1935-2017
From optical workshop to outstanding optical company

House of Outdoor & Optics
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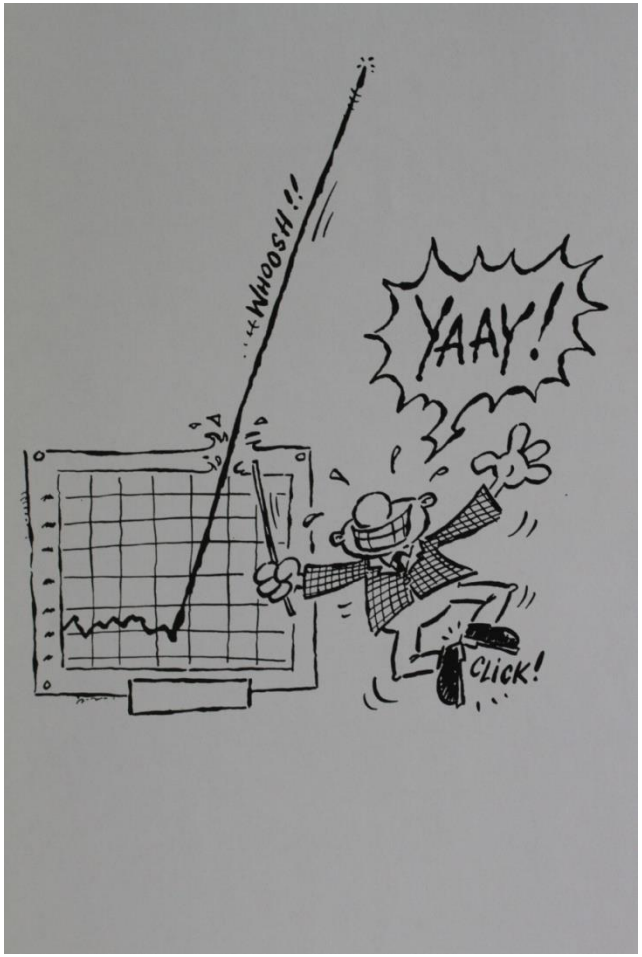
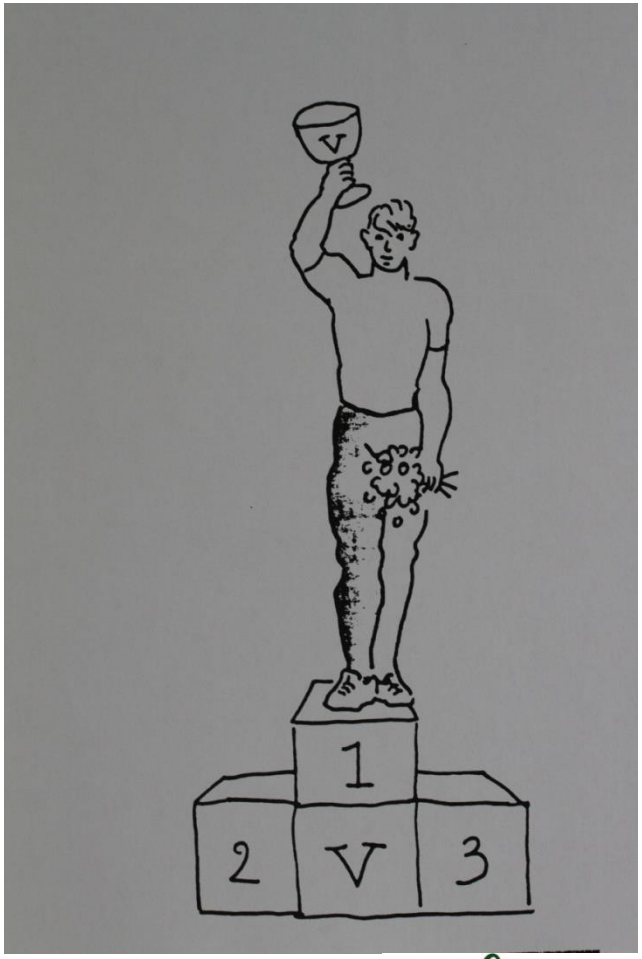
A lecture by Dr. Gijs van Ginkel on October 9, 2011 at the meeting of the Binocular History Society in Jena, Germany.

SWAROVSKI OPTIK AUSTRIA: HISTORY AND QUALITY DEVELOPMENT





SURPRISE: NOT A LOT CAN BE FOUND IN THE PRINTED LITERATURE ABOUT THE SWAROVSKI HISTORY AND ITS MILESTONES

Looking for Swarovski Optik in the binocular literature

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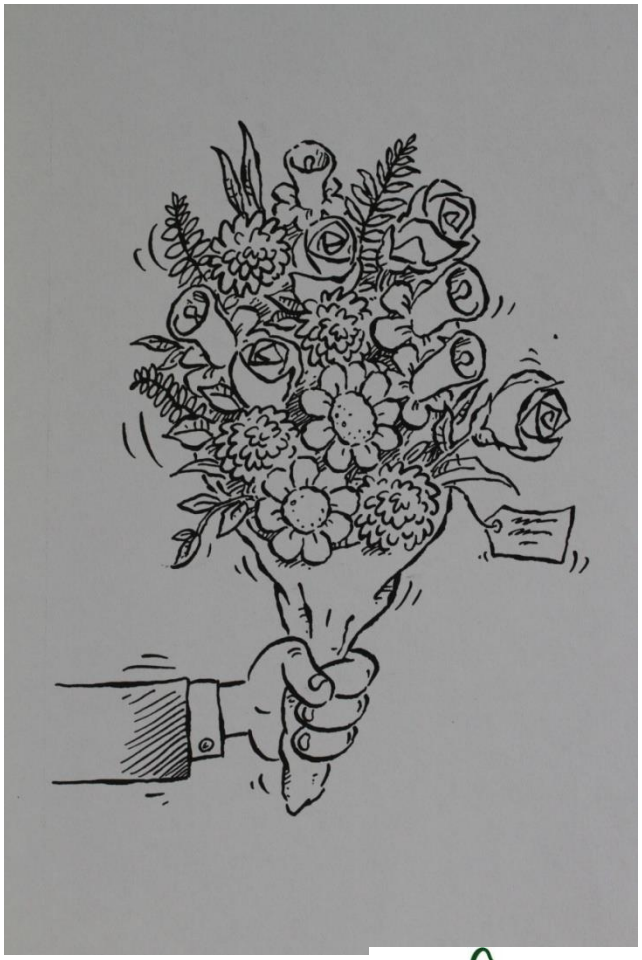
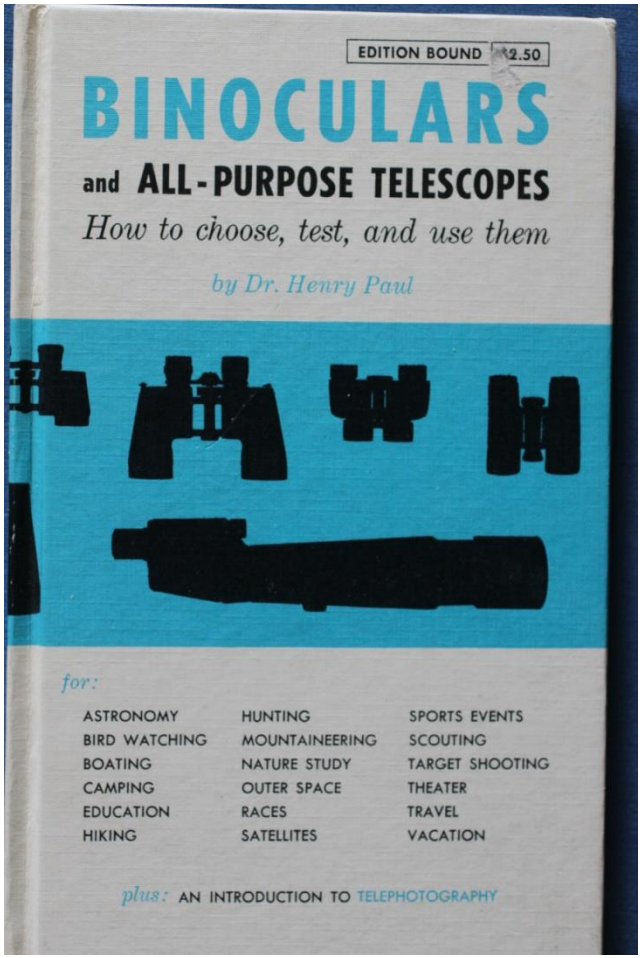
The excellent book about army binoculars by Dr. Hans Seegers mentions a 6x30 Porro Dienstglas from Swarovski in Wattens



The 6x30 Swarovski Dienstglas shown in the following two slides belongs to the collection of Jack Kelly

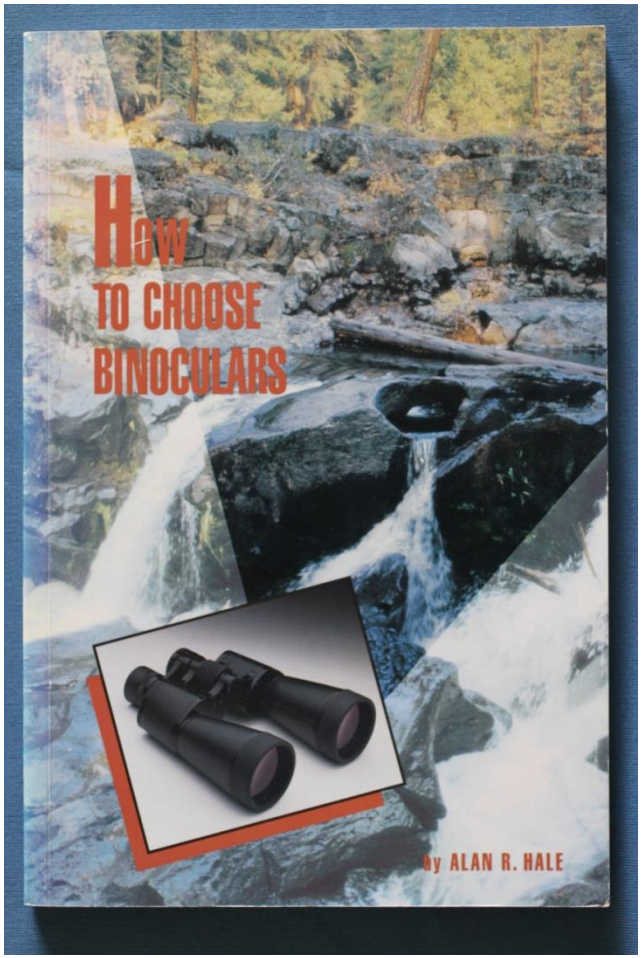
Swarovski Porro Dienstglas 6x30 made for the German Army in 1940-1945

“BINOCULARS” by Dr. Henri Paul (1964) with list of binocular distributors in the USA



1901 Levee St., Dallas 7, Tex.; I. *Miller*, 703 S. 3rd St., Phila. 47, Pa.; *Mirakel* Optical Co., Inc., Mt. Vernon 1, N. Y.; O. F. *Mossberg* & Sons, Inc., 2510 St. John St., New Haven 5, Conn.; *Nikon*, Inc., 111 Fifth Ave., New York 3, N. Y.; *Olden* Camera Co., 1265 Broadway, New York 1, N. Y.; *Photographic Import. & Distr.* Corp., 708 Byron Ave., Franklin Square, N. Y.; *Questar* Corp., New Hope, Pa.; Ben *Rosenberg*, 106 W. 47th St., New York 36, N. Y.; *Ross* Ltd., London; *Scope* Instr. Corp., Scope Bldg., Harrison, N. Y.; *Selsi* Co. Inc., 29 E. 22nd St., New York, N. Y.; *Spiratone* Inc., 369 7th Ave., New York 1, N. Y.; *Stellar*: see Astra Trading; *Swift* Instruments, Inc., Boston 25, Mass.; *Tasco* Sales Inc., 1075 N. W. 71st St., Miami, Fla.; *Tinsley* Laboratories, Inc., 2448 6th St., Berkeley 10, Calif.; John *Unertl* Optical Co., 3551-55 East St., Pittsburgh 14, Pa.; *United Binocular* Co., 9043 S. Western Ave., Chicago 20, Ill.; *Unitron* Instrument Co., 66 Needham St., Newton Highlands 61, Mass.; *Wall St.* Camera Exchange, 120 Wall St., New York 5, N. Y.; Carl *Zeiss* Inc., 444 Fifth Ave., New York 18, N. Y.; *Zuiho*: see Adirondack Radio.

“HOW TO CHOOSE BINOCULARS “ by Alan Hale (1991) mentions under SWAROVSKI Porro Habicht , Porro Habicht SL , 7x30 and 8x30 SLC roof prism binoculars and 8x20 Pocket binoculars.

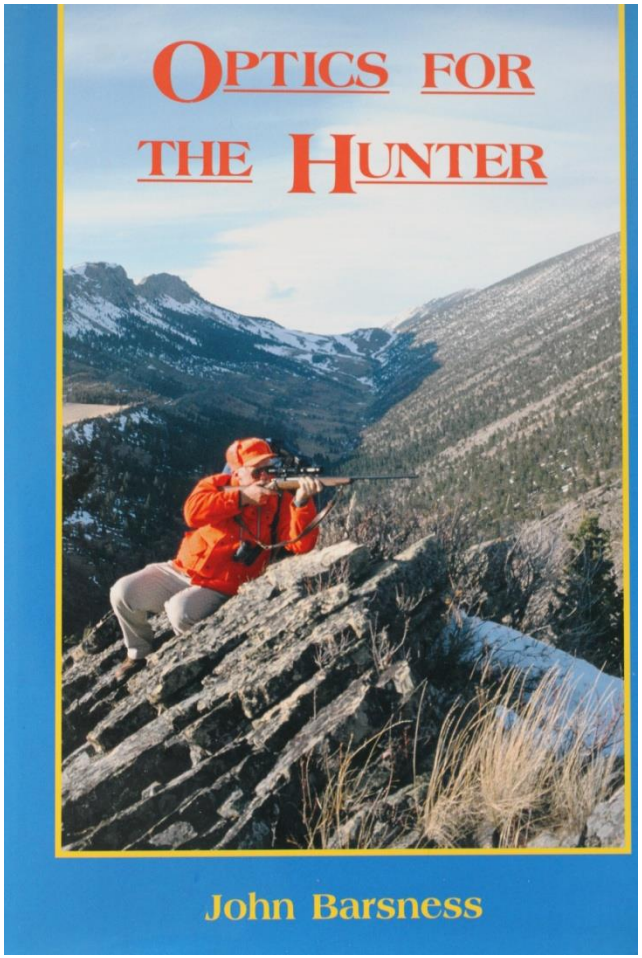


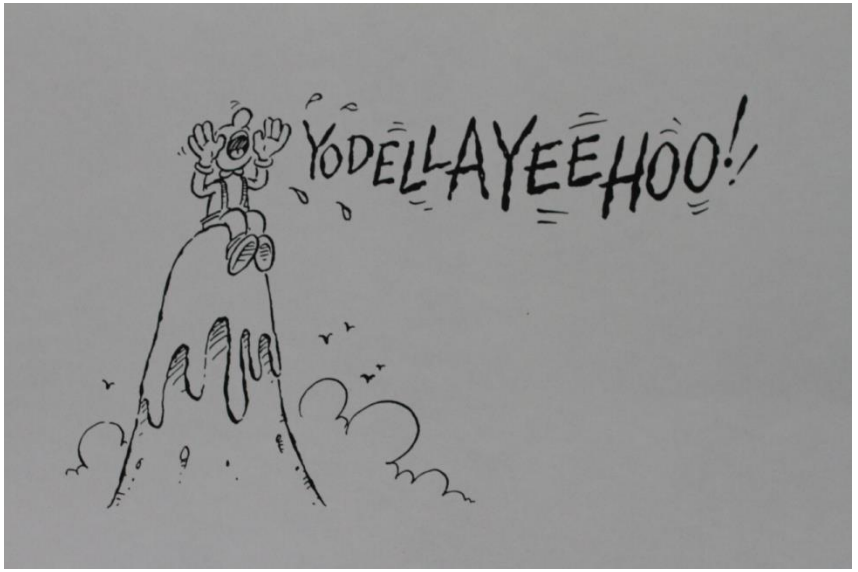
SWAROVSKI

SIZE	SERIES	MODEL	FOV	RA	ER	PR	CO	NF	TOF	WP	CA	S	CPS	TA	WT	SL
6 X 30	TRADITIONAL	B 6 X 30-M	8.5	N	13	PP-4	FMC	15	CF	Y	Y	Y	N	N	18	$445
8 X 30	TRADITIONAL	B 8 X 30 N-M	7	N	12	PP-4	FMC	18	CF	Y	Y	Y	N	N	18	495
8 X 30	TRADITIONAL	B 8 X 30 N-MGA	7	Y	12	PP-4	FMC	18	CF	Y	N	Y	Y	N	20	625
8 X 30	TRADITIONAL	B 8 X 30 W-M	7.9	N	12	PP-4	FMC	18	CF	Y	Y	Y	N	N	19	515
8 X 30	TRADITIONAL	B 8 X 30 W-MGA	7.9	Y	12	PP-4	FMC	18	CF	Y	N	Y	Y	N	20	650
7 X 42	TRADITIONAL	B 7 X 42 B-OGA	6.5	Y	14	PP-4	FMC	16	IF	Y	N	Y	Y	N	26	715
7 X 42	TRADITIONAL	B 7 X 42-M	6.5	N	14	PP-4	FMC	16	CF	Y	Y	Y	N	N	23	490
7 X 42	TRADITIONAL	B 7 X 42-MGA	6.5	Y	14	PP-4	FMC	16	CF	Y	N	Y	Y	N	26	640
10 X 40	TRADITIONAL	B 10 X 40-M	6.3	N	12	PP-4	FMC	13	CF	Y	Y	Y	N	N	24	565
10 X 40	TRADITIONAL	B 10 X 40-MGA	6.3	Y	12	PP-4	FMC	13	CF	Y	N	Y	Y	N	27	715
7 X 42	SL	B 7 X 42-SL-BA	6.5	N	13	PP-4	FMC	16	CF	Y	N	Y	Y	N	31	740
7 X 50	SL	B 7 X 50-SL-Y	7.1	N	21.5	PP-4	FMC	19	CF	Y	N	Y	Y	N	38	840
8 X 56	SL	B 8 X 56-SL-BA	5.8	N	18	PP-4	FMC	20	CF	Y	N	Y	Y	N	43	950
10 X 40	SL	B 10 X 40W-SL-BA	6.3	N	13.5	PP-4	FMC	13	CF	Y	N	Y	Y	N	31	830
10 X 50	SL	B 10 X 50-SL-BA	5.8	N	13.5	PP-4	FMC	20	CF	Y	N	Y	Y	N	36	915
7 X 30	SLC	B 7 X 30B-SL-C-BA	7.4	N	18	RP	FMC	15	CF	Y	Y	Y	Y	N	19	600
8 X 30	SLC	B 8 X 30W-SL-C-BA	7.8	N	15.5	RP	FMC	15	CF	Y	Y	Y	Y	N	19	610
8 X 20	?	B 8 X 20 B-P	6.6	N	13	RP	FMC	13	CF	Y	Y	Y	?	N	8	470

Swarovski binocular programme around 1985-1995

“Optics for the hunter” by John Barsness (1999) is the first book I found with fairly detailed quality information about Swarovski products (binoculars, rifle scopes etc.)





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The start of the Swarovski success story is the production in 1895 by Daniel Swarovski of (fashion) crystals and the materials and equipment to make these crystals. Photograph shows Daniel and Marie Swarovski with their three sons Wilhelm, Friedrich and Alfred

Daniel und Marie Swarovski mit ihren drei Söhnen Wilhelm, Friedrich und Alfred.

In 1895 Daniel Swarovski rented a building in Wattens, Austria in which he started the production of the now world famous Swarovski crystals

Das von Daniel Swarovski im Jahre 1895 in Wattens gepachtete Fabrikgebäude.

Daniel Swarovski (1862-1956, left) and his son Wilhelm Swarovski(right). Wilhelm Swarovski (1888-1962) was interested in astronomy, nature and optics. Driven by this interest he became the founding father of Swarosvki Optik. In 1935 he constructed the first 6x30 Porro binocular in Wattens, Austria

The continuous production of the Swarovski 6x30 Porro started in Wattens in the period 1939-1945 with the Porro 6x30 Dienstglas for the German army.

Some photographs of the Swarovski optical workshop in Wattens, Austria showing Wilhelm Swarovski at work (left 1942, right 1943)

SWAROVSKI DIENSTGLAS 6x30, ARMY CODE CAG, MADE IN THE PERIOD 1939-1945.

- The two pictures in the previous slide show one person working under rather primitive circumstances at the construction of the CAG-Swarovski Dienstglas. We know, however from the available CAG serial numbers that during World War 2 approximately 180.000 instruments were made in two different types:
- -1- a lightweight black version and
- -2- a heavier white version.

For the construction of such an amount of binoculars a lot of personnel had to be involved and it seems likely that many coworkers of the Swarovski crystal section had to turn to the construction of binoculars. The construction work could be continued undisturbed to the very end of the war, as becomes clear from a letter by Richard Faltermaier to G. van Ginkel dated September 9, 2011. It sais (quote):

"Aus einen Dokument in meiner Sammlung vom 26 April, 1945, Geheime Kommandosache (also wenige Tage vor Kriegsende), geht hervor, dass Swarovski/cag die letzte Firma war, die noch DF für die Wehrmacht herstellte. Cag hatt damals noch ein Bestand von 5000 Gläsern. Auf weitere Fertigung wurde kein Wert mehr gelegt. Ich habe das Dokument an Swarovski weitergegeben…"

1948-1949 Official start of SWAROVSKI OPTIK in the newly built optical factory in Absam , Austria. The photograph is from around 1950.

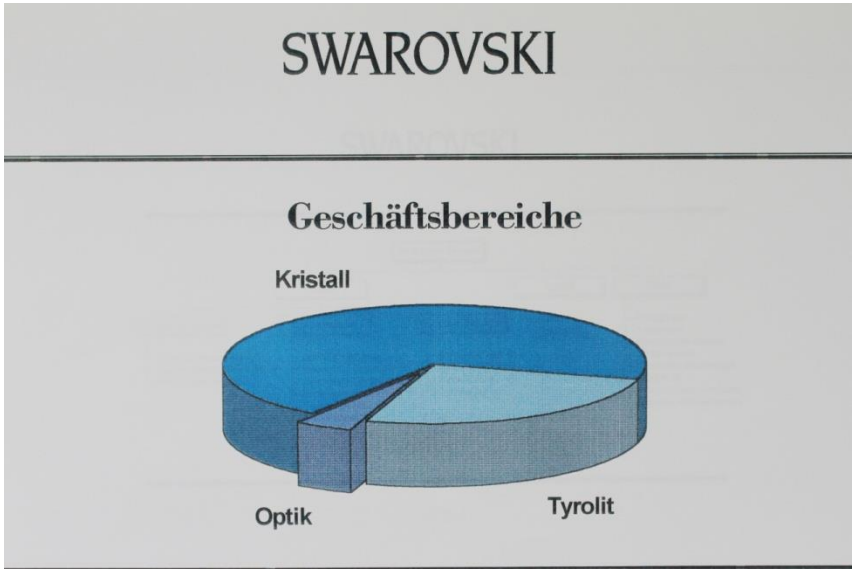
Recent picture of Swarovski Optik in Absam

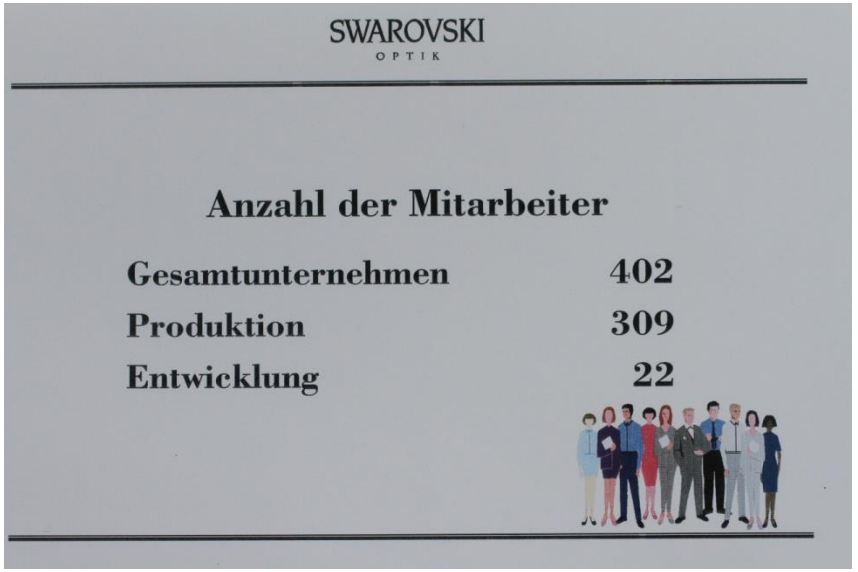
The Swarovski group consists of different divisions:

-1- Swarovski crystal

-2- Tyrolit: equipment and material for cutting, grinding and polishing crystal and glass.

-3- Swarovski Optik: binoculars, telescopes, optronic devices, lenses, prisms and equipment for the construction and quality control of optics. The number of employees mentioned in the table is from 1995. Since then Swarovski Optik has grown substantially (approx. 700 employees in 2010). Volume of trade in 2010 is 94 million euros.





Key leaders of Swarovski Optik after the death of Wilhelm Swarovski: (left photograph: Gerhard Swarovski (l) and Ludwig Pernstich(r), right photograph Carina Schiestl-Swarovski)

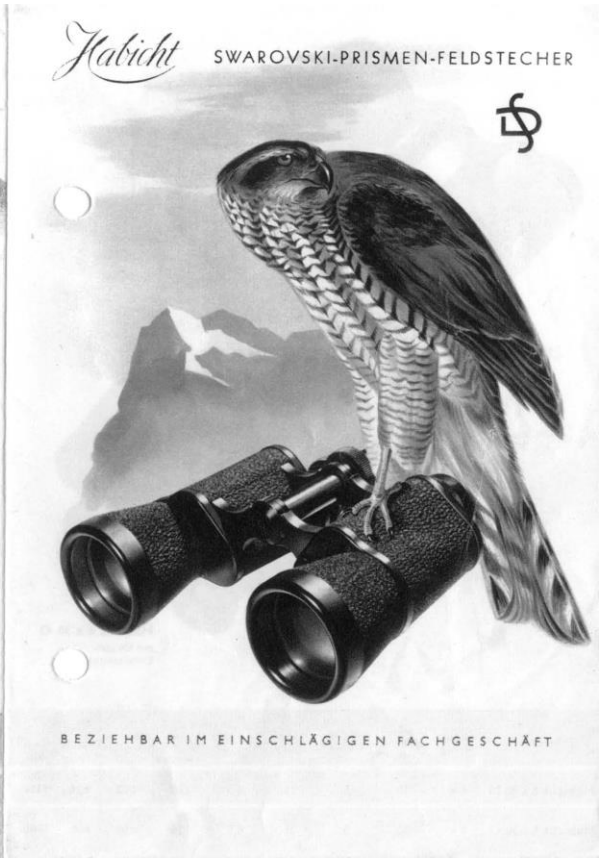
Carina Schiestl-Swarovski

Swarovski highlights 1949-2011
First period 1949-1985: good but no world leader
Second period 1985-2011: growth to leading company

- **First period (1949-1985):** ***Porro dominates***
- 1949 Production of Habicht Porro binoculars (6x30, 8x30, 7x42 and 10x40)
- 1958 Production of theatre binoculars
- 1957 Production of 30x75 draw tube telescope
- 1966 Production of 8x30 and 10x40 photomonoculars
- 1976 Swarodur anti-reflection coating patented
- **Second period (1985 until now):** ***from Porro to roof prisms and telescopes***
- 1980-1984 Production of Habicht Porro SL binoculars (7x42, 10x40, 10x50, 8x56)
- 1982 Production of 23x75 and 30x75 double telescopes
- 1985 Production of 7x30 and 8x30 SLC roof prism binoculars later followed by SLC 7x42, 10x42, 7x50, 8x50, 10x50, 8x56 and 15x56
- 1989 Production of pocket 8x20 roof prism binoculars
- 1990 Production of AT80 and ST80 observation telescopes
- 1993 Production of CT75 and CT85 draw tube telescopes
- 1999 -2002 Production of 8,5x42, 10x42, 8x32 and 10x32 EL binoculars
- 2002 Production of 65mm and 80 mm ATS/STS telescopes
- 2009 Production of 65 and 80 mm ATM/STM observation telescopes with new 25-50 zoom eyepiece
- 2010-2011 Production of new Swarovsion EL 8,5x42, 10x42, 10x50 and 12x50 binoculars and introduction of new 8x42 and 10x42 SLC-HD binoculars
- 2011 New Compact Line introduced, the CL 8x30 and CL 10x30 and two EL Range models: 8x42 and 10x42
- 2012 -2013 Introduction of Compact line 8x25 and 10x25 , new SLC 8x42 WB, 10x42 WB, 8x56 WB , 10x56 WB and 15x56 WB and modular ATX telescope with 65, 85 or 95 objective module.
- 2017 BTX binocular eyepiece and 1,7x extender introduced for use with the ATX telescope system

First page of Swarovski binocular flyer from 1952.
Wilhelm Swarovski baptized his binoculars with the name “Habicht”, a name which is used up to now for different Swarovski Porro binoculars.

Modell	Vergrößerung	Objektivdurchm. mm	Durchm. d. Austrittspupille mm	Lichtstärke	Gesichtsfeld Grad	Gesichtsfeld auf 1 km Distanz m	Gewicht Gramm	Preis mit Belag
Habicht 8 x 30 M	8 x	30	3,75	14	8,5	150	505	öS 1395.-
Habicht 8 x 30 O	8 x	30	3,75	14	8,5	150	485	1305.-



Second part of Swarovski binocular flyer of 1952

Modell	Vergrö-ßerung	Objektiv-durchm. mm	Durchm. d. Austritts-pupille mm	Licht-stärke	Gesichtsfeld Grad	Gesichtsfeld auf 1 km Distanz m	Gewicht Gramm	Preis ohne Belag	Preis mit Belag
Habicht 6 x 30 M	6 x	30	5	25	8,5	150	490	öS 850.-	öS 1150.-
Habicht 6 x 30 O	6 x	30	5	25	8,5	150	450	760.-	1060.-

Modell	Vergrö-ßerung	Objektiv-durchm. mm	Durchm. d. Austritts-pupille mm	Licht-stärke	Gesichtsfeld Grad	Gesichtsfeld auf 1 km Distanz m	Gewicht Gramm	Preis mit Belag
Habicht 7 x 42 M	7 x	42	6	36	6,5	114	655	öS 1380.-
Habicht 7 x 42 O	7 x	42	6	36	6,5	114	605	1290.-

SWAROVSKI BINOCULAR FLYERS FROM 1955, 1957 AND 1959

PATH OF LIGHT RAYS

IN THE HABICHT (HAWK) DOUBLE BLUECOATED PRISMATIC BINOCULARS

10 x 40 M DV

The illustration shows the light rays passing through the components of a DOUBLE BLUECOATED HABICHT-DIANA Binocular 10 x 40, first through the two-lens objective, then through the two image reversing prisms and finally through the eyepiece consisting of six lenses.

SWAROVSKI-OPTIK K. G.

ABSAM NEAR SOLBAD HALL (TYROL) AUSTRIA

SO 1041. 5 M 7.57 JENNYDRUCK INNSBRUCK

Habicht Prismatic Binoculars

(Hawk)

SWAROVSKI BINOCULAR FLYERS FROM 1955, 1957 AND 1959. The Porro Habicht binoculars now get type indications like MARS, MERKUR AND DIANA

Habicht-Mars 6x30 M DV
with center focussing

The lightweight double bluecoated Binocular for sport and travel

Habicht-Merkur 8x30 M DV
with center focussing

The double bluecoated wide-angle Binocular for highest requirements

(can be delivered without wide-angle eyepiece (N) also)

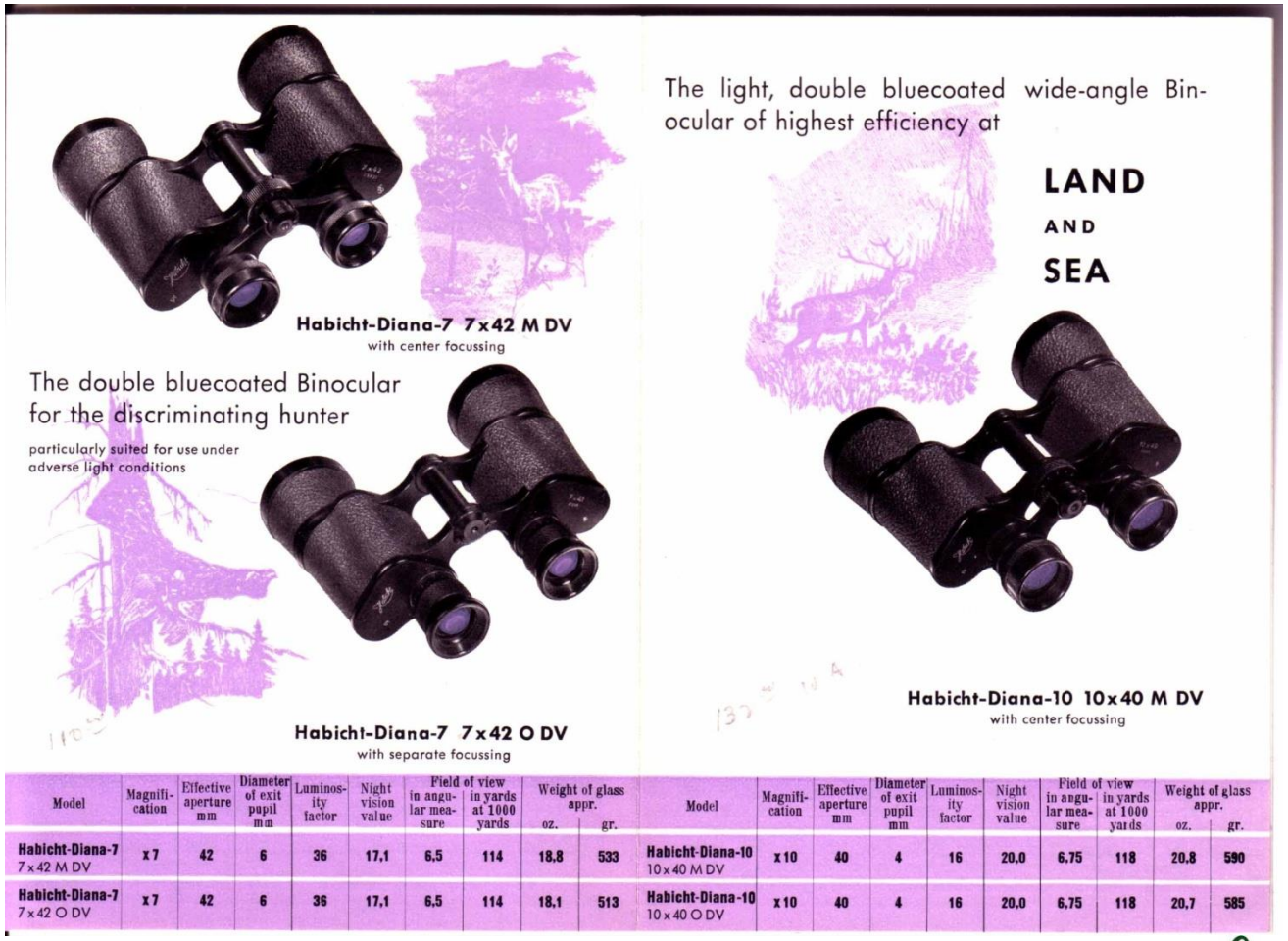
Habicht-Mars 6x30 O DV
with separate focussing

Habicht-Merkur 8x30 O DV
with separate focussing

Model	Magnification	Effective aperture mm	Diameter of exit pupil mm	Luminosity factor	Night vision value	Field of view in angular measure	Field of view in yards at 1000 yards	Weight of glass appr. oz.	Weight of glass appr. gr.
Habicht-Mars 6x30 M DV	x 6	30	5	25	13.4	8.5	150	14.8	420
Habicht-Mars 6x30 O DV	x 6	30	5	25	13.4	8.5	150	13.9	395

Model	Magnification	Effective aperture mm	Diameter of exit pupil mm	Luminosity factor	Night vision value	Field of view in angular measure	Field of view in yards at 1000 yards	Weight of glass appr. oz.	Weight of glass appr. gr.
Habicht-Merkur 8x30 M DV	x 8	30	3,75	14,1	15.5	8.5 N 6,5	150 N 114	15.9 N 14,8	450 N 420
Habicht-Merkur 8x30 O DV	x 8	30	3,75	14,1	15.5	8.5 N 6,5	150 N 114	15.7 N 13.9	445 N 395

SWAROVSKI BINOCULAR FLYERS FROM 1955, 1957 AND 1959



Habicht-Diana-7 7x42 M DV
with center focussing

The double bluecoated Binocular
for the discriminating hunter

particularly suited for use under
adverse light conditions

Habicht-Diana-7 7x42 O DV
with separate focussing

The light, double bluecoated wide-angle Binocular of highest efficiency at

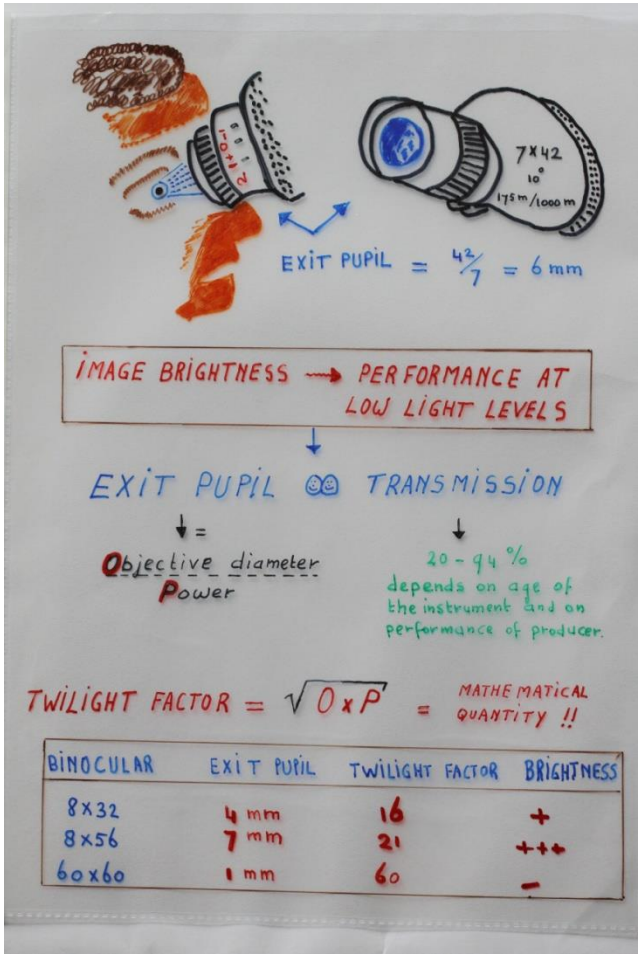
LAND
AND
SEA

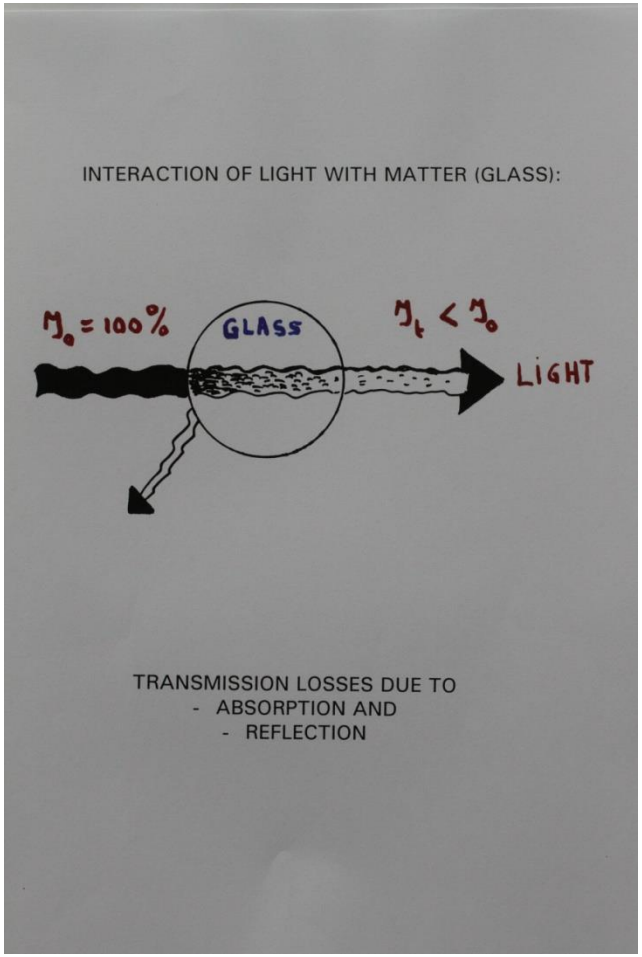
Habicht-Diana-10 10x40 M DV
with center focussing

Model	Magnification	Effective aperture mm	Diameter of exit pupil mm	Luminosity factor	Night vision value	Field of view in angular measure	Field of view in yards at 1000 yards	Weight of glass appr. oz.	Weight of glass appr. gr.
Habicht-Diana-7 7x42 M DV	x7	42	6	36	17,1	6,5	114	18,8	533
Habicht-Diana-7 7x42 O DV	x7	42	6	36	17,1	6,5	114	18,1	513

Model	Magnification	Effective aperture mm	Diameter of exit pupil mm	Luminosity factor	Night vision value	Field of view in angular measure	Field of view in yards at 1000 yards	Weight of glass appr. oz.	Weight of glass appr. gr.
Habicht-Diana-10 10x40 M DV	x10	40	4	16	20,0	6,75	118	20,8	590
Habicht-Diana-10 10x40 O DV	x10	40	4	16	20,0	6,75	118	20,7	585

Quality development is investigated by measuring optical light transmissions, since:
Image brightness of binoculars governed by :
-1- size of exit pupil
-2- light transmission of the optical system





In “Optik and Photonic” of May 2011, Dr. Ralf Jedamzik, optical glass specialist of Schott AG, writes: *”Improving the light transmittance of a glass by only a few percent can have a tremendous effect on the quality of an optical system”.*


THE AUTHOR

RALF JEDAMZIK

Dr.-Ing. Ralf Jedamzik works as an Application Manager at Schott AG, Advanced Optics. He studied physics at the University of Düsseldorf, Germany, from 1990 to 1995 (Dipl.-Phys.). Ralf Jedamzik earned his doctorate degree in Material Science in 1999. He started as a Quality Engineer in the Optics Division of Schott AG, where he was the responsible Quality Manager for large telescope projects like Grantecan and Vista. In 2003, he joined application engineering where he is responsible for managing international projects in the fields of optical glass and Zerodur.

Dr. Ralf Jedamzik

Dr. Jedamzik “states in his paper that especially for sport optics: *“*A few percent transmittance improvement in the glasses used in binoculars, for example, can significantly improve their mesopic vision capabilities” *(mesopic vision = vision at a light level at which both retinal rods and cones of the eye function to some degree) .*

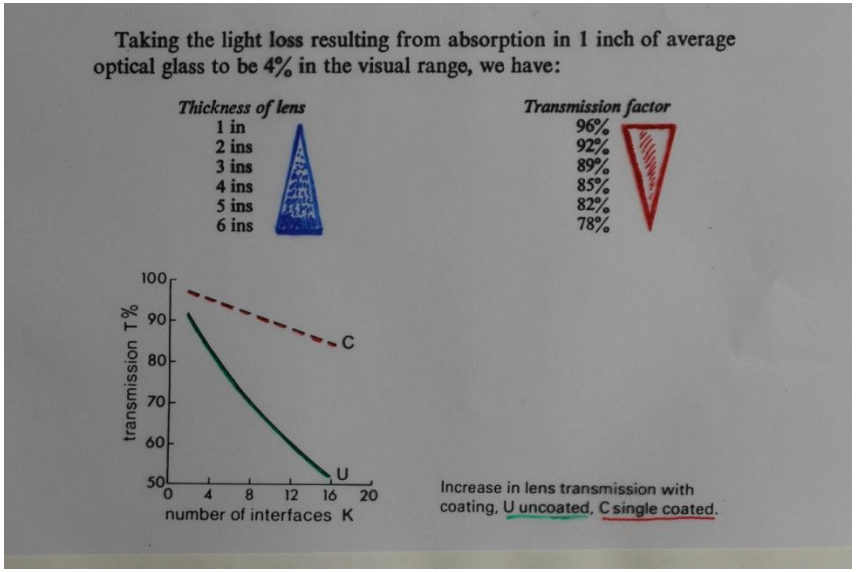
Another example is the application in sports optics. Here, one major target is to achieve good viewing quality even at dawn and nightfall. The sensitivity of the human eye shifts towards the blue spectral range at low light conditions. A few percent transmittance improvements in the glasses used in binoculars, for example, can significantly improve their mesopic vision capabilities.

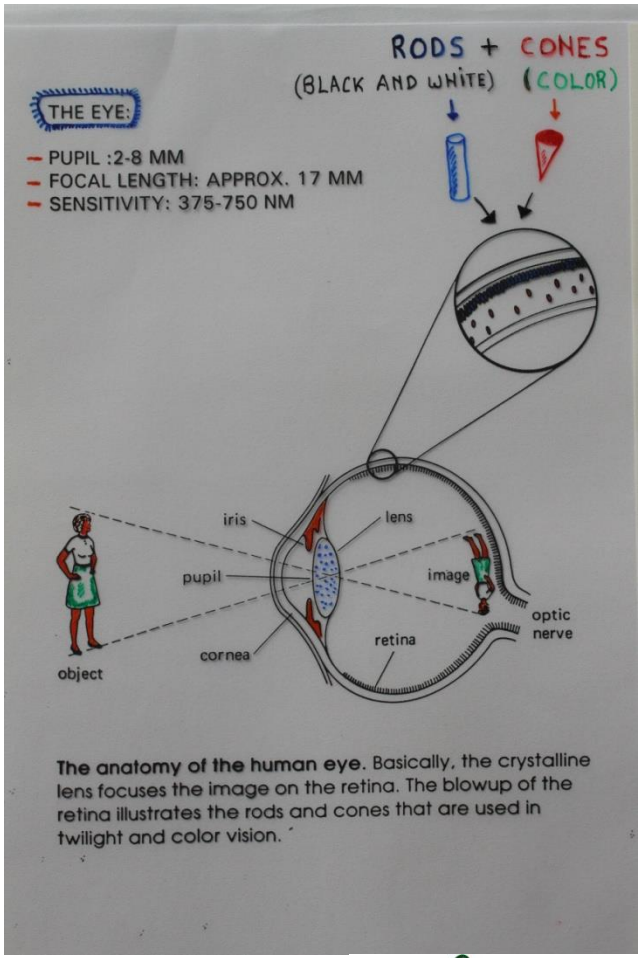
TAB. 1: **Optical properties of HT and HTultra glasses; n_d: refractive index, ν_d: Abbe number, τ_i: internal transmittance.**

Glass	n_d	ν_d	τ_i*
N-BK7HT	1.51680	64.17	0.998
N-SK2HT	1.60738	56.65	0.996
F2HT	1.62004	36.37	0.996
N-LASF45HT	1.80107	34.97	0.886
SF6HT	1.80518	25.43	0.941
N-SF6HTultra	1.80518	25.36	0.887
N-SF6HT	1.80518	25.36	0.877
SF57HTultra	1.84666	23.83	0.924
N-SF57HTultra	1.84666	23.78	0.830
N-SF57HT	1.84666	23.78	0.793
N-LASF9HT	1.85025	32.17	0.843

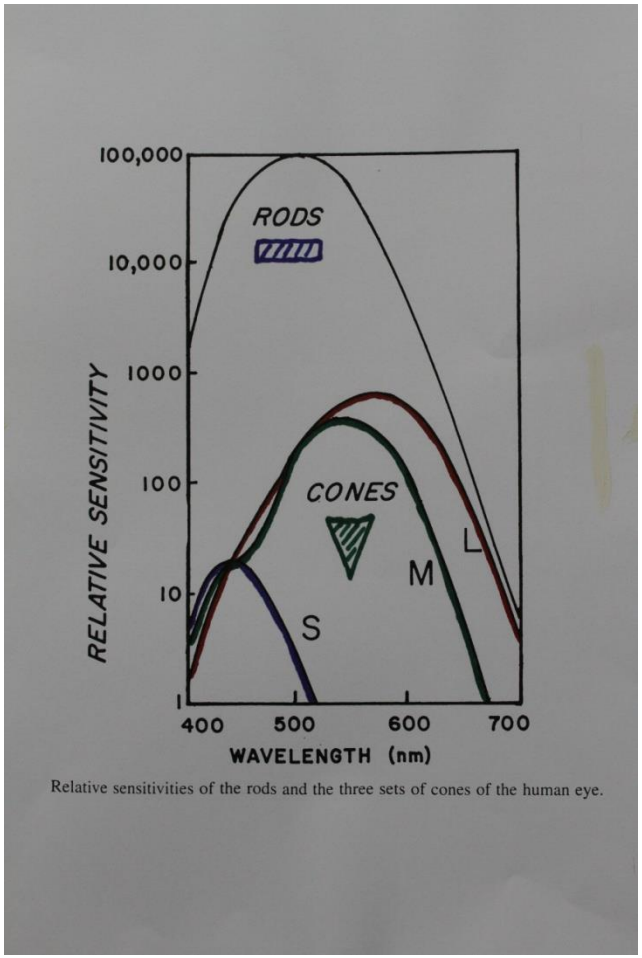
new variants / * 10 mm thickness, 400 nm wavelength

Left: example of light losses in and on optical glass due to absorption and reflection of light
Right: the optical system of the human eye

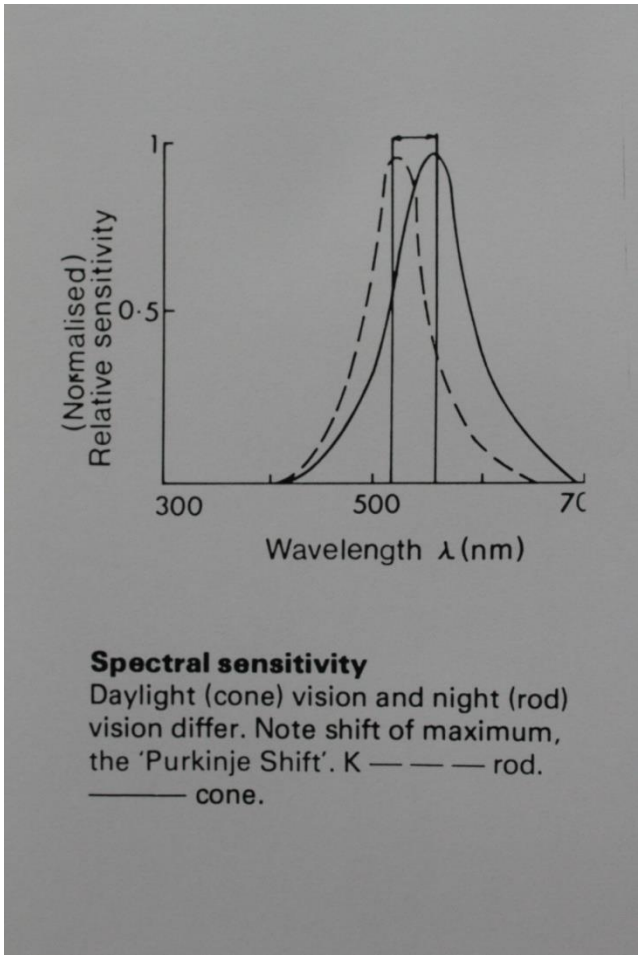




Left: the light collecting structure in the eye consists of
-1- Blue sensitive rods which are responsible for sensitive black and white vision at night
-2- Color sensitive cones for daylight vision with maximal sensitivity in the green part of the spectrum. Far less sensitive than rod-vision

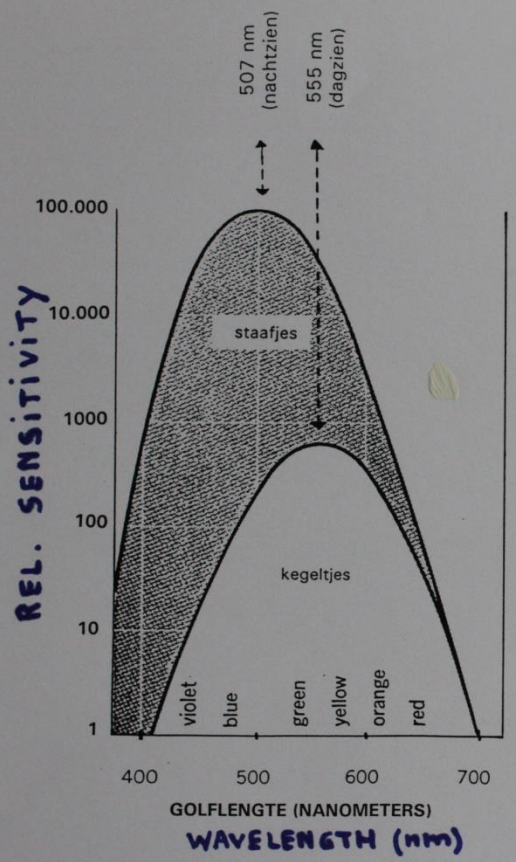


Relative sensitivities of the rods and the three sets of cones of the human eye.



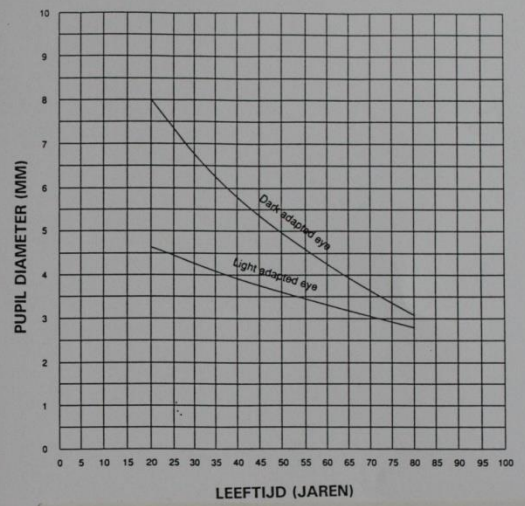
Spectral sensitivity
Daylight (cone) vision and night (rod) vision differ. Note shift of maximum, the 'Purkinje Shift'. K — — — rod. ——— cone.

OOG GEVOELIGHEID BIJ DAG EN BIJ NACHT

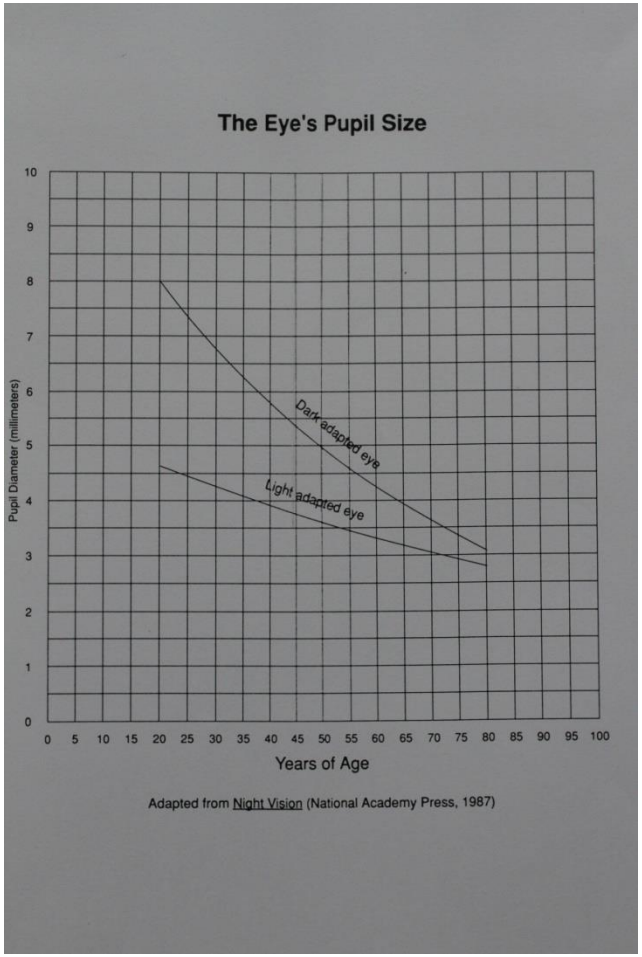


DE PUPIL DIAMETER ALS FUNCTIE VAN DE LEEFTIJD

-1- als het oog aangepast is aan het donker (dark adapted eye)
-2- als het oog aangepast is aan daglicht (light adapted eye)



The ageing eye:
Left: the maximum reachable pupil diameter decreases with increasing age.
Right: The eye lens gradually yellows with increasing age. As a consequence less light reaches the light sensitive pigment system in the eye.



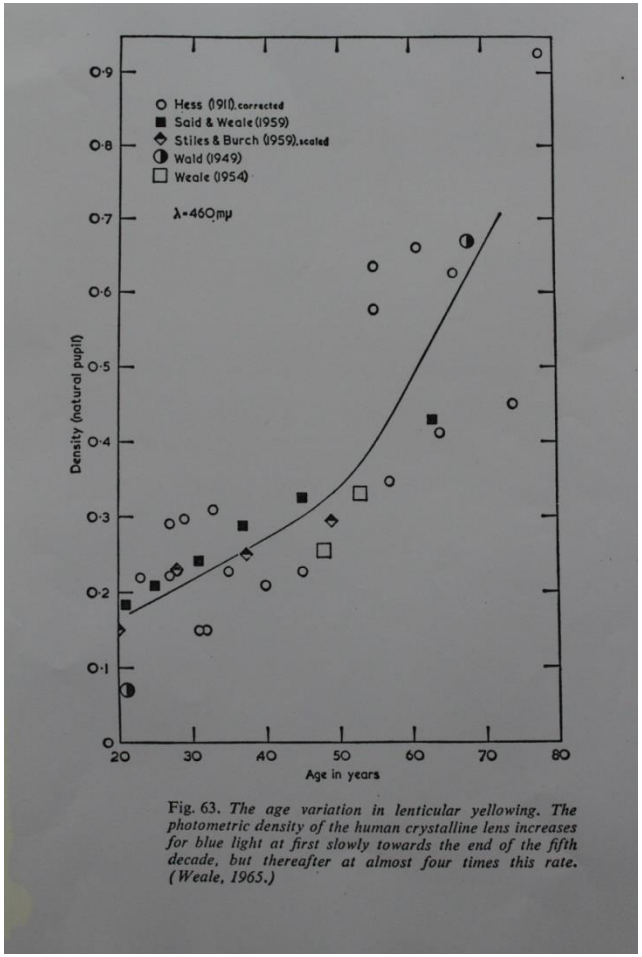
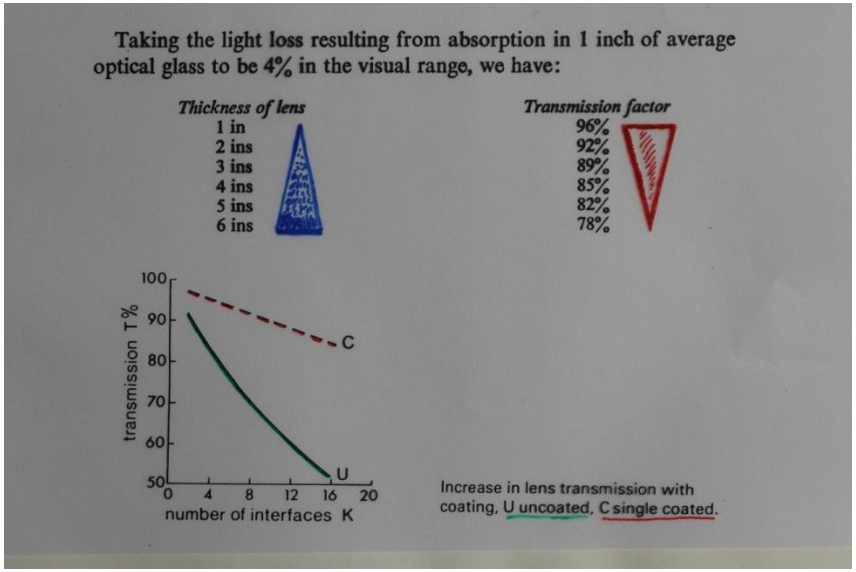


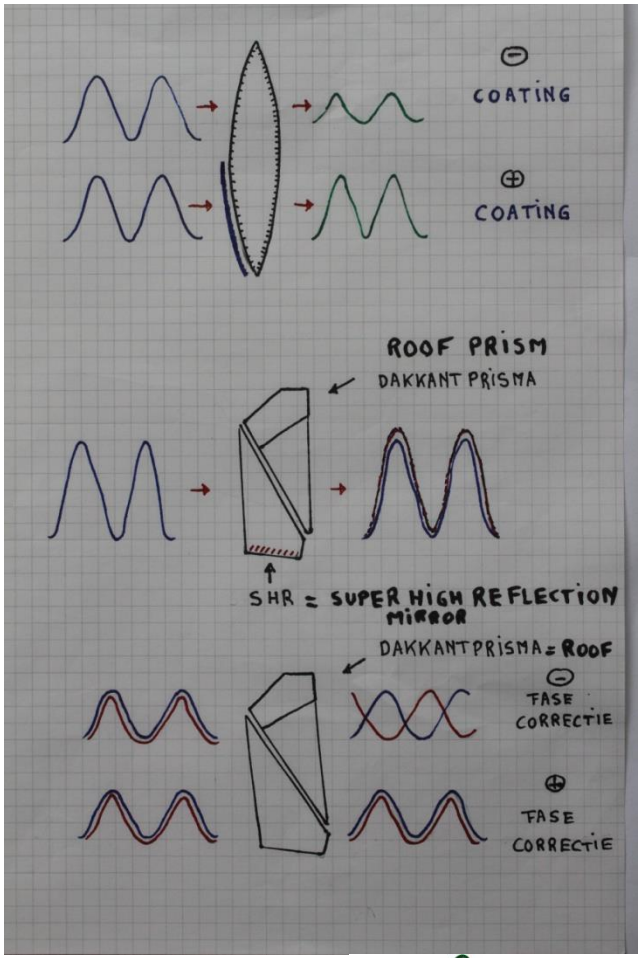
Fig. 63. *The age variation in lenticular yellowing. The photometric density of the human crystalline lens increases for blue light at first slowly towards the end of the fifth decade, but thereafter at almost four times this rate. (Weale, 1965.)*

The light detection system of the human eye, therefore, is for optimal vision, helped by a high light transmission of binoculars and telescopes . That can be reached by:

-1- using optical glass with high light transmission

-2- using proper coatings to diminish light losses due to reflection.





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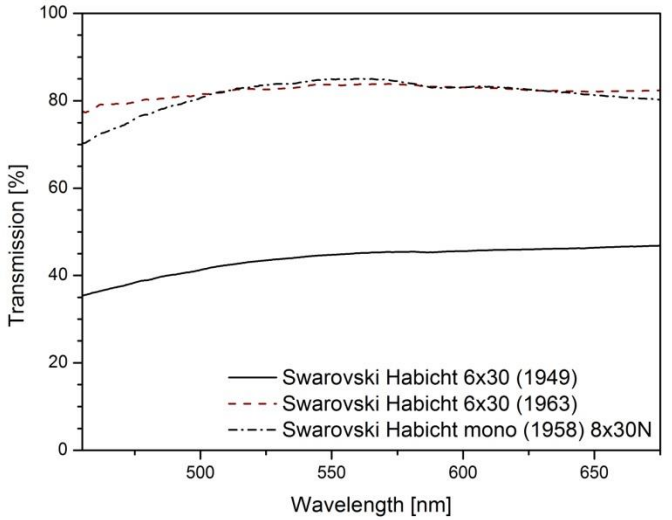
Light transmission of 30 mm Swarovski Habicht binoculars from different years (1949, 1958, 1963) as a measure of the quality of the optical glass and of the coatings used by Swarovski Optik.



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Swarovski Habicht Porro monocular 8x30N from 1958

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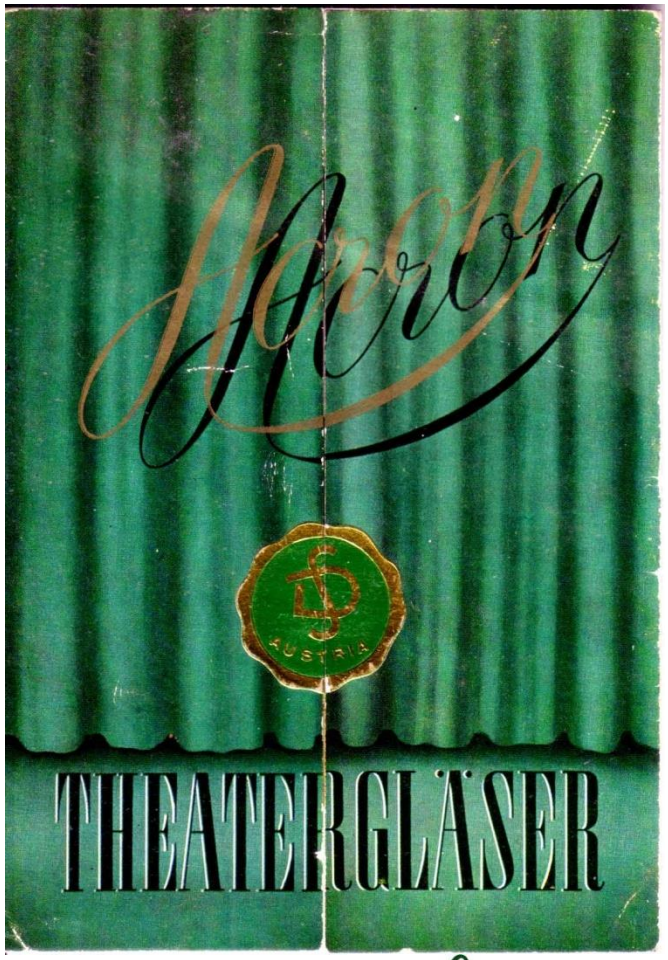
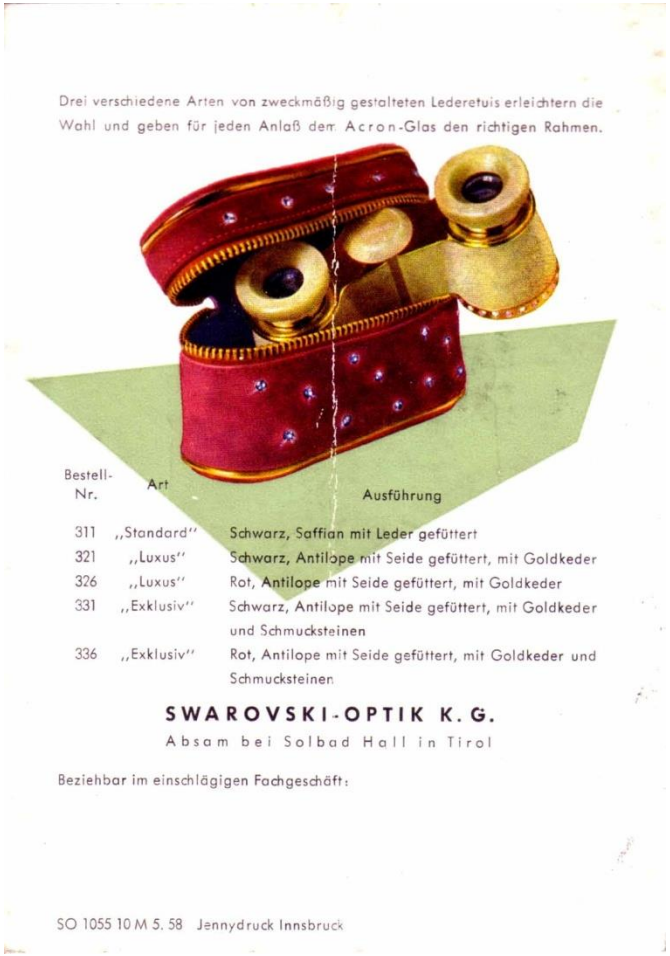
Collectors item: the Swarovski Acron theater glasses introduced in 1957-1958. According to information from Swarovski, the lady on the left carries a Swarovski Acral theater glass produced in 1971.



Swarovski Acron theater glasses from 1958



Drei verschiedene Arten von zweckmäßig gestalteten Lederetuis erleichtern die Wahl und geben für jeden Anlaß dem Acron-Glas den richtigen Rahmen.

Bestell-Nr.	Art	Ausführung
311	„Standard"	Schwarz, Saffian mit Leder gefüttert
321	„Luxus"	Schwarz, Antilope mit Seide gefüttert, mit Goldkeder
326	„Luxus"	Rot, Antilope mit Seide gefüttert, mit Goldkeder
331	„Exklusiv"	Schwarz, Antilope mit Seide gefüttert, mit Goldkeder und Schmucksteinen
336	„Exklusiv"	Rot, Antilope mit Seide gefüttert, mit Goldkeder und Schmucksteinen

SWAROVSKI-OPTIK K. G.

Absam bei Solbad Hall in Tirol

Beziehbar im einschlägigen Fachgeschäft:

SO 1055 10 M 5. 58 Jennydruck Innsbruck

Mehr und besser sehen - miterleben mit einem Acron-Theaterglas!

Im Theater, Konzert und Varieté wird die Beobachtungsfreude gesteigert und der Genuß erhöht. Bei Sportwettkämpfen wird das Geschehen dem Sportfreund nahegebracht, er kann jede Phase des Kampfes genau beobachten. Bei Vorführungen und Experimenten läßt das Acron-Glas jede Einzelheit erkennen.

Das Acron-Glas wirkt durch seine einfache Linie elegant, während seine handliche Form sich im Gebrauch besonders nützlich erweist. Das Acron-Glas kann dank seines leichten Gewichtes überallhin mitgeführt werden, wirkt nie störend, bereitet aber immer Freude.

Nicht nur einen nützlichen Gebrauchsgegenstand, sondern auch ein formschönes Schmuckstück besitzen Sie in einem Acron-Theaterglas!

Type 1 mit einfachem Goldring — Bestell-Nr. 1042

Type 2 mit mehreren Zierringen — Bestell-Nr. 2055

Type 3 mit Schmucksteinverzierung — Bestell-Nr. 3022 Smaragd

Höchste Ansprüche erfüllt das Acron-Theaterglas hinsichtlich optischer Leistung.

Leistungszahlen:

Vergrößerung	2 ½ x
Objektivdurchmesser	26 mm
Austrittspupille	10 mm
Lichtstärke	100
Gesichtsfeld auf 100 m Entfernung	ca. 20 m
Abmessungen	ca. 100 x 33 x 45 (52) mm
Gewicht	ca. 105 g

Für jeden Geschmack die richtige Farbe:

Schwarz	Blau
Elfenbein	Violett
Rot	Braun marmoriert
Grün	(Schwedische Birke)

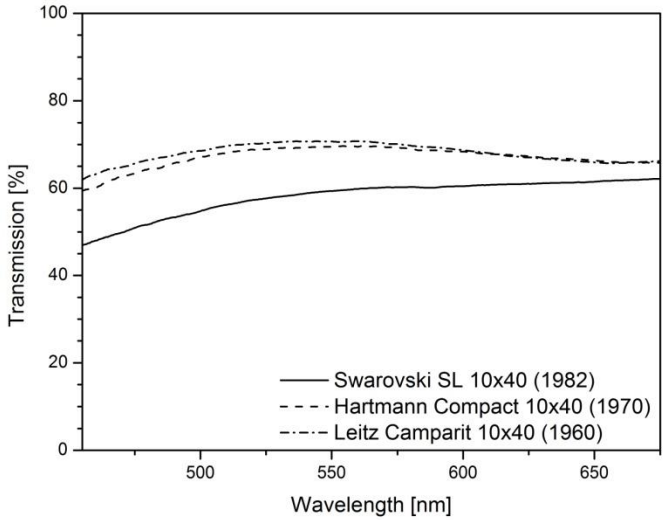
Type 3 ist mit Schmucksteinen in folgenden Farben lieferbar:

Kristall	Olivin
Saphir	Smaragd
Siam	Rauchgrau
Topas	Rosa
Amethyst	Grünturmalin

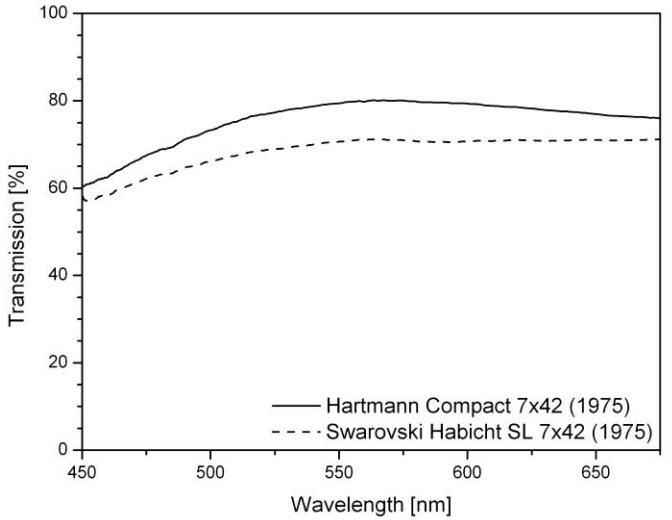
Swarovski Habicht 8x30 and 10x40 “Fotomonokulare”, the flyer is from 1966.

The new series of Porro Habicht SL binoculars was introduced in 1980. Left: 7x42 SL, right 10x40 SL

The Hartmann Compact 10x40 and Leica Camparit 10x40 have a considerable higher light transmission then the Swarovski Habicht 10x40SL



The Hartmann Compact 7x42 beats the Swarovski Habicht 7x42 SL



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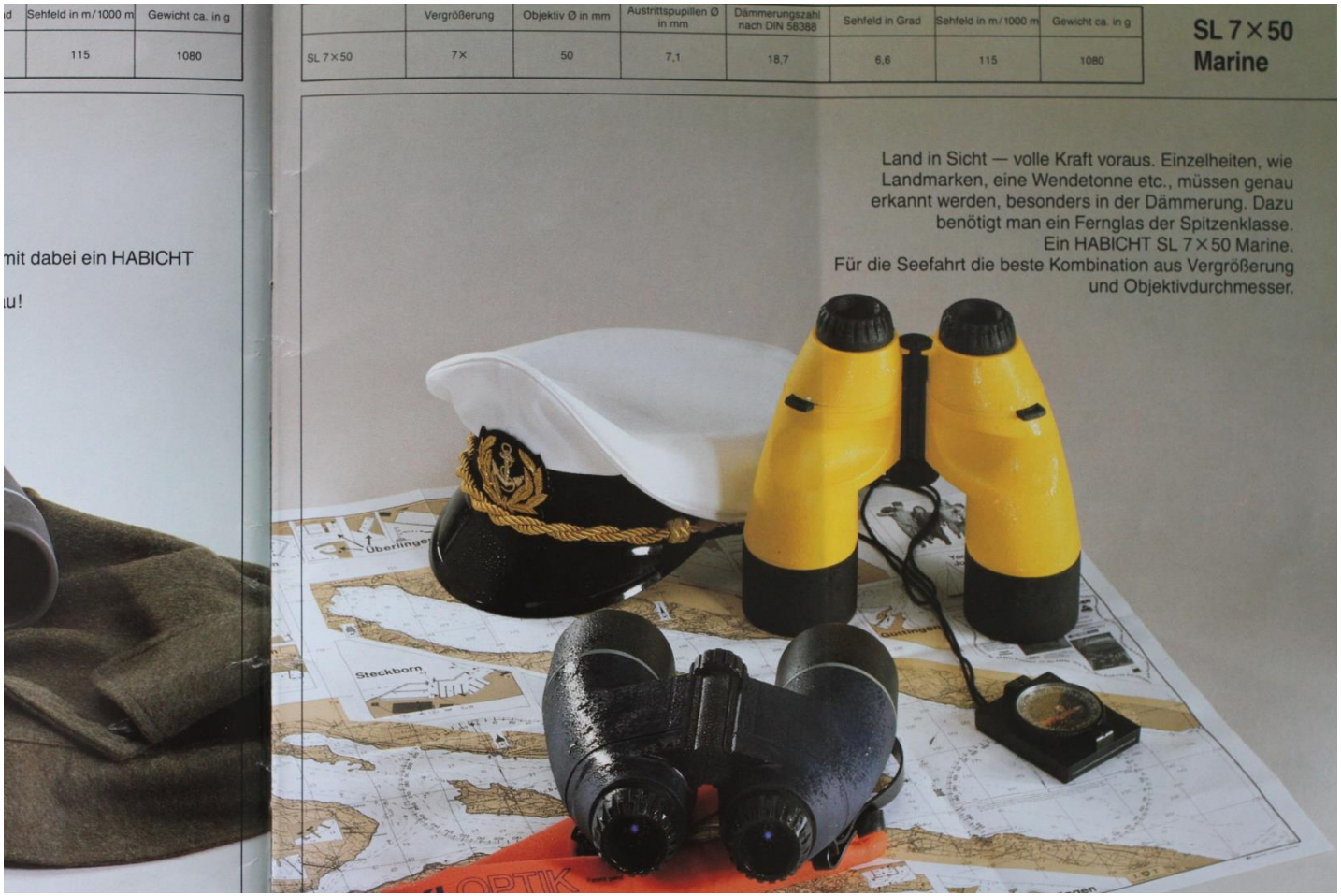
The popular Swarovski Habicht 7x50 SL



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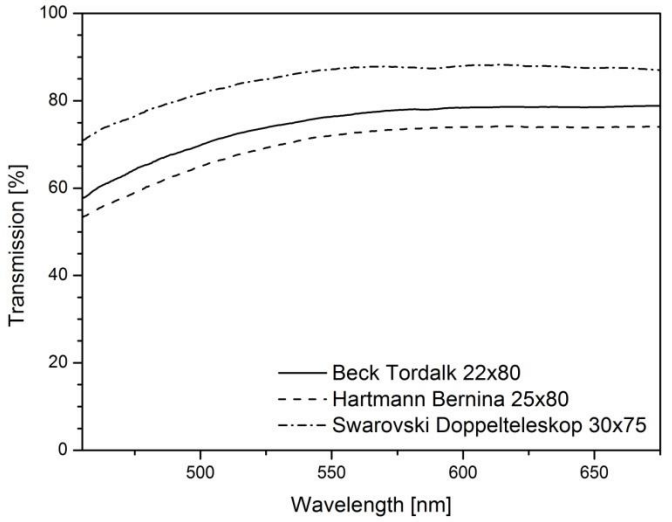
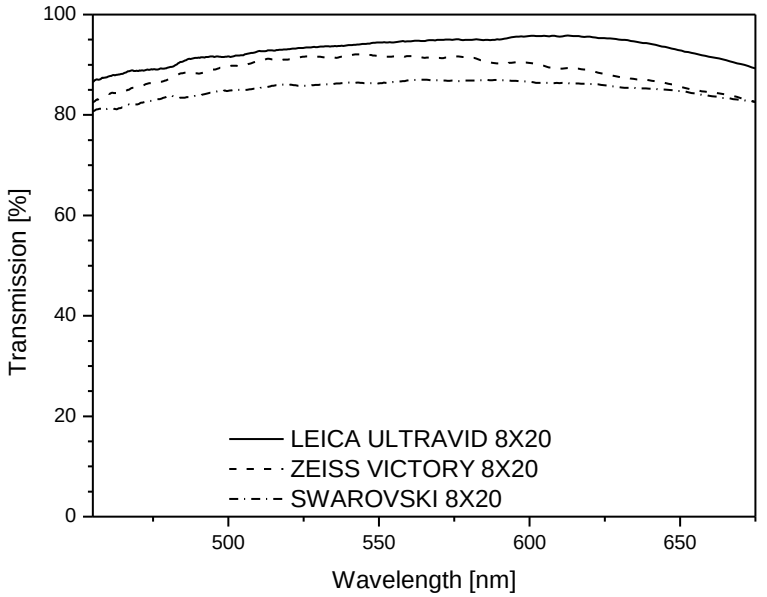
In 1982 Swarovski started production of two “Double telescopes”: the 23x75 and the 30x75

The light transmission of the 30x75 Swarovski double telescope (made in 1990) beats the performance of competitors like the Beck Tordalk 22x80 (1975) and the Hartmann Bernina 25x80 (1970).



In 1989 Swarovski started a new line of roof prism binoculars: the first model is the Pocket 8x20, which is later followed by the Pocket 10x25. Both pocket binoculars are in 2013 still in production.

Left: Swarovski 8x20 and 10x25 Pocket binoculars
Right: Light transmission spectra of the Leica Ultravid 8x20, Swarovski pocket 8x20 and Zeiss Victory 8x20



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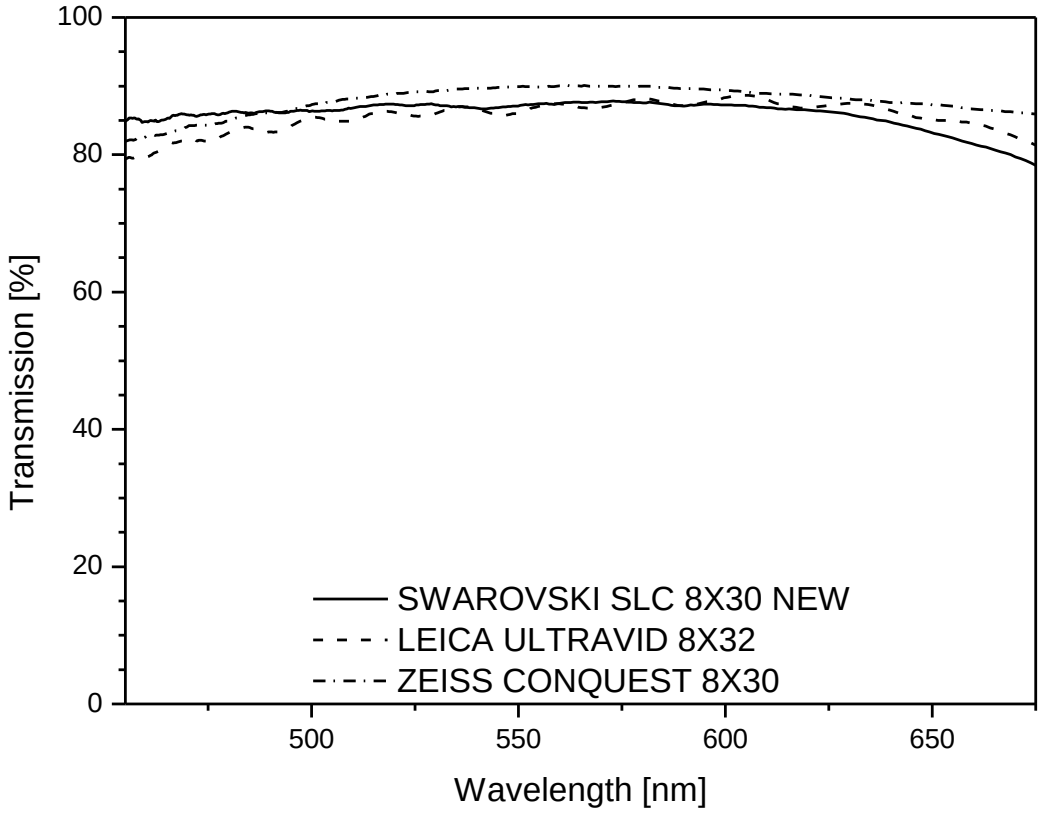
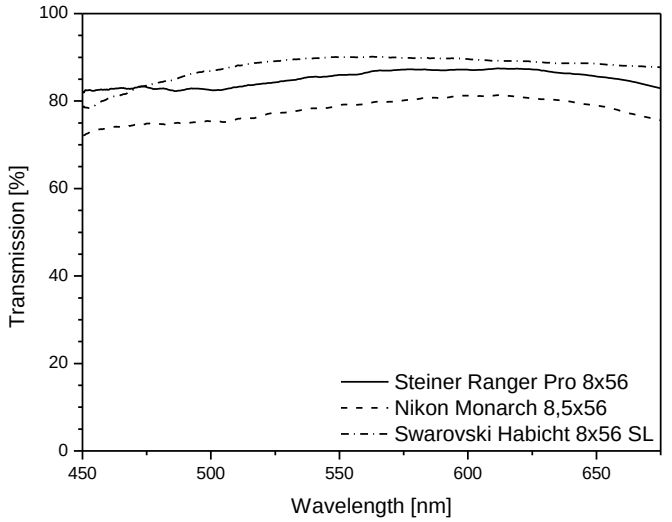
Photograph of (left to right):
-1- Leica Ultravid 8x20, Zeiss Victory 8x20 and Swarovski 8x20
-2- Zeiss Conquest 8x30, Swarovski SLC-New 8x30 and Leica Ultravid 8x32

2005: Spectra of the light transmission of:
-1- Swarovski SLC-New 8x30
-2- Leica Ultravid 8x32
-3- Zeiss Conquest 8x30



Photograph (left to right): Nikon Monarch 8x56, Steiner Ranger Pro 8x56 and Swarovski SL Habicht 8x56. The 8x56 Habicht Porro SL was introduced in 1985.
The light transmission spectra in the graph on the right show that the Swarovski Habicht 8x56 SL beats the much younger competitors of Nikon and Steiner, although Steiner has the better color reproduction.



DESIGN
SINCE 1976

SLC - COLLECTION

1976
SL

Austrian
Design Award
1979

1995
SLC

2004
SLCnew

TELESCOPE - COLLECTION

1990
AT 80

Austrian
Design Award
1990

2004
ATS 80

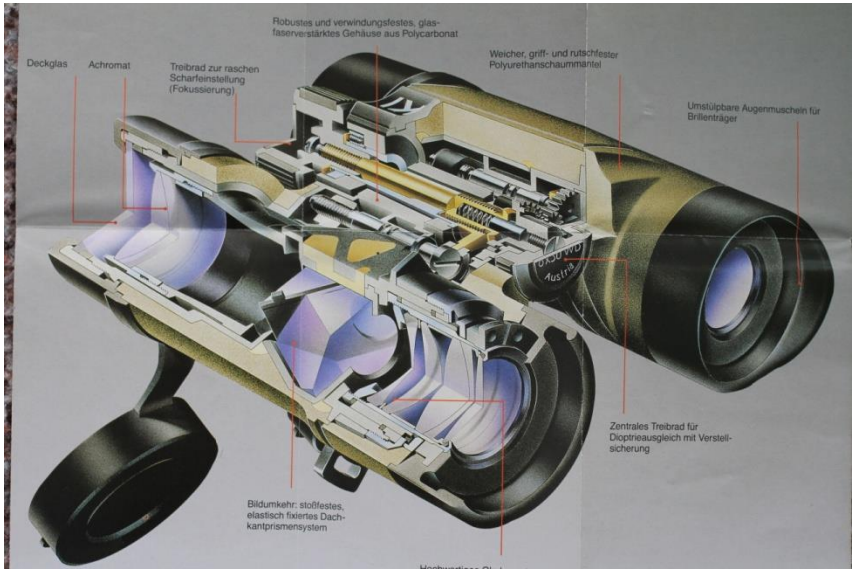
BINOCULARS AND RIFLE SCOPES

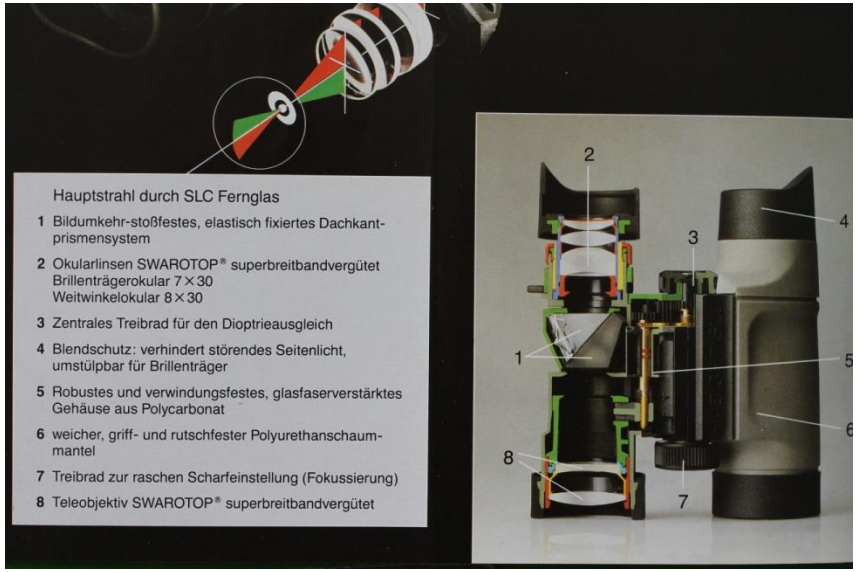
1999
EL

Red Dot
Award

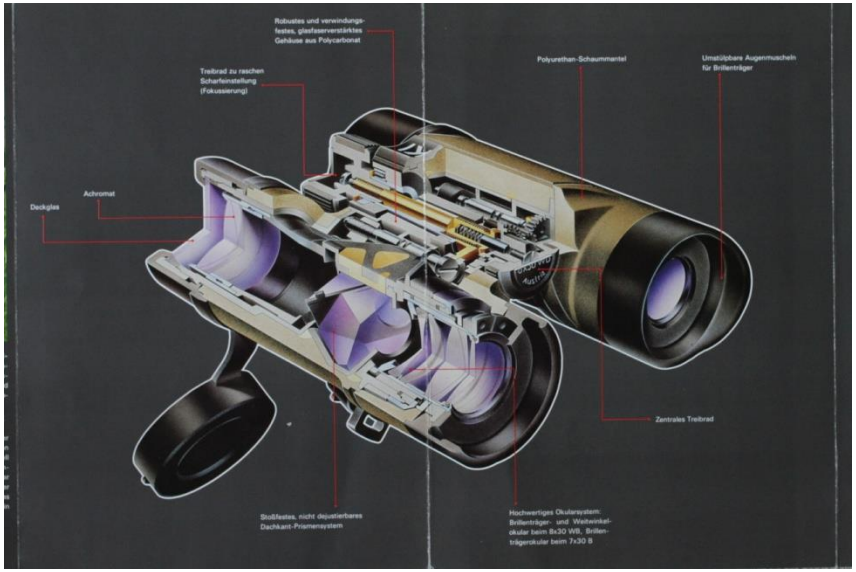
2007
Z6

1985. Swarovski starts next the production of other binoculars with roof prisms. The 8x30 SLC is the first model to appear. The performance of the model and its appearance are gradually upgraded. Light transmission is increased and color balance is improved (higher image brightness, better twilight performance and excellent color reproduction).

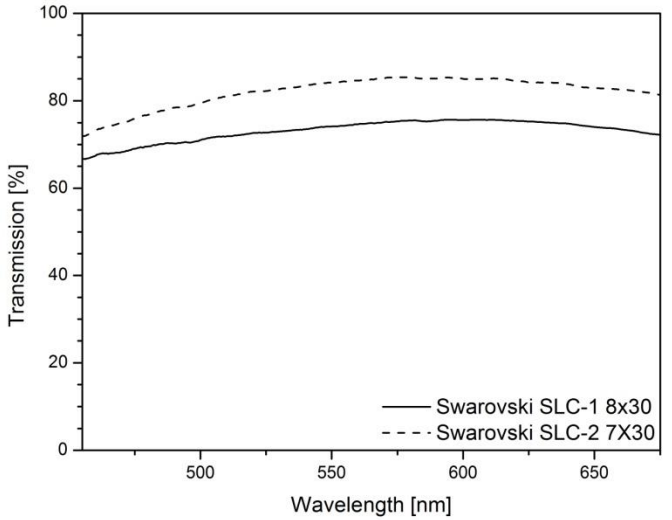




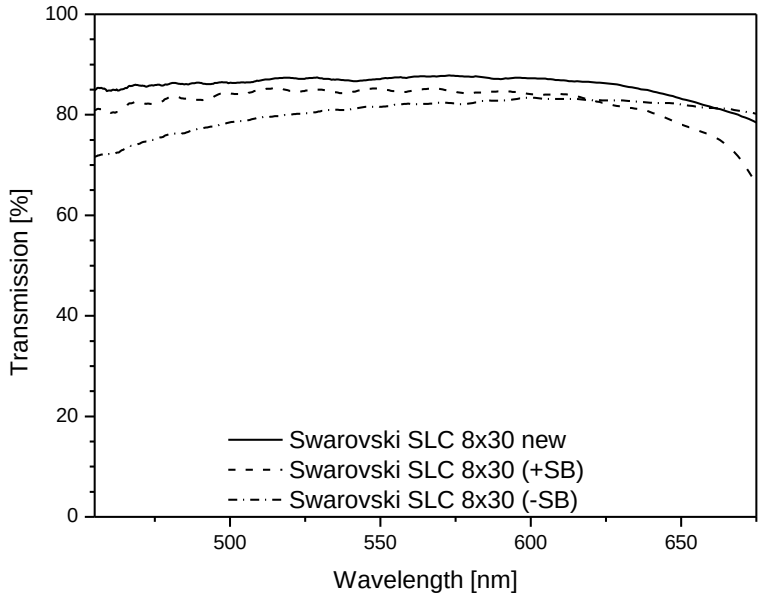
SWAROVSKI SLC MARK 2 COMES IN 3 DIFFERENT COLOURS. MODELS 7X30 AND 8X30



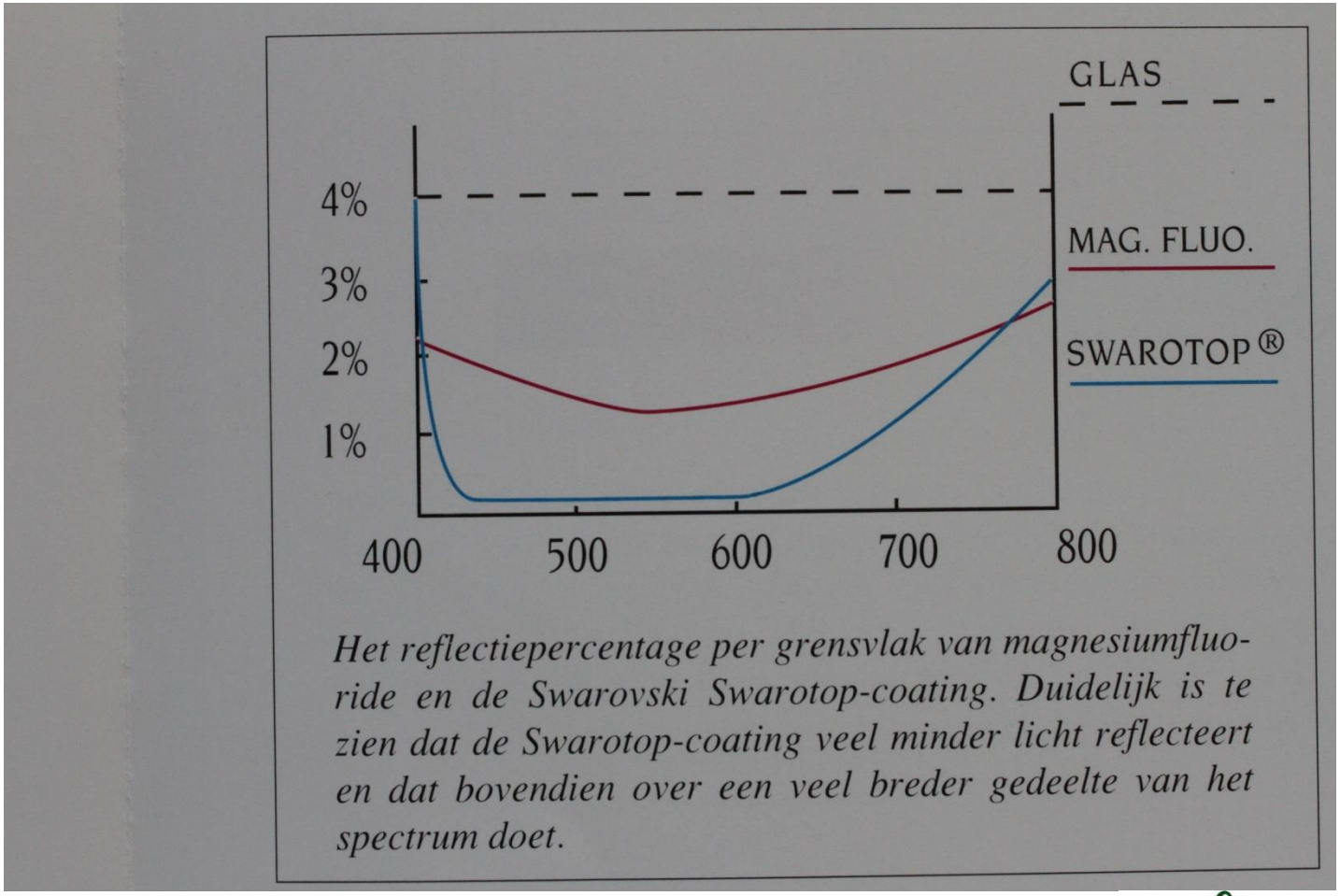
Left: SLC model 1(8x30) from 1985
Right: SLC model 2(7X30) from 1991
Light transmission and color reproduction are considerably improved in model 2



3x Swarovski SLC 8x30. From left to right:
-1- (black): no Swarobright coating,
-**2**- (light green in the middle): plus Swarobright coating,
-3- (dark green to the right): plus Swarobright coating and improved anti-reflection coatings.
Result in -3-: high light transmission and perfect color reproduction

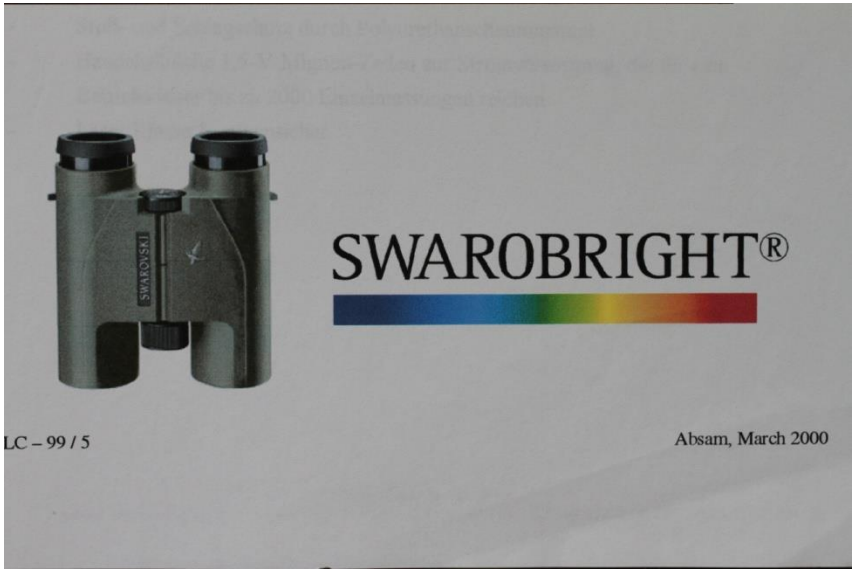


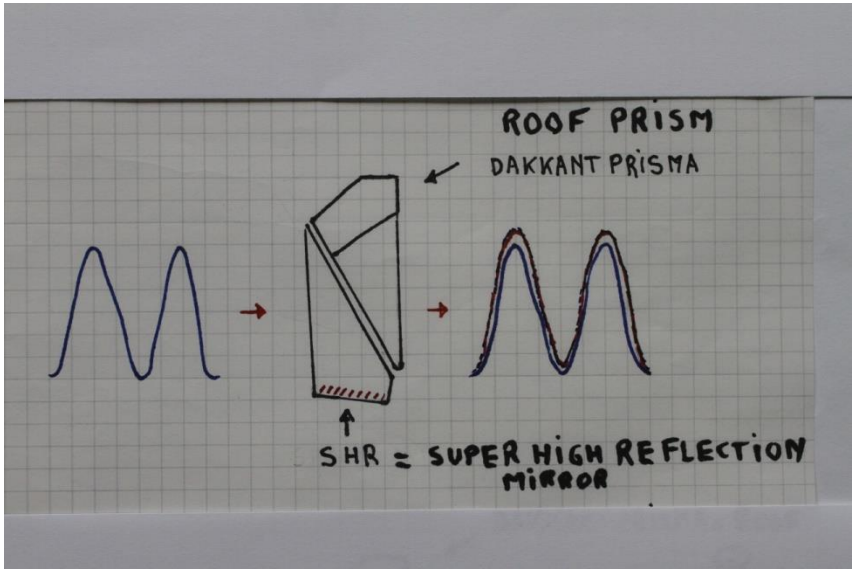
Swarovski develops new coating types, which are patented. One of them is the Swarotop broadband coating, which generates a flat optical response from about 430 nm to 620 nm



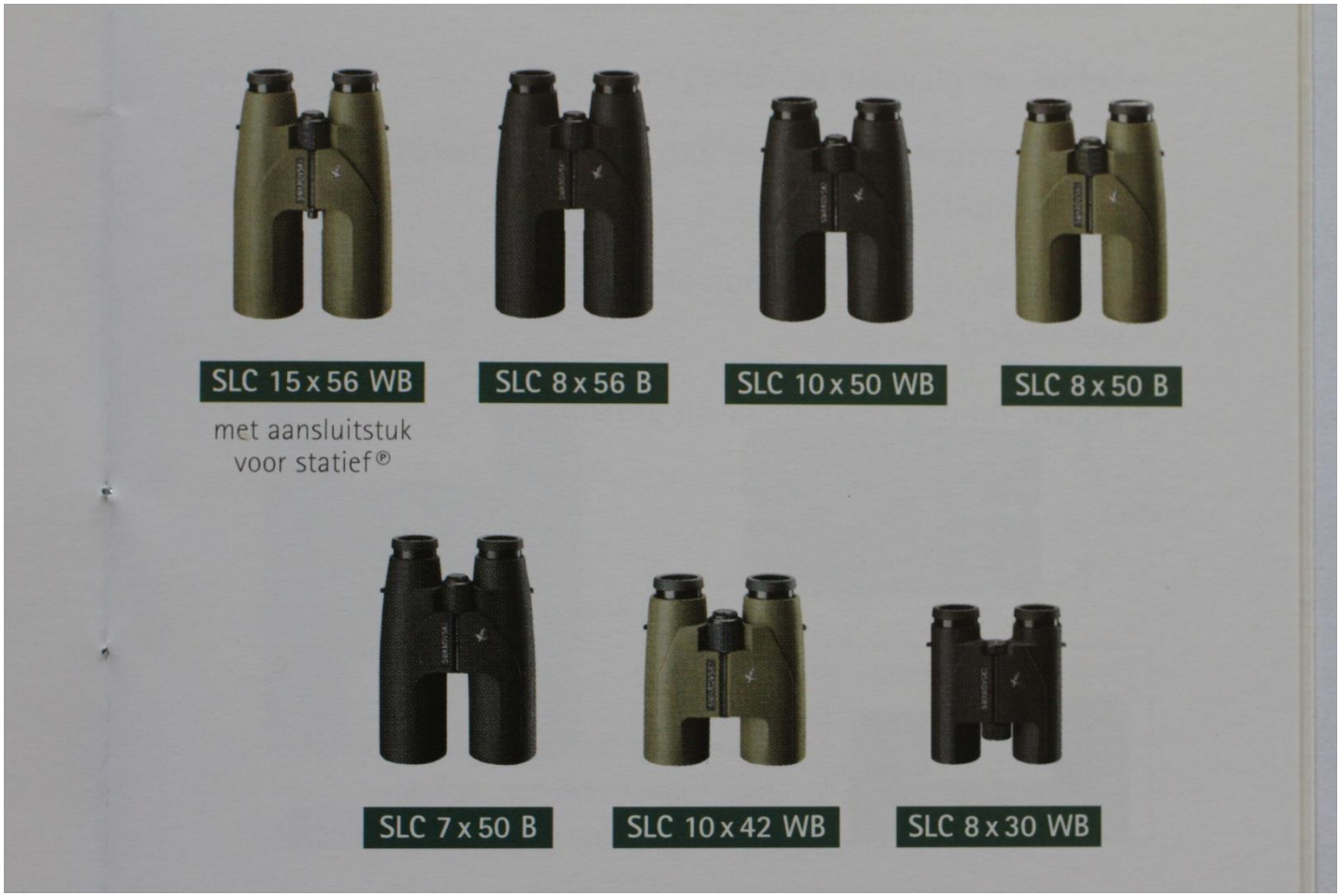
Het reflectiepercentage per grensvlak van magnesiumfluoride en de Swarovski Swarotop-coating. Duidelijk is te zien dat de Swarotop-coating veel minder licht reflecteert en dat bovendien over een veel breder gedeelte van het spectrum doet.

Another coating which greatly improves the light transmission of binoculars with Schmidt-Pechan roof prisms is the Swarobright coating, see below.





An overview of the series SLC binoculars



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The Swarovski draw tube telescopes CT 75 (30x75) and CT 85 (30x and 20-60x zoom eyepieces)

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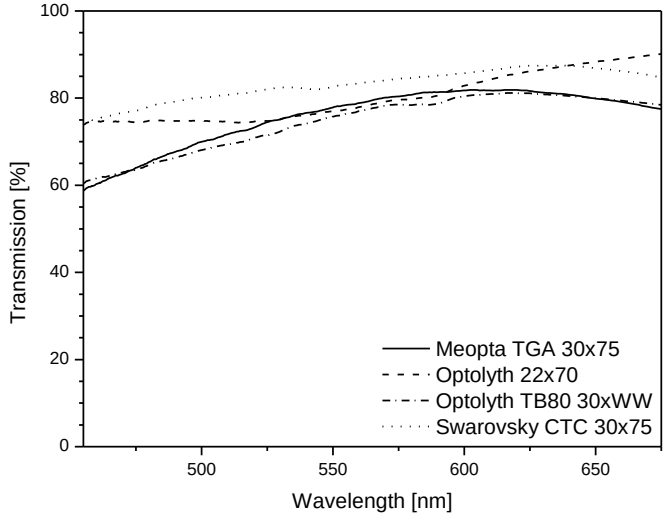
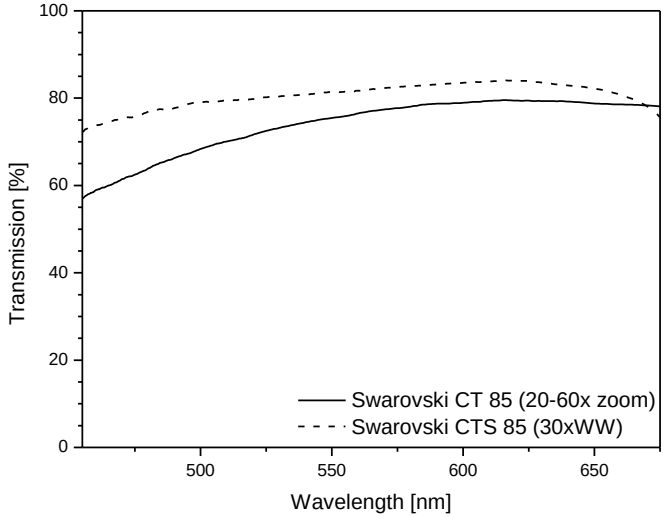
Left to right: Meopta TGA 30x75, Optolyth 22x70, Optolyth 30x75, Optolyth TBS 30x80, Swarovski CTC 30x75, Swarovski CT 85 (+20-60x zoom), Swarovski CTS 85 (+ 20-60x zoom)

The left slide shows that the Swarovski CTC 75 beats the light transmission of its competitors Meopta and Optolyh. The right slide shows the quality improvement of the CTS 85, the upgraded CT 85





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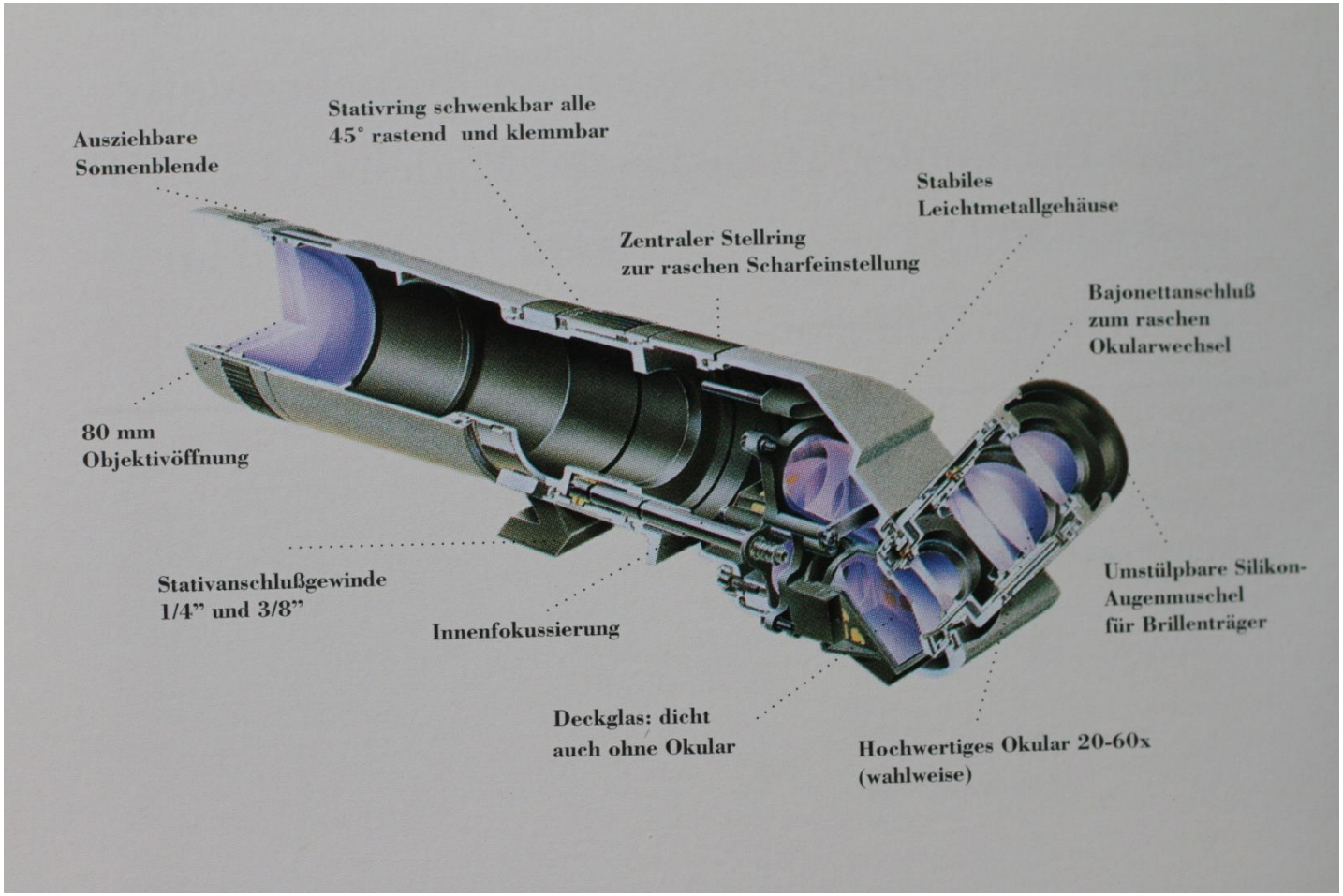
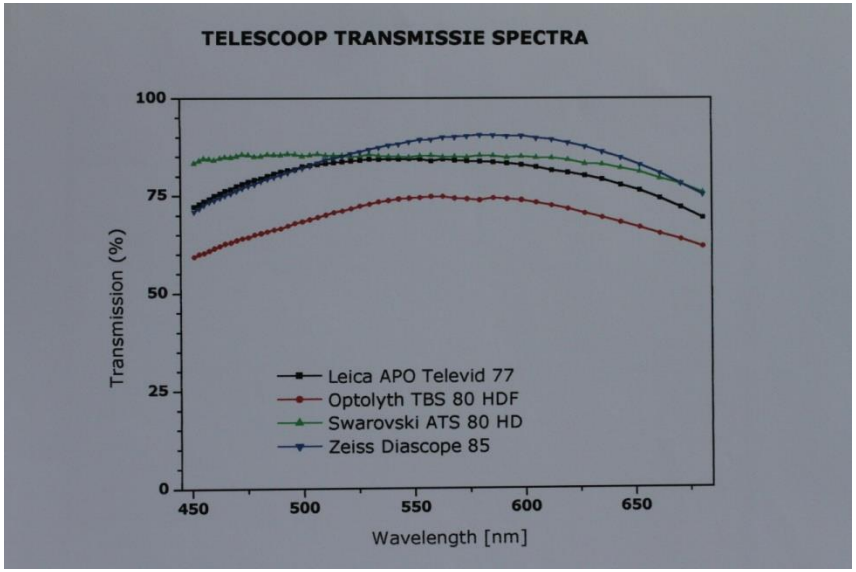
1990. March to become a leading company: the introduction of the new AT/ST 80 observation telescopes (Porro prisms) with very good quality exchangeable eyepieces among which a 20-60x zoom eyepiece.

Cutaway from Swarovski AT80 observation telescope



The introduction in 2002 of the new Swarovski ATM/STM 80 and 65 observation telescopes stirs the world of telescope users by their high optical and handling qualities.



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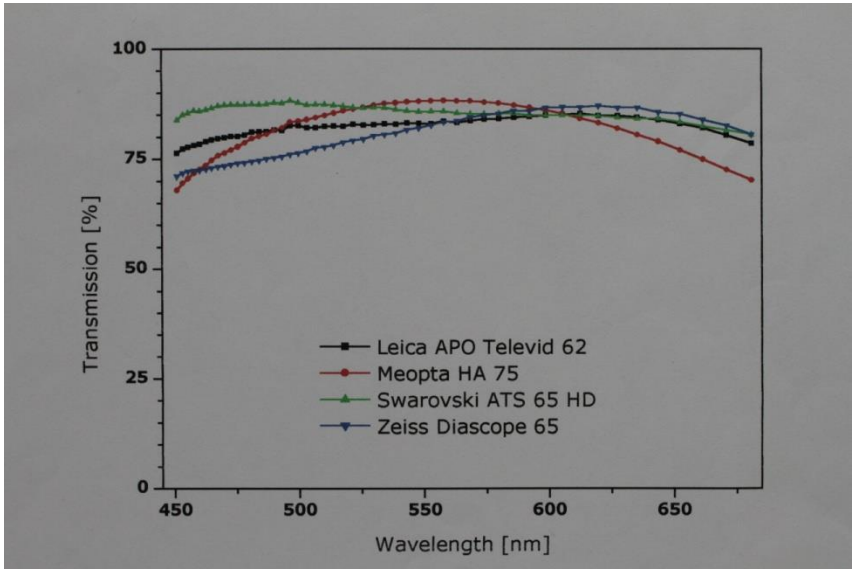
The light transmission of the Swarovski ATS 65 compared with that of the Leic APO-Televid 62, Meopta HA 75 and Zeiss Diascope 65



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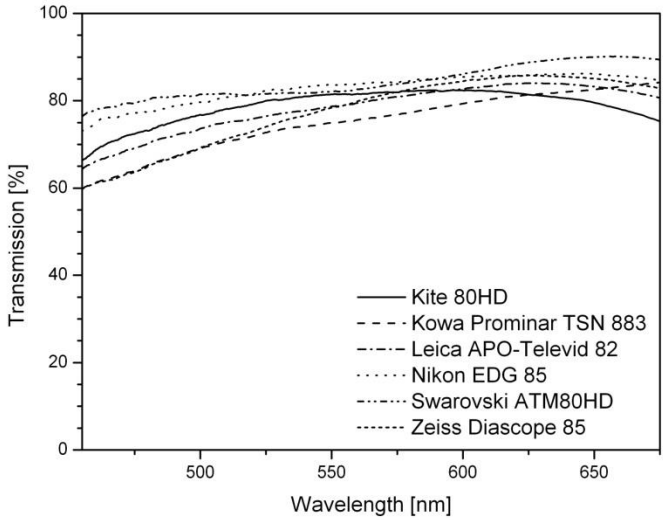
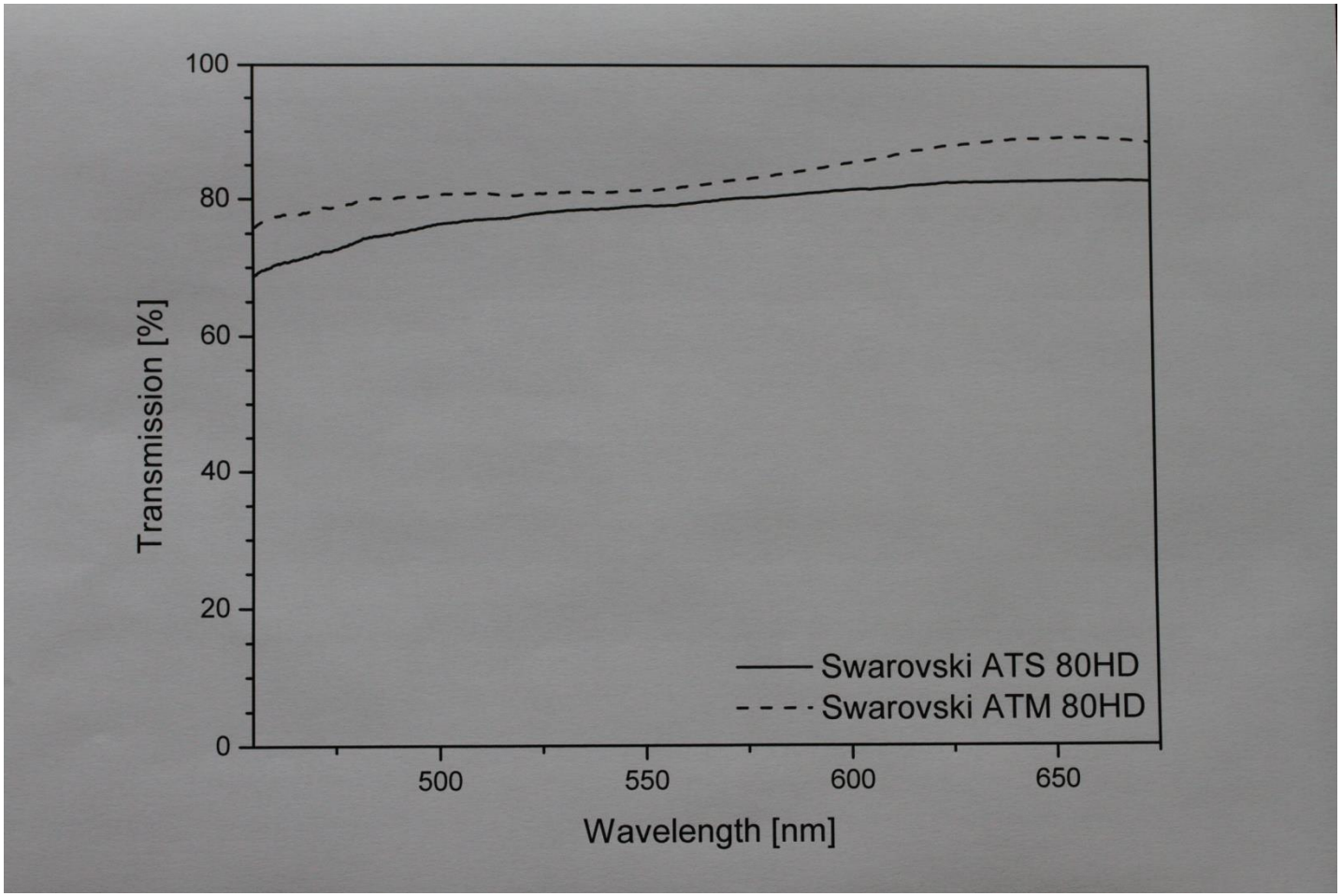
2009 : ATS/STS 80 mm and 65 mm TELESCOPES UPGRADED WITH ATM/STM MODELS: less weight, optical performance increased

Left to right: Swarovski ATM80HD, Kite KSP80HD, Leica APO-Televid 82, Nikon EDG 85, Kowa Prominar TSN 883, Zeiss Diascope 85FL



Swarovski ATM 80HD (2009) shows improved image brightness due to higher light transmission and improved color reproduction compared with the ATS 80HD telescope (2002)



Werner Hölbl designed the housing of the very succesfull Swarovski EL binoculars, which came on the market in 1999. Hölbl designed virtually all Swarovski binoculars and telescopes.

Body and optical construction of Swarovski EL 8,5x42 and 10x42.
This model brought Swarovski Optik definitely to the world top.

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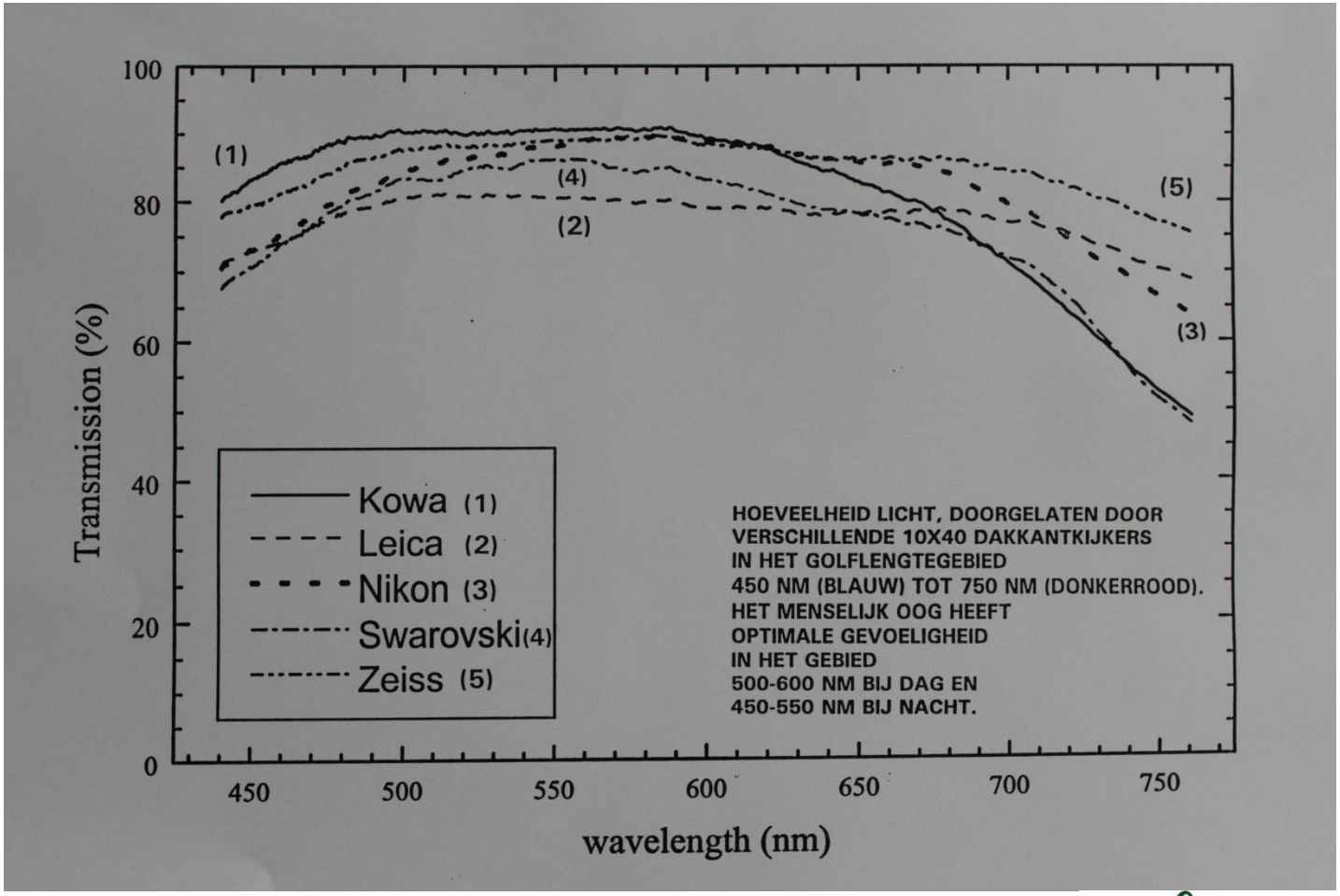
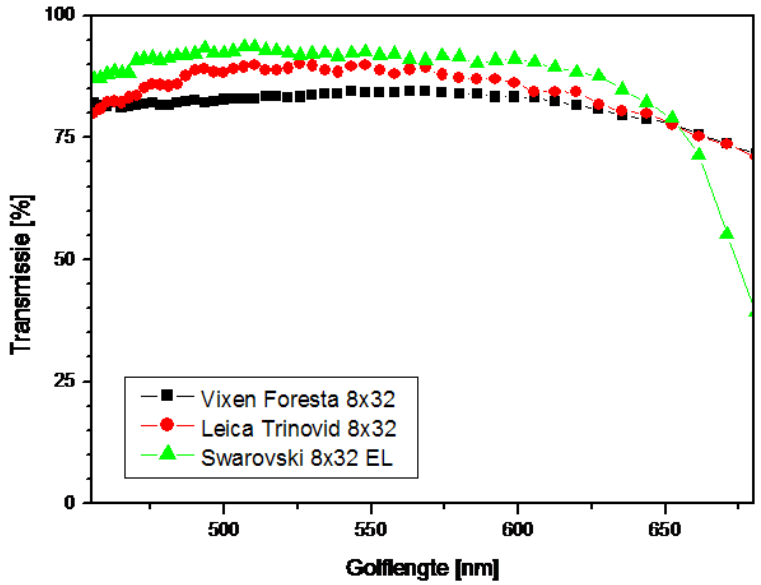
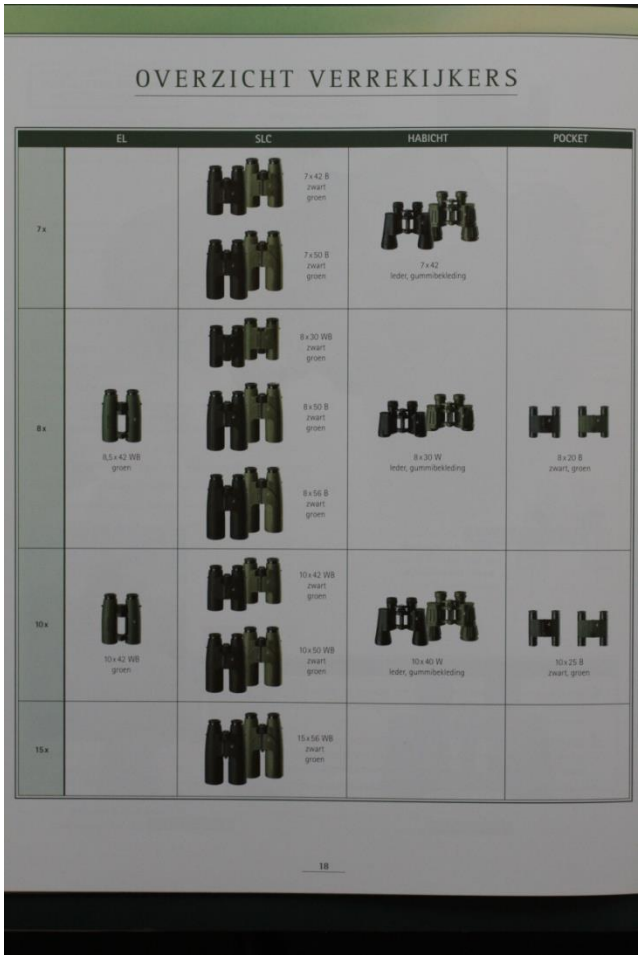
In 1999 Gijs van Ginkel wrote a test report in the Dutch journal "Camaramagazine" under the title: *"Swarovski leaves competitors behind*".



In 2002 the 8x32 and 10x32 EL binoculars were added to the 42 mm EL series.



Around 2004 Swarovski Optik had the binocular programme shown in the picture left. Right: the 8x30 Laserguide with built in range finder.



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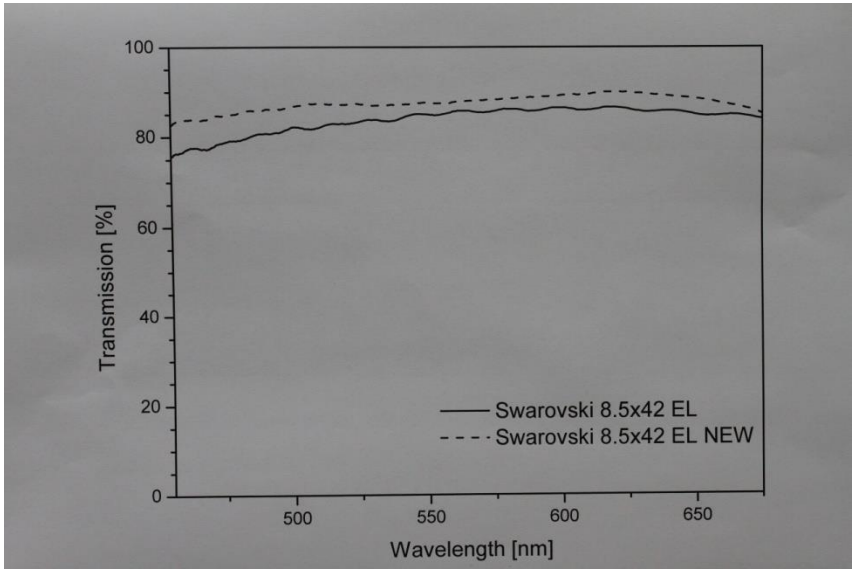
Photograph(left): Swarovsion EL 8,5x42 (in the plot indicated as EL NEW) from 2009, (right) EL 8,5x42 from 1999.
Transmission spectra of both binoculars show a substantial change in light transmission and an improved color reproduction in the new Swarovision EL.



In 2010 the SLC series was considerably upgraded with the 8x42 and 10x42 SLC-HD models. Picture right shows the new SLC model.

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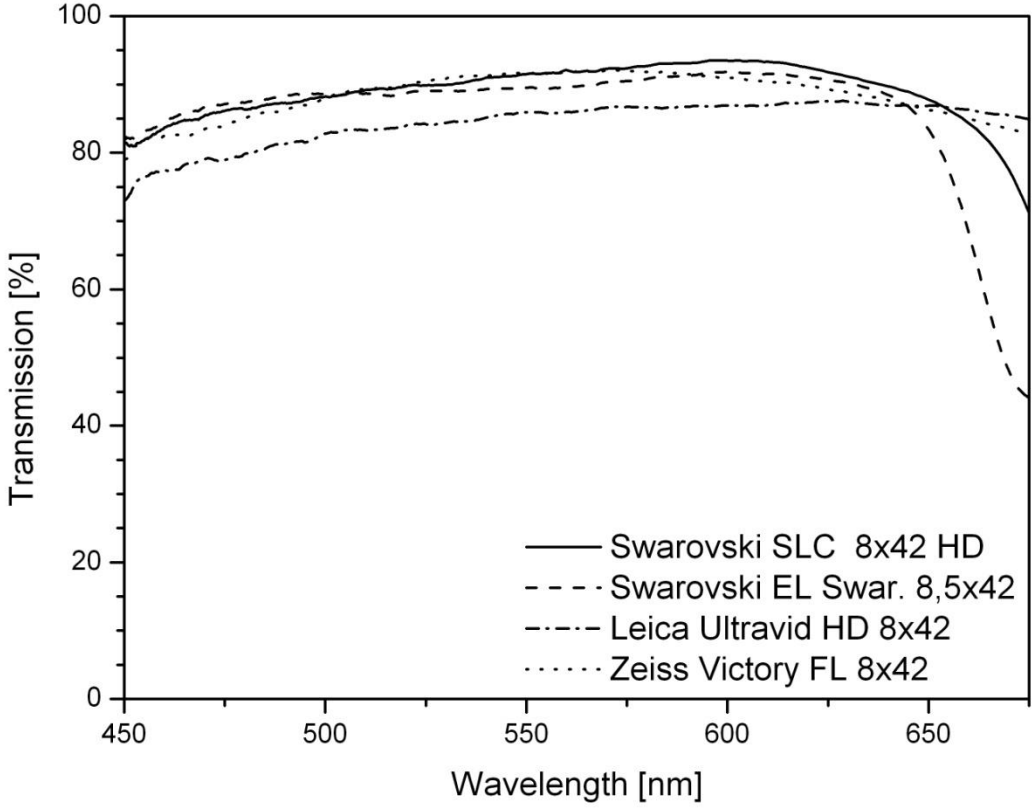
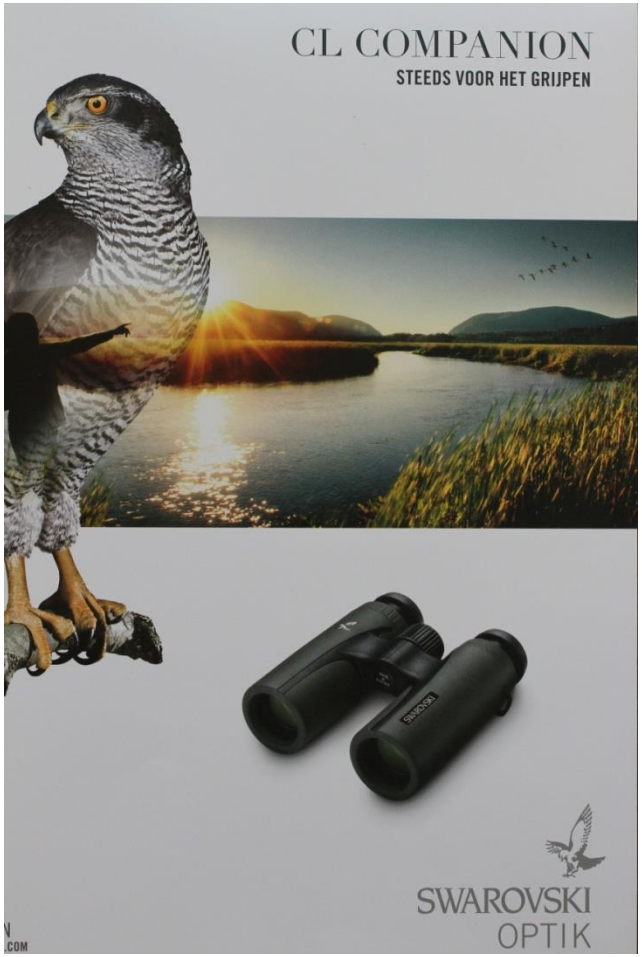
The transmission plots show that Swarovski and Zeiss are on similar light transmission levels, but the Leica Ultravid 8x42 HD falls behind



2011. Introduction of new Swarovski models:
Left: the CL Companion 8x30 and 10x30
Right: the Swarovision EL 10x50 and 12x50

The CL Companions come in green, black, or sand

(later also a brown (= desert-Africa) one and a blue one (polar) in limited editions)



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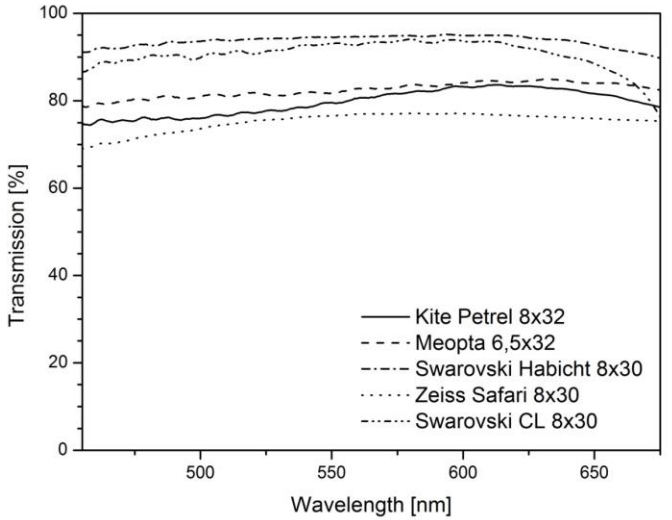
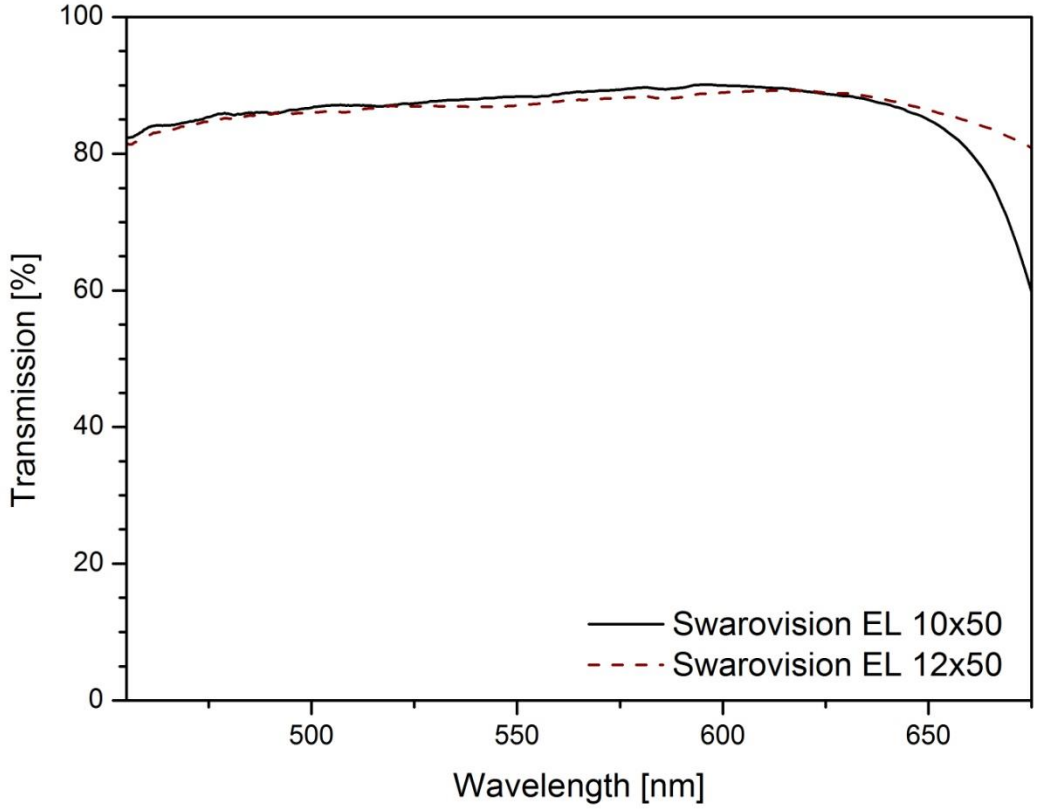
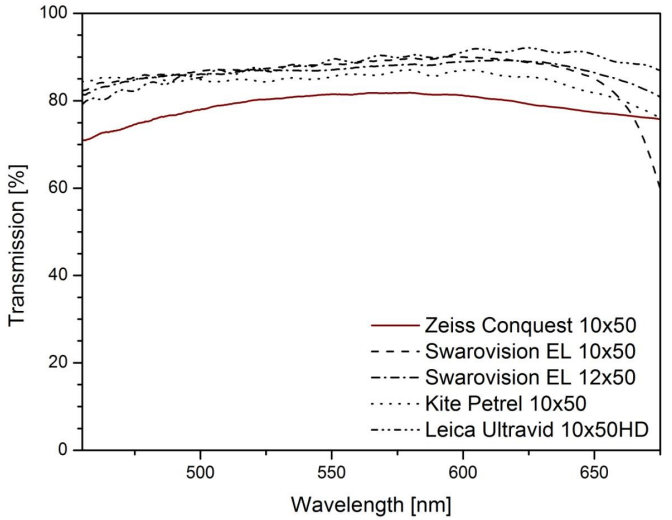
The light transmissions of the Habicht 8x30 (already made in 1949 but still in production) and the new 8x30 CL companion beat that of the competitors. Both distinguish themselves by an exceptional bright image and very good color reproduction



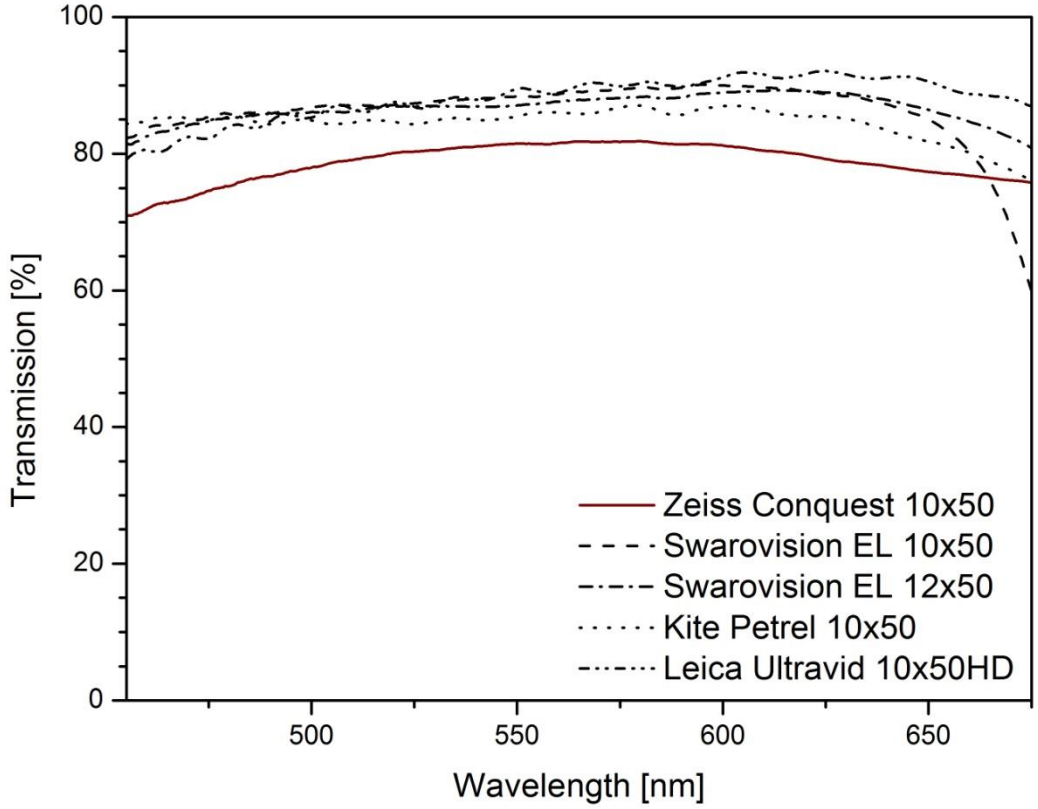
Light transmission spectra of the 2011 Swarovski Swarovision EL 10x50 and 12x50



Light transmission spectra of the new 50 m Swarovision EL binoculars compared with the performances of some competitors



Light transmission spectra of the new 50 m Swarovision EL binoculars compared with the performances of some competitors



New in September 2011: Swarovski EL Range, open bridge binoculars 8x42 and 10x42 with built in rangefinder.
Specifications: approx 900 grams, 91% light transmission in both tubes, measuring range 30-1375 meters

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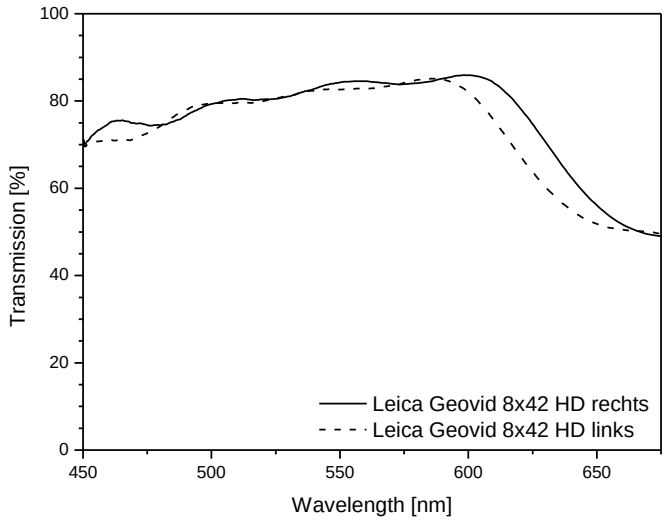
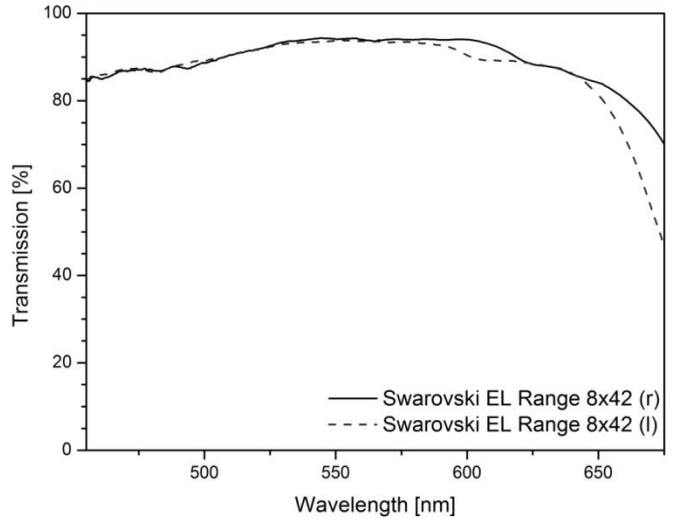
Light transmission spectra of Leica Geovid 8x42HD (left) and Swarovski EL Range 8x42 (right)





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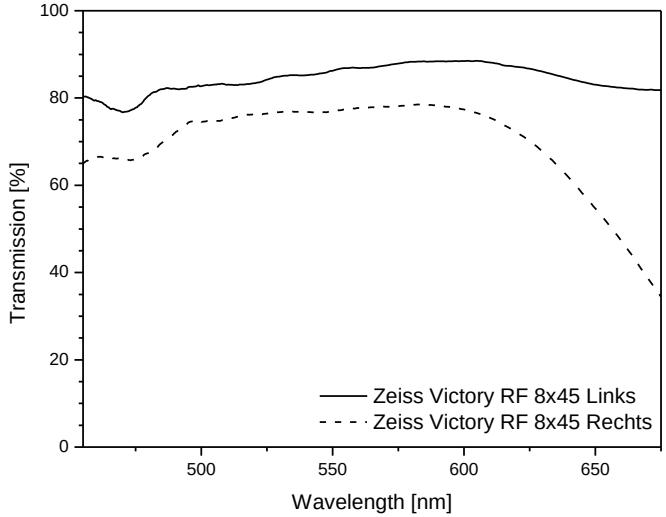
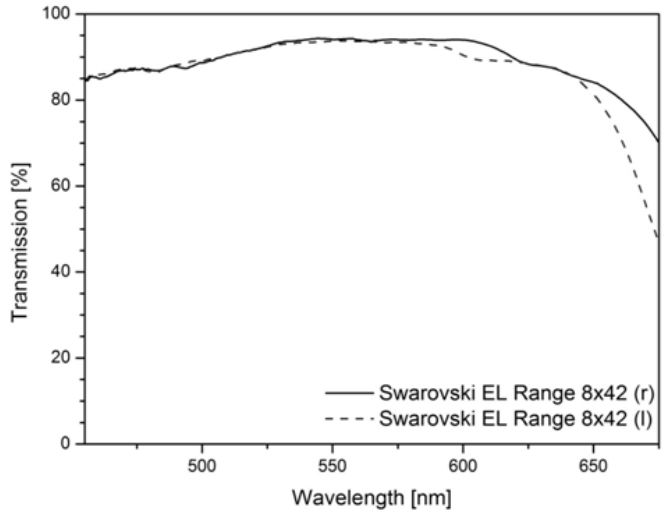
Light transmission spectra of the Zeiss Victory 8x45 RF (left) and the Swarovski EL Range 8x42 (right)





Light transmission for night vision and daylight vision of range finder binoculars

Binocular	**Leica Geovid 8x42 HD**	**Swarovski EL Range 8x42**	**Zeiss Victory RF 8x45**
Light transmission 500 nm (**night vision**)			
Left	**80%**	**89%**	**87%**
Right	**80%**	**89%**	**78%**
Light transmission 550 nm (**daylight vision**)			
Left	**80%**	**94%**	**83%**
Right	**84%**	**94%**	**75%**

2012-2014: Introduction of CL Pocket line 8x25 and 10x25
Photograph left: CL Pocket 8x25 (left), Kite Lynx 8x30HD (middle) and CL Companion 8x30 (right).
Photograph right: modular ATX and STX telescopes with 65, 85 and 95 mm objective modules (left) and ATX and STX eye piece modules (right)

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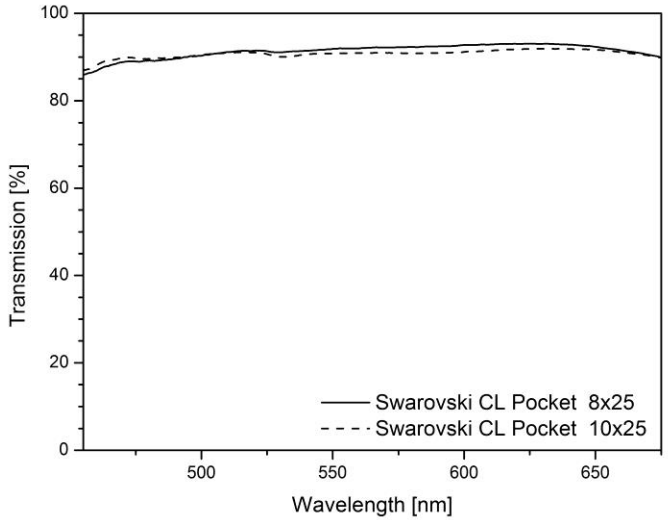
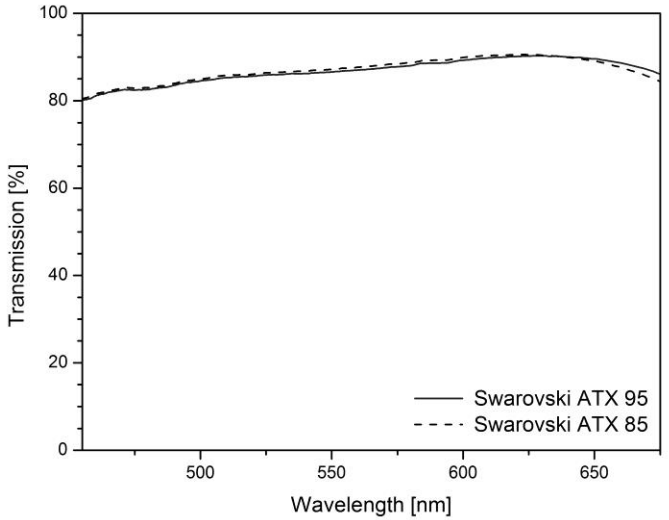
TRANSMISSION SPECTRA OF THE NEW CL POCKETS 8X25 AND 10X25 (LEFT) AND THE ATX 85 AND ATX 95 TELESCOPE





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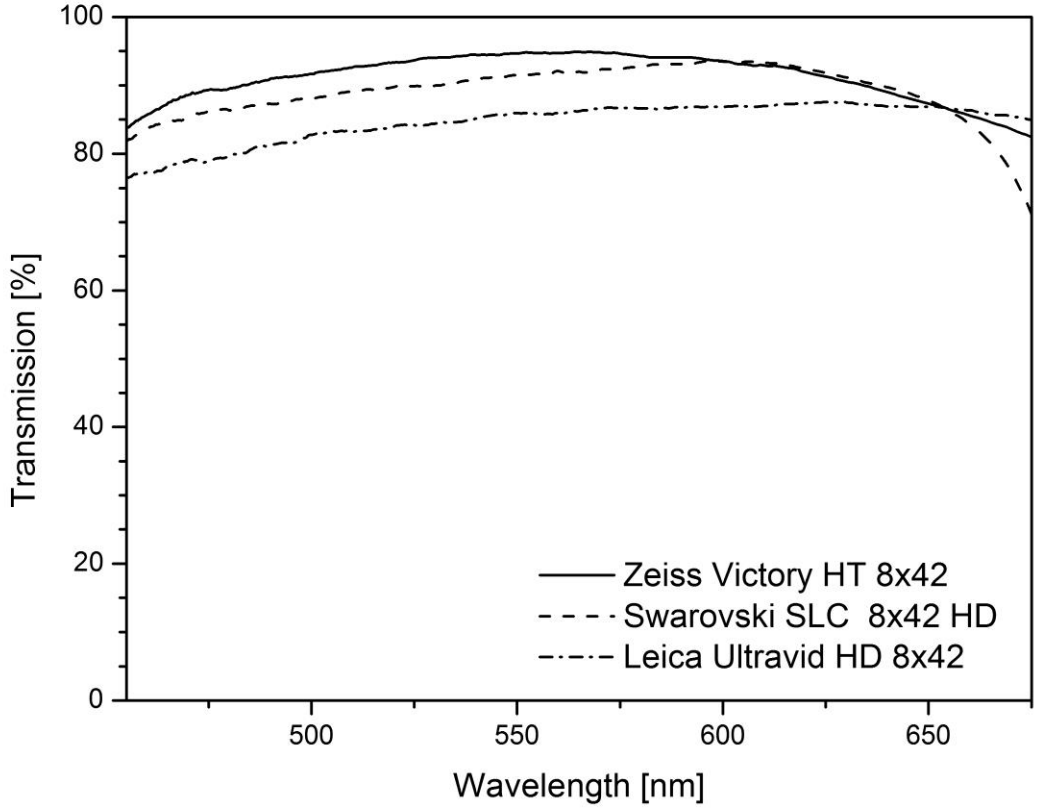
FROM LEFT TO RIGHT: SWAROVISION 8X42, SLC-HD 8X42 AND SLC 8X56 WB

TRANSMISSION SPECTRA OF THE ZEISS VICTORY HT 8X42, SWAROVSKI SLC 8X42 HD AND LEICA ULTRAVID HD 8X42



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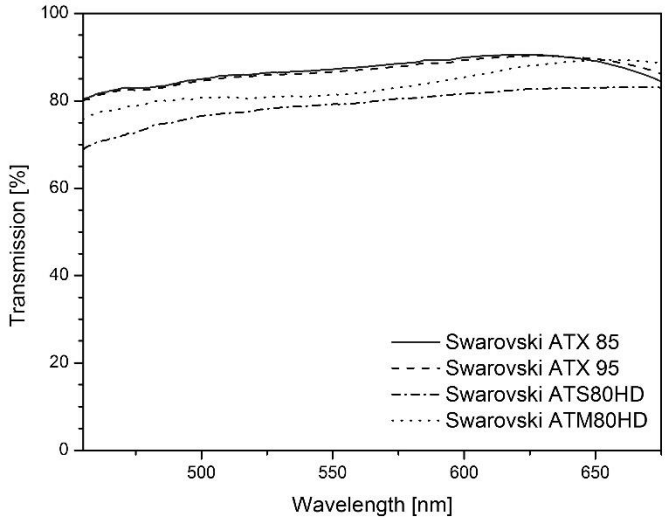
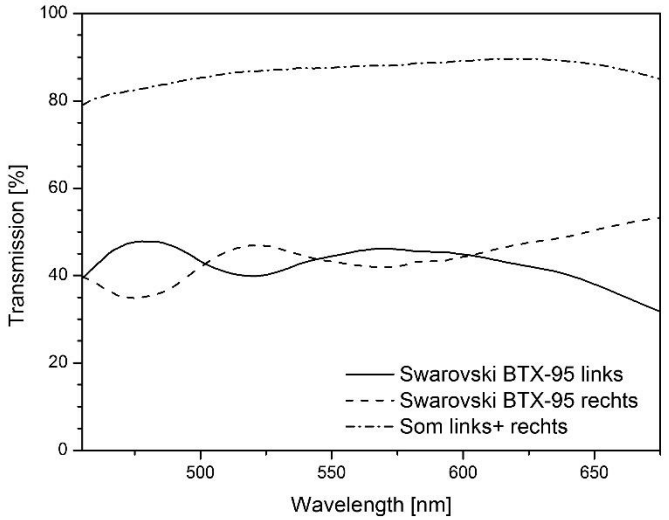
(33)

2012: SWAROVSKI ATX/STX 65, 85 AND 95 MODULAR TELESCOPE SYSTEM
2017: ADDITION OF BINOCULAR EYEPIECE plus 1,7X EXTENDER TO THE ATX/STX/BTX SYSTEM

TRANSMISSION SPECTRA OF:
LEFT: SWAROVSKI ATM80HD, ATS80HD, ATX 85 AND 95
RIGHT: SWAROVSKI BTX95 FROM TWO EYEPIECES SEPERATELY AND SUM SPECTRUM OF BOTH





Conclusions

- **-1- Swarovski Optik has in about 60 years developed from a simple optical workshop to world leader in the production of high quality binoculars and observation telescopes.**

- **-2- The historical development of Swarovski Optik shows that it fully lives up to its motto: *"Continuously improve the already good quality",* a motto that is realized by an exceptional high quality management.**

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This story could not have told without the help of the persons mentioned. I am very grateful for their help, information and support.

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- Jack Kelly, USA
- Dave van den Heuvel, Utrecht University, The Netherlands

Night vision equipment made by Swarovski Optik

Laser range finders made by Swarovski Optik

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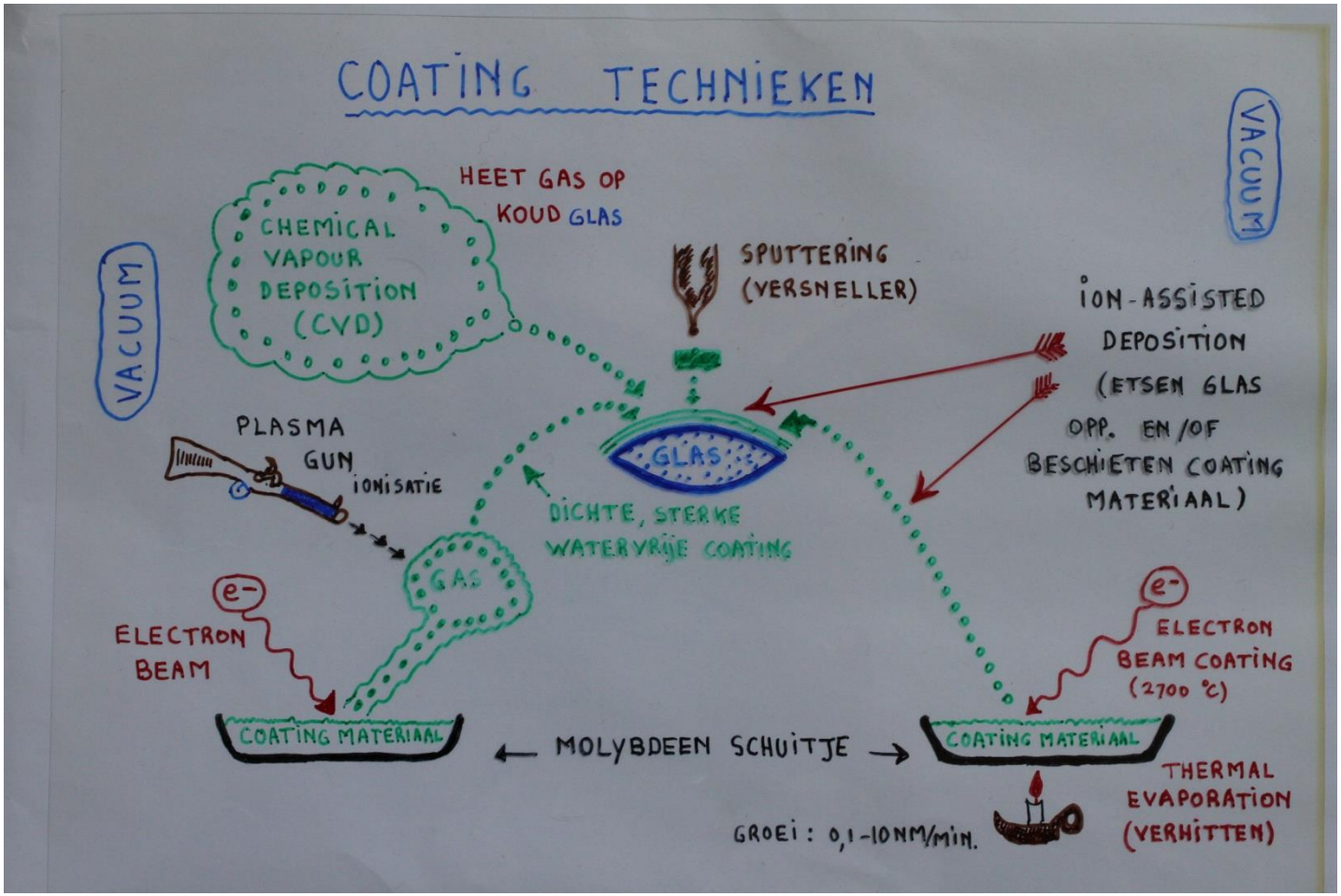
Table Properties of common materials for thin-layer coatings.

Material	*Refractive index*	*Wavelength region of use*
Magnesium fluoride	1.38	vUV–nIR
Cryolite	1.35	vUV–IR
Aluminium oxide	1.62	UV–nIR
Silicon dioxide	1.46	UV–nIR
Zirconium dioxide	2.00	UV–nIR
Titanium dioxide	2.30	V–nIR
Cerium dioxide	2.20	V–nIR
Thorium fluoride	1.52	vUV–IR
Zinc sulphide	2.30	V–nIR
Silicon monoxide	1.90	V–nIR
Silicon	3.50	nIR–IR
Germanium	4.05	nIR–IR
Zinc selenide	2.44	nIR–IR
Cadmium telluride	2.69	nIR–IR
Lead telluride	5.10	IR

vUV, vacuum ultraviolet. UV, ultraviolet, V, visible. nIR, near infra-red, $\lambda < 5\ \mu$m. IR, far infra-red, $\lambda > 5\ \mu$m.

DIFFERENT COATING TECHNQUES



The Swarovski binocular type name “Habicht” is inspired by the Habicht mountain (3277 m) in the Austria Stubaier Alps. It was later attributed to the Habicht= Hawk