

## 4 Test Instructions

Please refer to the assessment forms located in Appendix C when reading this section. The psychometric properties of the assessments are located Appendix B.

### 4.1 Visual Acuity

The biVABA includes 3 standardized charts to measure acuity. The LeaNumbers Intermediate Acuity Test Chart and the Warren Text Card measure high contrast distance and reading acuity respectively. The LeaNumbers Low Contrast Flip Chart measures contrast sensitivity.

#### 4.1.1 Assessment Considerations

##### 4.1.1.1 Why You Should Measure Visual Acuity First

The three assessments that comprise the visual acuity screening are core tests that should be completed as early as possible on EVERY client. A client who is struggling to see may miss critical features/items or perform very slowly on tasks. If visual acuity is not assessed first, these behaviors may be mistakenly attributed to changes in cognition instead of a vision deficit. Bertone et al.<sup>22</sup> demonstrated this in a study where they artificially blurred the vision of normally sighted college students and tested their ability to complete nonverbal neuropsychological tests used to assess cognitive status in adults. They found that even a slight reduction in acuity from 20/20 to 20/40 resulted in poorer performance on certain nonverbal tests. Similar studies have also shown that uncorrected visual impairment can mistakenly appear as cognitive impairment in adults<sup>75, 111, 217</sup> and children.<sup>192</sup> Most neuropsychological assessments assume that the client has normal acuity and do not require assessment of visual acuity prior to administering the test. But not knowing the client's acuity status risks that impaired acuity is misidentified as cognitive impairment and the acuity deficit is never addressed. The high incidence of poor acuity among hospitalized adult patients is another reason an acuity screening should be the first assessment completed.<sup>172, 268</sup> Leat et al.<sup>134</sup> found that 89% of inpatients on a general medicine floor had vision impairment but only 30% reported vision problems. Within this group 62% had low vision on testing including 36% with severe low vision. Ten of the study participants experienced a fall during hospitalization and 100% of the fallers had vision impairment. In another study, Rowe et al.<sup>195</sup> found that 56% of a cohort of 1,033 persons admitted for stroke had reduced acuity from central visual field impairment. In addition, patients are often admitted without their prescribed eyewear. Lotery et al.<sup>140</sup> found that over a quarter of inpatients on a stroke rehab floor, did not have their eyeglasses with them in the hospital. Among those who had glasses, nearly 25% were dirty, scratched or needed repair. Roche et al.<sup>187</sup> reported similar findings in a study of persons admitted onto an orthopedic floor: 25% of the patients did not have their glasses with them and of those who did, 85% of the spectacles were dirty or in poor repair.

#### 4.1.1.2 Room Lighting

Acuity shares a linear relationship with illumination. As illumination decreases, so does acuity (no one can read a letter chart in the dark). The eye chart must be fully and evenly illuminated to obtain an accurate acuity measurement. The room should also be illuminated with a non-glaring light source to reduce visual stress.

#### 4.1.1.3 Viewing Distance

Because acuity is depicted as a fraction of distance over letter size, the measurement is not accurate unless the viewing distance is accurate. The two high contrast acuity test charts are fitted with a cord to measure the viewing distance.

#### 4.1.1.4 Client Response

Clients with brain injury often experience deficits in cognition, language and attention that may interfere with their ability to provide an accurate and timely response when identifying optotypes on a chart. An optotype is the target that the client views on the acuity chart. It is usually either a number, letter, or symbol.

- The client may need extra time to locate the optotypes on the chart, process the image, and respond.
- Slowness in responding does not necessarily indicate that the client lacks the acuity to identify the optotypes. Instead observe whether the client's speed in identifying the optotypes slows down as they become smaller or fainter.
- Quickly identifying optotypes on preceding rows and then suddenly slowing down and struggling strongly indicates that the client has reached their maximum acuity.
- If the client struggles to identify optotypes on every row-but is accurate-continue the test until the client can no longer identify the majority of the optotypes in the row.

#### 4.1.1.5 The Client's Primary Language and Reading Grade Level

The most accurate *near* vision charts use sentences rather than single optotypes. Persons with reduced visual acuity often experience *crowding* when reading where the space between letters and words are diminished. Crowding makes it harder to clearly distinguish letters and words.<sup>136</sup> As a result, a client's reading acuity level is often lower than their single optotype acuity. Reading is the most often completed near acuity activity and reading acuity provides a better indicator of the client's ability to complete this task. However, the ability to read words accurately and fluently is also strongly influenced by the client's primary language and literacy level. Clients asked to complete a reading acuity chart in their second language or to read beyond their grade level may stumble on words and read slowly (e.g., low reading fluency) or misread words (e.g., low accuracy). To obtain an accurate measurement, the reading acuity chart must use the client's primary language and the sentences should be at or below the client's reading grade level. The biVABA includes an English and Spanish version of the Warren

Text Card with sentences written at the 6<sup>th</sup> grade reading level. Appendix G provides information on how to determine the reading grade level for text.

#### 4.1.1.6 Eye Dominance

The dominant eye establishes and directs fixation on an object; the non-dominant eye follows the lead of the dominant eye and assists in the process. A preference has been shown for right eye dominance, but it does not match the predominance of right handedness.<sup>13</sup> Many persons cross dominance where they are right-handed and left eye dominant or vice versa. Some persons are *equi-dominant* and have no specific eye dominance.<sup>13</sup> A person with strongly established dominance is likely to use the dominant eye at least 3 times to view a target.<sup>13</sup> Persons with a different acuity level or type of refractive error in each eye may use one eye for distance and the other eye for near. Eye dominance may be resistant to change once established. For example, a person may automatically attempt to use the dominant eye to direct fixation in reading even if that eye has been injured or has poorer acuity or resist occluding the dominant eye to eliminate diplopia. Because it influences how the client uses the eyes for reading and viewing objects, eye dominance should be measured prior to measuring acuity.

#### 4.1.1.7 Distance vs. Near Acuity

Focusing deficiencies, uncorrected refractive errors, and paralytic strabismus affect near and distance acuity differently. For example, a client who has difficulty focusing may experience blurred vision when attempting to read, but clearly see the road when driving. In contrast, a client with paralytic strabismus from a 6<sup>th</sup> CN lesion will see clearly to read, but experience doubling/blurred vision when driving. Because brain injuries frequently cause focusing issues, it is important to measure the client's near and distance acuity and **compare** the difference in acuity levels. **An acuity level that is 2-3 lines lower for near vision than distance vision suggests that the client may have a focusing deficiency.**

#### 4.1.1.8 Use of Prescription Eyewear

Eyeglasses and contacts correct for refractive errors that the client was born with or acquired in life. Refractive errors may remain stable during childhood and early adulthood and a client's prescription may not need to be changed. However, the refractive capability of the eye begins to change during one's 40's due to aging. *Presbyopia* is common and reduces the person's ability to focus up close to see print clearly. Reading glasses or bifocals are needed to make up the difference. Older adults experience more age-related diseases that reduce acuity including cataract, macular degeneration, glaucoma, and diabetic retinopathy. It is important to question the client about their need for non-prescription and prescription eyewear and ask how often they see the eye doctor and the approximate date of their last eye exam. Older adults without eye disease should have their eyes examined yearly. Older adults also frequently need to have their eyeglasses updated. Many countries with universal health care pay for new eyeglasses and eye exams. In the U.S., Medicare pays for an annual eye exam but does not pay for the

eyeglasses. This prevents adults without the financial resources to purchase new eyeglasses from achieving optimal visual acuity.

#### 4.1.1.9 Visual Complaints

Persons with significant vision impairment may periodically experience a visual disturbance where they see unusual visual images. *Phantom vision* (also known as Charles Bonnet Syndrome) is the best known of these visual conditions.<sup>162</sup> It is often reported by persons with macular degeneration and other age-related eye diseases; persons with hemianopia may also experience it.<sup>246</sup> The person has periodic episodes where they see images that aren't really there. The person may see a formed image such as a Cheshire cat sitting on the television or see a pattern of flashing or swirling lights. No sounds or smells accompany the images, and the person knows that they are not real. The images typically appear randomly and last just a few minutes. The exact cause of phantom vision is still unknown, but it is considered a benign condition. A client experiencing phantom vision may be reluctant to mention these episodes because they fear appearing "crazy." Asking whether the client "sometimes see things that aren't really there" provides an opportunity to educate the client about the condition and provide reassurance that it is common, and the images will eventually stop appearing. Clients with TBI or stroke may also report episodic shimmering vision in the peripheral or central visual field. Less is known about this condition. Its appearance in the central field—usually during reading—may signal that the person is unable to maintain binocular vision during focus (see section 2.3.3.1). Its appearance in the peripheral visual field may be related to a visual-vestibular impairment (see section 2.3.3.2).<sup>194</sup>

#### 4.1.2 Test Instructions

General Instructions to the Client:

*I am going to give you some tests to see how clearly you can see at a distance and up close. You will need to wear your eyeglasses for some of these tests if you use them to see far away objects or for reading. I am going to ask you a few questions before we get started with the tests.*

##### 4.1.2.1 Key Visual Complaints/Observations

Test Item:

Visual Acuity Assessment form

Procedure:

1. Use the checklists embedded throughout the assessment to identify potential limitations and strengths using vision. Begin making these observations during your first encounters with the client and as you work with them on ADLs. Use the checklist with family members and other team members to verify your observations and obtain a different perspective on the client's abilities.

2. Be sure to observe for light sensitivity as this is a very common co-impairment that causes significant visual stress.
3. Look for consistencies in behaviors and use this information to determine the key assessments you should complete.

#### 4.1.2.2 Questions about Eyewear, Eye Care and Visual Complaints

Test Item:

Visual Acuity Assessment form

Procedure:

1. Begin the assessment by asking the client (or family) about the use of eyewear. This includes use of contact lenses.
2. Use the *Eyewear Use* checklist. Be sure to tick all of the boxes—each answer helps to determine whether the client should see an eye doctor.
3. Ask the client to describe their vision. Use the *Key Visual Complaints/Observations* checklist to prompt the client about commonly occurring complaints.

#### 4.1.2.3 Pupil Size and Symmetry

Test Items:

Visual Acuity Assessment form

Distant target (large enough to be seen easily at 6 feet without eyeglasses)

Environment: well-lighted room with a non-glaring light source. Ensure that the light source does not shine directly into the client's eyes

Procedure:

1. Seat the client comfortably without eyeglasses; bring the target closer if the client has difficulty seeing it at 6 feet (do not bring the target closer than 3 feet). The client can also wear their eyeglasses to see the target.
2. Observe the pupils of both eyes as the client fixates on the target.
3. Record whether the pupils match each other in size on the assessment form.

Instructions to the Client:

*"I am going to look your pupils to see if they are the same size. Please look straight ahead and keep your eyes fixed on the [target] as I check your eyes."*

#### 4.1.2.4 Eye Dominance

Test Items:

Visual Acuity Assessment form

Plastic card with 8mm hole

Flower design card (from the design copy test)

Environment: well-lighted room with a non-glaring light source directed from behind the client onto the design card; ensure that the light source does not shine directly into the client's eyes.

Procedure:

1. Seat the client comfortably, wearing eyeglasses if needed.
2. Place the card with the 8mm hole on the table in front of the client.
3. Hold the flower design card directly in front of the client so the client can easily see it. Instruct the client to pick up the card and look through the hole with one eye to view the flower. **DO NOT** explain eye dominance or why you are giving this test until **afterward-it is important that the client respond automatically, without thinking about which eye to use.**
4. Repeat the test three times.
5. Record the eye the client used to view the flower on the 3 trials.

Instructions to the Client:

*I am going to check to see how well you can see the flower (show flower design copy card) when you look through the hole in this card (show card with 8mm hole). Please pick up the card with the hole in it and hold it up to your eye to view the flower."*

*2<sup>nd</sup> Trial: "Great job, let's do it one more time"*

*3<sup>rd</sup> Trial: "Great job, let's do it one final time"*

#### 4.1.2.4.1 Alternate Methods for Determining Eye Dominance

1. Hand the client a cardboard tube or a rolled-up piece of paper. Instruct the client to use the tube to view a specific distant target. Repeat the test 3 times using different targets. The eye that the client uses to view the object is the dominant eye.
2. If the client is unable to communicate or follow directions, question family members/friends as to whether they remember the eye the client uses to view through a camera, a gun scope, a magnifier, a telescope, or a microscope.

#### 4.1.2.5 Distance Acuity

Test Items:

LeaNumbers Intermediate Acuity Test Chart  
Visual Acuity Assessment form  
Clip-on occluder or eye patch (optional)  
Easel to hold chart if needed

Environment: well-lighted room with a non-glaring light source directed from behind the client onto the chart; ensure that the chart is FULLY illuminated, and that light source does not shine directly into the client's eyes.

Procedure:

1. Seat the client comfortably. If the client wears prescription eyeglasses with distance correction, they **must be worn for this assessment**.
2. Instruct the client to hold the black spoon occluder attached to the chart against the eye that is not being tested. The client should hold the occluder with the handle horizontal to the ground to keep the cord from crossing their line of sight. If the client is unable to hold the occluder, use a clip-on occluder for the eyeglasses or an eye patch to cover one eye.
3. Stretch the cord attached to the occluder until it is taut to position the chart at 1 meter. Measure this distance starting from the face of the chart to the client's cornea (don't touch the cornea) or to the surface of the client's eyeglasses lens.
4. Center the chart at the client's midline (hold the chart or place it on an easel).
5. Make sure that the chart is **fully and evenly illuminated** (the room does not need to be well illuminated as long as the chart is fully illuminated).
6. Instruct the client to begin reading the numbers starting at the TOP of the chart (20/1000 acuity line). Most clients will have much better visual acuity than 20/1000 but starting at the top enables the client to practice identifying the numbers and moving across the line and from row to row. It also provides an opportunity to observe for the effect of a hemianopia on reading (see section 4.1.3.1.3).
7. The client uses the reading pattern to progress through the chart-moving across each row from left-to-right, and through the rows from top-to-bottom. You may use a pointer to highlight the number and help the client proceed through the chart.
8. If the client accurately identifies the numbers on the front of the chart, turn the chart over and proceed through the rows on the back of the chart.
9. Allow the client with perceptual and cognitive deficits as much time as needed to identify the letters and encourage the client to give their best performance (see section 4.2.1.5)
10. If the client wears a bifocal, observe to make sure they use the upper portion of the lens to view the chart. Pay careful attention to whether the client tilts the head back to use their reading ad to view the chart as this suggests difficulty clearly seeing the numbers on the chart. If you observe this, stop the test, and remind the client to view through the top portion of their eyeglasses.
11. Record the Snellen and metric fractions and the metric (M) print size for the last row on which the client can accurately identify 3/5 of the numbers.
12. Test the dominant eye first, then the non-dominant eye, then using both eyes together. Remove the occluder and reestablish the 1-meter test distance when testing the eyes together.
13. For a quick screen, omit testing the eyes individually and just test both eyes together.

Instructions to the Client:

*"I am going to check how well you can see by having you read out the numbers on this chart. Please start at the top of the chart and read the numbers down as far as you can. Because each of your eyes may see differently, we will complete the test 3 times. First using your \_\_\_ eye, then your \_\_\_ eye and then using both eyes together. Please hold this*

*occluder in front of your \_\_\_\_ eye to make sure that you can't see anything with that eye. During the test you can turn your head from side to side if that helps you to see the numbers more clearly, but you cannot lean forward or away from the chart."*

#### 4.1.2.5.1 Modified Procedures for Clients with Limited Language, Cognition, Attention

Clients with limited language, cognition or attention may have difficulty following standard test procedures. Several procedures can be modified without compromising the acuity measurement as long as the test distance and chart illumination are not altered. Acceptable modifications include:

1. If the client has difficulty locating the target number in a row and pointer doesn't help, cover up the other numbers on the row (or all of the other numbers on the chart) so that only the target number is visible. Record the client's acuity as the last line the client can easily identify the single presented target.
2. If the client is unable to verbally identify the number, create a card with the 4 numbers printed on it and instruct the client to point to the number on the card that matches the number seen on the chart.
3. If the client has good yes/no reliability using a head nod or raising the hand, use a forced choice method and ask the client is this an \_\_\_\_ or an \_\_\_\_?
4. If the client has difficulty focusing and sustaining attention, divide the test into short segments and test 1 row at a time over several days. Allow the client as much time as needed to identify the target and provide rest breaks as needed.

#### 4.1.2.6 Reading Acuity

Test Items:

Visual Acuity Assessment form  
Warren Text Card (English Version)  
Warren Text Card (Spanish Version)

Environment: well-lighted room with a non-glaring light source directed from behind the client onto the card; ensure that the chart is FULLY illuminated and that the light source does not shine directly into the client's eyes.

Procedure:

1. Determine the client's eye dominant eye and distance acuity before giving this test. In addition, query the client about their ability to read (primary language and reading grade level) to ensure that this test card is appropriate (see section 4.1.1.5). Being asked about the ability to read could be embarrassing for a client who may have received less education or has a reading disability or believes they should be able to read English well even though it is their second language. Thoughtfully approach the topic to determine if the client can read English at a 6<sup>th</sup> grade reading level.



2. Seat the client comfortably. If the client wears prescription eyeglasses with near correction (single lens or bifocal), they **must be worn for this assessment** to obtain an accurate measurement of the client's reading acuity.
3. Test the client's vision using *both eyes together*; each eye is **not** tested separately.
4. Center the card at the client's midline; the client can hold the card, or it can be placed on an easel; make sure that the card is fully and evenly illuminated.
5. Stretch the cord until it is taut to position the card at 16 inches (40cm). Measure this distance starting from the card's surface to the client's cornea (do not touch the cornea) or to the surface of the client's eyeglass lens.
6. Instruct the client to read the sentences out loud starting on the top row and continue reading down the card as far as possible, turning the card over for the smaller print.
7. Allow clients with language and/or cognitive deficits as much time as needed to identify the words.
8. Record the Snellen fraction, the metric print size and the diopters of magnification needed for the last row the client was able to accurately read most of the words in the sentence without effort. These are located on the right side of the card.
9. Do not count it as an error if a client with hemianopia misreads a word due to the field cut but note such errors as they suggest that the hemianopia may be interfering with reading.

Instructions to the Client:

*"This test is to find out the smallest size of print that you can read. Please hold the card and read the sentences out loud to me beginning with the sentence at the top of the card (indicate location of the first sentence). Some of these sentences are silly so don't worry whether you are reading them correctly. You can turn your head from side to side if that helps you to see a word more clearly but do not to move the card closer or farther away than this (demonstrate the card distance).*

4.1.2.7 Contrast Sensitivity

Test Items:

LeaNumbers Low Contrast Flip Chart  
Soft tipped pointer  
Visual Acuity Assessment form  
16-inch (40cm) length of cord/ribbon (see procedure step 4)

\* NOTE: The surface of the test cards is extremely sensitive to environmental pollutants. Take the following precautions to avoid damaging the card surface.

- Always close the flip chart after use.
- Do not leave the test cards exposed to light or dust.
- Do not touch the surface of the cards with your fingers (use the pointer).
- Always keep your fingers on the edges of the chart.
- For cleaning instructions see Appendix K.

Environment: well-lighted room with a non-glaring light source directed from behind the client onto the chart; ensure that the chart is FULLY illuminated, and that light source does not shine directly into the client's eyes.

Procedure:

1. Measure distance visual acuity prior to giving this test.
2. Seat the client comfortably wearing eyeglasses if needed.
3. Hold the chart by the side edges-do NOT touch the face of the cards.
4. Center the chart at the client's midline 16 inches (40cm) from the client's cornea (do not touch the cornea) or from the surface of the client's eyeglasses lens. Note-this chart does not come with an attached 16-inch (40cm) cord. Make your own using string, ribbon, or cord.
5. Test the client using both eyes together-each eye is **not** tested separately.
6. Explain to the client that the test uses the numbers 5, 6, 8, 9.
7. Flip the cover of the chart back to reveal the first card.
8. Use the soft tipped pointer to point out the first number on the card (*remember do not touch pointer to the card*).
9. Instruct the client to identify the number.
10. If the client accurately identifies the number without effort, move on to the next card.
11. If the client hesitates to read the number or misreads a number on a card, return to the previous card, and instruct the client to read the entire line of numbers, then have the client try again to identify the numbers on the next card. It takes effort to see the faint numbers and some clients need to practice focusing before they can see them.
12. If the client reports seeing nothing on the card, encourage them to continue to view the card to see if the number slowly appears on the line. Images appear and disappear when the client is close to their contrast threshold, and it may take longer to recognize the number.
13. Record the percent of contrast on the last card that the client was able to accurately identify a number.
14. Refer to the table in Section 4.1.3.1.5 to identify the functional limitations the client may experience.

Instructions to the Client:

*"The purpose of this test to find out how well you can see objects that are very faint-for example water spilled on the floor. Sometimes a brain injury will cause you to lose this kind of acuity. The test measures this by asking you to identify numbers on these cards. The numbers are 5, 6, 8, 9. I will ask you to tell me the first number in each line. The numbers will become fainter as we flip through the chart, and it may be hard to see them. Take your time and do your best. You can turn your head from side to side if that helps you to see the number more clearly but do not move the card closer or farther away than this (demonstrate the card distance)."*

### 4.1.3 Interpreting the Client's Performance on the Acuity Assessments

#### 4.1.3.1 Key Client Complaints/Observations

##### 4.1.3.1.1 Pupil Size and Symmetry

Normal pupils are round, normal size, and symmetrical. Pupil size is partially determined by the amount of ambient light available. In a well illuminated room, the normal size of an adult's pupil is approximately 3mm and a child's pupil may be up to 5mm. Older adults may have smaller pupil sizes. Some medications such as those prescribed for glaucoma may also reduce pupil size.<sup>137</sup> Approximately 20% of the adult population have asymmetrically sized pupils (a condition known as physiologic anisocoria) but the difference in pupil size is less than 1mm and the pupils respond consensually (equally) to light.<sup>137</sup> Impaired pupil responses can have many causes. A dilated pupil in one eye may indicate blindness in the eye, optic nerve atrophy, or a 3<sup>rd</sup> cranial nerve lesion among other conditions. A physician evaluates the pupil to determine whether there are unilateral afferent abnormalities caused by conditions such as optic neuritis, optic nerve injury or retinal detachment. Changes in the pupil's ability to respond to light can affect the client's ability to read, see in dimly lit rooms and adjust to changing light levels within environments. The client may experience visual stress in these circumstances, reducing their motivation to engage in reading activities and a desire to avoid challenging environments.

***The client's pupil(s) is small and constricted.*** This indicates that diminished light is coming into the eye that may reduce retinal function (in the way low light affects exposure of camera film); the client may require a brighter non-glaring light to clearly see objects and details.

***One pupil is dilated.*** If the client has vision and the pupil remains dilated during accommodation, the client may experience blurred vision when focusing at a near distance. This could cause difficulty reading and completing other near vision tasks. If the pupil doesn't constrict in bright light, the client may have trouble transitioning from brightly lit to dark environments or increased sensitivity to light.

##### 4.1.3.1.2 Eye Dominance

Near distance activities typically require better acuity and more refined oculomotor control because the eye is moving short distances between targets (think of moving the fovea from word to word when reading). Reduced acuity or oculomotor control in the dominant eye typically has a greater detrimental effect on reading performance or activities that require precise eye/hand coordination than impairment in the non-dominant eye. A client with strong eye dominance will have difficulty and may be unable to successfully switch to using the other eye to direct reading saccades and precise hand movements. Eye dominance doesn't significantly contribute to completing daily activities if both eyes have normal vision. Strongly dominant clients with significant vision impairment in their dominant eye, usually experience fatigue when forced to use their nondominant eye to complete reading and other fine motor

activities. The client may experience frustration and subsequent avoidance of the difficult activities. Eye dominance is also an important factor in applying occlusion to eliminate diplopia due to oculomotor impairment. See section 5.7.1.3 and Appendix H for additional information.

***The client consistently uses either the right eye or the left eye to view the flower through the hole in the card during all three trials.*** This indicates that the eye is the dominant eye for viewing near distances.

***The client uses either the right or left eye to view the flower through the hole in the card.*** This indicates that the client may not have a dominant eye for near distances and switches dominance depending on the task demands.<sup>13</sup>

#### 4.1.3.1.3 LeaNumbers Intermediate Acuity Chart

***The client's visual acuity using the eyes together is 20/60 or less.*** Eye doctors measure visual acuity to determine whether magnification is needed to see visual detail-and if it is needed-how much magnification should be used. The client with visual acuity in the normal to near normal range (20/20-20/60) may just need a stronger refraction in their eyeglasses and should be referred to an optometrist or ophthalmologist. A client with acuity less than 20/60 when wearing their eyeglasses may have a condition that causes low vision. Any client with acuity below the normal range, should be referred for an eye exam to determine the reason for acuity loss and to determine if, and how, vision can be enhanced. Unless someone on the rehab team has experience or credentialing in low vision rehabilitation, a client with diagnosed low vision should be referred to a low vision optometrist or a low vision rehabilitation program.

***The client leans into the chart to view the numbers.*** Leaning towards the chart indicates that the client is reaching their limit of resolution and can no longer clearly see the numbers.

***The client turns the head from side to side to view the target number.*** Clients with an established macular scotoma from macular degeneration may use a head turn to move the scotoma out of the way to clearly see the target number. The same behavior may be observed in a client who is aware of their hemianopia or tunnel vision. This is a useful compensatory strategy, and it indicates that the client has insight into how their field loss affects their vision. It also doesn't alter the distance from the chart, so the acuity measurement is still accurate.

***The client omits numbers on one side.*** Clients with left homonymous hemianopia or hemi-inattention may make errors such as starting to read in the middle of the line of numbers rather than on the left side (see section 2.4.3.2). Clients with right homonymous hemianopia may not finish reading a line of numbers. When this is observed, point out the omitted numbers and ask the client to identify them; remind the client to turn their head if needed to see the numbers in the row. A client with hemianopia should be able to comply with this request; a client with hemi-inattention may not have the attentional capability to comply.

**The client misreads numbers with similar configurations.** Generally, errors where the client misreads similar numbers—such as a 5, 6, or 9, instead of an 8 suggests reduced acuity rather than a deficit in cognition, perception, or language. The exception is the client who has aphasia or dyslexia.

**The client has greater difficulty identifying larger numbers than smaller numbers.** This may indicate that the client has a significant visual field deficit and may have only a small island of visual field remaining. This type of visual field deficit can occur following central retinal artery occlusion, an optic nerve injury or an occipital lobe injury. In a client with macular degeneration, this behavior can indicate the presence of a ring scotoma where the client has a small island of intact retina surrounded by a donut shaped scotoma.<sup>210</sup> Regardless of the cause, specialized low vision reading instruction is needed to enable the client to read and referral should be made to a low vision specialist.

#### 4.1.3.1.4 Warren Text Card

Reading is an integral component of many important I-ADLS. Consulting and collaborating with eye doctors, providing appropriate assistive technology and instruction, modifying tasks to reduce reading demands are all important OT interventions.

**The client is unable to accurately read the sentence at the 20/20 or 20/25 line** (“you cannot leave without the children” or “I could have driven some more this morning”). Eye doctors strive to provide eyeglasses that enable the person to see print as small as (.4M-.5M) to provide reading reserve (e.g., less stress and fatigue) when reading the more commonly used print size of 1M (20/50 acuity). A client who easily reads the 20/50 line (“Kim does not like to wear cold shoes”) should have sufficient acuity to read most print materials but may have difficulty with small print. Difficulty reading below 20/50 may indicate that the client’s eyeglasses need to be updated. The *metric diopters needed* (third column on the chart) indicates the strength of the eyeglasses needed to enable the client to see the corresponding sentence on the card. For example, a client who can’t read the 20/50 line would need at least 2.5 diopters of strength in a pair of store-bought reading glasses to read the sentence “Kim does not like to wear cold shoes.” You might provide a pair of 2.5-3 diopter reading glasses to see if they help the client read more easily (see section 5.5.3.5). BUT NOTE: this is a very simplistic explanation of **one** of the factors that influence acuity; **many other factors** go into determining the best refraction for the client. A client with **less than 20/25** vision should be referred to an eye doctor in order to have optimal vision.

**The client leans into the chart to read the sentences.** Leaning towards the chart indicates that the client is reaching their limit of resolution and can no longer clearly see the words.

**The client leans away from the chart to read the sentences.** Leaning away from the chart may indicate that the client is having trouble with accommodation and is trying to increase the distance from the chart to reduce visual blur. This behavior is often observed in clients with convergence insufficiency.

***The client shuts one eye or squints to read the sentences.*** This indicates that the eyes are not working together. The client with diplopia from a 3<sup>rd</sup> or 4<sup>th</sup> CN lesion may be trying to remove one image to reduce visual blur and see the words more clearly. If the client has macular degeneration, it may indicate non-congruous macular scotoma in the eyes (e.g., the size and shape of the scotoma in one eye is very different from the size and shape of the scotoma in the other eye). The client shuts one eye (often the non-dominant eye) to remove one of the images in order to see more clearly.

***The client complains that the text is shimmering, floating, changing colors, disappearing.*** These odd visual changes generally indicate the eyes are no longer able to maintain fusion and focus to see print clearly. Clients with convergence insufficiency and other focusing issues may complain of odd visual changes in text as their eyes become fatigued from the effort of trying to work together to maintain a clear image.<sup>121</sup>

***The client omits letters or words on one side.*** Clients with left or right homonymous hemianopia and those with macular scotomas may make errors where they omit the beginnings or ending letters of words or transform words (into a similar word) because they do not see the entire word during fixation. They may also omit words at the beginning or end of a line of text. Generally, these types of errors occur more frequently on larger text and less frequently as the text decreases in size. If perimetry testing shows the presence of a field deficit in the fovea, the client may require specialized low vision intervention to learn to compensate for field loss when reading (see section 5.8.7). Clients with neglect may make similar errors on the left side of words or sentences and may start reading a sentence in the middle.

***The client has difficulty reading words in larger print sizes and less difficulty as the words decrease in size.*** This may indicate the presence of a visual field deficit that narrows the central visual field to a small “island” of vision. This type of field loss can occur following central retinal artery occlusion, optic nerve injury or occipital lobe injury. For clients with macular degeneration, it can indicate the presence of a ring scotoma where fixation is surrounded on three to four sides by dense scotoma. Specialized low vision reading techniques are needed to enable the client to read.

#### 4.1.3.1.5 LeaNumbers Low Contrast Flip Chart

Dr. Lea Hyvarinen is a low vision ophthalmologist and internationally recognized expert in vision charts. Her Lea Charts are widely used with children and adults. Dr. Hyvarinen developed the flip chart to provide quick screening of contrast sensitivity by testing only the range of contrast levels required to complete most everyday activities. Dr. Hyvarinen believes that there is little value in classifying contrast sensitivity as mild, moderate, severe, profound and her charts do not assign such values.<sup>113</sup> She recommends instead that therapists think about how a decrease in high or low contrast information will impair the client’s performance in various activities. To assist biVABA users to document the results of the client’s performance on the Flipchart, Dr. Hyvarinen developed a set of clinical observations paired with the contrast level that the client can identify on the chart. This provides a functional interpretation of the client’s performance

that can be used for documentation, client/family education and recommendations to the team.

Interpretation of Client Accuracy on the LeaNumbers Low Contrast Flip Chart Test	
Client correctly identifies numbers on all 5 lines (1.25% contrast level)	The client has good contrast sensitivity for communication, orientation, and mobility; special modification of the environment is not needed.
Client only correctly identifies numbers on the first 4 lines (2.5% contrast level)	The client will likely have difficulty seeing facial expressions and recognizing friends across the street. He or she may have difficulty detecting curbs and other low contrast drop offs. Increased lighting may assist the client to recognize low contrast features. Modification of the environment to increase the contrast of important environmental features is recommended.
Client only correctly identifies numbers on the first 3 lines (5% contrast level)	The client likely will have difficulty detecting subtle changes in the support surface, reading materials printed in low contrast formats, seeing black and white photographs, facial features, water, and other low contrast items. Magnification and increased lighting may assist the client to recognize low contrast features. Driving performance should be carefully evaluated especially with regards to night driving and driving in cloudy conditions.
Client only correctly identifies numbers on first 2 lines (10% - 25% contrast level)	Enhancement of contrast is needed for the client to function safely and independently. The client may require assistance to walk safely in environments. Driving performance should be carefully evaluated especially with regards to night driving and driving in cloudy conditions.
Client does not see any numbers (Contrast level is above 25%)	Contrast sensitivity function is extremely limited, and enhancement of contrast is needed for the client to function (see section 5.5.2). The client may require assistance to ambulate safely in environments. Ability to resume driving is highly questionable and should be carefully evaluated.