The Helmholtz ‘Augen-spiegel’: A Forgotten Treasure

D Cugley.
Royal Victorian Eye & Ear Hospital, East Melbourne, Victoria, Australia.

Background & Inception

Hermann Ludwig Ferdinand von Helmholtz (31/8/1821 – 8/9/1894), Physician, Physicist and Philosopher made famous in Ophthalmology as the inventor of the first ophthalmoscope, was the son of an academic that suggested Medicine as a more financially lucrative career. He was a graduate of military medical school in Berlin in 1843, appointed Professor at University of Königsberg, Germany.

It was during preparation of his lectures in 1850 that he devised the ***‘Augen-spiegel’*** (German for ‘eye mirror’), later known as the direct ophthalmoscope, which would allow clinical examination of the posterior segment in a living patient: something not previously possible. ‘Up until now, a number of important eye diseases were lumped together under the name of “black cataract:” because we knew nothing about the pathological changes in the living eye, not even at autopsy. Thanks to my invention, the most detailed examination of the inner structure of the eye is possible.’

Ultimately this helped disprove the notion that an internally emitted light was responsible for vision in dark environments. Helmholtz regarded this accomplishment as a, ”discovery more than an invention.” (Hirschberg et al, 1992)

Figure 1: Photograph of Hermann von Helmholtz. In: Helmholtz, H. Helmholtz's Treatise on Physiological Optics. Southall, JPC. Menasha, Wisconsin. Optical Society of America, 1924.

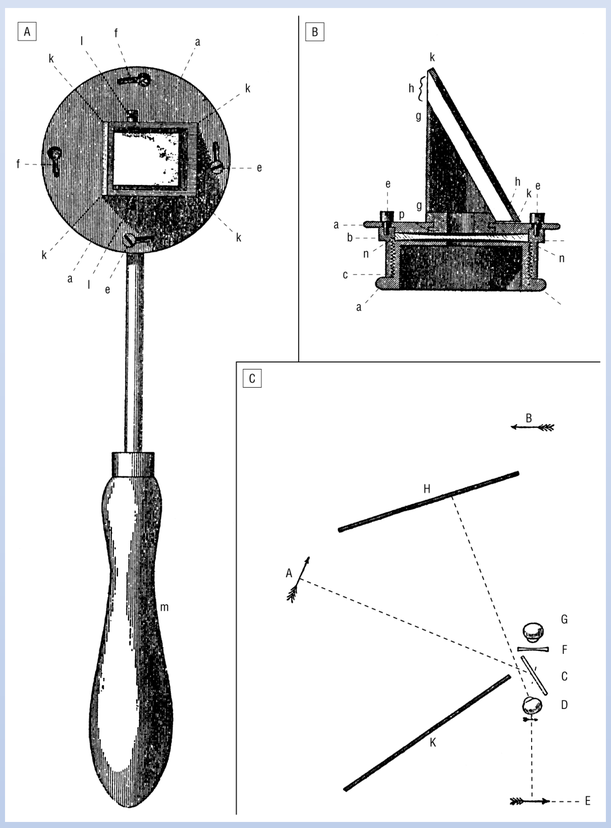

Figure 2: Helmholtz’s own schematic and optical ray diagram of his Ophthalmoscope. In Helmholtz, H. *Beschreibung eines Augen-Spiegels.* Berlin, Germany. A Förstner'sche Verlagsbuchandlung, 1851.

Optics & Clinical Use

Key to development was the central assertion that: light emitted from the pupil follows the same course as that entering the pupil, then the emitted light is also the reflected light back to its source. It required a beam splitter to separate incoming and outgoing light rays. The key development by Helmholtz was the manipulation of light, directed by thin parallel sheets of glass with a central aperture. Small ‘compensating’ lenses were inserted just behind the viewing aperture.

Using the Ophthalmoscope was challenging, with a steep learning curve. Light was provided by candle flame or paraffin burning lamp, and examination often undertaken through non-dilated pupils (due to patient dislike of the only available, long-lasting cycloplegic available; atropine). Modern developments would include electric bulb illumination, concave mirror replacement of glass sheets and addition of lenses that allow correcting for patient refractive error.

Effect in Ophthalmology

Helmholtz’s ‘discovery’ has had such a profound effect that many historians divide Ophthalmology into ‘pre’ and ‘post’ ophthalmoscope periods. Despite pressure from his father at the time to patent the invention (for undoubted commercial benefit) – he never did, preferring to make invention widely available to benefit mankind than for personal economic advancement. However, its widespread use took time and the device has subsequently undergone numerous advancements. It also led to the development of the first Indirect Ophthalmoscope, credited to another German Ophthalmologist Dr Christian Rueth in 1852 – just 2 years later. The first modern head-mounted Binocular Indirect Ophthalmoscope was developed by the Belgian Dr Charles Schepans in 1945.

Helmholtz was also known for many other contributions to Ophthalmology and Optics, which were particularly well outlined in his ‘Handbook of Physical Optics’, which included cutting edge theories on depth & motion perception, colour vision and accommodation.

Helmholtz was awarded the Legion of Honour in 1881, a ‘Von Graefe Medal’ by the Heidelberg Ophthalmological Society in 1886 and was elevated to nobility in 1883 (acquiring von prior to his surname) . The largest German research group (the Helmholtz Association) is named in his honour.

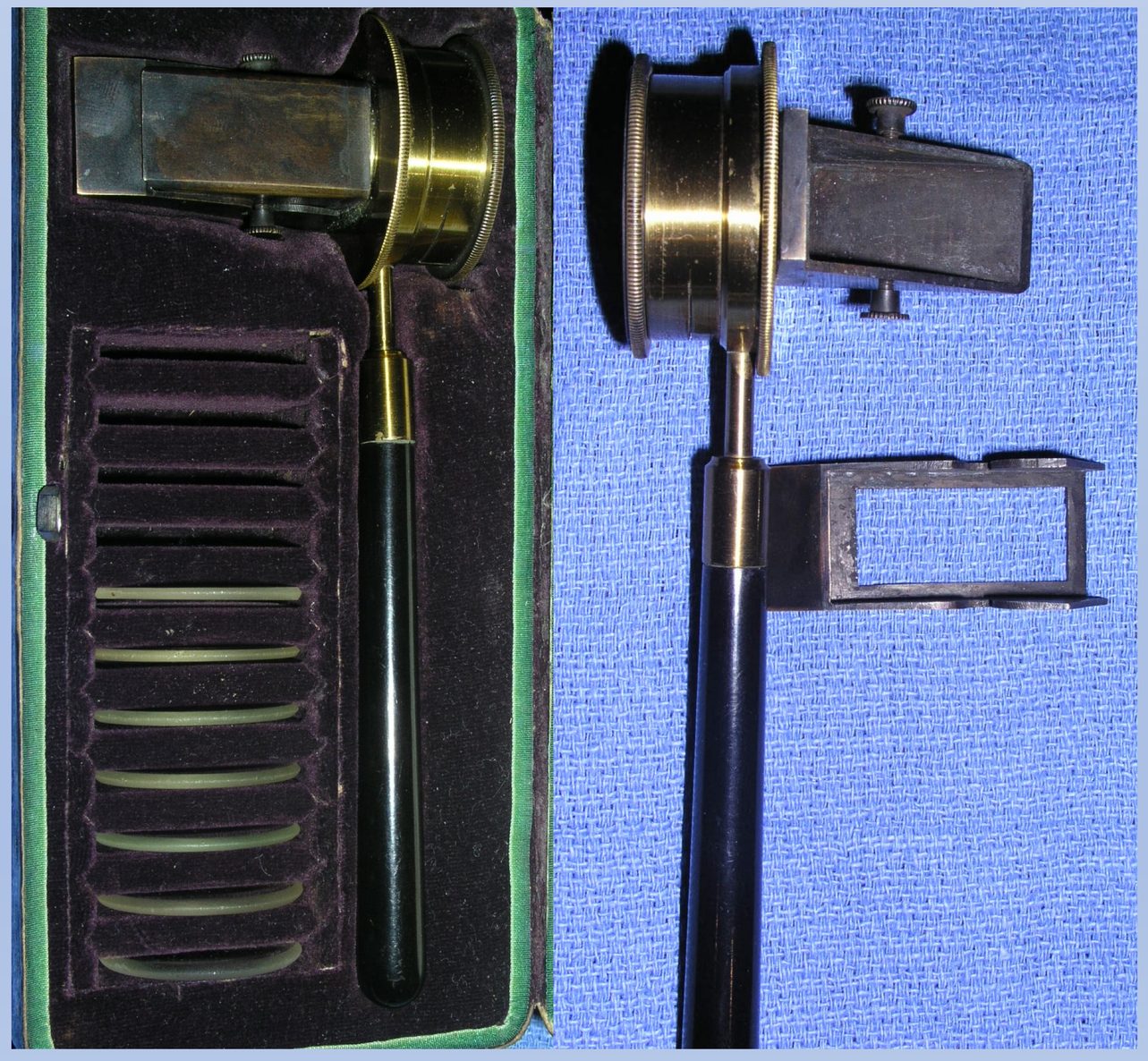

Figure 3 : Photographs of a Helmholtz Ophthalmoscope, owned and courtesy of Professor Ian McAllister.

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Acknowledgements

Prof. Ian McAllister, for providing pictures of his authentic Helmholtz Ophthalmoscope.
Dr. David Kaufman, Curator, RANZCO Museum, for support in preparation of this poster.
Email Correspondence: Dean.cugley@eyeandear.org.au