Leica R lenses

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Chapter 14:
LEICA VARIO-ELMAR-R 80-200 mm f/4.0

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__Background

Around 1960 the first generation of vario lenses hit the market and offered good performance. As a start many manufacturers had a standard zoom (from about 40 mm to 80 mm) and a long tele zoom (from about 70 mm to 250 mm) in the program. The long zoom lens was mostly seen in combination with a motor drive unit to make clear that this type of lens had been designed for photographic applications where a quick change of magnification and picture angle was essential, in combination with a rapid sequence of pictures at different angles of view and moments. It was clearly intended for scientific photography and event' photography in a wide sense of the word. Sports, reportage, wild-life and nature photographers were the first buyers. It is an interesting observation, that the traditional type of static photography (select a focal length, decide on the location and wait for the right moment to happen) was changing to a dynamic type, were the aim was to take as many pictures as you can and select the right shot after the event. The adoption of the cinematographic attitude and the post-selecting of the images is now the mainstream approach in the current digital scene, but was a revelation in those days.

The maturing of the telezoom reduced the market for fixed focal length lenses and at the same time increased the wish for quite extended vario ranges. The original Japanese vario ranges comprised the range form 85 mm to 250 mm and 85 mm to 300 mm. Since then we have seen a reduction to 70 mm to 210 mm and 80 mm to 200mm and an expansion to 28 mm to 200 mm and even 18 mm to 200 mm. These two trends (narrow range and extended range) are the result of two different design approaches.

It was Bill Clinton, who noted: "it is the economy, stupid!" when campaigning. In optical design, one could exclaim: "it is the size, stupid!" It is not often appreciated that the two prime parameters that limit the possible image quality of an optical system are the size and the weight. A wide aperture telephoto lens by necessity has a large front diameter and a big mount, both responsible for weight and size. Add demands like even illumination, excellent performance, durability and you end up with a mount that cannot be reduced in size without compromising these demands.

The choice by Leica for the range from 80 mm to 200 mm is a bit staid, but becomes understandable when we look at the performance figures.

To give you some perspective, let us take a look at the very compact current wide range vario lenses, like a 28 mm to 200 mm zoom lens. These designs cannot be constructed, using the classical zoom designs with four or two main moving groups (the focusing and the compensation groups). The new designs consist of up to five independently moving groups, including that of the diaphragm. Autofocus systems are really needed to adjust the internal zooming groups for reasonably accurate focus of the lens. Lens design, autofocus design and miniature electromechanical components are all integrated into one very complex system.

With more lens groups that can move in combination, the designer has the option to create a large zoom range that can be subdivided by the movements of all the groups, such that every group has only a small movement to make. The lens can be designed without any motion becoming excessively long. An additional feature is the independent movement of the diaphragm. Normally the aperture position is fixed and therefore the exit pupil is fixed too, not only in location, but also in size. The exit pupil has to illuminate and cover the whole negative area. When the location of the diaphragm can move according to the zooming motion, the designer can try to locate the diaphragm at a position that is as close to the film plane as possible when the lens is zoomed to its maximum focal length. When the diaphragm is very close to the film plane, the exit pupil is also very close to the film gate and can be made smaller in diameter. This approach helps to keep the size of the lens down.

The reduction in image quality that is initiated by the compromises in weight and size in combination with a long zoom range would be unacceptable for the Leica designers. It is maybe a sign of the times, that many photographers are quite happy with the results. Leica users will and can demand an optical performance that is situated at a much higher platform.

The first vario lens in the telephoto range for the Leica R system was the LEICA VARIO-ELMAR-R 80-200 mm f/4.5, introduced in 1974. It was followed by a LEICA VARIO-ELMAR-R 75-200 mm f/4.5 in 1978, a LEICA VARIO-ELMAR-R 70-210 mm f/4.0 in 1984 to be replaced in 1996 by the current LEICA VARIO-ELMAR-R 180-200 mm f/4.0 with specifications close to those of the original version. If we look at the lens layout of the current version and compare it with the previous versions, there is quite strong family resemblance. But we know that we cannot judge a lens on its layout, but need to incorporate information about the glass types that are used, as this selection is often more important than the physical shape of the lens element.

It is no secret that the first two designs were adopted from Minolta, the third incorporated more Leica thinking and the current one is an original Leica design, derived from the LEICA VARIO-APO-ELMARIT-R 70-180 mm f/2.8. It took the Solms designers 18 months to complete the LEICA VARIO-APO-ELMARIT-R 70-180 mm f/2.8, but the LEICA VARIO-ELMAR-R 80-200 mm f/4.0 was finished in about six months. This state of affairs begs the question when is a design a true Leica design.

We all have the romantic impression of that famous Leica designer, Dr. Berek who is known to have been sitting in the evenings at his desk at home, sketching with pencils on squared paper, making calculations while exploring uncharted optical properties. Berek was responsible for the main calculations and the overall concept, but the laborious raytracing, that took many years to complete had to be done by his team of assistants. But Berek was not working in a vacuum. The basic designs he used where well known in the optical community of which he was a member. Articles and books were available, exploring all aspects of design and performance. The same basic six element design could deliver

LEICA VARIO-ELMAR-R 80-200mm f/4.0
Photographer: Oliver Richter

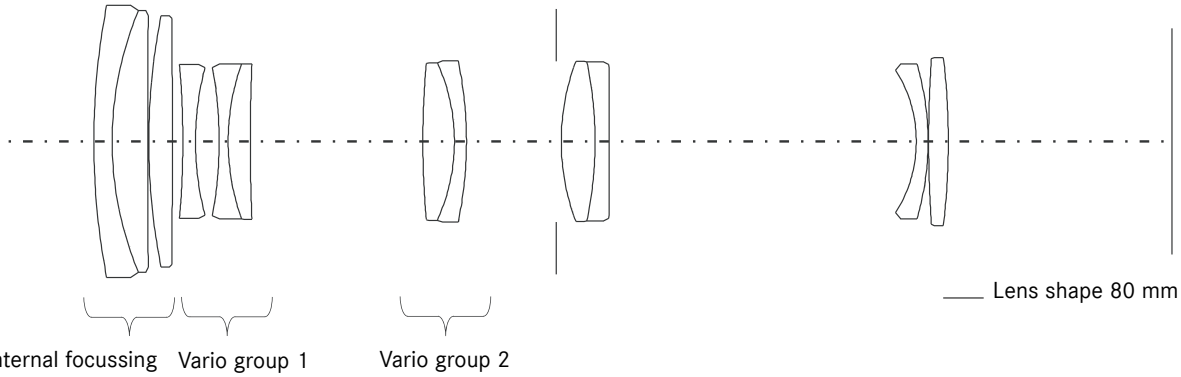
excellent results and sometimes just good results depending on design effort, creative hunches as well as on manufacturing quality.

Today we have a fundamentally different situation. The optical design community is a global affair, with tens of thousands of patents and examples on which to base a new optical system. The powerful optical design programs that are used by every company can create designs within a day or two, when an experienced designer manipulates the program. And these designs are really light years ahead of what Berek could do in his time. All serious optical manufacturers use the same (American) design program and Leica is no exception. Every design program however uses algorithms for optimization and glass selection that reflect the bias of the design team of the program. The mathematical background for aberration correction is common knowledge, but not the way to balance the errors and the approach to reduce the errors to some small numerical value. That is the reason why Leica also uses a proprietary design programs, originally created by Prof. Marx (of Noctilux fame). Quite often in the design process, the program has no solution to offer and then the Leica programs have to add the finishing touches to create a design that satisfies the goals of the Leica design teams. The hallmark of a Leica lens are the careful selection of glass types, the rigorous correction of the aberrations of a high degree to the smallest possible values, the meticulous surface treatment of the glass elements and the narrowest possible mechanical tolerances when manufacturing the mount and fitting the glass elements.

The origin of a design is less important than the changes that the Leica designers make to the design to fit their own specifications. Leica has changed the original Minolta design in the third version with the introduction of different glass types to improve the performance and to create the typical optical fingerprint that is characteristic of all Leica lenses. There is no reason to keep a parochial stand here. Leica offers outstandingly good designs, but they are not alone in this field.
Unique for Leica is the tight coupling of optical design and manufacturing tolerances to ensure that every lens performs durably to the design specifications.

LEICA VARIO-ELMAR-R 80-200 mm f/4.0
Photographer: Oliver Richter

__Optical considerations

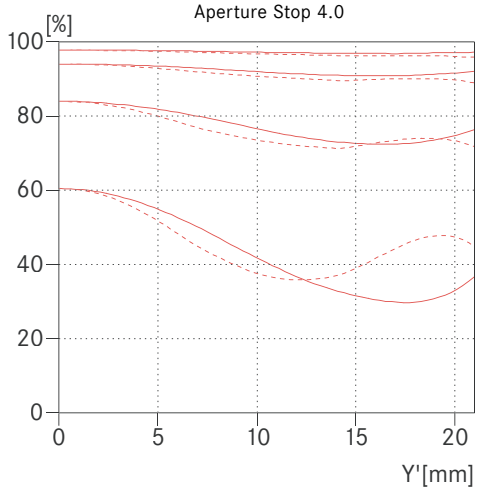


The LEICA VARIO-ELMAR-R 80-200 mm f/4.0 has 12 elements, arranged in eight groups (the original brochure counts nine groups). Six elements have glass with anomalous dispersion and/or high refractive index. In total eleven different glass types are employed. Compare these figures with the LEICA VARIO-APO-ELMARIT-R 70-180 mm f/2.8: 13 elements in ten groups, 5 special glasses and in total 12 different glass types. The large amount of different glass types is typical and probably unique for current Leica designs: this large selection allows the designer to improve image quality substantially, as every glass type adds two degrees of freedom to the design possibilities (any glass can be characterized by two numbers: dispersion and index of refraction). But the number of permutations and combinations increases exponentially and computer programs do not like this as there are too many solution directions. Here we note another special Leica characteristic: the special knowledge about glass types (related to the period when Leitz had their own experimental glass lab) and the experience with the treatment of 'difficult' glass surfaces. Leica designers are able to choose and treat glasses that offer exciting possibilities but are too problematic for large-scale series production.

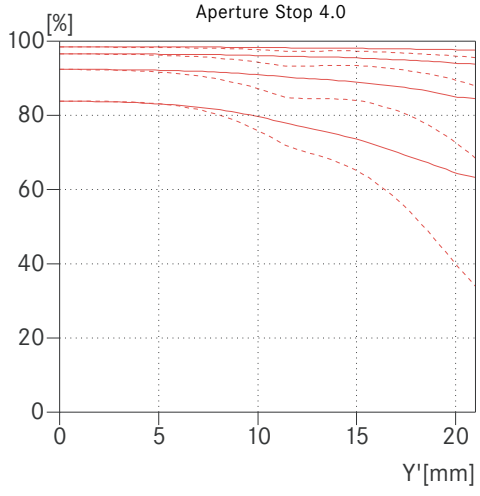
The optical performance wide open is excellent. At the shortest focal length the quality is a bit less than at the longer focal lengths, where really good imagery can be expected. In fact the quality profile favours the midrange (around 140 mm) with the short and long focal lengths a bit less good. This choice of the way of correcting the lens is a sensible one. Leica lenses at the fixed focal length of 135 mm have vanished for a long time, but it still is a very interesting focal length where exacting performance may be required. And around 200 mm current prime lenses are outstandingly good and it is reasonable that the photographer expects the same type of performance of the vario lens at this focal length of 180 mm to 200 mm.

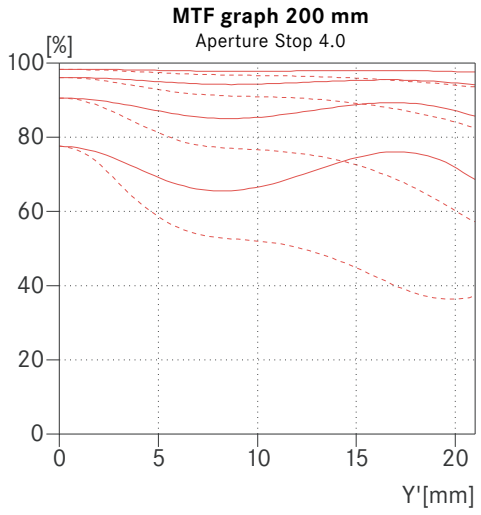
Stopping down to 1:5.6 brings a visible improvement at the 80 mm setting and a slight improvement at the other settings (140 mm and 200 mm). Overall the image quality is now quite even at all apertures and focal lengths. Pictures made with the LEICA VARIO-ELMAR-R 80-200 mm f/4.0 offer a high contrast, crisp definition of very fine detail and the clarity of colours and gradation that are the hallmarks of a well corrected design. You will notice, when studying the MTF graphs that there is a widening of the gap between the sagittal and tangential lines at the higher frequencies.

MTF graph 80 mm
Aperture Stop 4.0



MTF graph 135 mm
Aperture Stop 4.0

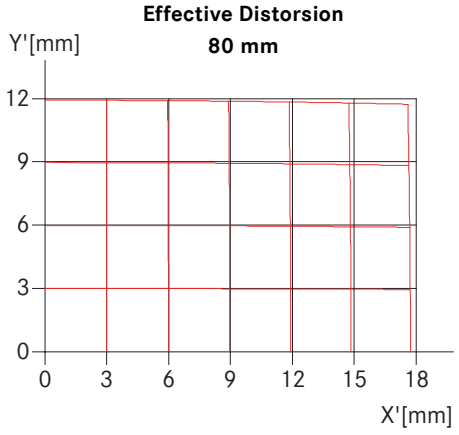


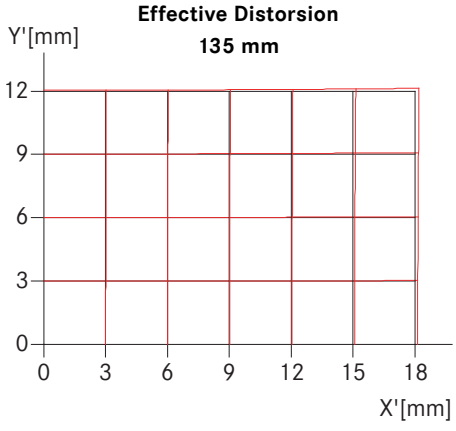


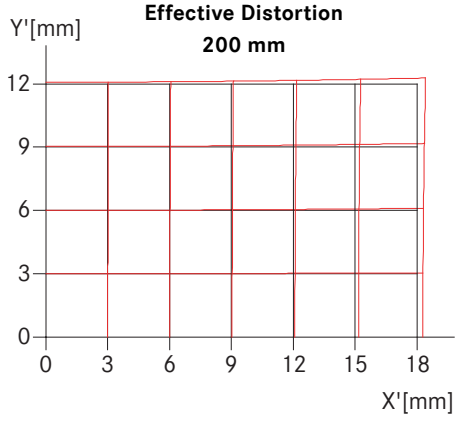
This implies that the correction of the secondary spectrum and astigmatism is not perfect. In practice you will be able to notice this contrast drop at high magnifications on very small textural details, but most often the occurrence of the grain pattern and the blur effects of hand held shooting will be more pronounced. It is interesting to compare this performance to the previous version (the LEICA VARIO-ELMAR-R 70-210 mm f/4.0). The gain in performance is most pronounced at the 80mm setting where the current lens produces an image with much higher contrast. At the longer focal lengths the improvements are subtler and can be found in a more crisp definition of fine detail and a more even performance over the whole film area. The older lens has a stronger drop of performance at the edges of the image. The LEICA VARIO-ELMAR-R 80-200 mm f/4.0 can be used with confidence at all settings and apertures without fearing that there will be a big variation in image quality.

The background blur at wider apertures and longer focal lengths is typical for telephoto designs and a bit harsh, and main outlines become quite blurred. Veiling glare and secondary reflections hardly occur and only when the rays of the light source are directly hitting the front surface. You can always deliberately provoke secondary reflections, caused by the reflections by the aperture blades. High class images have an extended tonal range and it is killing for a picture when the highlights and especially the specular highlights in reflective surfaces, like gleaming metal, are washed out or when the small spots of light are diffused by flare effects. In this respect the LEICA VARIO-ELMAR-R 80-200 mm f/4.0 behaves commendably, especially when using slides, where highlight rendition is very important.

The main differences between the three focal length positions are the amount of distortion. The 80 mm has a -3% barrel distortion that is visible when straight lines are reproduced at the edge of the frame. At the 140 mm and the 200 mm position there is pincushion distortion of 1.5% and 2.5% respectively.

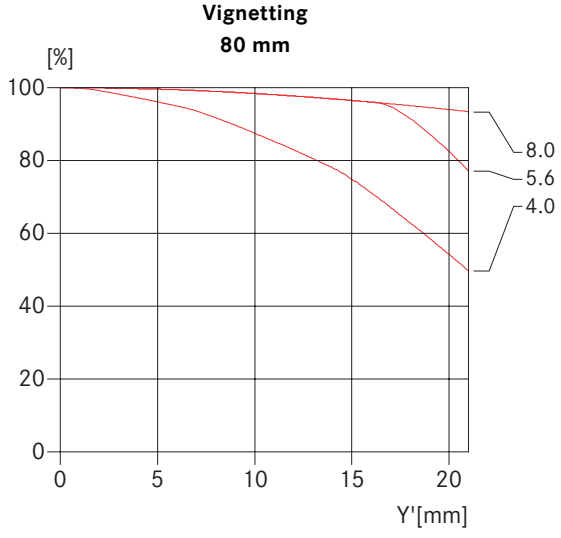


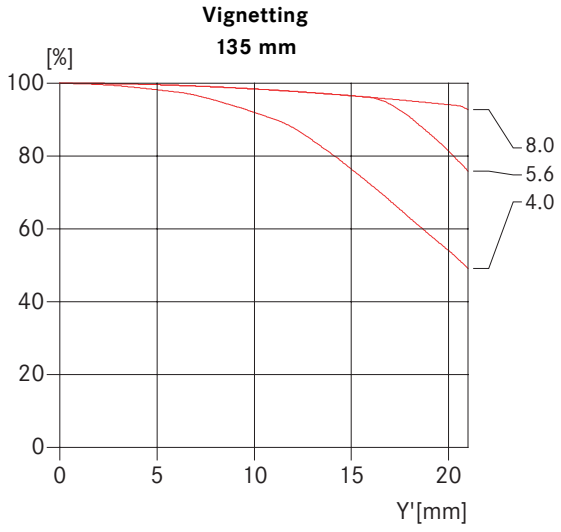


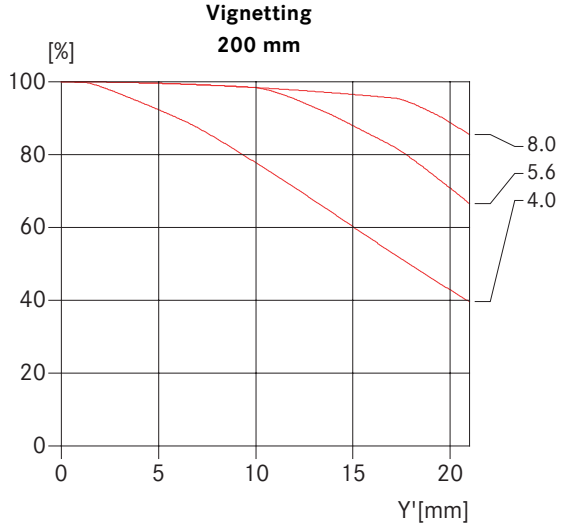


The previous version has -4%, 2% and 3% distortion.

Vignetting is low at all settings with a value of 1stop, where the previous version had 1.5 stop and more. A loss of light at the corners of 1 stop sounds severe, but you see from the graphs that the change in value is very gradual and the human eye is very tolerant for this type of gradual changes. When you really want or need absolutely even light distribution, you can stop down to 1:8, as you would have to do anyway when photographing scenes that require the best of image quality. Working at wide apertures often implies photography where the main motive is located in the centre of the image.







__Summary

The LEICA VARIO-ELMAR-R 80-200 mm f/4.0 is a worthy complement to the VARIO-ELMAR-R 35-70 mm f/4.0. With these two lenses you can cover a focal range from 1:5.7. The quality of the VARIO-ELMAR-R 80-200 mm f/4.0 is excellent over the whole range of focal lengths and apertures and distances. The lens can be used in a wide range of situations and subjects, but if you are looking for more limited but dedicated imagery of a very high order, the fixed focal lengths of 100 mm and 180 mm might be the first choice. The near focus limit of 1.1 meter is a big improvement over the 1.7 meter limit that the VARIO-APO-ELMARIT-R 70-180 mm f/2.8 offers. As usual it is best to stop down to 1:8 or smaller when working that close. This is advisable not only for the performance improvement, but mainly for the increased depth of field. As the little brother of the redoubtable LEICA VARIO-APO-ELMARIT-R 70-180 mm f/2.8, the lens stands a bit in its shadow, but the reduction in aperture brings a welcome reduction in weight from 1.87 kg to 1.02 kg.

As noted at the start of this review, the lens is very suitable for 'event' photography, but can be used very favourably as a portrait lens in studio and on location shoots. Common sense will advise you to use the 90 mm or the 100 mm focal length for portrait work. The 150 mm to 200 mm settings bring a very pleasant perspective and a very natural looking representation of a humans face. With an Apo-Extender-R 2x we get a 160 mm to 400 mm lens at aperture 1:8. This combination is not the best there is for handheld shooting, but on tripod and stopped down to 1:11 it helps you to bring home exciting pictures at long range. Photography is a demanding profession and hobby and we are all inclined to stay into well-confined paths that evade surprises and unexpected views in order to get the required results. The nice aspect of the Leica system is that you can experiment with different combinations and settings and in doing so will support your creative potential and can expand your visual horizon and experiences. The LEICA VARIO-ELMaR-R 80-200 mm f/4.0 covers a very potent range of focal lengths including the classical 90 mm, 135 mm and 200 mm. The focal length range from 80 to 200 mm offers a world of possibilities in one package. It is the photographer who chooses what focal length to use in a given situation, not traditional prescriptions.

LEICA VARIO-ELMAR-R
80-200 mm f/4.0
Photographer: Oliver Richter