# A SENSORY INTERVENTION FOR VISUAL PROCESSING DEFICITS USING PRECISION COLORED FILTERS

BY HELEN L. IRLEN, MA, BCPC, LMFT

**HELEN L. IRLEN, MA, BCPC, LMFT,** is an internationally recognized educator, researcher, scholar, and expert in the area of visual processing problems. Ms. Irlen has been in the field of education for over 40 years, with a background as a school psychologist, licensed child and family therapist, educational therapist, board certified professional counselor, and founder and director of the adult learning disabilities program at California State University/Long Beach. She is currently founder and executive director of the Irlen Institute, which has over 174 affiliated Irlen Centers worldwide and over 7,000 educators trained as certified Irlen screeners. Her method for treating visual processing deficits is used in 54 countries. She is the author of *Reading by the Colors* and *The Irlen Revolution: A Guide to Changing Your Perception and Your Life – How a Simple Method Can Change the Lives of Children and Adults with LD, AD/HD, TBI, Dyslexia, Autism, Headaches, Medical Conditions,* and *Much More.* Please see **www.irlen.com**.

*I believe my distorted and fragmented perception is one of the major reasons for my problems. I hope a better understanding of how I see leads to new ways of treating those of us with autism.* – Heidi, ASD client

The number of children identified with an autism spectrum disorder (ASD) has risen dramatically in recent years and is expected to double again in the next decade.[1] The US Centers for Disease Control and Prevention (CDC) estimates that nearly 1% of children across the country have some form of autism – 20 times the prevailing figure in the 1980s.[1] In California alone, the cost of state-funded developmental services for people with autism has climbed more than 300% over the last decade.[1] There is no agreement on what causes autism, and there is no blood test or other biological marker. The growing number of children diagnosed with ASD raises issues for families, educational systems, governmental entities, and researchers.

Although individuals on the autism spectrum share the same label and sometimes the same behaviors, they often have different underlying causal factors. ASD is thus a complex disorder to treat. Treatment for ASD often necessitates a multidisciplinary approach that addresses biochemical abnormalities, food allergies, heavy metal toxicity, cholesterol, nutritional deficiencies, and/or immune system dysfunction. Hyper- or hyposensitivity to what the ASD individual sees, hears, smells, touches, and tastes may also need to be addressed because one or many of these areas may contribute to the individual's difficulties. Although the number of therapies available has increased, families are often unsure about which therapies are most indicated for their child. Moreover, some therapies are not covered by insurance companies or are not provided by the educational system. Individuals with ASD also may benefit from one therapy or a combination of different therapies. Therefore, it can be confusing to know which therapies to choose and in which order. While parents work toward and hope for a cure, those who live with ASD also need more immediate solutions.

When it comes to sensory sensitivities, there are therapies to address tactile and auditory sensitivities. However, visual processing deficits frequently have been overlooked within the ASD population.

A survey conducted in 1994 by the Geneva Centre for Autism in Toronto, Canada, found that 81 percent of those on the autism spectrum reported distorted perception. The most common problems were difficulties with depth perception; distorted perception of size, shape, and motion; seeing only small details and not the whole; and visual overstimulation.

In this article, I confirm the existence of sensory processing deficits that are visual in nature and seek to help parents and professionals see the world through the eyes of those with ASD. The article outlines areas of visual difficulty and describes the limitations that visual processing deficits impose on functioning. I also review relevant research, describe how to identify visual processing deficits, explain a brain-based treatment for addressing visual processing difficulties, and provide simple environmental modifications that can be implemented at home and in the classroom to reduce visual processing deficits.

## RECOGNIZING SENSORY AND VISUAL PROCESSING DEFICITS

Rimland in 1964[2] was one of the first to talk about sensory processing disorders, and a theory of sensory dysfunction was formulated by Delacato in 1974.[3] For some time, however, recognizing and addressing sensory processing deficits was considered a low priority for those with ASD. One reason may be that the current *Diagnostic and Statistical Manual of Mental Disorders* of the American Psychiatric Association (DSM-IV-TR) focuses on communication, social interaction, repetitive motion, and restricted interests as the main areas of impairment in people with autism. The edition due to be published in 2013 (DSM-V) will broaden the definition of autism to include sensory integration deficits as part of the criteria for diagnosis. This should more firmly establish the fact that people with ASD perceive the world differently and that treatment of sensory processing difficulties should be an integral part of working successfully with people on the autism spectrum.

Unusual sensory experiences have been reported by ASD adults and professionals for years. Well-known adults on the autism spectrum such as Temple Grandin[4] and Donna Williams[5,6] mention sensory sensitivities as major issues and underlying causes for some of their behaviors and inability to function. Other authors have written books that explain how those with ASD see, feel, hear, and think about the world differently and how this affects their ability to interact with the world.[7-9] Once one begins to see the world through the eyes of someone with ASD, it becomes easier to understand the reasons behind the behaviors often associated with ASD. The ASD adults we work with in our clinics frequently state that their behaviors are symptoms, saying, "Thank you for recognizing and removing my sensory processing difficulty. Trying to change or control my behaviors so that I look more normal to you without addressing what is causing those behaviors really doesn't change my ability to function and feel better."

Those with visual processing deficits describe their world as distorted, fragmented, frightening, and threatening: "It is like swimming against the tide and not with it. People look like things thrown at me through the screen of a 3-D movie, and I don't feel safe. Nothing is together, and everything is in pieces, and I must retreat into my own world." A survey conducted in 1994 by the Geneva Centre for Autism in Toronto, Canada, found that 81 percent of those on the autism spectrum reported distorted perception.[10] The most common problems were difficulties with depth perception; distorted perception of size, shape, and motion; seeing only small details and not the whole; and visual overstimulation. Our clinical findings over the last 20 years confirm that difficulty in the inhibition of sensory information leads to sensory overload, resulting in visual fragmentation, avoidance behaviors, poor social interaction, communication difficulties, and shutdown.

## WHEN THE VISUAL SYSTEM WORKS AND WHEN IT DOESN'T

Vision is the dominant sense that provides us with information about our world. However, we see what our brain wants us to see (see Figure 1). An estimated seventy percent (70%) of the information an individual receives enters through the eyes and must be correctly interpreted by the brain.[11] The brain is constantly bombarded with visual information that has been dissected into millions of signals, each processed separately and put back together into the picture we see. These signals are simultaneously processed by independent, parallel pathways, some of which process shapes, others color, and still others movement, location, and spatial organization.[12] It is an amazingly complex process, and it is no wonder that problems can arise. Problems in the way we see or, more accurately, in how our brain processes visual information can, in turn, cause difficulties in our ability to function in a number of areas.

Each individual's brain is unique, and no brain is perfect. Each brain perceives and responds to external stimuli differently. The brain is the driving force controlling activities and regulating all functions of the body. When the brain is happy, the body is in balance. When the brain perceives external stress from the environment, however, it sends out messages to alert all the other systems of the body that there is trouble, causing other systems of the body to react. According to Dr. Daniel Amen, "The brain controls how we think, how we act, and how we feel. When the brain does not work right, you cannot work right."[13] If we think of the brain as an orchestra, for those who experience sensory overload, there is a lack of successful coordination and timing between all the instruments, resulting in music that is cacophonous chaos instead of a beautiful symphony.

## FROM READING TO SEEING THE WORLD

I have been researching and helping individuals who struggle with visual processing deficits for over 30 years.[14] Visual processing difficulties are not unique to those with ASD but can affect individuals across a wide variety of diagnoses, including those labeled with attention-deficit/hyperactivity disorder (ADHD) and dyslexia. In 1980, the main focus of my research was to identify underlying causes of reading problems and other academic difficulties that were not being detected by psychoeducational testing. These difficulties

**OPTICAL ILLUSION**

It is interesting to note that we can all be made to see things differently than they appear. For example, if you look at an optical illusion (Figure 1), you will see how the pictures can appear to move, change, or have colors when in reality they do not. For most people, the illusion causes the brain (not the eyes) to improperly filter the image.

**Figure 1.**

Research shows that somewhere along the journey that visual information makes from the eye to the brain, appropriate filtering of the information can become disrupted, resulting in visual fragmentation or distorted visual processing that is similar to what occurs with an optical illusion. There are different theories about why the brains of certain individuals (including those with ASD) perceive the environment differently. Regardless of the theory, the end result is the same: distorted and fragmented perception.

typically stayed with an individual for a lifetime, affecting their attention, concentration, performance, and achievement. For these individuals, instruction, remediation, practice, and repetition did not provide solutions. Moreover, visual testing did not show any problems that needed correction.

My research uncovered a type of sensory processing deficit that was related to the brain's inability to accurately filter and process visual information. This is *not* a difficulty related to vision.

Over time, my research uncovered a type of sensory processing deficit that was related to the brain's inability to accurately filter and process visual information. This is *not* a difficulty related to vision. Since the processing of visual information is a basic function, any disruption of this process can cause difficulties. The adults living with the problem provided me with information about what they experienced, what they saw, and how they felt – information that had never been shared with doctors, teachers, or other professionals. These adults described trying to read while seeing a wide variety of visual distortions. Words would appear and disappear, swirl, shift, pulsate, melt, and go in and out of focus. The adults described the page itself as flickering, flashing, glowing, and either being too painful to look at, mesmerizing, or distracting.

I developed a method using colored overlays to eliminate the visual distortions that impeded reading and the ability to comprehend and learn from what was read. I expected my adult clients to be thrilled with the fact that they could now read easily and comfortably, without having to reread for comprehension. Much to my surprise, they instead began describing other areas of their lives where they also experienced distorted perception related to difficulties with perceptual processing. They informed me that they perceived numbers, math signs, musical pages, and their environment in the same distorted way. Armed with knowledge about what these individuals were actually experiencing, I searched for answers and, ultimately, was able to develop a solution. After years of research, the concept of wearing color as glasses or contact lenses was born.

Adults with ASD and Asperger's syndrome, in particular, heard about the wide variety of visual distortions that people with reading problems reported on the printed page and were struck by the similarity between these distortions and the visual fragmentation they experienced every minute of every day. However, there were also striking differences between those with ASD and those with reading difficulties. Those with ASD were living in an environment that appeared significantly more distorted, fragmented, unstable, and frightening. For those on the autism spectrum, the world often took on a sinister aspect, with objects appearing to "come at them" and "attack them" (see *Living with visual distortions: what it's like before precision colored filters*). The adults with Asperger's syndrome who were able to articulate these difficulties captured the experiences of many more individuals with ASD who could not speak for themselves.

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## LIVING WITH VISUAL DISTORTIONS: WHAT IT'S LIKE BEFORE PRECISION COLORED FILTERS

Seeing may be easy for you and me but can be a Herculean effort for some individuals with ASD. Visual processing deficits have been described as constantly being swamped by a tidal wave of fragmented and incomprehensible visual information or "visual noise." This can be like having millions of flashbulbs going on and off which you cannot stop. It can be loud, incomprehensible, and bombarding. What the individual sees is not what actually is. The refrain I hear over and over again from adults with Asperger's syndrome is, "Don't try to cure me with therapy and ignore my piecemeal perception."

An ASD woman named June (not her real name) came into my office one day carrying her laptop, which spoke for her. She described her world as "broken, with disconnected pieces and constantly moving static everywhere." June explained that her world was so frightening, bombarding, and assaulting that she had no choice but to retreat into her own private fantasy world. Donna Williams has shared similar comments, stating: "I see things bit by bit, a string of pieces strung together"; "The house seemed full of colors, and everything seemed to move too fast to make out"; "Colors and things and people would fly... it was never whole people, only their pieces."[5] A man named Richard put it this way: "I looked in quick glances, understood by piecing fragments. I see cracked children, cracked steps, print, and writing."

Doris (not her real name) was a young adult with ASD who reported to me that smells, sounds, touch, lights, patterns, and textures were bothersome and painful. She was mesmerized, (almost hypnotized) by colors, patterns, stripes, textures, and spinning objects, which constantly changed like an optical illusion. Stairs were frightening because they had no depth. Certain patterns seemed to move and double. Doris found it easier and less painful to look at things with her peripheral vision. However, she could not see a whole object, only small components, and things appeared and disappeared in her peripheral vision. She also could not see curbs, cracks, or steps. Doris described fragmentation of both her visual and auditory processing. She could not easily pull her thoughts together, making talking difficult and conversations impossible. Listening and comprehending were especially difficult under fluorescent lights. Doris was able to read but without comprehension. She described the page as visual static moving all around. Her world was seen in broken and disconnected pieces, with constant moving static everywhere. It was difficult for her to make sense out of what she heard because all sensory input became fragmented.

## THE WORLD OF MISPERCEPTION: TYPES OF PROBLEMS

Visual sensory overload can affect individuals with ASD in a number of ways, causing environmental distortions, light sensitivity, physical symptoms, and reactions to colors, patterns, and shapes. Visual sensory overload also can affect depth perception, communication, reading and academic tasks, and behavior.

1. Environmental distortions: Individuals with visual processing deficits describe their environment as inconsistent, uncomfortable, confusing, and scary. Distortions may include visual fragmentation, patchy vision, missing pieces, multiple images, things disappearing and suddenly reappearing, things coming at the person (a feeling of being attacked), seeing the world in pea-size pieces, and only being able to see the colors and sparkles in the air. These result in difficulties associated with understanding emotions, recognizing people, interpreting social situations, making eye contact, and gross and small motor coordination.

2. Light sensitivity: Sunlight, bright lights, and fluorescent lights increase visual fragmentation and pain. What is simply bright to one person can be blinding and extremely painful for an individual with ASD.

3. Physical symptoms: The constant difficulty involved in processing the world can result in a variety of physical symptoms, including panic, anxiety, agitation, irritability, headaches, dizziness, fuzzy thinking, nausea, and feelings of complete disorientation.

4. Colors, patterns, and shapes: Lights, colors, patterns, sparkles, and spinning and moving objects can become hypnotic or mesmerizing, causing some on the autism spectrum to stare. For other ASD individuals, these stimuli may be bothersome, painful, or aversive, causing the individual to look away, look down, or look in short glances.

5. Depth perception: Individuals with visual processing deficits experience difficulties in judging heights, distance, and speed and have spatial awareness challenges that mean that stairs, escalators, and curbs are not seen accurately. This may also affect the individual's gross motor skills and ability to catch and throw balls. Poor depth perception can cause some individuals to bump into tables, walls, and doors, knocking over and dropping things, tripping, falling over things, missing steps, and misjudging heights. Others may walk touching the walls to know where they are.

6. Communication: Many individuals with ASD report that visual distortions affect their ability to put words together in sentences. They cannot talk because they cannot think clearly. They may not be able to respond because they are not aware of what is going on and cannot link the sounds of language to objects in their environment or to meaning.

Visual sensory overload can affect individuals with ASD in a number of ways, causing environmental distortions, light sensitivity, physical symptoms, and reactions to colors, patterns, and shapes. Visual sensory overload also can affect depth perception, communication, reading and academic tasks, and behavior.

Neurological studies using objective measurement devices to explore cortical processing involvement support my belief that the issues faced by people with visual processing deficits are the result of how the nervous system encodes and decodes visual information and not vision problems per se.

7 Reading and academic tasks: Reading, copying, distractibility, and problems staying focused when reading and doing academic tasks can also be a problem. Often those with autism have good, even advanced, reading skills but poor comprehension.

8 Behaviors: Sensory bombardment can result in anxiety, feelings of being threatened, outbursts of anger, aggressive and violent behavior, screaming, wailing, running out, and swearing. When the familiar becomes unrecognizable, such as when someone moves the furniture, changes their hair style, or wears different clothes, this, too, can result in anxiety, fear, and outbursts of anger.

Like most individuals who experience visual processing deficits, individuals on the autism spectrum are either unaware that they have a problem or are unable to communicate the problem. Fortunately, these individuals' behaviors can provide important insights into which issues need to be addressed with appropriate sensory interventions. It is, therefore, important to explore the reasons behind behaviors of the type described.

- The *rhythmic, repetitive, self-stimulatory, and ritualistic behaviors* that often are seen in individuals with ASD appear to be coping mechanisms used for calming down and reducing the stress, panic, and anxiety caused by an unpredictable environment.

- Other *seeing behaviors*, such as looking in short glances, looking down or away, squinting, looking sideways rather than directly at something, looking through the fingers, and avoiding eye contact may reduce or eliminate the pain and bombardment of the environment.

- Some behaviors may be *indicators of discomfort*, such as squinting, rubbing or pushing on the eyes, and hitting the eyes.

- Other sensory behaviors (such as feeling, touching, smelling, and tasting) help make sense of a distorted environment. When seeing isn't working, it is not uncommon for an individual with visual processing deficits to *use their other senses* to "see," understand, orient, and derive meaning.

## AUTISM, VISUAL PROCESSING, AND THE BRAIN: WHAT DOES RESEARCH TELL US?

Ordinarily, we all have a natural filtering system that allows us to see, hear, touch, and taste things the way they are. However, for individuals with conditions such as ASD, the brain can no longer filter sensory information properly. As a result, the brain becomes disorganized and chaotic trying to deal with the constant flow of sensory information. When considering visual processing deficits, why do some individuals have altered perception while others do not? Why are signals inhibited normally for some individuals but not others? What is the underlying physiological basis for optical anomalies, and can this explain why using color to filter out specific wave lengths of light is able to stabilize perception?

In 1980, my research first documented visual-perceptual distortions and/or somatic issues,[15] which subsequently attracted the attention of other researchers.[16-22] Later research documented a variety of symptoms, including blurred or double vision and illusions of shape, color, and motion (that is, letters that appear to move, float, or flicker).[14,19,21,23-28] In addition, research found comorbidity with sensitivity to the lighting condition in the environment; this type of sensitivity can lead to general fatigue, print resolution issues, reduced attention span, and poor depth perception.[14,17,29]

Although originally thought to be associated solely with reading problems, research has linked visual processing difficulties to a range of other disorders, including ADHD, ASD, learning disabilities, anxiety, and certain emotional and psychological issues.[14,29] Visual processing challenges also overlap with other neurological conditions such as migraines and epilepsy.[30-33] Biochemical differences have been shown to exist for those with visual processing deficits.[34] One study demonstrated that brain abnormalities that cause difficulty tracking moving objects run in families with autism, although family members who share the brain abnormality do not develop autism.[35]

In recent years, two theories have been proposed to explain visual processing deficits as either (1) a transient visual subsystem deficit, or (2) hyperexcitability of the cortex. The *transient deficit theory* assumes that the difficulties arise as a result of issues with the transient visual subsystem, that is, the magnocellular pathway.[18,25] The magnocellular pathway's axons carry information directly to the primary visual cortex[18] and convey information about motion.[18,36,37] According to Stein and others, a dysfunction in the magnocellular pathway could cause visual processing difficulties.[18,25,38,39] Color filtering has been found to improve the functioning ability of the magnocellular pathway.[36,40]

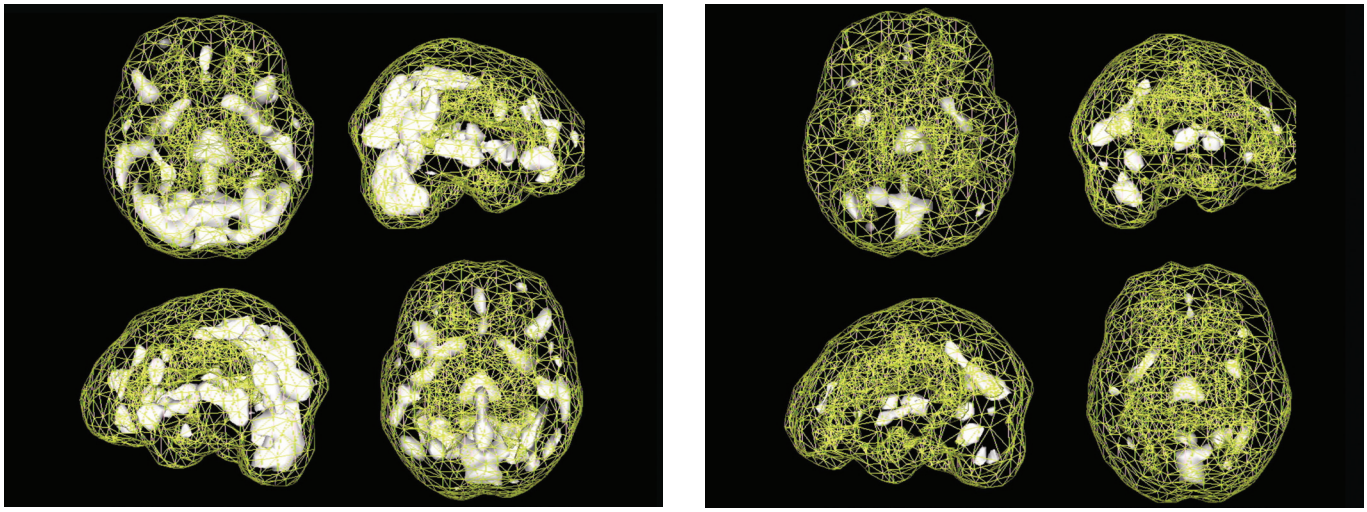
The *cortical hyperexcitability theory* proposes that in the visual cortex there are orientation columns, which are groups of cells that respond together to stimuli with particular orientations,[12,41] and lack of inhibition of these columns causes excitation to spread throughout the visual system,[30,32,33] resulting in difficulty in processing visual information.[42] If colored filters change the distribution of the firing pattern within the visual cortex, this would provide another possible explanation as to why individualized color prescriptions ameliorate visual-perceptual distortions and somatic issues.[17,33,41,43]

Neurological studies using objective measurement devices to explore cortical processing involvement support my belief that the issues faced by people with visual processing deficits are the result of how the nervous system encodes and decodes visual information and not vision problems per se.[29] Recently, researchers have been able to further study the underlying mechanisms causing perceptual difficulties

## Figure 2.

Irlen Syndrome without Irlen Filters

Irlen Syndrome with Irlen Filters



These three-dimensional scans using SPECT technology show the portions of the brain that are in heavy use, or "hot." Both scans are of the same brain without, and then with, Irlen Filters. In the scan on the left, there are many parts of the brain that are "hot"—many more than is the case for a "normal" brain. The scan on the right shows that the brain is "normalized" once the Irlen Filters are used.

SPECT scans from the Amen Clinic, Newport Beach, CA

using new advanced imaging technologies such as functional magnetic resonance imaging (fMRI),[30,31,44] visual evoked response (VER, a type of electrophysiologic retinal testing used to measure the electrical potential resulting from a visual stimulus that flows from the retina to the visual cortex),[45,46] and SPECT (single photon emission computed tomography) scans. These tools have helped objectively document the profound effects of sensory overload, while also credibly demonstrating the positive effects of filtering visual information using individually prescribed colored lenses to alleviate visual distortions.

In 1991, I hypothesized that individually prescribed colored lenses could filter out the specific wave lengths and frequencies of the light spectrum to which a person is hypersensitive and which the person's brain is unable to adequately filter.[14] Recognizing that each individual's brain is different, it follows that each individual will need his or her own unique color lenses, which will vary in hue and density. The color serves to filter the specific wave lengths of light that a given individual's brain has difficulty processing. I theorized that using individually prescribed colored filters is successful because it helps the brain filter visual information in a tailored fashion.

Research has gone on to establish the relationship between perceptual processing deficits and improved facial recognition with colored filters.[47] My clinical findings indicate that colored overlays (which are plastic sheets) and colored filters (worn as glasses or contact lenses) eliminate visual processing distortions and accompanying physical symptoms. A substantial body of research now supports the hypothesis that use of colored filters is beneficial,[16,20,23,43,48-51] including longitudinal studies.[20,23,33,45,49,50,52,53]

Research supporting my hypothesis would be expected to show a change in brain functioning when wearing individually prescribed colored filters (Figures 2 and 3). Using VER, Lewine[44] found that in subjects who showed a more complex and disorganized field pattern when processing visual information, the disorganized pattern became organized when precision colored lenses were worn. Another study using fMRI that compared the brain activation patterns of individuals with and without visual processing deficits showed potentially important patterns of differences.[54] Individuals with visual distortions and fragmentations had an early hyperreactivity to visual stimuli that delayed complete processing of visual information. When a second stimulus occurs while the brain is still processing an initial stimulus, the concurrent processing of different stimuli can be responsible for the distortions experienced by some individuals. These distortions are normalized with Irlen colored spectral filters.[54]

The overall effect of sensory overload can best be seen in SPECT scans conducted by the Amen Clinics. These scans show that when the brain is not able to accurately filter and process visual information, there is a highly significant degree of increased activity in the brain's emotional and visual processing centers along with decreased activity in the cerebellum, the area that helps to integrate coordination and new information. Pre and post brain scans of several people with visual processing difficulties show that treatment with Irlen colored spectral filters significantly helps to balance brain function.[13]

### COLOR FILTERING AS A SENSORY INTERVENTION

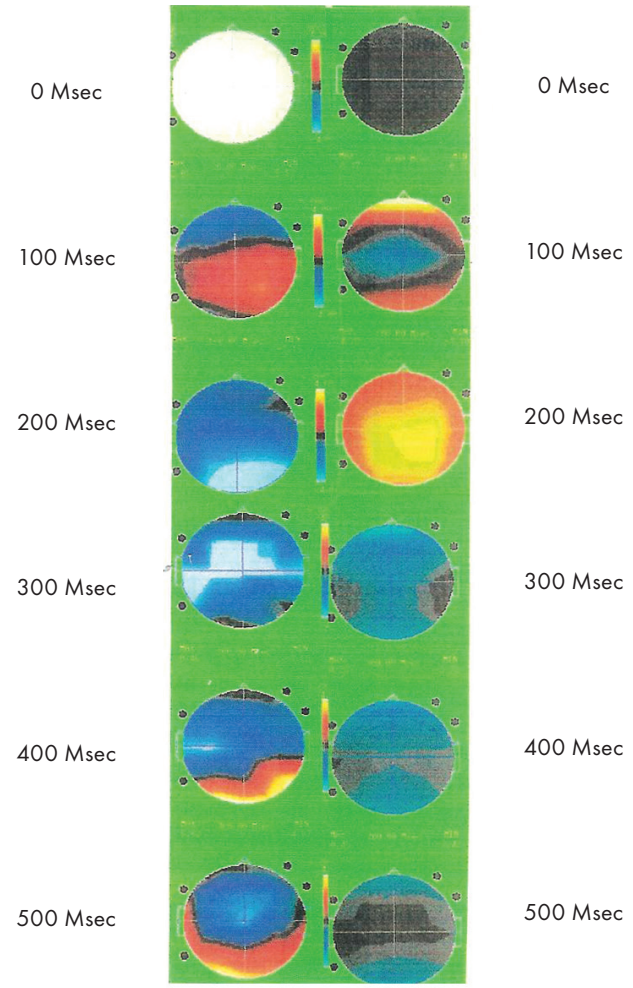
Although there are therapies to address other sensory sensitivities associated with ASD, visual processing deficits have often gone unaddressed. As we have seen, however, research has clearly established that it is possible to effectively address visual processing deficits by using color to filter visual information so that it is accurately processed by the brain. The Irlen Method, used for nearly 30 years to help individuals suffering from reading difficulties and physical discomfort related to perceptual difficulties, has also proven helpful over the past 15 years for individuals on the autism spectrum who suffer from sensory overload related to visual processing deficits. The Irlen Method determines the exact wave lengths of light (color) to which each individual is uniquely sensitive, thereby allowing the individual's brain to process visual information correctly. The ability to

## Figure 3.

### VER Brain Scan
### Yellen-Schweller Effect

SUBJECT WITH IRLEN SYNDROME "Y-S EFFECT" Early Hyperactivity Followed By Delayed Visual Response

SUBJECT WITHOUT IRLEN SYNDROME Normal Visual Response






determine and precisely filter just those wave lengths of light that are creating problems is the key to the method's success.

Since everyone's brain is different, each individual needs his or her own unique color, which must be determined on a case-by-case basis using a well-researched diagnostic process. Testing identifies and uses changes in behavior to determine which filter is most helpful. Choosing the right color is critical. The wrong color can make things worse, causing more stress and increased visual fragmentation and discomfort. Behavioral changes in response to diagnostic testing are immediate and are used to determine the exact color, or combination of colors, and densities. (Note that because the appropriate colors are worn as glasses, only individuals who can tolerate wearing glasses should be tested.)

The diagnostic technique is noninvasive and does not depend on verbal reporting, which is especially important for individuals with ASD who may have little or no language, difficulty expressing themselves, difficulty understanding what is asked of them, or engage in behaviors that interfere with their ability to cooperate. Testing to determine the correct color is not dependent upon the ability to communicate, follow directions, or answer questions. Children as young as four years of age can be tested. Certified Irlen diagnosticians are specially trained to work with those on the autism spectrum.

Individuals who begin wearing individually prescribed precision colored filters (called Irlen Spectral Filters) experience immediate changes and improvements in perception. These changes do not require daily or weekly therapy sessions, nor does implementation of this color method require individuals to develop skills, unlearn behaviors, or be trained in different behaviors. The emphasis of the method is not on making individuals look "normal" but rather on eliminating the reason for the compensatory behaviors in which they engage. By eliminating the need to block out or reduce sensory overload, normal behaviors automatically replace the compensatory behaviors.

In my practice, the ASD adults who originally self-identified with visual distortions wanted to find out if wearing my precision colored lenses would stabilize their world in the same way that the lenses had been able to stabilize the printed page for struggling readers. We learned that the colored spectral filters indeed were able to calm and eliminate their visual distortions so that their whole environment was clear, stable, comfortable, and easier to process. Tony Attwood, author of *The Complete Guide to Asperger's Syndrome*, has described children and adults with Asperger's syndrome "who have reported a considerable reduction in visual sensitivity and sensory overload when wearing Irlen lenses." Integrative medicine practitioner Angelika Maria Koch has also described her experiences with the Irlen Method:

> *I attended more than a dozen tinting sessions of children and adolescents with ASD as an interpreter. I can only describe the relief and amazement of these people when the right color is found, using their words: "So, this is the world." "Now I can comprehend details and the picture." A young man (high-functioning autism) said his Irlen filters work as "signal correctors" or "brain organizers."*

## PRESCREENING INSTRUMENTS FOR HOME USE

We have had good results predicting which ASD individuals will benefit from wearing individually prescribed colored lenses using a prescreening questionnaire. The autism prescreening questionnaire asks about the behaviors and problems that have been found to be associated with visual processing deficits. The parent completes the questionnaire and sends it to the Irlen Institute; once the questionnaire is evaluated, a report is sent back to the parent to explain whether color can help.

For younger children or for those with little language, parents can also complete a series of activities at home using different colored light bulbs and record the child's responses. Individuals who are likely to benefit from the colored lenses sensory intervention will display an immediate and noticeable positive change with certain colored light bulbs and negative changes with other colors. We have found that there is a high correlation between the positive changes in behavior that occur when changing the color of the lighting and changes with Irlen precision colored filters.

## RECOMMENDATIONS FOR PARENTS AND TEACHERS

A number of changes can be made to the home and classroom environments to facilitate children's sensory processing.

1. Dim the lighting. Dim the lighting at home and in the classroom. Use soft lighting and turn off the fluorescent lights. Even though indirect natural lighting is the best lighting, too much is not good. Put up curtains or blinds to be able to control the amount of natural lighting. In classrooms and in therapy rooms, turn off fluorescent lights when there is enough natural lighting, or reduce them by half by turning off half of the fluorescent bulbs in each fixture. It is a myth that dim lighting will hurt one's eyes, just as whispering will not hurt one's ears. For those on the autism spectrum who cannot filter information, it can help to reduce both lighting and noise in the classroom.
2. Have the child wear hats with brims. Having children with visual processing deficits wear hats with brims can be helpful both inside and outside, including in grocery stores and other places with fluorescent lights. Make sure that the underside of the brim is a dark color, such as black, brown, or gray.
3. Have the child use colored paper instead of white paper. Try having the child use different colored paper for assignments, including math and written assignments. Notice if a particular color makes the assignment seem easier or more comfortable or if your child pays more attention when using one color over the others or over white.
4. Eliminate patterns, stripes, polka dots, and bright colors from walls, wallpaper, carpets, and floors. Keep the carpet and wall colors soft and neutral.
5. Watch what adults wear. Bright colors, stripes, polka dots, and certain patterns, as well as bright and shiny earrings and necklaces, can increase the difficulty that ASD children have in looking at adults in their environment.

When individuals gain confidence that what they see is correct, a whole array of inappropriate behaviors disappears because the behaviors are no longer needed.

## FINAL THOUGHTS

Sensory processing deficits can be part of a composite of difficulties for those on the autism spectrum. Visual processing deficits, in particular, are experienced by many with ASD. There are many different side effects to living in a visually distorted world, including using inappropriate behaviors as coping strategies, poor social skills and language, and large and small motor difficulties. As these deficits become part of the definition of autism spectrum disorders and more parents become aware of these silent difficulties, treatments that address sensory and visual processing issues need to factor into parents' and professionals' goals. Minimizing sensory bombardment should be an essential intervention and part of the treatment program for many on the autism spectrum.

Adults with Asperger's syndrome recognize that visual sensory issues and distortions are a significant underlying factor affecting their ability to function. A consistent request by these adults is that professionals focus on eliminating the underlying cause rather than focusing on changing their behaviors. With understanding and attention, behaviors become meaningful and can be used to determine appropriate interventions.

The Irlen Method is the only research-based sensory intervention currently designed to address the visually distorted world of those with ASD by eliminating distortions so that their world is clear, stable, and comfortable. When individuals gain confidence that what they see is correct, a whole array of inappropriate behaviors disappears because the behaviors are no longer needed. Although visual processing difficulties may not be the only hurdle that those with ASD face, removing this one significant barrier can make it easier to function, leaving the individual with more energy to deal with other challenges.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