03/30/2018

Grade: 6th
Exam Date: 02/22/2018

Dear █

I recently had the pleasure of seeing our mutual patient, █ for a comprehensive developmental optometric and visual processing evaluation. As you will recall, █ is a 12 yo girl with a complex past medical history, including being born with a right frontal lobe cortical dysplasia and intractable seizures. To help control these seizures, she underwent a surgical right hemispherotomy leaving her with a left bilateral homonymous hemianopsia. I reviewed Dr. █ report and found it to be very thorough in describing his ophthalmic findings and ocular health assessments, from both a functional and structural interpretation. His assessment found her to have a dense left homonymous hemianopsia with macular sparing of the OD (right eye) by about 10 degrees and a superior preservation of a wedge of her left eye by about 10 degrees. His OCT findings indicate a reduction of the left nasal retinal nerve fiber layer, thus correlating to the left hemianopsia. Her Ganglion Cell Complex of both eyes were very reduced and they correspond to the Goldman visual field findings. These are structural findings that correlate to her functional left homonymous hemianopsia. He also observed and described a saccadic dysfuntion that tends to show a lagging behind the moving target requiring a need to produce a "catch-up" saccade and other saccadic intrusions. He observed moderate large amplitude double saccadic pulses upward and to the left. He also felt that she might have a visual neglect of the left side and a central visual impairment. In addition, her psychiatrist, █, MD,PhD., at █ diagnosed her with anxiety, depression, and an adjustment disorder. █ and her mother report the following frequent symptoms: head tilt to the left, eyestrain, intermittent double vision/overlapping words, words that move on the page, trouble keeping attention centered on reading, difficulty copying from one plane to another, dizziness/nausea with near work, blurred vision which worsens when reading beyond 3-5 minutes at a time, reduced reading comprehension, skipping of words/lines while reading, head/body movements while reading, and loss of place when reading, She currently takes the medications Lamictal (24 HR lamotrigine 100 MG Extended Release Oral Tablet), Zoloft (Sertraline 50 MG Oral Tablet), Keppra (24 HR Levetiracetam 750 MG Extended Release Oral Tablet), 12 HR Clonidine Hydrochloride 0.1 MG Extended Release Oral Tablet. She does not report any medical allergies.

The following is a summary of the significant findings:

Visual Acuity

At Distance (Uncorrected):	OD: 20/25	t Near (Uncorrected):	OD: 20/20
	OS: 20/40		OS: 20/20

Note: After the sensorimotor evaluation, near vision worsened to 20/60 equivalent OU.

Ocular Health
All internal and external ocular structures appeared healthy. Some mild optic disc pallor noted in both eyes.

Cover Testing
Distance: 2^ exophoria
Near: 4^ exophoria

Contour Stereopsis
■■■■■■■ stereopsis was reduced at 16 seconds of arc. The norm is 20 seconds of arc.

Binocularity and Accommodation
The results from ■■■■■■■ sensorimotor evaluation revealed a very reduced near point of convergence since she was unable to follow the moving target with both eyes to less than >12" of her nose. Normal levels of convergence occur within 2 inches of the nose without eyestrain. She also had very reduced base-in and base-out compensating fusional vergence ranges (the ability to keep both eyes aligned for sustained periods of time) at distance and near. Her fusional facility (ability to align both eyes accurately while switching rapidly from far to near) was reduced due to difficulty with fusion of BO prism. Her accommodative amplitudes (maximum focusing ability) and accommodative_facility (ability to change focus from far to near) were found to be reduced. Testing of basic focusing skills showed that ■■■■■■ has difficulty in maintaining focus on near objects and text for sustained periods of time and in switching rapidly between distance and near.

Ocular Motility
■■■■■■■ pursuit ocular motor skills revealed similar findings to Dr. ■■■■■ in which she appeared to have a lag behind the target. Additional testing was done to further document her pursuit eye movements using the Right Eye infrared system. The RightEye testing system is a portfolio of eye-tracking tests that use infra-red technology to evaluate and provide information and feedback relating to a broad range of conditions including brain injury, Parkinson's disease, autism and one's ocular motor pursuit and saccadic functioning. The RightEye replaces current manual, subjective testing in a reliable and valid manner. Every test result is compared against norms of at least 100 individuals for every peer group. The results of the ocular motor pursuits are as follows:

Circular Smooth Pursuit: What is important to note is that the two eye recordings were printed nearly on top of each other revealing a moderate angle exotropia as indicated on the left side of the red/blue circles, which are the right and left eye recording respectively. Both eyes show a a higher than average saccadic percentage, which correlates to my observations above and Dr. ■■■■■■. There is a higher than average eye target velocity error percentage and lower than normal horizontal synchronization percentage. The submetric findings show a very abnormal pursuit accuracy result due to abnormally high incidence of predictive and latent pursuit percentage. These results show problems with accuracy of both eyes for smooth circular pursuits.

Horizontal Smooth Pursuit: Again, both eyes show an exotropia as there is a shift of the right and left eye recordings. Both eyes show a high saccadic percentage, especially the right eye, and a higher than average eye target velocity error in both eyes; thus, showing difficulty with accuracy of horizontal smooth pursuit skills.

Vertical Smooth Pursuit: Both eyes have an above average smooth pursuit percentage with a lower saccadic and fixation percentage. Her vertical smooth pursuits are more intact and normal However, both eyes have a higher than normal eye target velocity error and a lower than average vertical synchronization percentage than the norm.

During the saccadic testing, I observed over and undershooting of the target with both eyes, especially when fixating from right to left. This would account for difficulty while reading from text. She shows difficulty tracking from right to left because of her left homonymous hemianopsia.

She is having difficulty scanning into the left sided field loss. Additional tests were done to evaluate her saccadic function (ability to look quickly and accurately from one target to another along the same plane) by using the Developmental Eye Movement (DEM) Test and an infrared eye monitoring system. The Developmental Eye Movement Test is a visual/verbal screening test for saccadic function and consists of 2 parts. First, ████ was asked to call off numbers arranged vertically as quickly as possible. She completed part one of the test in 29 seconds, placing her in the 85th percentile. Then ████ was asked to call off widely spaced numbers arranged horizontally as quickly as possible. She completed part two of the test in 54 seconds, placing her in the 1st percentile. Accuracy was significantly reduced due to 17 errors. Due to the difference between the vertical and horizontal times and the frequent errors, the data suggests that ████ has an ocular motor disorder.

The ReadAlyzer™ Eye-Movement Recording System is a special infrared device that analyzes eye movements while reading. An individual silently reads a paragraph to themselves while wearing goggles with microelectronics that capture extremely accurate recordings of the eye movements while they read. The individual is then asked 10 questions in which a score of 70% or better is required to ensure that they were fully engaged while reading the paragraph. The captured data is then analyzed with normalized data to provide a detailed measurement and report of one's saccadic function. Three recordings were done, using a 6th grade level text, but they had reduced reliability due to abnormally high number of anomalies and very reduced cross correlation, indicating issues with saccadic function. The results of the ReadAlyzer with the highest reliability showed that her reading is characterized by a prolonged duration of fixation and multiple anomalies. The data suggests that she has difficulty with pointing both eyes at the same spot while visually scanning text. She is getting many small pieces of the text into her mind in an unorganized fashion. This makes reading difficult for her because her eyes are working so hard to gather information appropriately and efficiently while simultaneously attempting to program her next eye movement. Overall, her saccadic function is at a 4.5 grade level. Please see the additional information regarding the ReadAlyzer results and profile at the end of this letter.

The RightEye™ Eye-Movement Recording System is another special infrared device that analyzes eye movements while reading. An individual silently reads a paragraph to themselves while microelectronics capture extremely accurate recordings of the eye movements while they read. The individual is then asked 10 questions in which a score of 70% or better is required to ensure that they were fully engaged while reading the paragraph. The captured data is then analyzed with normalized data to provide a detailed measurement and report of one's saccadic function. One recording was done, using a 5th grade level text. The results of the RightEye show that her reading is characterized by a prolonged duration of fixation. This recording had a high reliability factor of 91%. Overall, her saccadic function is at a 1.9 grade level. Please see the additional information regarding the RightEye results and profile at the end of this letter.

Visual Information Processing Evaluation
In order to fully evaluate the role of vision and how the brain processes visual stimulation in the activities of daily living; such as, reading and writing, ████ was given a comprehensive neuro-processing evaluation. These standardized tests assess the skills that allow us to look at printed symbols and analyze their shape, size, color, and direction. These tests also evaluate what an individual sees and how information is manipulated. This ability allows one to separate that which is important from the background, identify form even when it is oriented differently, and evaluate the amount of time it takes to analyze and interpret visual information. Further testing of a patient's visual attention and visual processing speed is also evaluated. Visual or neuro-processing testing evaluates one's ability to interpret or give meaning to what is seen; to recognize, differentiate and remember what has been read, and to ascribe meaning to visual information. Details of all the visual information processing evaluation are attached at the end of the letter.

Diagnoses	Codification (ICDM -10Codification)
1. Homonymous bilateral field defects, left side	H53.462
2. Other irregular eye movements/ Def. of Pursuits	H55.89
3. Saccadic Dysfunction	H55.81
4. Convergence insufficiency	H51.11
5. Accommodative Insufficiency, bilateral	H52.523

Impressions

My findings appear to correlate and confirm Dr. ███████ findings. She has a bilateral left homonymous hemianopsia secondary to her hemispherotomy. She also has a significant convergence and an accommodative insufficiency along with reduced ocular motor function of her pursuits and saccades. Collectively, all these conditions account for her symptoms and her reading difficulties.

The right hemispherotomy has affected her left eye as this eye has a reduced visual acuity most likely secondary to the optic nerve pallor seen by Dr. ███████ and myself. Dr. ███████ thorough evaluation using the OCT actually confirms that there is retinal thinning of both eyes associated with the left sided field loss. The field loss and surgery also account for the abnormal saccadic and pursuit function. This would account for the reduced reading speed that was recorded through both the RightEye system and the ReadAlyzer infra-red system. Both show that there is a prolonged duration of fixation. Actually her number of fixations and regressions was average to above average but she takes a longer time to process the information gained through her visual system. This is explained, in part, due to the frequent anomalies and low cross correlation, which indicates the presence of a convergence insufficiency or other binocular eye teaming condition.

Proper visual skills are foundational to lifelong learning. Lack of good visual skills may affect comprehension of all subjects. Efficient vision requires many visual skills including sustained focusing, eye coordination, and eye tracking. Inadequate fixation ability may result in changing beginnings or endings of words read, and words and lines may be skipped or re-read. Tracking problems may also limit the amount of information that can be processed at any given moment. Inadequate focusing skills cause difficulty shifting attention from the chalkboard to the book and back, causing fatigue and blurred vision. Lack of adequate eye teaming makes it hard to maintain attention on near point tasks and may result in fatigue, motion sickness, dizziness, headaches and double vision. These symptoms are a sign of visual stress and can absolutely be explained by her complex neurological medical history.

Many tests showed that ███████ is struggling with visual stress and ocular motor anomalies. Due to her exophoria and convergence insufficiency, she is unable to point both eyes to the exact same location, thereby causing visual stress and she cannot work adequately enough at near to allow her to work for extended periods of time. When the visual system is stressed, a person develops a kind of reduced functional tunnel vision-like condition. It is almost as if one is not able to fully see the whole word or groups of words in a sentence. When paired with an actual left bilateral hemianopsia, she will most definitely have difficulty with her look-ahead skills necessary for fluent ocular motor scanning and reading. The results of the ReadAlyzer and RightEye confirm this. ███████ performance shows a significant problem with making those eye movements accurately and efficiently.

Additional testing of her processing skills revealed further visual information processing delays that are also contributing to her academic and learning success. The difficulty with visual processing further compounds the ability for her to perform academically. I have documented multiple areas of visual concern: her focusing ability, her eye teaming ability, visual tracking and eye movement control, visual motor integration, visual memory, visual form analysis, and her peripheral vision.

It is important to realize treatment of all vision and visual perceptual-motor problems with vision rehabilitation therapy, to the fullest extent possible so that these contributing problems do not impede progress in educational therapy. She should look for another developmental optometrist near her location to further look into this treatment to improve her conditions. In the meantime, she will require extensive accommodations and compensations to assist her in her daily activities in the educational environment.

Recommendations

Due to her symptoms, conditions, and the noticeable impact on her performance, an individualized neuro-optometric rehabilitation program is medically necessary and recommended for █████ which primarily includes in-office therapy with supplemental home support rehabilitation activities. A home computer program, which can be monitored from the office, will be prescribed to reduce the duration of the program. The neuro-optometric re/habilitation sets the stage for █████ to learn many visual skills designed to improve her ability to gather and process visual information in a more efficient and comfortable manner. This allows her to quickly absorb, understand and use more information through her visual system more efficiently.

Therapy conducted in my office consists of a once-weekly, fifty minute session with 20-30 minutes of homework to be done 4 times a week or every other day. At the completion of 12 sessions of office therapy, █████ will be evaluated to determine any progress and when to discontinue in-office therapy. The treatment program for a convergence insufficiency, an accommodative insufficiency, a saccadic and pursuit disorder, and visual perceptual deficiencies associated with a traumatic brain injury or surgery such as her situation, typically requires 35-50 visits. One should administer both an in-office program and a home support program to enable █████ to get the highest success rate in the shortest amount of time. She should be closely monitored over the course of her therapy program and her program should be discontinued when she has reached maximum medical improvement or achieved the goals of therapy.

█████ was issued a multifocal prism spectacle prescription to be used especially for reading, writing, and computer use. These glasses, however, will not correct her underlying eye focusing, and eye coordination dysfunction. The purpose of the lens would be to reduce the stress placed on █████ visual system to better allow her to continue working and concentrate on the task.

There are 3 general approaches to helping children succeed despite visual developmental delays and other associated binocular visual conditions: compensatory, accommodative, and therapeutic. Compensations "go around" the problem, accommodations minimize the impact of the problem, and therapeutic approaches are designed to eliminate the problem.

Accommodations:

The following accommodations are also recommended to reduce █████ visual stress.
- █████ is considered visually impaired and this should be noted on her IEP.
- Use large print at a minimum of 14 point font.
- Use a sloping work surface for reading when possible.
- Reading and writing should be done at a distance equal to the length of the student's arm from elbow to middle knuckle (Harmon distance).
- Encourage proper posture and paper placement when writing.
- Due to her left peripheral vision loss, there is concern of her left side, especially when walking down the hallways, across streets, or when moving around in the classroom. She should be seated on the left side of the room so that she does not have to worry about too many objects on her left side and to enable her to use her right sided peripheral vision to scan more adequately the board. Materials and books should be placed on her right side.
- Use a finger or guide to help follow the line of print when reading.
- Provide frequent breaks after 30 minutes of sustained near vision work to counter fatigue and to optimize attention. Ex: Closing eyes or looking into the distance for 5-15 seconds.

- Minimize chalkboard-to-desk copying by substituting desk copy work instead.
- When possible, allow ███ to take a visually demanding test orally.
- Reduce the amount of visually demanding homework and classroom materials as this is difficult for ███ It is also difficult for her to write independently on school worksheets efficiently. Therefore, a 1:1 aide can assist her with this classroom demand. I recommend Worksheet conversion apps that would allow her to independently answer questions using her finger either on an IPad or an electronic whiteboard. An electronic whiteboard would allow for movement, to be able to get out of her seat and to physically engage with the electronic whiteboard.
- Reduce the amount of written homework due to visual motor integration weakness.
- Remove materials unrelated to the task and other peripheral stimuli to increase attention.
- Allow ███ to have untimed tests or projects requiring sustained reading and writing.
- Allow visually demanding sections (reading and writing) of state testing to be administered over the course of several days.
- She should be allowed to use a high contrast keyboard (ie: white or yellow keys with black letters) as well as a one-handed keyboard.
- She should have orientation and mobility training.
- A teacher of the visually impaired should work with her for at least 30 minutes a week. The teacher should consult with the classroom teacher to help ensure ███ receives appropriate access to technology and determine if a Bluetooth keyboard for the IPad is better than using the onscreen keyboard. The teacher should also help the classroom teacher understand how her visual conditions are affecting her schoolwork.
- If schoolwork is presented on a worksheet, the following modifications should be made: no more than one column of text on a page, size of pictures/visuals should be high contrast color (ie; 5 cm by 5 cm in size). The number of math problems or pictures per page should be no more than 10.
- Media and her teacher should be physically close and audibly close to ███
- Taped recordings of lectures or note takers would also be required for accurate retention because of the difficulty in copying from far to near.
- Assistive technology such as Kuzweil 3000 is a program that I feel is required for studying and reading textbooks. Other programs I feel are necessary are eClipse Reader, Inspiration, and Dragon Naturally-Speaking.
- Consider the Resources from the ███████ They have a very thorough Fact Sheet regarding educational strategies for children with homonymous hemianopsia. Their information packet is very helpful in also understanding the visual conditions and their effects on reading and other near point work. The same organization also produces a guide for children after a hemispherectomy that can serve as further documentation of conditions and their effects on activities of daily living.

Lastly, ███ complex neurological medical history understandably resulted in multiple visual conditions that collectively are causing a visual impairment. She deserves and requires a comprehensive and complex educational environment as well as ongoing and frequent services including a teacher of the visually impaired of 30 minutes/week. She should have all the benefits that technology can provide and you can look into a technological company called Savanna. I completely support the logical recommendations of her previous doctors including Dr. ███ and Dr. ███, her neuropsychologist, in that she should have the provision of an aide that is working with her on a 1:1 basis and the attendance to a smaller, more specialized school that can provide the accommodations and compensations in a more efficient and comprehensive manner.

I look forward to hearing about her progress in the future. We are excited that we will play a part in helping her achieve the most out of her education and life. She is a very inspiring young woman that has the potential to achieve much in her lifetime educationally and otherwise, but she will require extensive work on everyone's part to help her achieve her goals. I enjoyed my time with

████████and look forward to seeing her again for a progress evaluation in about a year. If you have any questions or concerns, please feel free to contact me.

Sincerely,

████████████████

████████████ O.D.

DDB/ja
Cc:

<u>Visual Processing Test Results for</u> ██████████

TEST PERFORMED	DATE Results
Visual Analysis Skills	
• Monroe Visual 3 Memory	Age Equivalency: 8 yo. **
• Motor- Free Visual Perceptual Test (MVPT-4)	3%**
Visual Motor Integration Skills	
• Visual Motor Integration (BEERY) 6th Ed.	5% **
Eye Movement Test	
• Groffman Visual Tracing Test (Upper Level)	Age Equivalency: 7 yo. **

** = inadequate performance

Observations during Testing

████████was pleasant, attentive and cooperative during the testing.

<u>Description of Developmental Visual Information Processing Skill Tests</u>

The Monroe III Visual Memory Test
This consists of 16 symbols that are shown in four groups of four for ten seconds each. Individuals are asked to write down as much as they can remember about each of the symbols. Individuals with deficient scores on this test often express difficulty with decoding, reading comprehension, organization of details, and pattern sequence. Children who score below their age equivalency often struggle in areas of reading and math.

Motor- Free Visual Perceptual Test (MVPT-4)
The MVPT-4 is designed to assess visual perception and provides a single score that represents the individual's general visual perceptual ability. Tasks include matching, figure-ground, closure, visual memory, and form discrimination. Deficiencies in these areas may result in letter/word confusion, poor spelling, reversed letters/numbers, and poor reading comprehension.

Beery-Buktenica Developmental Test of Visual-Motor Integration Full Form, 6th Edition
The test of Visual Motor Integration Test is a test of neurological development. This task requires one to reproduce geometric designs of increasing complexity, and it shows how well the visual system controls the fine motor (i.e. writing) system. In order to accurately copy a visual stimulus, the patient must be able to see that the pattern is made up of a finite number of parts and that these parts interrelate in a very specific manner. These abilities are referred to as analytical skills. In order to reproduce the pattern, one must call upon these analytical skills, integrate this information, with other systems and generate a motor response. Deficiencies in the area of visual motor skills may make handwriting more difficult resulting in poor spacing, inability to stay on the line, and excessive erasures. One's ability to complete written work within an allotted period of time may also be affected.

The Groffman Visual Tracing Test

The Groffman test consists of intertwined lines that must be followed from beginning to end. Two factors are measured, those of speed and accuracy. This test is felt to relate to those tasks where eye monitoring skills and eye-hand coordination is essential such as reading, hand writing and copying from board to book. It is also a test of visual attention.

ReadAlyzer and Right Eye Analysis Report

Due to the complaint of reading difficulties a special eye movement recording test was done. The ReadAlyzer is a special infrared device that analyzes eye movements while reading. The microelectronics inside the goggles allow for extremely accurate high-speed recordings of the eye movements during the reading of a short selection of text. The data is captured by a computer and analyzed automatically. The ReadAlyzer provides a detailed measurement of the efficiency of the foundational silent reading visual scanning skills. The reports generated by the ReadAlyzer provide an objective measure of a student's existing visual saccadic ability, as well as the gains made during and after the completion of their vision rehabilitation program. A paragraph is read silently by the individual for comprehension as he/she is asked ten (10) questions in which a score of 70% or better is required to ensure that the person was engaged while reading the paragraph. Therefore, the measurements were properly obtained and not measurements of random eye movement. Performance on this test is directly related to the eye movements associated with silent reading.

Number of Fixations: This is the number of times the eyes stopped to read the words in the passage. An average adult will make 8-10 fixations when reading a 10 word line. A superior reader will make about 5, while a child in elementary school will fixate 13-22 times in 10 words. The "word by word" reader does not make one eye stop per word but usually 1-2.

Number of Regressions: This is when the eyes are observed to go backwards in the middle of a line to either re-read a word or part of a word. The count of regressions does not include the normal return sweep of the eyes to the beginning of the next line. Excessive regressions can result from inadequate binocular coordination, conditioning during "beginning to read" stages, and visual perceptual inadequacies.

Average Duration of Fixation: This is the amount of time that the eyes stopped in order to figure out what is being seen. An average elementary school child might pause 0.33 seconds. A college student will average 0.24 seconds.

Reading Rate with Comprehension: This is calculated by combining all the above factors yields to determine an overall reading speed of numbers or words per minute. The factors that influence the reading rate are visual efficiency, perceptual accuracy and efficiency, and ocular motor development.

Grade Level of Efficiency: The grade level of efficiency is based on the consideration that fixations, regressions, and reading rate are the most important components of efficient reading.

Cross Correlation: It is designed to evaluate the adequacy of binocular coordination. A cross correlation of 90% or lower is considered to be clinically significant for a binocular dysfunction.

Anomalies: When this number exceeds 4 in any of the 4 categories, it is considered clinically significant.

RightEye Test Metrics Explained
The following document includes a description of how each metric within the tests are calculated.

CIRCULAR, HORIZONTAL, AND VERTICAL SMOOTH PURSUIT
Smooth Pursuit (%): is calculated as the user's eyes following the target within a velocity range of the target. This is then calculated as a percentage of the overall test time. Smooth pursuit divided by the total test time multiplied by 100/1 is reported for each test.

Saccade(s) (%): are fast eye movements that are not associated with stimuli, or change in velocity over time. This metric accounts for velocity of the user's eyes. The number of saccades divided by the total test time multiplied by 100/1 is reported for each test.

Fixation (%): Fixation is a stopping point of the eye of 100ms within a one-degree diameter dispersion. This is then calculated as a percentage of the overall test time. Fixation is divided by the total test time multiplied by 100/1 is reported for each test.

Eye/Target Velocity Error (°/s): refers to how far the user's eyes were away from the target (non-directional). This metric is calculated by subtracting the phase of the stimuli and the user's eyes at same sample time, and then it is converted and reported as degrees per second.

Horizontal synchronization SPEM (0-1): refers to how far off on the X plane (coordinate) the user's eyes were during the test. For example, if a user's eyes were on target and perfectly synchronized on the X plane, (s)he will receive a reported score of 1.0.

Vertical Synchronization SPEM (0-1): refers to how far off on the Y plane (coordinate) the user's eyes were during the test. For example, if a user was on target and perfectly synchronized on the Y plane, (s)he will receive a reported score of 1.0.

On Target Smooth Pursuit (%): refers to the user's eyes having followed a target within a velocity range of the target (for example, if the user's eyes executed the same velocity range as the target). For each smooth pursuit, if the eyes were on the stimuli and between 0.0 and 1.95 cm, it is classified as an on target smooth pursuit. This is then calculated and reported as a percentage of on-target smooth pursuits over total test time.

Predictive Smooth Pursuit (%): refers to the user's eyes having followed but lead the target (for example, if the eyes moved in the same velocity range but are directionally ahead of target). For each smooth pursuit, if the user's eye was in front of stimuli and between 1.95 and 5.03 cm, it is classified as predictive smooth pursuit. This is then calculated and reported as a percentage of predictive smooth pursuit over total test time.

Latent Smooth Pursuit (%): refers to the user's eyes having followed but lagged behind the target (for example, if the eyes moved in the same velocity range but were directionally behind the target). For each smooth pursuit, if the eyes were behind the stimuli and between 1.95 and 5.03 cm, it is classified as a latent smooth pursuit. This is then calculated and reported as a percentage of latent smooth pursuit over total test time.

RightEye

Head Movement

Name : ▮

Grade Level Equivalent : 1.9

Age: 12 years 10 months

Title: Tree Leaves

Grade level of text read: 5.0

Vergence

- • Fixation
- ⌃ Saccade
- ⌄ Regression
- ⌄ Return Sweep

Average: 17.27 exo

The leaf is the part of a tree that changes light from the sun into energy and food for the tree. A large tree may have more than 100,000 leaves. Leaves live for about 100 days on a tree, and then the water and sugars of the leaf drain back into the tree. The leaf dies, breaks off, and falls to the ground. Insects in and on the ground digest the fallen leaves to release the nutrients in the leaf. The tree will use these nutrients as food the next year. The sugars in the leaves change chemically, which causes the leaves to change color. The colder temperatures of fall can lead to these changes in color. How quickly the nights turn cold affects how the leaves change color, making some autumn prettier than others.

Reading Profile

Grade Average vs Reading Metrics (WPM, Fix/100, Fix Dur, Reg/100)
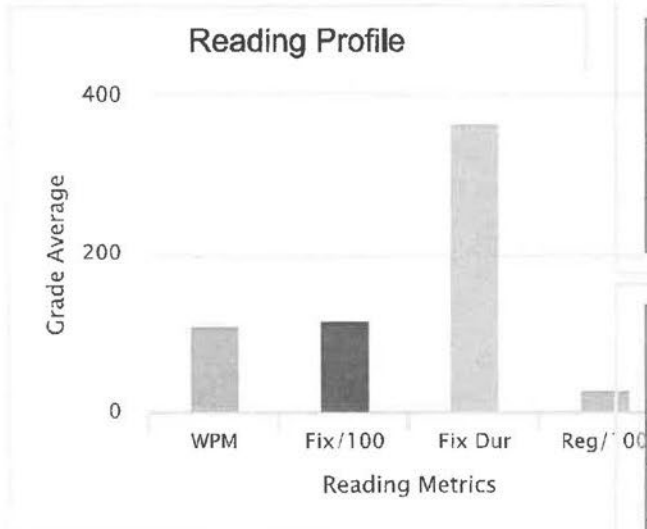
READING RESULTS	METRICS
Lines to analyze : Lines Found in Text	10 : 22
Recording Time	03/16/18 03:49 PM (EST)
Analysis Reliability	91%

VISION INDICATORS	Y/N	LEVEL	RECOMMEND
Dry Eye	No	Low	No issue identified
Visual Fatigue	Possible	Moderate	May see vision specialist
Binocular Vision Issue	Yes	High	See vision specialist

Tracking Over Time

Legend: Grade Level, Reading Rate, Fixations, Duration, Regressions
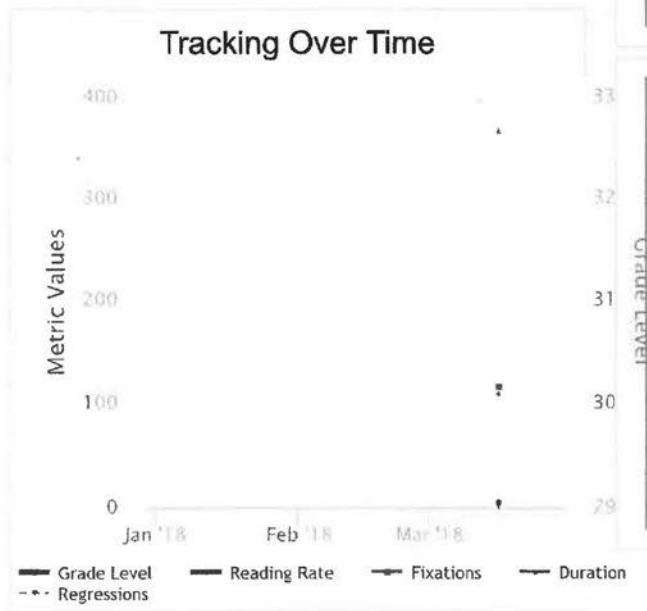
READING METRICS	MY EYES	GRADE AVERAGE
Correct Comprehension Answer (%)	90	70
Reading Rate (wpm)	110	173
Fixation / 100 words (#)	117	129
Average Fixation Duration (ms)	366	270
Regressions / 100 words (#)	29	28
Regression/Fixation Ratio (%)	24	22
Disparity (mm)	105	4

Disclaimer

The RightEye Reading EyeQ test is not a substitute for a comprehensive eye exam.

The information in this report is for general educational purpose only. Information you read in this report is provided for comparative purposes, does not constitute a diagnosis of any kind and cannot replace the relation that you have with your healthcare professional. We do not practice medicine or provide medicinal services or advice as a part of this report. You should always talk to your healthcare professional for diagnosis and treatment.

Guidelines

• **Grade Level Equivalent:** determines where the reader falls on the grade level reading scale.

• **Age:** is the age of the reader at the time of testing.

• **Title:** is the title of the text read

• **Grade Level of text read:** Is the grade level of the text chosen. This is validated grade reading content.

• **Head movement (%):** is the percentage of the movement done with head versus eyes.

• **Vergence:** refers to the ability to coordinate and use both eyes as a team. Vergence indicates the point at which the eyes converge compared to the reading stimuli.

• **Reading Profile::** shows the four most important metrics for determining your reading level.

• **Lines to Analyze:** is the number of lines of text that were shown minus the first and last lines.

• **Lines Found in Text:** are the number of lines found by the reader.

• **Recording Time:** Refers to the amount of time useful data was recorded. Recording time is one factor that influences analysis reliability.

• **Analysis Reliability (%):** refers to the level of confidence in the report metrics and outcome. If you receive an analysis reliability score lower than 80%, please retest. It is important to be sure that the reader has successfully calibrated and is seated at the required 60cm distance to obtain high reliability analysis scores.

• **Dry Eye:** clinically dry eyes can cause discomfort and affect performance in reading and other tasks.

• **Visual Fatigue:** refers to the tiredness of the readers eyes. Tired eyes can affect the ability to read efficiently.

• **Binocular Vision Issues:** provides indication of whether the eyes are working together, as a team, or not. If the eyes do not work together reading and other visual tasks can become difficult.

• **Fixations/100 Words (#):** is a stopping point of the eyes, represented per 100 words of text read.

• **Regressions/100 words (#):** is the number of time the reader looked backwards, in English content this is from right to left, while reading.

- **Average Fixation Duration (ms):** is the average amount of time the reader stopped (fixated) while reading.

- **Reading Rate (words/minute #):** refers to how many words were read per minute of reading.

- **Regression/Fixation Ratio (%):** is regressions divided by fixations represented as a percentage.

- **Correct Comprehension Answers (%):** how many comprehension questions were answered correctly.

- **Disparity (mm):** is the difference between the left and right eye taken at fixations then divided by the number of fixations. Represented in millimeters.

NOTE: ALL aspects measured above can be modified either by vision training or other optometric methods e.g. glasses, eye drops.

RightEye Report

Participant Id	Participant Name	Assessment Date	Assessment Type	Notes
■■■■	■■■■	03/16/18 03:38 PM (America/New_York)	Neuro	

# Circular Smooth Pursuit

The recommended distance from the screen is >58cm and <67cm. The average distance from the screen during this test was 60 cm.
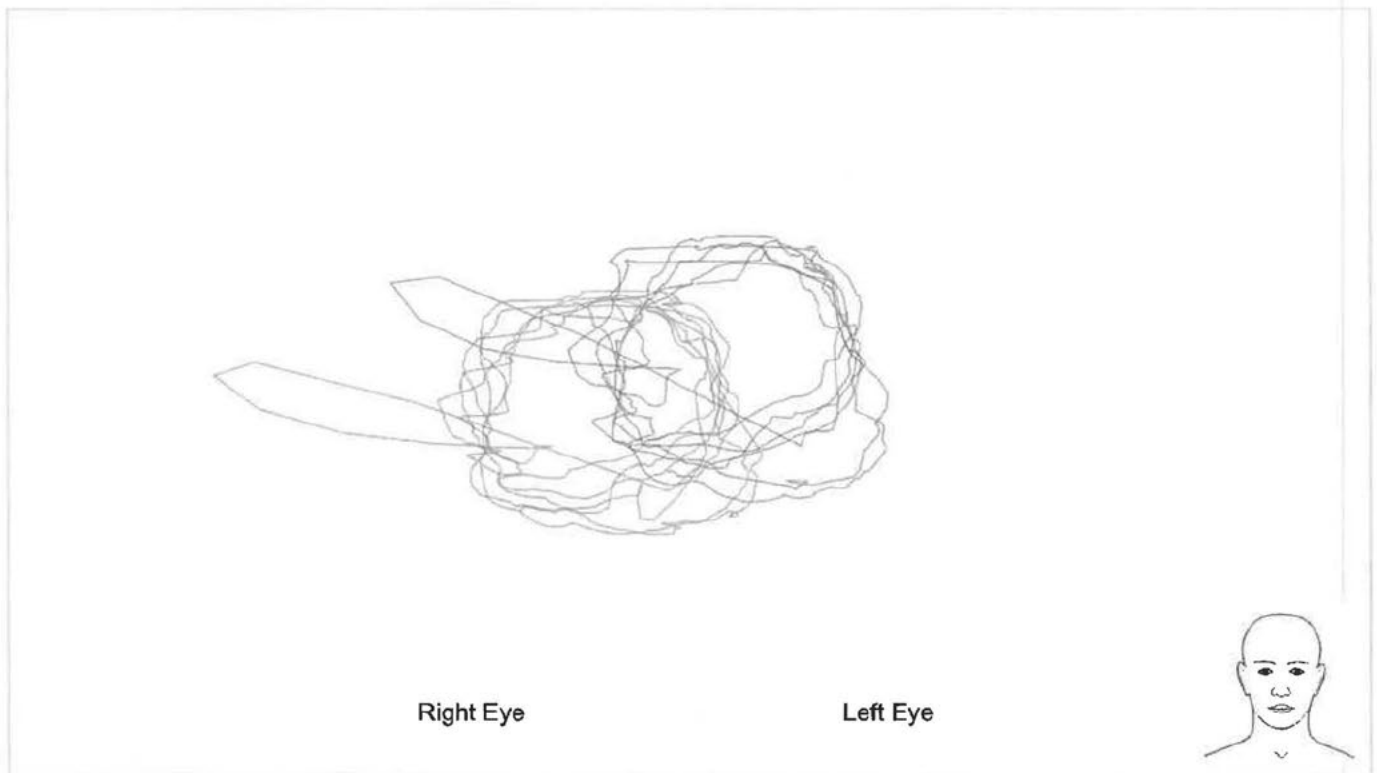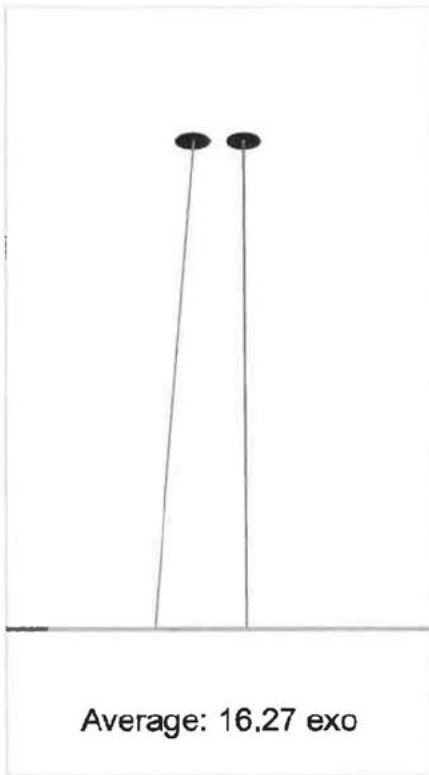
Average: 16.27 exo

Right Eye   Left Eye

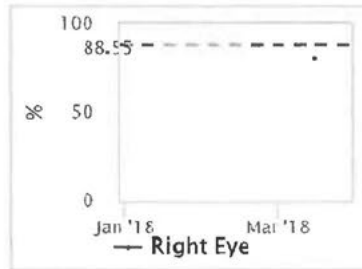| Metrics	Right Eye		Left Eye		Both	
	Actual	Population Age 9-16	Actual	Population Age 9-16	Actual	Population Age 9-16
Smooth Pursuit (%)	89.43	90.86	87.79	90.79	89.89	92.91
Saccade (%)	9.64	4.81	10.21	4.97	9.70	4.07
Fixation (%)	0.92	3.92	2.00	3.75	0.41	2.59
Eye Target Velocity Error (°)	18.38	14.71	17.34	14.56	17.96	14.66
Horizontal Synchronization SP (0-1)	0.38	0.9	0.45	0.9	0.85	0.91
Vertical Synchronization SP (0-1)	0.86	0.86	0.74	0.88	0.86	0.87
Sub-Metrics	**Right Eye**		**Left Eye**		**Both**	
	Actual	Population Age 9-16	Actual	Population Age 9-16	Actual	Population Age 9-16
On Target Smooth Pursuit (%)	0.00	63.73	0.00	66.4	46.94	67.09
Predictive Smooth Pursuit (%)	36.80	5.4	63.20	4.13	30.29	4.23
Latent Smooth Pursuit (%)	52.63	10.83	19.11	8.5	12.66	10.56

SP% refers to % of time spent in SP with acceptable distance and speed. 100% is perfect.
Saccade and Fixation % should be low.
Eye/Target Velocity Error refers to speed represented in degrees per second off target. A low number is better.
Horizontal and Vertical Synchronization SP refer to stay on/off target in horizontal/vertical (x and y) plane. 1.0 is perfect.
Predictive and Latent SP refer to 7 mm or more ahead or behind target at the same speed as the target.
On Target SP refers to % of time within 9mm of the target while in SP.
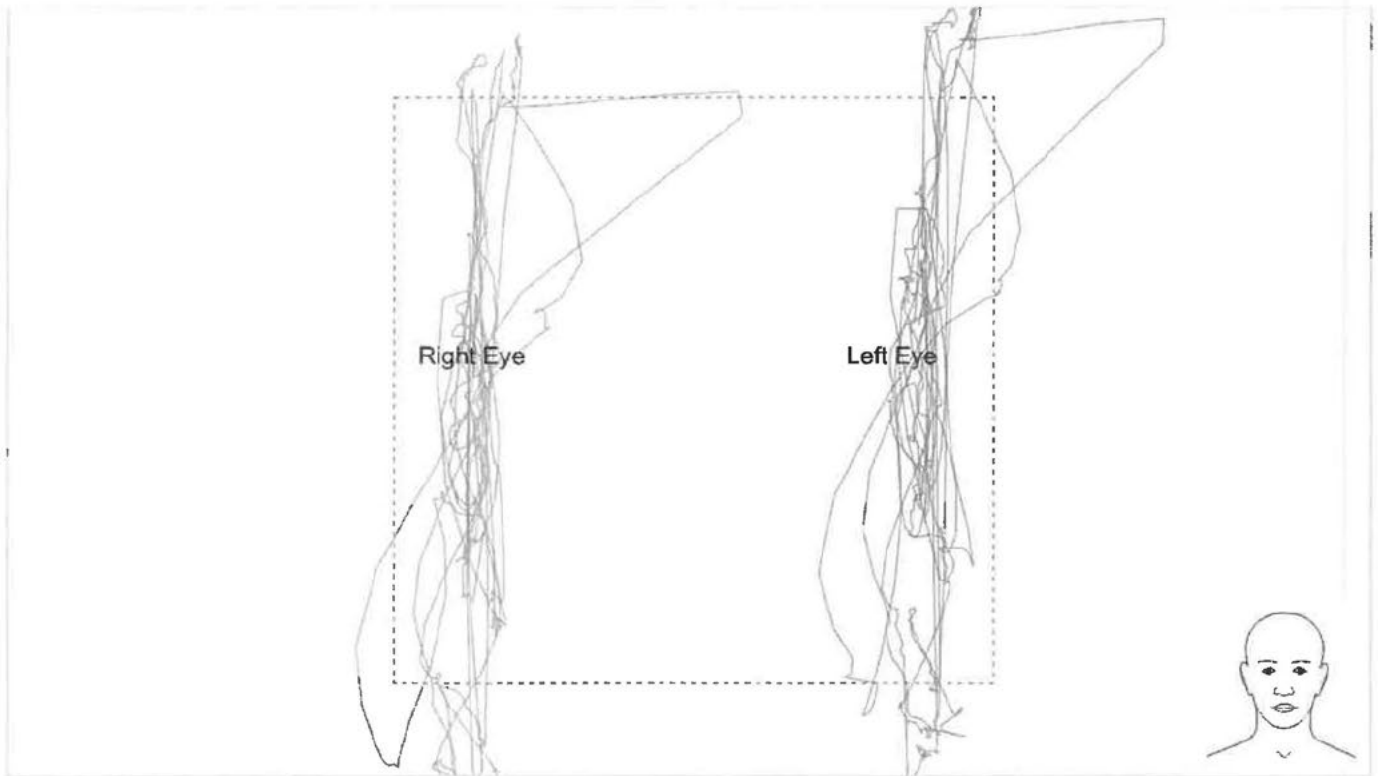
Smooth Pursuit (%)
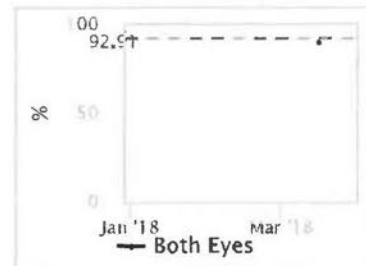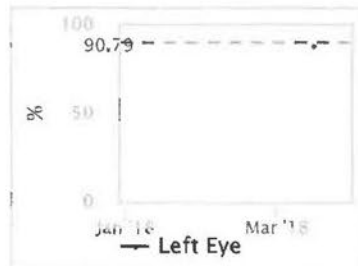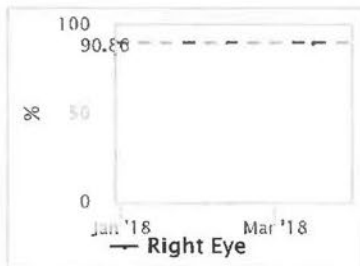
Eye/Target Velocity Error (°)
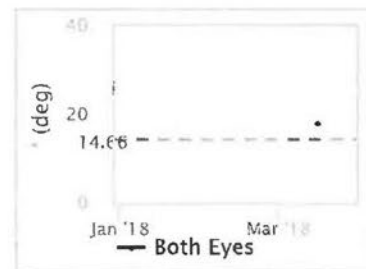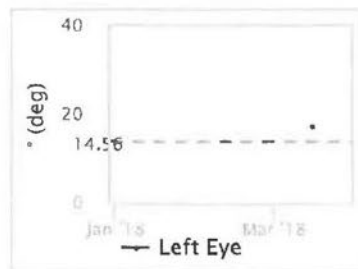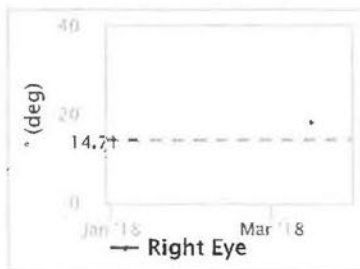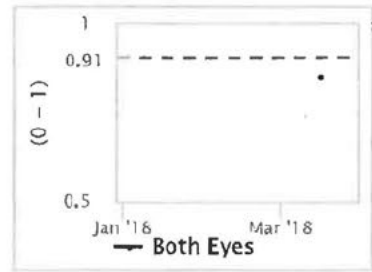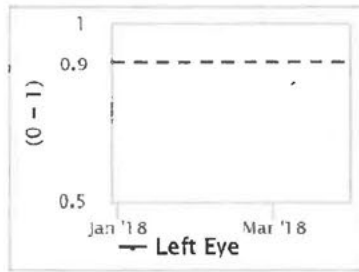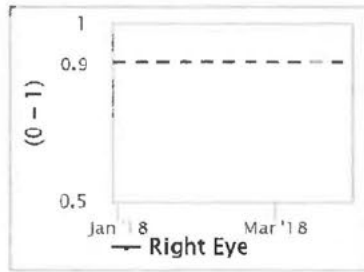
Horizontal Synchronization SPEM (0-1)

Right Eye	Left Eye	Both Eyes

Vertical Synchronization SPEM (0-1)

Right Eye	Left Eye	Both Eyes
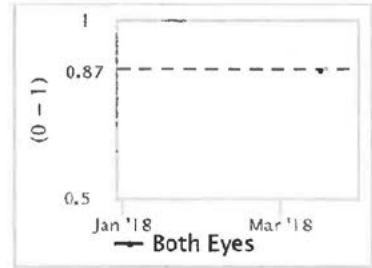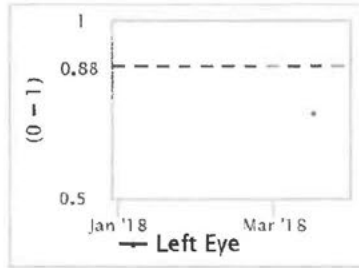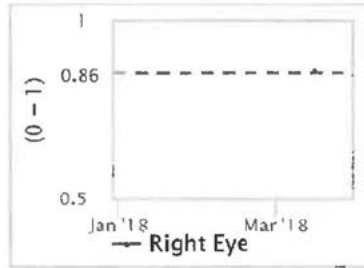
Horizontal Smooth Pursuit

The recommended distance from the screen is >58cm and <67cm. The average distance from the screen during this test was 61 cm.

Average: 12.95 exo
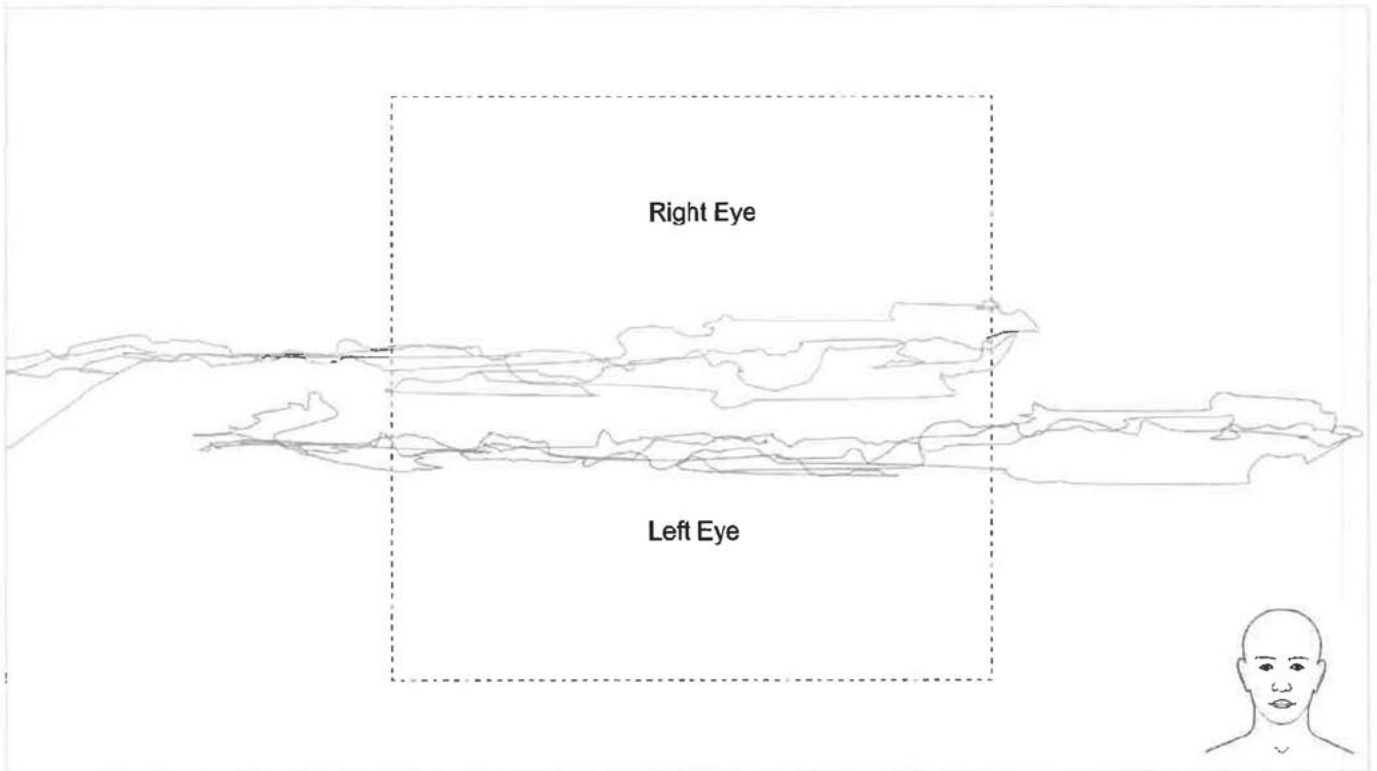
Right Eye

Left Eye

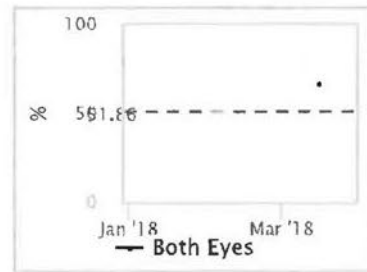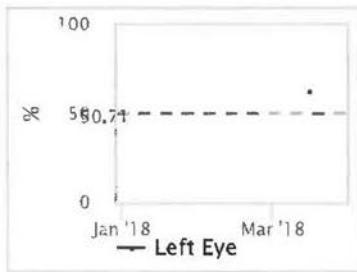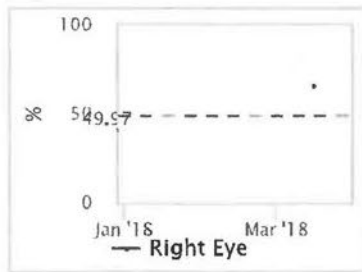| Metrics	Right Eye		Left Eye		Both	
	Actual	**Population** Age 9-16	**Actual**	**Population** Age 9-16	**Actual**	**Population** Age 9-16
Smooth Pursuit (%)	80.66	88.55	86.66	88.68	84.17	89.4
Saccade (%)	13.83	3.91	8.89	3.86	11.11	3.77
Fixation (%)	5.51	6.93	4.45	6.76	4.72	6.21
Eye Target Velocity Error	22.28	18.01	20.60	17.96	21.67	18.21
Horizontal Synchronization SP (0-1)	0.90	0.97	0.87	0.97	0.89	0.97

SP% refers to % of time spent in SP with acceptable distance and speed. 100% is perfect.
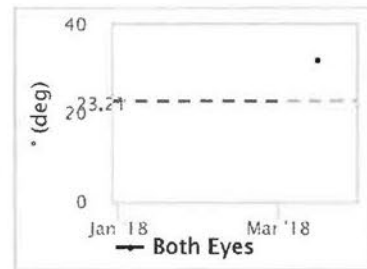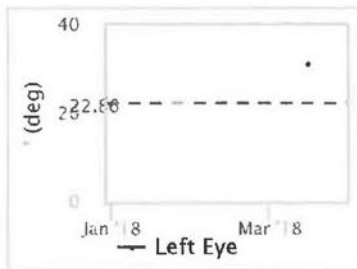Saccade and Fixation % should be low.
Eye/Target Velocity Error refers to speed represented in degrees per second off target. A low number is better.
Horizontal Synchronization SP refers to stay on/off target in horizontal (x) plane. 1.0 is perfect.
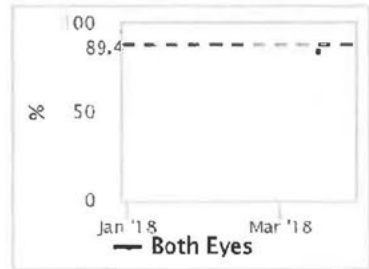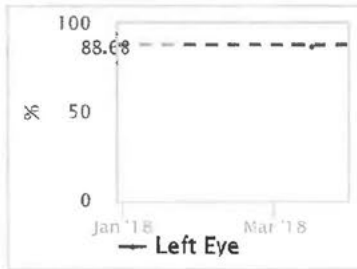
Smooth Pursuit (%)

Eye Target Velocity Error
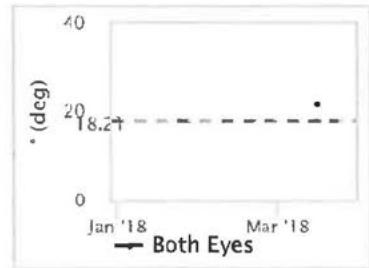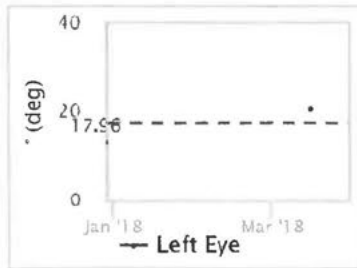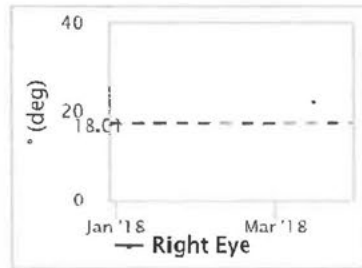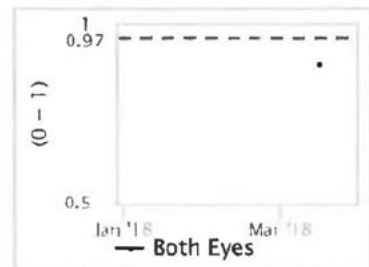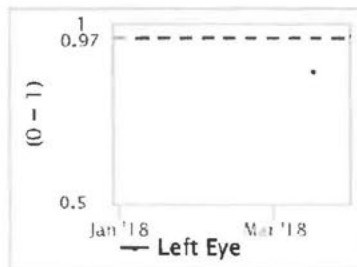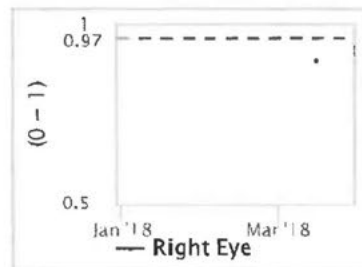
Horizontal Synchronization SP (0-1)

Vertical Smooth Pursuit

The recommended distance from the screen is >58cm and <67cm. The average distance from the screen during this test was 61 cm.

Metrics	Right Eye		Left Eye		Both	
	Actual	**Population** Age 9-16	**Actual**	**Population** Age 9-16	**Actual**	**Population** Age 9-16
Smooth Pursuit (%)	65.80	49.97	62.16	50.71	66.53	51.86
Saccade (%)	16.31	22.57	18.58	22.49	15.75	19.7
Fixation (%)	17.89	24.44	19.26	24.65	17.73	25.2
Eye Target Velocity Error	32.20	23.24	31.13	22.86	31.97	23.21
Vertical Synchronization SP (0-1)	0.65	0.72	0.59	0.72	0.60	0.71

SP% refers to % of time spent in SP with acceptable distance and speed. 100% is perfect.
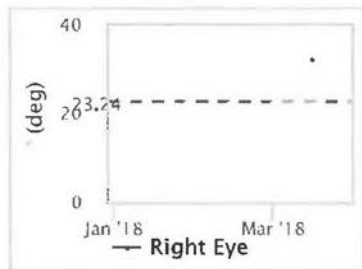Saccade and Fixation % should be low.
Eye/Target Velocity Error refers to speed represented in degrees per second off target. A low number is better.
Vertical Synchronization SP refers to stay on/off target in vertical (y) plane. 1.0 is perfect.
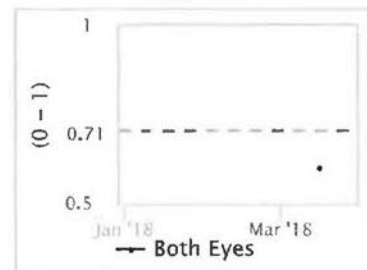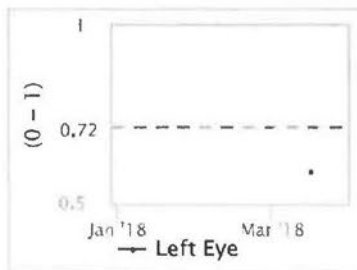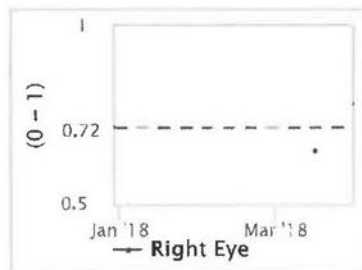
Smooth Pursuit (%)

Right Eye — 100, % 549.57, 0, Jan '18 — Mar '18

Left Eye — 100, % 550.74, 0, Jan '18 — Mar '18

Both Eyes — 100, % 551.86, 0, Jan '18 — Mar '18

Eye Target Velocity Error

Right Eye — 40, °(deg) 23.24, 0, Jan '18 — Mar '18

Left Eye — 40, °(deg) 22.86, 0, Jan '18 — Mar '18

Both Eyes — 40, °(deg) 23.24, 0, Jan '18 — Mar '18

Vertical Synchronization SP (0-1)

Right Eye — 1, (0-1) 0.72, 0.5, Jan '18 — Mar '18

Left Eye — 1, (0-1) 0.72, 0.5, Jan '18 — Mar '18

Both Eyes — 1, (0-1) 0.71, 0.5, Jan '18 — Mar '18

General Terms

Saccade: rapid eye movement to get from point A to point B

Fixation: Stopping point for the eye

Smooth Pursuit: following the target within an average speed and distance

Population: average based on group of 2500 people aged 11-62

Left and right eye fixations and saccades can vary up to 10 points between eyes.

DISCLAIMER

RightEye Report

Participant Id	Participant Name	Assessment Date	Assessment Type	Notes
███	███	03/16/18 03:47 PM (America/New_York)	Performance	

Simple Reaction Time

Suggested training includes targeting one object

Metrics	My Eyes	Population
		Age 9-16
Simple Reaction Time (ms)	327	437

◄   ►

Refers to how long it took you to press the button when you see the target (alien).