JHARKHAND
Rai University

Still Photography

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Subject: STILL PHOTOGRAPHY **Credits: 4**

SYLLABUS

Introduction to Photography
Beginning of Photography; People who shaped up Photography.

Camera; Lenses & Accessories - I
What a Camera; Types of Camera; TLR; APS & Digital Cameras; Single-Lens Reflex Cameras.

Camera; Lenses & Accessories - II
Photographic Lenses; Using Different Lenses; Filters.

Exposure & Light
Understanding Exposure; Exposure in Practical Use.

Photogram
Introduction; Making Photogram.

Darkroom Practice
Introduction to Basic Printing; Photographic Papers; Chemicals for Printing.

Suggested Readings:

1. Still Photography: the Problematic Model, Lew Thomas, Peter D'Agostino, NFS Press.
2. Images of Information: Still Photography in the Social Sciences, Jon Wagner,
3. Photographic Tools for Teachers: Still Photography, Roy A. Frye.

Introduction to Photography

Course Descriptions

The department of Photography at the IFT offers a provocative and experimental curriculum in the setting of a large, diversified university. As one of the pioneers programs of graduate and undergraduate study in photography in the India , we aim at providing the best to our students to help them relate practical studies in art & craft in professional context.

The Photography program combines the teaching of craft, history, and contemporary ideas with the critical examination of conventional forms of art making. The curriculum at IFT is designed to give students the technical training and aesthetic awareness to develop a strong individual expression as an artist. The faculty represents a broad range of interests and aesthetics, with course offerings often reflecting their individual passions and concerns.

In this fundamental course, students will identify basic photographic tools and their intended purposes, including the proper use of various camera systems, light meters and film selection. Students will analyze photographs to determine their positive and negative attributes and apply these principles to produce their own visually compelling images by employing the correct photographic techniques

Black & White Processing and Printing (Ranging from Photograms to photographs) would be explored. Besides equipment handling students will also learn the usage of classical rules of composition to make a visual statement.

STILL PHOTOGRAPHY

CONTENT

LESSON 1
BEGINNING OF PHOTOGRAPHY

First, the name, we owe the name “Photography” to Sir John Herschel, who first used the term in 1839, the year the photographic process became public. The word is derived from the Greek words for light and writing.

Before mentioning the stages that led to the development of photography, there is one amazing, quite uncanny prediction made by a man called de la Roche (1729- 1774) in a work called Giphantie. In this imaginary tale, it was possible to capture images from nature, on a canvas that had been coated with a sticky substance. This surface, so the tale goes, would not only provide a mirror image on the sticky canvas, but would remain on it. After it had been dried in the dark the image would remain permanent. The author would not have known how prophetic this tale would be, only a few decades after his death.

There are two distinct scientific processes that combine to make photography possible. It is somewhat surprising that photography was not invented earlier than the 1830s, because these processes had been known for quite some time. It was not until the two distinct scientific processes had been put together that photography came into being.

The first of these processes was optical. The Camera Obscura (dark room) had been in existence for at least four hundred years. There is a drawing, dated 1519, of a Camera Obscura by Leonardo da Vinci; about this same period its use as an aid to drawing was being advocated.

The second process was chemical. For hundreds of years before photography was invented, people had been aware, for example, that some colours are bleached in the sun, but they had made little distinction between heat, air and light.

- In the sixteen hundreds Robert Boyle, a founder of the Royal Society, had reported that silver chloride turned dark under exposure, but he appeared to believe that it was caused by exposure to the air, rather than to light.
- Angelo Sala, in the early seventeenth century, noticed that powdered nitrate of silver is blackened by the sun.
- In 1727 Johann Heinrich Schulze discovered that certain liquids change colour when exposed to light.
- At the beginning of the nineteenth century Thomas Wedgwood was conducting experiments; he had successfully captured images, but his silhouettes could not survive, as there was no known method of making the image permanent.

The first successful picture was produced in June/July 1827 by Niépce, using material that hardened on exposure to light. This picture required an exposure of eight hours. On 4 January 1829 Niépce agreed to go into partnership with Louis Daguerre . Niépce died only four years later, but Daguerre continued to experiment. Soon he had discovered a way of developing photographic plates, a process which greatly reduced the exposure time from eight hours down to half an hour. He also discovered that an image could be made permanent by immersing it in salt.

Following a report on this invention by Paul Delaroche , a leading scholar of the day, the French government bought the rights to it in July 1839. Details of the process were made public on 19 August 1839, and Daguerre named it the Daguerreotype. The announcement that the Daguerreotype “requires no knowledge of drawing....” and that “anyone may succeed.... and perform as well as the author of the invention” was greeted with enormous interest, and “Daguerreomania” became a craze overnight. An interesting account of these days is given by a writer called Gaudin, who was present, the day that the announcement was made. However, not all people welcomed this exciting invention; some pundits viewed in quite sinister terms. A newspaper report in the Leipzig City Advertiser stated:

“The wish to capture evanescent reflections is not only impossible... but the mere desire alone, the will to do so, is blasphemy. God created man in His own image, and no man-made machine may fix the image of God. Is it possible that God should have abandoned His eternal principles, and allowed a Frenchman... to give to the world an invention of the Devil?”

At that time some artists saw in photography a threat to their livelihood, and some even prophesied that painting would cease to exist.

The Daguerreotype process, though good, was expensive, and each picture was a once-only affair. That, to many, would not have been regarded as a disadvantage; it meant that the owner of the portrait could be certain that he had a piece of art that could not be duplicated. If however two copies were required, the only way of coping with this was to use two cameras side by side. There was, therefore, a growing need for a means of copying pictures, which daguerreotypes could never satisfy. Different, and in a sense a rival to the Daguerreotype, was the Calotype invented by William Henry Fox Talbot , which was to provide the answer to that problem. His paper to the Royal Society of London, dated 31 January 1839, actually precedes the paper by Daguerre; it was entitled “Some account of the Art of Photogenic drawing, or the process by which natural objects may be made to delineate themselves without the aid of the artist’s pencil.” He wrote:

“How charming it would be if it were possible to cause these natural images to imprint themselves durably and remain fixed on the paper!”

The earliest paper negative we know of was produced in August 1835; it depicts the now famous window at Lacock Abbey, his home. The negative is small (1" square), and poor in quality, compared with the striking images produced by the Daguerreotype process. By 1840, however, Talbot had made

some significant improvements, and by 1844 he was able to bring out a photographically illustrated book entitled "The Pencil of nature."

Compared with Daguerreotypes the quality of the early Calotypes was somewhat inferior. (See comments on Claudet). However, the great advantage of Talbot's method was that an unlimited number of positive prints could be made (see also Brewster). In fact, today's photography is based on the same principle, whereas by comparison the Daguerreotype, for all its quality, was a blind alley.

The mushrooming of photographic establishments reflects photography's growing popularity; from a mere handful in the mid 1840s the number had grown to 66 in 1855, and to 147 two years later. In London, a favorite venue was Regent Street where, in the peak in the mid 'sixties there were no less than forty-two photographic establishments! In America the growth was just as dramatic: in 1850 there were 77 photographic galleries in New York alone. The demand for photographs was such that Charles Baudelaire (1826-1867), a well known poet of the period and a critic of the medium, commented:

"our squalid society has rushed, Narcissus to a man, to gloat at its trivial image on a scrap of metal."

Talbot's photography was on paper, and inevitably the imperfections of the paper were printed alongside with the image, when a positive was made. Several experimented with glass as a basis for negatives, but the problem was to make the silver solution stick to the shiny surface of the glass. In 1848 a cousin of Nicephore Niépce, Abel Niépce de Saint-Victor, perfected a process of coating a glass plate with white of egg sensitized with potassium iodide, and washed with an acid solution of silver nitrate. This new (albumen) process made for very fine detail and much higher quality.

However, it was very slow, hence the fact that photographs produced on this substance was architecture and landscapes; portraiture was simply not possible. Progress in this new art was slow in England, compared with other countries. Both Daguerre and Fox Talbot were partly responsible, the former for having rather slyly placed a patent on his invention whilst the French government had made it freely available to the world, the latter for his law-suits in connection with his patents.

In 1851 Frederick Scott Archer, who introduced the Collodion process, introduced a new era in photography. This process was much faster than conventional methods, reducing exposure times to two or three seconds, thus opening up new horizons in photography.

Prices for daguerreotypes varied, but in general would cost about a guinea (£1.05), which would be the weekly wage for many workers. The collodion process, however, was much cheaper; prints could be made for as little as one shilling (5p).

A further impetus was given to photography for the masses by the introduction of carte-de-visite photographs by Andre Disdéri . This developed into a mania, though it was relatively short-lived.

The collodion process required that the coating, exposure and development of the image should be done whilst the plate was still wet. Another process developed by Archer was named the Ambrotype which was a direct positive.

The wet collodion process, though in its time a great step forward, required a considerable amount of equipment on location. There were various attempts to preserve exposed plates in wet collodion, for development at a more convenient time and place, but these preservatives lessened the sensitivity of the material. It was clear, then, that a dry method was required. It is likely that the difficulties of the process hastened the search for instantaneous photography. Skaife, in a pamphlet, aptly commented (1860):

"Speaking in general, instantaneous photography is as elastic a term as the expression 'long and short.'"

The next major step forward came in 1871, when Dr. Richard Maddox discovered a way of using Gelatin (which had been discovered only a few years before) instead of glass as a basis for the photographic plate. This led to the development of the dry plate process. Dry plates could be developed much more quickly than with any previous technique. Initially it was very insensitive compared with existing processes, but it was refined to the extent that the idea of factory-made photographic material was now becoming possible.

The introduction of the dry-plate process marked a turning point. No longer did one need the cumbersome wet-plates, no longer was a darkroom tent needed. One was very near the day that pictures could be taken without the photographer needing any specialized knowledge.

Celluloid had been invented in the early eighteen-sixties, and John Carbutt persuaded a manufacturer to produce very thin celluloid as a backing for sensitive material. George Eastman is particularly remembered for introducing flexible film in 1884. Four years later he introduced the box camera, and photography could now reach a much greater number of people.

Other names of significance include Herman Vogel , who developed a means whereby film could become sensitive to green light, and Eadweard Muybridge who paved the way for motion picture photography.

Popular in the Victorian times was stereoscopic photography , which reproduced images in three dimensions. It is a process whose popularity waxed and waned - as it does now - reaching its heights in the mid-Victorian era.

" Well, actually, not quite" Whilst Herschel used the term first in a lecture before the Royal Society on March 14, 1839, he was in fact beaten to the post by an anonymous writer with the initials "J.M." a few weeks earlier, on February 25. Eventually a scholar was able to determine that this anonymous writer was in fact Johann von Maedler (1794-1874), who was an astronomer in Berlin. However, Hershel was undoubtedly the person who, with his fame and position, made the word "photography" known to the world.

LESSON 2
PEOPLE WHO SHAPED UP PHOTOGRAPHY

DAGUERRE, Louis Jacques Mande (1787-1851)

Daguerre (pronounced Dagair) was perhaps the most famous of several people who invented photography.

He began work as an apprentice architect, and at the age of sixteen was an assistant stage designer in a Paris theatre, his elaborate stage designs winning him considerable acclaim. He had an astonishing ingenuity in the handling of light and lighting effects, and he supplied the scenic and lighting effects for a number of operas in theatres in Paris. He developed an impressive illusions theatre, which he termed Diorama; it was a picture show with changing light effects and huge paintings measuring 22 by 14 meters, of famous places. This became the rage in the early twenties.

He regularly used a camera obscura as an aid to painting in perspective, and this had led him to seek to freeze the image. In 1826 he learned of the work of Nicephore Niépce, and on 4 January 1829 signed up a partnership with him.

The partnership was a short one, Niépce dying in 1833, but Daguerre continued to experiment. He made an important discovery by accident. In 1835, so the story goes, he put an exposed plate in his chemical cupboard, and some days later found, to his surprise, that the latent image had developed. Daguerre eventually concluded that this was due to the presence of mercury vapor from a broken thermometer. This important discovery that a latent image could be developed made it possible to reduce the exposure time from some eight hours to thirty minutes.

Though he now knew how to produce an image, it was not until 1837 that he was able to fix them. This new process he called a Daguerreotype.

Daguerre advertised his process and sought sponsorship, but few seemed interested. He then turned to Francois Arago, a politician, who immediately saw the implications of this process, took his case up, and the French government commissioned a report on the process, to be chaired by Paul Delaroche. On 7 January 1839 an announcement was made of the discovery, but details were not divulged until 19 August when the process was announced publicly, the French government having bought the rights to the process from him, and given it free to the world. However, this process had also been patented in England and Wales on 14 August - only five days previously. As Lady Eastlake pointed out:

"...by some chicanery a patent for the daguerreotype was actually taken out in England, which for a time rendered this the only country which did not profit by the liberality of the French government. The early history of photography is not so generous in character as that of its maturity."

From the day the announcement was made of this new discovery, the process came to be used widely. The claim was made that the daguerreotype "requires no knowledge of drawing...." and that "anyone may succeed... and perform as well as the author of the invention."

The early daguerreotypes had several drawbacks.

- the length of the exposure necessary all but ruled out portraiture.
- the image was laterally reversed (as one sees oneself in a mirror). Many of the portraits reveal this from the way the coat was buttoned; if one required a picture the right way round, the camera would be pointed at a mirror reflecting the sitter's image. Initially this will not have bothered people, who were used only to seeing their mirror image in any case.
- it was very fragile.
- perhaps most limiting of all, it was a "once only" system; what was needed was a means whereby copies of a photograph might easily be made.

Taken in 1839, this picture of a boulevard gives the impression of empty streets, because with long exposures moving objects would not register.

However, there was an exception when a man stopped to have his shoes shined, (see bottom left of the larger picture) and though he and the person shining the shoes remain anonymous, they may have the distinction of being the first people ever to have been photographed.

In 1851 Daguerre died. In a sense this symbolically ended an era, for that very same year a new technique was invented, which was another milestone in photography - the wet collodion process by Frederick Scott Archer.

Niépce, Joseph Nicephore (1765-1833)

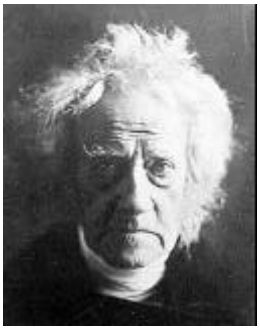
Niépce (pronounced Nee-ps) is universally credited with producing the first successful photograph in June/July 1827. He was fascinated with lithography, and worked on this process. Unable to draw, he needed the help of his artist son to make the images. However, when in 1814 his son was drafted into the army to fight at Waterloo, he was left having to look for another way of obtaining images. Eventually he succeeded, calling his product Heliographs (after the Greek "of the sun"). Lady Elizabeth Eastlake, writing in 1857, informs us that he was a man of private means, who had began his researches in 1814. When he eventually succeeded, he came over to England later that year and sought to promote his invention via the Royal Society (then as now regarded as the leading learned body concerned with science). However, the Royal Society had a rule that it would not publicize a discovery that contained an undivulged secret, so Niépce met with total failure. Returning to France, he teamed up with Louis Daguerre in 1829, a partnership which lasted until his death only four years later, at the age of 69. He left behind him some examples of his heliographs, which are now in the Royal Photographic Society's collection.

This is the first known photograph.** There is little merit in this picture other than that fact. It is difficult to decipher: the building is on the left, a tree a third in from the left, and a barn immediately in front. The exposure lasted eight hours, so the sun had time to move from east to west, appearing to shine on both sides of the building.

Though Niépce's contribution is interesting, for the purposes of photography as we know it today, it is irrelevant.

** I have been taken to task by some who point to the picture in the Turin Shroud as being the first photograph. Whether the shroud dates back to the time of Jesus Christ, which most scholars discount, or whether it dates from around 1000AD, it does certainly show an image of a dead person. Whether this was produced intentionally though is more unlikely. The picture shown here is generally acknowledged to be the first image produced intentionally.

Herschel, Sir John Frederick William (1792-1871)



The only son of the distinguished British astronomer William Herschel, Sir John himself also became a well-known astronomer, and published an influential book on the subject.

He became interested in capturing and retaining images, and in 1839 had managed to fix pictures using hyposulphite of soda. In fact it was he who had discovered twenty years previously that hypo could dissolve silver salts.

Herschel, of course, had the fortune to be around just at the time both Daguerre and Fox Talbot were announcing their discoveries. He was evidently very smitten by the Daguerreotype**,** and conveyed the following news to Fox Talbot:

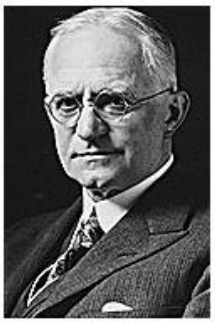
"It is hardly too much to call them miraculous. Certainly they surpass anything I could have conceived as within the bounds of reasonable expectation.... Every gradation of light and shade is given with a softness and fidelity which sets all painting at an immeasurable distance.... If you have a few days at your disposition....come and see!"

Fox Talbot, for his part, would not have been very happy about this news, as he was already upset that Daguerre had pipped him to the post in announcing his discovery!

It is also to Herschel that we also owe the word "photography", a term which he used in a paper entitled "Note on the art of Photography, or The Application of the Chemical Rays of Light to the Purpose of Pictorial Representation," presented to the Royal Society on 14 March 1839. He also coined the terms "negative" and positive" in this context, and also the "snap-shot".

The picture of Heschel, on the left, was taken by J M Cameron, and on the right is the very first photograph to be taken on glass. It was taken by Sir John Herschel in 1839, and shows his father's telescope in Slough, near London. (Science Museum, London).

Eastman, George (1854-1932)



Up to the time of Eastman photography, though already popular, was still considered too complicated for ordinary users, and George Eastman is remembered for having made photography accessible to all.

Eastman started off as a bank clerk, and then became interested in photography. He is particularly remembered for introducing flexible film in 1884.

Four years later he introduced the box camera incorporating roll film, and with his slogan "You press the button, we do the rest" he brought photography to the masses.

The box camera had a simple lens focusing on 8 feet and beyond. One roll of film took a hundred images, all circular in shape. The entire camera would be posted to the factory where the film was processed and the camera re-loaded and returned to the user, the charge for this being £2.2s (£2.10).

The photographs were of about 65mm diameter, and opened up a new world for popular photography.

Eastman's contribution not only made photography available to all, but also resulted in a gradual change in what constituted acceptable photography. Paul Martin**,** who worked with a large portable camera, had found it difficult to get his informal pictures accepted at exhibitions. To have pictures accepted, he complained, one would need to take "... a noble and dignified subject, a cathedral or mountain..."

and that

"few envisaged the popular snapshot until the coming of the hand camera and the Kodak."

From the age of 76 onwards, Eastman was becoming increasingly ill. Eventually, having settled his affairs, he took his own life. Next to his body was a note which said simply "To my friends, my work is done - why wait?"

If you have the opportunity, do visit the Kodak Museum at the National Museum of Photography, Film and Television in Bradford. It houses a huge collection of interesting images and objects connected with popular photography.

Stieglitz, Alfred (1864-1946)

Stieglitz, an American photographer, probably did more than any other individual to promote photography as an art at the same level as other arts, and has been dubbed the "patron saint of straight photography."

It is said that at the age of eleven he had begun to take an interest in photography, and learned by observing a local portrait photographer work in the darkroom. His blunt nature often came over: on one occasion he observed the photographer re-touching a plate, and on enquiry, was told that this made the subject look more natural - to which he replied "I wouldn't do that if I were you."

He studied mechanical engineering and photography at the Polytechnic of Berlin. In 1883 Stieglitz saw a camera in a shop window in Berlin, bought it, and photography in earnest began. Many years later he wrote "I bought it and carried it to my room and began to fool around with it. It fascinated me, first as a passion, then as an obsession." From 1892 he was becoming famous for his photographs of everyday life in New York and Paris. There is a tremendous atmospheric quality in many of his outdoor scenes.

In the 1890s Stieglitz took a pioneer step in moving towards a hand-held camera. In "The Hand Camera - its present importance" (1897) he wrote:

"The writer does not approve of complicated mechanisms, as they are sure to get out of order at important moments, thus causing considerable unnecessary swearing, and often the loss of a precious opportunity. My own camera is of the simplest pattern and has never left me in the lurch, although it has had some very tough handling...

A shutter working at a speed of one-fourth to one-twenty-fifth of a second will answer all purposes. A little blur in a moving subject will often aid to giving the impression of action and motion.

In order to obtain pictures by means of the hand camera it is well to choose your subject, regardless of figures, and carefully study the lines and lighting. After having determined upon these watch the passing figures and await the moment in which everything is in balance; that is, satisfied your eye. This often means hours of patient waiting. My picture, "Fifth Avenue, Winter" is the result of a three hours' stand during a fierce snow-storm on February 22nd 1893, awaiting the proper moment. My patience was duly rewarded. Of course, the result contained an element of chance, as I might have stood there for hours without succeeding in getting the desired pictures."

In 1902 he became one of the founders of the Photo-Secession, a group of talented avant-garde artists. In 1905 he also founded and directed the Photo-Secession Gallery in 291 Fifth Avenue, New York, a gallery which came to be known as the "291", and which exhibited not only the work of contemporary photographers, but also works of Picasso, Rodin, Matisse and Toulouse-Lautrec.

Speaking in New York, in 1902, Stieglitz said

"The result is the only fair basis for judgment. It is justifiable to use any means upon a negative or paper to attain the desired end."

Stieglitz, committed to the idea of photography as art, often found this challenged.

"Artists who saw my early photographs began to tell me that they envied me; that my photographs were superior to their paintings, but that unfortunately photography was not an art.... I could not understand why the artists should envy me for my work, yet, in the same breath, decry it because it was machine-made - their...'art' painting - because hand-made, being considered necessarily superior....There I started my fight...for the recognition of photography as a new medium of expressions, to be respected in its own right, on the same basis as any other art form."

In 1903 Stieglitz launched, edited and published Camera Work - a magazine which became world famous and continued publication for a number of years. Amateur Photographer was most enthusiastic, and on its first edition of 1903 wrote:

"For Camera Work as a whole we have no words of praise too high, it stands alone; and of Mr. Alfred Stieglitz American photographers may well be proud. It is difficult to estimate how much he has done for the good of photography, working for years against opposition and without sympathy, and it is to his extraordinary capacity for work, his masterful independence which compels conviction, and his self-sacrificing devotion that we owe the beautiful work before us."

In 1907, it was during a trip to Europe that one of his most well-known photographs was taken It is called "The Steerage":

"There were men and women and children on the lower deck of the steerage.... I longed to escape from my surroundings and join them.... A round straw hat, the funnel leaning left, the stairway leaning right.... round shapes of iron machinery... I saw a picture of shapes and underlying that, the feeling I had about life..."

Stieglitz did much to promote photography, and to get it talked about. There were two stages in his life: at first he produced somewhat romanticized pictures of an Impressionistic style, then later moving over to realism of a high order.

He also had pronounced views about the current controversy over amateur photographers and the professional.

Not the easiest of people to get on with, his leadership was little short of dictatorial and he was an insufferable egocentric windbag, but he made a distinct and influential contribution to the development of new styles of photography. He was a visionary of the highest order. His own photography alone makes him stand out as one of the greatest of photographers; his influence over photography has been enormous.

Talbot, William Henry Fox (1800-1877)

His signature is Henry Talbot, and though he is said to have disliked being called Fox Talbot, that name has stuck.

Though Fox Talbot was not the first to produce photographs, he made a major contribution to the photographic process as we know it today.

Talbot studied the classics and mathematics at Cambridge, was elected a Fellow of the Royal Astronomical Society in 1822, and a Fellow of the Royal Society in 1832. He was also an MP, Biblical scholar, a Botanist and Assyriologist, making a contribution to the deciphering of cuneiform inscriptions brought to England from Nineveh.

Though some of his pictures show a measure of artistic taste, it was his inability to draw which caused him to experiment with a mechanical method of capturing and retaining an image. Talbot attempted to draw with the aid of both a camera obscura and a camera lucida when producing his sketches, one of which was Villa Melzi. Later he wrote:

"(In) October, 1833, I was amusing myself on the lovely shores of the Lake of Como in Italy, taking sketches with a Camera Lucida, or rather, I should say, attempting to make them; but with the smallest possible amount of success...

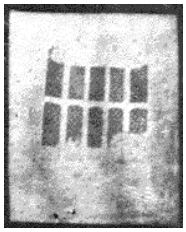
After various fruitless attempts I laid aside the instrument and came to the conclusion that its use required a previous knowledge of drawing which unfortunately I did not possess.

I then thought of trying again a method which I had tried many years before. This method was to take a Camera Obscura and to throw the image of the objects on a piece of paper in its focus - fairy pictures, creations of a moment, and destined as rapidly to fade away...

It was during these thoughts that the idea occurred to me... how charming it would be if it were possible to cause these natural images to imprint themselves durably and remain fixed on the paper!"

The earliest surviving paper negative is of the now famous Oriel window in the South Gallery at Lacock Abbey, Wiltshire, where he lived. It is dated August 1835. Talbot's comments read "When first made, the squares of glass about 200 in number could be counted, with help of a lens."

Talbot described how he took his pictures:



"Not having with me... a camera obscura of any considerable size, I constructed one out of a large box, the image being thrown upon one end of it by a good object-glass fixed at the opposite end. The apparatus being armed with a sensitive paper, was taken out in a summer afternoon, and placed about one hundred yards from a building favorably illuminated by the sun. An or so afterwards I opened the box and I found depicted upon the paper a very distinct representation of the building, with the exception of those parts of it which lay in the shade. A little experience in this branch of the art showed me that with a smaller camera obscura the effect would be produced in a smaller time. Accordingly I had several small boxes made, in which I fixed lenses of shorter focus, and with these I obtained very perfect, but extremely small pictures..."

These "little boxes", measuring two or three inches, were named "mousetraps" by the family at Lacock, because of the various places they were to be found.

January 1839 was a busy month as far as announcements of discoveries were concerned. On 7 January Daguerre announced the development of his process. A few days later Talbot wrote **to Arago,** who had promoted Daguerre's invention, suggesting that it was he, not Daguerre, who had invented the photographic process. (At that time he was unaware that the process was entirely different). One of Arago's fellow-scientists replied that Daguerre had, in fact, devised a number of processes over fourteen years.

Doubtless annoyed that Daguerre had been put in the limelight he felt he himself deserved, Talbot began to publicise his own process. On 25 January 1839 he announced the discovery at the Royal Institution of a method of "photogenic drawing."

At the time the sensitivity of the process was extremely poor. Then, in September 1840 Fox Talbot discovered the phenomenon of the latent image. It is said that this was a chance discovery, when he attempted to re-sensitize some paper which had failed to work in previous experiments; as the chemical was applied, an image, previously invisible, began to appear. This was a major breakthrough which led to drastically lowered exposure times - from one hour or so to 1-3 minutes. Talbot he called the improved version the calotype (from the Greek

"Kalos", meaning beautiful) and on 31 January he gave a paper to the Royal Society of London. The paper was entitled "Some account of the Art of Photogenic drawing, or the process by which natural objects may be made to delineate themselves without the aid of the artist's pencil."

A very patient coachman at Lacock Abbey. Taken in 1840 - exposure three minutes!

Talbot patented his invention on 8 February 1841, an act which considerably arrested the development of photography at the time. The patent (a separate one being taken out for France) applied to England and Wales. Talbot chose not to extend his patent to Scotland, and this paved the way for some outstanding photographs to be produced in Edinburgh by Hill and Adamson.

In 1844 Talbot began issuing a book entitled "The Pencil of Nature", the first commercial book to be illustrated with actual photographs. In order to produce these prints, he helped his former valet, Nicolaas Henneman to set up the Reading Establishment, a photographic processing studio within relatively easy reach of both London and Lacock. This however lasted only four years, as it was not a financial success.

Talbot's process in general never reached the popularity of the daguerreotype process, partly because the latter produced such amazing detail, but partly because Talbot asked so much for the rights to use his process. A writer of the time, Henry Snelling, commented:

"He is a man of some wealth, I believe, but he demands so high a price for a single right.... that none can be found who have the temerity to purchase."

Consequently calotypes never flourished as they might have, and the fault must lie largely with him.

The newly formed Calotype club sought unsuccessfully to persuade Talbot to relax his restrictions in order to encourage the growth of photography. It is claimed that Talbot, somewhat put out by the fact that Daguerre had received many honors whilst he had been given none, was reacting accordingly.

Sadly Talbot's name was somewhat tarnished by his series of attempts to enforce his patent. A claim in 1854 that the Collodion process was also covered by his calotype patent. was lost in court, and from then onwards, knowing that the faster and better collodion process was free for all to use, there were no further restrictions and photography began to take off in a big way.

Having said this, there exists some evidence that there had been a concerted attempt to discredit Talbot in order to overturn the patent. Talbot increasingly viewed the defence of his calotype patent as a defence of Henneman, who had invested heavily in setting up the Reading Establishment . Talbot was enormously loyal to Henneman, and concerned about profit being made at his expense It is possible, therefore, that history has been a little too harsh on Fox Talbot. He too had spent a considerable amount of money developing his invention, and it has been suggested that his enforcement of patents was more due to his careful upbringing as far as finances were concerned than his desire to make a fortune. Other documents, particularly relating to the early days of the Photographic Society, reveal him to be far more magnanimous and generous than is commonly supposed.

Talbot summarized his achievement thus:

"I do not profess to have perfected an art but to have commenced one, the limits of which it is not possible at present exactly to ascertain. I only claim to have based this art on a secure foundation."

The Royal Photographic Society has two complete sets of the limited edition of "Pencil of Nature", together with many of Fox Talbot's letters, books and documents.

August 1999: A new web-site led by Professor Larry J. Schaaf is becoming the definitive site on this remarkable inventor. It is part of a three year project, and is a *must* for any student of Talbot. It is located at http://www.foxtalbot.arts.gla.ac.uk/

PS On a lighter note, in a discussion on Talbots' name, someone came up with what must be the definitive answer: "He was called Fox because he was a particularly cunning animal, and finally outran the Dag-hare!"

Muybridge, Eadweard (1830-1904)

Edward James Muggeridge was born in Kingston on Thames, and it is said that because this area is associated with the coronation of Saxon kings, he took on a name closely resembling (as he saw it) the Anglo Saxon equivalent. In his early twenties he went to live in America, gaining a reputation for his landscape photographs of the American West. As he used the collodion process, like other travel photographers he would have needed to take with him all the sensitizing and processing equipment, as all three processes of sensitization, exposure and processing needed to be done while the plate was still wet.

During the late sixties and early seventies he made some two thousand pictures, exposing negatives size 20x24 inch. Though he is not given due acclaim, many his landscape studies rank with the best.

However, Muybridge's main claim to fame (apart from being tried and acquitted for the murder of his wife's lover!) was his exhaustive study of movement. Just about this same time the French physiologist Etienne Marey was studying animal movement, and his studies began to suggest that a horse's movements were very different from what one had imagined. One of the people who became aware of this research was Leland Stanford, a former governor of California, who owned a

number of race horses. Stanford was determined to find the truth about this. It is said that he bet a friend that when a horse gallops, at a particular point all four feet are off the ground simultaneously. To prove his case he hired Muybridge to investigate whether the claim was true.

By the 1870s lengthy exposures had been reduced to a minimum, and thus it became possible for photography to begin to extend one's vision of reality. It took a little time, however, for Muybridge to perfect a way of photographing which would supply the answer, for the Collodion process was rather slow.

Whilst working on this project Muybridge also undertook other assignments, and it was on his return from one of these, we are told, that he became aware that his wife was having an affair with another soldier. In true Wild West style he shot the soldier dead, and was duly imprisoned for murder; however, presumably partly because of his connections, he was acquitted a little later, and was asked to photograph the Panama railroad, some distance away from the scene of the crime.

Returning to his movement experiments, a few years later Muybridge was able to photograph a horse galloping, using twenty four cameras, each triggered off by the breaking of a trip-wire on the course. He not only proved Leland right, but also showed that, contrary to what painters had depicted, a horse's feet are not, as hitherto believed, outstretched, as if like a rocking- horse, but bunched together under the belly. This discovery caused considerable controversy, but eventually became more generally accepted.

Muybridge's studies are very comprehensive, and include some detailed studies of men and women walking, running, jumping, and so on.

In 1878 an article in Scientific American published some of Muybridge's sequences, and suggested that readers might like to cut the pictures out and place them in a "zoetrope" so that the illusion of movement might be re-created. Intrigued by this, Muybridge experimented further, and in time invented the zoopraxiscope, an instrument which in turn paved the way for cine photography. This invention was greeted with enormous enthusiasm both in America, whilst in England a demonstration at the Royal Institution in 1882 attracted such people as the Prince of Wales, the Prime Minister (Gladstone), Tennyson, and others.

In 1884 the University of Pennsylvania commissioned Muybridge to make a further study of animal and human locomotion. The report, "Animal Locomotion" was published three years later and still ranks as the most detailed study in this area. It contains more than twenty thousand images.

In 1900 Muybridge returned to Kingston, where he died a few years later. His zoopraxiscope, together with many of his plates, were bequeathed to the Kingston-upon-Thames Museum, where they are on display. Other plates are in the Royal Photographic Society's collection.

Notes

LESSON 3
WHAT A CAMERA

I am often asked if there are important differences in performance between good cameras of the same size. There are many excellent cameras available, and the photographer should select one that performs well for him and that is well made throughout its system, of course within the limits of cost and need. In addition, there is a "fie!" about a particular camera; an emotional empathy seems to develop toward certain equipment. I sometimes sense that the camera itself may encourage the photographer to relate to particular subjects favorable to the cameras format and other characteristics. This is, of course, a subjective appreciation of the capabilities of the eye and the camera. - ANSEL ADAMS

What a Camera is and Does

Cameras consist of only four essential parts: a *camera body,* a *film holder and/or transport mechanism,* a *lens,* and a *shutter.* Each of these serves a specific purpose. Figure 2.1 is a drawing of a simple box camera, of which all other cameras are variations.

With cameras that are part of *systems,* some components are sold as *modules* that can be snapped together as needed - for example, separate lenses and camera bodies. Modular designs make a camera more flexible. With interchangeable film holders, you can use the same camera body and lens with several different types of film. Thus, if you want to take both black-_and-white and color photographs of a scene, you just change the film holder - it is cheaper and easier than buying and carrying two cameras.

The Camera Body: The body of a camera is simply a light-tight box that serves as the supporting structure for the lens and the film holder and may also house some of the controlling devices needed to operate the camera system. On some cameras (including view cameras, folding cameras, and a few roll- film and 35 mm camera systems), the lens is focused to produce a sharp image on the film by expanding or contracting the camera body.

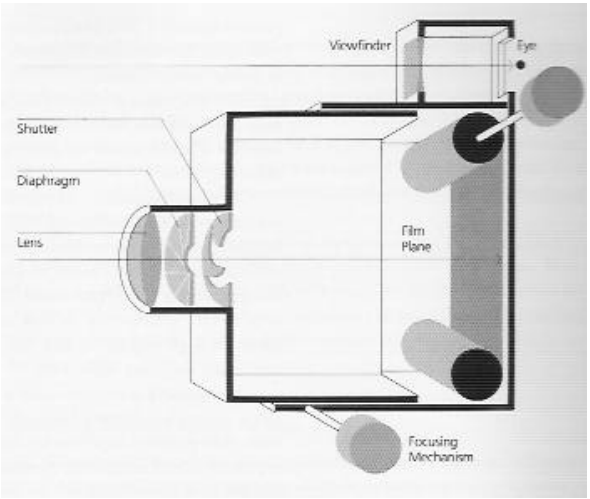


Figure 2.1: The elements of a camera. The following elements, common to all cameras, are housed either in or on the camera body, a light-tight supporting structure. The lens forms an inverted image on the film. The film plane holds the film Rat and at exactly the right distance behind the lens for precise focus. The focusing mechanism moves the lens closer to or farther away from the film, causing subjects at different distances from the camera to be brought into focus. The diaphragm controls the amount of light admitted by the lens. The shutter, used in conjunction with the diaphragm, controls the duration of the film's exposure to light. The viewfinder, or other viewing system, indicates to the photographer the area that will show in the final picture.

The Film Holder and/or Transport Mechanism

A camera must have a means of holding a sheet of film or a segment of a roll of film on a flat plane opposite the lens while the photograph is being taken. In cameras that use *roll film,* the film is wound from one spool onto another; guide tracks and pressure plates frame the film and keep its surface flat and perpendicular to the lens. In most 35mm cameras, the film holder is an integral part of the camera body, while with 2IA-inch roll-film cameras, the film holder may be in the form of separate and interchangeable magazines, or *backs.*

Film for 35mm cameras is packaged in *metal cassettes.* A leader of film that extends from the cassette is threaded onto a second spool (usually part of the camera body) that is geared to advance the film after each exposure. Meter the film has been completely exposed, it is rewound into the cassette by means of a rewind knob *before* it is removed from the camera. In cameras with *motor drives,* the film is rewound automatically after the last exposure is made.

Film is packaged on *paper-wrapped spools* for cameras that use roll film and have formats larger than 35mm. The opaque paper leader is threaded onto a second spool that takes up the film as it is advanced in the camera. When all of the exposures have been made, the camera's film-advance lever is used to complete the transfer of the film from the original spool to the take-up spool. The roll of film must then be removed from the camera and sealed with a glued paper strip attached to the wrapper. This protects the film from being further exposed by the surrounding light.

With cameras that use *sheet film,* individual sheets contained within special light-tight holders are inserted into the camera body before the exposure is made.

The Lens

the camera's lens forms the image that is projected onto the surface of the film. Lenses can be either built into the camera body as permanent fixtures or attached separately. Cameras with

interchangeable lenses are more versatile and more expensive than those without them.

A lens can vary from a simple pinhole (which is technically not a lens, though it does form an image) to a complicated assembly of a dozen or more simple lenses nested in combination. The advantages of a lens over a pinhole are that the image projected on the film is sharper and the exposures are shortened because the lens allows light to pass through a considerably larger opening.

The image produced by a lens can be larger or smaller than the original subject. The magnification produced by a lens depends upon its *focal length* (a measure of magnifying power) and the distance between the lens and the subject. Most cameras have a *focusing knob* or otherwise enable the lens to be adjusted to bring objects into sharp focus on the surface of the film.

In addition to forming an image, lenses are also used to control the amount of light that strikes the film. A roughly circular *diaphragm,* incorporated within the lens barrel and operated by a lens collar, masks off part of the outer circle of the lens, reducing its effective diameter. The diaphragm determines what fraction of the maximum lens diameter is used to allow light to pass through the lens.

The *f-stop,* or simply *stop* (both terms are used), is a measure of the degree to which a lens transmits light. Various diaphragm settings corresponding to discrete *apertures* (f-stops) are etched onto the controlling lens collar. You will see them written as *f/ number* - for example, f/2.8. On a lens barrel, the *f/* is omitted for reasons of space and only the numbers appear, adjacent to the appropriate set points on the lens.

The Shutter The shutter is a mechanical device that acts as a gate to control the passage of light from the lens to the film. A *leaf shutter* consists of a nest of thin metal blades, shaped to approximate a circle and located in the lens barrel. It is activated when tension is applied to a spring. When the exposure button is pressed, the shutter opens for a set period of time, allowing light to strike and expose the film, and then it snaps shut to prevent further exposure. Leaf shutters are used extensively in lenses for medium- and large-format cameras.

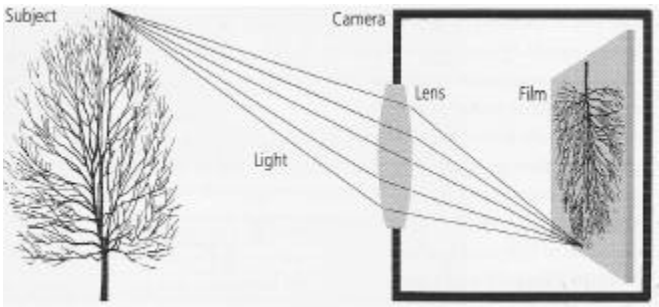


Image Formed on Film

Figure : Image formation by a simple lens. Light from a subject point falling on any part of the lens surface is focused at a single point behind the lens, and the total image is the accumulation of all such points. The lens "gathers" light over its entire surface and focuses it to produce a bright, sharp image.

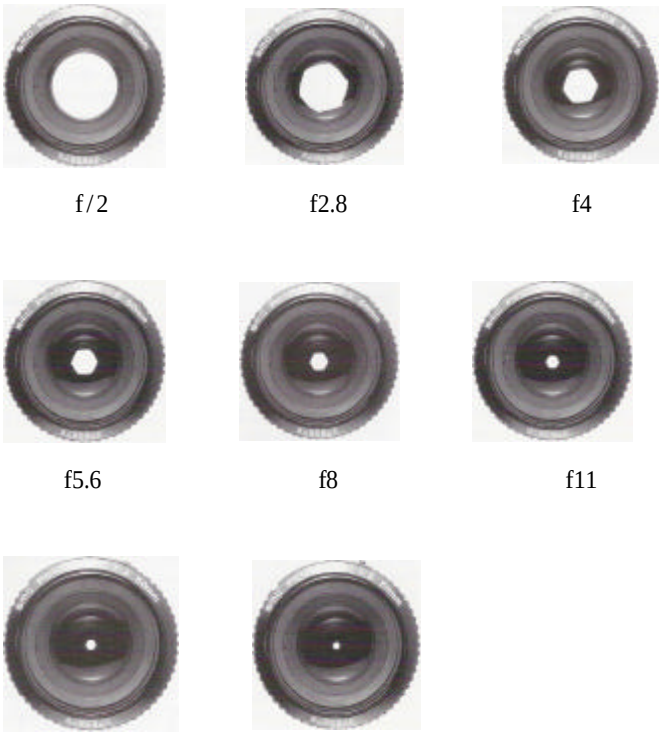


Fig: Different Aperture Openings, Wider opening Less gives less depth of field.

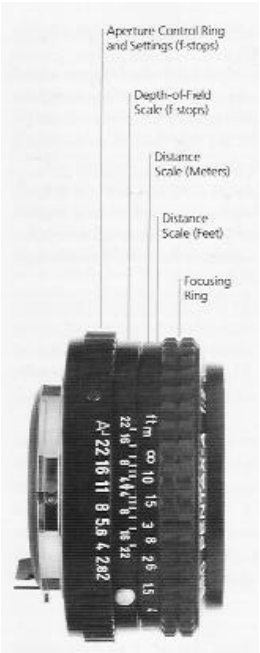


Figure : Lens markings and aperture settings. Lenses for small-format and medium-format cameras have a focusing ring located adjacent to a distance scale. When the lens is focused on an object, the distance between the two will appear opposite the diamond marker on the depth-of-field scale. The depth of field can be estimated by reading the distances on either side of the

marker opposite the aperture chosen. The aperture control ring is coupled to an adjustable diaphragm that halves the effective surface area of the lens (thereby also halving the amount of light passing through it) each time the aperture is decreased by one stop. When the aperture is increased by one stop, the amount of light reaching the film is doubled. Pictured here are apertures with corresponding f/stops.

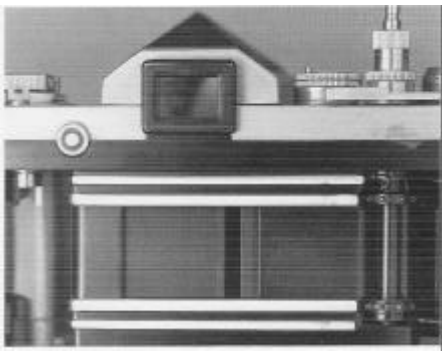
A

B

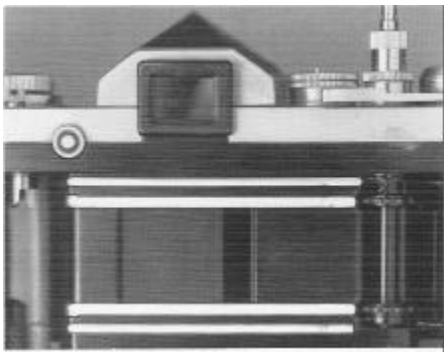
C

D

Figure : Leaf-shutter. Figures A, B, C, D show the opening sequence of a leaf shutter. The blades open and close quickly. (It is impossible to construct a “perfect” shutter - that is, one that opens and closes instantaneously.)



A



B

Figure 2.2: Focal-plane shutter. **(A)** The slit shown here travels very fast across the film from right to left, producing an exposure of 1/500 second. **(B)** This wider curtain slit corresponds to an exposure of 1/250 second. At exposures of 1/60 second or longer, the first curtain fully uncovers the film before the second begins moving to terminate the exposure. The object of any good focal-plane shutter is to ensure consistent speed and equal illumination over the entire area of the film.

For 35mm and a few medium-format cameras, a *focal-plane shutter (fig2.2)* is used. The focal-plane shutter consists of a curtain with a gap whose width can be varied. It is located in the camera body, not in the lens. The curtain travels across the front of the film during exposure; its rate of travel and the size of the gap determine the exposure time of the film. With focal-plane shutters, then, shutter speeds are independent of the lens that is attached to the camera. One advantage of this is that it allows lenses to be built without internal shutters, thereby greatly reducing their cost; a disadvantage is that the camera’s use is generally limited to shutter speeds of 1/60 second or slower with an electronic flash.

LESSON 4
TYPES OF CAMERA

35mm Cameras

A small camera does not imply low cost; a good *small camera is necessarily expensive, and a good enlarger (also expensive) is essential for fine results. Equipment in the small-camera field* must *be of high quality, otherwise results will be disappointing.*

Facility of operation of the camera comes only with practice; manipulation of the camera in the dark or with the eyes closed will be helpful in giving the "feel" of the instrument at different settings. Even if these adjustments are roughly approximate, they save time. Such familiarity with the instrument will assure rapid basic operation and assist in capturing the fleeting scene before us.

Technical advances in photography over the past fifty years have made 35mm cameras the most popular and versatile cameras ever. The array of equipment and films available for the 35mm format is unrivaled in any other system. The incorporation of computer technology, coupled with recent advances in black and-white and color film formulations, has resulted in cameras that are highly sophisticated and capable of producing images of consistently superb quality.

When you consider purchasing a 35mm camera, it is wise to choose a body and lens that are part of an entire camera system. Leica, Nikon, Canon, Pentax, Contax, and Minolta, for example, all produce professional-quality equipment that has stood the test of time and the marketplace. Each manufacturer offers a variety of lenses, filters, lens shades, motor drives, electronic flash units, and other accessories that are completely compatible with its camera bodies. If you acquire a camera body that is part of a system, all accessories will fit properly, and the camera ought to perform according to its specifications.

Fig Leica M6

35mm Rangefinder Cameras

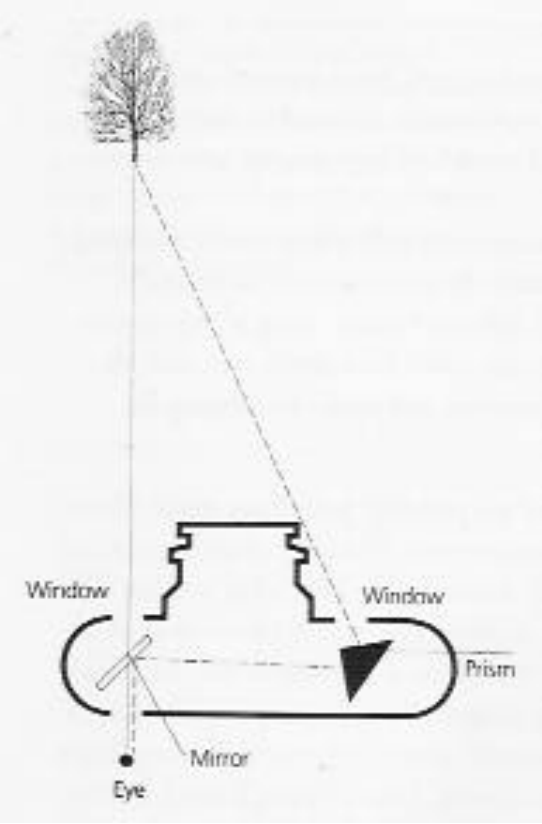


Figure : Rangefinder optical system. The viewfinder image, seen through the window at the left end of the camera, includes a small-superimposed rangefinder area controlled by the prism at the right. The prism is coupled with the lens focus setting and rotates in such a way that the image it forms comes into alignment with the primary viewing image when the focus is correct. The greater the distance between the rangefinder windows (sometimes referred to as the rangefinder base length), the more accurate the system is likely to be.

LeicaM6 Leica "invented" 35mm still photography with the introduction of the Leica 1 in 1925. From the beginning, the Leica sought to marry simplicity of design and operation and the finest mechanical and optical quality that was technically possible. The Leica M6 continues the Leica tradition of 35mm cameras that are unsurpassed in terms of image quality.

All 35mm cameras are classified according to which system is used to view the image being photographed. *Rangefinder cameras* have a "window" built into the camera body, which contains a framed area that approximates what the lens sees.

Leica has resisted the temptation to integrate the latest electronic controls into the design of its cameras, opting instead to maximize optical performance and mechanical operation. Its only concession to automation is the incorporation of a through-the-Lens light-metering system in the camera body.

Focusing and Framing the Image The viewfinder of the Leica M6 is a window built into the top of the camera. Bright lines corresponding to the image areas covered by 28mm, 35mm, 50 mm, 75mm, 90mm, and 135mm lenses appear in the window when the respective lenses are attached to the camera. In the center of the window is a small rectangle, part of the mechanical rangefinder used to determine proper focus. To focus, you rotate the lens collar until the image in the center of the screen is superimposed on the larger image in the window.

Focusing with the rangefinder on the Leica M6 is quick and precise, and Leica has designed the viewing frame so that parallax errors are minimal. *(Parallax* is the term used to describe the fact that the image seen through the viewfinder is not exactly the same as the image that is being photographed, because the viewing and taking lenses are in different locations; see figure 2.2.) For an example of parallax, look at an object about two feet away from you. Without moving your head, cover first one eye and then the other. The position of the object relative to the distant background will be quite different in the two instances.

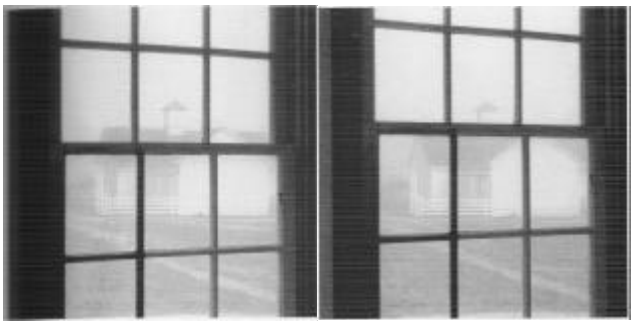


Fig 2.2: Parallax. (A) The image seen through the viewing lens (B) The same scene as photographed by the picture-making lens.

Rangefinder cameras have at least two advantages over single lens reflex cameras: first, for wide-angle lenses, focusing tends to be more accurate with a rangefinder; second, the image in the rangefinder's viewing window is much brighter than what you see with an SLR. This is an important consideration for photography in low-light situations.

One drawback of rangefinder cameras is that since you do not see the image through the camera's lens, you cannot visually judge the depth of field. Markings on the lens will tell you what the range of acceptably sharp focus is for any lens setting, and with a 1ittle experience you will develop a feel for the effects of the various settings, but cameras in which you look through the lens to compose and focus the image have a decided advantage here.

Exposure Determination The two small light-emitting diodes (LED's) in the viewing window of the Leica M6 are connected to a light meter built into the camera. To activate the meter, you touch the shutter-release button; then you adjust either the lens aperture or the shutter speed as needed. When both LED's light up, the aperture/shutter speed settings correspond to a normally "correct" exposure.

A

B

View through a rangefinder Camera. When the two superimposed are aligned, as in figure B, the focus is correct.

Other Leica M6 Features Without a lens, the Leica M6 weighs 1 1/4 pounds, considerably less than the average SLR; it is small enough to fit into a jacket pocket. The fastest shutter speed is 1/1000 second. Full complements of wide-angle and telephoto lenses are available to fit it, as is a motor-drive attachment that allows you to take up to three exposures per second. Leica offers special seminars on the use of its cameras and publishes books and a periodical that are an excellent source of information on the use of Leica equipment.

Overall Considerations In terms of quality and performance, the Leica M6 is in a class of its own. The lenses are superb, and every mechanical aspect of the camera reflects the maker's dedication to craftsmanship. It is one of the simplest and quietest cameras to operate. (Since only the focal-plane shutter curtain moves when the exposure-release button is pressed, the camera is almost noiseless - in contrast to an SLR, whose moving mirror produces a noticeable click.) With care, a Leica will give you a lifetime of good use. The camera and lenses are at the top of the 35mm-camera price range.

Contax G2 Contax has entered the modern 35mm rangefinder field with the introduction of its G-series cameras. The Contax G2 is a highly sophisticated camera that features superb-quality interchangeable Carl Zeiss lenses and can be operated in either an automatic or manual mode. The handsome camera body is made of die-cast aluminum covered with a titanium outer body and its design and features reflect the extensive experience of Contax in the 35mm field. The camera integrates very sophisticated electronic features into its operating system. The electronically controlled shutter sets exposures that can range from 1/6,000 up to 16 seconds. A photo diode provides centerweighted light readings at whatever aperture the lens is set. You can specify exposure compensation of +/ - 2 steps to

accommodate unusual lighting situations. Flash synchronization up to 1/200 second is an attractive feature. Through the Lens direct flash control automates the use of the flash unit and ensures correct exposures.

The viewfinder is a zoom telescope, and the frame area changes automatically as the focal length of the lens and focusing distance are changed. As you look through the viewfinder, an LCD displays the shutter speed, an exposure warning if there is insufficient light, flash-ready and exposure-OK symbols, and a distance scale with the autofocus readout or measured focus indications. A motor drive is available for the camera that enables you to expose lip to four frames per second. A three-frame auto bracketing option that can be set in full- or half-step variations is an interesting feature. The camera also has multiple exposure capabilities, a built-in self-timer and auto film loading.

Contax G2. By integrating modern electronic features into a 35mm camera in the rangefinder format, Contax created a niche between the Leica and modern SLRs. The camera has a rugged titanium-clad aluminum body and offers auto focusing, automatic exposure control, shutter speeds up to 1/6,000 second, and a series of superb Zeiss lenses spanning focal lengths from 16mm to 90mm.

Zeiss lenses that are available for the Contax G2 are the 16mm Hologon, the 21 and 28mm Biogon, the 35 and 45mm Planar, and the 90mm Sonnar. The quality and performance of these lenses is excellent and though they are fewer in number than those offered by Leica, they cover the range of focal lengths most likely to be used by photographers. The selling price of the Contax G2 is significantly below that of the Leica M6 and the impressive quality, capabilities, and performance of the camera have made it an “instant classic” well worth considering.

Notes

LESSON 5
TLR, APS & DIGITAL CAMERAS

Twin-Lens Reflex (TLR) Cameras

The twin-lens reflex was for many years a standard of the photographic world. The design, developed by Rollei, became an acceptable press and documentary camera in the years when the 4 x 5 press camera was standard and the 35mm was viewed by many as too small for professional work.

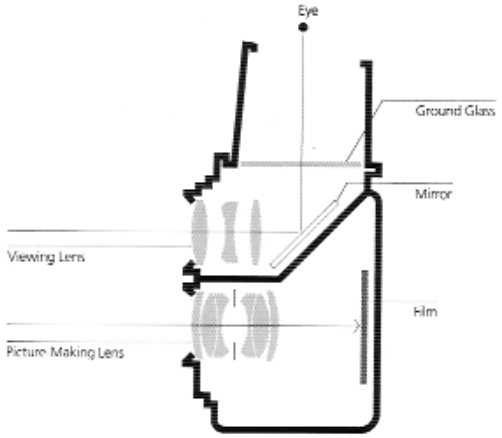
Excellent results are possible with some models of this design, and they often represent the least expensive way for a photographer to begin working in medium-format.

A *twin-lens reflex (TLR) camera* is a modified box camera with a viewing lens mounted above the camera lens. The viewing lens has the same focal length as the picture-making lens and projects an image off a mirror and onto a groundglass screen, enabling you to focus and compose the scene. The image on the screen is reversed from left to right, which is somewhat disconcerting when you first use the camera. Because the viewing lens is located a few inches above the camera lens, a small degree of parallax error is unavoidable. You can correct for parallax by composing the image with the camera mounted on a tripod, then raising the camera by the precise distance between the centers of the two lenses.

Mamiya C330. This venerable twin0lens reflex camera features sturdy construction and interchangeable lenses with excellent optics; 120 and 220 roll films will produce twelve or twenty-four 2 ¼ inch square negatives, respectively. While this and most other twin-lens reflex cameras have been discontinued in favor of single Lens reflex models, they can be found in excellent used condition in many camera stores at modest prices. Because of the fine lens quality and large negative size, the twin lens reflex cameras like the Mamiya, Rolleicord, and Yashica Mat are an excellent choice for both amateur and professional photographers who want to explore possibilities beyond the 35mm.

Most twin-lens reflex cameras do not have interchangeable lenses; there are attachments to modify the normal focal length of the camera to wide-angle or telephoto, but the optical quality will inevitably be compromised. Mamiya, however, makes a TLR camera with interchangeable front panels, which permits you to change both viewing and taking lenses in one simple operation. Lenses are available for this camera in focal lengths ranging from 55mm to 250mm. In addition, Mamiya offers a prism that can be attached to the viewing screen to rectify the image on the ground glass so that what your eye sees corresponds to the actual scene.

A used twin-lens reflex camera may be well worth your consideration, especially if you are looking for a second camera. For years Rollei made a TLR that set the standard in the field for superb optics and durability.



Cross-section of a twin-lens reflex camera. With this design, separate lenses of identical focal length form the viewing and picture-making images. The two lenses are contained in a single focusing mount so that when the viewing lens focuses the subject on the ground glass, the primary lens focuses it on the film plane. The image seen on the ground glass is reversed from left to right because of the mirror. Because the viewing lens is a few inches above the taking lens, parallax is unavoidable.

Parallax. (A) The image seen through the viewing lens of a twin-lens reflex camera (B) The same scene as photographed by the picture-making lens of twin lens reflex camera.

To avoid parallax problems and ensure that the image you photograph is the same one you see through the viewing lens of your twin-lens reflex camera, after composing the image, raise the stage of your tripod by an amount corresponding to the distance between the viewing and picture making lenses.

Advanced Photo System (APS) Cameras

It is significant that the greatest creative photographers use simple basic equipment - everything of adequate quality, nothing that is unessential. If the photographer will first think of the camera in its most elementary terms, he will better understand what equipment is most suitable for his needs. Rather than work from the complex down, it is better to work up from the simple!

George Eastman's genius was recognizing that photography would become a universal pastime only if the entire photographic process could be made as simple as possible. "You push the button, we do the rest" neatly encapsulates his philosophy. The original box cameras produced by Eastman Kodak more than a century ago contained a 100.exposure roll of film. After the film was exposed, the entire camera was sent back to Kodak, where the film was developed, the negatives printed, and the camera reloaded with film and returned to the owner for a modest fee. With the passage of time, picture taking and processing became ever easier.

The technical progress made by the photographic industry is primarily a reflection of the improvement in film technology. With the transition from paper negatives to wet plates, dry plates, and, finally, emulsions coated on flexible films, cameras have decreased in size and increased in sophistication. Advances in lens technology and electronics have introduced an era in which miniature cameras are capable of delivering photographs of outstanding quality. The Advanced Photo System (APS) is a synthesis of the best in current films, cameras, lenses, and computer technology.

APS Film Cartridges

The heart of the APS is the system's film cartridge. The film is contained within a sealed cartridge that is dropped into the camera body. When the film chamber is closed, the film automatically advances to the correct frame for exposure. The size of the negative area for each frame is approximately ¾ x 1 ¼ inches or 2/3 the size of a 35mm image (1 x 1 1/2 inches). However, because of the fine-grain characteristics of the films used, enlargements of up to 8 x 10 inches yield prints of quite comparable quality.

The APS camera allows you to choose from one of three print formats: C-print (classic - 4 x 6 inches); H-print (HDTV format, i.e., full frame for TV screens - 4 x 7 inches); or P-print (panoramic - 4 x 10 inches). A dial on the camera is used to set the image framed in the viewfinder to correspond to the format you select for each exposure. The format can be changed for each exposure. What actually occurs is that each exposure produces a full-frame negative but the camera prints a magnetic strip along the edge of the negative that provides instructions to the film processing-and-printing machine to crop the image according to the specified format (C, H, or P). Options are also available that enable you to record the date and time of the photograph on the front or back of the print and to print photo titles. The prints that are returned from the processor include one or more sheets of index prints that display positives of the pictures you have taken. Enlargements can be ordered in whatever format you choose. If *you* intend to print the negatives in your own darkroom, you can crop the image to *your* liking.

Several manufacturers are producing scanning devices that will produce a digital file directly *from* APS film. The cartridge is inserted into the scanner and the data is automatically transferred to a computer, where the rapidly evolving techniques of digital imaging can be applied. Alternatively, a photo player can be connected to a television set and the images viewed in the same way as a videocassette. A remote control allows *you* to zoom in or pan around the subject, add music or sound, and create an "electronic photo album."

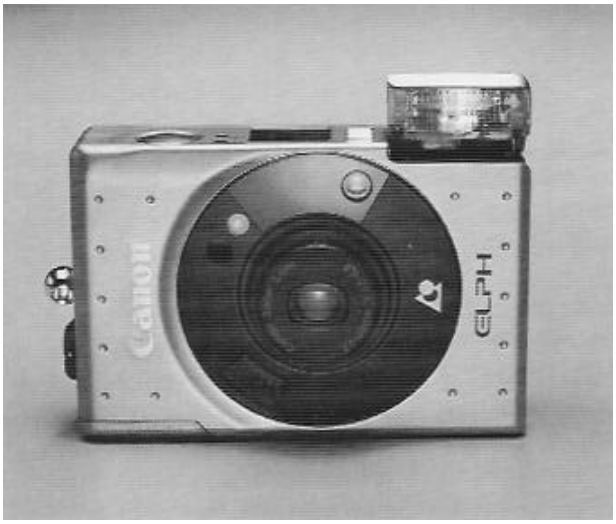
A significant advantage of APS films over 35mm is that film cartridges can be changed in mid-roll, *so* that a single camera can be used to expose color negative, black-and-white, and transparency films simply by rewinding and exchanging film cartridges. When a partially exposed roll of film is reinserted into the camera, it will automatically advance to the correct frame for the next exposure. Also, in the more advanced APS cameras, exposure data recorded on the magnetic strip will override the normal automatic adjustments made by photo-processing equipment and ensure that the print you receive will have the color balance and exposure you planned when *you* took the picture. (Automatic color-processing equipment sets the exposure and color balance *for* each print by averaging all of the colors and light values of each negative and assuming that they equal a middle gray tone. While this assumption is generally valid, most color processors will produce a very poor print if there is a dominant color in the scene or if the lighting is unusual, despite the fact that the negative may be perfectly exposed. To obtain a print that is faithful to the negative the controls on the printer must be overridden manually.)

APS Camera Systems

APS cameras generally look like small versions of 35mm point-and-shoot or single-lens reflex cameras. They are highly automated, have a built-in flash unit, and are usually fitted with a zoom lens. The choices of cameras and features are rapidly expanding and all major manufacturers of cameras now offer one or more APS models.

The Canon Elph is a superb example of a rangefinder APS camera and features a high-quality zoom lens (24—48mm f/4.5-6.2) that produces sharp, contrasty images. The camera has a sophisticated autofocusing system automated exposure that can detect backlighting situations and compensate with fill-in flash or additional exposure. The stainless steel body is extremely sturdy, and the camera is light and small enough to fit comfortably in the palm of your hand, shirt pocket, or purse. It is an ideal "snapshot" camera, well suited for taking travel photographs and pictures that you would like to put in a fine photo album.

The view through the finder shows the image with the edges of the selected format masked in black. As you rotate the switch that controls the format selection, the shape of the mask changes to reflect the new selection. The controls for the zoom lens are very responsive to a touch of the thumb and make arriving at tightly framed images easy. With small film formats, where substantial degrees of enlargement are the norm, it is critical to waste as little of the available image area as possible.



Canon Elph. An amazing number of features - autoexposure control, autofocusing, a high-quality zoom lens, built-in flash, format selection (classic, HDTV format, or panoramic), date and message imprinting, film cassettes that can be changed mid-roll- are housed in an attractive, sturdy metal body. All of these features are hallmarks of this delightful, high-performance APS camera.

The Canon EO5 IX, Nikon Pronea 6i, and Minolta Vectis S-1 are examples of single lens reflex cameras that utilize AP5 technology. All of these cameras feature the advantages of through-the-Lens viewing and interchangeable lenses. With the Nikon and Canon AP5 cameras, most of the lenses that are used on recent models of their 35mm camera systems can be used on their APS camera bodies. For the Minolta Vectis S-1 two standard zoom lenses (28- 56mm and 22-80mm) and two telephoto zoom lenses (56-170mm and 80-240mm) are available, along with a macro lens designed for close-up photography. All three of these cameras have extremely sophisticated electronics built into the bodies and require careful study of the operating manual. They have been designed for use by advanced amateurs and professionals and are definitely not in the simple point-and-shoot category. These camera systems merit serious consideration as alternatives or supplements to a 35mm camera *if* the features and limitations of a small, flexible camera system complement your photographic objectives.

Digital Cameras

Photographic films and paper respond to the impact of light (photons) on crystals of silver halides, and after chemical development a visible image appears. If the film in a camera is replaced with a light-sensitive chip (usually referred to as a *charge-coupled device (CCD)),* the light striking the chip is sensed and recorded electronically. For storage purposes the surface of the chip is divided into a very fine grid of pixels (a contraction of *picture elements),* so that the CCD resembles a sheet of graph paper with very fine divisions. A computer notes the *x* (horizontal) and *y* (vertical) coordinates for each pixel and records the color and intensity of the light rays that strike it analogously to the way that the silver particles record the action of light on film. The information is stored electronically in a file.

Prom the photographer's perspective, the major distinction between the two recording media - film versus digital- is the degree of resolution that each medium can deliver. The ability of film to record detail is orders of magnitude greater than the capability of current digital camera systems because the practical size of the grid into which the electronic data from a CCD can be collected and stored is currently limited. While this gap will continue to narrow, it is highly unlikely the resolution that can be achieved with a digital camera will approach that of film in the foreseeable future. Despite the shortcomings of the current crop of digital cameras, however, they offer advantages that make them worth considering for certain applications.

The least sophisticated digital cameras now sell for less than $500 (1999) but are little more than modern equivalents of "box cameras." Most of these cameras capture images in the resolution range of 480 x 640 pixels. The pictures from these cameras are suitable for display as windows on a computer web site or on a TV monitor, but any attempt to display or print the image in a large size (greater than 4 x 6 inches) will be disappointing.

Digital cameras selling in the range of$500 to $1,000 (1999) offer more features and higher resolution. The Kodak DC-210 looks and handles like a 35mm point-and-shoot camera and delivers a resolution of 864 x 1,152 pixels, which provides sufficient detail to enable you to make a good-quality 4 x 6-inch dye-sublimation print or a 3 x 4-inch photo-quality ink-jet print. A 1.8-inch LCD (liquid crystal display) panel on the back of the camera displays a full-color image of the picture for 10 seconds after each exposure, and you have the option of either saving or deleting the image from a temporary storage file. This "instant editing" feature enables you to save only those pictures that live up to your expectations - if someone blinks at the moment of exposure, erase the shot and try again. Images are stored on a removable 4MB (megabyte) Compact Flash removable memory card (Kodak picture card) that enables you to store from 13 to 31 images in high-resolution mode or 28 to 59 images in low-

resolution mode (640 x 480 pixels) - the number depends upon the data-compression mode you choose for image storage. The camera has an autofocus zoom lens with excellent optics equivalent to a 29 to 58mm zoom on a 35mm camera.

With all digital cameras you will need a computer system equipped with suitable hardware (a color printer and a CD-ROM drive) and software to make optimal use of the camera and its capabilities. A cable is provided to enable you to download digital data directly into your computer, and the software that is bundled with the camera includes Kodak's Picture Easy Software 3.0, Adobe PhotoDeluxe, Adobe PageMill, Windows 98 mounter, and Twain driver for a Pc. Macintosh computer users will need to purchase a special connection kit. All of this equipment is easy to use if you are computer literate and are willing to spend some time learning a new approach to photography. A digital camera is not a simple alternative to traditional point -and-shoot 35 mm or APS cameras.

If you are looking for a digital-camera that will deliver good-quality images capable of modest (by film standards) enlargement, you can expect to pay in the range of$10,000 to $25,000 (1999) for the basic Camera. Photojournalists in circumstances have used cameras such as the Kodak DCS-460, where timely transmission of a photograph to a newsroom via a telephone modem is urgent. It is probable that digital cameras will play an increasingly important role in the field of reportage.

Kodak also makes a digital camera back (the Kodak DCS-465) for a medium-format camera that can be used with a Hasselblad 500CM or Mamiya RZ67. The back will deliver a resolution of up to 2,036 x 3,060 pixels, which is sufficient to make a good-quality 8 x 10 print. The digital-images can be stored as they are taken on PC-Type III hard-disk cards (170MB capacity), and a single card can accommodate up to twenty-six high-resolution images. All of the normally operative camera lenses and accessories can be used with the digital back. The ability to display the image immediately on a video monitor, edit it with computer software, and download the file directly to a print shop has proven to be useful for catalog production and other advertising applications. Digital backs for larger-format cameras are also available.

Notes

LESSON 6
SINGLE-LENS REFLEX CAMERAS

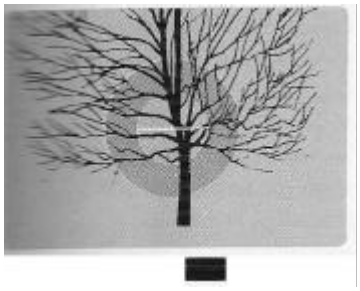
SLR Camera

Single-lens reflex (SLR) cameras now dominate the 35mm-camera market . The viewing system is designed to let you look through the lens of the camera so that the image you see corresponds to the image that will appear on the film. This is made possible by a mirror placed behind the lens, which reflects the image onto a focusing screen at the top of the camera. When the shutter-release button is depressed, the mirror swings out of the way and the shutter opens to expose the film. The mirror then immediately returns to its original position.

To make the image as bright as possible, the lens diaphragm is automatically on the wide-open setting for focusing and framing. At the instant of exposure, the diaphragm closes gown to the programmed aperture and the exposure is made.

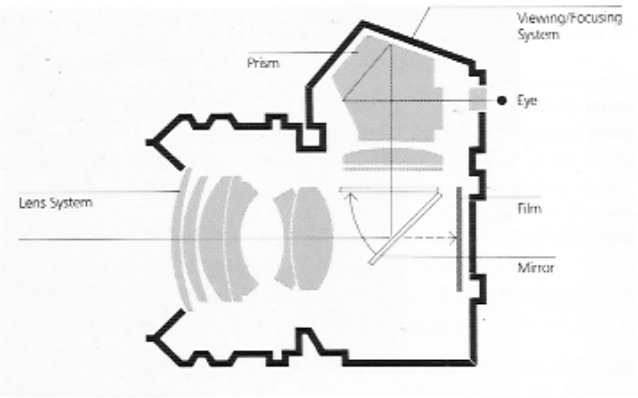
Some cameras have depth-of-field preview buttons that let you see what the scene will look like at the programmed aperture. The darkened image that: appears when you depress the button corresponds to what the camera will' actually photograph. This feature is particularly useful in situations where the depth of field is very limited (in close-up photography of flowers or insects for example).

A



B

View through a single-lens Reflex camera. The viewing field shows exactly the same image that will be photographed when the shutter-release - is pressed. The split-image circle at the center of the field functions like the superimposed image of a rangefinder: when the focus is correct, a straight line passing through the viewing field will be unbroken as in figure B).



Single-lens reflex optical system. The mirror located in front of the film, deflects 1ight entering through the lens upwards to a focusing screen. This image is then reflected through a prism to the eye for viewing. When the shutter-release button is pressed, the mirror swings up against the viewing screen and light passes to the film for exposure, which is controlled by a shutter located just in front of the film plane.

Camera Components

Inside the Camera

When you look in the viewfinder of an SLR camera, you are actually seeing through the lens. The diagram below shows how an image is transported through the lens to both your eye and film. If you follow the line you will see that as the light rays collected by the lens enters the camera body, they are reflected upward by an angled mirror into a prism housing on the top of the camera. Due to the characteristics of lenses the image is turned upside down and reversed on passing through the lens. The mirror turns the image right side up, and the prism turns it around and reflects it into the eyepiece. By the time it reaches your eye, the scene looks like the one you see without the camera, which will then appear in the final photograph.

Other than to compose your picture the other purpose for looking through the viewfinder is so you can accurately focus your image. To help you do this a focusing screen is placed just under the penta prism and above the mirror. It is actually the focusing screen you are looking at when you are focusing the camera. For the system to work the focusing screen is the same distance from the lens as film plane, so if the image appears sharp on the focusing screen it will be sharp on the film plane. In the center of the focusing screen there are two devices that appear as circles, one within the other, to help you accurately focus the image. The center one is made from two small

triangles of glass, this is used when your subject has some sort of line in it, such as a tree branch. If the camera is correctly focused, any line that passes through this area will appear unbroken, if on the other hand the image is not focused, the line will appear disjointed as shown in the diagram. The outer circle is called the micro prism and is formed from thousands of pyramids of raised glass, the micro prism is used where there are no lines in the picture. If the subject is correctly focused the micro prism will appear clear, if incorrectly focused the image will appear as a blur through the micro prism. With the advent of auto focus lenses these aids have mostly been replaced with a small square in the center of the viewfinder to indicate what part of the image the lens is using to calculate the focusing distance.

When you press the shutter button to take a picture, the angled mirror flips upward to permit light to pass to the back of the camera, where the film is. Simultaneously, the shutter, a pair of curtains just in front of the film, opens to let the light hit the film. The shutter remains open for a precise amount of time, which is determined when you set the shutter speed. As soon as the shutter closes, the mirror drops back to its normal viewing position. Because the mirror rises to allow the image to pass through to the shutter and then to the film, the viewfinder goes black momentarily when you take a shot.

Most modern SLR's have a built in exposure meter. One or more photocells located in the light path measure the intensity of the light reflected by the subject and admitted by the camera. On an automatic camera, the shutter speed or lens aperture, or both, are set automatically, according to this measurement. On a manual camera, or automatic camera in manual mode, you set the shutter and aperture by hand to achieve the proper exposure. Correct combinations of the two are indicated in the viewfinder by a matching needle, light-emitting diode (LED) or liquid crystal display (LCD). On an automatic camera, the aperture or shutter speed or a combination of the two chosen by the camera will usually be displayed in the viewfinder. Refer to your instruction manual for an explanation of your camera's viewfinder display.

Outside the Camera

The exteriors of most 35mm cameras have an almost bewildering array of dials, levers, rings, and other controls. But they are all easy to use once you understand their function. Two basic controls, the focusing and aperture rings are on the lens; the aperture will be looked at more closely in Depth of Field. The other basic control, the shutter speed, allows you to choose the amount of time the shutter will remain open. On a SLR the shutter speed dial is usually a small cylindrical control on the top of the camera, to the side of the prism. Some newer models have buttons that change the shutter speed, an LCD display usually indicates the chosen speed, on certain older models, a ring on the lens barrel itself may control shutter speeds. The shutter speed function will be looked at more closely in the Shutter speeds section. You activate the shutter by pressing the familiar shutter release button. It is located on the top of the camera, where you can press it easily with your right index finger. Most shutter release buttons are threaded to accept cable releases, an accessory that enables you to trigger the shutter without touching or jiggling the camera, often at a distance, refer to the section on Camera accessories. With many of the newer cameras on the market, the cable release plugs into the side of the camera and is activated electronically. Many cameras also have a self-timer lever, which delays the exposure for 8 to 10 seconds for you to include yourself in the photograph, once again it, with many modern cameras this function is set electronically on the camera.

Most SLRs have a device called the film advance lever, located on the right side of the top of the camera. When you move the lever, an unexposed frame of film moves forward out of the cartridge, into position for the next picture. Many newer SLRs and compact cameras now have internal motors that automatically advance the film when you take a photograph. In either case, advancing the film changes the film counter, which is adjacent to the lever or shutter button or displayed on a central LCD panel and indicates how many pictures have been exposed on the roll. On the left side of the camera top is the rewind knob, used for winding the film back into the cartridge. This is also automatically done on many cameras. Before this knob will work, you must disengage the film advance mechanism, in most cases with a small rewind release button on the bottom of the camera. When you have rewound the film, the same knob is usually pulled up to open the back of the camera so that you can remove the film.

Most modern cameras also have several controls for their built in exposure meters. One is simply a switch for turning the meter, and the camera itself, on and off and is usually on the top of the camera. Another lets you adjust the meter for the sensitivity, or speed, of your film. On most SLR cameras this film speed dial is located around the rewind knob. You should set this dial according to the ISO number of the film you are using. With the event of DX coding on film canisters, which allows sensors on modern cameras to identify the ISO of a film automatically, manual setting of ISO is becoming less common. On many cameras the dial also has an exposure compensation feature built into it (marked 0, +1, -1 etc.), often engaged with a small release button that allows you to override the automatic exposure system or bracket your exposures. Finally, the meter of an automatic camera may be affected by an exposure mode selector switch, which allows you to choose automatic and manual exposure modes and is frequently integrated into the shutter speed dial. On a few recently released cameras very specific exposure parameters can be programmed into the camera, via cards you insert into the side of the camera, the cards contain programs for the specific needs of sport, portraiture, wildlife photography etc.

There are two ways to connect an electronic flash unit to a camera, both of which establish electrical contact, synchronizing the flash with the shutter. One is the hot shoe outlet, almost always located on top of the prism. On most SLR's you can also plug you flash into an outlet on the front of the camera called the X sync. Also found on the front of many SLR's is a depth of field preview button or lever that allows you to view the scene through the aperture you have selected to examine the zone of sharpness it will provide in the scene, and a lens release

button that permits you to unlock and remove the camera's lens.

Although there are fewer elements on the back and bottom of a 35mm camera than on the front and top, it's just as important to understand their functions. The most significant feature on the back is the viewfinder eyepiece, through which you compose and focus your picture. On nearly all SLR's, the viewfinder is located behind the prism in the center. On most range finders, the viewing window is found more towards the left. If you wear glasses and have trouble seeing through the viewfinder with them on, you may wish to investigate the possibility of getting a corrective lens for your camera's eyepiece. Rubber eyecups are also available to prevent the camera from scratching your glasses.

On the bottom of the SLR three main components are found, the small button for disengaging the rewind button as discussed before, tripod mounting socket and the compartment for placing the batteries in. The battery compartment lid can be usually unscrewed with a coin. You should replace the battery once a year to avoid corrosion.

Shutter Speeds

The shutter is a mechanical means of controlling the amount of time light is allowed to pass through the lens to the film. The period of time is known as the shutter speed. Shutter speeds are calibrated in seconds and fractions of seconds i.e. 1/2 1/4 1/15 1/30 1/125 1/250 1/500 each shutter speed is doubling or halving the previous one and has a direct relationship with the aperture.

The first basic skill in using the shutter is being able to judge the slowest shutter speed that will do the job. In most situations that depends on how active the subject is, but at the slower shutter speeds the camera sets the limit.

Most photographers tend to think in only three dimensions. We see the subject in front of us, we look at the surroundings, we check out the background to see what sort of depth of field we need, or weather we should consider changing camera position to make it less obtrusive But this, three - dimensional view of the world is not complete. TIME, the fourth dimension, also plays a crucial role in photography. Careful consideration should always be given to the use of appropriate shutter speed for each photographic situation as your choice of shutter speed can have a dramatic effect on how your final photograph appears.

Fast shutter speeds can be employed to stop subject movement; a good example is sport photography. For most sports a minimum shutter speed of 1/250th is needed to effectively stop all movement. Another requirement of sport photography is the need to fill the camera's frame from a distance, which means using a lens of around 300mm focal length or more. Due to the magnification of long lenses such as the 300mm lens any camera movement is greatly enhanced so once again a fast shutter speed would be required to stop any blurring caused by the camera. A rule of thumb for selecting the appropriate shutter speed to stop lens movement is to turn the lens focal length into a shutter speed, so a 300mm lens would require a shutter speed of 1/300th of a second or faster to avoid vibration.

With very fast moving subjects such as cars another problem you will encounter is shutter release time lag. There is a delay of 40-60 milliseconds between depressing the button and the shutter opening, to allow for the diaphragm to close and the mirror to swing up. It doesn't sound long, but a car moving at 100km/h, for example will have covered almost 2 meters in this time. If you plan on shooting a lot of motor sport practice will allow you to obtain pin sharp pictures.

Much also depends on how the subject is moving, relative to you. If it is coming towards you, a comparatively slow speed of 1/125 may freeze the action. If it is traveling across your line of sight, a faster shutter speed may be needed to avoid blur. Another alternative is to pan your shot, panning, or moving the camera with the subject to keep it sharp and blur the background, creates a real sense of movement. To pan, select a shutter speed of 1/15 to 1/60s. Hold the camera firmly against your face and focus the lens on the point where you expect the subject to pass. Start moving the camera before you trip the shutter and continue the movement after the exposure is over.

Not all pictures are best taken at high shutter speeds, using slower shutter speeds you can create all sorts of special effects. Streets and highways at night are popular subjects .The moving lights of cars draw streaks across the frame. Shutter speeds of 4 to 10 seconds are ideal for this situation. Don't worry if you have an older camera as most were made with a "B" setting, at which the shutter will be opened as long as the shutter button is depressed. Flowing water is a subject that which is greatly influenced by shutter speed. At 1/1000s, you can freeze every droplet of water in a waterfall whereas at 1sec only streaks of white are visible. It really depends on what sought of effect you want to achieve. On other occasions, such as taking a portrait, the choice of shutter speed is not as critical as your choice of aperture, so a medium speed such as 1/30th or 1/60th of a second will be adequate to avoid any movement in your subject.

The Focal Plane Shutter

There have been many shutter designs through history but the common design for SLR cameras is the focal plane shutter. This type of shutter is positioned as close as possible to the focal plane. In it's simplest form it consists of an opaque blind with a slit, which makes the exposure as it is driven past the film. Exposure duration is controlled by the adjustment of the slit width and blind speed or both. Modern focal plane shutters have two blinds, one with an opening in it which, when the shutter is fired moves to a position allowing light to strike the film and another which, at the end of the exposure time, moves across the opening to stop the light striking the film.

Advantages of the Focal Plane Shutter

Focal plane shutter enable very fast shutter speeds to be obtained. Some reaching as high as 1/4000th of a second. Because this type of shutter is positioned at the focal plane within the camera body, a complete range of lenses can be used without shutters.

Disadvantages of the Focal Plane Shutter

Focal plane shutters have many advantages but it is very important to recognize its disadvantages and their effects on photography. It's only at slow shutter speeds that the shutter exposes the entire film surface at the same time. At moderate and fast shutter speeds the second blind has started to close before the first blind has fully opened. This creates problems when using electronic flash because the duration of an electronic flash is extremely short so when the flash fires only the part of the film opened to the light by the slit of the shutter will be exposed. Modern high quality 35mm cameras will allow speeds as high as 1/250th to be used whilst still exposing the entire frame. The other problem created by focal plane shutters is one of distortion, which is caused by the movement of the image during exposure. Focal plane shutters also tend to be noisy in operation and can be rather bulky. Technology continues to improve in these areas.

Advantages and Limitations of 35mm Cameras

The flexibility and portability of the 35mm camera make it the camera of choice for many photographers. It is ideal for photographing people in action, for doing close-up work (such as shooting wildflowers), and for use in certain aspects of nature photography. Virtually all newspaper photographs and all images in most of the magazines are the product of 35mm cameras.

The variety of film available for 35mm cameras is unrivaled in any other format, and the same can be said for lenses. The cameras themselves can be adapted to other instruments ranging from microscopes to telescopes, and with the appropriate accessories they can be used underwater or in outer space. If one had to use a single word to describe the 35mm camera, it would be *versatile.*

There are two major limitations with 35mm cameras, however - one physical, the other psychological. The physical restriction is the size of the negative produced by the camera: 24 x 36 'mm, or 1 x 11/2 inches. Two factors that influence the quality of a photographic print are the resolution of fine details and the tonality, or how smoothly colors and tones are rendered. Because a 35 mm negative needs to be enlarged substantially to make a print, the resolution and tonality can never be as good as they would be in a print made with a similar film in a larger negative format (assuming that the lens qualities are comparable).

The 35mm camera can also embody a subtle psychological pitfall that photographers need to guard against. Thirty-six exposures, automatic exposure control, automatic flash exposure at low light levels, automatic focusing, motor drives, and other "automatic" features offer enormous photographic potential. It is easy to slip into the habit of taking a picture of anything that catches your eye for a moment and hoping that a few negatives may be interesting enough to print. A state of mind can develop in which chance displaces creativity. At that point the camera controls the creativity of the photographer, rather than the other way around. Awareness and selectivity are critical characteristics of fine photography, and it is essential that "automation" not be allowed to diminish those personal qualities.

One final note of caution: *always check your camera s batteries before you use it, and keep a supply of spares in your camera case!* With most modern, highly automated 35mm cameras, the camera will cease to operate the moment the batteries run down.

35mm Cameras: Summing Up

One often-asked question is, Can you really tell the difference between photographs taken with a good $500 35mm camera and ones shot with a camera that costs $4,000? The answer is probably, though it depends on how careful you are when you use the camera. The optical performance of a lens is a measure of its *resolving power* and *contrast.* Optical performance can be compromised by poor mechanical assembly or by wear or play in the threads of the focusing mechanism built into the barrel of the lens.

Assuming that everything on the two cameras is in working order and that the cameras themselves are secured on tripods to take the photographs, a critical examination of the resulting negatives or slides will probably reveal slight but perceptible differences. For hand-held shots, any differences may be eradicated by the slight motion of the camera when you take the photograph. Is the distinction between the two results important enough to warrant consideration?

The answer is again relative. If your confidence is enhanced by knowing that you are working with the finest optical instrument available, and if you respond to the challenge and opportunity it offers, the answer is yes. Remember, however, that as factors in the quality of the photographs produced, the physical properties of cameras and lenses are less limiting than the photographer's technique and imagination.

Notes

LESSON 7
PHOTOGRAPHIC LENSES

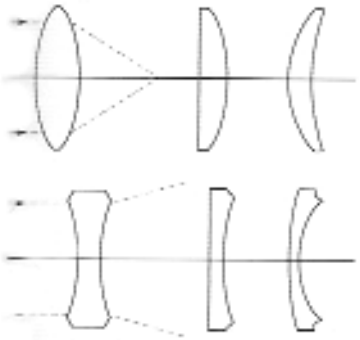
Photographic Lenses

A simple glass lens gives you a much better image than a pinhole. However, its quality is still a long way short of the standard needed for photography. Simple single lenses often distort shapes, create odd colour fringes or give a general 'misty' appearance. Occasionally such results work well as interpretative romantic images, but it is better to have a lens capable of producing utmost image clarity and detail. Then you can add a diffuser to the camera or later manipulate results digitally when you want pictures of the other kind.

The main object of *photographic* lens design and manufacture is to produce lenses which minimize optical defects (known as 'aberrations') while increasing resolution of detail and image brightness. To achieve this a range of special optical glasses is used, each type having different refraction and dispersion properties. So a photographic lens has a 'compound' construction, containing a series of elements of different shapes and made from different glass types to help neutralize aberrations. In fact, a camera lens of normal focal length typically has 5-8 elements (Figure 3.1). Their centering and spacing within the metal lens barrel is critical, and can be upset if the lens is dropped or roughly knocked. But even the number of elements causes problems, as the tiny percentage of light reflected off every glass surface at the point of refraction multiplies as scattered light. If uncorrected, the result would be images that lack contrast and sparkle - like looking through a window with multiple double-glazing. Modem lenses therefore have their elements surface-coated with one or more extremely thin layers of a transparent material, which practically eliminates internal reflections under most conditions. However, light may still flare if you shoot towards a bright light source just outside the picture area and fail to use lenshood

Your camera or enlarging lens is therefore a relatively thick barrel of lens elements, all of them refracting light but together having an overall *converging* effect. Every photographic lens has its focal length (usually in millimeters) clearly engraved around the lens barrel or front-element retaining ring.

Engraving around lenses here shows (top) name of lens; maximum aperture f/5.6 and focal length 180 mm and (bottom) name, f/1.7 maximum aperture, 50 mm focal length.



Single lens elements can be made in a great range of shapes and glass types. The top row here converge light. The bottom row, which are all thinnest in the center, cause light to diverge. Diverging lens elements are combined with (stronger) converging elements in photographic lenses to help counteract optical defects.

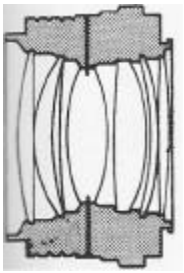


Fig 3.1 *One type of 50 mm lens made as the normal focal length lens for 35 mm camera. It combines seven lens elements, five converging and two diverging light*

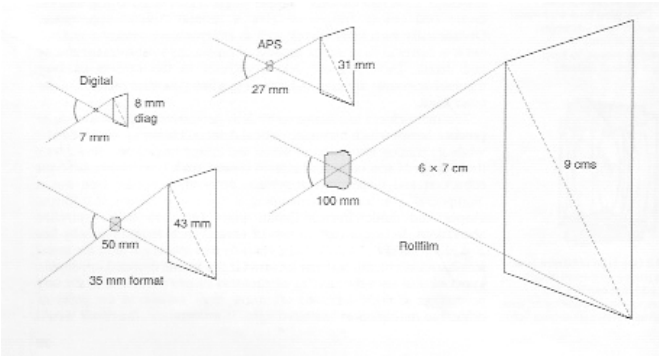


Figure 3.4 Angle of view. All four lenses here give a similar angle of view. They each differ in focal length but are used on different format cameras, maintaining a close ratio of focal length to picture format diagonal. Each combination will therefore include about the same amount of your subject in the picture.

Focal Length and Angle of View

The focal length photographers and manufacturers regard as 'normal' for a camera is approximately equal to the diagonal of the camera's picture format. In other words:

For a 6 x 7in rollfilm camera, a lens of about 80-105 mm would be considered normal.

For a 35 mm (24 x 36 mm) camera, between 35 mm and 50 mm focal length is normal.

For APS (17 x 30) picture size cameras, the normal lens is 25 mm.

And for a digital camera with a tiny 4.8 x 6.4 mm sensor, the lens would only be 6-10 mm focal length.

The shorter the focal length the smaller the *image* the lens produces. But a lens of short focal length used with a small-format camera gives the same *angle of view* as a lens of longer focal length used in a bigger camera. You are just scaling everything up or down. All your combinations above therefore give an angle of view of about 45°, and so each camera set up to photograph the same (distant) subject will include about the same amount of the scene, see Figure 3.2.

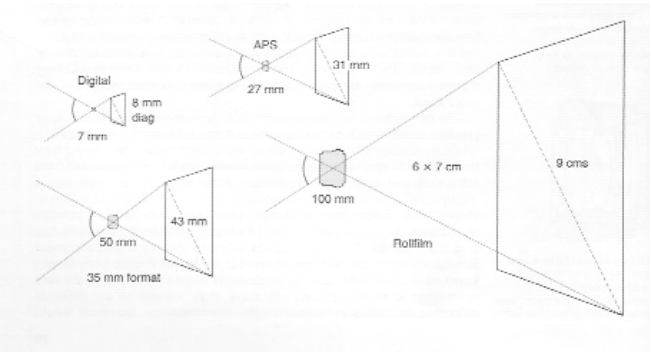
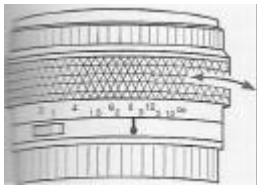


Figure 3.2 Angle of view. All four lenses here give a similar angle of view. They each differ in focal length but are used on different format cameras, maintaining a close ratio of focal length to picture format diagonal. Each combination will therefore include about the same amount of your subject in the picture.

Focusing Movement

Cheap simple cameras have lenses which are so-called 'focus-free'. In practice this means the lens is fixed in position to sharply image subjects about 2.5 m from the camera. The assumption is that this is a typical situation for snapshots, and items slightly nearer or further away will appear reasonably sharp due to depth of field.

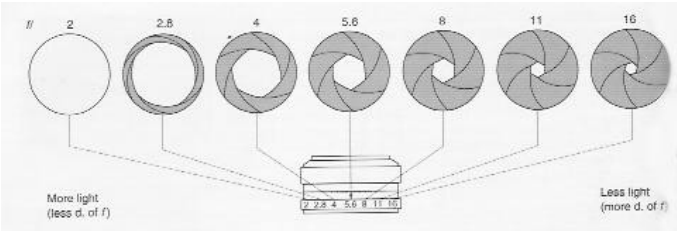
Most lens units include some means of adjusting its position forwards or backwards for focusing subjects closer or more distant respectively. Typically the whole lens shifts smoothly by a centimeter or so within a sleeve (or internal elements alter position). Focus is manually adjusted by rotating the lens barrel, or via a motor under the control of a sensor which detects when the image is sharp. See *autofocusing.* Often point-and-shoot autofocus compact cameras show no distance settings on the lens. Lenses on cameras offering greater control (all single-lens reflexes for example) show a scale of subject distance which moves against a setting mark.



Lens focusing movement: Typical focusing ring on a manually focusing 35 mm single-lens reflex camera.

All lenses can be set to focus for infinity. The closest subject distance offered depends on a number of factors. For example, the lens may not maintain the same high image optical resolution at close distances and mechanically it may be difficult to shift the lens further forward. The longer the focal length the greater the physical movement needed for adjusting focus settings. Again, close-up focusing may be purposely prevented because the lens is part of a camera with separate direct viewfinder. This grows increasingly inaccurate in framing up your picture the closer you work.

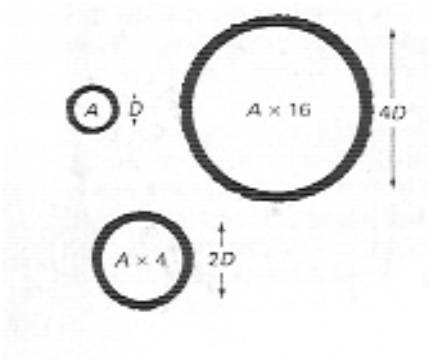
Normal lenses for large-format sheet film cameras need more focusing movement to cover a similar range of subject distances, owing to their longer focal length. The whole front unit of the camera moves independently of the back, the two being joined together by bellows. There is seldom any scale of distances on lens or camera body; you focus by checking the actual image on a ground glass screen at the back of the camera.



Typical f-number sequence (some lenses may open up beyond *f/2,* and stop down beyond *f/16)*

Aperture and f-numbers

Inside most photographic lenses you will see a circular hole or aperture located about midway between front and back elements. Usually a series of overlapping black metal blades called an iris diaphragm allows the size of this aperture to be narrowed continuously from full lens diameter to just the center part of the lens. It is adjusted with a setting ring or lever outside the lens barrel. Most smaller-format cameras control the aperture size automatically, at the moment of exposure. (On single-lens reflex cameras you may not see the aperture actually alter when you turn the ring, unless you first detach the lens from the camera.

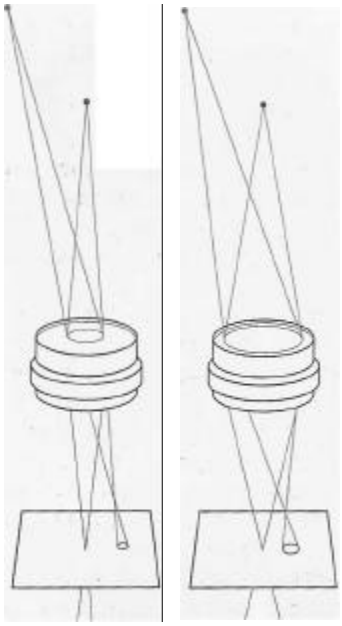


The basis of f-numbers. Each time the diameter (D) of a circle is doubled its area (A) increases four times

A series of relative aperture settings can be felt by 'click' and are shown on a scale of figures known *as f-numbers.* Notice that the *smaller* the relative aperture the *higher* the f-number. They typically run:

***F/2;* 2.8; 4; 5.6; 8; 11; 16; etc.**

The f-numbers follow what is an internationally agreed sequence relating to the brightness of the image. It is like operating a 'light tap' each change to the next highest number halves the amount of light passing' through your lens. And because the aperture is positioned in the lens center it dims or brightens the entire image evenly. The f-number system means that every lens set to the same number and focused on the same (distant) subject gives matching image brightness, irrespective of its focal length or the camera size. You can change lenses or cameras, but as long as you set the same f-number the image brightness remains constant.



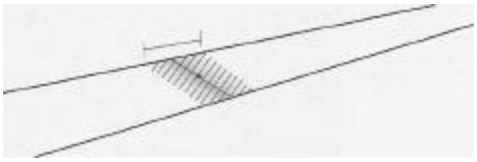
Subjects

Why aperture diameter alters depth of field. Right: When you focus a lens for a close subject it images each detail of a more distant item as an unsharp disc of light. Left: Stopping down to a smaller lens aperture narrows all cones of light. Although still not in critical focus other items begin to look sharp too.

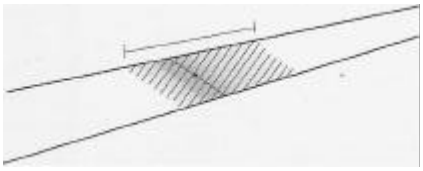
Depth of Field

Your lens aperture is an important control for dimming or brightening images - helping to compensate for bright or dim subject conditions. But it has an even more important effect on visual results whenever you photograph scenes containing a number of items at various distances from the lens. Imagine for example that the shot consists of a head-and-shoulders portrait with a street background behind and some railings in front. If you focus the lens to give a sharp image of the face and take a photograph at widest aperture, both the street and railings will appear unsharp. But if you stop down to, say, f/*16* (giving more exposure time to compensate for the dimmer image) you are likely to find that everything appears in focus from foreground through to background. This changing' zone' of sharp focus, nearer and further than the object distance on which you actually focused, is known as *depth of field.*

Depth of field is the distance between the nearest and furthest parts of a subject that can be imaged with acceptably sharp detail at one focus setting of the lens.



f2.8



f11

The practical effect of d1anging depth of field. The focus setting of the lens remained the same for both shots. (A slower shutter speed was needed for the right hand version to maintain correct exposure)

Widest aperture (smallest f-number) gives least depth of field, while smallest aperture (highest f-number) gives most. There are two other significant effects: (1) depth of field becomes less when you are shooting close-ups and greater when all your subject matter is further away; (2) the longer the focal length of your lens the less depth of field it gives, even with the same aperture and subject distance.

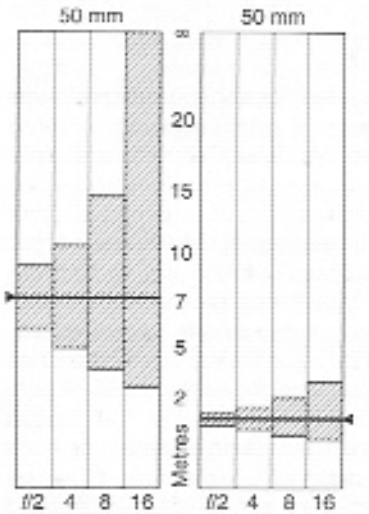
Practical Significance

It is very important to be able to control depth of field and make it work *for* your pictures, not *against* them. By choosing shallow depth of field you can isolate one item from others at different distances. You can create emphasis, and 'suggest' surroundings without also showing them in such detail that they clutter and confuse. Such pictures are said to be 'differentially focused', Figure 3.12. But remember that minimizing depth of field with a wide aperture also means you must be really accurate with your focusing - there is much less latitude for error. You may also have exposure problems if you choose to shoot at wide aperture in bright lighting, or with fast film, or want to create blur effects by means of a slow shutter speed.

On the other hand, by choosing greatest possible depth of field your picture will contain maximum information. It can be argued that this is more like seeing the actual subject, because the *viewer* can decide what to concentrate on, rather than being dictated to by you. For most commercial and record photography, people expect photographs to show detail throughout. Just be careful that you notice (and avoid) any unwanted clutter in the foreground or background. Where possible, check the actual focused. picture with the diaphragm aperture at the same diameter to be used for photography.

Sometimes you cannot produce sufficient depth of field by stopping down (perhaps lighting conditions are so dim or film so slow that an unacceptably long exposure is needed). In such cases take any step which makes the image *smaller*. Either move back or use a shorter focal length lens or smaller-format camera. Later you will have to enlarge the image in printing, but you still gain on depth of field.

Shallow depth of field. Using a wide aperture (f/2) limits detail, concentrates interest on an element at one chosen distance the pollen-covered flower, other flowers are out of focus.



Depth of field at different apertures when a 50 mm lens is focused for 7 meters (left) and for 1.5 meters (right). Depth of field is greatly reduced with close subjects.

How Depth of Field Works

To understand why depth of field changes you need to remember how a lens critically focuses an image point at one distance only, depending on how far the lens is from the

subject. In this position light from other parts of the subject nearer or farther from the lens comes to focus farther away or nearer, forming discs instead of points of light. They are known as *circles of confusion.* Large circles of confusion, overlapping (Figure 2.3) give the image an extremely unsharp appearance.

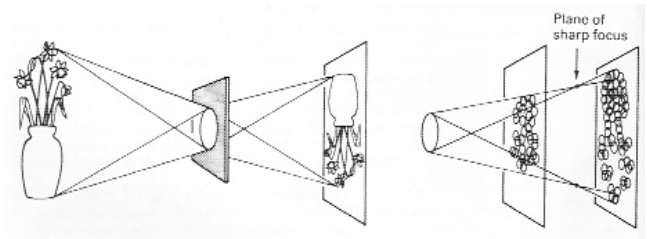


Figure 2.3 A converging lens bends diverging beams of light to a point of focus. However, if the lens-to-screen distance is incorrect, either too near or too far as shown right, images again consist of fuzzy 'circles of confusion'.

Since your eyes have limited resolving power, when viewing a final print or slide you rate an image acceptably sharp even when tiny discs are present instead of dots. The upper limit to what most people accept as sharp is taken to be 0.25 mm diameter on the final print. (The same applies to the dot pitch on a computer screen.) Lens manufacturers for 35 mm format cameras assume that if 25 x 20 cm (10 x 8 in) enlargements are made (film image magnified x 8) to this standard then the largest acceptable circle of confusion *on film* is 0.25/ 8 = 0.03 mm.

By accepting discs up to this size as sharp, subjects slightly nearer and farther away than the subject actually in focus start to look in focus too. And if the lens aperture is made smaller all the cones of light become narrower, so that images of subjects even nearer and farther are brought into the zone of acceptable sharp focus. Depth of field has increased.

Again if you move farther back from the subject or change to a shorter focal length lens, the positions of sharp focus for images of nearest and farthest subject parts bunch closer together. Their circles of confusion become smaller, again improving depth of field.

So remember that you produce greatest depth of field when:

- f-number is high (the lens is stopped down);
- subject is distant;
- focal length is short;
- you can accept relatively large circles of confusion (big enlargements won't be needed).

With subjects beyond about ten focal lengths from the lens, depth of field extends farther behind the subject than towards the lens. Hence the photographer's maxim 'focus one-third in', meaning focus on part of the scene one-third inside the depth of field required. With close-up work, however, depth of field extends more equally before and behind the focused subject distance.

Maximum depth of field. This scene has important elements at several different distances and was shot at f/16 to produce sharp detail throughout

Using Depth of Field Scales on Lenses

You may find that your camera lens carries a depth of field scale, next to its scale of subject distances. The scale gives you a rough guide to the limits of depth of field and is useful if you are 'zone focusing' - presetting distance when there is no time to judge focus and depth of field visually. Scales also show how you can gain bonus depth of field in shooting distant scenes. For example, if it is focused on infinity (losing half your depth of field 'over the horizon'), read off the nearest subject distance sharp. This is called the 'hyperfocal distance' for the f-number you are using. Change your focus to this setting and depth of field will extend from half the distance through to the horizon.

Depth of field is also exploited in some cheap cameras with simple symbols for setting lens focus. Typically a silhouette of mountains sets the lens to its hyperfocal distance; a 'group .of people' symbol means 3.5 meters; while a 'single head' is 2 meters. Provided the lens has a small working aperture, these zones overlap in depth of field. So users stand a good chance of getting in-focus pictures as long as they make the correct choice of symbol.

Remember that depth of field limits don't occur as abruptly as the figures suggest - sharpness deteriorates gradually. Much depends too on what *you* regard as a permissible 'circle of confusion'. If you intend I to make big enlargements, your standard of sharpness on film must be higher, and this automatically means less depth of field. Even if your camera allows you to observe depth of field effects on a focusing screen you should work well within the limits of what *looks* sharp, or you may be disappointed with the final print.

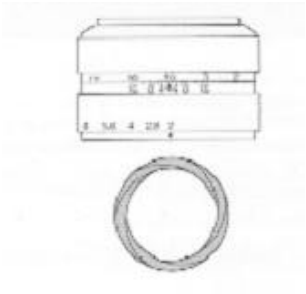


figure : Using zone focusing. The lens above has a depth of field scale located between focusing and f-number scales. To zone focus; first visually focus the nearest object you want sharp noting the marked distance. Then do the same for the most distant part . Using the depth of field scale, set the lens for a distance which places both near and far parts within the zone of sharp focus at a small aperture. Here f/16 is needed . Remember to set a slower shutter speed to maintain the same exposure

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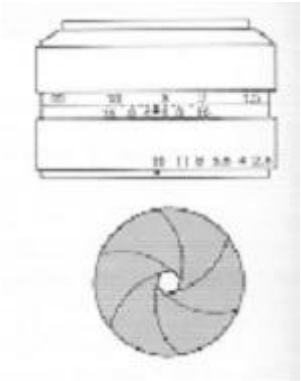


figure : Using zone focusing. The lens above has a depth of field scale located between focusing and f-number scales. To zone focus; first visually focus the nearest object you want sharp noting the marked distance. Then do the same for the most distant part. Using the depth of field scale, set the lens for a distance which places both near and far parts within the zone of sharp focus at a small aperture. Here f/16 is needed . Remember to set a slower shutter speed to maintain the same exposure

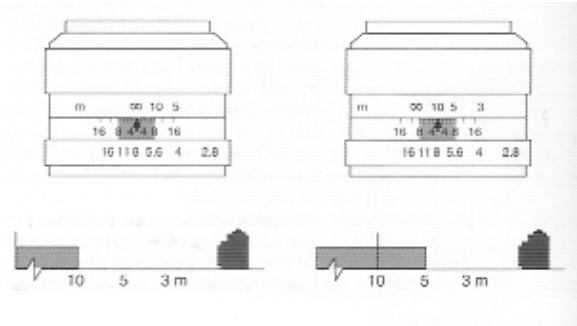


Figure : Using hyperfocal distance. For maximum depth of field with distant scenes, first set the lens to infinity. Note the nearest distance still within depth of field for the f-number you are using, here 10 meters (left). Then refocus the lens for this 'hyperfocal' distance (right). Depth of field will extend from half this distance to, infinity.

When using a camera giving a large-format image you can anticipate less enlargement than, say, with a 35 mm camera. But although this makes a larger circle of confusion permissible, the long focal length lens needed by the large camera to include the same angle of view has a much stronger and opposite influence. In practice the smaller your camera the greater your depth of field. However you also have to bear in mind the effect of the grain pattern of the chemically recorded image when a smaller film is enlarged. The same applies to the number of pixels used by a digital camera. Since final sharpness in your photograph is influenced by these factors as well as depth of field, the small camera is deprived of some of its advantages.

Depth of Focus

Depth of focus often gets confused with depth of field. But whereas depth of field is concerned with making light from different subject distances all come to focus at one lens setting, depth of focus refers to how much you can change the lens-to-image distance without the focused image of anyone subject growing noticeably unsharp. It is therefore concerned with tolerance in the lens-to-sensitive material distance in your camera or enlarger, and accuracy in focusing

As *Figure 3.5* shows, the two 'depths' have certain features in common. Depth of focus increases with small aperture and large permissible circle of confusion. However, depth of focus becomes greater the *closer* your subject and the *longer* the focal length of the lens. (Both changes cause light to come to focus further from the lens, making the cones of light narrow.)

These reversed features mean that in practice:

A small-format camera needs its lens more precisely positioned relative to the film than a large camera. This is due to its shorter focal length normal lens, as well as smaller acceptable maximum circle of confusion. A large-format camera does not therefore need "engineering with quite the same precision as a 35 mm camera, and its greater depth of focus also allows more use of 'camera movements'.

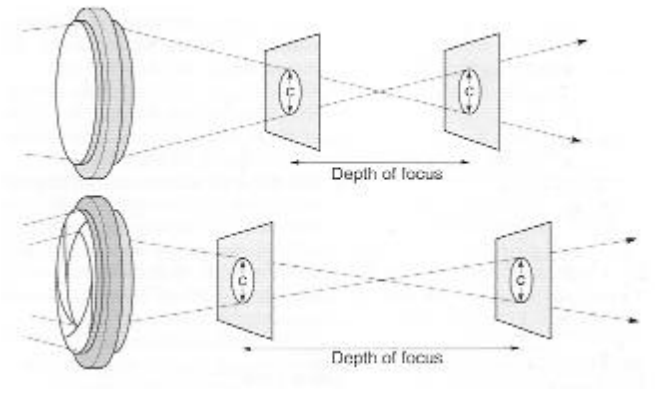


Fig 3.5: Depth of focus. Unlike depth of field this is concerned with focus accuracy between lens

And image, e.g. in the camera or enlarger. The smaller the lens aperture and larger the maximum permissible circle of confusion. (C) The greater the depth of focus. (Think of this focusing latitude as the distance you could freely move a ring along two cones positioned apex to apex)

When you visually focus the image given by a camera or enlarging lens, always have the lens at widest aperture. This minimizes depth of focus, making it easier to see the true position of accurate focus. The picture is brighter too.

Using your camera to photograph very close subjects (photo-macrography) it is easiest to alter lens focus to get the image roughly correct size - then *move the whole camera* backwards or forwards to get the picture pin-sharp. You will be focusing by exploiting the shallow depth of field under these conditions, rather than struggling with deep depth of focus, which could keep you finely adjusting lens focusing for a long time.

Lens Care

Your lens is the most important part of the camera or enlarger. It is I important to prevent damage to its glass surfaces. On a camera you can help to do this with some form of lens cap, or a clear glass UV filter. Avoid carrying a camera over your shoulder or in a bag containing other loose items without some lens protection. A small speck; on the glass is relatively unimportant - it just minutely reduces; illumination, but a greasy finger mark, scratches, or a layer of dust will scatter and diffuse light, so your images have less contrast and detail.

Loose dust and debris is best puffed away with a blower brush or gently guided to the rim of the lens. Grease or marks left by spots of rain may have to be removed with a soft tissue moistened in lens cleaning fluid. A scratched lens will probably have to be sent for re-polishing.

Don't become too obsessive about polishing lenses. You will do far more harm than good if you start to mark permanently the surface of the glass or top coating. Prevention is much better than cure.

Projects

1 Visually check depth of field. Use a single-lens reflex camera fitted with a preview button (or work with a large format camera). Arrange a scene containing well-lit objects at, say, 1 m, 2 m and beyond 3 m. Focus for 2 m and view the result at widest aperture. Next set the lens to *f18,* press the preview button if using an SLR, and *ignoring the dimmer image* see how nearest and farthest objects have improved in sharpness. Test again *atf/l6.* Also compare the effects of focusing on closer or more distant groups of objects.

2 Bright out-of-focus highlights spread into approximately *circular* discs of light because lens and diaphragm are nearly circular. Cut out a star or cross shape from black paper and hold it against the front of your SLR camera lens, set to widest aperture. View a subject full of sparkling highlights (such as crumpled foil) rendered out of focus, and see the change of appearance your shape gives.

3 Using your camera on a tripod, compose a picture containing detailed objects over a wide range of distances, from about 0.5 m to the far horizon. Take a series of shots at (1) widest aperture and (2) smallest aperture, with the lens set for (a) infinity, (b) the hyperfocal distance for your aperture (read this off the depth of field scale), (c) a foreground object, (d) the same object as (c) but with the camera twice as far away and refocused. Compare results for depth of field changes. Remember to adjust exposure time for each change of aperture.

Notes

LESSON 8
USING DIFFERENT LENSES

Using Different Focal Length Lenses, Camera Kits

If you are using an SLR or view camera the camera itself is only pan of the 'tool box' you need for taking photographs. Ability to interchange lenses means you will soon want to explore use of different focal lengths. Even if you work with a compact camera permanently fitted with a zoom it is worth understanding how its range of focal lengths influence picture making. Remember too that there are dozens of accessories - from tripods and other supports to flashguns and camera bags - worth considering as useful practical kit for your kind of photography.

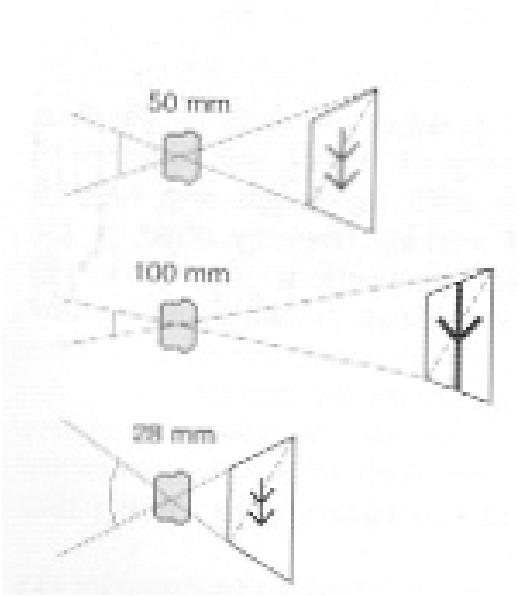


Fig 3.1Changing focal length but keeping the same picture format alters the combination's angle of view.

Why Change Focal Length?

Lenses of fixed focal length (i.e. not zoom) regarded as standard for cameras reviewed in the last chapter are typically 100 mm focal length for 6 x 7 cm format; 50 mm for 35 mm (compact cameras 34 mm focal length); and 27 mm for APS cameras. As Figure 3.2 in last chapter showed, most of these combinations gives an angle of view of about 45°.

To help understand why 45° is considered normal, try looking through a 35 mm SLR fitted with a standard lens, holding the camera in upright format and *keeping both eyes open.* Compare picture detail on the focusing screen with the subject seen direct. Your naked eye sees a great deal more of your surroundings, of course. But within the area imaged by the standard lens and isolated by the picture format the relative sizes of things at different distances match normal eye sight.

If you keep to the same format camera but change or zoom the lens to a longer or shorter focal length you can:

1. Alter angle of view (enlarge or reduce image detail and so get less or more subject in).
2. Disguise how far or how close you are from the subject and suppress or exaggerate perspective in your picture.

Each of these changes has an important influence on how your picture is structured.

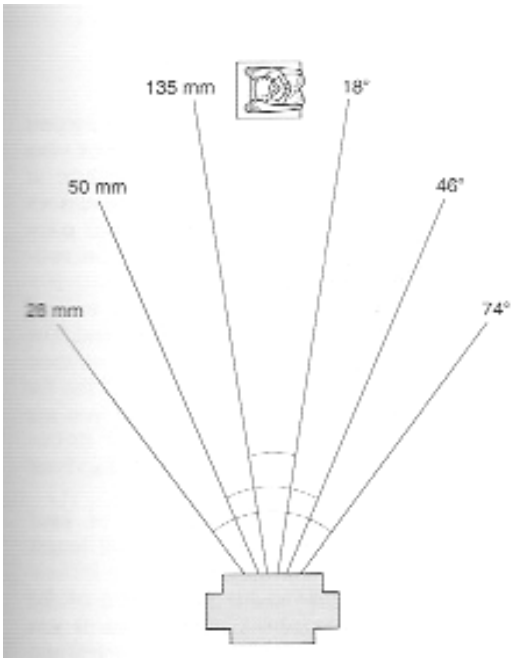
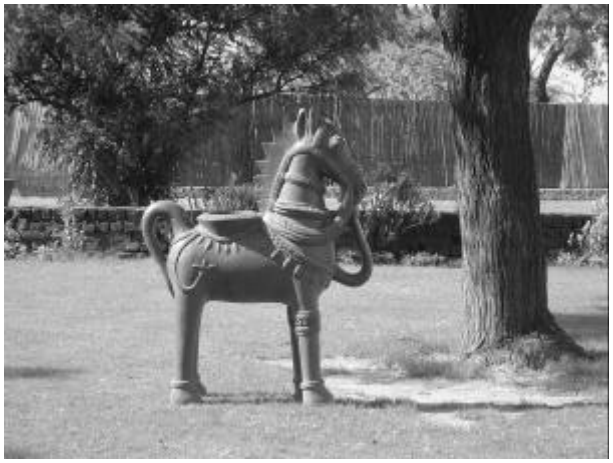


fig 3.2: Angle of view on changing foal length

1) 28 mm

2) 50 mm



3) 135 mm

4) Enlargement of center of 28 mm shot

Fig 3.2: Angles of view given by lenses of different focal lengths used on a 35 mm format camera. Appearance when focal length is altered without change of subject distance.1: enlarging part of the 28 mm lens image proves that lens change alters magnification, but not perspective. All shots were taken at the same aperture. Note the 28 mm blow-up has greater depth of field, but enlarged grain gives poorer detail than sharply imaged parts of the 135 mm lens version.

Getting Less, or more, Subject in

Changing the lens in your camera to a longer focal length (or zooming to 'tele') makes the image detail bigger - so you no longer include as much of the scene and the angle of view becomes narrower (Figure3 .1). At first sight you seem closer to your subject but this is only an illusion due to enlargement; see Figure 3.2. Creating larger detail this way is handy if you cannot get dose enough to your subject - for example in sports and natural-history work, candid and architectural detail.

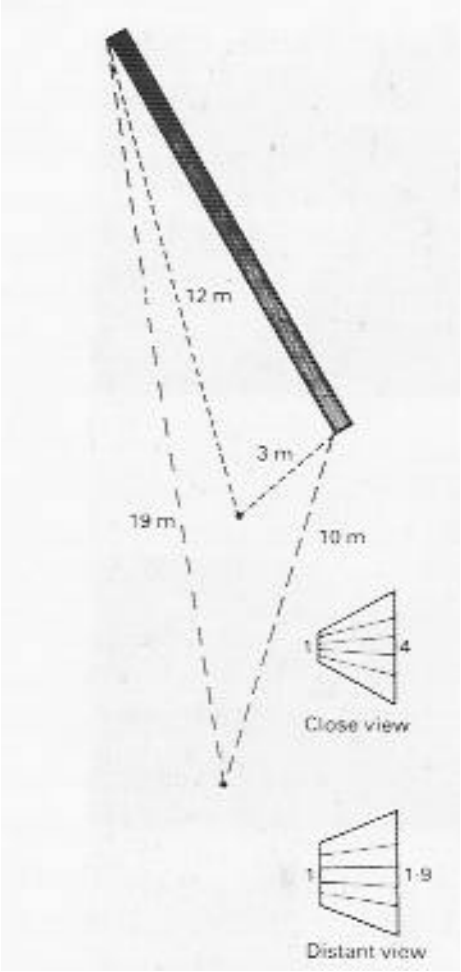


Figure3.3: Viewpoint and perspective relationship. The apparent convergence of horizontal lines in this oblique wall grows less steep as the viewer's distance increases.

Any slight movement of the camera is also magnified, so if you are using it hand-held, consider picking a faster shutter speed to avoid blur. Other changes include less depth of field for the

same f-number. A 100 mm lens gives half the angle and twice the image magnification of a 50 mm lens, assuming distant subjects.

Changing instead to a shorter focal length lens (or zooming to 'wide') gives all the opposite effects. You include more scene noticeably foreground and surroundings, everything is imaged smaller, and there is greater depth of field. A wide-angle lens is particularly useful for cramped locations, especially building interiors where a standard lens never seems to show enough. Similarly, you can shoot views, groups, or any large subject where it is otherwise impossible to get back far enough to get everything in. The lens must be *designed* as a wide-angle. Don't try to take a standard 50 mm lens from a 35 mm format camera and use it as a wide-angle in a large format camera - the picture will probably look unsharp and dark at the corners.

Altering Perspective

By changing focal length *together with your distance from the subject* you exert an important, powerful influence on the perspective of your pictures. Perspective itself is concerned with the way objects at different distances appear to relate in size, and how parallel lines seer; from an oblique angle apparently converge towards some far-off point- all of which gives a strong sense of depth and distance in two dimensional pictures of three-dimensional scenes.

As Figure 3.3 shows, if you look obliquely at a garden wall of uniform height you see the nearest end much taller than the far end. The difference between these two 'heights' is in direct ratio to their distances from you, so if the near end is 3 meters away and the far end 12 meters, ratio in height is 4:1. But move back until you are 10 meters from the near end and the far end will be 19 meters (l0m + 9m) away. The ratio becomes only 1.9:1, and the wall's visual perspective is less steep.

Perspective therefore alters according to the distance of your viewpoint from the subject. But if you can change lens focal length you can disguise a viewpoint change by adjusting the lens to include the same amount of subject. Imagine taking one photograph of the oblique wall using a 50 mm lens, 3 meters from its near end. If you then stepped back to 6 meters and took another shot using a 100 mm lens instead, the wall's near end would record the same size but have a less diminished far end, giving flatter perspective and therefore less apparent depth.

Use ***steep perspective*** (close viewpoint, plus wide-angle lens or shortest focal length zoom setting) whenever you want to exaggerate distance, caricature a face into a big nose and tiny ears, or dramatically emphasize some foreground item such as an aggressive fist, Figure 3.4 by exaggerating its relative size. Similarly use it to create a dynamic angle shot looking up at a building and exaggerating its height.

Fig3.4 Exaggerated scale gives dramatic emphasis. Shot from a viewpoint close to the hand, using a 35 mm camera with 24mm wide-angle lens, at wide aperture.

Use ***flattened perspective*** (distant viewpoint, plus telephoto lens or longest focal length zoom setting) to compress space, to make a series of items one behind the other appear' stacked up', adding a claustrophobic effect to a traffic jam or a crowd. In landscapes it helps to make background features dominate over the middle distance, or merges both into flat pattern. Portraits tend to be more flattering, with nose and ears shown in proportions closer to true size.

Explore these controls over perspective and learn how they can help make the point of your picture. But if overdone (the two extremes of focal length giving either telescope or fishbowl effects) they easily become gimmicks, which overwhelm your subject matter.

Fish-eye lens distortion. Inside University (A-41)Delhi Center, taken with a 35 mm camera and an 8 mm . Fisheye lens designed to give a 220° angle of view. This extreme lens forms a circular picture with vertical and horizontal lines increasingly bowed according to their distance from the center.

The appearance of perspective in a photograph also depends finally on its finished size and the distance from which it is viewed. Strictly speaking, the image appears natural in scale and perspective if your ratio of *picture width to viewer distance* matches the ratio of *subject width to camera distance* when the shot was taken. This means that if something 4 meters wide is photographed from 8 meters (ratio 1: 2) the print will look normal seen from a distance twice its width - perhaps a 12.5 cm wide print viewed from 25 cm, or a 50 cm print viewed from 100 cm. In practice you tend to look at all hand-size prints from a 'comfortable" reading distance of about 25-30 cm, which usually works out right for natural perspective appearance from normal-angle lens photography. Bur reading wide-angle close shots and long focal-length distant shots from the same viewing position makes their steepened or flattened perspective very apparent. If you want to exaggerate the illusion of compressed space and flattened perspective, print long-focal-length (narrow-angle) shots big, and hang them in enclosed areas where the viewer has to stand close.

Interchanging Lenses in Practice

The greatest variety of interchangeable lenses today are made for, single-lens reflexes, especially 35 mm format. Originally their range was very restricted by the need for wide-angles to be placed close to the film, where they fouled mirror movement, and the awkward physical length of long focal length lenses. (This distancing problem is now solved optically by making long-focus lenses of *telephoto* construction and wide-angles of *inverted telephoto* construction.) Most small- and medium-format wide-angle optics today are of inverted-telephoto design, and virtually all long focal lengths intended as narrow-angle lenses are telephotos. This is why we tend to use the word 'telephoto' to mean the same as long focus.

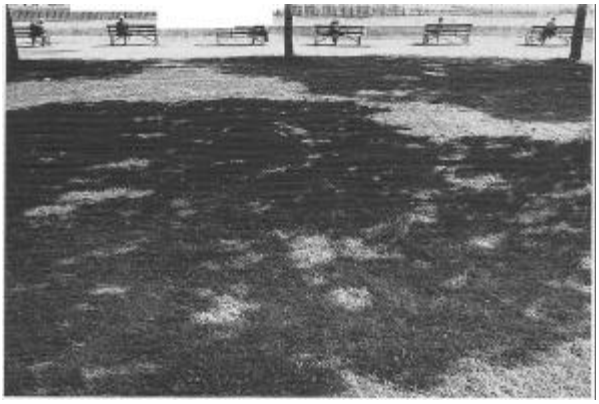


Fig: Using a wide-angle 24mm lens here allowed all six benches to be included andexaggerates the much closer shadowy foreground.

Lens coverage. As Figure 3.5 shows, there are limits to the area a lens will cover with an image of acceptable quality. Designed for a 35 mm camera it will certainly perform well over a patch at least 43 mm diameter. But used on a 6 x 6 cm format picture corners show poorer definition, and on 4 x 5 in edges and comers become darkened.

Figure 3.5: Lens coverage. The total circular image patch formed by an 85 mm lens designed to cover 35 mm format (inner frame). Used as a normal angle lens on a 6 x 6 cm format camera edges begin to darken. And attempting to use it as a wide-angle on 4 x 5in (outer frame lines) uneven illumination and corner 'cut off' becomes obvious, particularly when the lens is stopped down.

Irrespective of focal length then a lens is designed to 'cover' adequately a particular picture size. You could possibly use it in a *smaller* format camera, but not a larger one. In practice you cannot make mistakes Oil small- and medium-format cameras because their lens mounts prevent you attaching unsuitable optics.

The lens mounts for these camera sizes also differ brand-for-brand you cannot fit lenses from a Nikon to an Olympus body, and so on. Each maker also has different (patented) mechanical and electrical couplings between body and lens to convey information about the aperture set, to control autofocus, etc. Occasionally, when a maker develops a new body, lens mounts are changed - but this is done as rarely as possible to keep faith with previous purchasers of their equipment.

Independent lens makers produce optics to fit a range of cameras: you specify the type of body and the lens comes fitted with the appropriate coupling. The quality of the independent lenses varies more than lenses supplied by the camera manufacturer. The latter have to reach a minimum optical standard common to an entire range. The best independent brands are consistently good too, but cheapest lenses undergo less rigid quality control and may be anything from quite good to poor.

Lens Kits

Wide-angles. There is no doubt that standard lenses (normal focal length) represent best value for money. Made in large quantities, they tend to be cheaper and have wider maximum apertures than wide-angles and longer focal length lenses, including zooms. However, if you often photograph architectural interiors and exteriors or need to use dramatic angles and steep perspective, the next interchangeable lens to buy after a standard is a wide-angle. A popular focal length wide-angle, giving about 70-80°, is 28 mm for 35mm format (40 mm for 6 x 6 cm, or 90 mm for 4 x 5 in). Using lenses wider than 80° (24 mm focal length on a 35 mm camera) begins to introduce 'wide-angle distortion', making objects near comers and furthest edges of your picture appear noticeably elongated and

stretched. It is like having additionally steep perspective in these zones, although you can help to disguise the effect by composing plain areas of sky, ground or shadow here.

Another feature of a wide-angle lens is that it gives greater depth of field than a standard lens at the same aperture. This can be an advantage, but also makes it more difficult to pick out items by differential focus. Extreme wide-angles virtually need no focus adjustment and record everything in focus - from a few inches to infinity. Also they may no longer accurately image vertical and horizontal lines near picture edges as straight, becoming 'fisheye' lenses.

Wide-angle distortion. Extreme wide-angle lenses (here 16 mm used on a 35 mm camera) gives unacceptable distortion with a subject of known shape, unless you want a special effect. However, viewing this page from 3.3cm would make picture perspective appear normal.

			Wide-angle					*'Normal'*					*Long focal length*					
	100°	94°	90°	80°	74°	62°	56°	50°	46°	28°	24°	21°	18°	14°	12°	8.5°	6°	2.5°
35mm	18	20	21	25	28	35	40	45	50	85	100	120	135	180	210	300	400	1000mm
6x6cm			38	45	55	65	70	80	93	150	185	220	240mm					
6x7cm			45	50	60	70	80	90	105	165	210	240	270mm					
5x4in			75	90	105	130	140	165	180	300	370mm							
10x8in					210	265	285	330	360	600	740mm							

Angle of view given by different combinations of lens focal length and camera format diagonal. Lenses must be capable of fully covering the picture format

Long focal lengths. Perhaps you will choose a telephoto instead of, or as well as, a wide-angle. A moderately long focal length, such as 100 mm on 35 mm format (24°) makes a good portrait lens. It will allow you to fill the frame with a face from a distance of about 1.5, meters, which avoids steep perspective and a dominating camera presence. Longer lenses will be needed for natural history subjects, sports activities, etc., which you cannot approach closely, or any scene you want to shoot from a distance to show it with bunched up, flattened perspective.

Working in the studio on still life, moderately long focal length lenses are again an asset. With food shots, for example, such a lens allows the camera to be kept back from the subject, avoiding any elliptical distortion of plates, tops of wine glasses, etc.

In general, lenses with angles of view of less than 18° begin to make you conscious of 'unnatural' scale relationships between nearest and farthest picture contents. This is more like looking through a telescope than seeing the scene direct. The longer the focal length, too, the more difficult it is to get sufficient depth of field and avoid camera shake when using the lens hand-held. (As a rule of thumb the longest safe shutter speed is the nearest fractional match to lens focal length, e.g. no slower than 1/250 sec with a 200 mm lens.)

Your image contrast is frequently lower than with a standard lens, especially in landscape work where atmospheric conditions over great distances also take their toll. Image definition is easily upset in pictures taken through window glass. Another problem is the size and weight of long focal length lenses. Beyond 500 mm it is usual to have to mount *the lens* on a tripod, with the camera body attached.

Wide-angle and telephoto' converter' attachments are available for some SLR lenses. A wide-angle device fits over the front of the prime lens and typically reduces focal length by 40 per cent. A tele attachment fits between lens and body and typically doubles the focal: length. Provided the tele attachment is a multi-element unit designed for your particular lens, image quality will be maintained. The combination has its aperture reduced by two f-number settings if focal length is doubled. Wide-angle attachments are more prone to upset your image definition near picture edges - you should always use them well stopped down.

Macro Lenses

Most lenses will not allow you to take a tight close up photograph, such as a small flower, due to the lenses optics. To over come this problem macro lenses were designed, although more expensive than conventional lenses, they offer a new world of close up opportunities to the photographer. Strictly speaking, this lens should be called a close focusing lens, since the term macro implies making an image life size or larger on film. When used by themselves at their closest focusing distance, these lenses can produce a film image that is about half the size of the subject. For most close up subjects this range is more than adequate. With the addition of extension tubes or bellows between the camera and the lens, the range of the macro lens can be extended even further to reproduce subjects at two, three or more times larger than life. The main problems associated with macro lenses are their extreme lack of depth of field and their need for a long exposure time.

Fixed focal lengths, or zooms?

A zoom is a lens of ***variable*** focal length - altered by shifting internal glass elements. It is built into most modem compact cameras, which do not allow interchangeable lenses anyway. However, for cameras such as SLRs you can decide between a chosen set of lenses of fixed focal length, or have one (or perhaps more) zoom lenses. The control on the lens for changing focal length is usually a separate ring or, with some longer focal length zooms, a sleeve on the lens barrel that you slide forwards and backwards. Turning the same sleeve focuses the lens ('one-touch' zooms). A zoom lens fitted to a compact camera is altered by W and T buttons or a switch controlling a motor inside the body. This also adjusts the viewfinder optics to match the changing angle of view.

Good quality zooms are optically complex - the focused subject distance must not change when you alter focal length, and the diaphragm must widen or narrow to keep the f-number constant. Also aberration corrections must adjust to maintain acceptable image quality throughout the entire range of subject distances and focal lengths. The -best-quality zooms give image quality as good as fixed-focal-length lenses. Limits to their aberration correction at the extremes of zoom range typically show up as straight lines near frame edges bowing inwards or outwards. The greatest choice of zoom lenses is to be found in the standard-to-telephoto (50-200 mm) range band. But increasingly you can also get wide-angle zooms spanning 24-85 mm, or tele-zooms 200-600 mm. Perhaps handiest of all are zooms which range more moderately either side of normal, such as 28-80 mm.

The practical advantages of a zoom are:

1 A continuous change of image size is possible within the limits of its zoom range - far more flexible than having several interchangeable fixed focal length lenses.

2 Ability to frame up action shots, candid, and sports pictures where things can happen unexpectedly and you may be too far away or too close with any regular lens.

3 No risk of losing a picture because you were changing lenses at the decisive moment.

4 Fewer items to carry.

5 Ability to' zoom (or' change image size in steps) during actual exposure, for special effects.

6 On most zooms, there is a 'macro mode' facility for ultra-close work,

70-210mm zoom used at its focal-length extremes (top)

when zoomed throughout a 1/2, second exposure.

A zoom's disadvantages are:

1 Widest aperture is about 1- 1 ½ ; stops smaller than a typical fixed focal length lens, e.g.f3.5 instead of f2.

2 It is more expensive and often bigger than anyone fixed lens within its range.

3 The continuous focusing scale does not usually go down to close subject distances.

4 Some cheaper types give poorer image contrast and definition, and distort shapes when used at either limit of their zoom range.

5 Zooms can make you lazy about using perspective well. It is tempting to just fill up the frame from wherever you happen to stand. Instead, always try to choose a viewpoint and distance to make be& use of juxtapositions, give steep or flattened perspective. Only then adjust focal length to exactly frame the area you want.

Even high quality zooms may change their maximum aperture between the extremes of zoom range, for example giving half or one stop less light at the longest focal length setting (maximum aperture is then engraved f3.5/4.5 or similar). This is unimportant provided you are using a through-the-lens meter, but remember to allow for it if you arc shooting at the lens's widest settable aperture and working with a separate meter, or a non-dedicated.

Depth of field always changes throughout the range, unless you compensate by altering f-number. It is greatest at shortest focal length, so whenever practical focus your zoom at its longest focal length setting, making critical sharpness easy to see - then change to whatever focal length you need.

Far fewer zoom lenses are designed to cover rollfilm formats. Not only is the market smaller, but size and weight greatly increase if the lens is to have a usefully wide aperture. (A *100-200mm f/4.8* zoom may easily weigh 2180 g, against 480 g for a 80mm *f/2* fixed focal length lens.) Other lenses worth considering for a small- or medium format camera kit are a shift lens and a macro lens. It is seldom worth buying lenses of extreme focal length; for example a f/4 600mm lens for 35 mm costs over thirty times the same maker's 50 mm standard lens! Instead it is possible to hire them for unusual jobs, when optical distortion and unnatural perspective are perhaps an essential element in a picture. For most work such devices are a distraction, and become monotonous with overuse. You will often do better by moving either closer or farther back, and using more normal optics.

Essentials, and Extras

Tripod/monopod

Choosing other accessories for your camera kit is mostly a matter of personal selection. Build them up from essentials - for example, a cable release and a tripod. (with a pan and tilt top) are needed sooner or later for every camera type. Match the tripod to the camera's size and weight, and don't overlook the value of a small table tripod or clamp fitted with a ball and socket head. One of these will pack easily into a shoulder bag. For support in action photography especially when you use a telephoto lens - tryout a monopod, or a pistol grip camera support. These are all more portable and less obtrusive than a tripod.

If your camera has no built-in exposure meter you must have a hand meter. You will also need filters for black and white and colour photography, plus some form of filter holder to suit the front diameter of your set of camera lenses. The holder can form part of a lens hood an accessory always worth fitting to reduce flare when your subject is lit from the side or rear. It can also protect your lens. However the hood must not be so deep that it protrudes into the field of view. Take care when using a zoom lens set too wide, and stopped down.

You will probably need a portable flashgun for use on location. This might be a powerful 'hammer-head' type sufficient to light fairly large architectural subjects, or a smaller dedicated gun which mounts on the camera.

There are several worthwhile accessories for view finding and focusing. An SLR viewfinder eyecup helps to prevent reflections and stop sidelight entering the eyepiece, which confuses the meter system on some models. A right-angle unit is helpful for low viewpoints and when the camera is rigged vertically for copying. A few 35 mm and most rollfilm SLR cameras allow the pentaprism to be interchanged. You can then fit a waist-level finder, a high-magnification finder, or an action finder, which allows you to see the image from a range of distances and angles. You can also change focusing screens to suit work you are doing - perhaps fit a cross-line grid screen for copying.

You will also need one or more cases for your camera kit. There are three main kinds. Large metal cases with plastic foam lining have compartments for the various components of a view camera outfit plus accessories. This kind of case has the advantage that you can stand on it-when, for example, you are focusing the camera at maximum tripod height. A smaller, foam-filled metal attaché case suits a medium or small-format kit and is designed for you to cut away lumps of foam to fit your own choice of components. A tough waterproof canvas shoulder bag with pouches and adjustable compartments is one of the most convenient ways of carrying comprehensive 35 mm outfit.

Projects

1 Get some practical experience of a range of lens types for your camera. Compare the size of image detail, the depth of field (at same f-number), the balance and weight of body plus lens, and degree of image movement produced by camera shake when hand-held. Check out the closest subject distance you can focus.

2 Take full-face head shots of someone you know, using each of a range of lenses from wide-angle to telephoto or different settings of an equivalent zoom. For each focal length adjust your distance so that the subject's eyes are imaged the same distance apart in every picture. Compare the perspective in your results.

3 Test a zoom lens by imaging a squared-up modern building or grid-type subject. Arrange horizontal and vertical lines to run parallel and close to all four-picture edges. Check that these lines remain straight and in focus at longest and shortest focal length settings.

4 Try zooming during exposure. Use shutter speeds around ¼ second. Have the camera on a tripod and either zoom smoothly throughout exposure or add a brief static movement at the start or finish. Make your center of interest dead center in the frame, and include patterned surroundings.

5 Check out the maximum magnification you can obtain with your equipment. Image a ruler and count how many millimeters fills the width of your frame.

Notes

LESSON 9
FILTERS

Introduction to Filters

Filters are made of either glass, plastic, acetate, or gelatin and are usually placed in front of the camera lens. The exception is that some filters intended for use with view cameras are placed inside the camera behind the lens. Lens filters can also be employed in the darkroom on your enlarging lens to dramatic effect, as well.

Plastic and glass filters are available either as square plates that require a filter holder system (see illustration), or round metal-rimmed disks, which are threaded to screw onto the front of the lens. Gelatin filters generally come only in the square plate form. The square filters require a filter holder that mounts onto the lens. These filters can be easily interchanged and used with many cameras each with their own filter holders.

There are many different uses for lens filters, from subtle changes in tone or color to dramatic alterations of color and light. The following pages depict many types of filters categorized by their most generally used function. Of course, the creative mind will not restrict the use of *anything* to conventional use…

Color Correction Filters

Color correction (or conversion) filters are used when the color balance or your color slide or negative film is different than the light under which you are shooting. For instance, using film balanced for daylight when the subject is indoors in incandescent lighting.

The filter numbers below refer to the Kodak set of conversion filters.

Filter No.	Filter Factor	Used to convert...	Filter Color
80A	4	**3200K to Daylight**	Blue
80B	3	**3400K to Daylight**	
80C	2	**3800K to Daylight**	
80D	1.5	**4200K to Daylight**	
85C	1.5	Daylight to 3800K	Amber
85	3	Daylight to 3400K	
85B	3	Daylight to 3200K	

Polarizing Filters

Light rays from the sun or other light source diverge in a manner similar to that of a water wave that vibrate at many angles simultaneously. This is called **unpolarized light**. Light rays vibrating in only one direction are called **linear polarized light**. Polarizers have a foil "grid" cemented between two pieces of glass. This grid construction is invisible to the eye, and it only allows light rays vibrating parallel to the foil grid to pass through. Light rays which are vibrating perpendicularly to the foil grid are blocked while other directions are partially suppressed.

When light is reflected from a surface, a polarization of the reflected light develops. The degree of polarization depends on the angle of incidence of the light, which varies according to the type of surface material. Light reflecting off water surfaces has a maximum polarization of under 37º, while reflection off glass is under 32º. Wood, grass, plastics, and lacquer also polarize light. (Untreated metal surfaces reflect light randomly, and their reflections cannot be reduced by a polarizing filter.) With the aid of a correctly positioned polarizing filter, reflections can be eliminated or reduced. This occurs when the illumination angle and picture-taking angle are almost equal and the angle of the maximum polarization is in the range of 30-40º. The effect of polarizing filters can be observed through the viewfinder while rotating the front element of the polarizer.

Linear and circular polarizer both consists of a linear polarizer foil but differ in their construction in the following way. Modern SLR cameras have a beam-splitting prism that sends part of the incoming light to the meter and part to the viewfinder. The affect is that the light entering the meter is partially polarized by the beam-splitter. A linear polarizer placed on the lens of such a system will act as a second polarizer and block light to the meter to a degree dependent an the angle between the prism and the polarizer on the lens. The result is incorrect exposure/aperture values from the meter. The circular polarizer circumvents this problem through the addition of a 1/4-wave retarder, or delay, foil. This ensures that the linearly polarized light is changed into a rotation that appears unpolarized to the meter, resulting in proper exposure/aperture readings.

Using a polarizer to intensify cloud formations has a dramatic effect in landscape photography. The blue of the sky polarizes much more than the light scattered by the clouds. Polarizers can also bring out deep, rich greens in foliage and reduce the objectionable effect of smog in a photograph of a cityscape horizon.

Special Effect Filters

These filters are for a wide variety of uses and most can be used for both color and black & white photography. Although some of the filters listed in this section aren't normally considered "special effects" filters, they are included here because of their versatility of use in both color and black & white applications.

Among the most commonly used filters in this category are the **UV** or **haze filters**. Although they do not yield any "special effects," they reduce the amount of ultraviolet light that reaches

the film. This in turn reduces the “haze” or smog effect around distant objects. This filter is so ubiquitous that it is usually used as a lens protector.

Another commonly used filter is the **neutral density filter**. Again, no actual special effects here. These filters reduce the amount of light (stops) reaching the film without changing the color of the light. These filters are used when a slower shutter speed or lower f-stop is desired. The filter density is the mathematical log of the filter factor for all neutral density filters.

Filter Name	Filter Factor	Comments
Neutral density filters densities: 0.3, 0.6, 0.9, 1.2, etc.	2, 4, 8, 16, etc.	See above.
Polarizing filter	2-4	See Polarizing Filters.
UV (sky or haze) filter	1	See above.
Close-up filter	0	Used to allow closer focusing of a normal lens for macro photography. These lenses can be combined for increased effect.
Soft focus/soft spot filters	0	Softens the image, particularly the highlights, without decreasing sharpness. Come in varying degrees of softness and are used for a wide variety of effects. With some filters, the softening effect will vary with the size of the aperture. Soft spot filters are clear in the middle to create softness only around the edges of the image. Correction may be needed because of the contrast reducing effect of some of these filters.
Fog effect filter	0	Image appears to have been taken in a light mist. Correction may be needed because of the contrast reducing effect of this filter.
Star effect filter	0	Grid pattern on filter creates multi-beam star pattern from reflections and point light sources. Available in a number of different patterns.
Graduated filters	see comments	These filters come in either neutral density gradations or colors. The neutral density type are used to reduce the exposure of half of the scene by one or two stops to adjust the brightness range of the scene. The color type is used to enhance or adjust color in part of the scene. Graduated filters are used to darken skies, enhance sunsets, and create unusual color changes.

Filter Factor

Because a filter can prevent some amount of light from reaching the film, exposure often needs to be increased to obtain a correct exposure. This amount of increase is expressed by a number called a **filter factor**. Each number represents the number of times more light required. For example, a filter factor of 2 means that two times more light is needed for accurate exposure of the film. Because one stop is a halving or doubling of the amount of light, a filter factor of 2 means the opening up of one stop.

Since the wavelength composition of tungsten light differs from that of normal daylight, some filters will have different filter factors depending on the lighting conditions of the scene. Different films, also, will slightly affect filter factors due to their different spectral sensitivities.

An **exposure factor** is also a change in exposure described in multiples of additional light needed. When using a camera that uses a bellows for focusing, for instance, the exposure factor is added to compensate for light fall off inside the bellows at long extensions.

Below is a quick reference chart for determining the amount of stops relative to the different filter (or exposure) factors on panchromatic film. If the number you are looking for is not here, use the next highest number:

Filter Factor	Increase in Stops	Filter Factor	Increase in Stops
1.5	1/2	12	3 1/2
2	1	16	4
3	1 1/2	24	4 1/2
4	2	32	5
6	2 1/2	48	5 1/2
8	3	64	6

Example: If the light meter reading gives an exposure of 1/125th at *f* 11, the correct exposure using a filter with a factor of 4 would be 1/125th at *f* 5.6 or 1/30th at *f* 8, etc. (see reciprocity).

Filters for B&W

These filters are color filters that are used, in a general sense, to control the contrast of values between objects in the scene when using black & white film. The actual effect obtained depends on the spectral sensitivity of the film, the color and reflectivity of the subject matter, the color of the light, and the color of the filter used.

Because of the difference between what we perceive and what the film “sees”, what we see is often not what we get on film. This makes the use of color filters particularly helpful in balancing out this difference. They can also, of course, be used to achieve unrealistic or exaggerated effects as well.

These effects are achieved because the filters lighten objects of the same color and darken objects of the opposite color.

1. This is a color picture of red begonias against green grass. Notice the contrast in color between the flowers and the grass
2. This is a black & white photo of the same scene using **no filters** on the lens. Notice there is no differentiation of tones between the flowers and the grass.
3. This is a black & white photo using a **green filter**. Note that the filter darkened the red of the flowers and lightened the green grass
4. This is a black & white picture using a **red filter** on the lens. Notice the filter lightened the flowers and darkened the green of the grass.

The following chart will explain the different filters, listed by the Kodak Wratten filter numbers, and their properties. Note that some filter manufacturers will use a different naming or numbering system for their filters:

Filter Number	Filter Color	Filter Factor		General Effect (Daylight only)
		Daylight	Tungsten	
3, 6	Light Yellow	1.5	-	Slight darkening of blue skies.
4, 8	Yellow	2	1.5	Slight darkening of blue skies.
9 12, 15	Deep Yellow	2 2.5	1.5 1.5	Darkens skies; increases the brilliance of sunsets; reduces haze in distant landscapes; enhances texture in sunlit stone, wood, etc. in architecture.
11	Yellow-green	4	4	
13	Dark Yellow-green	5	4	
23A	Light Red	6	3	Slight darkening of blue skies, but more so than #15 Deep Yellow.
25	Red	8	5	Darkens skies darker than #15 Deep Yellow; increases the brilliance in sunsets; greatly reduces haze in landscapes; lightens red, orange, and similar colors for more detail or contrast; greatly enhances texture in sunlit stone, wood, etc. in architecture.
29	Deep Red	16	8	Almost blackens blue skies; greatly reduces haze in landscapes. Used with black & white infrared film to virtually eliminate all but the red and infrared light.
47	Blue	6	12	Increases haze in distant landscapes for effect; lightens blue, purple, and similar colors to show more detail or contrast.
47B 50	Deep Blue	8 20	16 40	Same as #47 Blue.
58	Green	6	6	Lightens foliage to show more detail or contrast.
61	Deep Green	12	12	Same as #58 Green.

Notes

LESSON 10
UNDERSTANDING EXPOSURE

Understanding Exposure

Films differ greatly in their sensitivity to light. Some require a lot of light to record an acceptable image, while others need much less. If your film receives the proper amount of light, the final image will reproduce your subject in it's proper tones and colours. But if the film gets too much light (over exposure), the image will be pale and lacking in detail; if it gets too little light (under exposure), the image will be dark and muddy. To avoid under and over exposure, it's important to understand how to use the two controls that adjust the amount of light reaching the film, the aperture and shutter speed.

Exposing film to light can be compared to filling a bucket with water from a tap. You can open the tap wide and fill the bucket quickly, or open it only a little and let the water trickle slowly. The two variables are how much you open the tap and how long you leave it on. The two exposure controls on the camera work much the same way. Like the valve on the tap, the aperture controls the size of the opening in the lens that admits the light. The shutter speed determines the length of time that the shutter will stay open to let the light pass through.

The exposure meter on your camera reads the total quantity of light reflected from the subject and tells you, or the camera, which combinations of shutter speed and aperture will produce the correct result on the film you are using. Because apertures and shutter speeds work on the principal of halving and doubling as you change their setting, a variety of aperture and shutter speed combinations will produce the same quantity of light on the film surface. For example, if the camera came up with an exposure of 125th of a second at f5.6, you could change the setting by halving the shutter speed to 250th of a second and doubling the aperture to f4 and still achieve a correct exposure. By using the principal of halving and doubling your aperture and shutter speeds, you can select the creative parameters of your photograph. If you require a very fast shutter speed for a photograph you can sacrifice your depth of field by using a wide aperture to achieve this. On the other hand if a small aperture is required you can choose a lower shutter speed to correctly expose the film.

Unless there is a lot of light around or you are using a very light sensitive film you will have to make a creative decision with many of your photographs as to whether you want to highlight shutter speed or depth of field.

Metering Problems

The different light levels of the many things you will want to photograph call for changes in exposure settings. A park scene on an overcast day, for example, requires a wider aperture or a slower shutter speed or both than does the same park on a sunny day. This is because film of a specific sensitivity to light needs more or less the same amount of light in each case to produce a well-exposed image. If the illumination is even and not too dim and the subject reflects an average amount of light, your camera's meter is fairly reliable in selecting the proper setting. Keep in mind though, that a light meter is only a mechanical device designed to take a general reading of the light in a scene. In some situations, this reading will not produce the results you want.

Your meter may be particularly prone to error in measuring strongly lighted scenes with bright highlights and deep shadows. In such cases, it may be best to take local readings from both dark and light areas, then choose an exposure midway in between. The meter assumes that the tone in anything that you show it will average to a medium gray (called 18% gray) and recommends an exposure that will conform to this average. But in a subject such as a beach scene, where most of the tones are light, this will result in under exposure, the meter will try to make the white beach gray. If you have manual exposure control, you can take a reading off a photographic gray card, which is what the meter is calibrated for, to avoid this error. With slide film, sometimes metering off a gray card will produce a light result, so you may want to decrease the indicated exposure by one half stop. With any film, to be on the safe side in tricky lighting situations, you should bracket your exposure, take extra pictures that give you one half or one stop more or less exposure than indicated.

Metering Patterns

It's also important to understand the metering pattern of your camera, so you can be aware if it's being adversely influenced by the various reflective levels in a part of the scene you are photographing. Currently there are 4 main types of metering patterns found in cameras today, some of the more expensive cameras actually offer a choice of metering modes.

The first is center weighted metering; this is by far the most common meter type to be found in today's cameras. Center weighted metering considers the light levels through out the scene but gives more emphasis in it's exposure calculation to the central area of the picture, the manufactures assume that most photographers tend to place their subject in the central part of the frame so correct exposure of this area is more important than the surrounds. So it is worth bearing this in mind if you subject is to the side of the frame and the brightness levels in the center of the frame are different to your subjects.

The second type of metering pattern is the average pattern, now less common in cameras, this system bases it's exposure on all the subject area. You will generally only find this meter pattern on older cameras. Once again consideration should be made in your exposure if your subject's brightness varies widely from the overall brightness levels.

The next type is spot metering. Spot metering is generally found on cameras that offer a choice of metering systems, this meter only bases it's exposure on a very small part of the scene that falls in the center of the frame, so extreme care should be used when using this metering method. Many spot meter modes on

more expensive camera systems allow you to take multiple readings, each one is stored in the camera's memory and then averaged out with the others to give you an overall exposure. This method of exposure calculation is very useful in difficult lighting situations.

The last metering mode has a number of names, but the most common is multi-program. The metering system is only found on the newer electronic cameras. Manufacturers have devised varying versions of a similar system where the camera takes several readings from over the scene and gives each a particular weighting for the exposure calculation. In essence it is very similar to center weighted metering but this system is usually far more reliable.

Exposure Modes

There are four main metering modes that camera manufacturers employ with their camera systems; these are TTL metering, shutter priority, aperture priority and program mode. Some manufacturers will only offer one system with their camera, while others will offer two or more. The number of methods offered are usually governed by the price of the camera.

Manual Metering

Manual, is the most basic of the four systems. Exposure is achieved by the built in meter, reading the light through the lens. By manipulating the aperture ring and shutter speed control, the correct exposure is displayed in the viewfinder when the needle or diode is centralized or matched.

Shutter Priority

The user sets the camera speed and the camera automatically selects the appropriate aperture for the given lighting conditions. To assist the photographer the selected aperture is usually displayed in the viewfinder.

Aperture Priority

The same as shutter priority, but this time the photographer sets the aperture while the camera selects the appropriate shutter speed.

Programmed Operation

In this mode the camera selects both the aperture and shutter speed for the photographer. On newer, more expensive cameras a "bias" may be selected, in this mode to compensate for the special needs of sport etc., where a high shutter speed is the most critical factor. If you are in the market for a new camera, and intend to use it creatively, look to purchasing either a fully manual or semi automatic camera. This way you will have control over the aperture and shutter speeds used on your camera. Which will allow you to put your own creative stamp on the image.

Notes

LESSON 11
EXPOSURE IN PRACTICAL USE

The interrelationship between film and light is at the heart of the photographic process. Everything else is merely an accessory to these two fundamental elements. How the two react to each other is the most important thing you must learn to become a good photographer.

Many people assume that film is film, and that the camera knows what the exposure should be. They're content to let the photo fall where it may. But for the serious nature photographer, this isn't an option. Most of the joy of outdoor photography is in the details of light and color. The way you control these elements is by learning what films will bring out colors and what types of lighting will achieve the mood you're trying for. Understanding these elements is the foundation for all your future photographic success. Once you have a grasp of these fundamentals, the sky is the limit. You'll have the essential tools for making your individual statement about how you see the world, and you'll find dozens of ways to manipulate every scene.

The camera's exposure meter is designed to give proper exposure for subjects of middle tone, the gray tone halfway between light and dark. The exposure meter chooses the correct exposure for recording your subject in the midrange between light and dark

Some cameras have a spot-metering system that lets you choose the area of the frame you wish to have exposed properly. This makes things a little easier, but you alone should make the final decision on your exposure setting. Photography is a creative endeavor, and the way you control the light that strikes your film is the single most important factor dictating how your final product will look.

Underexposed – not enough light; too small an aperture, or too fast a shutter speed. This however can sometimes be of benefit; stronger contrasts are obtained, and some systems allow for controlled under exposure; this is known as exposure compensation.

Overexposed – too much light; too slow a shutter speed. To large an aperture, this often leads to a washed out or overly bright image which is displeasing to the eye. Detail is lost and the result is unacceptable.

Measuring and Controlling Light

The light that comes into the camera is controlled by two settings—shutter speed and aperture. Each is represented in increments called stops. Each stop either doubles or halves, depending on which direction you are adjusting, the amount of light that reaches the film. Controlling the light that reaches the film is a matter of combining these two settings to create the effect you wish to achieve. Each control method provides different attributes, so understanding them independently will maximize your control over your images. This bears repeating: shutter speed and aperture always work together.

Sunny 16 Rule

Shutter Speed = 1/ISO speed at f16

You may also be able to get an idea of the proper exposure by using a gray card, a piece of cardboard that is an 18 percent reflectance middle-tone gray color. Such a card will allow you to find the proper midtone reading for your light. You can then stop up or down to adjust for the subject's color

Sunsets

Sunsets are always beautiful and there are a couple of pointers here. Take a number of pictures at different exposure (this technique is called "exposure bracketing") as the sunsets. Since you are shooting into the sun, your camera's exposure meter is guaranteed to be fooled unless you use the appropriate scene mode or manually adjust your exposure one to two f/stops down. You got to be quick because once the sun gets to setting, it sets real fast! By taking a number of shots until the sun is below the horizon, your chances of getting just this one perfect shot increase. Now, I know, you can also go into Photoshop and adjust it, Interestingly, some digital cameras now has auto-bracketing where the camera takes a number of shots at different over- and under-exposed settings. One of those shots will probably returns the "correctly" exposed shot that your eyes automatically compensated for.

Fireworks

Forget it, those pictures of fireworks of the Eiffel Tower or the Statue of Liberty are almost always composites! See, your expertise in Photoshop really pays off now, eh! To capture the full effect of fireworks, your camera needs to have a "bulb" setting that allows you to open the shutter and keep it open as long as you keep your finger there. You also need a piece of black cardboard or material that you put in front of your lens when bright objects pass by (e.g. a car) and then remove whenever fireworks explode. All the while, you keep the shutter open in the bulb setting. When you've got enough firework explosions, stop. Then, go into Photoshop and make a composite of all those fireworks explosions with your favorite landmark.

The Fair

Usually there are bright lights at the fair, and the surreal effect adds to the charm of a fair. Use fill-in flash for portraits. Use long shutter speeds (e.g. 1/30 sec.) to blur the spinning and twirling lights attached to the rides and carousels.

Scene Modes

Many digital cameras do not allow any exposure adjustment and so you are at the mercy of your camera. Others provide convenient scene modes for taking various situations, such as portrait, landscape, sports, night shots, etc. They essentially automate what we have talked about here. More high-end models allow you to select your own shutter speed and aperture (f/stop) by providing shutter priority and aperture priority

modes. We find that, if you are basically a point-and-shoot type of photographer, you will find the higher-end models confusing — at first. Though we do not recommend any particular model of camera, we do recommend that you seriously consider those cameras that provide scene modes.

Here is a run down of the most common scene modes and what they mean technically. These are my own guesses and by no means the gospel on the subject matter. They also do not cover ALL that is going on when you select a certain scene mode on your digital camera, only the MAIN requirements, and only those I personally believe are the ideal requirements. Less than ideal specifications will no doubt still give great results in many cases.

Sports or Action

1) The camera chooses the fastest shutter speed it has (say, 1/1,000 sec.) and
2) Then adjusts the aperture, starting from the largest aperture it has (say, F2.8) and going smaller until the proper exposure is obtained.
3) If, at the largest aperture, there is not enough light for a proper exposure, the camera selects to use the flash, and then cycles through step 2 again to obtain a correct exposure.
4) If there is still not enough light, the camera might attempt to switch to a higher ISO (e.g. ISO 400), and cycle through step 2 again.
5) Failing all that, the camera will select a slower shutter speed (not slower than 1/125 sec.) and retry steps 2 through 4.
6) Finally, if there is still not enough light for a proper exposure, the camera will progressively reduce the shutter speed until it has a shutter speed/aperture combination for correct exposure. These steps are just my guesses but seem to be what I would do manually. Different cameras may do steps 3 through 6 in different order. For example, a camera might select to progressively reduce the shutter speed (step 6) before opting to use the flash (step 3).
7) The camera might also select the correct White Balance if the shots are being taken indoors under artificial lighting (e.g. fluorescent or tungsten).

So the requirements for Sports or Action shots are:

1) Fast shutter speed (1/1,000 sec. and above)
2) Large aperture (F1.8 and larger)
3) ISO of 400 and above
4) White Balance for Fluorescent and Tungsten
5) Small shutter lag (you'll never catch the action if the shutter clicks 2 sec. after you press the shutter release)

Night

1) The camera selects the largest aperture it has (say, F2.8).
2) It then adjusts the shutter speed starting from the slowest (say 4 sec.) and moving up until correct exposure is obtained.
3) If there is not enough light, it might opt to use flash or increase the ISO sensitivity.

So, the requirements for Night shots are:

1) Large aperture (F1.8 and larger)
2) Slow shutter speeds (1 sec. and lower, plus Bulb)
3) ISO of 400 and above
4) White Balance for Tungsten

Landscape

1) The camera selects the smallest aperture it has (say, F8) for maximum depth of field.
2) It then adjusts the shutter speed until correct exposure is obtained.

So, the requirements for Landscape shots are:

1) A small aperture (F8 and smaller)

Portrait

1) The camera selects the largest aperture it has (say, F2.8) for minimum depth of field.
2) It then adjusts the shutter speed until correct exposure is obtained.
3) It might opt to use fill-in flash for correctly exposing the face.
4) It might zoom in to around 105mm to crop out extraneous surroundings.

So, the requirements for Portrait shots are:

1) A large aperture (F8 and smaller)
2) Fill-in flash
3) Zoom up to 105 mm

Museum

1) The camera shuts down flash.
2) It selects a shutter speed/aperture combination (and perhaps also the ISO sensitivity) for correct exposure.
3) It adjusts the White Balance for artificial light.

So, the requirements for Museum shots are:

1) Ability to shut off flash
2) Large aperture
3) White Balance for artificial light

LESSON 12
INTRODUCTION

History

A Photogram is a photographic image, but it is produced without the use of a camera. The image is the shadow or silhouette of objects recorded by placing them between a light source and light-sensitive paper or film. An example of the process occurs during the summer among sunbathers. The sunlight's darkening effect of the skin is similar to what happens when light strikes a photographic emulsion.

The Photogram is one of the oldest forms of photographic reproduction and illustrates many of the principles of the process. One of the first images was produced by Johann Schultze during his experiments to prove the sensitivity of silver nitrate to light. In effect, Schultze produced a Photogram when the wrapped a bottle containing silver nitrate and chalk with paper in the shape of cut out letters and exposed then to light until the silver nitrate darkened. When the bottle was unwrapped, a photographic image of the cutout letters were recorded dark against the white unexposed background. The photgram had been produced, but Schultze, like other early experimenters, failed to make the image permanent. It continued to react with light and eventually became equally dark overall.

Other early experimenters produced "silhouettes" by placing objects on sensitized paper or leather and exposing the material to direct sunlight. The physical conversion of the **silver halides** to metallic silver produced an image with reverse tones similar to those made with today's photographic papers.

The main difference, however, is that the early photograms were made by a direct reaction with light rather than through chemical development of the image. Early experimenters found that the Photogram was the easiest image to produce because of the shorter exposure time required when a lens is not used. The camera lens allows only a small portion of the total light to strike the light-sensitive emulsion as compared to the amount striking an object in bright sunlight. Over the years the Photogram has had alternating periods of popularity. Lazzlo Moholy-Nagy, Man Ray, and other artists have used it as a medium of artistic expression. Since it is created without a camera, it more closely approaches a classical art form than many of the photographs made with the technical oriented camera procedures.

A Photogram is a contact print. It is made by placing something opaque or translucent on light sensitive material and then exposing it to light. This blocks out part of the light, and makes a pattern or picture on the light sensitive material when it is exposed to light and processed.

Materials

Any light sensitive material may be used, including black and white or color, direct or reversal photographic paper or film; hand sensitized papers such as blueprint, gum bichromate, or brown print; commercial blueprint paper; color key. Outdated or partly fogged photographic paper or film may be used. Outdated materials may need longer exposure times than the same materials new. Fogged materials might give interesting effects (blotches, overall grays, pale thin spots or dark dense spots, etc.)

Block out the light with things that have interesting shapes or can be arranged in interesting patterns. Some possibilities are:

- dried flowers and leaves
- toothpicks, pins, other small objects
- seeds, marbles, beads
- household objects and tools
- glassware, lenses
- plastic (objects, crumpled sheets)
- sand, salt
- string, hair, thread, wire
- crumpled tissue paper
- paper cutouts, lace
- collaged negatives
- overhead transparencies
- drawings on plastic or glass or tracing paper
- use your hands or other body parts, or entire body on large sheet of paper or smaller sheets arranged underneath
- lay glass over light sensitive material and pour opaque or translucent liquids over glass, or arrange thinly sliced fruit
- use fast film or flash and use small animals or insects to block light (taking care not to harm them)

Procedure

Place objects on light sensitive material. If objects are thin enough, cover with glass to hold in place.

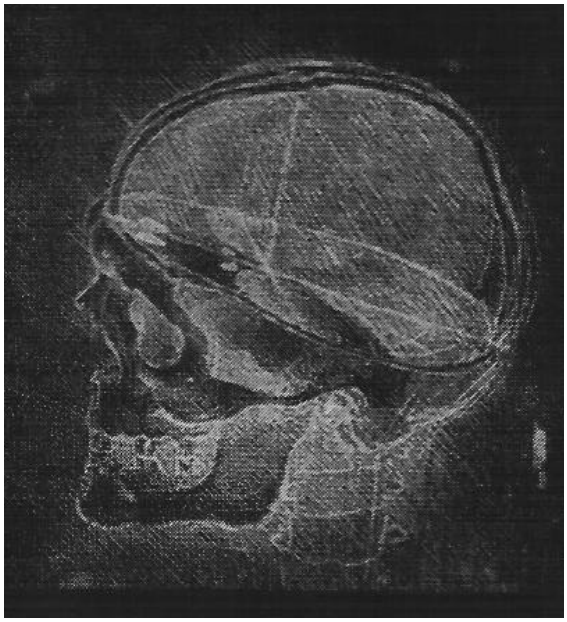
Expose to light. Use enlarger, room light, sunlight, depending upon type of material. Use standard exposure times for the particular material. For example, if the average time for blueprints is 15 minutes in bright sunlight, a blueprint Photogram will take about 15 minutes in bright sunlight; or, if your photo paper usually needs about 10 seconds in the enlarger, a Photogram on that paper in the enlarger will take about 10 seconds.

Process according to manufacturer's instructions for specific light sensitive material.

For variations, try:

- multiple exposures, rearranging things between exposures;
- multiple exposures with different colored light or moving translucent colored objects between exposures (on color photographic paper);
- multiple layers in blue or gum prints (sensitize, expose, process, dry, then add a new layer of sensitizer, etc.);

- coloring or drawing on finished prints.



Rajnish Kashyap (B.A. Hons Graphic Design University.)

The Photogram has been around as long as photography itself. Many of the first images were made by laying an object on top of a light-sensitized plate of glass and set out in the sun to be exposed. Today, the process is still the same, but generally with the use of an enlarger instead of sunlight. Photograms can be made in either black and white or color with a variety of opaque and translucent objects placed on the easel directly on or above the paper.

Penpa Dolma (GPD Still Photography. University)

Notes

LESSON 13
MAKING PHOTOGRAMS

How To Make a Photogram (Step by Step)

The procedure for making a Photogram is similar to that for exposing and developing film and for making photographic enlargements. It is helpful in familiarizing the beginning photographer with the darkroom and the process of making enlargements.

Step 1. After selecting materials to form the image, the first step in making a Photogram is to raise the enlarger's lamp housing almost as high as it will go. Then rotate the lens aperture ring on the lens until the most light is being projected through the lens. Focus the light on the baseboard and then rotate the lens aperture to about f/8.

Step 2. Cut your enlarging paper into small pieces of about 2 by 8 inches to conserve paper. Larger sheets are unnecessary at this stage. Select an item from the materials to be used in making the Photogram and place it on one of the pieces of paper.

Step 3. With the enlarger timer set on about 2 seconds, cover three-fourths of the photographic paper with an opaque piece of board and make an exposure. Cover half of the paper and make a second exposure and then cover a fourth of paper for a third exposure. Finally, uncover all of the paper for a fourth exposure. This will give you exposures on different areas of the paper of 2, 4, 6 and 8 sec.

Step 4. Place the exposed photographic paper into the print developer for the amount of time recommended. Keep the print in constant motion during the development stage. Drain the print over the developer for a few seconds and then transfer the print to the stop bath for 10 to 30 sec to stop the developing action. This will produce a developed but unfixed image. **Do not** expose the image to light at this point.

Step 5. Remove the print from the stop bath, drain and transfer it to the fixer. The fixing bath will dissolve the light-sensitive silver halides from the emulsion, which have not been converted to metallic silver, and make the photographic image permanent. After the print has fixed, you can inspect the image in regular light to select the exposure time, which produced the desired tones in the material. If your test strip does not produce the desired tonality, remake the test strip using longer times for a darker image or less time for a lighter image.

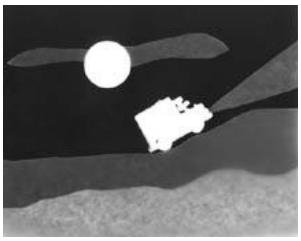
Step 6. Once you have selected an exposure time, compose your Photogram and set the timer.

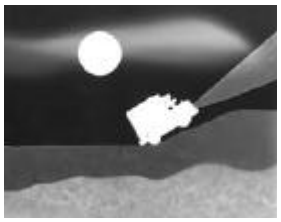
Step 7. After making the exposure, process the Photogram through the chemicals at the same times and at the same rate of agitation as your test strip. The tonalities you get on the Photogram should match those of the test strip.

Variations of Photograms

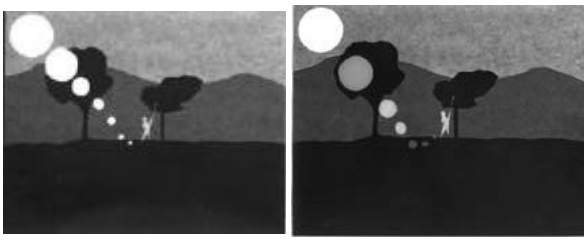
The procedure for making photograms can parallel that for making photographic enlargements, or it can diverge into experimentation and expression. The object can be recorded in a different way by simply moving the light source to an angle**.** Although this change in light direction would not be readily apparent in two-dimensional objects, those with depth take on a different recorded form caused by the different way the shadow is thrown from the object.

Photogram materials located at different heights above the light-sensitive paper produce changes in the recorded image. Normally, they are placed directly on the enlarging paper. This produces sharp edges that delineate the shape of the object. As the material is raised above the level of the paper and suspended, however, the edges of the shadows become more diffused, and the image takes on a ghostly appearance. Combining the sharply defined figures and the unsharp areas for contrast also gives the sense of depth to the image.





Another technique to add life to the stationary photogram and increase the amount of tones at the same time is to place opaque and translucent object on the paper during a portion of the exposure and then reposition or remove the items during the remaining time of exposure.



The Photogram image does not have to be limited to found of constructed objects. It can be a combination of media, such as drawn or painted areas, or it can consist of drawn or painted scenes alone. Another variation is to make the image on cloth or glass, or metal. The availability of photographic emulsions, which can be made at home or purchased from specialty companies, make this technique possible.

Procedural variations such as these certainly are not all inclusive. Imagination and creative experimentation will produce many more interesting formations and effects. Possibilities are unlimited.

Notes

LESSON 14
INTRODUCTION TO BASIC PRINTING

A negative is only an intermediate step toward the finished print, and means little as an object in itself Much effort and control usually go into the making of the negative, not for the negatives own sake, but in order to have the best possible raw material for the final printing The making of a print is a unique combination of mechanical execution and creative activity. The basis of the final work is determined by the content of the negative.

Printing is both a carrying-to-completion of the visualized image and a fresh creative activity in itself .As with other creative processes, understanding craft and controlling the materials are vital to the quality of the final result. You will find it a continuing delight to watch prints emerge in the developer and see that your original visualization has been realized, or in many cases enhanced by subtle variations in value. You should strive to remember the visualization what you saw and felt - at the moment of making the exposure. - ANSEL ADAMS

Ansel was fond of remarking that the negative corresponds to the score in music, and the print to its performance. You have the opportunity to be creative at two points during the photographic process. Visualizing a fragment of the world as a photograph and organizing it within the confines of the' camera frame constitute a creative act, one that marks the beginning of communicating through images: a message has been received by you, the viewer and photographer. The print, the visual expression of your thoughts and emotions, is your communication with your audience.

The operations and processes that must take place between the moment you snap the shutter and the time you turn your attention to printmaking are mechanical and, with practice, easy to master; the development of negatives does not require complex manipulations. Similarly, the procedures, equipment, and supplies used in making a print are not particularly complicated: you can become a competent printer after only a brief learning period. Mastery of the art of printing negatives, however - *and it is an art*- depends upon your aesthetic sensibility, a sense that expands with experience.

The Printing Process

The basic steps in making a photographic print are essentially the same as those followed in making a negative. Sensitized paper (corresponding to the negative) is exposed by light passing through the negative (corresponding to the scene); a latent image is formed. The latent image is then developed following the same procedure used for processing film, but with one significant exception: since black-and-white photographic papers are orthochromatic (sensitive primarily to blue light), you can handle and develop them in trays under dim red or yellow lights rather than in complete darkness or in a developing tank. You can even use the same solutions to process the paper, though in practice slightly different formulations are more efficient.

The simplest way to make a print is to place a sheet of photographic paper on a flat surface, lay the negative on the paper, cover both with a piece of plate glass, and expose the paper by turning on a light. Prints made with this technique are called *proof sheets* or *contact prints;* is used to obtain proof sheets of negatives and fine prints from large negatives. Contact printing is also used for nonsilver photographic processes such as *cyanotypes, platinum* and *palladium* prints, and prints made with *printing-out papers,* or *POPs* (which allow an image to print out in sunlight, without chemical development).

Equipment for printing and enlarging. (a) Safelight. (b) Timer. (c) Focusing magnifier. (d) Compressed air. (e) Level. (f) Minimag flashlight and safelight filters. (g) Metronome. (h) Antistatic brush. (i) Contrast filters.

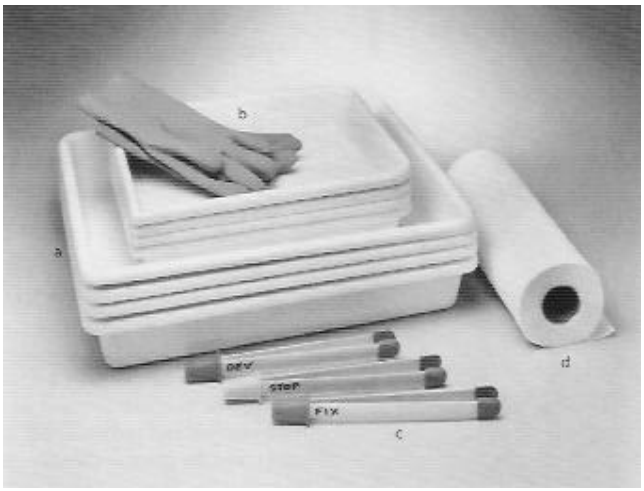
With contact printing, the image produced is the same size as the negative. To overcome this limitation, most photographic prints are made with a device called an enlarger. An enlarger is a special camera that illuminates the negative and projects its image onto a sheet of photographic paper during exposure, just as a slide projector enlarges an image and throws it onto a wall or screen. Almost any degree of magnification or reduction of image size is possible.

Equipment for Printing and Enlarging

To create a photograph from a negative, you will need printing paper, the appropriate chemicals, and some basic equipment. The following items are either necessary or useful in making photographic prints.

- Contact printing frame enlarger
- Safelight
- Contrast filter

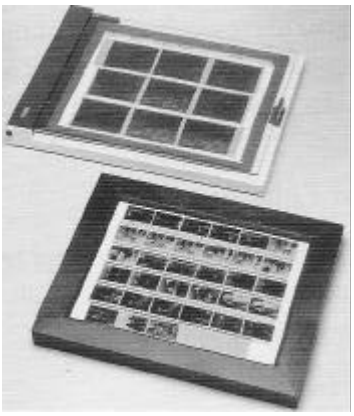
- Easel
- Focusing magnifier timer
- Antistatic brush
- Compressed-air blower
- Flashlight with safelight filter
- Dodging and burning devices print tongs
- Rubber gloves
- Paper towels
- Bucket
- Notebook and pen or pencil
- Processing trays
- Print washer
- Hypo test kit
- Drying screen
- Paper trimmer



Equipment for developing prints. (a) Trays. (b) Rubber gloves. (c) Print tongs. (d) Paper towels.

Contact Printing Frame

The simplest device for contact printing consists of some foam rubber and a piece of quarter-inch plate glass large enough to handle at least one complete roll of thirty-six-exposure 35mm film (approximately 8 X 10 inches). A 12 x 16-inch sheet of glass will suffice for paper sizes up to 11 x 14 inches. To make a contact print, lay a piece of soft foam rubber on a flat surface, position a sheet of printing paper over it, set the negative(s) in place on top of the paper, and cover the stack with the plate glass. Window glass can often be used instead, but it may not be heavy enough to press the negatives firmly into contact with the printing paper.



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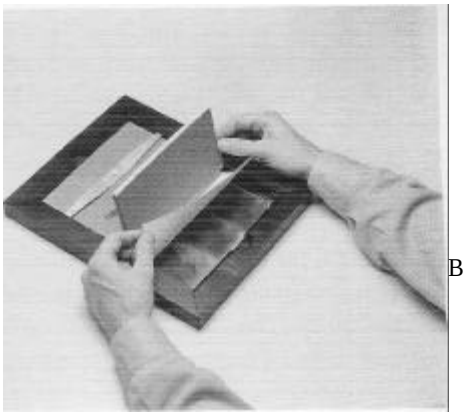

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Contact printing frames. (A) Hinged (top) and spring-backed (bottom) printing frames for making contact prints. (B) With a spring-backed printing frame, half of the frame can be lifted up while the other half remains in place. For printing processes in which a visible image is formed by the action of light alone, this allows you to monitor the progress of development while insuring that the negative and printing paper will remain in precise registration when the back is re-closed.

On a simple commercial contact printing frame, the foam and glass components are joined at one end by a hinge. The printing paper and negative(s) are placed on the foam, and then the glass overlay is lowered over the sandwich and clamped tight.

A second type of frame is made like a frame for a photograph, with a back that is hinged in the middle. The negative is positioned on the glass surface and covered with the printing paper, and then the hinged back is set in place and clamped tight. These frames are versatile and especially convenient for use with printing-out papers, as they allow you to check the degree of development by swinging back half the frame and inspecting the image.

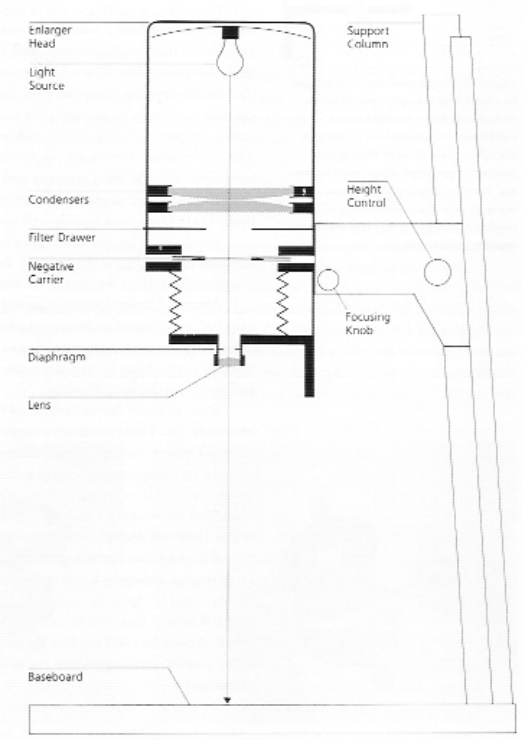
Enlargers

An enlarger is really a camera used in reverse. It consists of a light source, a condenser (optional), a lens, a negative carrier, a baseboard, and a support system. Each of these features needs to be evaluated when you are considering a purchase. Figure 8.5 is a schematic drawing of a typical enlarger.

The light source, condenser, lens, and negative carrier are all part of the *enlarger head,* which is connected to a post and can be raised or lowered to magnify or reduce the size of the projected image. Each component of the head serves a specific purpose.

Light sources: The lamp in the enlarger head illuminates the negative and exposes the printing paper. The light source has an effect on the quality of the print produced.

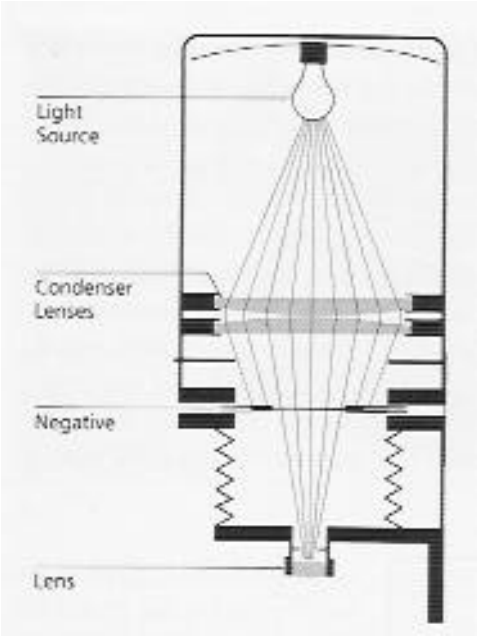
A very small, bright light used in conjunction with *condenser lenses* (which concentrate the light beam; see below) is referred to as *point-source illumination.* It functions as a spotlight and projects the sharpest image possible, with maximum contrast; unfortunately, it also reveals every flaw in the negative and exaggerates the grain of the film. Point-source enlargers are most useful for projecting line drawings and microfilm documents.



Schematic drawing of a typical enlarger

When the light source consists of a large frosted bulb located above IWO condenser lenses, the enlarger is referred to as a *simple condenser enlarger.* These enlargers project bright, contrasty images, but they also expose negative defects such as scratches, dust particles, and grain (though not to the same degree as point-source enlargers). The easiest way to minimize these minor negative defects is to use a *diffuse light source,* which can be created by inserting either a piece of milk glass or a translucent white plastic plate in the enlarger head, directly above the negative. The light from the lamp is projected onto the white plate, which then becomes a secondary, diffuse source of light for the negative - and, unfortunately, also greatly reduces the light intensity. Many older condenser enlargers come with a diffusing device as an accessory. Condenser lenses are not necessary in this type of arrangement, but since they increase the overall intensity of light reaching the negative, they can be used to reduce the exposure time. (A note of caution: Since tungsten bulbs generate considerable heat, it is important to make sure the enlarger head is well ventilated to avoid damage to the negative; most condenser enlargers also have a sheet of heat-absorbing glass that is placed above the negative to minimize heating.)

A more efficient way to convert an ordinary enlarger into a diffusion enlarger is to replace the lamp with a *cold light head,* an array of fluorescent tubes located behind a diffusion plate. Cold lights provide soft, even illumination that is excellent for enlarging and results in a print quality that many believe cannot be approached by any other system. For some time they were the light source of choice for photographers who strive to produce fine black-and-white prints, but with the emergence of modern variable-contrast papers, they are no longer as useful. .



Simple condenser enlarger head. In a condenser enlarger, a pair of lenses immediately below the light source concentrate and increase the intensity of the light passing through the negative, making the projected image much brighter and therefore reducing the required exposure time. One disadvantage of condenser enlargers is that they emphasize negative grain and flaws.

For anyone acquiring a new or used enlarger, the purchase of a dichroic or variable-contrast head is strongly recommended. Dichroic and variable-contrast heads generate cyan, magenta, and yellow light, and blend them in a mixing box. The color spectrum of the light controls the contrast of the variable-contrast papers now on the market. Simply by changing the ratio of yellow and magenta (or blue and green), the paper contrast can be made to vary from Grade 1 or less to-Grade 5.

The convenience of being able to purchase a single box of paper rather than a series with different fixed contrasts and not having to use a series of variable contrast (and image-degrading) filters far outweighs the additional cost of the head. These heads work equally well with graded papers.

Condensers: The condensers are a pair of convex lenses that focus the light from the light source on the negative. By concentrating the light, they serve to substantially increase the level of illumination.

Negative Carrier: During enlarging, the negative must be held in place in a flat and level plane; if it tilts or buckles, the projected image will not be in sharp focus. Negative carriers are metal frames that secure the negative by clamping it along its edges. After the negative is inserted in the carrier, the whole assembly is slipped into the lamp housing.

Some negative carriers consist of two glass plates that hold the negative absolutely flat. There are disadvantages to glass carriers: they attract dust, and they give rise to *Newton rings,* rainbow like optical-interference patterns that show up on enlargements. You can avoid the latter problem by adding very thin spacers between the negative and the glass to minimize their surface contact, bur unless you are working with large negatives that cannot easily be kept flat, you will be better off with glassless negative carriers.

Enlarging Lens: An enlarger should be used with a lens designed specifically for enlarging. Enlarging lenses maximize optical performance at close working distances and are optically corrected to project the image in a flat plane, unlike a typical camera lens. You should buy the best-quality enlarging lens you can afford. A poor lens will produce an image that is not sharp at the corners and edges, and this can compromise the investment you have made in your camera equipment.

High-quality enlarging lenses are coated to minimize lens Rare and thereby enhance image contrast. For color enlarging, it is important that your lens be *color-corrected;* otherwise, light rays of different colors will not focus in the same plane. A lens that is not properly corrected will produce a photograph with poorly resolved edges at the junction of such colors as red and blue.

When you buy an enlarging lens, make certain that it has sufficient covering power to project the entire negative image with minimal fall-off of light intensity at the corners. It is generally wise to use as long a focal length as practical when enlarging; this insures reliance on the central part of the lens, where resolution is highest. However, lenses of long focal length require greater bellows extension on the enlarger and increase the distance needed between the enlarger head and the printing paper. These are often limiting factors in the choice of an enlarging lens. Table 8.1 gives suggested focal lengths according to negative format.

Recommended Focal Lengths for Enlarging Lenses

Like camera lenses, enlarging lenses project the sharpest image with the greatest contrast when set at two or three stops below their maximum aperture.

General Considerations: Most enlargers can accommodate only a limited number of negative sizes - for example, a typical brand will normally accept negatives from 35mm up to 6 x 6 cm *(2V>* inches square). A 4 x 5 enlarger can be used for any negative up to and including 4 x 5 inches. Although you can purchase an enlarger made specifically for the 35mm format, if you later decide to move up to a medium- or large-format camera system, you will have to buy a new enlarger as well. It makes more sense for you to get an enlarger for a bigger format in the first place if there is any possibility of your scaling up in the foreseeable future.

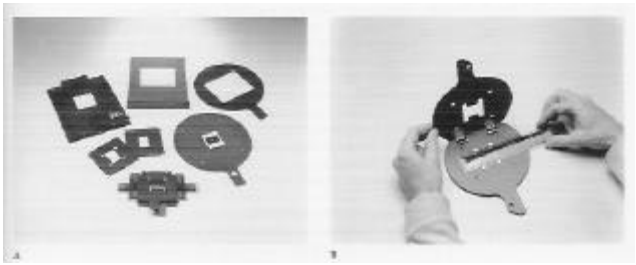
With any enlarger, physical stability is a primary concern. Make certain that the center post is sturdy, or that the supporting struts are strong. The enlarger head should be firmly mounted on its support. You can check this by placing a negative in the carrier, turning on the enlarger light, and then tapping the lamp housing with your finger. If the projected image vibrates excessively, tighten the appropriate screws and nuts. If this does not solve the problem, look for another enlarger.

If your enlarger rests on top of a table or bench when you use it, be sure the support itself is steady. If passing traffic or footsteps cause the enlarger to vibrate, your prints will not be sharp. Stiff rubber padding placed under the enlarger will help to dampen any vibrations.

Negative Format	Focal Length
35mm	50mm
2 ¼ X 2 ¼ inches	80mm
2 ¼ X 2 ¾ inches	90-100mm
2 ¼ X 3 ¼ inches	105mm
4 X 5 inches	150mm
5 X 7 inches	210mm
8 X 10 inches	300mm

Another important quality is ease of adjustment. The lamp housing should move freely up and down the supporting frame, and it should be easy to make fine adjustments in the position of the head and in the lens-focusing mechanism.

When the enlarger is assembled, it is imperative that the planes of the lens mount, the negative carrier, and the baseboard be parallel. Significant deviations can create focusing difficulties or distort the shape of the image. Use a small carpenter's level to check the alignment of the planes. Static electricity acts like a magnet for dust and is a particular problem when the humidity is low. By grounding your enlarger, you will avoid a buildup of static electricity.



Negative carriers. (A) Devices to clamp the negative in position in the enlarger are provided by the enlarger manufacturer. Some carriers have glass plates that sandwich the negative and prevent it from buckling. (B) After thoroughly cleaning both the

negative and the carrier, place the negative between the guides and clamp it in place by lowering the hinged top of the carrier.

Safelights

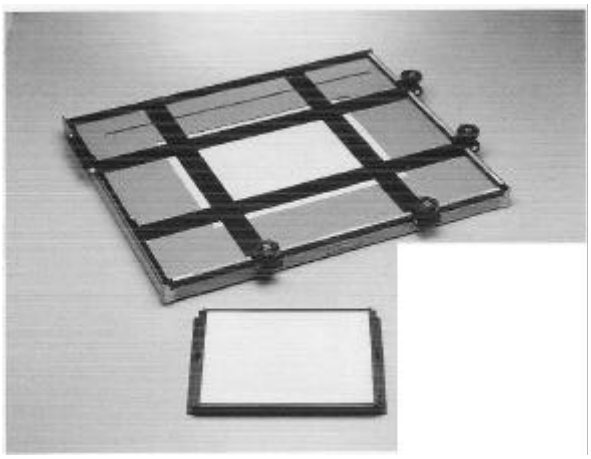
Most graded photographic papers are sensitive to blue light, not yellow or red. This allows you to light your darkroom with red or yellow *safelights* and do all of your black-and-white printing in reasonably well-lit surroundings. Two types of safelights work well. The simplest and least expensive kind consists of a lamp housing that accepts Kodak's or other brands of safelight filters. The lamps are designed to be used with a I5-watt tungsten light bulb and should be located at least four feet away from the paper. A couple of lamps - one near your enlarger, one near your developing trays - will generate a pleasantly lit working environment to which your eyes will quickly accommodate.

A very high level of illumination can be obtained with another type of safelight, a sodium vapor lamp designed especially for the darkroom. The lamp is hung from the ceiling, and its bright yellow light is directed upward and reflected. These lamps can *fog*, or partially expose, some papers, though, so you will need to test each paper before printing

If you use variable-contrast papers, *be sure to follow the manufacturers recommendation* on safelights; lights that are suitable for use with graded papers (e.g., sodium vapor lamps) will often completely fog a variable-contrast paper. Do not be tempted to save money by using colored cellophane or gels - safelight filters are specifically designed to keep you from wasting printing paper!

Contrast Filters

Variable-contrast printing papers require the use of special filters to control the contrast of the image. If your papers need filters, insert them *above* the negative if at all possible, not below. Filters located immediately above or below the enlarging lens can cause sufficient distortion of the projected image to degrade the effective quality of the lens itself. When placed above the negative, on the other hand, filters have no effect on the focus or the optical characteristics of the image. High-quality thin gel filters are best for this purpose and cause minimal distortion of the image; In any case, be sure to focus your image on the surface of the easel with the filters in place, as they can cause a significant shift in the focal plane. As mentioned above, a dichroic or variable contrast enlarger head does away with the need for contrast filters and accomplishes the same objective far more easily.



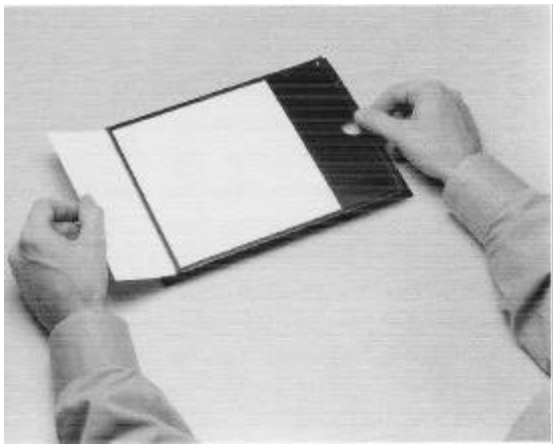


Figure 8.8: Enlarging easels. (A) The Saunders four-bladed easel (top) enables you to set the location and width of each print margin individually. The edges of a single-size easel (bottom) form a nonadjustable border for the print. (B) To load a single-size easel, insert the printing paper into the slot at either end.

Easels

The easel is a piece of equipment used to hold the printing paper in place on the baseboard of the enlarger during exposure. The best easels have adjustable blades that serve as a framing device and enable you to mask off parts of the image and define the edges of the photographic print you will ultimately make. When purchasing an easel, you should check the blades at several settings to make certain that they meet at right angles; take a square or a large sheet of graph paper along with you to test this before you buy.

Four-bladed easels are the most versatile kind because they allow each blade to be adjusted independently, meaning that the width of each border on the print can be individually set. Saunders and Kostiner are two companies that produce high-quality easels of this type.

Two-bladed easels, which have two fixed and two adjustable margins, are less expensive than four-bladed models but force you to work with at least two thin margins of 14 inch each.

Wider margins offer greater protection to the print surface and are frequently desirable for aesthetic reasons.

Single-size easels such as the Speed Ez-EL are available in sizes from 4 x 5 to 16 x 20. The major disadvantage of these is that they allow no cropping of the image unless you are prepared to trim the photograph to size after enlarging. Moreover, for the larger sizes, the curl of the enlarging paper can make it difficult to insert it into the easel.

The surface of any easel should be painted either yellow or black to reduce the possibility of back reflection and fogging with single-weight papers. Alternatively, you could use a thin sheet of dark paper and insert it beneath a single-weight sheet of enlarging paper.

Timers

Accurate timing of exposures during printing and development is essential if your trial exposures are to be useful and if you want to make several prints that are identical. Digital timers are far more accurate than mechanical or electric interval timers and are capable of reproducing exposure times to within 1/10 second. The more sophisticated digital timers can be configured to turn off safelights during exposure and to time the development of prints (the latter can also be accomplished with the interval timer with which you monitor development).

A problem with using a timer to control print exposure is that Operations such as burning and dodging are difficult to monitor unless you reprogram me timer for each step - and this quickly gets to be a nuisance. A more serious concern is that accurate timing is important only if you can be confident that the light intensity emanating from the enlarger is constant throughout the exposure and your printing session - which is more often the exception rather than me rule. Unless the enlarger head is warm, the light intensity in a cold darkroom can increase dramatically as the lamp heats up during an exposure. One solution to the problem of variable light intensity is to turn the enlarger light on well before you begin to work and leave the enlarger light on during the entire printing session. Expose the print by removing the lens cap while shielding the paper with a sheet of cardboard, then move the cardboard aside to expose the paper. Terminate the exposure by reversing the steps.

Metrolux II enlarger lamp monitor. The light intensity emitted by most enlargers will vary dramatically as a function of bulb temperature. The Metrolux II is used in place of a timer and consists of a probe, inserted directly into the enlarger lamp housing, that constanly monitors light intensity and controls the specified quantity of light (Lux) delivered by the enlarger rather than the number of seconds of exposure. The device ensures that all of your exposures will be consistent from print to print

An elegant way to achieve reproducible exposures is to insert a light _ into the enlarger head to measure and control the enlarger's *total light output.* Red-light Enterprises manufactures a device that does this. *Units of light (Lux)* are keyed into a box that looks and operates like a digital timer but monitors exposure units instead of time. In another mode the unit also functions as a traditional timer. It is a worthwhile investment if you intend to do much black-and-white or color printing.

Metronomes

In this age of digital controls the metronome remains a highly useful monitoring device for printing. An inexpensive audible metronome can be purchased at any music supply store. Set it to one beat per second and you will be free from the necessity of watching a clock dial or repeatedly pressing timer buttons as you expose, dodge, and burn a print. It does require that you count the beats when you make test strips and during exposure of the image - a practice that will soon become second nature to you. After the basic exposure and dodging of the paper has been completed, "burn in" areas of the print that require additional exposure, then cover and cap the enlarger lens. A simple sketch of the photograph on a sheet of paper with notes can be used as a record of the burning and dodging pattern needed. A metronome has the virtue of making basic exposure, dodging, and burning operations easily controllable and repeatable.

Processing Trays

Black-and-white photographic paper can be conveniently processed in trays made especially for this purpose. Plastic trays

are inexpensive, impervious to chemicals used in the darkroom, and easy to clean; many have ridges or troughs on the bottom that make it easier to pick up prints and negatives. You should acquire several sets for use with various print sizes.

It is important that you get into the habit of cleaning your trays and the inside of the sink thoroughly when you finish working. With the possible exception of the fixer, you should discard all solutions at the end of a printing session: the few cents you might save by recycling them cannot justify the risk of a print's being flawed by chemical contamination. One sound procedure is to pour the developer out into the sink, empty the stop bath into the developer tray, and then rinse each tray with hot water and stand it on end to drain and dry. Stainless steel trays are excellent and virtually indestructible, but very expensive. Kitchen-supply stores often carry used stainless hot trays that are suitable for darkroom use.

Print Washer

Washing prints after processing is one of the most critical steps in printmaking: if you fail to remove the excess fixer, the image will fade over time. Because nothing visible happens during the wash cycle, it is easy to lull yourself into complacency, but what you don't see may come back to haunt you if your washing is not thorough.

There are two basic kinds of equipment that you can use to wash prints. The least expensive and least satisfactory device consists of a *tray and siphon.* A Kodak tray siphon clips to the side of a tray and is connected to your faucet by means of a hose; when you turn the faucet on, the tray fills with water, then drains. The stream of water provides some agitation as it enters the tray, but unless you are prepared to shuffle prints every few minutes, you should not attempt to wash more than one at a time. Prints that stick together in the wash water will not be adequately cleared of hypo. If you are developing several prints you will probably find it easier to place each in a separate tray and change the water every five minutes until a test with *Residual Hypo Testing Solution (HT-2)* is negative. Test a print by cutting off a small corner of the margin, blotting its surface, and, in subdued light, putting a small drop of HT-2 on the emulsion. If a brown or yellow stain forms immediately, further washing is necessary.)

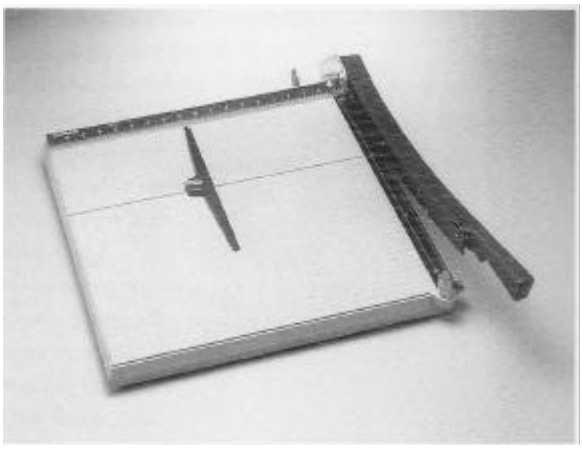
Drying

Screen After prints have been processed and washed, they must be dried. The simplest and safest way to do this is to place the drained print facedown on a clean plastic-mesh screen. You can have screens made to your specifications at most hardware stores. A convenient size is 22 x 44 inches; this will accommodate two 16 x 20-inch prints or up to ten 8 x 10 prints. Several screens separated by spacers will handle as many prints as you are likely to make in a single darkroom session. The screens should be washed occasionally with a brush and soap and water to insure that they remain absolutely clean.

Paper Trimmer

Various types of trimmers are available and suitable for darkroom use. Rotating-wheel trimmers are the safest kind and are excellent for trimming photographic paper, prints, and dry-mount tissue, though they are not sturdy enough to cut through mounting board. Heavy-duty blade trimmers can serve both purposes, but you must beware of poorly constructed models, which will cause prints to "creep" while you are trimming, making it almost impossible for you to cut a clean edge or a straight line.

Kutrimmer and Dahle trimmers are both well made, and each includes a pressure bar that clamps the paper or mat along its entire edge to prevent "creeping." On any trimmer, the pressure bar should be wide and padded underneath to avoid leaving any indentations and to hold the paper firmly in place. Before you begin to cut anything, always check the pad to make certain that it is free of any grit that might mar the surface of a print - dents are highly visible and cannot be repaired.



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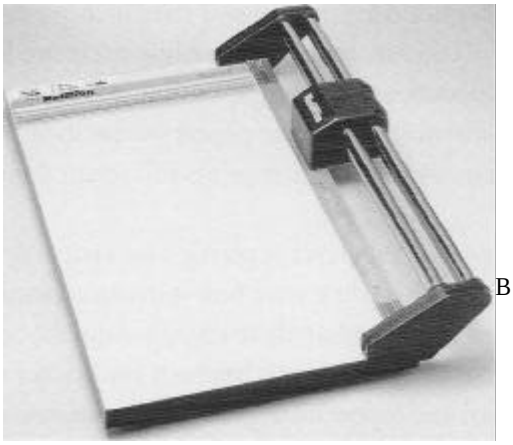


B

(A) Rotary trimmer. The Rotatrim cutter is a safe and precise tool, suitable for use on photographs, mounting tissue, and light Weight mounting board. A transparent plastic straightedge allows easy positioning of the material being cut and holds it firmly in place during cutting. The shielded blade sharpens itself as it cuts.

(B) Blade trimmer. Paper cutters that use a cleaver Knife are suitable for trimming paper or heavy mounting board. To avoid the crooked edges that could result if the paper were to shift during cutting, it is helpful for the trimmer to have a pressure bar to hold the paper securely in place.

Paper trimmers that lack suitable blade guards can cause serious injury and must be used with extreme caution.

Miscellaneous Items

As you gain experience in the darkroom, you may want to try out some of the many useful gadgets on the market . Every photographer swears by one or more "indispensables" that others deem totally useless; the following are some items - both exotic and practical- that you may wish to think about including on your own "must-have" list.

Antistatic brushes help to remove surface charges from film and glass carriers. When the humidity is low, it is almost impossible to remove the last traces of dust without one. Kodak makes a helpful static-eliminator unit, and small brushes containing polonium cells are also excellent but you must be sure to follow the instructions and precautions for the use and disposal of the latter.

Compressed-air blowers can be useful for clearing dust particles from me surface of a negative, but often they stir up as much dust as they remove. Some contain freon as a propellant and are therefore a serious environmental hazard - *do not use these!* Cleaning the area around your enlarger with a small battery-powered shop vacuum is an excellent way to minimize dust accumulation **on** your negatives.

A *small flashlight with a safelight filter* can be very handy. It will allow you to find things easily in the dark and let you check aperture settings on your enlarging lens without turning the lights on. You can either buy a flashlight designed especially for the darkroom or make one yourself by taping a red filter over an ordinary flashlight lens. Some "mini-mag" lights come with filters.

In most prints, certain areas will require either more or less light than they would ordinarily get through a simple exposure of the negative. Odd-shaped scraps of cardboard or old sheets of paper with holes in them can be used to "dodge" (hold back light from) or "burn" (selectively expose) a portion of the scene. ***Dodging and burning devices*** can be made out of wire clothes hangers or baling wire and tape or scraps of thin cardboard.

The best way to process and deal with wet prints is with your hands. The gelatin surface of a wet piece of photographic paper is very fragile and must be handled gently. ***Tongs with rubber tips*** can be used to grasp single prints if you take care not to damage the emulsion, but they are impractical when you are developing a stack of prints or working with papers larger than 8 x 10 inches.

A small percentage of people are allergic to metol, an important component of many developers. The substitution of a developer that contains phenidone instead will often solve the problem. If not, ***thin rubber gloves*** may help with allergic reactions, though they can make it difficult to hold prints, and perspiration inside the gloves can be an irritation in itself Generous use of a hand cream such as Kerodex at the end of a darkroom session is recommended, but be careful not to handle your prints with greasy fingers!

Inexpensive ***cotton hand towels*** and a supply of *paper towels* are needed in a darkroom. Printing requires frequent immersion of your hands in various solutions, and it is important to avoid cross-contamination. Rinse, wash, and dry your hands after each contact with darkroom chemicals and solutions and launder towels after every darkroom session. Use a cellulose sponge to wipe up spills before they dry and leave stains that are difficult to remove.

A ***notebook*** is a vital accessory. Write down data for each enlargement you make, noting print size, aperture setting, exposure time, rough details of dodging and burning requirements, type of enlarging paper used, developer, and so on. All of this information is useful and will make it easier for you to reprint the, negative later.

Notes

LESSON 15
PHOTOGRAPHIC PAPERS

Photographic Papers

Photographic films and printing papers are fundamentally similar. The only real difference between the two lies in the support used for the emulsion transparent plastic versus paper stock. In black-and-white photography, the photographic print is the final expression of your visualization, and the printing paper you choose is a key element in how effectively that visual message will be conveyed to the viewer. When selecting a paper, you should consider the following variables.

Paper Stock

All modern photographic papers belong to one of two basic types: they are either fiber-based or resin-coated.

Fiber-based papers are high-quality rag papers that incorporate certain fillers and optical brighteners. They vary in tone from white to cream. Paper can last for centuries, and properly processed photographs should be able to endure for as long as the paper they are printed on. The papers we use today were first introduced in the 1880s, and many of those first prints still retain their original qualities.

Resin-coated (RC) papers have a thin layer of plastic over a paper or polymer base to make them waterproof When they were first introduced in the 1970s they proved to be unstable, and the images on them degraded quickly, especially if they were exposed to light. Significant progress has been made since then, bur tests still indicate that RC papers and images undergo serious degradation over time. They should not be used to make fine prints.

In terms of convenience, RC papers are a pleasure to work with: processing is rapid and they are ideal for making proof or study prints. A good strategy is to use RC papers while you are learning how to print and in situations where prim permanence is not a concern. When you think you have an image that deserves to be hung on the wall and appreciated by future generations, print the photograph on a fiber-based paper.

Paper Surface

Photographic emulsions and papers are formulated to produce glossy surfaces, matte (dull) surfaces, or some variation thereof in the final print; some papers are even textured to look like canvas. Much of the impression that a print makes depends upon its surface characteristics. Air-dried glossy papers and papers with a matte finish are preferred by most photographers who want to make serious statements through their images.

The print surface has a direct effect on the "feeling of light" conveyed by the image. When we view a print, what we see is reflected light; thus, a glossy print will seem more "brilliant" than a matte print of the same image. Similarly, the "black" of a dry glossy print will appear to be much "blacker" than that of a dry matte print, although the two may look identical if they are compared when wet. Closely related tones, especially at the darker end of the scale, are more difficult to distinguish on matte-surface papers. For some images this may be appropriate; for others it may not. In the end, the choice of paper surface is an aesthetic decision that should reflect your personal taste.

Paper Weight

Printing papers are manufactured in *single* (5), *medium (M)*, and *double (D)* weights. Single-weight papers are less expensive than double-weight but require extreme care when they are wet to prevent them from creasing or tearing. They must be handled with your fingers, not with tongs. Single-weight prints need less washing time than double-weight prints, but they must be dried between blotters or on a heated drum; with no such restraint, they will curl unmercifully.

Medium-weight papers are usually confined to RC stock; they behave more like double- than like single-weight papers. Double-weight papers can withstand the rigors of normal processing and handling. Prints made from them require extensive washing but tend to be more durable than single-weight prints.

Image Tone

Black-and-white prints can have very subtle but distinctive colors ranging from brown to cold blue. The "white" paper base varies according to the manufacturer, and may be any shade from neutral white to ivory or buff; the hue of the print itself, moreover, can be altered by means of post development toning procedures.

The tint of a black-and-white image, like the print's other surface characteristics, strongly influences the impression that the photograph makes on the viewer. Ansel found that cold black tones deepened the emotional impact of his photographs; he used Rapid Selenium Toner to achieve the image tone he favored. Decisions regarding print tones are personal and should reflect your own aesthetic - but bear in mind that certain toning processes can cause the image to fade in time, and make your choice accordingly.

Paper Speed

Like film speed, the inherent speed of various photographic papers can be measured. Paper speeds are published as ANSI numbers, but unlike ASA or ISO numbers, these are seldom used by photographers or printers. Exposures are best determined by trial-and-error methods, since in making an expressive print, you are striving to create a mood, something that cannot be measured with an exposure meter.

Paper-speed numbers can be marginally useful if you decide to make a print on another type of paper (perhaps one with different contrast characteristics) after you have determined the proper exposure time for one type. By comparing the relative paper speeds, you can calculate the required adjustment in exposure time (for example, if the new paper has twice the speed of the first, half the exposure time will be needed). In

practice, however, you will find that it takes longer to do the calculations than to make a new test print!

Paper Contrast Grades

As photographic enlarging papers evolved, manufacturers discovered that by altering the formulation of the emulsion, they could control a paper's *inherent contrast.* Thus, prints made on *low-contrast* paper that has been given four, eight, and sixteen seconds of exposure may show even steps of gray ranging from white to mid-gray, while an identically exposed *high-contrast* paper will produce three steps varying from white to mid-gray and black.

You can purchase papers in contrast grades from 1 (lowest contrast) to 6 (highest contrast), though not all grades are available for all types of paper. Grade 2 is generally considered to be *normal contrast*, but since there is no universal industry standard, you may find that a Grade 2 paper of one brand is approximately the same as a Grade 3 paper of another. For a given brand, however, the range of contrasts will be internally consistent.

You can also modify paper contrast through your choice of developer. This capability, combined with the many options available in contrast grades, provides you with a powerful creative control to exercise in printmaking.

For many photographers *variable-contrast papers* are now the preferable alternative to individually graded papers. They come in both resin-coated and fiber-based formats. Multiple-contrast papers have a blend of two emulsion (one high-contrast, the other low-contrast), each containing dyes sensitized to respond to a different part of the visible spectrum. By altering the color balance of the enlarging light with filters or using a *color head* (a variable-color light source), you can change the effective contrast grade of the paper. *(Note:* Because variable-contrast papers are sensitive to a wider spectrum of light than most other papers, you need to be certain that your safelights will not fog them.

Variable-contrast papers can be especially useful when you are learning to print, as they will save you from having to buy several different-contrast grades of the same brand of paper.

Notes

LESSON 16
CHEMICALS FOR PRINTING

Chemicals for Printing

The chemistry of development for photographic papers is the same as that for film, except that an extra step - *toning-is* sometimes added to alter the print color, intensify the blacks, and insure the permanence of the image.

Image contrast can be influenced by the temperature of development; for optimal processing, the temperatures of all the solutions should be kept near 68° F. *As* a practical matter, if your darkroom is within a temperature range of 65-75 ° F while you are printing, no additional efforts at temperature control will be necessary. If the ambient temperature is significantly higher or lower than this range, place the tray of developer in a larger tray of water (again, as close to 68° F as possible) to regulate its temperature. *As* long as they remain within reasonable limits, the temperatures of the other solutions are not critical.

Developer

The components of paper developers are essentially the same as those of film developer, though the formulations differ considerably. Virtually any printing task can be accomplished through the judicious use of one or both of two proprietary formulas such as Kodak's *Dektol* and *Selectol-Soft,* both low-contrast developers. The mixing of developers in varying proportions affords considerable contrast control during enlarging. Until you become highly skilled at making prints, you should restrict your use of print developers to these two or any other comparable pair that you can obtain commercially.

Dektol, in a standard dilution with water of 1:2 or 1: 3, gives what we define as normal contrast with a development time of2 to 3 minutes at 68° F. A quart of Dektol diluted with three quarts of water *can* develop sixty-four 8 x 10-inch prints or sixteen 16 x 20-inch prints, but it is never wise to use solutions to the point of chemical exhaustion. With Selectol-Soft, one ounce of stock solution, diluted 1: 1 or 1: 2, is required for each 8 x 10 print.

Excellent developers are offered by Ilford, Agfa, Cachet, Edwal, and others and may work especially well in combination with a specific paper. Photographers have historically liked to tinker with darkroom and developer formulas, often mixing chemicals from their basic components and insisting that Amidol or "Beer's Formula" or some other concoction works better than anything else. The truth is that all developers ultimately accomplish the same task, with only subtle nuances differentiating the final result. At the early stages of learning how to make a print it is best to stick with one or two basic commercial formulations.

Stop Bath

Development is terminated when the print is submerged in a stop bath consisting of a 1- to 2-percent solution of acetic acid. If you use 28-percent acetic acid as a stock solution, mix 1 V2 ounces with 1 quart of water. If you use glacial acetic acid, prepare the 28-percent acetic acid stock solution by mixing 3 parts of acid with 8 parts of water - *but be sure to add the acid to the water, not the other way around!* Some photographers simply pour a "dash" of glacial acetic acid into water to make the solution, but this is a bad habit to get into: while the exact concentration of acetic acid in the stop bath is not critical, it is always best to measure.

Fixer

"Fixers" dissolve undeveloped silver salts, which are then washed from the print. Kodak Fixer is a powdered blend of sodium thiosulfate and an alum hardening agent that toughens the gelatin to prevent scratching or peeling of the surface of the print during processing. Unfortunately, hardeners also inhibit toning and increase the required washing time. Unless you are forced to keep prints soaking for an extended period of time or use wash water at temperatures above 80° F and experience emulsion damage during print handling, *use an ammonium thiosulfate fixer without adding the hardener*.

Ilford Universal Fixer, Edwal Quick Fix, Kodak Rapid Fixer, Heico NHS Fixer, and Agefix Rapid Fixer are all ammonium thiosulfate-based products and work very well as print or negative fixers. Fixing and washing times are markedly faster with these products and archival permanence is easy to achieve when you follow the procedure detailed in the subsequent text.

Washing Aid

Washing aids, "or hypo clearing agents, accelerate and promote the elimination of fixer from the paper and the emulsion and in so doing substantially decrease washing time. Since paper is highly absorbent, this is an *extremely* important step in the post fixing treatment of the print.

Toner

Toners serve the dual function of adding color and depth to black-and-white photographs and protecting them from the elements.

Sulfide toning converts the print to a brown or sepia color, and the image is permanent. The process is used primarily by studio photographers for portraiture or for "old-time" effects.

Selenium toning causes a shift in print color to a cool black tone, or a red-brown hue if the toning is prolonged or if warm-tone papers are used. Selenium toning is inexpensive, and the toner can often be added to the washing aid, thereby saving you an extra step.

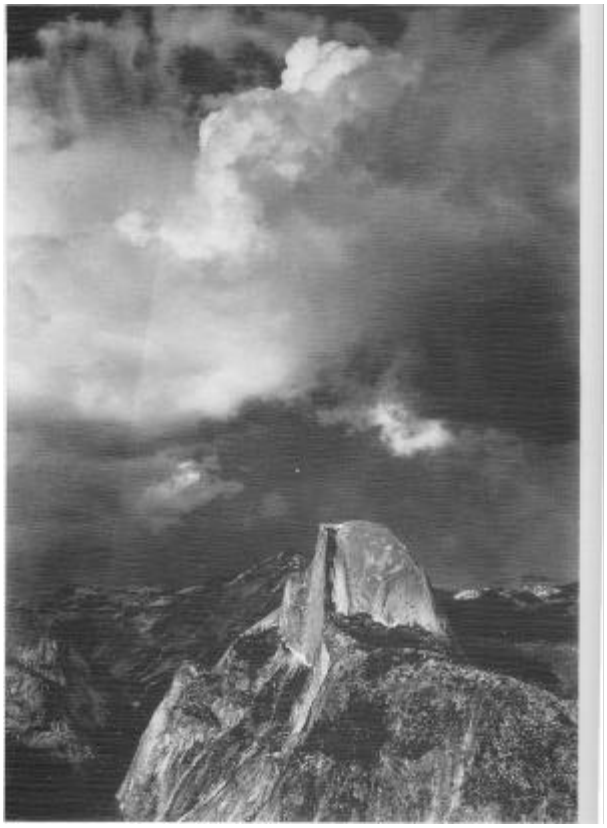
Gold toning produces a blue-black print color, but with some warm-tone papers tones ranging from red-brown to blue-black can be obtained by controlling the duration of toning and alkalinity of the bath. Gold toning enhances print permanence.

A number of toners on the market convert black-and-white prints to various colors. These should be used with caution

since they often degrade the image over time and can easily result in a print that is "kitschy."

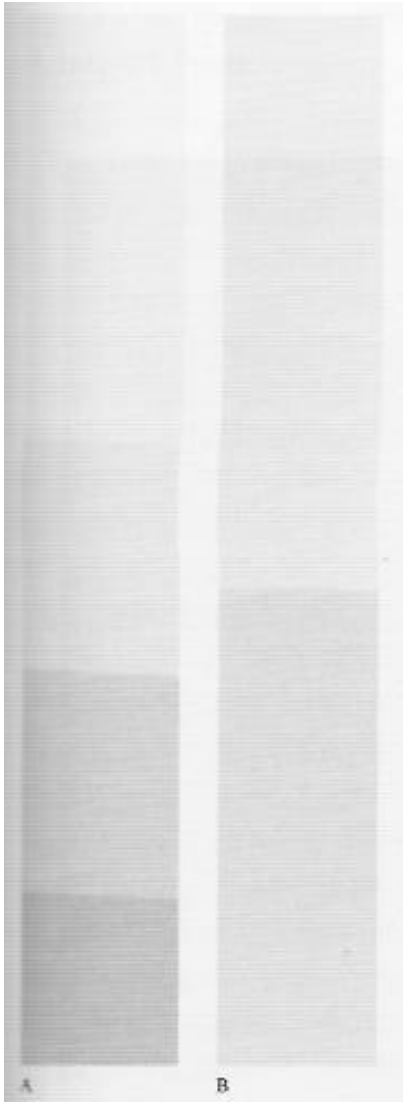
Testing Your Safelights

Safelights should be bright enough to enable you to see well in the darkroom but not so bright that they fog your printing paper. Fogging is most obvious in the highlight areas of a print, where light grays are degraded to darker grays. The following tests will help you determine whether the intensity of your safelights is too great. The ease of processing offered by RC papers makes them an ideal choice for these tests and for proof prints.



Effects of safelight fog. The left third of this image illustrates the problems caused by too-bright safelights. Fogging primarily affects the lighter tones, degrading brilliant highlights to grays. (Ansel Adams, Half Dome from Glacier Point, Thunderstorm, Yosemite National Park, 1947)

1. Place your package of printing paper, a scissors or paper trimmer, and a sheet of opaque cardboard (about 11 x 14 inches) near the enlarger. **Turn off all the room lights EXCEPT for the safelights.**
2. Remove a single sheet from the package of printing paper and cut it into a series of strips about 1 inch wide. Put all but one of the strips back in the package and reseal it.
3. Place the strip of printing paper in your contact printing frame, emulsion (shiny) side up, and close the frame. Center the frame directly below the light source and cover it with the sheet of cardboard.
4. Make a series of exposures in steps of 5 seconds as described in the procedure for making a proof print, leaving an unexposed segment at the end of the strip.
5. Develop and fix the test strip: At the same time, put an unexposed, undeveloped strip of paper directly into the fixer; this will serve as a reference for the *paper-base white tone.* Halfway through fixing, you can **turn on the room lights.**
6. Examine the exposed strip Look for a segment that is just slightly off-white and darker than the unexposed section. Note the exposure time of that segment. If all of the segments are too dark, repeat the experiment, bur this time stop down the enlarger lens further, raise the height of the enlarger head, or use shorter increments of exposure.
7. **Turn off all the room lights EXCEPT for the safelights** and remove two strips from the package of printing paper.
8. Place the two strips in the contact printing frame and expose them simultaneously for the amount of time required to produce the off-white tone.
9. Cover half of each of the exposed strips with the sheet of cardboard and allow them to remain on the baseboard for 3 minutes, illuminated only by the safelight that normally covers that area.
10. At the end of the 3 minutes, put one of the strips back in the package to protect it from further exposure, then develop the other strip **with the safelights on.**
11. **Now turn off all the safelights.** Remove the second strip from the package and develop it.
12. When processing is complete, **turn on the room lights** and examine both strips. If they look identical and there is no difference between the two ends of each one, your safelights are safe to use as they are. If the strip that was processed in the dark is lighter than the other one, the safelight over your processing trays is too bright; move it farther away from the trays, or use a bulb with lower wattage. If the two ends of each strip do not match, the safelight near your enlarger or light source is too bright; move it farther away from the baseboard and repeat the experiment until no difference is visible.



Testing for safelight fog. (A) Test exposures to determine the exposure time needed to obtain a light-gray tone. The exposures correspond to 6, 12, 15, 20, and 25 seconds, from top to bottom. (B) A strip that was exposed for 12 seconds, then covered and further exposed to a too-bright safelight.

Printing Proof Sheets

No one is a complete photographer until he or she gains a fundamental knowledge of darkroom practice. This course is designed to provide students with that knowledge. It covers the basic aspects of black-and-white film processing, printing, and enlarging. Students who finish the course should be well acquainted with the functions and purposes of darkroom equipment and darkroom procedures. Moreover, students should be able to complete all the steps in black-and-white photography by themselves, from purchasing the film to mounting the finished print.

Students need no prior knowledge of darkroom techniques, but they will need some previous picture-taking experience. Students who have completed the course in Basic Photography are well qualified to take this course. They will also need a camera and several rolls of black-and-white film.

Students also will benefit from reading some of the Glossary of Photographic Terms. You will find that the course will progress more smoothly if your students have some understanding of the material to be covered at each meeting. Near the end of the course, some students may wish to practice in the darkroom during time other than meeting time. In this case, try to arrange some period when they can use the darkroom with or without supervision. There are good reasons why your class should be fairly small. First, each student should have access to all the necessary equipment. (Ideally, there should be an enlarger for each student; but if this is impractical, several students can share each enlarger.) Second, as darkroom practice in the beginning stages requires individual supervision, you won't want to spread yourself too thin. Ten students is reasonable.

Instruction (Making Proof Sheets)

Demonstrate making a proof sheet* and let each student make one. Have some negatives on hand, with a good proof sheet for quality comparison. Also, have all the necessary chemicals prepared.

*Making a proof sheet — If you've processed your own film, you have already prepared the stop bath and fixer. Mix the developer according to the instructions. Be sure to label jars as DEKTOL Developer, Stop Bath (or Stop), and Fixer. Make up a working solution by diluting your prepared developer with water as recommended on the package. Pour it into a jar labeled DEKTOL Developer and start with step 2.

Step 2 — Stabilize the developer at 68° F (20° C) by pouring about 32 oz (946 mL) into your graduate and placing it into a tray of cool or warm water. Next pour it into a tray labeled Developer to a depth of about 1/2 inch.

Step 3 — Stabilize the stop bath at 65° to 75° F (18° to 24° C) and pour about 1/2 inch into a tray labeled Stop Bath or Stop.

Step 4 — Stabilize the fixer at 65° to 75° F (18° to 24° C) and pour about 1/2 inch into a tray labeled Fixer. Note: It's a good idea to rinse your graduate after steps 2, 3 and 4.

Step 5 — Arrange your trays in front of you so that, from left to right, you have developer, stop bath, and fixer. Then rinse your hands well and dry them thoroughly. Turn off all lights except for the safelight. The safelight should be placed at least 4 feet from your working area.

Step 6 — Open the package of paper, remove one sheet, and close the package again so that light can't get in. Place your negatives so that their dull side faces the emulsion (usually shiny) side of the paper. The negatives should be near the light source. Cover with glass.

Step 7 — If you're using a printing frame and a 7-watt bulb to make your proof sheet, hang the bare bulb 2 feet above the frame and turn it on for about 10 seconds. You may have to experiment a bit (see step 12) to get the correct exposure time for your negatives.

Step 8 — If you're using an enlarger, place the empty negative carrier in the enlarger, and set the lens at *f*/11. Adjust the enlarger so that the light covers an area just a bit larger than your paper. Expose for about 8 seconds. Again, you may have to experiment to get the correct exposure time.

Step 9 — Remove the paper from your printing device with your left hand (don't get the right one wet with developer) and slide the paper, emulsion side up, into the developer (left-hand tray). Rock the tray gently for 1 minute by tipping up first one end, then the other.

Step 10 — Take the paper out of the developer with your left hand, and after letting it drain for a second or two, slide it into the stop bath solution (center tray). Agitate the tray for 5 seconds in the same manner you did in step 9.

Step 11 — With your right hand, withdraw the paper from the stop bath and slip it into the fixer. Agitate frequently for 2 minutes, and keep it separated from any other prints in the tray. After the print has been in the fixer for 25-30 seconds, you can turn on the room lights.

Step 12 — Examine your proof sheet and if most of the pictures seem too light, try again with double the exposure time you used at first. If most of the pictures seem too dark, use half the exposure time. It's a good idea to keep notes on your exposure times and the results. You'll soon be able to come up with a good average exposure time to use.

Step 13 — Using your fourth tray, wash the print for only 4 minutes at 64° to 75° F (18° to 24° C). The KODAK Automatic Tray Siphon provides continuous agitation.

Step 14 — Sponge or squeegee the surface water from both sides of the print and place it onto a flat surface to dry at room temperature.

Assignment

Have each member expose a roll or cartridge of black-and-white film and have it processed and a proof sheet made professionally unless he/she already has such a roll of film from a previous course in photography. Each time your students complete a picture-taking assignment, have them enter in a small notebook pertinent data such as lighting conditions, film speed, lens opening, and shutter speed (if an adjustable camera was used). This information will be helpful later when students begin other picture-taking assignments.

Notes

GLOSSARY FOR PHOTOGRAPHIC TERMS

Aberration

(1) Something that prevents light from being brought into sharp focus, disenabling the formation of a clear image.

(2) Lens flaw - the inability of a lens to reproduce an accurate, focused, sharp image. Aberration in simple lenses is sub-categorized into seven types:

Astigmatism - lines in some directions are focused less sharply than lines in other directions,

Chromatic aberration or ***Axial chromatic aberration*** - different wavelengths of light coming into focus in front of and behind the film plane, resulting in points of light exhibiting a rainbow-like halo and reduction in sharpness,

Coma - the image of a point source of light cannot be brought into focus, but has instead a comet shape,

Curvilinear distortion - distortion consisting of curved lines,

Field curvature - the image is incorrectly curved,

Lateral chromatic aberration also known as ***Transverse chromatic aberration*** - variation in the magnification at the sides of a lens (this aberration type used to be termed "lateral color"),

Spherical aberration - variation in focal length of a lens from center to edge due to its spherical shape - generally all parts of the image, including its center.

The effects of lens aberration usually increase with increases in aperture or in angle of field.

ABSORPTION - Occurs when light is partially or completely absorbed by a surface, converting its energy to heat.

Slow shutter speed resulted in an ABSTRACT image of a dance performance.

ABSTRACT - In the photographic sense, an image that is conceived apart from concrete reality, generally emphasizing lines, colors and geometrical forms, and their relationship to one another.

ACCESSORY SHOE - A fitting generally located on top of a camera to which accessories (such as a flash unit) are attached.

ACHROMATIC - Free from chromatic aberration. An achromatic lens is able to transmit light without separating it into colors.

ACUTANCE - A measure of the sharpness with which the film can produce the edge of an object.

ADAPTER RING - Also called a "Stepping ring" - enables a filter of one size to be attached to a lens of another size.

ADVANCED PHOTO SYSTEM (APS) - A camera system brought forth in 1996 as a new foolproof photography system for weekend snapshooters and people who had not yet ventured into photography. It introduced a new film size (requiring new camera designs to use it) and a new means of photo finishing.

AERIAL - Above ground; in the air. Also casually refers to a picture taken from the air, as in an "aerial" or an "aerial photograph."

AERIAL PERSPECTIVE - The perception of depth or distance caused by atmospheric haze and its effect on tonal change in an image.

AERIAL PHOTOGRAPHY - Photography conducted above ground, commonly understood to be picture-taking from an aircraft.

AF - Abbreviation for "Autofocus"

AF LOCK - Autofocus Lock - Causes the camera to stop automatically focusing. AF lock is typically used when the subject is outside of the viewfinder's autofocus sensor(s). The photographer first aims the camera so that subject comes automatically into focus, "locks" in that focus setting using AF lock so that autofocus is temporarily disabled, then recomposes the image and takes the picture.

AGITATION - Gentle movement of liquid photo-processing chemicals (developer, stop-bath, fixer) during processing of film or paper in order to achieve uniform results.

AMBIENT LIGHT - Existing light surrounding a subject; the light that is illuminating a scene without any additional light supplied by the photographer. "Available light" and "existing light" are two other terms that mean the same thing.

ANAMORPHIC LENS - a lens that compresses a wide-angle of view into a standard frame.

ANGLE OF INCIDENCE - Light striking a surface is called "incident light." It becomes "reflected light" when it reflects from the surface. The "angle of incidence" is the angle at which the incident light strikes the surface, and is measured from a line that is perpendicular to the surface (called the "normal").

ANGLE OF VIEW - Also known as the "Field of view," "FOV" and the "Angle of the field of view", it is the extent of the view taken in by a lens. Focal length of a lens, in conjunction with film size, determines the angle of view. A "standard" lens has an angle of view equal to the diagonal of the film, which is generally around 52° or 53°.

The APERTURE is the opening you see in the lens.

APERTURE - A circle-shaped opening in a lens (a hole, really) through which light passes to strike the film. The aperture is usually created by an iris diaphragm that is adjustable, enabling the aperture to be made wider or narrower, thereby letting in more or less light. The size of the aperture is expressed as an *f*-number, like *f*/8 or *f*/11.

APERTURE PRIORITY - A function of a semi-automatic camera that permits the photographer to preset the aperture and leaves the camera to automatically determine the correct shutter speed.

APO - See Apochromatic

APOCHROMATIC - often shortened to "APO," means corrected for spherical and chromatic aberration. Lenses that are *apochromatic* cause all visible light wavelengths to focus on the film plane. Lenses that are not corrected for chromatic aberration tend to focus red, green and blue wavelengths on different planes.

APS - Acronym for "Advanced Photo System".

ARCHIVAL TECHNIQUES - The handling, treating and storage of photographic materials in a manner that lessens their deterioration from aging or from reaction to other materials.

ARTIFICIAL LIGHT - Illumination that comes from a man-made source, such as electronic flash.

ASA - The now defunct film speed rating system of the USA Standards Institute, which was formerly called the American Standards Association - hence the acronym "ASA". The ASA system has been replaced by the more universal ISO system.

ASPHERIC (ASPHERICAL) LENS - A lens element that changes shape across its surface as opposed to one having a smooth continuous arc. Generally, an aspherical lens deviates slightly from an exactly spherical shape, and is relatively free from aberrations. Light rays are bent more at the edges of a conventional spherical lens than they are at the center, causing them to come into focus *before* the film plane. A lens made with aspherical elements focuses all the light rays passing through it *on* the film plane.

AUTOEXPOSURE - Shutter speed and aperture are set automatically by the camera based on its interpretation of the camera's exposure meter readings. Some high-end cameras employ highly-sophisticated, computerized autoexposure systems that seem to be almost foolproof, whereas most consumer cameras' autoexposure systems work best in average lighting situations.

AUTOFOCUS - Ability of a lens to focus automatically on an object within its focusing sensors.

AUTOMATIC APERTURE - An automatic aperture remains fully open until the shutter is released, at which time it closes down to the pre-set aperture size in order for the picture to be properly-exposed. An automatic lens has an automatic aperture.

All point-and-shoot cameras have AUTOMATIC EXPOSURE.

AUTOMATIC CAMERA - Camera that adjusts the aperture and shutter speed automatically using its built-in exposure meter.

AUTOMATIC EXPOSURE - Also known as "Autoexposure," this is a system in an autoexposure camera that meters the light and automatically adjusts the aperture and shutter speed settings for proper exposure of the film.

AUTOMATIC FLASH - Electronic flash unit that automatically adjusts flash duration based on flash-to-subject distance.

AUTOMATIC LENS - A lens that remains open at its widest aperture until the shutter is released, regardless of the aperture setting. Such a lens facilitates focusing with through-the-lens cameras since the maximum amount of light reaches the viewfinder. When the shutter is released, the aperture automatically stops down to its pre-set opening so that proper exposure is made, then returns to a wide-open position until the next time.

AUTOWINDER - Also known as Automatic Film Winder - A camera mechanism that automatically advances the film to the first frame, then advances to the next frame when the shutter is released to take a picture, and usually also automatically rewinds the film into its cartridge when the last frame has been exposed.

AVAILABLE LIGHT - Existing light surrounding a subject; the light that is illuminating a scene without any additional light supplied by the photographer. "Ambient light" and "existing light" are two other terms that mean the same thing.

One subject that can be photographed only in AVAILABLE LIGHT (unless you are an astronaut) is the moon.

B (Bulb) - A shutter speed dial setting that indicates that the shutter will remain open as long as the release button is depressed - also known as the "B setting " or "Bulb" setting. The "B" setting is used for time exposures.

B&W - Black and white. Also appears as "B and W" and "B/W."

BACKDROP - The background in a studio.

BACKGROUND - The area within the viewfinder that is behind the subject of a photograph.

BACK-LIGHTING - Light directed at the subject from behind the subject.

BACKSCATTER - Suspended particles in water that are illuminated, and therefore captured on film as a cloud or scattering of light dots, when using a flash underwater near the lens.

BALANCE - Compositional harmony of a scene based on the placement of elements of different sizes, shapes and colors.

BARE BULB - Electronic flash unit used without a reflector or diffuser.

BARN DOORS - These are small "gobos" (light-blocking devices) that fall under the general category of "grip equipment." They are accessories that attach to studio lights and swivel on hinges (just like the doors on a barn) to allow the photographer to control the light's direction and the width of the light beam.

Professional film is often sold in bulk packages with each individual roll bearing the same BATCH NUMBERS to ensure total exposure consistency.

BATCH NUMBERS - Series of numbers imprinted by the manufacturer on the packaging of film and light-sensitive products to indicate that the materials are all from the same production batch, and therefore share closely-similar qualities, such as film speed and contrast.

BELLOWS - A folding sleeve-like device that fits between the lens and the camera that allows for extended separation of lens and film plane. A bellows is used in close-up photography, and performs a function similar to that of extension tubes, except that the tubes are fixed and the bellows is minutely adjustable.

BETWEEN-THE-LENS SHUTTER - A shutter situated between two lens elements.

BLEED - Describes a photographic print that extends to the edges of the paper and has no visible border or defined margin area.

Any image that is made larger than the original negative or transparency is technically a BLOW-UP, but in common usage, a blow-up is considered to be an enlargement that is 8" X 10" in size or bigger.

BLOW-UP - As a noun, blow-up (or blowup) is another term for an enlargement of a photographic print. As a verb, it is the actual enlarging of the image, as in "Please blow up this negative to an 11" X 14" print."

BLUR - Denotes a photograph in which movement, either camera movement, zoom lens movement or movement within the scene (e.g. a subject in motion), is recorded at a slower shutter speed than is necessary to "freeze" the motion as a sharp image. Blur is often intentionally created by a photographer who wishes to convey a sense of motion.

BOUNCE FLASH - Flash illumination of a subject by reflection off a surface as opposed to direct flash, which is flash light aimed straight at the subject. (Sometimes also called "Bounce lighting.")

BOX CAMERA - Simple camera with a fixed, single-element lens and a light-tight box to hold the film. The shutter and aperture are usually pre-determined and unalterable (typically 1/25 sec at *f* 11.) Early consumer cameras developed by George Eastman were box cameras (e.g. the "Brownie" camera) . They could not be focused, per se. The lens was set to a hyperfocal distance that gave acceptably-sharp pictures if the subject was a given distance from the camera and correct exposure depended upon bright sun illuminating the scene.

BRACKET or **BRACKETING** - Refers to taking a series of pictures, at least three, of the same subject with varying exposures - (1) the main exposure, which is presumed to be

correct, but may not be; (2) an overexposure, generally of ½ or 1 stop's difference from the main exposure, and (3) an underexposure of ½, 1 or 2 stop's difference from the main exposure. The theory behind exposure bracketing is that the photographer may not be certain that the main exposure is best for the subject matter, and the subsequent exposures will provide "insurance" that at least one of the images will provide acceptable exposure. Sometimes, though, the photographer may simply want to see the effects of different exposures of a scene. The term "bracket" is analogous with grammatical brackets or parentheses, where they are located on either end of a phrase. "Bracketed" exposures fall on either side of the exposure that is presumed to be correct.

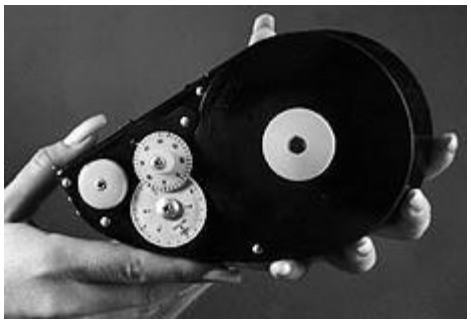
The BROWNIE is the original consumer camera, developed by George Eastman in 1888.

BROWNIE - Brand name of Kodak's first consumer box cameras.

B.S. B.S. refers to the British Standard for film speed measurement. BSI refers to the British Standards Institute which determined the B.S. system. It employed the same film speed numbering system as the American Standards Association-ASA. Both are now defunct, having been replaced by ISO for rating of the sensitivity of film and photographic materials.

BUILT-IN LIGHT METER - A reflective exposure meter that is a built-in component of a camera.

BULK FILM - Film produced in very long, uncut strips - rolls that are too long to fit into cameras not equipped with a bulk camera back accessory. Many photographers buy their film in bulk, then load the bulk film into a "bulk film loader" which permits them to cut the bulk film into however many frames they wish, and to load the smaller strips into film cartridges that permit film reloading. It is an economical way to purchase film.



BULK FILM is often loaded into a bulk film loader so that it can be manually loaded into smaller film cassettes of any length, usually at great savings to the photographer.

BURNING or Burning-in - Also known as "Printing in." In a darkroom, providing extra exposure to an area of the print to make it darker, while blocking light from the rest of the print.

C-41 - Kodak's standard photochemical process for developing color negative film.

CABLE RELEASE - A flexible cable with a push-button on one end that, when depressed, forces a wire through the cable to depress a camera's shutter release button. The cable release attaches to the camera directly over the shutter release button. A cable release has minimal effect on camera movement, and is therefore especially handy for the photographer who wishes to avoid blur in time exposures.

CALCULATOR DIAL - Adjustable scale on an electronic flash unit that, once it is set with the film speed, is used to determine the appropriate aperture for the flash-to-subject distance.

CAMERA ANGLE - Same as "shooting angle" or "viewpoint". The position of the camera relative to the position of the subject.

CAMERA OBSCURA - A device used by early artists (centuries before Christ) to display a scene on the wall of an otherwise-darkened room so that it could be more-easily copied. In a manner similar to the pinhole camera, a small hole placed in an opposite wall permitted light to enter the room (the "camera"), and the scene outside became transmitted inside, and was shown inverted on the rear wall or sometimes on a screen. The *camera obscura* is the origin of the modern camera.

CAMERA SHAKE - Slight movement of the camera when the exposure is being made.

CANDID - Candid pictures (sometimes referred to simply as "Candids") are unposed and often (but not necessarily) taken without the subject's knowledge.

CAPACITOR - A device used for accumulating and holding a charge of electricity. (Also called a condensor.)

CARTRIDGE - Film container, generally one that is factory-loaded, that is light-proof, enabling it to be handled in light without exposing the film. (See "Cassette.") A metal cartridge for 35 mm film is sometimes known as a "Magazine."

An unassembled CASSETTE that is used to hold 35 mm film.

CASSETTE - Better known as a film cassette, and sometimes called a cartridge, this is a light-proof container of metal or plastic into which film manufacturers (and bulk film loaders) roll strips of unexposed 35 mm film. APS film is also loaded by manufacturers into a cassette.

CATCHLIGHT - The reflection of a light in the subject's eyes in a portrait.

CCD - A digital camera records an image on a Charge Coupled Device (CCD) - a chip containing a grid-like field of extremely small, light-sensitive cells (photodiodes), each of which emits an electrical signal in proportion to the intensity of the light striking it.

CHANGE BAG or **CHANGING BAG** - A bag that is light-tight and fitted with arm holes that are elasticized to block light. It is used when it is necessary to work with unprotected film in a lighted area so that it doesn't become exposed to light.

CIBACHROME - A process used to make color prints directly from transparencies.

CIRCLES OF CONFUSION - Points of light from a scene being photographed formed by the lens into discs of light. The smaller the discs ("circles of confusion") are, the sharper the image appears. When the circles of confusion can be seen as discs rather than points of light, that portion of the image is considered to be unsharp.

CLEARING AGENT - Chemical that neutralizes hypo in film or photographic paper. Its effect is cut down wash time and assist in giving a more stable image.

CLOSE-UP - Generally, a picture of a subject that fills the frame, usually with the subject looking particularly close to the camera.

CLOSE-UP LENS - (1) An attachment lens that fits on the front of a camera lens, allowing photography at closer distances than than normal for that lens. (2) Also refers to a "Macro lens" - a camera lens that permits macrophotography.

CMYK - An acronym for the ink colors ***C****yan* (process blue), ***M****agenta* (process red), ***Y****ellow* and ***B****lack* used in four-color process printing. The primary colors of light (*not* of the inks used in printing) are *red, green* and *blue.*

COATED LENS - A lens that has a thin layer of transparent substance applied to its surface to reduce light reflection from the surface.

COLOR BALANCE - (1) The manner in which color film reproduces a scene's colors under different types of lighting (daylight or tungsten). (2) The adjustment of colors in making color prints.

COLOR NEGATIVE - Refers to film designed to produce a reverse color image that requires subsequent printing onto photo-sensitive material (generally paper used in making photographic prints) in order to view the true colors as a positive image.

COLOR REVERSAL - Refers to film designed to make a positive image when exposed in the camera (slide film or transparency film). Light must be transmitted through such film in order to view it, whether it is lit from behind when viewing or the light is projected through the film's image onto a viewing screen.

COLOR TEMPERATURE - The light spectrum is scientifically described in terms of color temperature, and is measured in degrees Kelvin (° K). Photographers use three standard light color temperatures. The first is called "daylight" for natural outdoors light, while the other two are incandescent (artificial light) color temperature standards: 5500° K (daylight); 3200° K (tungsten studio lamps) and 3400° K (photo lamps or photofloods).

COMPACT CAMERA - Commonly refers to a point-and-shoot camera.

COMPACT FLASH - Brand name for one type of digital camera's re-usable memory card on which images taken by the camera are stored.

COMPLEMENTARY COLOR - A complementary color is one of a pair of primary or secondary colors that are in opposition to each other on a color wheel. For pigmented colors, like paint, complementary color pairs include: orange opposed to blue, green opposed to red, and violet opposed to yellow. For the colors of light, complementary colors include: blue opposed to yellow, green opposed to magenta, and red opposed to cyan.

COMPOSITION - The arrangement of the elements (subject and other objects) in a scene or photograph.

CONDENSER ENLARGER - Photographic enlarger with an undiffused light enabling high contrast and definition in a print.

CONTACT PRINT - A print made with the negative in contact (held tightly against) the photographic paper so that both negative and print are the same size.

CONTACT SHEET - A contact print made from several negatives at one time.

An image with high CONTRAST has bright highlights and dark shadows.

CONTRAST - (1) the range of difference between highlights and shadow areas in an image. Many factors affect an image's contrast, including the degree of development and the contrast grade of the paper on which an image is printed. (2) The range of brightness in a scene or in the light striking a subject. (Sometimes contrast is also referred to as "Density.")

CONTRAST GRADE - A scale using numbers (generally 1 to 5) or terms (soft, medium, hard, extra-hard and ultra-hard) that refer to the contrast level of photographic papers. (A high contrast negative printed onto low-numbered or soft contrast grade paper will more closely reproduce the normal contrast of the original scene, and vice-versa.)

CONTRAST RATIO - The difference between the darkest and lightest areas of a subject, stated in a mathematical ratio.

CONTRASTY - A scene or an image that has an abnormally wide range of differences between the amount of light in highlight areas and the amount of light in shadow areas is said to be "contrasty."

CROPPING - (1) Removal of parts of an image in order to improve the image's composition. Cropping occurs when an area that is smaller than the entire image frame is printed or reproduced. (2) Cropping is sometimes also used in reference to a photographer moving closer to a subject, thereby eliminating (cropping) unnecessary surrounding elements from the composition.

CROPPING *removes portions of an image to improve its composition. Photo submitted by Pattabi Raman.*

DAGUERRE, Louis Jacques Mandé, 1789-1851 - French painter who, in 1839, with Nicéphone Niépce, invented the daguerrotype.

DAGUERROTYPE - (1) An obsolete photographic process in which a picture made on a silver surface sensitized with iodine was developed by exposure to mercury vapor. (2) A picture made by this process.

DARKCLOTH - Material used to cover the photographer's head and camera to block surrounding light in order to better view the image on the camera's ground glass viewing screen.

DARKROOM - A room in which total darkness is achievable, permitting light-sensitive materials such as film to be handled without fear of their exposure to light.

DARKSLIDE - An opaque sheet that is slid in place over the front of a sheet film holder to protect the film from exposure to light.

DAYLIGHT FILM - Color film designed to render correct color balance when exposed in normal daylight.

A camera equipped with a DEDICATED FLASH performs fully-automatic flash functions with simplicity.

DEDICATED FLASH - An electronic flash unit that integrates automatically with a specific camera's exposure meter and exposure controls, permitting simplified, fully-automatic use of the flash. A dedicated flash is designed to work with a particular brand or type of camera.

DEFINITION - Sharpness of an image (as seen by the clarity of detail) formed by an optical system.

DENSITOMETER - Instrument that measures optical density of part of a negative or print.

DENSITY - The relative opacity (blackness) of an area of a negative, a transparency or a print. The greater the density, the less light can be transmitted through it. (Sometimes density is also referred to as "Contrast.")

DEPTH OF FIELD - The range of distance in a scene that appears to be in focus and will be reproduced as being acceptably sharp in an image. Depth of field is controlled by the lens aperture, and extends for a distance in front of and behind the point on which the lens is focused.

DEPTH OF FIELD PREVIEW BUTTON - Many cameras are equipped with a preview button that, when pressed and held in, stops the lens down to the pre-selected aperture, allowing you to see how much foreground or background are in focus.

DEPTH OF FIELD SCALE - Markings on the barrel of a lens that show the depth of field for a particular aperture and a particular focus setting.

DEPTH OF FOCUS - A zone of focus in the camera. If an image is focused on a ground glass screen in a camera, depth of focus makes it possible to move the screen slightly backward or forward and still have the image in acceptable focus.

DEVELOPER - A solution for developing a film or photographic paper - i.e. for turning an exposed film's or paper's latent image into an image that can be seen.

DEVELOPING TANK - Container that is light-proof, used for processing exposed film.

An adjustable DIAPHRAGM in a lens controls the size of the aperture.

DIAPHRAGM - A ring or plate with a hole in the center that controls the amount of light entering the camera. An adjustable diaphragm in a lens controls the size of the hole, or aperture, thereby permitting more or less light to pass through the lens to the film.

DIFFRACTION - A phenomenon exhibited by a light's wave front when passing the edge of an opaque object (one that does not allow light to pass through it). The light becomes modulated, causing a redistribution of the light's energy within the wave front. You will see it at the edges of the object's shadow, in the form of minute dark and light bands. The edges of the shadow have a fuzzy appearance. Think of ripples meeting a rock in a pond. They go around the rock in a new series of ripples that can be seen on the sides of the rock. Light waves behaving in a similar manner are said to be diffracted.

DIFFUSED LIGHT or **DIFFUSE LIGHTING** - Light that is scattered and spread out as opposed to specular light. Diffused light is softer than direct light, with shadows that are less sharply-defined (lower contrast).

DIFFUSER - Material that diffuses light. A diffuser may be a translucent material or a rough-surfaced reflective material, both of which scatter light's rays, thereby softening the light.

DIFFUSING - (1) Softening of detail in a print with a diffusion disk or other light-scattering material. (2) Moderating light so that is softened (diffused), generally either by reflecting it off a material that scatters the light, or by placing a diffusing panel of translucent material between the light source and the subject.

DIFFUSION-CONDENSER ENLARGER - An enlarger that has both a condenser system (for greater contrast) and a diffused light, producing less contrast than a condenser enlarger but more contrast and sharper detail than a diffusion enlarger.

DIFFUSION ENLARGER - An enlarger in which the light is diffused, and therefore spread more evenly as it strikes and passes through the negative, resulting in less sharpness of detail. Negative flaws (scratches, etc.) are de-emphasized with a diffusion enlarger.

DIGITAL CAMERA - A camera that takes pictures without film, but instead records the image on an image sensor chip in a format that is readable by a computer.

DIGITAL ZOOM - Zoom effect in some digital cameras that is not true (optical) zoom, but is instead an enlargement of the information from the center of the CCD.

DIN - German standards system that expressed a film speed rating by a number followed by a degrees sign (°). DIN derives its name from the initials of the Deutsche Industrie Normen or Deutsche Industries Norm. The DIN system has been replaced by the more universal ISO system.

DIOPTER - A unit of measure of the refractive power of a lens.

DISTORTION - Misrepresentation of proportions of objects or of their arrangement in a scene. The two main types of lens distortion are: (1) *Barrel* distortion, in which the straight lines near the edges of the viewframe appear bowed outward from the center, like a barrel-shape; and (2) *Pincushion* distortion in which the same lines bend in towards the center.

DODGING - Blocking a portion of the light when printing a photograph so that an area of the print will be made lighter.

DOUBLE-EXPOSURE - Exposing the same film frame twice. A typical double-exposure shows the same subject twice in the same image.

DROP-IN LOADING - Camera system that automatically advances film to the first frame when the camera's back is closed.

This enlargement is DRY-MOUNTED to foam-core.

DRY MOUNTING - A means of attaching a print to a backing using a thin paper stock coated on each side with a dry cement that melts under heat.

DX - A coding system using a pattern of squares printed on a film cassette that can be read by a DX-enabled camera to automatically set film speed for the camera's exposure meter, to set the number of frames and other data. Also called "DX coding" or "DX encoding."

EASEL - A darkroom device used to hold paper flat while exposing it to light from an enlarger. An easel creates a white border surrounding a print because its "arms" block light from striking the print paper's edges. The sliding arms can be adjusted vertically and horizontally in order to create prints of specific measurements - e.g. 4" X 6" or 5" X 7" and so on.

An EASEL holds paper flat while exposing it to light from an enlarger.

ED - "ED" refers to "**E**xtra Low **D**ispersion" glass made by Nikon for some of its lenses. It ensures apochromatic-like performance, with high contrast and sharper images. An ED lens is one that has ED glass in one or more of its elements.

EF - Abbreviation for "electronic flash."

EI - Abbreviation for Exposure Index.

ELECTROMAGNETIC SPECTRUM - The entire range of electromagnetic radiation - all of its wavelengths, including those of visible light.

ELECTRONIC FLASH - Artificial light source produced by an electrical discharge traveling between two electrodes through a gas-filled tube. The light from electronic flash is approximately the same color as daylight.

ELEMENT - A single lens that is a component of a compound lens.

EMULSION - A light-sensitive composition consisting of one or more of the silver halides suspended in gelatin for coating a surface of a film, photographic paper and the like. The image is formed in the emulsion.

EMULSION SIDE - The side of the film or photographic paper that has the emulsion coating on it. The emulsion side of film is recognized by being dull, whereas the emulsion side of paper is shiny.

ENLARGEMENT - A photographic print that is larger than the film frame used in producing it. In popular use, however, most people think of an enlargement as being substantially larger than the image area of 35mm film - a print that is at least 5" X 7" or 8" X 10" in size. Also known as a "Blow-up."

ENLARGER - An adjustable light projection device used in a darkroom to project an enlarged image from a negative through a lens onto photographic paper in various degrees of enlargement.

EXISTING LIGHT - The light that is naturally illuminating a scene without any additional light that has been added by the photographer. Ambient light and available light are two other terms that mean the same thing.

A tricky play of light and shadow presents a challenge to obtaining proper EXPOSURE.

EXPOSURE - (1) Exposure occurs when light is permitted to strike film - i.e. when the film is *exposed* to light. (2) Exposure is the total amount of light striking the film or other photographic material. (3) Also refers to a combination of shutter speed and aperture used in exposing the film in a camera, as in "My light meter shows an exposure of 1/125 second at *f*/11." A particular aperture and shutter speed combinations are often referred to as "exposure settings." "Proper exposure" refers to exposure that produces an image satisfactory to the photographer.

EXPOSURE COMPENSATION - Deliberately changing the exposure settings recommended by a light meter in order to obtain proper exposure. (Sometimes an exposure meter or light meter is "tricked" into providing settings that will underexpose or overexpose an image, for example, when the subject is relatively small in a field of bright, white snow. In such a case, a light meter may provide exposure settings that would underexpose the subject, and the photographer needs to "compensate" for proper exposure.)

EXPOSURE INDEX or EI - A number that indicates a film's effective speed.

EXPOSURE LATITUDE - a measure of a specific film's ability to be overexposed or underexposed and still produce an acceptable image. It is measured in a range of *f*-stops. Most negative films (regardless of brand name) have an exposure latitude of five to seven stops, whereas most transparency (slide) films have less exposure latitude — in the range of three to five *f*-stops.

This handheld EXPOSURE METER measures both incident light and electronic flash.

EXPOSURE METER - An instrument containing a light-sensitive cell used to measure the amount of light reflected from or falling on a subject. The measurement is usually expressed in shutter speed and aperture combinations that will render an acceptable exposure. (Also known as a light meter.)

EXPOSURE SETTING - The aperture and shutter speed combination used to expose the film in a camera.

EXPOSURE VALUE - The Exposure Value (EV) system, which originated in Germany in the 1950s, was created to be a simple-to-use substitute for the shutter speed/aperture combination, using a single number instead of two.

EXTENSION TUBES - Tubes made from metal and, more frequently, plastic inserted between the lens and the camera, thereby making the lens to film distance greater. The result is increased magnification for close-up photography. They are sometimes also referred to as "extension rings". They are frequently sold in sets of three different lengths, each of which can be used on its own or in combination with the others. When stacking more than one extension tube between the camera and lens, magnification can exceed life size. However, exposure time can be quite long as magnification increases since light must travel much further to strike the film.

f-NUMBER - (*f*-number) A number that expresses a lens' light-transmitting ability - i.e. the size of the lens opening. Usually found on the barrel of a lens, f-numbers indicate the size of the aperture in relation to the focal length of the lens. A smaller number indicates a larger lens diameter. *f*/1.4 signifies that the focal length of the lens is 1.4 times as great as the diameter. All lenses set at the same f-number transmit the same amount of light.

***f*-stop** - (f-stop) A lens aperture setting calibrated to an f-number.

FALLOFF - Decrease in the intensity of light as it spreads out from the source.

FAST FILM - High speed film, i.e. film that is more sensitive to light, meaning less light is needed to obtain a properly-exposed image.

FAST LENS - A lens that has an aperture that opens particularly wide, making it able to gather more light than a slower lens at its widest aperture.

FIELD CAMERA - A type of camera known as the field" or "baseboard" camera is essentially a portable view camera, because it functions in much the same way and with similar controls and features.

FILL FLASH - Flash that is used in a supplementary manner to fill in a subject's shadow area with light, thereby reducing contrast. Also known as "flash fill" and "fill-in flash."

FILL LIGHT or "Fill-in light" - Secondary light from a lamp or reflector that illuminates shadow areas. Called "Fill flash" when the light source is a flash.

FILM - A transparent cellulose nitrate or cellulose actetate composition made in thin, flexible strips or sheets and coated with a light-sensitive emulsion for taking photographs.

FILM PLANE - The place in a camera where the film is located in readiness for it to be exposed to light.

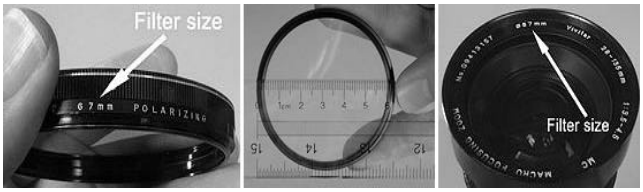
FILM SOLARIZATION - See "Solarization" in this Glossary.

FILM SPEED - A measurement of film's sensitivity to light, generally in numerical terms of an ISO exposure index - e.g. ISO 100. More sensitive (faster) films have higher ISO numbers and require less exposure in order to make a properly-exposed picture.

FILTER - Tinted glass, gelatin or plastic discs, squares or rectangles that modify the light passing through them. Filters are used in photography to change the appearance of a scene by emphasizing, eliminating or changing color or density, generally so that the scene can be recorded with a more natural look, on a particular film.

FILTER FACTOR - A number that indicates to what extent you must increase exposure when you use a particular filter (by multiplying the unfiltered exposure by the filter factor number). Filters absorb light. The filter factor allows you to compensate for this absorption. The amount of exposure compensation has been predetermined for every filter, and is expressed as a "filter factor" (sometimes also called an exposure factor, and also referred to as Exposure Magnification or EM values).

FILTER SIZE - is determined by the inner diameter of the front of a lens, more specifically the threads into which a filter is screwed to attach it to the lens. A 62 mm filter screws onto a lens that has threads that have a diameter of 62 mm. Most filters and some lenses are inscribed with their filter size in millimeters.



FILTER SIZE, measured in millimeters, is inscribed on the filter (left) and sometimes on the lens (right).

FINDER - A shorter word to use when referring to a camera's viewfinder.

FINE GRAIN DEVELOPERS - Film developers that minimize grain in the final image.

FIREWIRE - A computer connector that permits high-speed data downloading from a digital camera.

FISHEYE - Describes an extreme wide-angle lens that has an angle of view exceeding 100° - sometimes more than 180° - and that renders a scene as highly distorted.

FIXATION - In negatives and prints alike, the conversion of unused silver halides to a soluble silver so that the image remains stable and unalterable when exposed to light. Also known as "fixing."

FIXED FOCAL LENGTH - Descriptive of the lens in a camera that has one lens only that cannot be interchanged for another lens and that cannot be zoomed.

FIXED FOCUS - Refers to a lens, the focus of which cannot be changed. Found in simple cameras, the focus is preset (or fixed) by the factory, usually at the hyperfocal distance, resulting in image sharpness for most common shooting conditions for snapshots.

FIXER or "Fixing bath" or "Hypo" - The chemical solution used for fixation. It removes any photo-sensitive silver-halide crystals that were not acted upon by light or by the developer.

FLARE can show up as a plain area of unwanted bright light or in shapes matching the aperture.

FLARE - Light that doesn't belong in an image, often taking the shape of the aperture, generally caused by shooting towards the light source. The source may appear in the image as a reflection from the interior of the camera or from the lens. Flare often results in an overall reduction of image contrast.

FLASH - (1) A brief, sudden burst of bright light from a flashbulb or an electronic flash unit; (2) An artificial light source that provides brief, bright illumination of a subject in order to properly expose photographic film; (3) Often used in reference to the actual unit that produces the flash, as in "My flash is built into my camera."

FLASH BULB - A one-time-use glass bulb enclosing a pyrotechnic wire filament that burns out, generating a bright flash, when an electrical current is run through it.

FLASH CUBE - A cube-shaped unit containing four built-in flash bulbs that automatically rotates to the next usable bulb when one is fired. When all four flash bulbs have been fired, the unit is no longer usable, and is discarded. The flash cube is now obsolete, but was at one time a common flash accessory for many point-and-shoot cameras.

FLASH FACTOR - Also known as " Guide number," a number which serves as a guide to proper exposure when using flash. The number is based on a flash unit's light output and the film speed. When the flash factor is divided by the flash-to-subject distance, the correct aperture for proper exposure is determined. Flash factors may be quoted in meters or feet, according to which system is used for the measurement of distance.

FLASH FILL - Flash that is used in a supplementary manner to fill in a subject's shadow area with light, thereby reducing contrast. Better known as "fill flash" or "fill-in flash."

FLASH METER - Exposure meter designed to measure the light from electronic flash.

FLASH POWDER - Used in the early days of photography, a mixture of metallic magnesium with an oxidizing agent that, when ignited, produces a bright flash of light.

FLASH SYNCHRONIZATION - Timing the triggering of the flash so that it fires only when the shutter is completely open, thereby ensuring complete exposure of the entire film frame.

FLASH TERMINAL - Electrical contact on a camera to which a cord that is connected to a flash unit is attached, permitting flash synchronization.

FLAT - A negative, slide or print that is too low in contrast due to a limited range in density.

FLAT LIGHTING - Illumination that provides little contrast on the subject and light or imperceptible shadows.

FLOODLIGHT - Continuous (non-flash), artificial light source, generally used in the studio for evenly-spread illumination. Also known as Photoflood or Flood lamp. Has a color temperature of 3400° on the Kelvin scale.

FOCAL LENGTH is the determination of the relative size of a lens.

FOCAL LENGTH - Focal length is the distance between the focal point of a lens and the film plane when the lens is focused at infinity. It is used to designate the relative size and angle of view of a lens, expressed in millimeters (mm). A particular lens' focal length can generally be found engraved or printed on the front of the lens.

FOCAL PLANE SHUTTER - A camera shutter situated directly in front of the film, composed of an opaque curtain that contains a slit that moves directly across in front of the film, permitting light to strike the film.

FOCAL POINT - (1) The central or principal point of focus. (2) The optical center of a lens when it is focused on infinity.

FOCUS - (1) A point at which rays of light meet after being refracted or reflected. (2) Focal point of a lens. (3) The clear and sharply-defined condition of an image, as in "This image is in focus," meaning it is sharp and well-defined. (4) Adjustment of the distance setting on a lens to obtain a sharply-defined image.

FOCUSING - Means of adjusting a lens' elements in relation to the film plane so as to obtain the required sharpness in the image.

FOCUSING HOOD - A cowl around focusing screens that shields the screen from light other than the light from the scene being photographed..

FOCUSING MAGNIFIER - A simple magnifying lens that enlarges the image on a focusing screen.

FOG or "Fogging" - Unwanted density in an image caused by accidental exposure to non-image forming light or X-rays, poor storage conditions or improper chemical processing.

FORCED DEVELOPMENT - Another term for "Push-processing" - increasing development time of a film to "force" an increase in its effective speed.

FOREGROUND - The area of a scene that is closer than the subject.

FORMAT - The shape and size of a thing - used in photography principally in reference to small, medium and large format films and the photography equipment employed in handling each different film format (e.g. a "medium format" camera).

The subject is shown in a FRAME created by FOREGROUND tree branches.

FRAME - (1) The visible boundaries of a camera's viewfinder. (2) The area of a single exposure on a film. (3) An element in a scene, like a branch or doorway, that frames the subject. (4) A decorative border surrounding a print.

FRONTLIGHTING - Light illuminating the front of a subject - i.e. the side of the subject at which the camera is aimed.

GELATIN - A nearly transparent substance, obtained by boiling animal tissue in water, used as (1) the medium for suspending light-sensitive silver halide crystals on photographic film, and (2) in the manufacture of gelatin filters.

GELATIN FILTER - Also known as "gelatin slide" and "gel," a thin sheet of translucent colored gelatin for placing over lights to obtain lighting effects, and in the manufacture of photographic filters for lenses. Gels are available in a wide color variety.

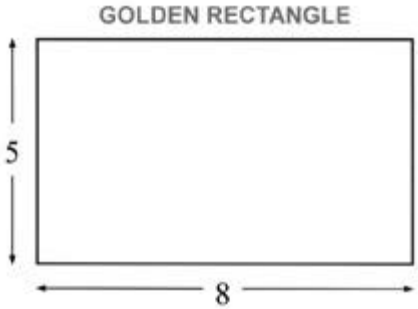
GELS - Generic term used in reference to any colored translucent material (color media) that is used to color a light, whether the material is made from gelatin, glass or plastic.

GHOST IMAGE - In time exposure photography, an object that is only partially recorded on the film and therefore has a translucent, ghost-like appearance. Ghosting also occurs when using electronic flash at a slow shutter speed, and a second image is captured on the film by ambient light. Some people also refer to "flare" as a ghost image.

GLOSSY PAPER - Shiny-surfaced paper used in making photographic prints.

GN - Abbreviation for Guide Number.

GOBO - A light-blocking device that falls under the general category of "Grip equipment." Generally used in a studio to prevent illumination from a studio light striking a portion of a scene. A "gobo" can be a simple piece of opaque cardboard or a sophisticated material in a specific shape, often a rectangle or square. "Barn doors" are gobos.



The rectangle defined by the GOLDEN MEAN.

GOLDEN MEAN - Also referred to as the "Golden section" and the "Gold mean," the Golden mean is an ancient fine arts formula that mathematically defines a rectangle of specific proportions. This rectangle, called the "Golden rectangle," is believed to frame objects in pleasing proportions. (See Rule of Thirds for more information.)

GOST - GOST is a standardization system developed by the All-Russian Scientific and Research Institute for Certification. Its coding system for film speeds, although similar to the ISO system, uses different numbers.

GRADATION - (1) An image's tonal contrast range. (2) The range of light and dark tones in a subject that a film is capable of showing (i.e. how a film reproduces contrast). (3) The gradual changing of one tint or shade to another by very small degrees.

GRADATED FILTER - Also called a "Graduated" filter. A filter that is not uniformly dense, but that gradually changes its density across the filter's field. A Gradated neutral density filter is clear from one edge to approximately the middle of the filter, then gradually increase in density towards the opposite edge. Colored gradated filters gradually change color density across the filter's field.

GRADE - A system of classifying the contrast of photographic papers used in making black and white prints, ranging from 0 to 5 (soft to hard).

GRAIN - Minute crystals of silver halides in the light-sensitive emulsion of film that react when exposed to light, turning black, are called "grains." (See Graininess of film.)

GRAININESS - Graininess occurs when clumps of individual grains are large and irregularly spaced out in the negative. They are visible to the naked eye in the finished print, particularly enlargements, as sand-like particles. When this occurs, the picture appears "grainy."

GRANULARITY - Describes a negative or film that shows a granulated structure, usually used to describe the degree of granularity that is visible.

The GRAY CARD is a simple but effective aid in determining proper exposure.

GRAY CARD - Also known as the "Kodak neutral test card," a gray card is an 8" X 10" (20 cm by 25.5 cm) card, about 1/8" thick, that is uniformly gray on one side. The gray side reflects precisely 18% of the white light that strikes it (corresponding to the calibration of a reflected-light meter). It is uniformly white on the other side, which reflects 90% of the light.

GROUND GLASS SCREEN - Flat sheet of glass in a camera treated so that it can be used for viewing and focusing an image, also known as the "Viewing screen."

GUIDE NUMBER - A number which serves as a guide to proper exposure when using flash. Also known as "Flash factor." The number is based on a flash unit's light output and the film speed. When the guide number is divided by the flash-to-subject distance, the correct aperture for proper exposure is determined. Guide numbers may be quoted in meters or feet, according to which system is used for the measurement of distance.

HALATION - Blurred effect at the edges of a highlight area of a photograph caused by reflection of light that passed through the film. The light is reflected from either the surface of the film or the camera back.

HAZE - An atmospheric condition characterized by fine particles of dust, smoke or moisture in the air that causes a loss of contrast in an image because the *haze* scatters light particles.

HEADSHOT - Photograph, often in black-and-white, of a person's head and shoulders. Promotional headshots of performers and models are usually printed in 8" by 10" size.

HIDE - Hide, another word for "Blind," is an enclosure that provides a concealed camera position within, and overlooking, an animal's territory. It is called a "hide" because it is meant to hide a photographer from the animals' vision.

HIGH CONTRAST - An image that is high in contrast (as opposed to a "flat" image), wherein the negative, slide or print contains a wide density range.

HIGH KEY - An image that is mainly made up of light tones, which relatively few mid-tones or shadows.

HIGHLIGHT - The brightest area of a subject or scene.

HIGHLIGHT DETAIL - Details that are visible in areas of an image that are brightest.

HOT SHOE - The sound you make when you sneeze. *Just kidding. We're checking to see if you're still awake.* A hot shoe is an accessory holder (or accessory shoe) on a camera that embodies an electrical contact so that, for instance, a flash unit can be triggered to go off. A small, portable flash that has a contact on its "foot" can be connected to a hot shoe, which will cause the flash to fire when you press the shutter release.

HYPERFOCAL DISTANCE - Technically, it is the distance between the camera and the hyperfocal point. But, in practice, Hyperfocal distance is a lens setting technique that allows you to shoot sharp pictures within a certain distance range without having to refocus. When the lens is focused on infinity, the hyperfocal distance is the distance of the nearest object in a scene that is acceptably sharp.

HYPERFOCAL POINT - When the lens is focused on infinity, the nearest point to the camera that is considered acceptably sharp is the Hyperfocal point. By focusing on the hyperfocal point, everything beyond it to infinity remains in acceptable focus, and objects halfway between the camera and the hyperfocal point will also be rendered acceptably sharp.

HYPO - A fixing bath composed of various chemicals including sodium thiosulfate and water. In processing film or prints, this solution removes any light-sensitive, silver-halide crystals that were not acted upon by exposure to light or by the developer, thereby stabilizing the final print or negative so that it will no longer react to light.

IF - Abbreviation for "Internal Focusing"

IMAGE - Two-dimensional reproduction of a scene.

INCIDENT LIGHT - Light falling on a surface - not the light reflected from it.

An INCIDENT LIGHT METER reads the light falling on the subject.

INCIDENT LIGHT METER - An exposure meter (generally hand held as opposed to a reflective meter that is built into a camera) that reads the amount of incident light. Since the meter does not read the light reflected from the subject, the subject's reflectance does not affect the exposure reading. Incident light meters are equipped with one of two types of light receptor diffusion cover - a round diffuser for three-dimensional subjects and a flat one for two-dimensional, flat subjects, such as a map or painting. Also called an "Ambient light meter."

INFINITY - Distance from the camera that is far enough away that any object at or beyond it will be reproduced sharply when the lens is focused on its infinity setting.

INFRARED FILM - Photographic film that is sensitive to infrared radiation.

INFRARED FOCUSING INDICATOR - A mark on the barrel of a lens that indicates proper focusing when using infrared film. The mark is typically a red or white line that is slightly apart from the focusing indicator for normal film. Sometimes the letter "R" is next to it.

INTENTIONAL OVER- or UNDER-EXPOSURE - Intentional over-exposure or underexposure is known as *increasing* or *decreasing exposure*. Many professional photographers will consistently underexpose (decrease exposure of) some slide films on purpose.

INTERCHANGEABLE LENS - One of a system of lenses of different characteristics, generally focal length variety, each of which fits a given camera body.

INTERNAL FOCUSING - Lens in which internal lens groups shift during focusing so that the external length of the lens does not change.

INTERPOLATION - Adding new pixels to a digital image between existing pixels. Interpolation software analyzes the adjacent pixels to create the new ones.

INVERSE SQUARE LAW - An equation that relates the intensity of a light source to the illumination it produces at a given distance. Light diminishes over distance in accordance with the Inverse square law, which states that doubling the flash-to-subject distance reduces the light falling on the subject to one-quarter.

The IRIS DIAPHRAGM controls the size of the aperture (the lens opening).

IRIS DIAPHRAGM - Also sometimes simply known as "Iris," a device inside a lens of thin overlapping metal leaves that move inwards or outwards, creating an aperture of variable size. The aperture size controls the amount of light passing through the lens to the film.

ISO - Film speed is designated by a single, almost universally-accepted common system developed by the International Organization for Standardization which uses the initials "ISO" before the film-speed number - e.g. ISO 100. (Note that many sources will tell you that the initials I.S.O. stand for "International Standards Organization," but they do not.)

IX - A feature of the APS is its encoding on the film itself of picture-taking and processing data. IX (Information Exchange) technology allows photofinishing equipment to read instructions on the film and therefore make processing and printing adjustments to provide the best results from different lighting and exposure conditions, and also allows such features as mid-roll change.

JCII - With the cooperation of Japanese camera manufacturers, the Japan Camera and optical instruments Inspection and testing Institute (JCII) was founded in 1954. It was formed to inspect all cameras exported from Japan in order to maintain quality standards.

JPEG - An acronym for ***J****oint* ***P****hotographic* ***E****xperts* ***G****roup* that describes an image file format standard in which the size of the file is reduced by compressing it. A "JPEG" image file name carries the extension "jpg" - e.g. "portrait.jpg"

JUNIOR MODEL - A youthful-looking, animated model.

JUXTAPOSE - In composition, to place two objects close together or side by side for comparison or contrast. Often helpful in showing scale in an image.

K - Abbreviation for Kelvin.

K14 - The chemical process for developing Kodachrome slides.

KELVIN - The visible light spectrum is scientifically described in terms of color temperature, and is measured in degrees Kelvin (°K).

KEY LIGHT - Also called "main light." The principal source of light on a subject or a scene, usually in reference to a studio light. The key light is generally the brightest light on the subject, or the one that will have the greatest overall effect on the image.

KEYSTONING - Distortion of a projected image when the projector is not directed perpendicular to the screen.

KICKER - (1) A side or back light often near lens height used to rim faces and model profile shots. (2) A light used to provide an additional highlight or accent on a subject.

KODAK NEUTRAL TEST CARD - Also known as the "Gray card," a Kodak neutral test card is an 8" X 10" (20 cm by 25.5 cm) card, about 1/8" thick, that is uniformly gray on one side. The gray side reflects precisely 18% of the white light that strikes it (corresponding to the calibration of a reflected-light meter). It is uniformly white on the other side, which reflects 90% of the light.

LAMP - The complete unit of an artificial light source, including filament or electrodes, bulb, base and other components.

LARGE FORMAT - Film format having individual frames of 4" X 5" or larger.

LATENT IMAGE - Image recorded on film that is made visible by development.

The image in the viewscreen of many cameras appears as a mirror image, or LATERAL REVERSAL image, requiring the photographer to move the camera to the right to see more on the viewscreen's left.

LATERAL REVERSAL - A mirror image, as seen in the viewfinders of some cameras where the scene appears flipped from left to right.

LATITUDE - Commonly "Exposure latitude" - The range of brightness, including shadow detail, that a film can record in a single image before the highlights wash out or the shadows become muddy. Fast films generally have greater exposure latitude than slow films. Knowing a film's latitude lets you know how much exposure can be varied and still produce an acceptable image.

LCD - Liquid Crystal Display - A small flat image-viewing screen in a digital camera.

LEADER - The part of film at the beginning of a roll that will not be exposed to make an image but is used to attach the film to the camera's take-up spool. 35mm film usually has a leader that is narrower than the rest of the roll - its shape originally designed for bottom-loading Leica cameras.

A camera LENS is actually an objective composed of a number of lenses.

LENS - A true "lens" is a single piece of glass (or other transparent substance) having one or more curved surfaces used in changing the convergence of light rays. What we commonly call a photographic lens is more accurately and technically called an "objective," an optical device containing a combination of lenses that receive light rays from an object and form an image on the focal plane. However, dictionaries have come to accept the usage of the term "lens" to mean the entire photographic objective itself. A photographic lens will always be called a lens, even though it is not a lens, but has a lot of lenses in it. A camera lens collects and focuses rays of light to form an image on film.

LENS HOOD or "Lens shade" - An accessory that attaches as a collar to the front of a lens to prevent stray light from striking the surface of the lens, and thereby causing flare.

LENS-SHUTTER CAMERA - A camera that has the shutter built into the lens itself.

LENS SPEED - The widest aperture at which a lens can be set. A lens with a fast speed has a very wide maximum aperture, such as *f*/1.4, for example, and transmits more light than a lens with a slow lens speed, such as *f*/8.

LIGHTBOX - A enclosure containing white-light balanced fluorescent tubes behind a flat translucent glass or plastic surface on which transparencies or negatives are laid in order to view them.

LIGHTING RATIO The brightness of the main light (key light) compared with the brightness of the fill light(s). A ratio of about 3:1 is normal for photography.

This is a hand-held incident LIGHT METER, different from a camera's built-in reflected light meter.

LIGHT METER - An instrument used to measure the amount of light reflected from or falling on a subject. The measurement is usually expressed in shutter speed and aperture combinations that will render an acceptable exposure. (Also known as an "Exposure meter.")

LIGHT TENT - Translucent fabric attached to a frame that surrounds a subject. Typically used to reduce reflection from highly reflective subjects. The light source is outside the enclosure, but the lens pokes through a hole in the fabric.

LIGHT-TIGHT - Impervious to light

LIGHT TRAIL - A line recorded on film resulting from movement of a point of light (or camera movement) during the exposure. Star trails are one example.

LIGHT TRAP - An opening through which light cannot penetrate, useful for ready access to a darkroom. Typically, the entrance is u-shaped, with a light baffle built down the opening of the "U". A person walks around the baffle, which blocks light, to enter and exit.

A LONG FOCUS lens is indeed a long lens, and often requires its own tripod mount to keep it steady.

LOCATION - A photography site that is outside of the studio. The often-heard term "shooting on location" refers to taking pictures at such a site.

LONG FOCUS - A lens of relatively long focal length with a narrower angle of view than a normal lens, but with a more enlarged view of the scene.

LOUPE - A small magnifying glass used in viewing transparencies (slides), negatives and contact sheets. Generally a loupe's magnification is eight times.

LOW KEY - Describes a mostly dark image, with few highlights.

LUMINOSITY - the brightness of a light source.

MACROGRAPH - A photograph that is the same size as or larger than the subject.

MACRO LENS - A lens with the ability to focus from infinity to extremely closely, allowing it to capture images of tiny objects in frame-filling, larger-than-life sizes. Sometimes called a "Close-up lens," although a close-up lens is usually a lens attachment for close-ups and does not generally have the ability to focus on infinity.

MACROPHOTOGRAPHY - Photography of a subject where the image is recorded in the same or larger than actual size.

MACROSCOPIC - Visible to the naked eye, as opposed to Microscopic, which means so small as to be invisible or indistinct without the use of a microscope.

MAGAZINE - A light-proof metal container for 35 mm film, also known as a cartridge.

MAIN LIGHT - Same as "Key light"- the principal source of light, usually in a studio, and generally the brightest light on a subject or scene.

MAKE-UP ARTIST - A person who specializes in applying and touching up a subject's make-up for photography sessions.

A MASK that blocked one half of the lens for the first exposure and the other half for the second exposure (with the subject repositioned to the other side of the car) resulted in this double-exposure.

MASK - (1) Opaque material (usually thin plastic) placed in front of the lens like a filter to block some of the light entering a lens. The mask may have a cut-out shape (a keyhole or heart-shape, for example) or may block half of the image frame to facilitate a double-exposure. (2) Opaque frame used to hold down the edges of photographic paper when making a print. Since the margin area beneath the mask is not printed, the print will have a white border.

MEDIUM FORMAT FILM - 120 roll film is the most popular medium-sized format film, and provides negatives or slides (transparencies) that are 2¼" by 2¼" (6 x 6 cm), 2¼" by 3¼", or 6 x 7 cm in size. 220 roll film is used to make the same negative and slide sizes, but has most of the paper backing that is found on 120 film eliminated, so the roll is longer than a 120 roll and provides twice as many frames as 120 film.

MEGABYTE - 1,048,576 bytes

MEMORY CARD - A removable device for storing images taken by a digital camera.

MICROPRISM COLLAR - Focusing aid in a viewfinder screen composed of small glass or plastic multiple prisms. An image that is in focus appears sharp and clear; an out-of-focus image has a broken-up, shimmery appearance. Called a collar because it is ring-shaped and encircles the center area of the lens (which may have a split-image screen in it) like a collar.

MIDTONE - Area of an image or a scene that displays average tonal values.

MID-ROLL REWIND - Feature on some cameras that permits the film to be rewound before the final frame is exposed.

MINIATURE CAMERA - Camera with a film format smaller than APS film.

MIRROR LENS - Lens with an internal mirror or mirrors that are usually curved, enabling comparatively-light lenses that are shorter than similarly-designated long focus lenses.

MODELING LIGHT - A tungsten light built into a flash unit that remains on while the flash is turned on in standby mode, permitting the photographer to assess highlight and shadow areas that will be created when subsequently exposing the film in the brighter light of the flash. The modeling light also permits focusing.

MODEL RELEASE - A contract in which a model consents to the use of his or her images by the photographer or a third party. Sometimes referred to simply as a "release."

MONOCHROME - An image of a single color in differing shades, descriptive of a black and white or sepia-toned image.

MONOPOD - A single-legged camera support that functions in a manner similar to a tripod. Also may be called a "Unipod."

MONTAGE - (1) Technique of combining in a single photographic composition elements from various sources, such as parts of different photographs. (2) A photographic image produced by this technique.

MOTOR DRIVE - Camera accessory (either built in or attached as a separate unit to some cameras) that automatically advances the film when an image has been taken and continues to recock and fire the shutter continuously, taking a rapid sequence of exposures at a predetermined rate of frames per second. A motor drive usually also rewinds the film when the roll has been completely-exposed.

MOTOR WINDER - Camera motor that automatically advances the film when an image has been taken, and usually also rewinds the film when the roll has been completely-exposed.

MOUNT - Frame or backing used to support and protect prints and transparencies. A transparency is generally called a slide once it is in a mount.

MULTIPLE EXPOSURE - More than one exposure on the same film frame. Called a "Double-exposure" when there are two exposures on a single film frame.

MULTIPLE FLASH - Simultaneous use of more than one flash unit.

ND - Neutral Density.

NEGATIVE - An image in which the brightness values are reversed - that is, reproduced so that the lightest areas are the darkest, the darkest areas are the lightest, and intermediate tones are similarly reversed. "Negative" commonly refers to such an image on exposed and developed photographic film that is intended for use in making positive prints of the image.

NEGATIVE HOLDER - A clamp-like device that fixes a negative in position in an enlarger.

NEGATIVE-POSITIVE PROCESS - Any photographic process in which a negative is first made and then used to produce a positive image (e.g. a print)

NEUTRAL DENSITY FILTER - Filter for use in front of the lens that absorbs all visible wavelengths to a more or less equal extent. ND filters can be used with both monochrome and color films, since they have no effect on color balance.

NEUTRAL TEST CARD - Also known as the "Gray card" or a "Kodak neutral test card," this is an 8" X 10" (20 cm by 25.5 cm) card, about 1/8" thick, that is uniformly gray on one side. The gray side reflects precisely 18% of the white light that strikes it (corresponding to the calibration of a reflected-light meter). It is uniformly white on the other side, which reflects 90% of the light.

Ni-Cd - Nickel-cadmium. Also referred to as "Ni-cad". A NiCd battery is one type of rechargeable battery that should be completely discharged of its energy before it is recharged.

NiMH - Nickel Metal Hydride. A NiMH battery is one type of rechargeable battery that does not need to be completely discharged of its energy before it can be recharged.

NON-LENS SPOTLIGHT - A light with variable field and beam angles obtained by changing the spacing between the bulb and reflector.

NORMAL LENS - Lens with a focal length approximately equal to the diagonal of the film format. A scene viewed through a normal lens appears to have the same perspective as if it was being viewed "normally" without a lens, just the way your eye sees it. Most 35 mm cameras' normal lenses have a focal length of approximately 50 mm.

OBJECTIVE - An objective (or object lens, object glass, objective lens or photographic objective) is an optical system or device containing a combination of lenses that receive light rays from an object and form an image on the focal plane. A photographic lens is an objective.

OFF THE FILM METERING - Known also by its initials, OTF metering is an exposure meter reading that measures light reflected from the surface of the film during exposure.

OPACITY - (1) State or quality of being opaque. (2) The degree to which a substance is or may be opaque. (3) The proportion of the light that is absorbed by the emulsion on any given area of the negative.

OPAQUE - (1) Does not transmit light. (2) Coloring used in photography to render parts of a negative opaque.

OPEN UP - Increase aperture size or reduce shutter speed to permit more light to reach the film.

OPTICAL GLASS - High-quality, color-free glass having specific refractive qualities, used in lenses and other components of optical systems.

OPTICAL ZOOM - A true zoom effect unlike a digital camera's digital zoom.

OPTICS - The branch of physical science that deals with the properties and phenomena of both visible and invisible light and with vision.

ORTHOCHROMATIC or "Ortho" - (1) Representing correctly the relations of colors as found in a photographic subject. (2) A photographic emulsion sensitive to all visible colors except red - i.e. an Ortho film is sensitive to blue and green light.

OTF - Off the film

OVER-EXPOSE - Expose a photographic emulsion to more than light than is necessary for proper exposure.

OVEREXPOSURE - Overexposure occurs when a photograph receives too much light. It results in a loss of resolution (very fine detail), more graininess and less detail in highlight areas. An overexposed negative is very dense resulting in light prints. A slide has very light density. *Intentional* over-exposure or underexposure is known as increasing or decreasing exposure.

PAINTING WITH LIGHT - Occurs when the photographer incrementally lights an otherwise darkened scene using a handheld flashlight or other small light source while the shutter remains open during a time exposure. The light is added to the scene in the manner of an artist using a "paintbrush of light".

PALLADIUM PRINT - *Palladium* is a silvery-white metal that appears black in powder form. A palladium print is a photographic monochrome print that is made using palladium. Like platinum prints, they are very stable and have a high degree of permanence. Palladium prints are generally warmer and more sepia-like than platinum prints. Palladium/platinum prints, using both metals, have also been produced.

PANCHROMATIC or "Pan" - Photographic film sensitive to all visible colors. Pan films record all colors in tones of roughly similarly relative brightness as seen by the eye in the original scene.

PANNING blurs the surroundings but keeps your moving subject sharp.

PANNING - Technique that involves taking a picture while moving the camera at a relatively slow shutter speed. It is almost always used when tracking a moving object, such as a race car, as it travels across the film plane. When properly carried out, the object is rendered relatively sharply while its surroundings are blurred.

PANORAMA - (1) An extended, wide view or pictorial representation of a landscape or other scene. (2) A camera mode that produces a proportionately wider or taller than normal image, depending on the camera's orientation.

PANORAMIC CAMERA - Camera with a lens that rotates to scan a scene, all the while projecting the image onto an abnormally wide film frame. The broad sweep of the rotating lens records the scene without distortion, and is very useful for photographing expansive landscape scenes and large groups of people.

PAPER SAFE - Light-tight container in which unexposed photographic paper is stored and easily accessed, for use in a darkroom.

The twin-lens reflex camera shares the viewfinder camera's problem of PARALLAX ERROR because the lens you look through is not the lens that takes the picture.

PARALLAX - The difference between what is seen through the viewfinder and what the camera records on film, caused by the viewfinder being separate from the camera lens.

PARALLAX ERROR - Also known as "Parallax effect" - the viewfinder camera's main disadvantage, making it almost useless for careful composition of close-up subjects. The scene viewed by the photographer through the camera's viewing frame is different from the scene the lens will capture because the viewing frame is offset from the lens.

PENTAPRISM - Five-sided prism in SLR cameras that renders a correctly-oriented view of the focusing screen.

PERFORATIONS - Holes punched on the sides of 35 mm film with regular spacing so that they line up with sprockets on the camera's film take-up mechanism.

PERSPECTIVE - Technique of depicting volumes and special relationships (a scene in three-dimensions) on a flat surface (an image having two dimensions).

PHOTIC - Of or pertaining to light.

PHOTICS - The science of light.

PHOTO - (1) Photograph; (2) Greek for "light"

PHOTOFINISHING - The act of developing films, printing photographs, etc.

PHOTOFLASH LAMP - Flash bulb

PHOTOFLOOD LAMP is an incandescent light source using a tungsten filament bulb set in a reflector.

PHOTOGENIC - Being an attractive subject for photography, or looking good in a photograph.

PHOTOGRAMMETRY - Process of making surveys and maps using photographs

PHOTOGRAPH - (1) A picture produced by photography. (2) To take a photograph.

PHOTOGRAPHER - Someone who takes photographs, especially as a profession. It could be said that a *good* photogra-

pher is a combination of an artist, craftsman and scientist, since knowledge and skills from all three professions play a part in good photography.

PHOTOGRAPHIC - Of or pertaining to photography.

PHOTOGRAPHY - The process or art of producing images of objects on sensitized surfaces by the chemical action of light. The word "photography" derives from the Greek and means, literally, "light writing."

PhotographyTips.com - The internet's #1 guide to better photography. (*It's a good thing we're not biased.*)

PHOTOMICROGRAPH - A photograph taken through a microscope.

PHOTO SLAVE - Also called a "slave unit." A light-sensitive triggering device that is built in or attached to an electronic flash unit, causing the flash to fire simultaneously with another flash unit.

PINHOLE CAMERA - A camera that uses a very small hole, as if made by a pin instead of a lens, for light to enter and form an image on the film or other light-sensitive medium. See Pinhole camera.

PIXEL - Abbreviation for PICture ELement, a pixel is a small square of colored light that forms a digital image. It is the smallest unit in a digital image.

PLATINOTYPE - (1) The process of photographic printing on papers coated with platinum-based materials. (2) A print made by such a process.

PLATINUM PRINT - A platinum print is a photographic monochrome print that is made using the semi-precious metal, platinum. Monochrome printing (mainly black and white) is commonly done using silver-based materials, such as are found in most ordinary photographic printing papers, to make paper photo-sensitive. They have an inherent impermanence. The prints won't last a long, long time. In the late 1800s, the *platinotype* process resulted in a more permanent print. Platinum is highly stable and won't tarnish in air. Instead of the image resting inside a binder on the surface of the paper, the image of a platinum print is actually absorbed into the paper's fibres. A platinum print takes on the texture of the paper. It is softer in appearance, appears to have more depth, has rich blacks and a highly-delicate tonal range. Platinum prints, in other words, are beautiful prints, with soft details, great tonal rendition and deep blacks. And, they are among the most permanent photographic images, capable of lasting perhaps thousands of years. They are ideal for fine art photography and the preservation and display of great photographs.

POLARIZING FILTER - A polarizing filter ("Polarizer" or "Polarizing screen") is an adjustable filter, with an inner ring that screws onto the lens and an outer ring that can be rotated. Turning the outer ring reduces or increases the filter's effectiveness. The polarizer absorbs glare, reducing or eliminating reflections and darkening blue skies. It works by transmitting light that travels in one plane while absorbing light that travels in opposing planes.

PORTRAIT - A picture of a person or persons that captures their likeness, especially their face. (See Portrait photography.)

PORTFOLIO - A collection of selected photographs intended to illustrate a photographer's style and range of photography, or in the case of a model's portfolio, a collection of photographs and/or tearsheets that demonstrate his or her modeling abilities and experience.

POSE - The position assumed by a subject in relation to the camera, including the angling and placement of head, hands, feet, etc.

POSING - Positioning of a subject in relation to the camera. Posing is generally controlled by the photographer, and sometimes by a skilled model.

POSITIVE - Opposite of a negative - An image, such as print or a slide, with the same tonal values and colors as the original scene.

A PRINT is a photograph printed on paper.

POSTERIZATION - occurs when a gradual or smooth tonal transition in an image appears or is made to appear as an abrupt change from one tone to another. Digitally, it can be achieved by limiting the number of colors in an image so that the change from one tone to another is sudden, rather than continuous and gradual. Posterization can be noticed, for example, in an image that has a relatively large area of color that appears banded where the tonal changes should instead appear to be gradual.

PRESSURE PLATE - A smooth plate found on the inside of the camera back that is forced towards the front of the camera by springs, causing it to hold the film evenly in place for exposure.

PREVIEW BUTTON - Many cameras are equipped with a depth of field preview button that, when pressed and held in, stops the lens down to the preselected aperture, allowing you to see how much foreground or background are in focus.

PRINT - A photographic image printed on paper, generally a positive image made from a negative. (Also refers to a photograph of a model that appears in print - in a newspaper or magazine, for example.)

PRINTING FRAME - A darkroom device used to hold negatives against photographic paper for contact printing.

PRINTING-IN - Also known as "Burning in." - In a darkroom, providing extra exposure to an area of the print to make it darker, while blocking light from the rest of the print.

PRINT SOLARIZATION - See "Solarization" in this Glossary.

PROCESSING - Producing an image (either negative or positive) from exposed film or photographic paper by developing, fixing and washing it.

PROGRAM EXPOSURE - A camera mode that automatically determines aperture and shutter speed for proper exposure.

PROJECTED FRAME - (Also known as "Viewfinder" or simply "Finder.") A viewing device on a camera used by the photographer to see the field of view taken in by the camera's lens and the portion of the view that will be recorded on film.

PROOF - A sample image intended to be used for the purpose of selecting a final image. Proofs are often stamped with the word "proof" on the face of the image to identify them as proofs and sometimes to prevent their being used in place of a final image.

PULLING FILM - Purposefully overexposing and underdeveloping film to reduce its effective film speed. (The opposite of "Push processing.")

PUSH PROCESSING - Increasing development time of a film to force an increase in its effective speed, generally done to normalize results when the film has been underexposed. Also known as "Forced development."

QUANTUM OPTICS - A branch of physics employed when studying detailed effects that occur when light is absorbed by matter, film's emulsion for example.

QUARTZ LIGHTS - Generic term for various types of lights that use tungsten-halogen lamps.

QUASI-FISH-EYE LENS - The Quasi-fish-eye lens produces an image on the film that covers the entire frame, whereas a *True fish-eye* lens has its circular image wholly within the film frame.

The true fish-eye lens has its image wholly within the film frame.

RANGEFINDER - An instrument for measuring the distance from the observer to a particular object, as for adjusting the focus of a camera. A rangefinder is included as an integral part of many cameras as a focusing aid.

RC - Resin-coated.

READY LIGHT - A small light on a flash unit that indicates whether there is adequate power to fire the flash.

RECIPROCITY FAILURE - When a film's speed cannot be relied upon for proper exposure at slow shutter speed, reciprocity failure (or the "Reciprocity effect") is said to occur. Additional exposure is required in order to achieve proper exposure for that film, even though your light meter may say differently. The additional problem of a shift in color balance that occurs with reciprocity failure can be more troublesome.

RECIPROCITY FAILURE results in underexposure and a shift in color balance.

RECIPROCITY LAW - The reciprocity law states that Exposure = Intensity X Time. "Intensity" is the amount of light, and "Time" refers to how long that amount of light is allowed to act on the film's emulsion. Intensity is generally controlled by the aperture and time is generally controlled by the shutter speed. The reciprocity law therefore means that an exposure provided by *f* 8 and 1/250 sec will gave the same results as *f* 11 and 1/125 sec., or *f* 16 and 1/60 sec., and so on. If one choice of settings provides proper exposure, then the others will as well. The law "fails," however, when slow shutter speeds change the film's apparent speed characteristics, making it seem to have a slower speed and produce color shift.

RECYCLING TIME - Amount of time for a flash to recharge once fired.

RED EYE is actually an image of the retina at the inside back of the eyeball.

RED EYE - An image in which a subject's irises are red instead of black. The red eye effect is caused by light from a flash traveling through the iris and illuminating the retina at the interior back of the eye— which is red in color due to its blood vessels — and the camera capturing that redness on film.

RED EYE REDUCTION - A feature of some cameras or flash units that is meant to reduce the effect of red eye by emitting multiple bursts of light immediately before the picture is taken. The intended result is a forced reduction in the size of the subject's iris.

REFLECTED LIGHT READING - An exposure meter reading of light reflected by a subject. The exposure meters in most cameras are reflected light meters.

REFLECTOR - Material used to reflect light onto a subject. A flash reflector is a shiny surface situated behind the flash tube that reflects light in a specific direction.

REFLEX CAMERA - A camera that has a mirror directly in the path of light traveling through the lens that reflects the scene to a viewing screen.

REFRACTION - Refraction is a change of direction of a ray of light. Light that is traveling in a straight line alters course - bends - when it strikes light-transmitting substances at any angle other than perpendicular.

RELEASE - Refers to a Model Release - a contract in which a model consents to the use of his or her images by the photographer or a third party.

RESIN COATED PAPER - Paper that has a water repellent base and is used for making photographic prints.

RESOLUTION - (1) Fine detail in an image. (2) Also means "Resolving power."

RESOLVING POWER - Ability of film, lens or both together to reproduce fine detail.

RETICULATION - Occurs during processing when the emulsion becomes cracked or distorted. The cause is usually exaggerated temperature variance or differences in chemical activity between solutions.

RETOUCH - To manually alter the appearance of a negative, slide or print using non-photographic methods, such as airbrushing, with the intention of improving the image's appearance.

RGB - An acronym for the primary colors of light, ***R****ed*, ***G****reen and* ***B****lue.*

RING FLASH - A circular-shaped electronic flash unit that fits around a lens and provides shadowless, uniform frontal lighting, especially useful in closeup photography.

ROLL FILM - Film with a lightproof paper backing that is wound onto a spool, such as 120 film for medium format cameras.

SAFELIGHT - A lamp, typically in a darkroom, that allows a person to view light-sensitive material without it being altered by the light. The lamp is generally coated with or enclosed in a partially-translucent filter that screens out light rays to which the film or paper are sensitive.

SANDWICHING - Combining two (or more) negatives or slides for simultaneous printing or viewing.

SATURATION - The degree of hue in color as perceived subjectively. Saturated color can be termed strong, vivid, intense or deep. Desaturated color can be termed weak, pale, washed out or dull.

SCALE is often revealed only when an object of known size is introduced in a photograph.

SCALE - (1) The relative size of an object. (2) A set of marks to indicate distances at which a lens is focused, often engraved near the focusing ring on a lens.

SCANNER - Electronic device that captures an impression of an object (commonly a photographic print or other flat document) and converts it into a digital image which can be edited and saved on a computer.

SELECTIVE FOCUS - Employing shallow depth of field through the use of a wide aperture so that the subject is isolated from its surroundings because they are not in focus.

SELF-TIMER - Mechanism that can be set to automatically release the shutter following a timed delay, usually covering a delay range of up to 10 seconds. Its principal use occurs when the photographer wishes to be included in the picture, but it is also useful in avoiding camera movement or vibration during time exposures.(Also known as "Delayed action")

SENSITIZED - Made photo-sensitive. Photo-sensitive paper for making prints has been "sensitized."

SENSITIVITY - The degree to which a photographic emulsion reacts to light. Fast film, for example, has greater sensitivity than slow film.

SET - A specific area in which objects and persons are photographed - generally in a photo studio - and comprised of a backdrop and props.

SHADOW DETAIL - Detail that is visible in an image's darker areas.

SHARPNESS - An image's degree of clarity in terms of focus and contrast.

SHEET FILM - Piece of film sized for one exposure in a view camera.

SHOOT - As a verb, to "shoot" is to take a picture. As a noun, a "shoot" is a photography session.

SHUTTER - A movable cover for an opening. In photography, that opening is the lens - more specifically, the aperture. The shutter blocks the passage of light traveling through the lens to the film when it is closed, and allows light to reach the film when it is open. Shutters are composed of blades, a curtain, a plate or another movable cover. They control the amount of time that light is allowed to pass through the opening to reach the film.

SHUTTER LAG - Using a digital camera, the delay that occurs between pressing the shutter release button and the actual moment the picture is taken.

SHUTTER SPEED - Controls the duration of an exposure - the faster the Shutter speed, the shorter the exposure time.

SHUTTER PRIORITY - An exposure mode (in a camera with automatic exposure control) that permits the photographer to preset shutter speed while the camera automatically determines the aperture setting required for proper exposure.

SIDE LIGHTING - Light falling on a subject from the side relative to the camera position.

SIMPLE CAMERA - A camera operated with minimal adjustment by the photographer, such as a point-and-shoot. Simple cameras usually do not have to be focused, and have only a single aperture and one or a couple of shutter speeds.

A SILHOUETTE is a dark shape with no three-dimensionality.

SILHOUETTE - A dark image outlined against a lighter background.

SINGLE LENS REFLEX - (SLR) A camera with one lens only for both viewing and picture-taking. The image is reflected onto a viewing screen by a moveable mirror in the camera. The mirror flips out of the way just before the shutter opens, permitting light to strike the film.

SINGLE-USE CAMERA - Camera that is used only once. It is disposed of after the film is removed for processing.

SKYLIGHT FILTER - a UV filter with a pale rose tinge to it to warm up images. Intended for use with daylight-type color slide films to reduce excess bluishness.

SLAVE UNIT - A light-sensitive triggering device that is built in or attached to an electronic flash unit, causing the flash to fire simultaneously with another flash unit. Also called a "photo slave."

SLIDE - A single frame of exposed transparency film mounted for protection and to facilitate use in a slide projector.

SLIDE FILM - Film used in making slides. Also known as "Transparency film," "Positive film" or "Reversal film."

SLOW FILM - Film with relatively low sensitivity to light - typically having a film speed in or lower than the ISO 50 range.

SLOW LENS -A lens with a relatively narrow maximum aperture - *f* /8, for example.

SLR - Abbreviation for Single Lens Reflex.

SMARTMEDIA - Brand name for one type of digital camera's re-usable memory card on which images taken by the camera are stored.

SNAPSHOT - An informal photograph, especially one taken quickly by a simple, hand-held camera.

SNOOT - A shield fitted to a lamp used to direct a concentrated beam of light onto a scene.

A diffusion filter is effective at creating a SOFT FOCUS effect in portraits.

SOFT FOCUS - A soft look achieved by bending some of the light from the subject so it is defocused while the rest remains in focus. Highlights are actually dispersed onto adjacent areas. The image still looks properly-focused overall, but its components are just enough out-of-focus that they are softened. Lines are slightly fuzzy and small details seem to disappear.

SOFT LIGHTING - Low contrast illumination.

SOLARIZATION - Print solarization occurs when a photographic print is partially developed, then exposed to white light before the print is completely developed. The effect is a reversal of all or some tones - i.e. some of the image appears to be positive while other portions of it appear to be negative. (Note: Some darkroom technicians obtain the effect by first *completely* developing the print, then exposing it to white light before immersing it in stop bath.) Black and white and color films and papers that are based on silver halide emulsions can also be solarized.

SPEC SHOT - A photograph taken on "speculation" that a photographer hopes will be sold on its own merits.

SPECTRAL SENSITIVITY - The relative response of a light-sensitive emulsion to wavelengths in the electromagnetic spectrum.

SPEED - A measure of the sensitivity to light of a photographic emulsion.

SPOT METER - A type of exposure meter with an acceptance angle of 1 degree or less used to obtain reflected light readings of a small area of a scene.

SPOTTING - Retouching of a photographic print using a brush with watercolors or dyes, or a pencil, to get rid of blemishes caused by dust or scratches on a negative.

STAIN - The discolored parts of a print or film caused by insufficient fixing, washing or agitation during processing, or by contaminated processing solutions.

STATS - A model's statistical information - his or her measurements, size, height, etc.

STOCK PHOTOGRAPHY - Images that are not photographed for a specific client or use, but are catalogued for review and selection by someone who may have a use for the image.

STOP -

(1) As a noun, a *stop* is a single aperture setting or shutter speed setting. A "one stop" change in exposure is achieved by changing either the aperture or the shutter speed to the next incremental setting - i.e. doubling or halving the shutter speed or aperture value. (A shutter speed of 1/125 sec is a one stop change from 1/250 sec. An aperture of f/5.6 is a one stop change from f/8.)

(2) As a verb, to "stop down" is to decrease exposure by reducing the size of the aperture or increasing shutter speed - e.g. a light meter reading may indicate that you should *stop down* by three stops for proper exposure.

STOP BATH - An acid bath or rinse (usually a weak solution of acetic acid) for stopping the action of a developer before *fixing* a negative or print.

STOPPING DOWN - Reducing aperture size - for example, from *f*/16 to *f*/22.

STROBE - Although commonly-used to describe an electronic flash unit, especially one used in a studio, a strobe (short for "stroboscope" or "stroboscopic lamp") actually refers to an intermittently-flashing, extremely-short duration, bright light source.

STUDIO - A room specially equipped for photography.

STYLIST - In photography of people, a stylist selects and coordinates garments and accessories to be worn by the subject. In food photography, a stylist prepares the food, designs the setting and arranges it for the photographer.

SUBJECT - (1) The principal object (person, animal, thing) in a photograph or being photographed. (2) A theme or topic in photography. (3) The most essential object in a photograph, without which the photograph's purpose or meaning would be unclear.

SYNCHRONIZED FLASH - Flash that is coordinated with shutter speed such that the shutter is fully open when the flash illuminates the scene being photographed.

SYNCH CORD - Also "sync cord." An electrical cord connecting a camera to an electronic flash unit to permit synchronized flash.

T - (which stands for "Time") - Shutter speed setting used for time exposures. The shutter opens when the release is pressed and closes when it is pressed again.

TEARSHEET - A copy of a published page (magazine or newspaper) in which a model's picture appears. Tearsheets are generally included in a model's portfolio as evidence of work the model has done.

TECHNICAL CAMERA - Precision view camera made of metal.

TELE-CONVERTER - a lens mounted between a camera body and a lens (usually a telephoto lens) to increase the effective focal length of the lens. Also referred to as a "tele-extender". Different tele-converters have different magnifying powers, ranging from 1.4 times to 3 times the lens' normal magnification (1.4X to 3X). The effect is to increase the lens' focal length by the degree of magnification, so a 3X tele-converter used on a 50mm lens triples the image size by tripling the effective focal length to the equivalent of a 150mm lens. The disadvantages of using a tele-converter are light loss and, generally, reduced image quality.

A TELEPHOTO LENS of this super size magnifies the scene like a telescope.

TELEPHOTO LENS - A lens with a narrow angle of view, a longer-than-normal focal length, the ability to magnify images, and exhibiting relatively shallow depth of field. Examples of 35 mm camera telephoto lenses include 85 mm, 400 mm and 600 mm lenses, to name a few.

TEST SHOTS - Photographs of a model who poses for them for free or at low cost in order to build a beginning portfolio.

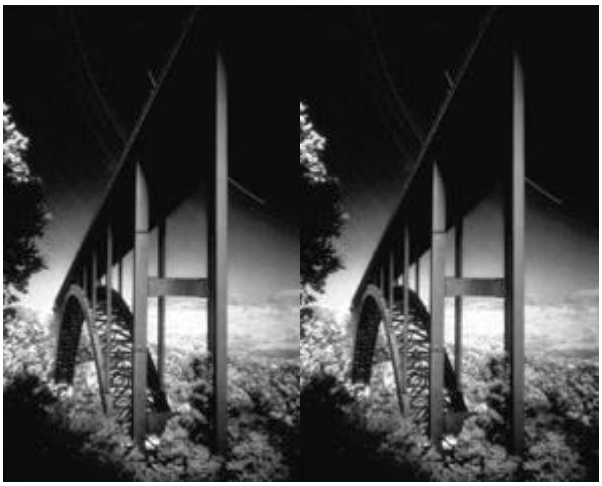
TEXTURE - The visual and tactile quality of the surface of an object, revealed in a photograph by variances in tone, depth and shape. Lighting has the most influence over how well texture is captured in an image.

TFP - "Trade For Prints" or "Trade For Pictures" - an arrangement between a model and a photographer where the model receives photographs in lieu of a modeling fee.

"THICK" NEGATIVE - *outdated term* a dense negative.

"THIN" NEGATIVE - a negative lacking density, due to underexposure, underdevelopment or both.

THROUGH-THE-LENS - Commonly abbreviated as "TTL". Refers to both exposure metering of the light passing through the lens (Through-the-lens metering, and TTL flash metering) and viewing a scene through the same lens that allows light to reach the film (Through-the-lens focusing).



A long TIME EXPOSURE is needed to capture star trails, noticeable as curved lines in the sky.

TIME EXPOSURE - An exposure with a duration of several seconds or longer, the timing of which is measured by the photographer.

TIME LAPSE PHOTOGRAPHY - Taking a series of pictures of the same basic scene at regular, timed intervals from the same viewpoint.

TINT - (1) Gradation or variety of a color or hue. (2) A color diluted with white. (3) Varying shades of white in a photographic print, from white to buff as determined by the color of the paper.

TONAL RANGE - The various shades of gray between solid black and absolute white.

TONE - also known as "Value" - The degree of lightness or darkness, or color variation from cold tones (blues) to warm tones (reds), in an area of a print, whether a color print or a black-and-white print.

TONING - Altering the tone of a print, generally by intensification. "Toners" are the solutions used to produce different color shades.

TRANSPARENCY - A positive image on transparent film.

TRANSPARENT MAGNETIC LAYER - Thin layer of magnetic particles coating the surface of APS (Advanced Photo System) film that records information such as the picture size selected by the photographer and processing data. IX (Information Exchange) technology allows photofinishing equipment to read these instructions on the film and make processing and printing adjustments for the best results from different lighting and exposure conditions.

A TRIPOD is an essential accessory for the photographer who uses slow shutter speeds.

TRIPOD - A pole on a base of three legs to which a camera can be attached, providing support that eliminates or reduces camera movement, useful for sharp images when using slow shutter speeds or to show blur from a moving subject. The height of the pole and of the individual legs can usually be adjusted. Various models have different characteristics.

TTL - Abbreviation for "through-the-lens".

TTL METER - A light meter that measures light travelling through the lens.

TUNGSTEN LIGHT - In photography, tungsten light is a generic reference to standard, artificial room lighting (the light from normal household bulbs, for example, but not fluorescent lamps.) Tungsten light is produced by an incandescent electric lamp in which the filament is made of tungsten, a rare, metallic element having a high melting point.

TUNGSTEN FILM - Film that is color-balanced for illumination from tungsten light. Also known as "Type B" color film.

TWIN LENS REFLEX - (TLR) A camera having two separate lenses of the same focal length - one for viewing and focusing; the other for exposing the film. The lenses are mechanically-coupled so that both are focused at the same time.

TYPE A FILM -Color film that is color-balanced for photography of scenes illuminated by artificial light sources at a color temperature of 3400K - typically flood lamps.

TYPE B FILM - Color film that is color-balanced for photography of scenes illuminated by artificial light sources at a color temperature of 3200K - typically tungsten and household lamps. This is the more commonly-used of the two types.

ULTRAVIOLET RADIATION - (UV) - Ultraviolet light is invisible to the human eye, but can be seen by bees and butterflies. Most photographic films are sensitive to this electromagnetic radiation.

A 17 mm lens is considered to be an ULTRA-WIDE ANGLE LENS.

ULTRA-WIDE ANGLE LENS - An extra-wide angle lens. Generally refers to 35mm camera lenses with focal lengths shorter than 24 mm.

UMBRELLA - A lighting accessory that resembles a rain umbrella, used to soften illumination by bouncing or diffusing the light.

UNDEREXPOSURE - An image is underexposed when the film receives too little light for proper exposure. Underexposure results in loss of detail in the subject's dark areas, which can be almost completely black and featureless.

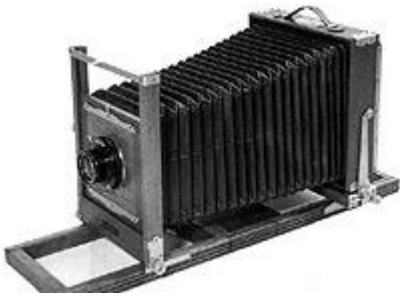
UNIPOD - A "Monopod," a single-legged camera support that functions in a manner similar to a tripod.

UV FILTER - a clear, neutral filter that absorbs ultraviolet radiation, with no effect on visible colors. The skylight filter is a UV filter with a pale rose tinge to it.

The UV FILTER is clear and colorless.

VARIABLE CONTRAST PAPER - Photographic paper of differing grades of contrast when exposed through special contrast filters.

VARIABLE FOCUS LENS - A zoom lens - one in which focal length is variable. Elements inside a variable focus lens shift their positions, enabling the lens to change its focal length - in effect, providing one lens that has many focal lengths.



The VIEW CAMERA is the largest of the basic camera types.

VIEW CAMERA - A large format camera - a term that applies to cameras that produce an individual image size of 5" X 4" or larger. It is most often found in a studio, and is sometimes even called a "studio camera," although the view camera can be transported and set up in the field.

VIEWFINDER - A viewing device on a camera used by the photographer to see the field of view taken in by the camera's lens and the portion of the view that will be recorded on film. (Also known as "Finder" or "Projected frame.")

VIEWFINDER CAMERA - Camera with a viewfinder that is separate from the lens used in taking the picture. A simple point-and-shoot disposable camera is an example of a viewfinder camera, but not all viewfinder cameras are simple.

VIEWPOINT - Location of the camera relative to the subject.

VIGNETTING - (1) Underexposure at the image's edges or corners caused by an unsuitable lens hood, filter or other attachment that partially blocks the field of view. (2) An image printing technique where the central area is fully printed but its edges gradually fade.

The VIEWFINDER CAMERA is the most popular type of camera.

VIEWFINDER CAMERA - Camera which has a viewfinder that is separate from the lens used in taking the picture. A simple point-and-shoot disposable camera is an example of a lenses viewfinder camera, but not all viewfinder cameras are simple.

VIEWPOINT - Location of the camera relative to the subject.

VIGNETTING - (1) Underexposure at the image's edges or corners caused by an unsuitable lens hood, filter or other attachment that partially blocks the field of view. (2) An image printing technique where the central area is fully printed but its edges gradually fade.

WASHING - The rinsing of film or photographic papers with water to remove chemicals from them.

WASHING AGENT - A solution that reduces washing time by more quickly removing processing chemicals.

WAVELENGTH - The distance - from peak to peak in a light wave - that determines the color of the light.

The 24mm lens is a WIDE-ANGLE LENS.

WETTING AGENT - A chemical solution that lowers surface tension and causes film to dry faster and more evenly, thereby reducing the risk of water spots on the film.

WIDE-ANGLE LENS - A lens with an angle of view that is wider than that of a normal lens, or that of the human eye. A wide-angle lens has a focal length which is less than the diagonal of the film format.

X-RAYS - Electromagnetic radiation similar to light but of shorter wavelength and capable of penetrating solids. X-rays can fog photographic film.

X SETTING - Shutter speed setting at which flash synchronization occurs. For some manual cameras, the X setting designates the maximum shutter speed at which the camera synchronizes with flash.

X-SYNC - Same as "X Setting"

Shutter speed dial showing various speeds, including the X SETTING.

YELLOW FILTER - The most-popular colored filter used with black and white film. Because a yellow filter absorbs blue (its complementary color), it provides significantly greater contrast between blue and yellow or white subjects. A yellow filter absorbs UV and is useful in reducing haze, particularly in aerial or mountain photography.

YELLOW-GREEN FILTER - Highly-useful for landscapes photographed in black and white, the yellow-green (or yellowish-green, or yellow-greenish) filter only darkens blue skies, whitens clouds, and enhances green foliage.

YELLOW-ORANGE FILTER - This filter has a stronger effect on skies than yellow filters, increasing darkness a great deal. It is also good for reducing blemishes and skin spots.

ZONE SYSTEM - A method introduced by photographer, Ansel Adams, for determining optimal exposure and appropriate development for an individual photograph.

ZOOM - The action of varying the focal length of a zoom lens to enlarge (zoom in) or reduce (zoom out) the image.

ZOOM LENS - A lens in which focal length is variable. Elements inside a zoom lens shift their positions, enabling the lens to change its focal length - in effect, providing one lens that has many focal lengths. (Also called a "Variable focus lens.")

Notes

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