

SEEING SPACE: UNDERGOING BRAIN RE-PROGRAMMING TO REDUCE MYOPIA

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Abstract

The author underwent myopia reduction from a spectacle prescription of -3.87 DS and -3.37 DS to -.50 DS and -.25 DS over a period of seven years. The essence of the program was passive adaptation to a series of weaker glasses and better vision in a reverse of the process of adaptation to stronger and stronger glasses and a more and more warped space world. General health work including nutrition, exercise, yoga, outdoor walks, postural training with the Alexander Technique, and advanced chiropractic were also helpful. The system worked because the practitioners and patient believed it could be done and did not overreact to transient bouts of less than 20/20 vision during adjustment periods. Active therapy was limited to six months of optometric office training to reduce the last diopter. Home therapy was monocular only and involved free space motor procedures.

Key Words

accommodation, Alexander Technique, ambient visual system, convergence, divergence, myopia control, myopia reduction, peripheral awareness, space volume,

I ntroduction

can still remember discussions with my brother when we first needed glasses at age 12; long wistful talks about the survival of the fittest and how we, with our nearsighted genes, were probably only allowed to survive childhood because of the invention of glasses. Otherwise, we would be run down by trucks or eaten by lions. Now, though, with our ophthalmic crutches we myopes could all go forth and multiply. That was evidently the reason that more and more of us appeared every year wearing glasses. Or was it? Yet when I told my ophthalmologist that surely God had not intended that evolution should lead to a human race so rampantly nearsighted, he assured me that whether God intended it or not, that was the way things were and anyone who said otherwise was a quack. I wasn't convinced, but gradually, as I lost more and more control of my vision, I started to believe him.

Many years later, when I went through a visual retraining program that reduced my then nearly -4.00 DS, OU prescription to practically nothing, I knew that ophthalmologist was wrong. Nevertheless, there are an estimated 60 to 80 million myopes in this country,^{1,2} most of whom go through similar experiences with no better help than I had. The purpose of this article is to suggest that this does not have to happen. It will address three topics: 1) the space changes that occur as one slips into myopia when no intervention is at-

tempted, 2) the type of whole body and brain re-programming that can reverse the myopic process, and 3) how an experience of learning to **see space** again shapes one's approach to treating nearsighted patients. A second article in a subsequent issue suggests a theoretical basis for understanding why myopia reduction of this kind works. It can be found in recent brain research on neuro-programming, plasticity, visual pathways, visual development, visual memory, and neuro-rehabilitation.

Functional myopia is not just an imbedded accommodative spasm³ and it is not just enlargement of eyeballs.² It is a reflection of the shrinking of the brain's space world by closure of the periphery, first by stress,⁴ and then by errors in spatial judgment induced by minus lenses. It is easy to observe this in children who are plunging deeper and deeper into nearsightedness. What has happened is that their space world has shrunk down to primarily central vision, so they cannot judge distances. The lenses induce such warped vision in the periphery that their brains have to screen it out. While stress and poor visual skills, nutritional sins and hereditary tendencies may have been the initial cause of their reduced periphery and acuity, the lenses deepen their dislocation in space. Lacking the periphery and experiencing the side effects of virtual images, they can no longer judge how far is far or where to look. So, naturally, they cannot see the chart clearly, and they frantically

accommodate and demand more and more minus in their lenses.

Increasing myopia is a learned brain program. It happens as a side effect of seeing virtual images centrally and blur on the periphery. Increment by increment, adaptations are made. Children going myopic are literally living in a “con-cave,” looking out at the world through the mouth of the cave, the center of the minus lens, unable to judge how far the chart is because they do not see anything around them or even between themselves and the chart. Their habits and the lenses have programmed their brains to think of vision as looking *at* something and seeing only that. To cure myopia, one has to re-program the brain to **see space**.

Remembrances of a Myopia Past

When I was a child, I understood as a child. I did not know that when people are under stress they “zero in” at near, stop looking far, and stop processing peripheral light.⁴ I figured out, though, that it was much easier to read and cast my eyes down than to deal with the hallways full of teenagers in my large junior high.

I noticed in eighth grade, when I sat in the middle of the auditorium that the people on the stage were blurry. I remembered that the year before they had been clear from the back of the auditorium where the seventh graders sat. I could still see the chalkboard but I failed the school screening. My first glasses were -1.25 DS, OU and with them I was given the power to see the veins on the leaves of the trees at astounding distances. Was this the good vision I had lost? After that I sat in the exam chair every year and demanded telescopic sight. I did not have words for the extra stress those glasses put on my accommodative system. I just took them off to read.

I did not know how to react to that panicky feeling brought on by the loss of clear sight. The inevitability of visual deterioration was the worst of it, with no way to stop the inexorable process of eyeballs growing longer and longer, I thought. I strained harder to see in the same way one might focus in dim light on tiny print at near. Soon I needed the glasses for the chalkboard as well as the auditorium. There was no one to tap my occipital bone and tell me to “see farther back in the head,” to “relax and look softly,” and to “hang on to the periphery.”

I felt I was an oddity, a genetic mistake, totally unlike all of my friends. Most people in those days had clear sight.⁵ Now we don’t, but our contact lens technologies and fashion frames have lulled us into thinking myopia, rampantly increasing as it is, is not such a loss. At age 12 in the fifties, though, it was socially and aesthetically catastrophic to become a myope. I was known as the “blonde bombshell” in junior high, but blondes were no longer bombshells in girls’ glasses with little rhinestones at the corners. Later, when frames were small black cat eyes, good looks were still elusive. With a prior self-image of beauty, I was suddenly caged in ugliness. I wore them only in class. The rest of the time I moved in a fog of vanity and became somewhat introverted. I stopped looking far. I felt my personality change behind my very eyes. My mother wondered what had happened to her “outgoing” daughter.

I was athletic and had won a letter the year before I became nearsighted. It was much harder to catch a ball with my glasses on. Things were smaller and closer than they were without my glasses, and I was in a different place. Behind my frames, I was no longer in the world, but looking into it, instead. There was fear of breaking glasses then, too. They didn’t have prescriptions in plastic then and the only contacts available to athletes were large, painful scleral lenses. Our babysitter wore them and my emmetropic mother looked at her coming up the walk, goggle-eyed, and said, “Poor Susan.”

My father was sorry that it was his “dominant” myopic genes that had made us so blind. He gave me a book by oculist Dr. William Bates on “better eyesight without glasses.”⁶ At 13 or 14, I faithfully did the exercises for three months, hoping to eliminate my then -2.50 DS with cylinder myopic correction all at once. I surprised my ophthalmologist that year because I did not get worse. He had predicted progression to age 16.⁷ In fact, I never did get worse until a whiplash injury at 22 put me over the -3.00 DS mark,⁸ and during my second pregnancy an appointment with an ophthalmologist unaware of hormones put me over the -4.00 DS mark at age 29.

Perhaps I even got better after “doing Bates,” but it was not part of my doctor’s model of vision to take minus away from a myope. I would “grow into it all soon

enough,” I heard him tell my mother. If perchance I was already fully grown, these would give me “extra help” when I learned to drive. Or so we thought.

I did not know that depth perception is affected by minus or that when one has to over accommodate, convergence is pulled in more or recalibrated. I just knew that space was so different in glasses that I wasn’t sure where things were any more. Once the driving instructor used his brake when I was certain we could turn without hitting those pedestrians.

I did not suspect that the higher the lens power, the more the periphery is warped by the lens, because light is focused for the benefit of foveal acuity at the expense of ambient vision. Nor did I understand that the more the periphery is warped, the harder it is to see the center clearly because you cannot judge how far it is without accurate peripheral cues. All I knew was that I didn’t feel safe driving. I could not see anything out of the sides of my eyes and had to whip my head back and forth and back forth and was in great danger of losing sight of the middle of the road. The driving instructor told me I had to keep my eyes straight ahead and not look to the side or I would drive off in the direction I was looking. I tried to do that, but it scared me so much I didn’t take my test until I was 20.

I thought glasses gave me good vision, though, because I could see the veins on the leaves of the faraway trees. I did not know that when you’re certain of what you see and where it is, that is good vision. All I knew was that I didn’t know *what* was there for sure without my glasses, and with my glasses I wasn’t sure *where* the *what* was. But I was a child.

When I was 21, my husband delighted me on our honeymoon by saying I was beautiful in glasses and, since I could not see him clearly across the table without them, he would be honored if I would wear them all the time. He was worrying about the risks of my hard (the old PMMA type) contact lenses because they frequently slid off my corneas when he was kissing me and had to be retrieved from somewhere awfully close to my brain. I was glad to get rid of them because I couldn’t read in them any more easily than I could read in my glasses. By then there was no longer any possibility of not wearing *something—except for reading*.

While I never read in glasses, I took notes in them. I sat through high school and college and graduate school in them. No one ever suggested a bifocal in class or plus spectacles over the contacts to read. I told two contact lens specialists in two cities that I couldn't read through my contact lenses. They both frowned and said "You *should* be able to read through them," and that was that when I was a child.

When I was 31, I was cyclopleged because another ophthalmologist thought my case-hardened coke bottle lenses were too strong. He gave me a -3.87 DS and a -3.37 DS, which I wore until I learned to reduce my myopia. I had to keep them by my bedside table, but I still took them off to read.

Then at 33 I took my oldest daughter to Dr. Amiel Francke in Washington, D.C., and was so interested in what this behavioral optometrist had to say about vision that I made an appointment for myself. Francke was the first optometrist I had ever known. I told him about my Bates experience. He explained that lens reduction must be gradual or it would be rejected. You couldn't just take off a strong lens all at once and see. He also allowed that he had a few more tricks up his sleeve than Bates. Indeed, he had managed to reduce his own myopia and that of many others, as well. One's "space world" had to change in order to do it, though.

I wondered what this meant at the time. Later, when I was wearing much weaker lenses, I knew. The space world is a mental perception of "how far is far" and "how deep is deep" and "how wide is wide." We can all measure 20 feet the same, but we all see that measured space in our own way. As I gave up lenses, I felt I was "pushing space out with my eyes." This new kind of looking occurred naturally, I wrote of it in my diary:

I seem to have pushed the horizon away quite a bit and it is still sharp and clear. I was getting very puzzled about how far is far? ...How do we know the farness that we see is the same as the farness that someone else sees? Physical space can be measured but visual space cannot. It is in the eye and brain of the beholder. Whose space is the true space? In my mind's eye I can shoot an arrow into the air and say, "It came to rest I know not where." In the reference frame of related things I can see what time it lands and where. And

so can anyone else in the vicinity. But what we each see when we say, "It went 50 meters" has no physical reality.

*It appears to me now that "On a Clear Day You **Can** See Forever."⁹*

That was a jarring perception for one who had lived in virtual reality for 25 years. There were many such perceptions as space expanded side to side, up and down, out in front; as color sensitivity increased; as stereopsis became more precise farther and farther away; as relationships in space were viewed all at once; as memories of the long, slow fall into myopia reawakened; as posture and energy levels changed; and as the new views changed patterns of thinking.

I discovered that each minus lens has its own virtual world that is achieved by the interaction of the individual and the optics of the lens, and once one adjusts to that lens, one is looking into that world and has learned a new brain program of spatial perception. The compressed view then continues one's need for the lens. That view is the force that maintains the positioning and focusing of one's eyes as if items in space were much closer than they really are. The deep three-dimensional reality of good vision becomes, in subtle ways, a two-dimensional image of reality in minus lenses. Even in contacts the spaces between objects are visually compressed.

To begin the process of giving up lenses and learning to see well again, my crisp 20/15 correction was exchanged for one that allowed flexibility at the middle of my range of 20/20. Besides locking me into a compressed space world, the 20/15 virtual vision did not let me perceive the momentary fluctuations of clarity at distance that a visually normal person experiences. I had forgotten how to converge at varying distances of "far" and refocus with just a blink of the eye. As I wore the weaker lenses, I became aware of these just noticeable differences (the JNDs that we train patients to see) and my brain learned to refocus my eyes far away in order to clear the view. It is simply not true that there is no significant visual difference between the 20-foot exam distance and infinity, except possibly from behind strong minus lenses.

Lens reduction is truly brain re-programming. It changes the world as one knows it and one's relationship to it,

yet it works even when one moves as slowly out of lenses and with just as little effort as one moved into them. It can also happen faster with high impact prism procedures and forced adjustment to weaker and weaker disposable contacts. Since I had no time or money for office training at first, I was put on the gradual lens reduction plan. The key to success was wearing reading glasses. The lenses did the first 2.50 DS reduction for me.

From 1975 to 1983, with Francke's help and that of Dr. James Blumenthal (when I moved to Illinois in '77), I adjusted to weaker and weaker lenses and learned to **see space**, until by 1983 I was wearing no lenses, or occasionally a -.25 DS and a Plano in spin-cast soft contacts. Office training for the entire process was limited to six months with Francke when I was in Washington again in '81 and '82. I kept a diary for that part of the process⁹ so I have vivid memories of what it was like to give up that last diopter.

The whole experience was so fascinating and changed my vision so radically that I decided to become an optometrist. I wanted to be certified to use and explore the enormous power of lenses to change perceived space, to change vision, to change the very functioning of the brain.

That was a new world for a former high school English and social studies teacher. I needed two years of pre-optometry credits before I could even begin. Finally, in 1985, I enrolled at the Illinois College of Optometry (ICO) and it became Blumenthal's task to help me hold the good vision during four stressful years there. I had already learned that lenses are brain-changing, brain-programming devices because they shape and control the light patterns hitting the retina and therefore the signals from the light coursing through the entire brain and influencing the entire body. They can make our vision worse or they can train us to reduce our myopia and **see space** differently.

My program for myopia reduction is described below. It no longer seems unusual to me because many of my own patients, as well as those of other optometrists, are doing the same.

Training to See Space

My training consisted of three phases: *First Phase, 1975-1981: Lens reduction without any specific training techniques until I wore a -1.50 DS and a -1.25 DS*

spherical prescription. Prior to '75 I wore a -3.87 DS and -3.37 DS with a small amount of against the rule cylinder. That Rx was based on a cycloplegic refraction in 1973 that had already cut me from my old -4.25 DS with cylinder OU prescription.

Second Phase, 1981-82: Office training with Francke for two three-month blocks of two one-hour sessions per week, with one month free between, and two months of a home program after. This took me down to what I now wear for good distance vision (-.50 DS and -.25 DS in spin-cast soft contact lenses). These lens powers were determined by retinoscopy, as well as the subjective refraction. When I left Washington, I was also wearing a +.25 DS pair of training spectacles over my contacts for walks, and getting excellent vision most days. During that year every lens cut was first practiced with plus spectacles cancelling out minus before I actually received new contacts. Even with no lenses at all, I was comfortable at the beach that summer, seeing numbers on the sailboats, addresses on the houses across the street, white caps on the bay.

Third Phase, 1983-89: Further Rx reduction with Blumenthal in Chicago to a -.25 DS and a Plano, and then a struggle to hold my gains. For six months I wore nothing on either eye except to read. There followed a private tutorial with Blumenthal on myopia control during two years of pre-optometry classes and four years at ICO. My vision held up fairly well through the first year and a half of optometry studies. Then there was some slippage in spite of our efforts, but now I am back to where I was in 1982 when I left Washington. This entire phase involved no actual vision training, just lens control.

First Phase

I reduced my need for minus prescriptions by gradually adapting to weaker and weaker lenses in the reverse of the process of adaptation that led me into serious myopia in the first place. No visual therapy techniques were used; only weaker lenses and reading glasses a half diopter weaker than my distance Rx. Nutrition, exercise, outdoor walks, good light, yoga and postural training also played a role, I am certain. I followed a careful diet and took megavitamins prescribed by a biochemical geneticist for another health problem and they improved my vision as well. I was ready for a lens cut three weeks after I

began the nutrition program.

I maximized activities outdoors. I was directed to walk frequently and wear large, comfortable shoes to prevent my toes from curling up and to keep the tripod of my footbones grounded for better proprioception and kinesthetic awareness. I also gardened without my glasses, especially on days before I made trips from Champaign to Riverdale to see Blumenthal for further lens reduction. I had full spectrum lights for my kitchen and bath. Space and light became a regular part of my life, which is unusual in modern city dwellers. I find it very difficult to get my Boston area patients to go for walks outdoors, yet when they do, they tell me in great surprise how much this helps their vision.

Binocular alignment at distance improves if there is some reason to look far and there are moving targets to watch.¹⁰ I would add that movement of oneself in space has even more advantages than spotting moving targets. It engages the whole body and brain along with the eyes, waking up the ambient visual system and stimulating peripheral motion detectors in the retina.

Besides my walks, I swam three times a week and did yoga other days. I meditated. I was home with small children, doing physical work and reading a lot. Two of those years I took evening college courses in science and math. Happily, Blumenthal refused to give more minus, so I sat in the front row in chemistry class. I learned that lecture hall vision breaks down first, not distance vision in the real world.

While in Illinois, I had Alexander Technique lessons which also helped my vision. This Technique is a form of postural reeducation, developed by F. M. Alexander,¹¹ who had been a Shakespearean actor with a voice problem. He discovered that the position of his head, neck and torso affected his voice and he learned to control it. He called this the "primary control mechanism" for posture and movement. Soon he was helping other actors and then people in other fields who heard of his success, including writer Aldous Huxley,¹² famed philosopher of education, John Dewey,¹³ anatomist Raymond Dart,¹³ and Nobel winner in medicine, Nicholas Tinbergen.¹⁴ All wrote praises of the Technique, which is now a complex hands-on body therapy system¹⁵ requir-

ing three years of intensive daily training for practitioner certification.¹⁶ The essence of the system is that the teacher, with subtle and firm touch, effects a change in the student's habitual posture which allows greater ease and energy economy in sitting, standing, and walking. One does not consciously try to change oneself, but rather "leaves oneself alone" and lets the teacher create a kinesthetic experience of proper body alignment and movement. Once upon a time, most of us had that "good use"—it is instinctive in healthy babies—but it gets warped by the stresses of childhood and youth, as well as by imitation of poor parental posture and by computer use.

After a lesson, one's brain tries to recreate the kinesthetic experience of correct posture because it is so much more pleasant and efficient than the habitual warp. With subsequent lessons, which are all kinesthetic experiences of better "use," the student gradually changes his habits of movement and stance; his "use of self" as Alexander called it.¹¹

A trained student can then achieve the improvement on his own with just a little attention to "direction" of his thought or awareness. Long-term stress causes one to revert to worse posture, though, just as it causes worse vision.

I also learned that "end gaining"¹¹ to get a project or some physical work done without considering Alexander's "means whereby"¹¹ led to slap-dash patterns of poor use that aggravated my vision problems over the years by draining energy and locking in poor posture. I discovered that I had often done things I "had to do" without really committing myself to the process and that this led to a tendency to be mentally somewhere else, and unaware of the ideal "means whereby." I would, as I put it, "hurry to get something done without really being a part of what I was doing."⁹

Both the vision changes and the Alexander work trained me to be more aware, to "be here now" in the present moment. Minus lenses have a tendency to remove one from the scene, to make one an onlooker, I concluded. Before I reduced the lens power, though, and trained to see "volume" wrapping around me, I never imaged that my space perceptions were warped in any way.

Alexander teachers do find that vision improves as patients continue lessons and

often lens prescriptions need to be reduced or further postural improvement is impossible.¹⁶ In his appendix to *The Art of Seeing*, Aldous Huxley reports that F. M. Alexander recorded cases of some myopic children who recovered normal sight when they learned proper head and neck alignment.¹² Darrell Boyd Harmon, too, emphasized the posture/vision connection.¹⁷

I know from experience that posture and vision are interactive. Neck tension is one of the major things that was released with Alexander Technique. Getting my neck “free and back” and my “energy up” reduced the amount of lens power that I needed to see clearly and reducing lenses, in turn, further reduced my neck tension. The best way to observe this interconnection is to wear some excessively strong lenses and be aware of the change in posture and feelings in the neck area. Or one can sit at a computer all day with chin up and neck thrust forward and note the blurry vision at the end of the day, as well as the stiff neck. Perhaps this warped VDT posture occurs because most people were more practiced at converging in downgaze prior to the rise of computers, so they simulate that position while facing straight ahead at the screen.

During those years of myopia reduction I was not using computers. I only read or typed. I placed a board across the arms of my reading chair like Thomas Jefferson, and propped the book parallel to my face to avoid leaning over my lap. Whenever my reading glasses became clear enough to see at distance, they became my new distance glasses. My distance frame was recycled into new reading glasses a half diopter less than the old reading prescription. As far as I know, I was exophoric, so theoretically plus should not have worked.¹⁸ Yet I reduced my lens power this way significantly. I was still so insecure in space, though, that I needed to keep my glasses at my bedside in case a child awoke at night.

Second Phase

I was back in Washington for a year and did six months of in-office training with Francke. During the first two months of the office program I also did one hour a day of vision procedures at home. The rest of the year I swam, walked, and observed my vision daily. I cut nearly all the rest of my lens power and learned to **see space**, as I described it.⁹

The first week in the program I was referred out for soft contact lenses of -1.25 D OU in a specified brand that allowed full-spectrum light into the eyes. Luckily they fit. The office training was all done in free space with training lenses over the contacts. No office procedures were done without lenses, yoked prisms in all directions, or pairs of dissociating prisms that created vertical diplopia. The procedures coordinated specific body and eye movements while demanding better posture, peripheral vision, and sharper kinesthetic and proprioceptive awareness. Most of the office procedures were binocular and were done standing or moving *with the shoes off*. Gradually, 12 home procedures¹⁹ and 10 office procedures²⁰ were given. Some of these were Francke originals, others came from the late Dr. Bruce Wolff. The home procedures were gross and fine motor activities involving posture, movement, proprioceptive awareness, and timing for one hour of daily home practice. They were all monocular and included movement of body and hands while fixating a target and forcing constant peripheral awareness until I could appreciate details and organization of space in the periphery.

The motor approach to vision therapy for myopia reduction worked and it is theoretically sound. It has long been noted that in the treatment of amblyopia the hands must be involved along with the eyes in order to establish good vision in the amblyopic eye.²¹ It is also recommended in the optometric literature that relearning for a head injury patient must use movement to expand the collapsed space world of the patient.^{22,23} This is because both of these conditions involve spatial awareness problems. So does myopia, I would argue, because of what minus lenses do to an individual's space world.

I had numerous “critical empathy” experiences as my brain reorganized its processing of space.²⁴ I saw space visibly expanding so that the interior of my house was bigger than I had known; my children were shorter; I was taller; the kitchen chopping board I used was farther from my eyes. Out on the Mall, the Washington Monument became taller and taller and the volume of space within the Botanical Gardens expanded enormously. My eyes seemed to “go back and back amongst the flowers.”⁹ I could pull up to the five-way intersection on 7th and Pennsylvania and

see the whole area and all the incoming streets in one glance.

One incredible evening, “the apparent motion” of the trees and hedges around the U.S. Capitol and the Supreme Court building where I walked caused me to perceive distances in new ways. I noted that the apparent speed of the stationary objects that seemed to move past me and around each other was all related to their distance from me as I walked past them. Walking under the arcade around the Capitol it felt as if the pillars were whizzing by. Down on the Mall the pavement rolled under my feet and the stars floated across the sky.

When I stabilized this new world again, it was a vast, mysterious, and beautiful place with tunnels of deep space under the overarching trees. The light was different—more mellow—and objects were rounder and fuller. Things seemed “more real.” All of these experiences were thrilling and released a great deal of energy that had evidently been locked up in maintaining my old virtual world. Then with each incremental downward shift in lens power there would be another major adjustment and further perceptual change. The lens reductions were the driving force for change.

During my training, the only props besides the lens changes and prisms were an eye patch, an 8-foot 2" x 2" walking rail, coins, straw, string, dowels, a silver wand, and a set of parquetry blocks. The thrust of Francke's training was to motorically re-program all parts of the brain for motion and spatial awareness simultaneously. In other words, to reawaken and enhance the ambient visual system and coordinate it with the central focusing and vergence mechanisms, as well as with the other senses. Bilateral motor equivalency was emphasized.

After about three months I did almost no home procedures. However, I continued to swim “the crawl” daily as fast as I could for 1/2 hour, breathing on alternate sides, and walked at least an hour outdoors, working on **seeing space**. Specifically, I learned to see large things like the front of the U.S. Capitol or the Washington Monument at 90 degrees to the east while I faced north or south by the reflecting pools on the Mall. I worked on intermediate sized objects, learning to see the colors and types of parked cars along East Capitol Street while I looked ahead down the sidewalk. I also worked on smaller de-

tails seen in peripheral view, like the face of my husband as he walked with me, faces around the dinner table, and faces of people sitting next to me on the subway.

I practiced looking farther than I believed possible, and adjusting neck positions, posture, and the flow of walking, to improve the vision. I focused and refocused my eyes to clear signs at different distances in ever weaker lenses. It became a game. I felt like Superman with x-ray vision. I couldn't see through walls, of course, but I could clear objects that had been behind the wall of my blur boundary. It was as if my vision went out to them and penetrated through the fog with just the blink of an eye. The horizon was clearer and clearer, farther and farther away.

I frequently wore +.25 DS or +.50 DS training glasses over my contacts for walks in order to push a shift to less power outdoors before I was ready to actually accept a weaker lens. I wore +.50 DS, OU, +.75 DS, OU or +1.00 DS, OU for reading, depending on comfort and my level of adaptation to the latest reduced contacts. I was not presbyopic at the time. All spectacles were in lightly tinted plastic frames to allow peripheral viewing. My contact lenses were gradually reduced in power, usually one eye at a time. I never read without plus spectacles. During part of the program I did not read at all in order better to explore three-dimensional space.

I had additional help from two more Alexander Technique teachers and a cranial chiropractor for re-programming my body balance. Cranial chiropractors treat a neurological programming fault known as "ocular lock."²⁵ As I worked through my old whiplash injury and other anatomical problems, I learned that good posture, hip and neck alignment, and subtle patterning in the nervous system are all crucial to good vision.²⁶ Periphery is wider if the ears are even with the shoulders instead of poked forward, but it is more than that. I noticed that I could noticeably improve my distance vision by moving my neck up and back, lowering my poked chin. I could blur it by raising my chin and tilting the top of my head back.

The latter is a posture typical of many myopic patients. It may result from poor distance or near convergence skills which are being supplemented by overaccommodation. When focus fatigues, the head goes back and the eyes go down to maintain single binocular vision

if it is easier for that individual to converge in downgaze. The relationship of the accommodation-convergence synchensis to the "primary control" head-neck-torso position of Alexander needs to be researched.

With the office training, I dropped another diopter of myopia. It is, by the way, the last diopter that is the hardest to give up. Everyone I know who has reduced some or all of their myopia says that "it is quite easy to get down from the high numbers." The last diopter is the *myopic core* and tiny increments of lens power have a major impact on clarity of sight and organization of space when one is -1.00 DS or under. This may be a myopia that was developed to make reading tasks easier when the sympathetic nervous system was flooding out normal accommodation under stress or during excessive attentional near work.^{27,28,29} Or it could be myopia that resulted from a divergence excess provoking the need for accommodation at distance to maintain single vision. Whatever the cause, this is the myopia that is lurking underneath all the layers of lens reductions, waiting to be uncovered and cured.

The last diopter was not just a matter of relaxing focus. I had to learn to *look far*. I discovered that distance vision required a variety of timed converging and focusing eye movements, the accuracy of which was enhanced by **seeing space** (expanding the periphery horizontally, vertically, and between oneself and the object of regard) so that one knows where to look. But **seeing space** is partly from the looking. It is a circular process and depends on both the central and peripheral vision systems. In strong glasses, though, one's ambient system is compromised. **Seeing space** is also somehow enhanced by visualizing the space behind one. I believe this is what breaks down the mental pattern of looking into space from outside, from behind the glasses.

In weaker contacts I "slipped into space again." That year, as I discovered the new view, I described my old visual experience as one of being "knocked out of space" and the new vision with minimal lenses as "slipping into space." That is literally how it felt to see differently, and I would "slip in and out of space" for a time until I discovered the mental attitude of being present. This is visual and perceptual. One minute I would see a vast expanse of space

stretching clear before and around me. The next minute I would be in a two-dimensional universe again with everything compressed. I compared my old view to "seeing as through a glass darkly," and the new to "seeing face to face."⁹ One of my patients described her life before she trained out of her minus lenses as "only watching a movie of my life and not actually participating in it."

The major changes in my vision were not so much in clarity, because one can obtain that in lenses, but in "volume" of space perceived. Objects were more solid and one fixation gathered more space. Spaces between things stretching in front of me were clearly visible and the distances were greater than I had imagined. My ambient vision was so enhanced by the prism training, the forced peripheral awareness, and the outdoor viewing that I was able to overcome the space world of minus lenses and recover a world of light—wide and deep and high, intensely beautiful, and wrapped all the way around me. It was quite different from the telescopic sight in my "strong, old, cold lenses," as I put it. I wrote in my diary then that my brain was being "re-programmed" to see in a different way.⁹

After this training, I became a vision therapist for a clinic in Chicago and had no trouble doing any of the procedures used in classical therapy, though I had never done them before.

Third Phase

This was done with Jim Blumenthal again in Illinois. On a home program, I cut the -.50 DS and -.25 DS that I left Washington wearing down to Plano OU with primarily "deep wink" and long walks. I wore no distance lenses for about six months until I went back to school. Then I began to notice the beginnings of the old myopic process under stress. I had to increase my lens power to -.25 DS and Plano. I realized that just a tiny amount of power could make a huge difference. I decided that many eye doctors were guilty of much overkill. Nevertheless, over the six years in school I had to fight to keep from resorting to stronger and stronger lenses, and I did not totally succeed.

Training had taught me that clear vision past 20 feet is not an automatic perception process but an active motor process. The constant refocusing and subtle convergence adjustments take energy. This is enhanced by peripheral awareness,

which is the first thing myopes sacrifice when stress is depleting their reserves, and when nearpoint is the all-consuming arena of action with no time to walk and look far. I can remember riding down Chicago's Lakeshore Drive on the bus with a backpack of heavy books, trying to "hang onto the periphery" and realizing that it took energy that I did not want to expend.

I had no time for vision training, so we tried gas permeable lenses, but I could not wear them. To slow the deterioration while I was in optometry school, I wore a bifocal over my soft contacts. It had a -.25 DS on top for classroom viewing and a plus add for in-class note taking. These provided constant training. If I could relax to be comfortable in the add at near, I could easily clear the lecture slides. If I were tempted to remove the plus at near, I knew my lecture hall vision would be worse. I had to force myself to clear the plus to get the distance back. Now I spend a lot of time on patient education regarding the purpose of bifocals and reading prescriptions, and why it is important not to take them off if they start to get too blurry at near because of stress myopia. I also prescribe separately for classroom vision and everyday vision.

Before I was presbyopic, I had several different powers of plus spectacles for reading, with and without my contacts. Later, in stressful situations, my new presbyopia became temporarily worse. My exophoria increased, but at times of extreme stress I tested esophoric. By fourth year, I wore a special against the rule astigmatic prescription over my contacts while doing binocular indirect ophthalmoscopy (BIO).³⁰ I kept them in my BIO case and used them *only* to see the peripheral retina. After I graduated I got a headache the first time I used them. I no longer needed cylinder. Neither could I wear the -1.00 DS and -.75 DS contact lenses that I wore my fourth year at ICO. I cut back to -.50 DS, OU.

My vision, though, became -.75 D worse again when I was first in practice working seven days a week in windowless exam rooms and sitting on an elective local school council many evenings. I saw Francke in May of 1990 and quickly cut back to a five-day work week. It still took a while to recover, though, because I did no training. I swam, but took no time to walk, in spite of having learned in Washington that "*when my vision worsens I can*

retrieve it walking."⁹ Unfortunately, the myopic solution to nearpoint stress and the habit of "end gaining" was in my brain program longer than **seeing space**.

Finally, by 1992, I was back to wearing the distance contacts Rx of -.50 DS and -.25 DS that I wore when I finished Francke's office program in 1982. I wear a Plano with a +1.75 DS (.25 extra plus) bifocal add over those for lecture hall vision.

Since I have learned to **see space**, a -2.00 flipper reveals a visibly flat and warped distance view. A -3.50 DS or a -4.00 DS is a swimming blur, the way my father's glasses seemed to me when I was a child. It is hard to believe I spent years looking through them. How was it possible?

By gradual, stealthy adaptation.

How did I get out of them, then?

By gradual de-adaptation.

"Undercorrection" during periods of "stress myopia" is comfortable for me because, since I had the office training, I do not rely as heavily on central acuity. My ambient vision, while not as good as it was before optometry school, is still so enhanced that I feel secure in space even when the signs are fuzzy. **Seeing space**, very different from having 20/20 sight, is the "vision thing" which is lost with strong lenses when central sight is all we optometrists prescribe for. Regaining it is what makes reducing and controlling one's myopia worthwhile.

The main thing I learned besides how to **see space** is that vision is a very flexible process and it is important that myopia control and reduction be an ongoing project for all functional myopes. There will be ups and downs because of stress, but vision can move towards better, as well as worse, if we take the long view and don't fixate on Snellen acuities or retinoscopy from a particular day. My own patients have reduced their myopia much faster than I did but *what is significant about my experience is that most of my lens reduction was done without any special effort other than faithful wearing of reading glasses, lifestyle changes for better health, and alertness to the need for prescription reductions. It could be duplicated easily with large numbers of functional myopes in primary care practices.*

Reflections on Myopia after Seeing Space

Whenever I am considering a minus lens increase for a progressing myope I think of Ray Bradbury's story, "The Man in the Rorschach Shirt," about the psychologist who got new glasses and suddenly saw only "pores." Losing his more holistic insights, he said: "Have you ever thought, did you know, that people are for the most part pores ... Pores. A million, ten billion ... pores. Everywhere and everywhere. People crowding buses, theaters, telephone booths, all pore and little substance. Small pores on tiny women. Big pores on monster men ..."³¹

The experience of giving up myopia has made me very conservative in lens prescribing, especially in new myopes. I see that our instruments and darkened rooms and the myope's tendency to accommodative spasm lead us to frequent overdosing with minus. This then unfortunately determines forever after that person's brain program for **seeing space**.

Arnold Sherman describes myopic progression as the process of the patient's visual system transforming itself so that it is suited for near, if flexibility is not possible. Then:

*When an adaptation is decompensated (by stronger minus lenses), a readaptation will occur in order to achieve steady state performance at near tasks, resulting in a further increase of myopia.*³²

He calls the continual prescribing of more minus without any intervention the "iatrogenic" cause of myopia. I would add to what Sherman has said that the adaptation to stronger and stronger minus lenses is a brain program and that reducing myopia is necessarily brain re-programming. It is the restructuring of one's entire perception of space, of where things are, and what size they are, and of how one's eyes respond to that motorically. It is my experience that minus lenses cause both the ambient and focal visual processes to be repatterned so that the resulting world is no longer the "space world" that one sees and the translation between the two is a constant effort that wastes brain energy. But I did not know this when I was a child. I didn't know it when I was grown up, either, until I had reduced enough of my myopia to see it.

Now, I explain to patients that when we prescribe maximum minus for central

acuity we sacrifice more of their ambient vision, more of the periphery. We also take away the comfort at near they have unconsciously achieved by becoming more myopic. If we increase minus we have to cancel it off at near with reading lenses in order to hold the line on further deterioration. If I must increase minus, I give separate lenses for the classroom with as little extra power as possible. Patients are instructed to sit in front where they "won't need binoculars." I tell law students that I am giving them just enough minus "to take the edge off their panic" in class, so they don't accommodate and make things worse. They are to wear it *only* in class in a bifocal prescription. Outside, they go back to their habitual Rx. If there is any plus acceptance, they get computer glasses as well. While there are those who will not budge from their need for more and more dioptric power for full-time wear, most people, I find, are eager to stop the process if someone will show them how. Others, though they are few, even want to attempt a reduction program. I warn them it is very long and very slow and involves many shifts in lenses. We can do it more easily now, though, with disposable contacts than when I was going through it in the '70s and early '80s.

"You train a patient whenever you put a lens on him," Francke told me. That means you change programs in the brain. Why not train patients into weaker instead of stronger lenses? Even if it takes seven years, that person can be changed for life.

In some cases, as Dr. John Thomas has suggested,³³ strong lenses may even *cause* tissue changes. We know from research with chickens and monkeys³⁴ that a blurry image on the fovea causes increased axial length and stretching in the posterior pole like that in some hereditary myopes. It also may be true of humans, as observed in identical twins.³⁵ Thomas speculates that it may be the blurry image *created by the high minus lens distortion at the periphery that causes myopic degeneration and eyeball stretching*. Indeed, in chickens "only peripheral field occlusion is necessary to induce a myopia shift, while the central retina is receiving sharp images," Crewther, Crewther, Nathan and Kiely reported.³⁶ Elio Raviola and Torsten Wiesel speculated years ago that "the retina exerts a control on eye growth by releasing regulatory molecules whose production is influenced by the pattern of light stimula-

tion."³⁷

Overall eye enlargement and increased axial length does exist in high myopia.³⁸ We automatically assume, though, that it is the elongation of the eye that occurs first, in some spontaneous manner, *causing* the myopia, *causing* the light to fall short. We think of this enlargement or elongation as the definition of myopia. We need to entertain the thought that myopic changes in the eyeball could develop secondarily from chemical signals put out by a retina responding to central blur caused by other factors such as accommodative spasm. This could then be compounded by blur in the periphery caused by the very compensatory minus lenses that are supposed to correct the problem.

We need to examine our model of vision again in the light of retinal research, successful myopia reduction, and a great many cases of multiple personality where, depending on the personality in charge, the glasses can vary in prescription quite significantly.^{39,40}

Luckily, I never did develop major retinal changes that we see in high myopes. I never wore my lenses full time because I could not read through them and I read a large part of every day. That also may be why it was relatively easy for me to train out of them.

Because of my own personal experience that myopia can be reduced, and because of the fact that many of my patients also reduce their prescriptions during or at the end of therapy, and because others report similar results,^{41,42,43,44,45} I had to evolve a model of vision that included traditional optometry as well as the new insights. Vision, I now see, is an intensely adaptive process, in which unconscious choices are made, depending on what solution is most useful for meeting an individual's visual demands, within the specific life, health and stress conditions he faces. Myopia is a good solution at near for the person who can't avoid close work and doesn't have the energy to stay flexible. Unfortunately, the same plasticity that allowed the myopia to develop in the first place remains after the minus lens is introduced to recover distance sight. Minimal prescriptions, therefore, are probably a better idea than a lens that recovers crystal clear distance again at the expense of comfort at near. I use plus at near as a counterforce to substitute for the adaptation so it need not occur. I am happier when my

lenses can be tools for change or prevention rather than compensatory crutches.

When we use lenses only to compensate for problems, we have thrown away our healing power, which is great, because we have at our command precision modifiers that shape, direct, and give controlled doses of the very stuff of the universe, which is light. They are awesomely powerful and optometry is the only field that has sufficient understanding of their use to apply them in a truly healing manner.

John Streff reminds us of the power of our tools.

*Lenses interact with the body motorically and affect timing. They are light transformers that amplify or dampen selectivity, size, distance, distribution of light to the eyes, and affect the ambient/focal balance of the system.*⁴⁶

The optical bench model distracts us. It makes us think that distance vision is a passive process of light falling on the fovea. It isn't. As I learned during my training, "vision is a motor act," and if patients realize this they are empowered to work on their vision. I never tell them they have long eyeballs. That is so fatalistic, so permanent, so mechanical, and so often wrong. The lenses we prescribe, if we believe that, are likely to be too strong to stabilize the system because we are going for precision in foveal focus instead of overall balance in a total system. We may even be creating tissue changes, just by blurring peripheral light, relative to the sharp focus we are delivering to the fovea.

Full minus also takes away an individual's ability to refocus at distance so that far vision does, indeed, become the passive process we have believed it to be. In addition, we recalibrate the whole accommodative and convergence system around that lens. How one perceives space, where one thinks objects are, has a large impact on how one's vision operates, I learned. The deep three-dimensional reality of good vision becomes, in subtle ways, a two-dimensional image of reality in minus lenses. Even in contacts, the spaces between objects are visually compressed, but only patients who get weaker lenses ever realize it. The virtual images have created a new brain program for spatial relations. Distance is brought in as if it were at near. The brain adjusts. If one wants to get out of minus lenses, one has to *intervene at the level of the brain program*.

This is my fundamental assumption based on experience. There are ways to do this, but they must all be done at once, together. A single factor, such as a bifocal, does not cut it. Lenses for different purposes, though, are a key part of any brain changing program.

In an article under preparation for the JBO, I discuss the brain and vision research which explains for me how it is possible to give up minus and learn to **see space** again. There is ample evidence that this kind of change is probably due to enhancement of the ambient visual system through peripheral awareness training, simultaneous movement training of eyes and body, stress management, and mental processing changes.

Many other professionals do myopia reduction—body workers of all types, yoga teachers, naturopathic doctors, and psychologists.^{47,48} Since lenses and prisms, combined with movement, are the most efficient tools for the space world expansion that reduces myopia, optometrists should be involved. We need to demonstrate the use of our tools for the healing of vision. Otherwise therapy will be taken away from us in the marketplace of health by healers who do.

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