How we see things and how we perceive things are both very important in our daily lives. This applies to what we physically see with our eyes and our ability to see things from another person’s perspective. In this month’s article, I’m going to talk about both types of seeing: the physical components to seeing and how that changes with dementia as well as why it is so important to try and see things from another’s perspective.

So, how do we get visual information into our brains? Visual data enters through our eyes, the light rays come through the cornea, cross the fluid in the eyeball and hit the retina, a photo-sensitive screen on the back of the eyeball. The rods and cones embedded in the layers of the back of the eyeball change the light rays into electro-chemical messages. These messages are loaded into the optic nerve that comes out from a center point in the retina of each eye (your blind spot). The information is specifically sorted by quadrants for each eye. Then something extraordinary happens, some fibers stay in their lane while others cross over at the optic chiasm. This is what gives human beings the ability to have binocular (stereoscopic) vision as well as providing the opportunity for both depth perception and hand-eye coordination. In dementia, we now recognize the role of glial cell activity changes in the onset of dementia and its progression, as glial cells in the brain have a major role in maintaining the health and well-being of this ocular system. It makes sense, then, that changes in vision are typically going to be a part of the development of dementia.

The optic messages carried by these revised optic nerve bundles go through the thalamus, have connections to many other places and spaces, but ultimately most land within the occipital lobes of the cerebral cortex. From there they go to many other areas of the cortex, including the executive control center, the sensory-motor region, the vestibular and auditory processing areas, and much more. The fibers associated with vision are both wide spread and powerful in human decision making and behaviors. There are some specific wiring patterns that exist and are important in daily function.

- The sight pathway wiring (seeing things)
- The vestibulo-oculo-reflex (balancing combined with vision – an example is the righting reflex – finding upright against gravity)
- The oculo-motor pathways (eye movement control)
- The dorsal stream (determining the where of objects, self, and movement)
- The ventral stream (determining the what that is seen and details of importance).

Although humans cannot begin to match eagles or other birds of prey for acuity, they do have fairly remarkable visual skills. They also have some unique wiring patterns that attach words to visual information, so that it can be shared among others when the item
or thing being talked about is actually not present. I am going to give you a short laundry list of many of the visual abilities we use each day to make our world flow smoothly for us.

- **Visual Field** - how much of the world can be taken in at any moment in time by the human visual system. There are three major areas: focused or targeted vision, central field vision, and peripheral vision, the outer rim of vision. The best target vision is about an 8° circle of the middle of vision at a distance of about 18“-36” from the human eye. The next 30° to either side is considered the center field of vision. It is about 36” wide at arm’s length. Then comes the peripheral region. It adds another 30° to either side and allows us to notice flashes of light, color, or movement, but not detail. For that we would have to adjust our eyes and head. Additionally, for intact adults we have a far peripheral field that extends about 30-40°. This is an area where we have awareness of movement and a range in which we are alerted of possible action, but a visual shift would have to happen for more information processing to occur.

- **Accommodation** - ability to adjust near-to-far and far-to-near acuity. Typically happens very rapidly, within 220-250 milliseconds. Inability to see well at arm’s length typically happens with increasing age.

- **Adaptation** - ability to adjust light to dark and dark to light conditions. This takes longer because it is mostly up to rods to do this work. It can take up to 20-30 minutes to fully adapt, so that color vision (cones) in limited light can still work.

- **Depth Perception** - ability to use the integrated images from both eyes to judge depth, distance, figure-ground, 2-D versus 3-D images, and organize hands, feet, and body to prepare, respond, and adapt to changing features and surfaces.

- **Organized Scanning** - ability to get the sets of six muscles around each eye to collaborate and coordinate to move in a seeking pattern throughout a visual range in order to find a pre-selected item or to locate an anomaly or unexpected element.
  
  - **Saccadic Eye Pursuit Movements** - point-to-point or item-to-item looking is called saccadic (picking spots and ignoring things between the spots). This
is used in reading, driving, walking, doing tasks, looking for something, and searching for things.

- **Smooth Pursuit Eye Movements** - smooth pursuit is used when tracking a moving object or following something with your eyes. It is rarely used if an item is not targeted.

- **Visual Attention** - ability to attend to some visual information while seeming to ignore or not process other visual information that is available. It is subdivided into three categories:
  - **Sustained Visual Attention** - ability to stay focused on a visual item or activity over time.
  - **Selective Visual Attention** - ability to pick out sought after or important visual data from background data.
  - **Divided Visual Attention** - ability to switch back and forth from one visual focus to another or pay attention to multiple aspects or items in a visual field.

- **Color Vision** - handled primarily by the cones that are concentrated in the more central part of vision. There are three cone shapes and each type handles one wavelength of light. Most are set for red, next comes green, and only a few pick up blue. People who are color blind have deficits in those cones. Loss of cones results in loss of ability to discriminate colors or accurately identify them.

- **Object Recognition** - is a highly complex skill and still under intense investigation. It is the ability of humans to assign a purpose and value to an object both in and out of context. It is also involved in the person’s ability to prepare to handle or use an object based on past experience with that object or similar objects.

- **Facial Recognition** - a particularly specialized function with a place in the human brain, where facial features are used to identify people. This regional system for associating a name with that face. Problems with recognizing faces is called prosopagnosia. It turns out that infants are good at recognizing positive and negative emotions before they are able to recognize specific details for people identification. They also are more reactive to negative emotions than positive emotional facial features from an early age. Ability to assign a face to a familiar or unfamiliar category comes next. Finally, the child can identify specific people of importance to them by about seven months of age.

- **Visual-Motor Integration** - ability of the visual cortex to work with the sensorimotor cortex and the cerebellum to allow for smooth actions based on visual input and sensory motor feedback loops.
• **Visual-Vestibular Function** - the wiring between the inner ear, the sensorimotor system, and the optic system to coordinate, gaze, body movement, and equilibrium with gravity constantly impacting what is done.

Since vision is such a vital part of sensory processing, changes brought on by dementia would be incredibly impactful for a human being. Each of the functions listed above has the potential to be greatly impacted by various forms of dementia. There are some areas spared with many dementias, while some dementias are particularly challenging for visual function.

**Posterior Cortical Atrophy** is a dementia that has a primary visual impact. It can and does rob a person of so many visual skills that function is often problematic from fairly early in symptom development. What is more problematic, is that many of these cases are not diagnosed until the problems and challenges are well advanced for the person and their support system.

People living with **vascular dementia** may well have both a loss of one entire side of vision brought on by strokes, as well as problems with processing and visual-perception changes due to the cortical changes of their dementia.

Individuals with **Lewy Body Disease** frequently experience visual activity that results in visual misperceptions or hallucinations as part of their condition, as is Capgras syndrome (the sense that a familiar person has been replaced by an imposter). People with other forms of dementia may also experience visual hallucinations when in physiological or emotional distress. Misunderstanding of hallucinations can cause acute health problems to be mismanaged or problematic medications to be used to treat a symptom of dementia, not a psychosis.

There is so much that can and does go wrong with vision and visual abilities in the world of dementia, it is easy to miss the exciting and important main consideration. Because vision is so central to human actions, reactions, and behavior, it is especially important to notice the visual shifts that are taking place for the person living with dementia and ensure that we use the abilities that remain in all that we do. We must also recognize the essential role our visual abilities will play in our interactions, our environmental considerations, and our responses to situations that arise.

In the world of dementia, being able to see things from another person’s perspective is critical to successfully:

• Form relationships that work
• Initiate interactions that have value and meaning for both people
• Get important tasks completed with limited stress or distress
• Live lives that are fulfilling and provide moments of joy and pleasure
• Be part of a community that acknowledges me, supports one another, celebrates victories, and most importantly, comforts in times of grief, loss, and sorrow
About two-thirds of all of our sensory processing is affected by visual data. There are about one million nerve fibers coming out of each eye. Eight of the twelve cranial nerves are somehow involved in visual processing. We use vision a great deal for most activities in which we engage or avoid. Control over our eyes is highly complicated and integrated, yet in some ways remarkably primitive. It is estimated that humans make decisions about liking or not liking another human being within seven seconds of visually regarding the person. Humans are well known for making snap decisions about meals or willingness to taste something based on appearances.

Seeing things from the other person’s point of view is not optional in dementia care, it is essential for the well-being of all involved. Making efforts to understand another perspective, trying out a task with limitations, considering how it might look if… are all possible ways in which we can improve our care support and setting of care for people living with various forms and degrees of dementia.