy-Nagy created a variety of approaches to art photography that exploited the characteristics of that photographic printing paper: the Photogram and other versions of camera-less photography, solarization, and the negative photograph, for example. The New Objectivity, whose goal was direct visual perception via the lens, created a new world of beauty by discovering subjects in every aspect of the world--things, human beings, plants, animals, still lifes, landscapes, factories, machines--through the mechanical gaze. The outstanding photographers of that group included Albert Renger-Patzsch and August Sander, who tried systematically to photograph representatives of all types of Germans, of every occupation and social class.

The depiction of the subject in the New Objectivity had much in common with the Straight Photography that Alfred Stieglitz came to conceive as a form of art photography. By positioning the photograph as a medium of individual expression, refining the point of view in the straight and precise way essential to the lens, America launched its own distinctive form of photographic art. Its leaders included Stieglitz, Paul Strand, Charles Sheeler, and Edward Weston and Ansel Adams, who led f.64, a society of purist photographers based on the West coast. Their new vision was the essential form that later inspired developments in documentary photography, photojournalism, and the advertising and fashion fields. In all their work, the dominant type of black-and-white photograph was the gelatin silver print.

Photogram

In a photogram, the subject is placed directly on photograph printing paper, and its image is captured without use of a camera. The technique had been used since the nineteenth century, but it was in the 1920s that László Moholy-Nagy and Man Ray "rediscovered" it as a modern means of expression. Man Ray called his photograms "Rayograms." The photogram is one of the expressive techniques that epitomize New Vision Photography.

Solarization

Solarization is a technique based on the Sabattier effect, in which a negative or positive is re-exposed to light when partly developed, producing a partial reversal of light and dark in the image. Man Ray, using it as a creative technique in art photography, gave it the name "solarization." The resulting image has a distinct rim or band around its perimeter and displays a mingling of negative and positive

images.

Negative Photograph

As the name implies, the image is printed in the negative, so that light and dark are reversed in the entire image. New Vision photographers actively used it to achieve special visual effects.

The Gelatin Silver Print

This process was discovered by Peter Mawdsley of the UK in 1873. Gelatin silver prints are stable and resistant to discoloration, and the process of developing them is not complicated. Thus they gradually replaced albumen prints to become the dominant black-and-white photographic process from 1900 on. The material for the prints, baryta paper or resin-treated paper coated with a gelatin emulsion containing photosensitive silver salts, which is then allowed to dry, can be mass produced in factories for use long after their manufacture.

2. Prints on Metal and Glass

The daguerreotype was the first photographic process invented. Unlike the calotype, however, the daguerreotype did not support making multiple positive images from a single negative. For some years after its invention, the daguerreotype overwhelmingly outstripped the calotype in popularity, partly because it rendered images in superb detail and partly because the French government actively promoted the process. The response was so strong that it became known as "daguerreotype mania."

The use of the daguerreotype developed most notably in the field of commercial portrait photography, with the appearance of commercial photography studios for that purpose. Matthew Brady, for example, opened a portrait studio in New York to great commercial success, creating system for large-scale production in which he applied a division of labor to the daguerreotype processes.

Daguerreotypes were difficult to create out of doors, where the facilities for developing them would not be available, and thus they were used far less for landscape than for portrait photography.

The daguerreotype was an extremely demanding, and expensive, process. Thus, when the ambrotype and tintype emerged as alternatives to it, they swiftly gained popularity. If the daguerreotype was the medium of choice for the affluent segment of society, ambrotypes and tintypes were popular among the masses. While inferior to the daguerreotype in image quality, the tintype had the advantage that, unlike the ambrotype, it did not use a glass base. Since tintypes were both strong and light in weight, it was possible, for example, to mail a tintype to a loved one.

The Daguerreotype

The daguerreotype, introduced by Louis-Jacques-Mandé Daguerre in 1839, was the world's first practical photographic process. A highly polished silver-coated sheet of copper is fumed with iodine to make it photosensitive, exposed for a long period, and developed by mercury vapor. The daguerreotype process produces extremely sharp, clear images, but each daguerreotype is a unique image, not susceptible of reproduction, since there is no negative from which to produce additional prints. Nonetheless, from its introduction until the mid 1850s, the daguerreotype attracted more interest than the calotype, which Fox Talbot had invented.

The Ambrotype

The ambrotype is a positive image created using the wet-plate collodion process that Frederick Scott Archer of the UK invented in 1851. First, a glass plate negative is coated with a photosensitive material, exposed while that material was still wet, and then developed and fixed. Next, black paper, cloth, or paint is applied to the back of the negative so that, when viewed in reflected light, the negative appears to be a positive image. After James Ambrose Cutting of the United States took out patents on the process, which he named the "ambrotype," in 1854, it came into widespread use. Particularly in the United States, ambrotypes became highly popular as inexpensive substitutes for daguerreotypes. The process was mainly used as a medium for portrait photography.

The Tintype

A simplification of the ambrotype, the tintype does not use a collodion-on-glass negative. Instead, a darkened sheet of metal is coated with photosensitized collodion emulsion and exposed in a camera to produce a positive image. First introduced by Adolphe-Alexandre Martin of France in 1853, the tintype was easier to produce and less expensive than the daguerreotype and thus became popular in the United States among immigrants and the working class. Used mainly in portrait photography, tintypes were light in weight and relatively sturdy; thus, during the American Civil War, many soldiers sent tintype portraits of themselves from the front to their families.

3. Development of Color Photographic Processes

As black-and-white photograph evolved, the pursuit of color began. From the dawn of photography, efforts were made to reproduce color by hand tinting daguerreotypes and by using carbon prints, gum-bichromate prints, and other pigment printing processes. In the 1840s, John Herschel and other researchers conducted repeated experiments on fixing the colors of the visible spectrum of light by means of the photosensitivity of silver halide, but achieved little success. The researchers thought of all the colors of the natural world as consisting of combinations of three primary colors: red, blue, and green. The spectrum of colors could be reproduced by changing the proportions of the primary colors or reducing them through the use of colored filters.

In 1861, the Scottish physicist James Clerk Maxwell created a color photograph by projecting three lantern slide positive images of a tartan ribbon, an additive process. At about the same time, in France, Louis Arthur Ducos du Hauron was conducting similar experiments and announced Heliochromy, a subtractive process for printing color photographs. Their approaches failed, however, to have sufficient photosensitivity throughout the visible spectrum and did not result in truly practical color photography.

(Film sensitive to all wavelengths in the visible spectrum did not appear until the early twentieth century, when Kodak invented its Panchromatic film.)

The commercialization of color film began in 1904 when the Lumière brothers, Auguste and Louis, invented the Autochrome process. Autochrome plates produced color transparencies or slides on glass. They were costly, required long exposure times, and produced images that had to be seen through a viewer, but they proved unexpectedly popular. The Autochrome had, however, considerable room for improvement in technique and in the naturalness of the resulting color.

Color photography in a true sense was not realized until 1935, when Eastman Kodak introduced Kodachrome, a three-layer positive film. Since then color photographs have acquired an overwhelming market share among the mass of amateur photographers. With subsequent development of the dye transfer, diffusion transfer, chromogenic, and silver dye bleach processes, color photography has achieved an unshakeable position in our lives.

Heliochromy

The first practical process for printing color photographs, heliochromy was invented by Louis Ducos du Hauron. It was in 1868 that he announced his subtractive method for making colored prints, based on the three-color process, which involves assembling three negatives of the same subject, each a dye image made with a different pigment: cyan, magenta, and yellow. The printing of enlargements of color photographs in natural colors was not, however, perfected until about 1900.

Autochromes

The Autochrome was the first commercially successful color process. The Lumière brothers, famous for the invention of motion pictures, began manufacturing and selling Autochrome plates in 1907. The resulting images are color transparencies or slides on glass. They were made by coating the glass plate with a random mosaic of grains of potato starch dyed in the three primary additive colors (red, blue, and green). That three-color mosaic filter and a black-and-white plate were combined so that, with the light passing through the microscopic three-color filter, color transparencies that resemble pointillist paintings could be created.

The Dye Imbibition Process

Improving on its Wash Off Relief dye imbibition process, which it released in 1935, Eastman Kodak gave the world the Dye Transfer process in 1946. Its clear colors, permanence, and ease of color manipulation made it a process used to create original prints in color. The color negative is reproduced as black-and-white negatives by using three filters, red, green, and blue, to make three color separation negatives. Then the images in relief created with those three negatives are soaked with dyes in the appropriate complementary color, yellow, magenta, or cyan. The negatives are placed in exact registration on paper covered with a gelatin layer, which is then contact printed.

The Diffusion Transfer Process

The physicist Edwin Land invented this instant photography system in the United States in 1947. The Polaroid process, using film and cameras made by the Polaroid Corporation, was the version most commonly used, but Kodak marketed its own internal dye diffusion products, as did Fujifilm (the Photorama). Polaroid ceased production of Polaroid film in 2008. Kodak had withdrawn from manufacturing products related to instant photography in 1985.

The Silver Dye-Bleach Print

A general term for processes used to make color prints directly from color positives, the silver dye-bleach print was developed as a film process for still photography and color motion picture work by Bela Gaspar, a Hungarian chemist, in the 1930s. It did not become widely used until 1963, when Ciba-Geigy Corporation of Switzerland announced the Cibachrome process. Silver dye-bleach prints use a paper that, like the paper used for most other color prints (chromogenic color process paper), contains three layers of photosensitive materials. In this case, however, the yellow, magenta, and cyan dyes are imbedded in the respective layers of emulsion at the outset. In developing a photograph, the silver and complementary color dyes in the areas exposed are selectively bleached out to produce a color print.

The Chromogenic Print

A general term for means of creating color prints from color negatives, the chromogenic print was the most widespread process used in color photography in the twentieth century. Agfa announced color negative film for making color prints in 1939; Kodak did so in 1942. Because such film was initially quite expensive, it was little used outside the world of advertising photography. In the 1970s, however, as color film prices came down, it became widely accepted among amateur photographers, and a transition from black-and-white to color photography occurred among society at large. Until then, color photography had also not been used extensively in art photography, but in the latter half of the 1970s, the New Color school of photographers began using it.

Chromogenic prints are also referred to as "Type-C prints," terminology derived from the Type-C chromogenic paper once offered by Kodak. Such photographic paper has three emulsion layers, sensitized to red, blue, and green light, and dye couplers in the paper; in the development process, the dye couplers bond with the silver halides to form color dyes, producing a color print.