The Varilux S Series™: SynchronEyes Technology™— A Powerful, Innovative Approach to Binocular Vision in Progressive Addition Lenses

Mark A. Bullimore, MCOptom, PhD, FAAO • Kirk L. Smick, OD, FAAO

Three groundbreaking technologies underlie the extraordinary benefits of new Varilux S Series™ lenses:

- **Nanoptix Technology™: A breakthrough technology that virtually eliminates "swim" compared to other premium progressive lenses. Nanoptix Technology™ reengineers the basic shape of the progressive lens by considering the lens as a set of many optical elements, allowing designers to minimize image deformation while maintaining the power progression.**
- **SynchronEyes Technology™: A powerful, innovative technology that integrates prescription data from both eyes into each lens, optimizing binocular visual fields and giving wearers expansive vision.**
- **4D Technology™: A revolution in lens personalization that enhances overall visual response times by ensuring the sharpest vision in the leading dominant eye™. (Available only on Varilux S 4D™ lenses.)**

This paper will introduce SynchronEyes Technology™ and describe how it calculates lenses as a pair for expansive binocular vision.

Binocular Vision

The human visual system is inherently binocular. In the absence of any ocular or neurological pathology, humans can see significantly better with both eyes than with either eye alone. Up to now, technological limitations have made it impossible for progressive lenses to work with the eyes' natural binocularity. Instead, it has been necessary to design and calculate lenses as if each eye were a monocular system to be optimized without reference to the fellow eye.

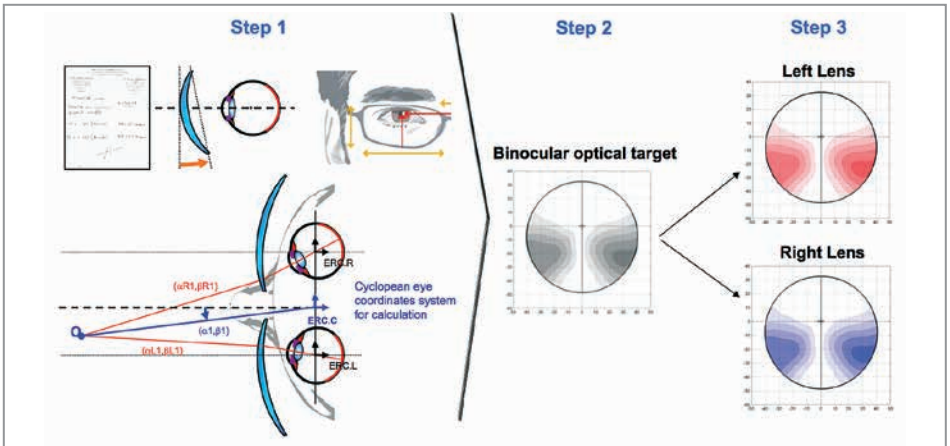

FIGURE 1 Beginning with individual eye parameters, SynchronEyes Technology™ creates a binocular optical system in which optical quality is balanced at homologous points on each lens.

Binocular vision takes place when the brain is able to integrate the slightly different images from each retina to create a single three-dimensional representation. For the brain to fuse the images from the two eyes, the retinal images have to be similar with respect to size, shape, color, brightness, and focus. Research has also shown that image fusion—and hence the quality of binocular vision—is best when the optical quality of the two retinal images is similar.

Enabling Binocularity

The ideal situation for binocular vision, then, is low aberrations in each eye *at each point of gaze*; the challenge for lens designers is to create this condition for every point of gaze.

When optical design is determined separately for each eye, it is virtually impossible to balance optical quality at each point of gaze because of each lens' distinct sphere, cylinder, and axis characteristics. Without a way to create equivalent levels of optical quality in *both* eyes at every direction of gaze, the primary requirement for optimal binocular vision cannot be met.

SynchronEyes Technology™ is a revolutionary technology that uses a mathematical model—the cyclopean eye—to balance aberrations at homologous points in the left and right lenses. (Homologous points are the two points—one on each lens—through which gaze is directed when both eyes are looking at the same point in space). With SynchronEyes Technology™, the homologous retinal images are balanced with respect to optical quality, and binocular vision is optimized.

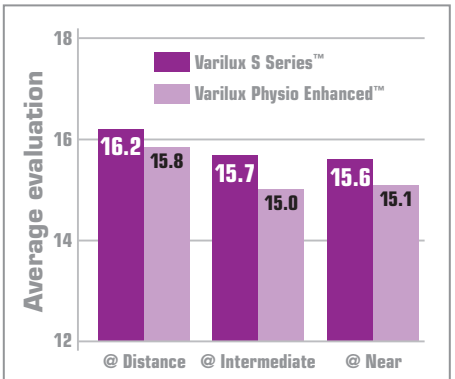

FIGURE 2 In wearer tests, subjects found wider fields of vision at all distances in Varilux S Series™ lenses than in industry-leading Varilux Physio Enhanced™ lenses. (Evaluations based on a 20-point scale.)

SynchronEyes Technology™ creates lenses in a three-step process (Figure 1). First, the parameters of each eye are measured and recorded; then, a binocular optical system is designed based on wearer parameters; and finally, the binocular optical design is applied, with the right and left lenses optimized to work together. As this takes place, Nanoptix Technology™ ensures that the lenses are virtually "swim"-free. The resulting lenses provide balanced retinal images with low aberration levels, giving wearers stable and expansive *binocular* vision—made possible by allowing the eyes to work together as one visual system (Figure 2). ■

For additional information:

www.VariluxUSA.com/variluxSSeries – Technical Information