0 Introduction

THE growth of the Leitz Werke from a humble optical workshop in 1869 (the year when Ernst Leitz bought the Kellner firm) to a major manufacturer of optical instruments in 1933 occurred during a period in which the industrial revolution and modernization alternated with two serious economic depressions. In less than half a century the German industry evolved from a collage of small workshops to the most powerful conglomerate of modern manufacture in Europe. The age from 1848 to 1933 has been called the German Age because German science, industry and culture dominated the European scene. The optical industry became one of the spearheads of modernization, starting from a handful of artisanal workshops around 1850. At the turn of the century Germany had more than 300 optical companies. The evolution and success of the Leitz Company is easier to understand against this background.

The invention and development of the Leica camera took place in the period from about 1905 to 1925 and this period is pivotal for the Leitz company and for the subsequent development of photography. A sketch of this crucial period, sometimes referred to as the Vertigo Years, introduces the artistic and cultural forces that helped the acceptance and later dominance of the Leica camera.

The gradual evolution from the Leica Standard to the Leica S2 constitutes an eventful and interesting story. The foundations on which the Leica camera was based are the precision manufacture of microscopes and the advanced design of optical components. These fundamentals have always had great weight in the construction and design of the photographic products and almost gave the company the coup de grace.

The current decade of the 21st century will determine the fate of the company: once again a pivotal change or a shaky balance between myth and professionalism on one level and between nostalgia and modernism on another level.

Leica M3

Leica M7

Leica MP

Leica M9

Ur-Leica

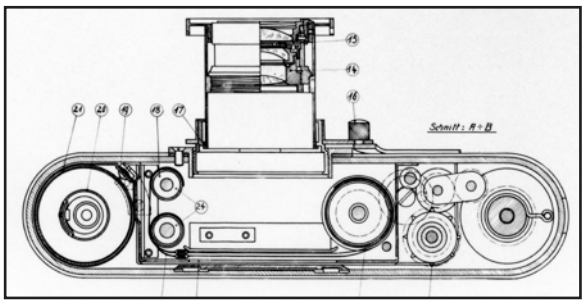
Leica I

0.1 1925: a new Leica camera

THE Leica camera was introduced to the public in the spring of 1925 by the Leitz Werke and at first received a mixed reception. It was a new concept, utilizing perforated movie film in a compact all-metal housing with a layout that supported handheld photography at eye level. You could take thirty-six pictures in rapid succession with this small and lightweight, but very solid camera with its exquisitely smooth operation. It took a few years before the camera was widely accepted in photography circles. In the mid-twenties of the 20th century the art world went through a revolutionary period. This was the industrial age and modern techniques received a lot of attention. Cinematography was widely seen as the exponent of modernity, closely followed by surrealism. It were the surrealist artists who quickly adopted the Leica as a tool for expression. The surrealist undercurrent would play an important part in the Leica style of photography and saw its zenith in the street photography in the period 1950 to 1970.

The Leica camera from 1925, the Leica I, can be regarded as a disruptive technology as it pushed aside the then popular rolfilm camera and its static mode of photography. This Leica model is also the most copied camera in the world with more than 300 clones and derivatives.

This was not the first time that a disruptive technology shook the very foundations of the photographic world. The first one is now almost forgotten, but the negative-positive process by Fox Talbot killed the promising technique of the Daguerrotype. The second disruption has been related to the introduction of the celluloid base for film, used in the Kodak camera around 1880. The third and most important disruption for modern photography occurred in 1925 when the Leitz Company introduced the Leica I.



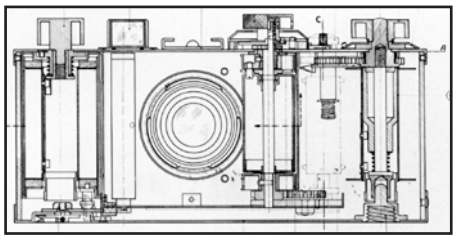
Leica I 1925

The camera design, revolutionary as it was, did not come into existence in a void. Many innovations happen because it is their time. Photography at the end of the 19th century was on a sidetrack, technically and artistically and a new impulse could overturn its established rules and conventions.

At first ridiculed by the established photographic community, the camera quickly gained acceptance with a new generation of artists and a decade later the camera was a global player in the photographic and artistic world.

This camera was the brainchild of the German engineer Oskar Barnack, who was brooding on the design in the first decade of the 20th century. The basic sketches for the design were made in the period from 1906 to 1910 when Barnack worked at the Carl Zeiss Werke, but the Zeiss management was not interested.

Barnack changed his job in 1911 when he joined the competing company of Ernst Leitz. In this environment he could develop and found acceptance for his design for a new type of camera. The final prototype was ready in 1914. After a long period of fine tuning the design, the camera went into production in 1924/1925. Several years later the small pocketable Leica camera was embraced by many modern artists and photography entered a new era. This did not happen overnight. The camera type and the style of



These drawings were not made by Barnack, but in the Leica factory at a later date.

photography that was made possible by its design and function matched the artistic and cultural mood of the period, known as the Vertigo Years and after the war of 14-18 the Weimar and Bauhaus Period.

The technique of photography was officially announced in 1839, just ten years before Carl Kellner established his workshop. Photographic products were quickly adopted by German manufacturers and in 1900 Germany dominated the world with its cameras, optics and chemicals. Camera and microscope manufacture are totally different worlds as are the markets for these products. The development of the Leitz company shows how uneasy the marriage between these product ranges is.

The prototype of the Leica was ready around 1914, but the great war from 1914 - 1918 and after 1920 the hyperinflation prevented the introduction of the camera. Germany had suffered a period of extremely high inflation and social unrest that only ended in 1924 after the Reichsmark was stabilized. From 1924 to 1929 (the panic on the Wall Street stock exchange) there was economic prosperity and political stability. It makes sense to introduce a new product in a period of beginning affluence.

0.2 Fin de siècle: cradle for the Leica

THE year 1900 marked the transition from the 19th to the 20th century. The forty years that separated the Crystal Palace in London (1851) from the Eiffeltower in Paris in 1889 witnessed an unprecedented growth in scientific knowledge and technological progress. The year 1900 is a symbolic watershed year, but modern thought took shape already in the last quarter of the 19th century and the first decade of the 20th century. The Newtonian universe with its mechanistic model, solid atoms and absolute time and space was replaced by a more relativistic approach and new concepts about nature became available, like quantum energy, relativity and uncertainty. These scientific revolutions affected the art world deeply.

The revolution in the art of painting were even more profound. Painters in Paris began to depict modern life itself, focusing on social life and leisure activities of the middle classes. Many of these artists were fascinated with light and color and the representation of momentary visual experience. These impressionistic paintings foreshadowed the revolution that was to happen in photography, until that time a very static process.

The period from 1895 to 1914 has been designated as la belle époque ("the beautiful age") because of the economic growth that added an enormous wealth to the new middle classes and the widespread excitement about modernism and the many new ideas and practices (like consumerism) that were introduced and eagerly embraced. The period has also been designated as the Vertigo Years, a period of dazzling and bewildering innovations. One of the core concepts of that period was speed. Contemporary artists and thinkers were impressed by machines and even worshipped the machine as the ultimate modern tool. Cinematography represented the machine age more directly than photography at that time did.

Stefan Zweig has summed up the mood of the time very well when he remarked that 40 years of peace had given the economy a boost, the technology had vitalized the rhythm of life, scientific discoveries had given a whole generation new confidence. The surge of modernism and optimism vibrated through the whole of society.

Zeiss had established a photographic department for the production of cameras, but this experiment did not go well. It is a sign of the times that Leitz did focus on the cinematographic equipment as a more promising economic endeavor. He employed Mechau to construct a projector for use in the large movie theaters.

It is against this background that the saga of the Leica camera begins with the arrival of Barnack in the Leitz company. When Barnack was employed at the Zeiss company in the first decade of the 20th century, he already had ideas about a compact camera. The Zeiss management however showed no interest as they were still contemplating the failure of their earlier attempts to enter the photographic market.

It took Barnack about ten years to proceed from first sketch to the final finished prototype. There have been several explanations that try to shed light on the motivation by Barnack to create, design and develop this camera. None of these is fully satisfactory and many important questions still remain to be answered. Presumably these answers will not be provided as the process of innovation is often not documented.

Barnack is often described as a solitary individual, but he was certainly well aware of what happened in the world. Newspapers and magazines reported about every trend and event that happened in Europe. The epicenter of modern art was Vienna, but München, Berlin and Dresden were important cities too. The modern

movement stressed new radical ideas, an admiration for the machine and the use of first-class machine-age material and technology as inspirations for design. Functionality, simplicity and usability were the guiding principles. These elements are clearly visible in the Leica prototype.

The trend in photographic equipment to design smaller cameras, based on industrial principles and with new functions was already visible in the Kodak Brownie camera from 1900. Several inventors were tinkering with the idea of a miniature camera based on movie film formats. The Ermanox of 1924 was almost as small as the Leica and offered in the beginning higher speed lenses (f/2 versus f/3.5).

It is not known why Leitz waited from 1914, when the prototype was finished to 1925 to start producing the camera. One of the most obvious reasons is the outbreak of the war 1914 - 1918. A second reason might be the fact that after the war the economic and political situation in Germany was quite volatile and Leitz depended for a large part on export for its survival. From 1925 on the situation was much more stable and the hyper inflation had stopped around 1923. The often presented argument that Leitz needed a new product to compensate the reduction in sales of microscopes and saves the jobs of the workers lacks depth. The microscope production did not fall that much and during the first years of production of the camera the output was quite small. The workforce could easily switch from making microscopes to making cameras.

0.3 Evolution of the Leitz Werke: 1869 to 1925.

THE Leitz company was established in 1869 as a continuation under new ownership of a modest optical workshop where microscopes were made in an artisanal way. The Kellner Optical Workshop was almost broke when Leitz took the lead. The company grew from 20 to 1000 persons between 1869 and 1910. This success was partly the result of the high manufacturing quality and the good design of the Leitz microscopes and other optical instruments. The period from 1870 to 1900 was also dominated by the creation of the German Kaiserreich and the Second Industrial Revolution which forced a rapid expansion of production capacity and the introduction of new technologies.. Germany became a powerful political entity not in the least because of a centralized industrial policy that promoted several core industries that would define the status of a modern industrial nation on a European scale. The mechanical-optical industry was one of the spearheads of this industrial policy and Zeiss and Leitz received much support in their efforts for worldwide export. The industry-friendly approach was an incidental circumstance for the growth of the optical industry in Germany. The optical industry became one of the spearheads of modernization, starting from a handful of artisanal workshops around 1850. The evolution and success of the Leitz Company can be better understood against this background.

Optical instruments were needed in science, research, technology and even in governmental circles where ordnance surveying and the military demanded optical instruments of high precision. For the production of optical devices it is not enough to have knowledge of the mathematics involved in ray tracing or have the expertise to design and manufacture the equipment with the required precision. In these domains the German companies had no superiors. But one needs glass of the required quality. And in this area the English and French were the masters. In the beginning of he 19th century the best glass came from England and from France, but the quality of the glass differed form batch to batch. And the best batches were obviously reserved for their own scientists and industrialists.

The period from 1849 to 1933 has been designated as the German Age. Germany in the second half of the 19th century had the most outstanding artists, scientists, inventors, engineers, writers and philosophers the world has ever seen. German ideas and genius dominated the intellectual and cultural landscape.

The German Government understood quite well the importance of a powerful industry to support the political power of the state . In the last quarter of the century the state established a coordinated industrial policy. One of the important strategic industrial sectors was the optical and mechanical industry. Leitz, but Zeiss too and several other companies benefitted from this policy. The expansion of the business and the growth to world fame was possible thanks to these two developments: the recognition of the strategic importance of the optical industry and the demand for high quality optical instruments from scientists and researchers. The demand for microscopes, telescopes and survey equipment of high quality was vast, but the quality of the instruments depended on the quality of the glass and the quality of manufacture.

The German optical industry in the 19th century had to use glass that was imported from the best French and British glass making companies, but there was no information about the all-important refractive indices of the glass batch. There was one company in Germany in the early part of the 19th century that produced the best glass in the world and had a reliable method for measuring the refractive indices: the von Fraunhofer Institute. The institute was part of a monastery and the method of glass making was jealously guarded and the secrets were never revealed and were lost when von Fraunhofer died. But the Fraunhofer example worked as inspiration and around 1880 Otto Schott could announce that he had found new ways to make glass of superior quality. Schott had joined the Zeiss company and with the help of the theoretical explorations of Abbe a long period of German hegemony in the optical industry began.

Wetzlar and Jena are 250km apart in a straight line and these cities, together with a few others like Berlin and München formed the poles of the emerging mechanical-optical industry. The firm of Leitz was the most important one in the Wetzlar region and experienced a strong growth. Leitz had to address the growing pains of the company and had to focus his attention on improvements of the factory organisation and the introduction of new production methods to modernize the manufacturing processes. A large part of the production was exported and the company had to secure its international logistics and sales force. Ernst Leitz I was a smart industrialist, more of a merchant than a scientist. He was acutely aware of the shaky foundations of the Kellner company when he became the owner and was determined to create a solid base for the expanding workforce that was dependent on the success of the company for their living.

Wetzlar is an unlikely place to become the nucleus for the growth of a mechanical-optical industry. There is a strong element of chance involved in the decision of Kellner to establish his Optical Workshop in Wetzlar and it is again by accident that Ernst Leitz came to Wetzlar.

The Leitz Werke had built their reputation on the manufacture of microscopes and other optical instruments. The quality of the products was very high, but the competition was strong and Zeiss in Jena was a formidable competitor. The Leitz workforce hit the highest level during wartime with 2000 persons, but it went down to just above 1100 in 1919. This is the same number of persons working now in 2010 in Solms and Portugal in the Leica factories. In the years after 1920 the workforce expanded, a bit but started to shrink again and was at its lowest point in 1926 with 1123 persons. It is evident that the Leitz company could not exploit the economic boom period with its existing range of products and the photographic camera offered an opportunity. This camera was not the result of a conscious product strategy, but a by-product from an earlier attempt to diversify the product range with a movie projector. The inventor or Konstukteur (in German) of the camera was Oskar Barnack who worked for the Zeiss company and came to the Leitz Werke . Zeiss has often indirectly influenced the fate of the Leitz (later Leica) company. Not only Barnack came from Zeiss, the current CEO of Leica, Mr. Spiller also was employed by Zeiss and so was Lothar Kölsch who was head of the optical department at Leica and revolutionized the design of lenses.

The manufacture of the Leica was a major gamble. The hegemony of the Leitz Werke as the biggest microscope company in the world was swept away by the war and could not be reclaimed quickly. Money for investments and expansion was scarce. More and more people had to be fired even after the introduction of the Leica camera.

In the overall turnover of the company the Leica camera had at first only a small percentage. In 1928 the percentage became substantial with 20% and would grow to 70% in 1932. This is the period of the Strukturwandel (structural change from microscope manufacturer to camera manufacturer. In 1953, just before the introduction of the M3, the company employed more than 5000 persons.

0.4 The Kellner Workshop 1849 - 1869

AT the beginning of the 19th century you could not speak of the German nation or country as the concepts are commonly understood. The Central-European space (the area that is now known as Germany) was

fragmented in more than 300 independent principalities, kingdoms, city-states and free cities of various sizes. Every power (little or big) had its own currency unit, unit of measure and customs duties. The political fragmentation and lack of domestic trade were compensated by a a fixation on a common culture and education (Kultur und Bildung). Around 1800 Goethe and Schiller work in Weimar, Kant in Königsbergen, Hegel in Jena and Von Humboldt in Berlin. These writers and philosophers bridge the romanticism of the 18th century and the modernism of the 19th century. In 1834 the Zollverein (tariff union), established under the aegis of Prussia, dismantles a number of commercial and industrial barriers. It is the start of the industrial growth in Germany. The take off from 1840 to 1880 leads to the railway explosion and the establishment of the heavy industry where the number of steam engines growths explosive. Technological research and science flourished in the wake of modernization and industrialization. Quality of education and the school system were the envy of Europe. In the period from 1890 to 1914 Germany became the most modern and strong industrial nation in Europe thanks to an unprecedented economic growth. It is often claimed that Germany in the 19th century was not a modern nation, but the contrary is true. Germany had an overdose of modernity: science, culture, industry and technology were on a very high and innovative standard.

In 1849 one could not have the faintest idea about these later developments. The industrial revolution was not yet under way and the political revolution of 1848 did shake the foundation of the country. One needed only a small investment to starting an optical workshop. A handful of tools and some workspace would suffice to begin. Carl Kellner considered several cities as a place of business, but opted for Wetzlar as he lived close to that city and his family loaned him money and provided him with a cheap location. Comparable conditions applied for Carl Zeiss and his decision to settle in Jena. In those days you needed to fulfill a number of requirements before a person could start his own company. First you had to work for several years as a journeyman and get good recommendations (the so-called Wanderjahre). Secondly the local authorities had to give permission to settle and practice a profession. This second requirement is one of the reasons why Kellner in Wetzlar and Zeiss in Jena could establish a company: there was no competition.

Kellner learned the craft of a mechanic during his Wanderjahre and because he showed considerable interest and practical knowledge of optical calculations, his teachers recommended him to start a career in optics. There was a strange dichotomy in the world of optics. The theory and mathematics for calculating lenses and mirrors was well-known, but the practical manufacture of lenses was a matter of chance and luck. The main obstacle was the quality of the glass and the fact that for a certain type of glass the refractive indices for the colors of light. There was no reliable method to find the refractive index for the several colors. The demand for optical instruments for scientific and technical investigations was growing. An additional boost came from the local and regional administrations where detailed maps of the area were required to register land ownership and collect taxes. The topographic mapping of the county with accurate theodolites gave a big impetus to the expansion of the optical craft. Most optical instruments needed an eyepiece (ocular) for human viewing, but the quality and performance of most available eyepieces left much to be desired. Kellner had drafted an improved eyepiece based on the Ramsden eyepiece and his design was indeed a substantial improvement. But the glass problem he could not solve..

The German optical industry stayed dependent on companies like Chance Brothers in England until 1880 when Carl Zeiss, Otto Schott and Ernst Abbe announced the manufacture of high quality optical glass.

Kellner was not able to to establish the exact indices for the glass he bought from other companies and had to turn to experiments to establish the values. This process was time consuming and could have had negative influence on the balance sheet.

The optical institute of Carl Kellner was taken over by Ernst Leitz in 1869. Kellner died very young, and he left a small and ailing enterprise that his successor could not turn around into a profitable company. The fortunes changed for the better after the company was taken over by Ernst Leitz who changed the artisanal workshop into a modern factory. Carl Zeiss in Jena faced the same challenge and the solution was almost identical.

0.5 Growth of the Leica system

THE dominant cultural force in the Weimar Republic and in modern Europe was the movie film. In this technique the combination of speed and new technical invention could be explored and exhibited. Leitz did try to get a foothold in this expanding business by trying to develop an advanced model for projection purposes. (the MECHAU projector). He did abandon this project relatively soon by selling the technology to Siemens. But one has to assume that Leitz was an entrepreneur who relentlessly tried to forge modern instruments for the new media. The demand for pictures was quite large as the European illustrated weeklies and monthlies grew at a phenomenal rate. Photography was expanding but picture making was still very old fashioned. Dynamic picture making was required. Is it too rash to assume that Leitz saw a future in this trend for the camera designed by Barnack?

It is indeed remarkable that the Leica was at first adopted by modern artists, especially in surrealist circles. The quick spreading of the Leica in the period 1928 to 1936 was the result of direct exposure of the camera by enthusiastic users. The memoirs of Dora Maar (one of the Picasso models and companions) give a vivid picture of the process.

Leica III late version

The Leica I was presented to the world at the Leipzig Fair in Spring 1925. The design deviated completely from the normal photographic apparatus. Its engineering was firmly rooted in the microscope production which was the core product of Leitz from 1860 on. Leitz manufactured all parts themselves and there was no need to follow industry standards or mass manufactured and standardized components. The smoothness of operation, precision of manufacture and stability of construction of microscopes was simply transferred to the camera design. The compact size, smoothly moving parts and ease of operation, durable full metal construction and the watch-like mechanical precision were new for its day. But the product fitted the Zeitgeist as a glove and the small, durable and fast operating camera became the daily companion of many modern artists, explorers and scientists. The first 1000 cameras were produced in 1925, the number 5000 was reached in 1927 and the number 10000 in 1928. The number 100000 could be clocked in 1932 and the number 200000 in 1936. The camera was in its third generation (Leica III and IIIa) and had evolved into a full camera system with a comprehensive lens range and a vast array of accessories for all kinds of photographic application.

The Leica was not simply a successful camera model but Leica photography was close to a Weltanschauung, a world view and a photographic philosophy.

Success asks to be copied and the number of Leica copies has been estimated as more than 300. From 1930 to 1950 the most dangerous competitor was the Zeiss Ikon Contax, in many aspects an advanced and more modern camera. That this camera did not get the upper hand is presumably the tight grip that the Leica philosophy held the photographic community spellbound.

A complex set up, but it works

The amount of cameras, lenses and accessories that left the factory did overburden the production logistics. Leitz was not used to real mass production as it is defined by Henri Ford. Within the Leitz factory the style of production had a strong artisanal flavor and a higher production implied hiring more people not making the production more efficient. This dilemma will haunt the Leica company till today.

This manufacture of components was not strictly regulated by construction and scale drawings. Many parts were only basically defined and it was left to the highly skilled workforce to produce these parts. The endless variations in construction details of the cameras and lenses is a delight for Leica collectors, but also an indication of the production methods. The heavy reliance on a skilled workforce and a high amount of manual labor becomes a burden in the 1950's (?) when the working week was reduced from 48 hours/week to 45 hours/week, implying a lower volume of production and/or an increase in production costs.

The main specifications of the Leica III remained stable during its production life from 1933 to 1960 when the final model IIIg left the factory. The characteristics of the camera (horizontal running cloth focal-plane shutter with speeds from 1 sec to 1/1000, coupled range finder and exchangeable lenses) would become the basic specifications for state of the art cameras.

The overpowering success of the Leica series I, II and III generated numerous competitors, the most

formidable is the Canon rangefinder camera. It is not too rash to suggest that the Canon was even better than the Leica camera in that period.

Leitz reacted with a landmark design that in its basic characteristics is even actual today and can be considered as the root of the current M9.

0.6 From Leitz Werke to Leica AG

IN 1949 the Leitz company (maker of the Leica camera) celebrated the fact that hundred years earlier the company was founded. During this century from 1849 to 1949 the European countries started with the industrial and social upheaval caused by the Industrial Revolution in great optimism and ended the period in deepest misery after the Second World War. In 1945 Germany experienced an all-time low with the Stunde Null, the Hour Zero. For most Germans life had come to a total standstill and that applied to most industrial firms as well. But a few years later, German industry was at the same level as in 1939, just before the war broke out.

The German photographic and optical industry had been the envy of the world and the Leitz company was certainly one of its flagships, towering above many other famous companies in the same industry. In 1849 however, there was no sign that the tiny workshop, founded by Carl Kellner in Wetzlar would reach world fame a hundred years later.

Precision mechanical engineering and excellent optical design were the twin pillars upon which the German photographic industry established its reputation and world dominance during the greater part of the 20th century. The two companies that stood head and shoulder above the others are Zeiss and Leitz. Both companies are still active in the photographic world, but they are now pale shadows of their glorious past.

The first decade of the current century (the 21st) saw the classical paradigm of photography quickly shattered by the tsunami of the digital technology that not only changed the workflow (habits) of photographers, but also the design and manufacture of the digital cameras.

Zeiss stopped making cameras in Germany in 1973 and Leitz sold the whole company to the Swiss firm of Wild Heerbrugg in 1986. The new combination will continue the camera and microscope production under the name of the Wild Leitz Holding AG. A great success this is not and in 1988 the camera division is separated from the rest of the company and a new independent firm, Leica Camera GmbH is established under the management of Mr Frey.

If the number of managers that succeeded the first one may be interpreted as a sign of the struggle to cope with the profound changes in the industry and the market, the Leica company is in stormy weather. The commercial and strategic brinkmanship of the persons at the helm of the company could not fend off an impending bankruptcy. The firm threatened to fall into an abyss, but for the financial injections of an Austrian investment company that buys almost all shares of the Leica company and is currently practically the sole owner of the Leica company. With new products and a new management, the company is girding itself for the next step: the inevitable transformation from a mechanical/chemical orientation to a future dominated by electronics and digital image processing.

The most prestigious product of the company is the Leica rangefinder camera, currently (September 2010) being offered in three models, the classical film-loading models M7 and MP and the sensor-fitted digital version, the M9. The M-camera model is in production since 1954 and has helped to shape the face of photography. The birth and evolution of this model and its range of lenses is the main focus of this book and will function as a leitmotiv for the history of the Leica camera in general and its lenses.

Manual assembly and controls is abundant in the manufacture of the Leica: it is a strength but also a weakness

The first camera in the M lineage, the M3 was introduced in 1954 and this year is without doubt one of the most pivotal years in the history of the Leitz company. (It may be a bit confusing to use Leitz and Leica in a seemingly disorderly manner. The name Leitz should be reserved for the description of the company that Ernst Leitz founded and sold in 1986. Ernst Leitz became the owner of an optical workshop in 1869 in Wetzlar, that was founded twenty years earlier by Carl Kellner. It is a question of pedantry what the true founding date of the Leitz Werke should be: 1849 or 1869. All historians and Leitz himself have chosen 1849. Leitz acquired the company in 1869, and that should be legally the date of the founding of the Leitz Company. The name Leica company refers to the company, established in 1986 in Solms, where it resides till this moment of writing. A plan to relocate the Leica company and factory from Solms to Wetzlar in a newly created "Industriepark" has not yet materialized due to the delicate financial situation. The camera models that have been produced by both the Leitz and Leica companies are all designated as Leica (from the original LEItz CAmera word combination). The very first camera model was briefly named Leca (from the more logical combination LEitz CAmera), but the name was quickly changed to Leica.

A camera, as significant as the M3 does not simply emerge out of the blue. There is a long history that precedes this camera and shapes the scene for its emergence and impact on the photographic world.

The Leica company was technically broke in the early years of the 21st century. This situation was not new for the company that had to be self-supporting since 1988. Wild (Schmidheiny) bought the company from the Leitz family in 1986 and it ws quickly decided that the department Photo was no longer part of the core business and became an independent company per 1.1.88 as Leica GmbH.

Early in 1986 the Wild Leitz Wetzlar GmbH considered the strategic move to separate the photo and binocular division from the rest of the company. Within this conglomerate the manufacture of the microscopes, scientific measurement apparatus and optonic sensors was focused on the scientific, medical and government markets. The camera production was seen as the odd man in. With its focus mainly on the amateur market, a different strategy was needed for survival. And the camera manufacture had always been considered as a cash-drain and a burden on the whole company, even in the days when the Leitz family owned the company.

Wild did not give the new company a dowry and even left the company with a minimum of cash. The official company policy that had to be adopted was a so-called "restriktive Modell-Philosophie" (conditional product strategy), implying that new products will be introduced when the technology and research indicate that a quantum leap is possible and will complement the demands in the market. In normal parlance: the company stays out of innovation for the short term. The basic slogan was that Leica products do deliver necessary functions for photography and should not develop gadgets. It is amazing how lofty the new managers of the company approached the photographic market that was in this period in a major crisis and in need of a new paradigm.

In the next two years preparations for the transfer from Wetzlar to Solms were made and in Solms there was a large manufacturing facility, previously used by a furniture company, that seemed to qualify for the location of the new camera and lens production.

The Leica Camera GmbH started on January 1, 1988 and its first act was to buy the Portuguese factory in Vila Nova de Famalicao. In 1990 the Zett Werke (projectors) were acquired from Zeiss and in 1992 the Feinwerktechnik Wetzlar was bought. The series of acquisitions ended with the purchase of the Minox company in 1996. While there was some logic in broadening the base of the newfound company, it also diverted energy and cash from the core business. In 2000 the Minox was made independent with a buy-out of the management. The separation of the Leica products in a scientific and consumer-oriented market made sense at that time. The change from the Leica Camera GmbH to the Leica Camera AG on July 22, 1996 introduced the idea of shareholder value in the company that used to be engineering driven. With 3 million shares of nominal value of DM 5.00 a substantial amount of new capital was injected into the Leica Camera AG. Part of this capital was invested in the acquisition of companies and part in the development of new products, including a first step into the world of the digital cameras.

0.7 Leica M3 to M6: retreat of the rangefinder

THE primary specifications of the M3 can be written down in a few lines, but in 1954 the introduction

of the M3 was short of a revolution. Present-day photographers who are obliged to wade through many pages of specifications, might not be able appreciate the impact of the M3 on the photographic scene.

A rapid wind lever, an extremely clear finder with accurate distance focusing, a smooth running silent shutter and a bayonet mount for fast changing lenses was a proposition hard to resist.The rangefinder was and is a masterpiece with parallax compensation of the finder frames which can be selected for three focal lengths (M3 = Messsucher mit drie Fenster) Add to these specs the high quality engineering and a new level of durability and reliability and it becomes understandable why the major competitors, after dismantling the camera concluded that they could not match this quality. More than 225.000 camera were manufactured in the period 1954 to 1967. To be fair, it has to be said that there was no strong competition. The single lens reflex cameras, like the Exacta Varex could boast of a larger system but the built quality and the dim finder-screen let it down. The Rolleiflex, a twin eyed medium format camera could challenge the quality of the Leica, but not its nimbleness and versatility. The three main competitors in the rangefinder scene, Nikon, Zeiss and Canon, offered excellent cameras with a fine lens range, but they could not challenge the integrity and homogeneity of the M3. But other Japanese companies, notably Asahi and Topcon were innovating the SLR concept and with a quick return mirror and brighter screens jumped over the drawbacks of models like Contax S and Exacta Varex and Edixa.

The Leica M3 was widely recognized as the best miniature camera for serious work by professionals and other ambitious photographers and could hold this role for over a decade. The camera world was neatly divided in a four-tier structure: the large format camera, the medium format, the precision miniature camera and the snapshooter cameras in roll-film and 35mm tastes. Leitz not only ruled in the precision miniature camera market but increasingly became a quite conservative company cultivating the Leica way of photography.

Around 1960 however the die is cast and the Japanese companies begin to conquer the German bastion. A decade later, the closure in 1973 of the famous Zeiss camera factories that produced the Contarex and the Contaflex sealed the fate of the German camera industry. Not only quality and versatility of the Japanese products, but mismanagement and a narrow view on the future sealed the fate.

M3 system

Leitz could not close his eyes for the signs of the time and halfheartedly agreed to allow the design a single lens reflex camera, the Leicaflex. The main interest of the Leitz Werke was divided over three product groups, microscopes, binoculars and rangefinder cameras.

Wide angle lenses became available with good quality and Leitz had to satisfy the growing demand for a Leica camera that supported the 35mm focal length without additional finders. The result was the M2, a very popular model. When Leitz introduced a 21mm lens, a whole new view for reportage photographers became available. Robert Lebeck, a famous German reporter, was amazed at the new vistas and possibilities and used the 21mm extensively and with great success. With shrinking demand for the rangefinder camera. Leitz could not afford to offer two closely related models and introduced the M4 as a successor. This camera and the Nikon F became the benchmarks in the photographic world for miniature camera precision and stamina.

The Japanese industry forced sales of new models with ever more and newer features and incorporated electro-mechanical components to lower production costs and allow a more sophisticated level of automation.

Leitz reacted to this challenge with one of the most daring and innovative rangefinder cameras ever, the M5. Introduced in 1971 and in production till 1974 (with a small additional batch in 1992??) the M5 was designed to break out of the traditional rangefinder concepts. Most Leica writers assume that the slightly enlarged size of the camera was the cause of the non-acceptance by professional photographers. Even within the Leica company this believe is wide spread. I am not sure this view is correct. The traditional merits of the rangefinder concept were incorporated into the M5, but these merits were at the same time serious inadequacies. The underlying and more basic cause for the failure of the M5 was the shrinking attractiveness of the Leica approach to photography. A generation of photographers had worked with the Leica way of taking pictures, based on meticulous craftsmanship, appreciation of visual sensitivity and the camera as extension of the eye of a sensible observer. The new generation, exemplified by the likes of David Bailey who used a camera as a tool to create images that were visually provocative. The heroic battles between Guy Bourdin and Helmut Newton who could produce the most daring fashion pictures were fought with single lens reflex cameras because the view on the ground glass did not ask for a mental and visual translation from direct rangefinder vision to a two dimensional picture. The rangefinder is an excellent instrument for measuring the distance and the direct viewfinder lets you see the scene as it appears to the human eye, but that is not the same view as is reproduced by the lens on the film. This shift in photographic culture and picture methodology clashed with the Leica way of taking pictures. The Leica was an excellent instrument for capturing the essence of human life and action, but was less suited for illustrating visual fantasies and this discrepancy is in my view the ultimate cause for the failure of the M5. Any rangefinder camera would have had troubles to support this new way of visualization.

Leica M5

After the M5, Leitz must have had serious doubts about the future of the rangefinder concept. The Leicaflex was selling quite well and the M5 seemed to end in a a cul-de-sac. The M4 continued to be assembled, but sold in very low quantities. The demise of the rangefinder camera as a preferred photographic tool for professionals was a fact. Production in the Leitz factories in Germany faced mounting costs and the Leitz management looked for cost reduction to the factory in Portugal and to increased cooperation with the Minolta company. The cooperation on the Leica CL (1973 to 1976) was a promising start.

The Leica CL, designed in Wetzlar in the same period as the M5, but manufactured by Minolta in Japan is the odd man out in the history of the M camera. It represented the attempt by Leica to produce a cheaper M-like model with compact dimensions that could appeal to quality-conscious snapshooters. It was not a great success, but the Minolta CLE, presumably with specifications provided by the Wetzlar engineers was a most advanced camera.

In 1973 the personnel costs amounted to 60% of all costs in the Wetzlar factories. An overblown hierarchy of management layers and administrative people are partly responsible for this state of affairs. But production methodology has hardly changed since the '30s and still relied on experienced manual assembly of complex products.

The magnitude of the problem can be gleaned from these figures: the Leitz company has in 1973 7000 different products, and production numbers per month vary from 1125 to 1, there are 40.000 different parts, that are being produced in 62 different prefabrication workshops and there are 60.000 production runs in a year, that comprise 540.000 different processing steps. In modern terms one would refer to this complexity as imperial overstretch.

Rationalization was required and both the M-line and the Leicaflex line were in the danger zone as the photo department only generated 25% of total turnover.

The single lens reflex production was continued with the R3, a cooperation with Minolta and a major boost for the fortunes of the Portugal factory where the R3 was manufactured.

The introduction of the M4-2 in 1977 saved the rangefinder concept, but production was transferred to Canada where the Leitz company owned a factory in which batches of M-cameras had been made in previous years. The M4-2 is basically an M4 with some modifications for simpler manufacture and assembly. The first production runs of the M4-2 could not compete with the Wetzlar versions for built quality. The operation and adjustment of the machinery had to be learned and the workforce had to adopt the engineering finesse of the Wetzlar workers when assembling and adjusting the camera. A contemporary view of a repairperson after dismantling the camera could be summarized that the M4-2 is an excellent camera after the proper adjustments would have been made.

The success of the M4-2 encouraged the Leitz management to try to promote the rangefinder concept as the best tool for reportage photography. With a new range of high speed lenses, notably the Summilux-M 1.4/75mm and the Noctilux 1.0/50mm, the message was clearly focused on the advantages of the rangefinder accuracy in combination with the superior performance of high speed lenses. The M4-P stayed in production in Canada till 1984 and was superseded by the M6, one of the most successful M models ever. The M6 can be described as an M4 with an integrated though the lens (TTL) exposure metering system. The M6, one might claim with some reason, is the direct descendent from the M3 with the same DNA.

Leica M4-2

It took the M6 more than 10 years to equal the production number of the M3 in the first three years. This fact is an indication that the magic and attraction of the rangefinder philosophy was in decline. Once the engineering of the Leica M cameras was the envy of the world, but since mechanical engineering had been supplanted by even more accurate electronic components, the Leica M camera had to rely on other characteristics to attract users. There are a number of outstanding features that distinguishes the M6 from the rest of the pack.

The lens mounts were the best in the world, the optical quality of the lenses was not surpassed by any one, the chrome and black paint layers were unique in its quality, the shutter was one of the most silent ever designed (the M3 shutter is still the most silent) , the rangefinder offered an accuracy that no slr screen could even begin to challenge, the M camera with its fast, silent and inconspicuous operation was the perfect instrument for the art of the snapshot, the poetic registration of fleeting moments in a days life of urban and human experience. Individuals like Garry Winogrand and Joel Meyerowitz were able to continue the tradition set by Henri Cartier-Bresson, but they were a minority, al be it a potent reminder that the Leica was still a professional tool to implement the style of Leica photography.

Leica M4-P

With the Leica M6 the Leica company changes course again. Unwilling or unable to break out of the straightjacket of history, the company increasingly promotes the M6 as a cult camera that embodies the Leica myth. No camera model has more special editions than the M6. The gradual shift from professional user to well-heeled collector is the most disturbing trend in the history of the modern Leica. The brochures about the M6 stress the myth of the Leica, the esthetic qualities, the silence of the shutter, and the fact that the camera allows the photographer to stand in the middle of the event. The M6 is indeed one of the most beautiful cameras and the sound of a well-tuned shutter mechanism is unique and signifies an engineering quality of the finest class. Reviews in magazines mostly refer to these characteristics and note that the M6 is the instrument for the street photographer par excellence. But the whole concept of the street as a reflection of the human micro cosmos is vanishing, partly by the introduction of laws that protect the individual in the public sphere and partly because the subject has been milked out.

The Leica engineers gave the photographer with the M6 the minimum of automation (exposure metering through the lens but with manual adjustment of speed and aperture). They also had to look after production efficiency and cost control. Most of the tooling for the main components of the M6 is of Wetzlar origin, but it is now impossible to manufacture every part in the factory. Parts have to be bought from outside suppliers and some of the over-engineering in the M3 and M4 has been compensated by simpler constructions. Under Leica aficionados there is and was a heavy discussion about the status of the M3 as the pinnacle of precision mechanical engineering and the M6 as a cheap successor defined by bean counters. The engineering quality of the M6 is certainly on the same level as that of the M3 or M4, but one should keep in mind two new elements. There is a shift in production methods with a greater emphasis on part fitting than on part shaping as the latter method is too labor intensive. The second new element is the use of new materials that can be produced in a more efficient manner. The feeling of the M6 is indeed slightly less silky smooth than an M3 in 'as new' condition. The reliability of the M6 is as good if not better.

Leica for a long time claimed that the combination of a silent vibrationless shutter and high speed lenses would suffice for available light pictures and did not pay much attention to electronic flash options. Fill-in flash to improve the quality of pictures taken with backlight could however not be ignored and a new model, the M6 TTL was introduced with a slightly increased body height to provide room for additional electronic circuits.

0.8 The art of Leica rangefinder photography

WHEN Robert Frank published his book: The Americans in 1958, a new photographic style was firmly established. The street photography focused on the dynamic and erratic life on the streets and the images were as informal as life itself. Matching style with substance, this new generation of street photographers broke with all formalism that had restricted the visual expression of landscape and portrait photography. For the next twenty-five years photography experienced one of its best chapters, the golden age of street and documentary photography.

Robert Frank used a Leica camera, a preferred instrument by many photographers and which he acquired in 1947. The fifties, the decade from 1950 to 1959, were not the dull period as characterized by many historians. You only need to look beyond the surface of the society to see the powerful pulse of a world ready for take-off.

In 1989 photography celebrated its 150th birthday and all signs indicated it had become a mature industry and an important component of modern culture and art. The instruments were highly evolved, photographs were used as visual means to inform, document and illustrate facts, ideas and products in every possible way. The art scene had at last accepted the photograph as a true art form and prices of old photographs skyrocketed at auctions.

One of the most penetrating essays on the state and cultural importance of photography has been written by Susan Sontag (On Photography, 1973). She discusses at length the two fundamental dimensions of photography: the photograph as art and the photograph as document. It would seem that there is a clear distinction between both modes, but in fact they are the logical consequence of the fundamental potential of photography: making notes about everything in the world from every possible angle.

The implementation of this role of photography has always been restricted by technical and economic arguments. A photographer needs expertise and money to take good photographs and therefore he has to choose carefully his moment and place to take pictures. The best philosophical statement about this choice has been made by Henri Cartier-Bresson when he defined his views on the decisive moment (Images á la sauvette, 1952). The economics of photography (cost of equipment, use of material like film, chemicals and paper) were also instrumental in limiting the amount of pictures taken. A proliferate photographer could amass in his entire life a pile of 50.000 to 250.000 negatives.

The speed with which the camera can record everything freed the photographer from the need for carefully considered choices. The Leica camera was the first one to implement this element of speed in its design and ergonomics.

Even Cartier-Bresson who professed the singularity of the decisive moment took scores of pictures in rapid succession with his Leica in order to penetrate the essence of the scene, as his contact sheets show without doubt. The camera is indeed the instrument for the fast look or glance and the camera may in many cases even be too fast. But the cult of the future (recording faster and seeing the result immediately) is unstoppable and with digital imaging now the ubiquitous tool for taking pictures it is in large measure implemented.

Two important technological shifts have worked together to make this change possible. The major change is the replacement of solid silver halide molecules to fix the image by volatile electronic digits that are basically dimensionless and hardly take space and volume. The other change is the replacement of mechanical components by electronic circuits. Both trends allowed for the physical shrinkage of equipment and a substantial reduction in manufacturing costs.

The ideal of photography, taking images of everything and anybody at every moment in time and at every possible place from every possible angle at no cost and by everyone, is now realized. It is the era of post-photography, pixel-based photography, photography with restless pixels or photography reborn (Jonathan Lipkin, 2005). This characterization refers to digital image making as a disruptive technology. The age-old photographic process of recording and printing pictures by means of chemical technology based on silver halide grains may continue to attract practitioners. This technique is still able to create very fine photographs of special visual and tactile quality. The record prizes paid at auctions for classical prints is a clear sign that the medium is alive. Mainstream photography however will be pixel based and the picture will for the foreseeable future reside in a numeric form as a matrix of numbers in a computer program..

0.9 Leica M6 to MP: focus on classical values

THE M6 was the first Leica CRF (coupled rangefinder camera) that combined M3 functionality and esthetics with operational convenience and integral exposure metering. In 1984, the year of the introduction of the M6 the AutoFocus revolution had not yet occurred in the professional photographic scene. The combination of a compact high performance rangefinder camera with in-camera exposure metering was at that time still convincing. Many photographers preferred to have the option of selecting speed and aperture in combination and deviate from the instrument's reading for interpretative reasons. Even today the method of handheld exposure metering is not obsolete as it provides the best assessment of a scene illumination. The M6 design offered limited scope for expansion and evolution and the factory had to become very inventive to keep the M6 attractive.

Not only did we get the M6TL and the a-la-carte program, but also the many rangefinder options from 0.58 over 0.72 to 0.85 (High Eyepoint and Classic and High Magnification). The M6 also has the distinction of being the chassis with the most special and commemorative editions. The Leica product strategy focused more on profitable niches for the Leica buyer than on the needs for the professional or seriously motivated photographer. The M6 stayed in production officially till 2002, but resurrected with slight outward and internal modifications as the Leica MP in 2003.

In 2002 the M7 was introduced and this model added automatic exposure metering to the specifications. The Leica M lenses have a mechanical linkage system between the aperture setting ring located in the front of the lens mount and the actuating mechanism for the aperture blades in the middle of the lens system. There is no room in the lens mount to incorporate an electrical or electronic system that can control the aperture blades. If you wish to introduce exposure automation the only option is to incorporate an electronically controlled shutter mechanism. This is the method of aperture priority exposure automation and is used in all M7, M8 and M9 models.The electronically controlled shutter of the M7 offered a higher accuracy than the mechanically controlled versions. It is also the only Leica M with the classical horizontally running cloth focal plane shutter where there is no sound of the slow speed escarpment gears when you set slow speeds below 1/15 second.

Aperture priority exposure automation is the preferred method used by purists as the control of the depth of field is more important for the composition of the picture that the selection of the shutter speed.

The M7 is the most advanced film-loading M camera that has been designed in Solms. The direct digital descendant is the M8 that was introduced in autumn of 2006. Some Leica users did not accept the amount of

The Leica M system

automation found in the M7 and in spring 2003 the Leica company responded with the classically looking MP, in fact an upgraded M6TTL with the look of an M3.

The M7 and MP are the latest and presumably the last representatives of their kind: the film-loading CRF with the quiet horizontally running cloth focal plane shutter.

With the introduction of the M6 the company had hopes for a revival or at least a prominent niche position of the CRF camera as a distinct photographic instrument. Leica literature, sales brochures and even management interviews however increasingly focus on the status of the M camera as a myth, a cult and a product with a long tradit

ion as the originator of modern 35mm photography. The values that are being emphasized are mechanical precision, optical excellence and half a century of evolution. But Leica is stuck in a dangerous groove with the M camera. The potential for development is limited as the camera has been honed for over fifty years and the sales volume does not allow major investments in new designs. The manufacturing technology with a high amount of manual labor for adjustments and inspections is expensive but cannot be changed because of the low production volume. The high production costs imply a high selling price which limits the market potential to buyers with a strong taste for tradition and quality.

Leica M6

The introduction of the MP in 2003 was part of a two-pronged strategy: cultivating the analogue tradition with the M line and changing the R-line into a digital platform with the R9/DMR and if possible full-digital reflex bodies later in the decade. The DMR did not bring the longed-for success as the pace and depth of innovation of the Japanese manufacturers was so high that the digital module concept was outmoded in a year. Sales of film fell much faster than could be anticipated in those days and even the M camera became an endangered species. The DMR did show that Leica could be a serious and promising manufacturer of digital photographic products. But the DMR adventure also showed quite clearly that a new digital SLR from Leica could only be based upon an effective autofocus lens system and a new body. The Leica management wanted to avoid the problems with the first reflex camera, the Leicaflex, that was obsolete at the moment of introduction. The Leica design process takes a long period and given the fast pace of development in the DSLR market it was evident that whatever concept the designers could envision, it would be out of date sooner than later. These considerations did lead to the abandonment of the whole idea of a new SLR built around a 35mm sized sensor and to the development of the S2.

The internal study of a single platform for the production of the CRF and SLR camera, known as the mythical M6E, showed that within the M body there was room for a modern vertically running metal blade shutter. The Konica Hexar RF was the living proof of this idea.

These components, the knowledge about the sensor of the DMR, the shutter of the R8/9 and the older design study, indicated that a new M body equipped with an improved version of the Kodak sensor could be a feasible way to build a digital M. The decision to proceed was made in the 2004/2005 time frame. The M8 was the result and while the camera had its troubles, it showed that the company could design a mature digital product and it also showed the incredible loyalty of the Leica clientele.

0.10 Birth of the Leicaflex

LEITZ did not like the concept of a single lens reflex and this fact may be a cause for the late introduction of the Leicaflex. Canon, Nikon and Zeiss had abruptly stopped producing rangefinders and could quite easily migrate to reflex models. Leitz however tried to put as much rangefinder DNA into the new reflex camera as possible. The Leitz tradition to improve on the best solutions of others and even to find new solutions for existing challenges. The Leicaflex is a well engineered camera with some novel solutions: the very bright screen with only a central grid with over 13000 individual prisms to facilitate focusing, the intricate mirror linkages to dampen vibration during the upward swing and en exceptionally quiet shutter mechanism. The CdS cell mounted on the front of the pentaprism housing made the camera already obsolete at the moment of introduction.

Leicaflex Standard

All the characteristics mentioned above can be described as single lens reflex interpretations of the major rangefinder traits. When dismantling the camera you will find metal gears with surface treatment to make it impossible to even scribe a mark and a lavish attention to detail like the prism mounting for maximum protection against shock by using a flexible material that acts as a cushion for the prism. On many locations you will find washers, shims, spacers, eccentrics and adjustment screws and much soldering. The whole construction is designed to allow fine tuning during assembly and during servicing.

The camera is an engineering tour de force, but it also shows the limits of camera manufacture in the classical Leitz style. The first version of the Leicaflex had circuit boards, resistors and soldered wire all over the camera. Later versions employed circuit boards with all components assembled on one board that could be removed without soldering wires. This construction facilitated assembly and servicing.

The Leicaflex showed the engineering and manufacturing principles that the Leitz company had honed to perfection since the introduction of the Leica I (Leica A in USA). The camera was designed as an integrated, even organic entity that could only be assembled by a highly trained workforce that understood the working of the components and could make the required adjustments for smooth and reliable operation.

The Japanese manufacturers had chosen a more efficient production methodology and used modular components that could be easily changed and improved. Compare for example the construction and the adjustment options of the Copal Square shutter and the Leicaflex shutter.

The Leicaflex was the last original Leitz design for a single lens reflex camera for the next thirty years. The R8 was a new attempt, but again was obsolete at the moment of its introduction. The most recent SLR fully designed by Leica is the S2, of course digital, which is for the third time in the Leica history a trend setting model and in many respects ahead of the competition. The original Leica I and the M3 are the other two models with great impact in the photographic world.

The Leicaflex was designed and manufactured within the tradition of the M-camera and the engineers tried to infuse into the SLR concept as much rangefinder-DNA as possible, and they tried to accomplish this trick again with the R8, commented upon by Geoffrey Crawley as the most M-like SLR. Both products failed, because an SLR is a totally different concept than a rangefinder. At least the S2 designers understood this basic design principle.

0.11 Leica R3 to R9 DMR

IN 1964, now 45 years ago, the Leitz company introduced the Leicaflex, a camera that was eagerly anticipated. In those days there was no internet to leak rumors and globally exchanging opinions. The few magazines that had advance information did look ahead, but waited for the official release. When the Leicaflex finally arrived, it was a disappointment. The features were already obsolete at the start and the camera lacked important elements that were required for a wide acceptance and to create a demand in the face of heavy Japanese competition. The Leicaflex was beautifully made and inherited the mechanical excellence of the M body. This M body was designed around a simple engineering principle. But the reflex camera was inherently much more complex and Leitz tried to find novel ways for its construction. The intricately moving mirror, the new shutter, the unique finder and the body shape fitted in the Leitz design tradition of improving upon existing constructions and finding new ways for classical problems. The Leicaflex tried to embody the clean operating principles of the M body into a reflex camera. It was not a great success and never was accepted as a professional camera.

The Leicaflex can be seen as the first generation of Leica reflex models. The next model was the Leica R3, a very nice camera with a sophisticated electronic heart. It borrowed heavily from the Minolta camera and was made in Portugal. This second generation was reasonably successful but it stayed in the shadows of the more potent Japanese cameras.

The third generation is again based on a Minolta camera, but now the Leica fingerprint is more obvious. A range of models form R4 to R7 were produced from 1980 to 1996. This generation incorporated as much automation as Leica could swallow within its own engineering philosophy of simplicity of operation and manual handling and focusing.

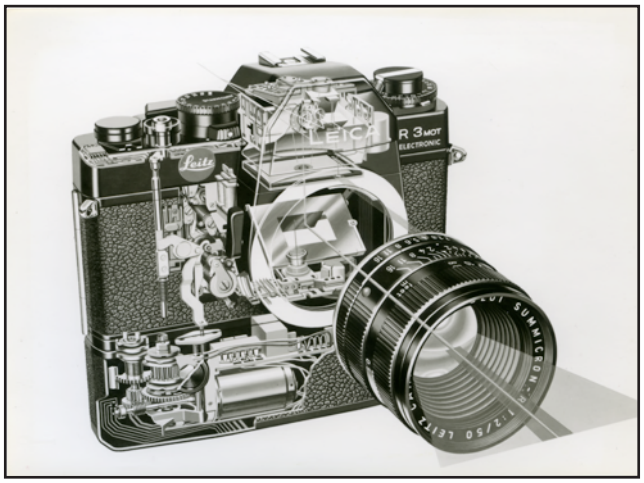
Parallel to the development of the reflex models, Leica designed a range of lenses for the reflex camera

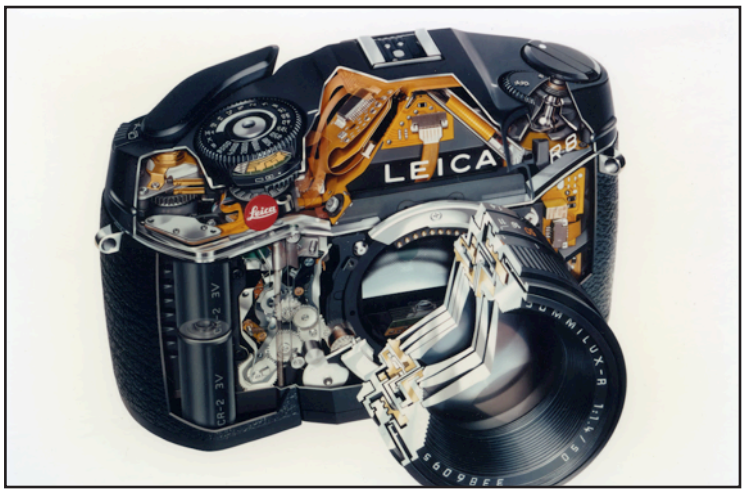
that consisted of a mix of outstandingly good and middle of the road designs. The mounts for these lenses were second to none, but many lenses were heavy and bulky and the evolution of the range lacked a strong and clear strategy. Leica stepped relatively late in the zoomlens world and created some of the very best designs ever found in this domain. But as a range it could not fully convince and given the price tags did not find many buyers.

The R8 arrived on the market in 1996 and was a new design fresh from the drawing board. It can be counted as the fourth generation of Leica reflex designs. All professional reflex models of that period were converging to one universal reflex design: fully automated, fully electronic and with fast autofocus and power drives. This convergence of features in the high end market is also the norm for current d-slr cameras.

Leica assumed that their single track approach as exemplified with the rangefinder camera could become successful in the reflex market too and the R8 was designed as a manually operating camera with a modicum of automation, just enough to support the photographer in his basic tasks of exposure metering. One concession the engineers were prepared to make: an integrated motor-drive was planned and the body designed for this feature. At the last moment the management did not dare to offer this feature and decided that a manual transport level should be fitted.

The camera did get the attention of the photographic world, but was seen more as an dead branch on the tree of camera evolution than as a new beginning. The R8 handled very well, had a very solid build and was based on a purist philosophy of picture taking. The company had put very high hopes in the camera and invested a very substantial amount of money in its development. In fact there was hardly any R&D budget on the balance sheet after the introduction of the R8. When the camera did not bring the desired success, Leica lost interest in the camera quite rapidly.





The R8 and later the R9 lingered on in the Leica catalogues as sales volumes were low and the reputation of the camera was not that positive, despite the optical and mechanical qualities.

In an attempt to move the R9 into the digital world, Leica introduced the DMR, a digital back. The idea seemed simple and effective: a removable back would allow owners of the R8/9 models to switch between digital files and film capture. What could work in the medium format world, did not work in the 35mm domain and the DMR did not offer the superior qualities that could convince photographers in a sufficient amount.

Lens design for the R-range was however halted as Leica shifted all attention and resources to the development of the digital M camera.

The death of the R9 in 2009 is an indication that the end of the film-loading camera is imminent. The fate of the Leica MP and the M7 is predictable. The only uncertainty is the moment of announcement. The Leica management has written off film as a viable photographic medium and is fully and completely focused on a

digital future. Bad from a perspective of nostalgia and photographic culture, presumably good as a business perspective.

0.12 Digital image capture: disruption again!

IN 1925 the German inventor Oskar Barnack presents the new Leica miniature camera for 35mm movie film to the market. In the same year the Scottish inventor John Logie Baird transmits for the first time television images. Photography and television followed two fully separate development lines until the introduction of the Sony Mavica in 1981 which merged both technologies. FIfteen years later high-quality digital photography was a fact.

The digital wave, that could have been seen coming since 1982, when Sony introduced the first (and now seminal) workable camera for digital capture, was at first interpreted as not very important by the Leica company. The focus was on the traditional products and their time-honored characteristics of high level of mechanical engineering and optical excellence. There were valid reasons for not giving too much attention to digital capture. Most predictions at that time mentioned a timespan of twenty years or even more, before the quality of the digitally captured image would be a serious competitor for the silver-based pictures. And twenty years are even for a company with very long product cycles a substantial period. Leitz already had recognized the need for cooperation from the days of the CL and the R3 (1973 - 1976). Mass production was an unknown territory for the company, as was the world of electronics and compact cameras. And the company could not muster enough money from their own operations to finance homegrown developments in these areas.

There is a difference between true mass production techniques and a large turnover based on the labour of craftspersons. Before the war and also in the days of the M3, more production capacity could only be created by hiring more people, who manufactured and assembled the cameras and lenses in the classical way with many manual labor and painstaking control along the line to ensure quality.

With mass production you try to automate and simplify processes to very simple units of work that could be accomplished by machines and with an assembly line, where a worker could perform only a very few and repetitive tasks.

After the dramatical collapse of the rangefinder dominance, Leica has always relied on outside cooperation to create new products. The first was Minolta, who early in the seventies manufactured the CL body and then were instrumental in the development of the R3. For the modern vertical running blade shutter, Leica cooperated with the Copal company. The knowledge and expertise to build these metal-bladed shutters was not available at Leica. And these shutters need to be made in large numbers to be profitable.

Why did Leitz coperate with Minolta? It seems reasonable to assume that Leitz would have approached Canon or Nikon and in fact they did. But the scale of the business and the expertise of Leitz would not of interest for these companies. The Minolta connection was established on personal sympathy between the Minolta and Leitz persons involved and that famous coincidence or opportunity.

From 1989 Leica started to sell compact cameras from several manufacturers, among them Minolta and Panasonic. At first rebadged products and later also products with a substantial Leica engineering and design (Minilux).

During 1997 the sales dropped significantly and the first big loss since 1993 occurred. The economic crisis in Asia was targeted as the cause of the problem, but that was of course only partly true. The product range was responsible for the downturn as the products did not have enough appeal for a photographic market that was rapidly changing in the direction of digital cameras and fully electronic compact cameras loaded with features.

In 1998 the Digilux arrived on the market and it was a Fuji product with a Leica badge.

Once again, Leica had under-estimated the underlying trends in the market. They were too late with a reflex camera, under-estimated the importance of the AF technology, did not see the massive turnaround to compact cameras and now were again quite late with digital technology.

In fact, the Leica company did study AF techniques, but assumed that the clientele did not want to use this feature. It is fair to note that the construction of the R-lenses could be adapted to Af, but the heavy investment was a strong threshold for the implementation. The M-lenses on the other hand can not be easily

adapted to AF.

The ill-fated S1 series gobbled up a fair slice of the investment and this adventure brought the message home to the management, that for digital products a partner was needed. Fuji became the partner , but it was not a happy deal. The influence of Leica was small, if not non-existent, on product development and specifications.

In 2000 a new partnership with Matshusita Electrical Company a very large Japanese conglomerate with products ranging from microchips to video-recorders, was established. This company already made for Leica some compact cameras, notably the Minilux.

In 2001 Hermes acquired more than 30% of the shares of the Leica Camera AG. Without this injection the company was probably broke.

The Leica marque was clearly under siege. The involvement of Hermes secured a minimum of cash flow to improve current products, but the photographic market had lost track of the Leica brand. In the photographic art world there was a trend was for post-modernist photography, a style where the traditional virtues of Leica cameras were less valuable. And Leica was cannibalizing its professional image by the endless list of collector models for the well-heeded Leica collectioneur.

It is customary to note that Leica has missed the digital trend. In fact they did not miss the trend, but were unable to react to this development in a commercially viable way. The company had invested its money in buying companies to diversify and to develop the R8, their answer to the SLR challenge of the Japanese companies. There was no money left to invest in a total restructuring of the product range. Even if the money had been available, it might be doubtful if Leica could have given full attention to digital cameras. One should understand the deeply felt commitment to the culture of high precision mechanical products that was developed and honed for more than fifty years. The company had no experience with products that fully consisted of electronic components and had no valid strategy for the marketing of products in the consumer electronics world. The optical department had seriously studied the digital technology and was concerned about the thick layers of glass in front of the digital sensor that had significant impact on the quality of the Leica lenses.

The decision to design and build the M8 was made in 2004. One of the triggers to start the project was the surprisingly positive acceptance of the Epson RD-1, a digital camera wit a quirky design, based on the Cosina Bessa chassis. The image quality was rather mediocre and Leica reasoned that they could easily up the ante. In addition, they were working with Kodak to design a totally new type of microlenses with a special shape to accept the skew rays from the wide angle lenses without cutting off the rays from their tele lenses. The success of this project paved the way for the decision to go for a digital M camera.

A major impediment for new developments was the small scale of the products involved. It was quickly established that a digital sensor suitable for the existing range of Leica lenses should be built with a layer of minimal thickness. The dilemma then and now is to find a manufacturer that can handle the specific demands of the Leica design at a reasonable cost in a small production run and deliver the required quality. Modern industrial production is geared to deliver high quality when production can be automated and this is only feasible when large quantities are being made. But the investment in money and technology is heavy and production volume must be substantial. Leica works in a contrary way. It has small production volumes and can not install the necessary equipment for automated production. Small companies with the necessary technology and experience that are able to produce special designs at a reasonable cost are scarce in the world.

In the search for response to the digital challenge Leica had to overcome two problem areas: a cultural and a technical one. Culturally and psychologically the Leica products were tightly immersed in the mechanical age. The company could mentally not make the switch to the world of consumer electronics. Technically the company had trouble to devise a production strategy that could be based on small batches of components supplied by outside parties that could guarantee the required quality at an acceptable cost.

0.13 Rites de passage: M8 and M9

THE Leica M8 shares with the Leica M5 and the Leicaflex the characterization of most eagerly awaited Leica products that did not live up to the expectations. The camera was announced for the Photokina of september 2006. The M8 and its successor model, the M8.2, are widely regarded as cameras manqué because of

the high infrared sensitivity that will record some synthetic materials not as black but as purple. Most commentators hold the view these camera models as a technical and marketing disaster. I do not share this opinion. There were solid technical and optical reasons to choose this solution. The rangefinder camera (in modern parlance the mirror-less camera) has a short back focal length of less than 30mm, compared to about 50mm for cameras with mirror boxes. Designs for rangefinder lenses have to accept account steeper angles for the rays that cover the format of the camera. Most digital cameras used thick layers of filters before the light-sensitive capacitors. Experiments showed that this thick layer did modify the path of the rays in an unacceptable manner. The combination of a thick layer and a steep angle forced the Leica designers to search for a solution with a thin cover glass. The cover glass in the M8 has a thickness of 0.5mm, as compared to the more than 3mm often encountered. The Kodak CCD KAF-10500 was the solution. The specs of this sensor describe a cover glass with an IR absorptive coating, including a transmission graph. The M8 and M8.2 have an IR filtering applied to the cover glass, but it is not very effective beyond the wavelength of 650 nm. There are situations where the shift from black to purple is most annoying, but there also many situations where it is no problem. And for black and white and infrared photography, the enhanced IR sensitivity is a bonus. The company did react to the IR problem with the delivery of additional IR filters for the lenses and this did solve the problem when it occurs. The crop factor (reduction of field of view) by 1.33 is easily seen in the smaller area for the bright-line frames in the rangefinder. One of the advantages of the Leica rangefinder is the possibility to oversee the scene that is being photographed as the rangefinder shows the total scene and the framelines indicate what section of the scene you are capturing. The M8 and 8,2 show the frame-lines for the focal lengths of 24mm to 90mm. You can use the 135mm lens, but the framelines could not be shown because of the pairwise selection of framelines and the small size of the frame.

The M8 had a number of small annoyances in addition to the IR sensitivity. The electronically controlled vertical running metal blade shutter produces more noise than the M-user is accustomed to and this noise is not the most pleasant one can hope to hear from a silent Leica rangefinder. The framelines were adjusted to the focus distance of 0.7m which causes a mismatch of frame selection and picture selection at longer distances.

The lack of a Moire filter enhances the clean definition of fine detail, but the software solution for moire-elimination is not always effective.

A hardly noticed consequence of the incorporation of the sensor in the Leica M body is the introduction of the two part body shell construction. All M models before the digital versions had a one-piece body for increased stability and this design implied too the typically film loading action through the bottom of the camera.

The M8 showed the difficulties that the company engineers had to cope with in the transition from AgX technology to solid sate capture, given these three conditions: a limited development budget and working in a time constraint, a seamless integration of the optical properties of all existing Leica M lenses, and a camera design and handling that is as close as possible to the acceptance space and working habit of the typical Leica M user. Leica had to depart as little as possible from the core values of the M system. This strategy is more difficult to implement than the solution that Olympus had chosen with the E-1 by abandoning the full AgX heritage and designing a integral digital concept from the ground up.

The one challenge that Leica could not and still cannot handle is the shift to short productcycles with products that offer a limited life expectancy. The M models are modified at a very leisurely pace and basically the MP is the same camera as the original M3.

The M8.2 is an improved version of the M8 with some fine additions, like the silent shutter mode, the sapphire cover glass for the monitor and more accurate frame lines. There are a few software enhancements and the user interface has been optimized. This is a very modest list that would not really qualify as a new model. The model designation shows the small gain. Japanese companies are able to create much more added value per camera upgrade and buyers are willing to buy the new model without any hesitation. It is a business model that the Leica camera company had never contemplated and is still adjusting to.

The alternative strategy was the Leica Upgrade Program (LUP), an ill-fated attempt to provide the M8 buyer with a sense of security about his investment and a forward-looking growth model. This program could have worked, but was a desperate attempt to combine Leica traditional values with fast progress in the world of

electronics. The other attempt to introduce a new marketing concept, the a-la-carte program for film-loading M-cameras, was equally unsuccessful.

The traditional worldview of Leica with its reliance on mechanical precision and optical excellence clash with the new combination of electronics and software programming.

The M9 is an M8.2 without some cost-saving to allow the inclusion of a cost-increasing 24x36 sized sensor. This Kodak supplied KAF-18500 is a dedicated construct for the Leica M9 (it is not listed in the Kodak imagers catalogue) with improved microlens design and a more effective IR-filter. The camera now can use all wide angle lenses with the indicated field of view. The success of the M9 has been complemented by the new high-speed lenses from 21mm to 50mm. of improved specifications.

AgX technology is no longer en vogue with Leica managers which is a pity. There are still valid reasons for the use of film and many modern emulsions provide better image quality with the Leica lenses than the digital technology can offer.

The Leica M9 is one of the most successful M models in recent history, but it still is a design more than half a century old. While the M9 may appeal to persons who like to combine digital efficiency with traditional style of photography, the future points an a different direction.

0.14 The Leica S2

THE original intention for the development of the Leica S2 was twofold: (1) to demonstrate that Leica could be profiled as a leader and major player in the digital imaging field (Technologieträger = platform for advanced technology) and to use the insights for a spin off into a new range of products. (2) to shift the focus for new digital products into a market that is less hotly contended than the high end slr segment.

Leica's alliance with medium format camera technology has a longer history. A number of years ago, the management was contemplating a takeover of Hasselblad. Several years later an attempt to buy Sinar was not successful and very recently a deal with Phase One was cancelled.

Barnack considered the 2:3 ratio as the best for aesthetic composition in pictures. The 1.5 ratio is closer to the so-called golden section or golden ratio, which is defined as "phi" or 1.618033988….. than the Linhof ratio. But the use and effectiveness of the golden ratio have been greatly exaggerated and common paper sizes (and television screens) are more often in the 4:3 ratio.

The S2 shape is closely modeled on that of a Sumo wrestler: strong and solidly standing on its feet, radiating uncompromising power, but it lacks the nimbleness and elegance of a distant predecessor like the Leica IIIc.

It is often assumed that the Barnack revolution was based on image quality and format size. The early adopters of the Leica camera were artists, many of them standing in the surrealist culture. Important for them were the compactness of the camera, the fastness of its operation and the fact that you could operate the camera at eye level. These features allowed for the creation of the new vision, the photography style characterized by a flexible and spontaneous view of life. The Leica could be taken everywhere and was ready to take pictures at any time of the day.

Image quality was not the prime concern of these photographers. It was as it were a byproduct. Surrealists were searching for essence, not surface representation.

In one sense the Sumo-Leica could re-enact the revolutionary spirit of the Barnack era. It is the only camera in the big sensor league that allows for natural eye-level operation. Whether this is enough to start a new (digital) New Vision remains to be seen.

The S2 is slowly changing its DNA: at first the camera was presented as a Technologieträger: a laboratory to demonstrate Leica's prowess in digital technology, but more and more the S2 is becoming a Hoffnungsträger, a platform of hope and promise, in fact one of the main pillars for the professional product range of the company.

The main selling point for the Sumo-Leica is the amalgamation of medium format image quality with 35mm ease of handling and speed of operation, allowing a new style of photography related to documentary photography in all environments (the weather sealing of the S2 is a point in case). Indeed, the weather protection

and the excellent close focus performance of the lenses are a direct attack on the Hasselblad and Phase One camera systems that are studio based, have limited open field deployment and provide lenses that are not so good wide open and at close ranges.

Leica, almost by tradition, is no technology leader, but capable of a high level of perfection. With the design and marketing of the S2 Leica proves that they are willing to take the plunge into unchartered terrain and redefine themselves as technology innovators by intelligently combining and enhancing third-party components (sensor by Kodak, processor by Fujitsu).

0.15 Leica lenses before 1950: Berek legacy

THE lenses that were specifically designed for the camera did evolve considerably while camera design was more or less stagnant. . Leica lenses are a main source for the Leica mystique. The important lens designs for photographic and cinematographic purposes were already analyzed and produced since 1896 when the classical optical designs were created. The Biotar, Sonnar and Planar types were well known before 1925 when Leitz introduced the Leica camera with its dedicated Elmar lens. The specifications are quite moderate: a focal length of nominally 50mm and an aperture of f/3.5. An excellent lens for small format cameras with a wider aperture of f/2 was already being proposed by Taylor and Hobson, the Opic design. Prof. Berek, the first optical designer in the Leitz company must have been aware of these lens designs. The Elmar four-element design is an improvement of the ubiquitous triplet construction, again introduced by Taylor and Hobson. Zeiss had a comparable design in its catalogue, the Tessar. Berek has commented on his choice for a moderate f/3.5 design. An f/2 design could have been designed by Berek and produced by the Leitz Werke, but its shallow depth of field would have restricted the photographer in the spontaneous use of the camera that was specifically designed fast operation which included a quick guess of the distance by the photographer. It is evident from these original specifications that Leitz was aware of the novel character of the camera and did not want to put up additional barriers to its acceptance. The larger bulk of an f/2 design might also have been an argument against its initial incorporation in the camera body. Another argument against the use of such a high speed lens is the thickness of the emulsion in combination with the spherical aberration of such a lens, taking into account the state of the art of lens design at that time.

Lens design in the in the early decades of the 20th century was characterized by a complex mixture of knowledge and tryouts. The mathematical formulae for the exact calculation of the path of rays in an optical system (ray tracing) were well known, but the practical computation was quite laborious. Logarithmic tables were needed to calculate to five or more decimal places. It took a lot of time to trace the path of one single ray through four or more lens elements. It was customary to select a handful of rays for calculations and infer from these results the performance of the system. Considerable skill and insights were required for this selection. The difference in performance between lenses can be attributed to this skill. Ray tracing was done only for rays in the so called meridional plane, that is an imaginary plane that contains the optical axis of the system. But most photographic scenes contain extended objects in three dimensions which implies that many object points do not lie in this plane but the rays will enter the lens with an oblique angle. Ray-tracing procedures for the oblique rays were known (it is still basic geometry), but the practical calculation is extremely complex and could not be done routinely before the advent of electronic computers. Some designers might trace an oblique ray through the system, but is was seldom done in a systematic manner. Oblique rays give rise to a different set of aberrations that do not appear on the lens axis. For 'axis' you might substitute a narrow bundle of rays of some extension around the axis. The last main problem in lens design was the selection of the glass types needed for the lens elements. Schott had introduced new optical glass types at the end of the 19th century with exiting properties for the lens designer. Glass does differ in refractive index, dispersive power and partial dispersion ratio, aspects that do influence the aberrations of the lens. A careful selection is of the utmost importance, but many properties of a glass type could only be found experimentally. A designer would be wise to stay with glass types that he knows well and selecting unknown glass could present unpleasant surprises. This is even applicable today and most recent Leica M lenses employ glass types with special properties not known to most designers.

> The importance of Berek for the Leitz company and the Leica camera is often underestimated. The major contribution of Barnack for the success of the miniature camera is the design of the 24x36 negative area and the all metal body. Berek however, singlehandedly, designed the lenses that could exploit the format in an efficient way. His theory of lens design is a major influence even today in the creation of Leica lenses.
> He was also the originator of the glass laboratory in 1949, a far-sighted initiative.

It took a designer several years to complete the design of a lens of moderate complexity when he could only use the log tables and even when he limited the number of rays to trace.

These limits in the knowledge of glass properties, ray tracing abilities and the occurrence and magnitude of aberrations forced a designer to stay on safe (well tried) ground or boldly tread where no one else has been. This could generate a brilliant design or a disaster. Both happened of course.

Optical aberrations are complicated phenomena. The optical and geometrical properties of an aberration might be studied in detail, but the effect of these characteristics on the photographic image could not be ascertained during the design stage. Depending on aperture and distance setting of the lens the behavior of aberrations in the sharpness plane but also in the unsharp areas has to be found by experimentation. Aberrations had to be balanced against each other to provide good image quality over the whole image area and at the aperture range and distance range. The designer had to find a balance between wide open performance and stopped down performance, select an optimum distance and balance the infinity and close up focus range, choose between center sharpness and edge softness, balance contrast with resolution, and weigh the type of representation of solid objects or flattened objects.

Higher speed lenses could be calculated with good performance, but in the absence of anti-reflection coatings the required high number of glass elements would produce a heavy amount of flare.

The Leica lenses that were designed in the period 1930 - 1950 covered the focal lengths from 28mm to 400mm. This extended range established the Leica camera as a true photographic system that could be used for every possible assignment and task. Most lenses had sober specifications as Leitz wanted to solve the practical problems of the photographer. A number of more exotic designs did establish the Leica as a pioneer, notably the Summarit 1.5/85mm, the Hektor 1.9/73mm, the Weichzeicher 2.2/90 and the Xenon 1.5/50mm.

It is very difficult to give a generalized impression of the qualities of the full lens range, but a pleasant definition of detail and plasticity of round objects might characterize these lens generations. There was hardly serious competition in the market of the 35mm miniature camera, which makes comparison not easy, but the contemporary Zeiss lenses for the Contax camera gave often an impression of higher sharpness. Later the Japanese competitors, Nikon and Canon also produced lenses went even a step further and for some photographers these lenses were too sharp.

Suitable performance criteria did not exist in those days and testing equipment was also very scarce and of limited usefulness. One had to rely on field tests by photographers or company personnel to get an impression of the quality.

The lens tests in this book are based on MTF measurements and field testing, and when you use modern criteria many older Leica designs are understandable not up to the current state of the art. But it is surprising how well tempered these lenses perform on modern equipment, including the digital M cameras.

One aspect that sets the Leica lenses apart from the competition is the mechanical quality of the lens mount and the accuracy of the lens centering. In this area we can detect the heritage of the microscope manufacturer where precise alignment is a basic rule.

0.16 Leica lenses 1950 -1987: the Marx/Mandler period

PHOTOGRAPHERS returning from the Korean War Theatre raved about the quality of the Japanese lenses from Canon and Nikon in particular that could be used on Contax and Leica bodies. It signified the start of a long period of battle for dominance on the optical front. The controversy between German and Japanese lenses focused on the quality of color reproduction and the contrast-resolution dichotomy. German lenses had the highest resolution and Japanese lenses the highest contrast it was claimed. While it is possible to optimize a lens design for contrast or resolution the practical effects are quite small. On the other hand there is some margin in choosing the effective focus plane in a camera-lens system and here the choice is between a point with a small core and a large blur circle (high resolution and low contrast) or a larger core with a smaller blur circle (low resolution and high contrast). As so often in photographic lore the debate continued even if the factual basis disappeared quickly.

The period starts with the new Summicron 1:2/50mm lens in 1953 and ends with the Apo-Macro-

Elmarit-R 2.8/100 in 1987. Dr. Walter Mandler worked for Leitz from 1946 to 1974. His influence on lens design and lens construction did not end until 1990 when a new approach for lens design was implemented.

Leitz had to battle on two fronts. The competition in the rangefinder domain quickly vanished and the focus shifted to the reflex world. The M camera had now to compete with the versatility of the reflex camera and the inherent advantages of zoom lenses and extreme wide angle and tele lenses that could be used with the reflex finder. The choice for the M was to capitalize on the advantages of the rangefinder for handheld photography in available light. High speed and compact size were the trade marks of the M lenses and this approach delivered lenses like the 2/35, 1.4/35, 1.4/50 1.2/50, 1/50, 1.4/75, several of these were designed by Mandler. The performance at maximum aperture was given high priority in the design consideration as it was in this area that the M camera could promise a decisive advantage. Lens design was revolutionized by the introduction of first the electronic calculator and later programs for lens optimization. An optical system is a very complex construct with a large amount of variables that operate within a wide range of possibilities. The final design is a balancing act between competing properties that is more art than science, especially because the relation between optical parameters and visual imagery is often indirect. Rangefinder lenses demand a higher order of accuracy during assembly than reflex lenses. The latter ones focus on the screen that can be visually inspected. The rangefinder mechanism is dependent on the mechanical coupling between the lens and the rangefinder movement.

The manufacture of the glass elements in those days was less accurate than the calculations demanded. The individual glass lenses differed in thickness and curvature. It was more economical to find a method to pair lens elements with compensating measurements than to make a new batch of lens elements. Sometimes a type of glass was no longer available or the glass maker had changed the properties a bit. In these cases the lens assembly had to adjust to these facts. Many of the differences that have been found in older Leica RF lenses can be attributed to these conditions. The pairing of glass elements and the adjustment and positioning of the lenses in the mount were very laborious. Mandler was constantly searching for ways to reduce cost while maintaining and even enhancing image quality. The famous redesign of the Summicron 50mm with the flat surfaces is an example. But he was also looking for designs that were less critical during assembly. His well-known study of the Double Gauss design and his exploration which design offered the best combination of performance and simplicity in construction is a land mark in the history of optical design. The basic design constraint for M lenses is the limited thickness (to minimize obstruction of the viewfinder field), short back focal length and the limited diameter of the bayonet flange. It is most difficult to design lenses with superior performance within these limits. The M lenses in this period are as good as their reflex companions, but cost reduction was as important as performance maximization. True to Leica tradition these lenses were the best mounted and assembled in the rangefinder world.

In the domain of the reflex lenses Leica saw formidable competition by Zeiss, Nikon and Canon. The Zeiss lenses for the Contarex system were of superior construction and finish, but had the performance characteristics of medium format lenses. The Canon system was very comprehensive and showed innovations all over: aspherical surfaces, floating elements, tilt and shift designs. The Nikon system was focused on filling every niche in the photographers lens armory. Leitz could not compete with this excess of lens designs and had to ask outsiders for help. The original Leica designs were complemented with designs by Angenieux, Schneider, Zeiss, Minolta and SIgma.

Leica could show impressive results in the rangefinder domain (the Noctilux, the Summliux 35 and 50, Summilux 75 and the Summicron 50), the list of lenses on the reflex side is less long.: Macro-Elmarit-R 2.8/100, Elmarit-R 2.8/28 and Apo-Telyt-R 3.4/180.

The Japanese manufacturers were most successful with their systems and deservedly so. A Canon F1 or Nikon F could win every contest with the Leicaflex or later Leica R4 or the Contarex or later Contax RTS. The high sales volume of the Nikon and Canon lenses allowed the makers to innovate more and to invest large sums into dedicated machinery. The German makers had to face the difficult challenge of maintaining high quality with a low volume and manual labor with an acceptable price.

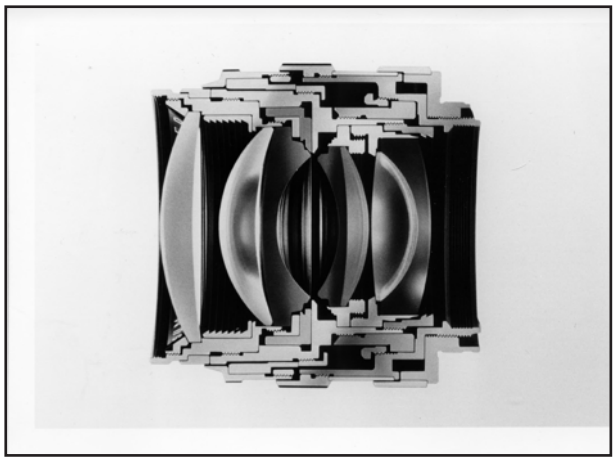
Zeiss choose the method of design relaxation for their new generation of lenses for the Contax RTS.

This approach implied that the lens constructions became less sensitive for small production and assembly errors. Zeiss alo introduced the use of MTF graphs, a method to relate optical performance directly and meaningfully to photographic quality. In this respect the Zeiss people were very idealistic, assuming that the users would appreciate honesty and a scientific approach.

Leica followed a different approach. The designers tried to find the simplest solution for a certain design with the least number of lens elements. And the lens elements should have surfaces that could be manufactured without a large failure rate. The logic in this approach is the major cost reduction when you can eliminate one lens element in the design, especially with the high level of manual labor involved. Leica evidently hoped that the basic qualities of the R lenses, superior mounting, durability and longevity of the lenses and a consistent high quality would generate enough sales.

The Leitz company had the luxury of two optical design centers, one in Midland under W. Mandler and one in Wetzlar under prof Marx. The department in Wetzlar worked also for the microscopy section. While it is Mandler who in most accounts gets the most attention, it was Marx and his successors who advanced the art and science of optical design and manufacture. In Wetzlar there was a strong drive to push and explore the limits, where Mandler was more interested in calculating lenses that could be manufactured in an economical way: he was focused on technical feasibility. The Wetzlar colleagues were focused on exploring the limits: here the aspherical technology was explored as was the creation of new glasses in the glass lab.

This approach could bring excellent lenses like the first Noctilux, but also projects like the extremely expensive, but not very useful test lab of Dr. Schaefer in the cellars of the Wetzlar buildings.



0.17 Leica lenses from 1987 to 2010: the Karbe era

AFTER the departure of Walter Mandler the Leitz optical department was managed by Wolfgang Vollrath. Under his guidance some outstandingly good designs were created, notably the Apo-Macro-Elmarit-R 2.8/100mm. But the most important designs were developed in the Zeiss optical department.

Designers like Wöltche and in particular Glatzel were more daring and created land mark designs. The contemporary Leica-R designs were competently calculated systems, but undeniably conservative. The arrival in 1990 of Lothar Kölsch from Zeiss in the Leica optical department should bring new blood and inspiration. Mr. Kölsch introduced the technique of blank pressed aspherical surfaces and pushed the design of zoom lenses, treated like a poor relation in the Leica list of optical priorities. Above all, he injected into the design team a new way of thinking about lens design. The result of these actions were impressive. In the R-range lenses like the Vario-Elmarit-R 2.8/35-70 and 2.8/70-180 set new standards for zoomlenses. New telelenses like the Apo-Summicron-R 2/180, the Apo-Telyt-R 4/280 and the Apo-Elmarit-R 2.8/180 offered superb image quality and were created by a designer who will rise to a prominent position in the Leica company.

> Excerpt from an interview with Mr. Kölsch: a really good optical system originates in the head of the designer and the know-how about the impact of every single parameter (radius, thickness, distance and glass selection) on the image quality. The computer is a required tool to check if the mentally designed system to predict with speed and certainty if the chosen route will deliver the intended results. The development time of a full year for the Vario-Elmarit-R 2.8/70-180 indicates that extensive exploration and in particular the questioning of established know-how was required to find the wished-for solution. The dedicated deployment of special glasses with anomalous dispersion and high refractive index is conditional for such a solution. These glasses however require a special treatment.

But the trend in reflex camera systems was unmistakably focused on autofocus designs, zoomlenses with a large focal range and image stabilisation constructs.

In the rangefinder world a whole new generation of lenses was introduced with the ASPH. postfix with focal lengths of 21, 24, 28, 35 and apertures from 1.4 to 2.8. The Summicron range evolved into a family of outstanding value with the 2/28, the 2/75 and the 2/90. The Tri-Elmar-M 4/28-35-50 ASPH. gave the M-photographer a new sense of flexibility. THis lens showed that Leica now could manufacture very complex mechanical mounts with automated machinery.

The rangefinder camera is limited by its viewfinder concept in the range of focal lengths that can be handled. In the past there was a Visoflex reflex housing that could be coupled to the M camera on one side and long focus lenses at the other side. Theoretically the lens range for the M camera could be extended from 200mm to 560mm. But in practical work even 135mm became a limit. The M-camera is predestined for photography at close range and in close contact with the subjects. The most promising expansion is the group of wide angle lenses. With lenses for 21, 24 and 28mm already in the program, the only way to add new designs is a change of maximum aperture. In 1998 the introduction of new M lenses had reached a temporary limit. The dearth of new designs was also caused by the difficult economic position of the Leica company. Between 1998 and 2006 only three new lenses were introduced, the Apo-Summicron-M 2.75, the Macro-Elmar-M 4/90 and the superb Summilux-M 1.4/50mm ASPH.

The core team around Mr Kölsch consisted of two other designers. Horst Schröder and Peter Karbe. When Mr. Kölsch left the company in 2002, Peter Karbe became his successor.

Around this time the rangefinder scene had been revived by the introduction of the Voigtländer Bessa range and the Zeiss Ikon camera, both produced in the Japanese factory of Cosina. A whole new palette of lenses was and would be created by the Cosina people. Their designs were at the same time cheap and daring and filled holes in the line up of Leica. The 15mm lens and the 12mm lens can be referred to as examples, but also a 1.2/35 and a 1.1/50mm. Many designs had specifications with emotional links to the glorious past. Mechanically and optically these lenses are not in the same legue as the Leica lenses, but the attention they received made it clear that there is a market for exotic designs. IN 2006 the Leica company needed new lenses to accompany the M8 camera and a Tri-Elmar 16-18-21 and a compact 2.8/28mm lens were designed. The team around Mr. Karbe, a multifaceted designer with a rare combination of vision, modesty and ambition added ten more lenses in two years time. This output exceeds the design effort of a full decade in Leica history. Among the new lenses were a range of compact and modestly priced Summarit designs of 35, 50, 75 and 90mm focal length to counter the Cosina attack. In addition a range of stunningly specified lenses came available in the wide angle to standard focal lengths. The new 1.4/21, 1.4/24, 1.4/35, 3.8/18, 3.8/24, 0.95/50 are very advanced designs that bring the state of the art at a higher level. It is as if Leica wants to show who is the boss in rangefinder country. For the new designs all stops are pulled with floating elements, aspherical surfaces and even aspherical elements, new glass types, new surface treatment, new coatings, new machinery and new mounting techniques. The basic challenge for Leica M lenses is the small size of the lens mount, that constraints the full exploitation of the design possibilities. A look at the cross section of a modern Leica lens shows the fight for every available millimeter of space.

The price level of these new lenses is quite elevated and an indication for the effort and costs involved to manufacture these lenses. The obvious challenge for the near future is to make the M lenses more affordable without compromising optical performance and mechanical quality.

If volume is not a constraint, lenses with a very high level of performance can be constructed as the examples from the S range show. Here the size is not a limiting factor and then an unprecedented level of performance is possible.

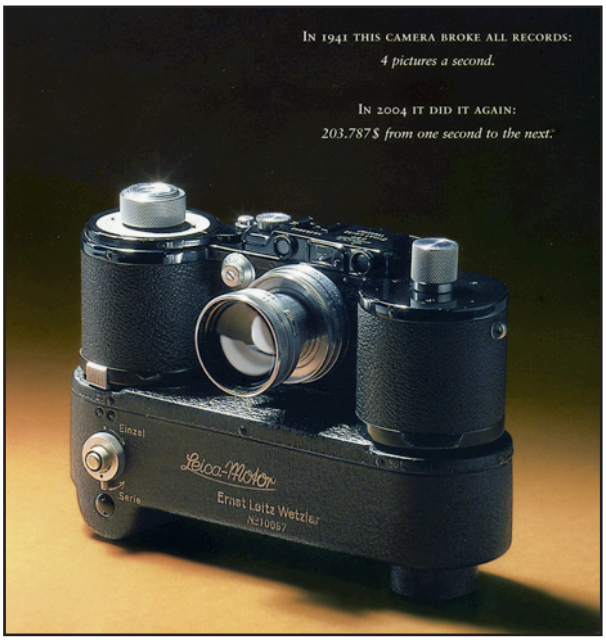
This is not a new insight as can be gleaned from the cinematography where Zeiss Prime lenses and now also Leica Summilux-C lenses set the norm. The huge size of these lenses dwarfs the M lenses and one can only have the highest admiration for the quality of the M lenses.

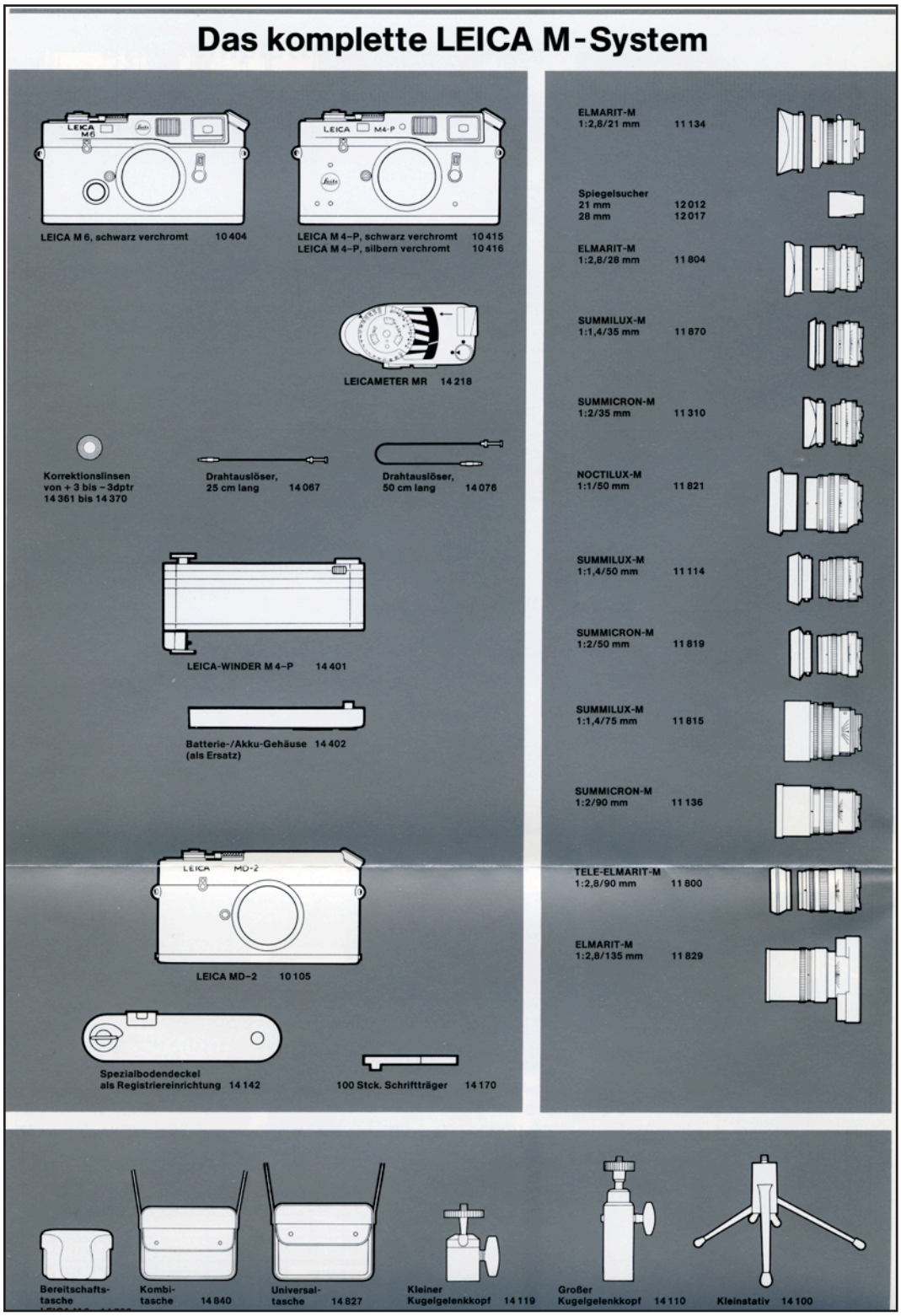
Picture pages

Leica promoted the system approach in compact format

But also exploits the links to history

Auctions earned money with old Leica cameras and Leica tried to do the same with special editions.





Leica M4P and M6 system: this type of overview is very illustrative

A modern M6 system dispay

Classic style of broschure

Sometimes the Leica company slides to a glamorous approach

But most of the time the company is rather conservative in the promotional activities