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Book Review
PSY 385

A Review of: "Fixing My Gaze," by Susan Barry

Susan Barry, Ph.D., M.A. author of "Fixing My Gaze: A Scientists Journey into Seeing in Three Dimensions"

On a normal November morning, twenty-year old Susan Barry attended a lecture for her college neurobiology class feeling "sleepy and sluggish." Her mood soon transformed, however, as her professor began to discuss the visual system and the details of how it develops. During his lecture, Susan's professor used the example of walleyed and cross-eyed kittens to describe how strabismus, or misaligned eyes, prevents the development of 3D vision in these kittens. At a very young age, Susan herself was diagnosed with strabismus, but she had undergone three eye surgeries to correctly align her eyes. After her surgeries, Susan's eyes now looked "normal," so she had assumed for many years that she now saw normal too. The professor went on to say that many scientists and doctors believed that strabismic cats and humans alike would never develop the ability to see in 3D, because this ability developed only during a "critical period" that occurred very early in life. The idea that she may be missing a key component to the way most people perceive the world ignited Barry's journey to better understand stereopsis. This visual phenomenon has eluded scientists for centuries and Barry's quest is the basis of her autobiographical book, "Fixing My Gaze: A Scientists journey into Seeing in Three Dimensions ."

Susan Barry received her B.A. from the Wesleyan University and went on to complete her Ph.D., M.A. at Princeton University. Currently she is a Professor of Biological Sciences for undergraduate students at Mount Holyoke College, specializing in stereovision and neural plasticity. Barry is also the Director of the Grass Fellowship Program at the Marine Biology Laboratory in Woods Hole, M.A. This program stems from the Grass Foundation; a small, non-profit foundation aimed to promote research

and education in the neuroscience discipline, and provides a first opportunity for neuroscientists in their predoctoral/postdoctoral years to conduct independent research. In her lab, Barry currently studies the role of ion currents in the behavior of protists and also the effects of antimalarial drugs on these currents.

Barry begins the story of her journey to seeing in 3D by helping the reader better understand what it means to truly see in three dimensions. "Stereopsis" is described by Barry as the ability to use the different viewing perspectives of one's two eyes to see three-dimensional space. Charles Wheatstone, a British scientist of the early and mid-1800's, is cited as the first to discover that the difference in viewing perspectives that our two eyes see is not an imperfection, but rather a tool that we use to perceive depth. Barry does a great job describing to her readers through detailed, yet comprehendible diagrams and text just exactly how this visual tool works: because the eyes are separated by our nose and other facial features, they capture slightly different visual perspectives, which are both sent to the brain where they are fused into one coherent, depth-filled view of the world. Barry goes on to describe the distinction between the two primary types of neurons found in the visual cortex: (1) monocular neurons respond to signals from the retinal cells of the left or right eye, and (2) binocular neurons respond to input from both the right and left eyes. People with strabismus are unable to fixate both of their eyes at the same point in space and utilize just one eye at a time. As a result, Susan and other people with strabismus do not develop functioning binocular neurons, and therefore lose stereovision.

In Chapter Two, "Mixed-Up Beginnings," Barry recounts the details of her childhood development. When she was just three months old, Susan's parents noticed that her eyed seemed to appear crossed and decided to inquire with her pediatrician, who suggested they wait to see if Susan's eyes would realign are she got older. The year was 1954 and many doctors were still unaware that the development of strabismus in infancy could lead to the permanent loss of stereovision. During this

passage and in many instances throughout the book, Barry expresses her discontent with the approaches that many visual doctors and scientists take when faced with a strabismic patient. It was not until she was two-years old that Susan was finally diagnosed with "constant alternating esotropia" by Dr. Rocko Fasanella, chief of ophthalmology in the Dept. of Surgery at Yale New Haven Hospital. This diagnosis meant that when Susan fixated with one eye, the other eye turned inward toward her nose and she would constantly switch her fixation between eyes. In many cases bifocal lenses can correct the misalignment between strabismic children's eyes. For Susan, however, this was not the case and after months of wearing her bifocals, Dr. Fasanella decided to operate on Susan's eye muscles in an attempt to straighten her gaze. After three surgical procedures, Susan's eye appeared to be aligned, but she was still missing the ability to see with stereovision. "For me , " Susan states, "cosmetic alignment of my eyes did not change the way I used them. I continued to see as I had before the surgery…Even though my eyes looked straight, they were not as straight as nature intended them to be."

My heart was flooded with sympathy as I read the struggled that Susan faced due to the extreme difference in visual input that her misaligned eyes sent to her brain. She suffered from double vision, as well as visual confusion. Barry says that everyone who suffers from strabismus finds a way to cope with this confusion at a very young age, which in her particular case was to resort to monocular vision by suppress the image from one eye by turning it inward, therefore sacrificing the ability to see with stereovision. During her school years, Barry faced many challenges that stemmed from her strabismus. Although her eyes each saw 20/20 individually and she always passed her school eye exams with flying colors, Barry's misaligned eyes caused her to struggle with reading. As a result, Susan was placed in the "below average" class at her school. Through numerous accounts, Barry shows in Chapter Three, "School Crossings," that many children with strabismus face similar difficulties in school. Eric Dore was determined in kindergarten to have attention deficit hyperactive disorder (ADHD) and often struggled to copy down all of the information on the board in his classroom. One night while reading Harry Potter

with Eric, Barry describes how his mother noticed that one of his eyes seem to drift from time to time. It turned out that Eric had developed strabismus and was struggling in school because of his inability to focus his eye, not because of an attention disorder. After only five months of vision therapy sessions, Eric's reading skills and grades improved, as well as his skill in his favorite sport: hockey.

"If you would have asked me in 2001 if I could gain stereopsis, I would have told you that there are limits to how much an older brain can change. A person whose eyes were crossed since infancy would always be stereoblind." Throughout much of this story, Barry describes how the majority of the scientific and medical communities believe in the theory of the "critical period" when it comes to the development of the visual system. According to this theory, certain components of the visual system develop during the initial years of an infant's life. If something irregular occurs during development and the visual system is not utilized in the correct manner, the window of opportunity to obtain certain abilities, such as stereovision, is surpassed. Many animal studies have supported the idea of the critical period, and it has also been shown that the human brain is most plastic or capable of change/adaptation during infancy and becomes more resistant to change as it ages. Susan was also found herself following this school of thought, until she came upon the work of the late 1800's French ophthalmologist Louis Emile Javal. Javal was a social reformer who advocated better living conditions for the poor and improved treatment for the blind. He was the first to develop a vision therapy program that aimed to recover stereovision. From the 1950's to the 1970's Dr. Fredrick Brock successfully treated people with strabismus using visual retraining techniques and his cases proved to refute the previous notion that stereovision could not be obtained after the critical period had passed. His success pushed Barry to pursue vision therapy in an attempt to finally experience what she had been missing all of these years.

"Perception is not something that happens to us, or in us. It is something we do." –Alva Noe, *Action in Perception.* In Chapter Five, "Fixing My Gaze," Barry depicts her experiences with her vision therapy program. Under Dr. Ruggiero, Susan performed multiple visual tasks all aimed at helping her focus her

two eyes at the same fixation point in space. "Smooth pursuit," "four-corners," and the "wall game" all seemed to be trivial to Barry as she began her treatment, but she soon realized that her progress at these simple games was gradual and often slow. In Chapter Six, "The Space Between," Barry introduces us to the simple device to which she attributes much of her success in gaining stereovision. Created by Dr. Brock in the mid-1900's, the "Brock String" has helped many strabismic people learn to fixate both of their eyes together at different distances from their face. Although the device is composed of only a bead on a string, Barry says that this tool was very helpful because it provided her with feedback as to where her eyes were pointing. With the help of the Brock string, Susan describes the small but significant strides she made towards coordinating her eye movements, and she explains with great excitement how great it felt to finally feel her eyes "moving as a team." Soon after, Barry had her first experience with stereovision at almost 50 years of age: "I got in my car, sat down in the driver's seat, placed the key in the ignition , and glanced at the steering wheel. It was an ordinary steering wheel against an ordinary dashboard, but it took on a whole new dimension that day. The steering wheel was floating in its own space, with a palpable volume of empty space between the wheel and the dashboard."

Through her success in gaining the ability to see in 3D, Susan Barry is living proof that the adult brain has the potential to learn, adapt, and change with the right form of training, something that was once thought to be impossible. She explains with great efficacy her perspective on how her brain learned to see in three dimensions and states that "vision therapy taps into the potential for stereovision that often lies dormant in a strabismic brain." Barry does not discredit past studies that have supported the "critical period" view on the development of stereopsis, but rather stresses the importance of careful experimental design when using animal models for strabismus and cautions future researches on the dangers of generalizing the results of animal experiments to human conditions. From her personal experiences with several doctors, Barry also portrays the need for communication between health

professionals, specifically optometrists and ophthalmologists, in order to provide patients with the best form of treatment. "Vision allows us to be active participants in our world, continually moving through it and molding it to our needs and our desires," Barry states and it is clear from her personal story that no one should be denied a chance to perceive the world in its fullest form, regardless of their age.

From enlightened to compassionate, frustrated to inspired, Susan Barry's personal story, as well as the compilation of stories from others with similar experiences, pulled the strings of all of my emotions. As previously eluded to, Barry's background as an educator aids in her ability to explain complex ideas about how the visual system and the brain work together in a manner that can be grasped by most members of the general public. She also provides a wealth of references at the back of her book in case a reader should wish to learn more about stereoblindness. My only concern with this book is that it can appear to present vision therapy as a "quick fix" to gain stereovision. The reader should keep in mind that this is a long and often frustrating process, and that in many cases people do not gain the ability to see in 3D. I would recommend this book to anyone who is stereoblind or has a loved one, friend, or acquaintance who is a strabismic. Additionally, all vision care specialist should read this book, as well as medical professionals in general. It truly sends the message that things are not always as they first appear, especially when it comes to matters of the brain.