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School of Occupational Therapy

Pediatric Cortical Visual Impairment: A Doctoral Capstone Experience

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A capstone project submitted in partial fulfillment for the requirements of the Doctor of Occupational Therapy degree from the University of Indianapolis, School of Occupational Therapy.

Under the direction of the faculty capstone advisor:

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A Capstone Project Entitled

Pediatric Cortical Visual Impairment: A Doctoral Capstone Experience

Submitted to the School of Occupational Therapy at University of Indianapolis in partial fulfillment for the requirements of the Doctor of Occupational Therapy degree.

By

Amanda Abbott

OTS

Approved by:

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Abstract

Cortical visual impairment (CVI) is the leading bilateral visual impairment in children under the age of 18. CVI is caused by an insult to the posterior visual pathway resulting in difficulties processing what the eye is seeing. Children receive a diagnosis of CVI through recommendations of an ophthalmologist or optometrist and results of a CVI Range assessment, often administered by an occupational therapist. Despite CVI being the leading bilateral visual impairment in children, there are few occupational therapists trained on general CVI knowledge and/or the CVI Range. The aims of this paper are (1) to describe how occupational therapy can provide a meaningful service to children with CVI and (2) to describe the process of creating training guidelines for the CVI Range.

Pediatric Cortical Visual Impairment and Occupational Therapy

Cortical visual impairment (CVI) is the leading cause of visual impairment for children in developing countries (Matsuba & Jan, 2006). As medical advances and perinatal care continue to increase the number of surviving babies, the number of children with CVI will continue to increase. Cortical visual impairment can inhibit performance and participation in many occupations, including activities of daily living, and significantly affects daily life for a child and his/her family. For children, this could mean increased difficulties in activities at school, during play, or even self-care tasks, such as dressing or brushing teeth (American Occupational Therapy Association, 2014). Occupational therapists can serve this population by adapting the environment to maximize and further develop residual vision for a better quality of life for children with CVI.

Literature Review

Cortical visual impairment is most commonly caused by perinatal hypoxic ischemia (Matsuba & Jan, 2006). Damages to the posterior pathways of the brain during birth or trauma inhibit visual processing, making it difficult for children with CVI to process visual input that is too complex (Roman-Lantzy & Lantzy, 2010). While children with CVI may initially present as blind, they actually retain ranging amounts of residual vision, which can be determined through interdisciplinary assessments and evaluations typically administered by an occupational therapist and ophthalmologist. Occupational therapists can have a particularly significant role in the lives of children with CVI by not only training these children on adaptive techniques to improve participation in daily activities, but also by implementing strategies and tools to increase residual vision that are specifically catered to a child's unique visual processing needs. There has been limited recent research on pediatric cortical visual impairment; however, researchers have found and suggested methods for evaluating and intervening with this population in the past.

It is recommended that evaluation of cortical visual impairment in children include the CVI Range designed by Christine Roman-Lantzy (2007). This assessment helps to determine what level of vision the child retains to help guide intervention. It also determines what phase the child falls into in regards to their visual function. Phase I (CVI Range 0-3) corresponds to building visual behavior; Phase II (CVI Ranges 4-7) includes integration of vision with function, and Phase III (CVI Ranges 8-10) categorizes resolution of remaining CVI characteristics (Roman-Lantzy, 2007). Identifying what phase of visual function a child has helps to guide intervention and treatment planning and can be used to quantitatively display progress of visual function. Further explanation of this assessment will occur in the methods section of this paper. Groenveld (1990) suggested an individualized approach for each child by spending generous time in observation during evaluation to understand the child's unique perspective. While this literature is outdated, the methodology is still relevant in CVI treatment today and highlights the need for more current evidence-based research in this area.

Specific interventions for children with cortical visual impairment vary depending on the child's unique visual capabilities. A study by Malkowics, Myers and Leisman (2006) educated parents on an intensive visual rehabilitation program including light reflex, a checkerboard environment for outline perception, locating light for outline perception, and additional interventions for developing the ability to see detail within a configuration. Parents used these interventions with their child multiple times per day for an average of 6.9 months. Results of this study included 76% of participants improving vision from CVI range score of 3 or below to CVI range score of 5 or above (Malkowics, Myers & Leisman, 2006). This study confirmed that vision could improve for children with CVI when implementing strategies that encourage use of their residual vision.

Roman-Lantzy and Lantzy (2010) performed a retrospective review of prior patients with CVI who had highly motivated parents, revealing that 95% of these children improved from Phase I to Phase III over the course of 3.7 years with individualized treatment. The authors suggest that the parents of these participants were highly motivated because they self-selected to partake in this study. The results of this study indicated the potential for improvement in visual function with specialized intervention and further implied the significance of caregiver's involvement in the development of visual function for children with CVI.

Since residual vision can vary so greatly amongst individuals with CVI, recommendations for intervention tend to be broad and unspecified. Ospina (2009) suggested that decreasing visual stimulation through presentation of simple visual environments as opposed to crowded visual environments could potentially enhance vision. Ospina further recommended incorporating contrasting colors and varying sensory input such as language and touch as cues to optimize residual vision. McKillop and Dutton (2008) suggested minimizing sensory distractions during intervention to encourage use of the visual sensory system. These researchers examined the literature to suggest management strategies for children with CVI in regards to specific problems, such as "colour vision and contrast sensitivity impairment," "impaired tracking," "identifying someone in a group," "difficulty reading facial expressions" and more (McKillop & Dutton, 2008, p. 5). These management strategies can be used to further improve participation in daily functional activities.

When working with children with CVI, it is important to consider the basics of pediatric care, such as using a family-centered approach. Frequently, pediatric CVI intervention includes parent education of adaptive techniques and visual rehabilitation strategies. Fingerhut et al. (2013) summarized three basic principles of family-centered practice in pediatric care found in the literature. The first principle is that families have spent the most time with the child in their

natural home setting, so they must be considered critical partners of the treatment team. Next, the therapist must identify the individual characteristics and desires of the family as a unit and design intervention to be flexible and realistic for that specific family. The third principle is that the goal of intervention should be to increase and support family functioning to maximize quality of life for the whole family (Fingerhut et. al., 2013).

The concept of family-centered practice aligns closely with the ideals from the Model of Human Occupation (MOHO). "The Model of Human Occupation provides therapists with a systematic approach to understanding and working with the values, needs, habits, and skills of the family and child within their environments (Catherine & Bhat, 2017, p. 26). Using these concepts, therapists can adapt the environment to improve the participant's volition and maximize performance in a meaningful occupation (Cole & Tufano, 2008; Kielhofner & Burke, 1980). For a family and child with CVI, these guidelines can help a therapist maintain a client- and family-centered approach to treatment while incorporating visual activities. Eliasson (2005) suggests the use of the MOHO to create intervention plans in pediatrics because the model is influenced by client-centered practice. The MOHO proposes that volition, or motivation, is the driving force behind participation (Keilhofner & Burke, 1980). When applying this idea to a child with CVI, understanding what motivates the child is crucial in terms of increasing visual participation. Children with CVI process objects that they are familiar with more easily than they process new items. This relates to the habits of the child and family, as objects that are familiar to the child are often well received because they are integrated into their specific daily habits and routines. With the MOHO as a guide, the therapist can remain family-centered by reflecting on the values and habits of the family to develop motivating, unique goals, and interventions to maximize visual participation and performance for children with CVI.

While the gap in the literature for CVI intervention is evident, it remains important to reflect on CVI guidelines and basic pediatric principles when working with children with CVI and their families. Researchers have confirmed that visual function can improve with specialized intervention for children with CVI (Roman-Lantzy & Lantzy, 2010). While future research is required to maintain evidence-based practice within this area, occupational therapists can use the Model of Human Occupational to guide specialized treatment and intervention planning that is family-centered to increase independence and quality of life for children with CVI and their families.

Evaluation of Cortical Visual Impairment Using the CVI Range

Children with a diagnosis or suspected diagnosis of CVI typically receive a referral for an occupational therapy evaluation using the CVI Range. The CVI Range was created by Christine Roman-Lantzy and categorizes the child's functional visual level into a range of scores (Roman-Lantzy, 2007). This score helps to guide treatment, establish goals, and track quantitative progress. There are ten characteristics of the CVI Range that an occupational therapist assesses to determine the child's functional use of residual vision. Each characteristic is scored using a point system from zero to one in .25 increments, and the scores are combined for a total score out of ten. A score of ten indicates near-typical visual function and a score of zero indicates no emerging visual function. This score is used to indicate a range for a second score, where the child is again scored on ten visual behaviors. The two scores are averaged for a specific score that the child receives, which is categorized into one of three phases of functional vision. Scores from 0-3 are in phase one, scores from 4-7 are in phase two, and scores from 8-10 are in phase three. Research has indicated that the CVI Range is a reliable instrument for evaluating children with cortical visual impairment. In one study, researchers assessed for reliability of the CVI

Range on 104 children. Researchers found the inter-rater reliability coefficient to be .98, the test-retest reliability to be .99, and the alpha to be .96 (Newcomb, 2010).

Characteristics in the CVI Range

The first characteristic is *color preference.* For this characteristic, the therapist is testing to see if the child has the ability to process all colors. This is tested by offering single-colored items one at a time, and evaluating if the child is able to attend to, fixate, and track that color. The therapist may notice extreme differences, such as the child only being able to acknowledge items that are red, or subtle differences, such as the child taking five seconds longer to notice items that are blue. For a child with lower visual function, it may be necessary to simplify the background to black for the child to attend to objects of any color. Researchers found that when comparing attention of a gray, non-moving stimulus to a colored, non-moving stimulus, children with CVI spent significantly more time looking at the colored stimulus than the gray stimulus (Cohen-Maitre & Haerich, 2005).

The second characteristic is *need for movement*. This can be defined as moving objects and objects with reflective properties. Cohen-Maitre and Haerich (2005) found that children with CVI attended to moving colored objects with significantly longer total fixation times as compared to non-moving colored objects. This is often tested in evaluation by observing a child's ability to attend to a plain, single-colored object and comparing this to their ability to attend to a reflective, same-colored object such as a pompom.

Visual latency is the next characteristic assessed during the CVI Range. This is the amount of time it takes a child to notice an item when it is placed in front of them. A child who can visually attend to an object within two to three seconds might score a .75. Another child may attend to that same object in 15 seconds or more, maybe only scoring a .25, The therapist should compare this between a variety of items and toys, including evaluating with an object the child is

familiar with and with an object that is new to the child. There is limited evidence on this characteristic in isolation from the other CVI characteristics.

The next characteristic of the CVI Range is *preferred visual field*. This is measured by offering a preferred, familiar toy in all visual fields and observing if the child is able to track in all fields, has a latent response in a certain field, or if the child will acknowledge an object in all fields. A child with a preferred visual field may be able to attend to, look and reach, and track when objects are presented in his/her preferred field like a child with typical vision, but might ignore everything to his/her in a different field. It is most common for children with CVI in the lower phases to have preferred peripheral field vision use, with increased difficulties in the central and lower visual fields. Among a group of 38 children with CVI, researchers found deficits in visual fields for all participants that could be tested (Groenendaal & van Hof-van, 1992). Jan and Groenveld (1993) also found that preferences in visual fields are present for the majority of children with CVI. While these statistics are outdated, they still indicate the relevance of assessing visual fields for children with CVI today to determine their individual strengths and weaknesses. This information can help to further develop specialized interventions for each child.

The fifth characteristic is difficulties with *visual complexity*. Roman-Lantzy divides complexity into four categories. The first category refers to complexity of objects and requires the therapist to score the child's ability to attend to and interact with objects of single colors and simple shapes versus a multicolored object that contains various shapes. The second category is called array, which refers to the child's ability to attend to objects against crowded backgrounds. The third category requires the scorer to assess the child's visual attention with competing sensory input such as distracting noises. Because CVI is a processing disorder, some children find it difficult or nearly impossible to process more than one sensory input at the same time. The

fourth category is for the child's ability to attend to faces. Visual complexity, like the rest of the CVI characteristics, can improve with intervention, maturation, and development. However, this tends to be a continual difficulty for individuals with CVI, even as they age and visual function advances. This is evidenced by residual deficits with only the most complex of visual environments during periods of exhaustion for high functioning children with CVI (Roman-Lantzy, 2007).

Light gazing is the next characteristic assessed within this tool. This is defined as fixations on primary sources of light. This characteristic tends to be more relevant in children with lower visual function and can be observed or verbally reported by the caregiver during evaluation. It is typically driven by the child's ability to process the simplest form of visual stimulation or an attempt to avoid looking at a more complex visual stimulation (Roman-Lantzy, 2007).

The next item is difficulty with *distance viewing*. This item is scored by the child's ability to see when items are held 12 inches, 3 feet, 10 feet, and 20 feet from his/her face. This characteristic is closely related to complexity, in that some children will hold items very close to their face to reduce the complexity of the background and environment and remove any unnecessary visual information (Roman-Lantzy, 2007). During assessment of distance vision, the therapist should use a simple environment with reduced clutter to evaluate the child's visual attention.

The eighth characteristic of the CVI Range is *reflexes*. It is common for children with CVI to demonstrate atypical responses when they are touched on the bridge of their nose and when they have something moving quickly towards their face. These reflexes are called visual blink response and visual threat response (Roman-Lantzy, 2007). A normal response to these

stimulations would be for the child to blink. Therapists should assess these reflexes while the child is distracted by a toy or separate activity.

The next characteristic is *difficulty with visual novelty*. Children with CVI often have fixations on objects that are familiar to them and avoid visually engaging with objects that are new. This is because novel or new items are harder for them to process. The therapist should use a toy or item brought in by the parent that the child interacts with on a daily basis, and compare the child's visual response to that of a brand new toy (Roman-Lantzy, 2007). Higher- functioning children may respond in the same manner for both objects, while children that are in the middle phase might look at the new item, look away for a few seconds to process, and then look back at the toy again. Lower-functioning children with CVI may not even acknowledge the new object at all.

The final characteristic is *absence of visually guided reach*. Typically developing infants develop the ability to reach at a very young age. Children with CVI often continue to have difficulties associating look and reach for several years. Therapists should test this skill using an item that the child is familiar with or can easily attend to, then allow the child up to a full minute to process and interpret the object and attempt to reach it. The therapist will score the child based on the time taken for the child to see the item and then attempt to reach or swat towards it (Roman-Lantzy, 2007).

The CVI Range is a tool that can significantly affect the occupational performance of children with CVI as it can be used as a guide for occupational therapists to identify the visual skills of these children. Once visual skills have been identified, occupational therapists can determine the gaps in these skills and implement adaptations to maximize visual participation and independence. These adaptations can help a child with CVI become independent in school, activities of daily living, and other meaningful occupations of their choice.

Implementation

This DCE included implementation of a document to standardize the tool kit and administration of the CVI Range. The need for this document was identified by two licensed occupational therapists with specialties in cortical visual impairment. As the number of children being referred to occupational therapy (OT) for evaluation of the CVI Range has increased, the need for therapists trained in the CVI Range has also grown. Since the CVI Range is a non-standardized assessment and this large children's hospital had almost 20 locations where OT evaluations can occur, it was common for differing techniques and tools to lead to inconsistent results. The use of a standardized manuscript and tool kit for this hospital helped to further train therapists on the CVI Range and increased consistency across locations.

Implementation of this DCE occurred in two steps. First, all outpatient locations with therapists interested in learning the CVI Range received a copy of the suggested tool kit. This tool kit included lists of toys, objects, and adaptive material for all phases of CVI so that during evaluation, children were observed with the same materials. Using this list, the participating sites gathered, purchased, and combined tools to create a CVI Tool Kit. Second, participating therapists read through the CVI Range Standardization document (see Appendix A for full standardization document) in addition to the scoring manual by Christine Roman-Lantzy (2007). These therapists had opportunities to observe a mentor on at least two CVI Range evaluations for a child with high visual function and for a child with low visual function. These opportunities allowed them to apply suggestions from the standardization document in real-time and observe typical CVI function during evaluation. The therapists then used the CVI Range Standardization document to further guide their evaluations upon returning to their site or setting.

Follow-up continued to occur post-DCE to examine the success, benefits, and needs of the CVI Range Standardization and Tool Kit. This document was open to change and updates throughout its implementation. Implementation solely occurred within this children's hospital.

Service Provision

Completion of this DCE project required strong leadership skills and interprofessional relationships. I demonstrated leadership through self-direction, initiation of contact between therapists, ophthalmologists, teachers of the visually impaired, and physical therapists, as well as effective communication to maintain these relationships and build rapport. Although physical therapists do not specifically evaluate or treat for cortical visual impairment, understanding CVI strategies is still crucial for maximizing performance and participation in any activity for a child with CVI. Each of these professions generally used a direct model of service provision, providing one-to-one care. This model of service provision led to the need for interprofessional collaboration during the creation of this CVI Range Standardization document in order to gather and combine pertinent CVI strategies and suggestions for a holistic document. It was important to utilize effective communication to build these relationships as this project was developed and implemented. Information gathered through these relationships was used to develop a comprehensive and inclusive CVI Range Standardization document and Tool Kit. I received constructive feedback from the leading occupational therapy researcher at this site throughout this process to improve the document.

Leadership Skills

Leadership skills were incorporated to maintain relationships among these professions as the document and tool kit were prepared for implementation. I was required to demonstrate leadership, advanced knowledge, and confidence in CVI clinical skills in order to develop trust with various professionals including occupational therapists. I also demonstrated leadership

through the self-direction of this project in identifying gaps in the CVI Range through observation, development of the standardization document, and time management of completing this project among many other responsibilities throughout this doctoral capstone experience.

Discontinuation and Outcome Phase

Once the CVI Range Standardization document was drafted, reviewed, and completed, two therapists with extensive CVI experience were trained and educated on the use of this document. These leading therapists committed to continual sustainment of the document once I leave the site and can no longer manage this training tool. These therapists will be responsible for answering questions and training new therapists on use of the tool. This document will continue to serve as a learning guide for therapists and outpatient sites within this hospital for increased consistency of administration of the CVI Range.

During the time of this doctoral capstone experience, one new occupational therapist was trained on the CVI Range using the CVI Range Standardization guidelines. This therapist created a new tool kit at her outpatient site following the instructions within the document. Future occupational therapists within this hospital center will use this standardization document to learn the CVI Range should they elect to acquire these skills.

The needs of society were met in several ways by this project. Primarily, consistent evaluations and interpretation of the CVI Range will improve as administration becomes similar across sites. This will allow for an easier training method of the CVI Range for new, interested therapists within this hospital, which will hopefully increase the number of trained therapists within this field. This meets the needs of society as cortical visual impairment is the leading cause of bilateral visual impairment in children under the age of 18, yet there are very few occupational therapists trained to treat children with this diagnosis. This problem has led to increased wait times for these children to receive evaluations. Increased training through

improved access to training for occupational therapists within this hospital should help to improve general CVI education and knowledge as more therapists provide treatment to more families and maximize independence for children with CVI.

To further meet the educational needs of CVI knowledge, a CVI Knowing Note was created for this site as a handout to parents upon receiving a CVI diagnosis for their child. This document continues to meet the needs of society along with this project as it expands the knowledge and access to education on CVI for patients and their families. This Knowing Note is found in Appendix B and will be continuously updated by the same leading CVI occupational therapist within this hospital.

As I will only remain at this site for a few weeks beyond the completion of this CVI Standardization document, it is difficult to anticipate continuous quality improvement needs that may arise. In order to combat the likely needs of CQI, a holistic, interprofessional approach has been taken to improve this document. After completing the final draft, this document was submitted to the two leading occupational therapists with CVI specialties within this hospital. Edits and input were included to the final draft to be sent off to an ophthalmologist to review before officially releasing this document to therapy staff. This approach allowed for a well-rounded collaboration of the document to be as inclusive as possible. Should needs for quality improvement arise in the future, the leading occupational therapist with CVI specialties at this site will manage the document. This will help for this project to remain up-to-date and in service for therapists at this site.

Overall Learning

This doctoral capstone experience provided opportunities for learning research skills, specialty pediatric skills, interprofessional and patient communication in-person, in writing and virtually, as well as leadership skills. I developed advanced research skills by studying the

literature on cortical visual impairment and participating in several CVI and occupational therapy research studies, including a grant-funded telehealth study. Through this study, I learned clinical and communication skills using a virtual format while implementing the latest evidence-based practice in occupational therapy for children with CVI. I also had the opportunity to learn specialty pediatric skills in cortical visual impairment. I learned how to adapt the environment, modify tasks, and assess children for their functional vision. In this process, I learned documentation of the CVI Range and how to effectively communicate a child's visual performance to parents and clinicians. I frequently communicated through e-mail to parents of patients on ideas for adaptive toys, visual activities, and school strategies to try on their own or at home to maximize their child's independence.

Interprofessionally and amongst experienced occupational therapists, I had a unique opportunity to develop professionally with my communication skills. After completing my initial literature review and observing 12-15 hours of CVI evaluations with my direct supervisor, I had gained enough preliminary knowledge to start asking questions and working more independently on this project. This challenged me to seek out input from other occupational therapists with CVI experience, other occupational and physical therapists with no CVI experience that had children with CVI on their current caseload, an ophthalmologist, teachers for the visually impaired (TVI), and community and mobility specialists. This holistic perspective provided me with more knowledge for the CVI Range Standardization document than I could have found in literature, and also further encouraged my ability to work with professionals from various areas with varying specialties.

The project described in this paper specifically highlights my detailed learning experience of the CVI Range, and the importance of administering assessments in a standardized fashion. I had the opportunity to advocate for the pediatric cortical visual impairment population

as I created this document and communicated interprofessionally to increase CVI knowledge within the therapy department.

The experiences I had and the skills I gained during this doctoral capstone experience will carry over into my future career, regardless of whether or not I serve a pediatric population. In my future practice, I will reflect on these sixteen weeks as a reminder to implement evidence-based practice, utilize various forms of communication to best educate and inform patients, families, and other disciplines, and incorporate holistic strategies to increase quality of life for individuals of all ages and diagnoses. Overall, I learned about the many roles an occupational therapist has in children in their families' lives as an advocate, therapist and researcher.

References

American Occupational Therapy Association (2014). Occupational therapy practice framework: Domain and process (3rd ed.). *American Journal of Occupational Therapy, 68*(Suppl. 1), S1-S48.

Catherine, C., & Bhat, V. (2017). Family centered developmental care as early intervention for children with special needs. *International Educational Applied Scientific Research Journal, 2*(12), 26-28.

Cohen-Maitre, S. A., & Haerich, P. (2005). Visual attention to movement and color in children with cortical visual impairment. *Journal of Visual Impairment and Blindness, 99*(7)*,* 389-402

Cole, M., & Tufano, R. (2008). *Applied theories in occupational therapy: A practical approach*. Thorofare, NJ: SLACK Incorporated.

Eliasson, A. (2005). Improving the use of hands in daily activities. *Physical and Occupational Therapy in Pediatrics, 25*(3), 37-60. doi:10.1080/j006v25n03_04

Fingerhut, P. E., Piro, J., Sutton, A., Campbell, R., Lewis, C., Lawji, D., & Martinez, N. (2013). Family-centered principles implemented in home-based, clinic-based, and school-based pediatric settings. *American Journal of Occupational Therapy, 67,* 228-235.

Groenendaal, F., & van Hof-van Duin, J. (1992). Visual deficits and improvements in children after perinatal hypoxia. *Journal of Visual Impairment and Blindness, 86,* 215-218.

Jan, J. E., & Groenveld, M. (1993). Visual behaviors and adaptations associated with cortical and ocular impairment in children. *Journal of Visual Impairment and Blindness, 87,* 101-105.

Keilhofner, G., & Burke, J. P. (1980). A Model of Human Occupation, part 1. Conceptual framework and content. *American Journal of Occupational Therapy, 34*(9), 572-581.

Malkowics, D. E., Myers, G., & Leisman, G. (2006). Rehabilitation of cortical visual impairment in children. *International Journal of Neuroscience, 116*(9), 1015-1033.

Matsuba, C. A., & Jan, J. E. (2006). Long-term outcome of children with cortical visual impairment. *Developmental Medicine and Child Neurology, 48*(6), 508-512.

McKillop, E., & Dutton, G. (2008). Impairment of vision in children due to damage in the brain: A practical approach. *British and Irish Orthoptic Journal, 5,* 8-14.

Newcomb, S. (2010). CEU Article. The reliability of the CVI range: A functional visual assessment for children with cortical visual impairment. *Journal of Visual Impairment and Blindness, 104*(10), 637-647.

Roman-Lantzy, C. (2007). *Cortical visual impairment: An approach to assessment and intervention.* New York, NY: American Foundation for the Blind.

Roman-Lantzy, C., & Lantzy, A. (2010). Outcomes and opportunities: A study of children with cortical visual impairment. *Journal of Visual Impairment and Blindness, 104,* 649-653.

Appendix A

Guidelines for Standardization of the CVI Range

Table of Contents

This document serves as recommendations for administration of the CVI Range for exclusive use at Cincinnati Children's Hospital Medical Center.

Occupational Profile and Parent Interview Questions

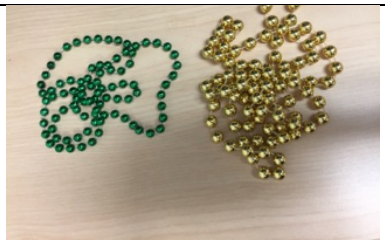
1. What does a typical day for your child look like?
2. What concerns do you have for his/her vision?
3. What toys does your child enjoy playing with?
4. What sense does your child typically use first when trying to find an object? (Sight, touch, movement)
5. How do you know when your child is looking at or has seen an object?
6. Does your child have a preferred visual field? (left, right, upper, lower)
7. How closely does your child typically hold objects to his/her face when looking at them?
8. Have you noticed your child looking at an object more intently if it has light, reflective, or movement characteristics?
9. Does your child have a favorite color of toys?
10. Will your child look at himself/herself in the mirror?
11. Do bright or shiny objects capture your child's attention?
12. Does your child ever stare at overhead lights or ceiling fans?
13. Will your child look at books? Does your child have a favorite book?
14. Does it take your child longer to notice an object if it is not touching her?
15. Does your child display increased difficulties using his/her vision when he/she is tired, stressed, or over stimulated?
16. Does your child enjoy watching television?
17. Does your child react differently when presented with new (novel) objects in compared to objects he/she is familiar with?
18. Does your child become easily distracted when there is music playing or other loud noise beyond the toy she is playing with?
19. Does your child make eye contact with you?
20. Do you feel that your child visually recognizes you without talking to him/her?

CVI Tool Kit

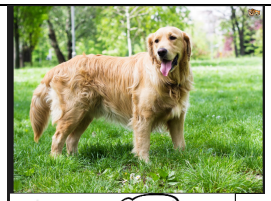
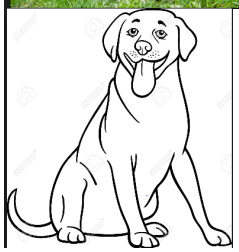
This document has three categories:

1. **Must-haves (things to order or make now if you do not already have in clinic)**
2. **Should haves: Pull from Toy Closet or order/make something similar (does not have to be same object, just general similar characteristics)**
3. **Other suggestions to consider**

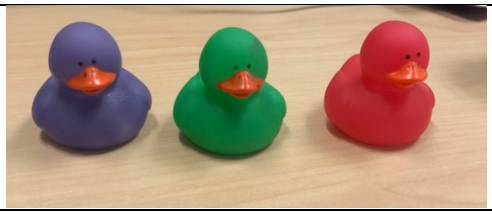
1. Must-Haves (things to order or make now that you may not already have in clinic):

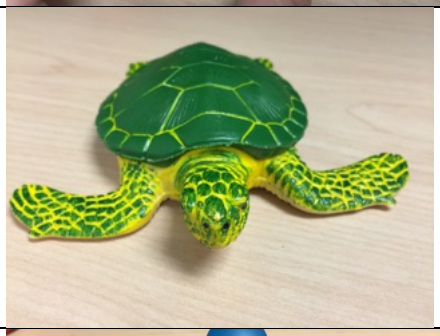
Characteristic/Purpose	Picture	Object Description
Single Color Shiny/Reflective (Movement Qualities)		**Pom Poms** -purchase in: red, yellow, blue, green, purple, and orange
		**Beads** -purchase in: red, yellow, blue, green, purple, and orange
		**Plastic Ornaments** -purchase in: red, yellow, blue, green, purple, and orange **Have only been able to find these at Cappels (plastic)
Single Color Light Up		**Light up wand** - purchase in: red, yellow, blue, green, purple, and orange

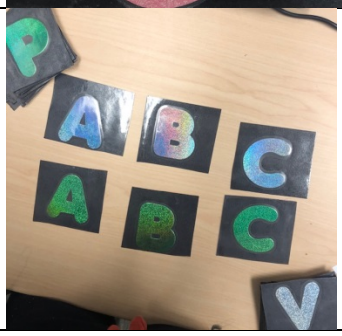
Single Coloring Moving (Non-reflective)		**Plastic Slinkies** - purchase in: red, yellow, blue, green, purple, and orange
Reduce Complexity of Background		**Black Foam Sheets** **The sewing room has made us some black felt boards and small black blanket
		**Black Tri-Fold**
Complexity		**Spot It Game**
		**Plastic placemats or laminated patterned paper** (varying patterns/colors, will use with Fruit Loops or small beads to have child find against like colors)

	  	**Laminated 2-d picture collection of familiar animals and objects** (use a picture of the actual animal/object, a colored cartoon picture of that animal/object, and black and white line drawing of object)
		**CVI Distance Pictures** (varying sizes of familiar simple and complex pictures to assess distance vision – do not laminate, adds glare) ***See attachment

2. Pull from Toy Closet or Order/Make something similar (does not have to be same object, just general similar characteristics)

Characteristic/Purpose	Picture	Object Description
Single Colored, Simple 3-d (non-reflective/Shiny) (DO NOT have to have all of these, there are just a couple suggestions for each category)		**Plastic balls** - purchase in: red, yellow, blue, green, purple, and orange
		**Rubber ducks** - purchase in: red, yellow, blue, green, purple, and orange

		**Plastic Rings** - purchase in: red, yellow, blue, green, purple, and orange
Single Colored, Non-reflective Novel		**Plastic Blowfish Character (or something they have likely never seen before)** - purchase in: red, yellow, blue, green, purple, and orange
Multi-color, Non-reflective 3-d (familiar and novel) (DO NOT have to have all of these, there are just a couple suggestions for each category)		**Bouncy Ball** (any multicolor)
		**Plastic Sea Turtle** (any multicolor animal)
		**Rubber Ball** (any multicolor, any shape that might be new/novel)
Complexity	Puzzles of varying difficulty and	Simple Puzzle (few

	complexity	colors) Complex: (Interlocking, multi color)
High Contrast Identification		**Very simple Homemade books** (High contrast red or yellow against black)
		**High contrast reflective alphabet cards**

3. Other Suggestions:

-Memory Card game for phases 2 and 3 (We often place face up spread out on the table to observe scanning in all quadrants and ability to pick out details using 2D materials. Depending on the child's ability level, we will either use very different pictures or very similar pictures to observe the level of detail in the picture they can find).
-Mylar shiny/reflective paper or tape for highlighting features of toys
-Cause and effect toys (easily lit/easily activated toys)
- Light up rattles (see toy list)
-CVI Complexity Sequences (order online, made by Christine Roman-Lantzy)
-Mirror (or child's toy/book with mirror on it)
-Simple children's book (such as Baby Faces/Emotions) and more complex children's book, also books with sound (match the object to the sound).

-iPad with CVI apps (see handout)
- Simple laminated matching books (wheels on the bus, Brown bear, etc)
- Different levels of puzzles
- Peg board
- Beads and string/pipe cleaner
- Velcro food
- Oreo puzzle
- Connect 4 (only for eye hand coordination)

Phase 1 Environment

For a child in the early phases of the CVI Range, start off with a treatment space with minimal visual and auditory distractions.

Recommendations to create an environment with reduced complexity:

- Simple background: Use a plain wall or black trifold/poster board to encourage visual attention toward the objects you are presenting; this eliminates complex background information.
- Present objects that are a single color.
- Minimize light distractions: Use a private treatment space, preferably with no windows and lights dimmed or off to decrease light distractions.
- Work in a space with minimal to no auditory distractions. Reduce the amount of talking while presenting objects.
- Seating: Provide as much postural support as possible. Consider using a table and chair, Rifton chair, tumbleform chair or in supine on the mat.
- Distance: Offer object to the child at a distance of 12 inches up to 3 feet away from face

Phase 1 Toolkit

Children in phase 1 have difficulty using their vision consistently and may need special objects to elicit vision. Objects that assist in eliciting visual attention may have a direct light source, are moving, reflective, and/or a single color. Based on information gained in the occupational profile, such as preferred and non-preferred colors, need for movement, etc., start with objects from the tool kit that match the child's preference.

Toy Recommendations:

- Color objects/boxes (Red, Blue, Green, Yellow, Purple, Orange): Select color boxes that include preferred colors and non-preferred colors with items such as shiny pom-poms, reflective and non-reflective balls, light-up wand/toys, slinkys, reflective beads, plastic food or plastic ducks (simple 3-D, single-colored objects), and 3-D stuffed animals in single colors (Ex. Elmo, Cookie Monster, Oscar, Big Bird, Barney, Nemo).
- Novelty item (will be child dependent) such as brown teddy bear, Ernie stuffed animal, infant toys
- Light up toys of varying colors
- Simple cause and effect toys
- iPad (see iPad list of recommended apps by phase)

Phase 2 Environment

A child who is able to look at 5-6 colors, have meaningful fixations 50% of the time or more, maintain visual attention on phase 1 toys for 8-10 seconds, and requires no more than 2-3 seconds of processing time between fixations in a phase 1 environment should progress toward a phase 2 environment. For a child in phases 2 on the CVI Range, continue to adapt the treatment space to control for complexity.

Recommendations to create an environment with reduced complexity (phase 2):

- Child may still require simple background: Use a plain wall or black trifold/poster board to encourage visual attention toward the objects you are presenting; this eliminates complex background information.
- Overhead lights may be slightly dimmed, may still need a private treatment space, preferably with no windows, to reduce sources of light during evaluation.
- Seating: Provide as much postural support as possible. Consider using a table and chair, Rifton chair, tumbleform chair or in supine on the mat.
- Distance: Offer object to the child at a distance of 3 feet up to 10 feet from face

Phase 2 Toolkit

Children in phase 2 may still require some objects that have a direct light source (especially when used with motor tasks), objects with movement/reflection (especially at a distance), or in a single color. Based on information gained in the occupational profile, such as preferred and non-preferred colors, need for movement, etc., select the tool kit that best match the child's visual preferences to start with.

Toy Recommendations:

- Color objects/box (Red, Blue, Green, Yellow, Purple, Orange): Select color boxes that include preferred colors and non-preferred colors with items such as pom-poms, reflective and non-reflective balls, light-up wand/toys, slinkys, reflective beads, plastic food or plastic ducks (simple 3-d, single-colored objects), and 3-d stuffed animals in single colors (Ex. Elmo, Cookie Monster, Oscar, Big Bird, Barney, Nemo).
- Non-Familiar/Novel item (will be child dependent) such as brown teddy bear, Ernie stuffed animal, infant toy
- Objects with increased complexity such as multicolor balls or blocks, simple puzzles, Legos, etc.
- Light up toys of varying colors
- Simple books and books with mild complexity
- Memory cards (start with pictures that are very different)
- iPad (see list of recommended apps by phase)

Note: as you add in complexity, notice if there is any difference in visual behaviors (visual glance, sustained gaze, simultaneous look/reach, avoidance, etc). If you add in complexity and the child's visual behavior decreases (less looking, unable to look and reach, etc), this will inform you that the complexity added was too much. If the child's visual behavior does

not change, this is a good match. Also, note any differences in visual behavior between 2D and 3D objects

Phase 3 Environment

A child who is able to demonstrate visual fixations on familiar and non-familiar 2-d real pictures on an iPad with backlight and is able to identify a familiar, preferred object or character on a book page while in a phase 2 environment should progress toward a phase 3 environment. For a child in Phase 3, use a treatment space that has increased complexities.

Recommendations to create an environment with added complexity (phase 3):

- Background: Consider a work space with both simple and increased background complexities, such as in front of a blank wall, in front of a wall with clutter (shelves, posters, etc.), near distracting noises. You can use visually complex placemats on the table to increase complexity. Again, notice if there is a difference in visual behaviors when the background is simple vs complex.
- Be aware of light distractions: Depending on the child, it might be appropriate to use a work space with windows and keep the light sources on.
- Seating: Provide as much postural support as possible. Consider using a table and chair, Rifton chair, tumbleform chair or in supine on the mat.
- Distance: Incorporate a hallway or large room where distance vision can be measured up to 20 feet

Phase 3 Toolkit

Children in phase 3 may only be able to see objects with increased complexity (multiple colors, make noise, etc). Based on information gained in the occupational profile, such as preferred and non-preferred colors, need for movement, etc., select the tool kit that best match the child's visual preferences to start with.

Toy Recommendations:

- Color objects/boxes (Red, Blue, Green, Yellow, Purple, Orange): Select color boxes that include preferred colors and non-preferred colors with items such as: pom-poms, reflective and non-reflective balls, light-up wand/toys, slinkys, reflective beads, plastic food or plastic ducks (simple 3-d, single-colored objects), and 3-d stuffed animals in single colors (Ex. Elmo, Cookie Monster, Oscar, Big Bird, Barney, Nemo).
- Non-Familiar/Novel item (will be child dependent) such as brown teddy bear, Ernie stuffed animal, infant toy
- Objects with increased complexity such as multicolor balls or blocks, simple puzzles, etc.
- Simple and complex books
- A variety of 2D materials such as memory cards, Spot It, hidden pictures
- CVI Complexity Sequences
- CVI Distance Pictures
- Simple and complex puzzle

- Eye/hand coordination activities such as stringing beads, peg board, Legos, etc.
- iPad (see list of recommended apps by phase)

Note: as you add in complexity, notice if there is any difference in visual behaviors (visual glance, sustained gaze, simultaneous look/reach, avoidance, etc). If you add in complexity and the child's visual behavior decreases (less looking, unable to look and reach, etc), this will inform you that the complexity added was too much. If the child's visual behavior does not change, this is a good match. Also, note any differences in visual behavior between 2D and 3D objects

Tips for CVI Range Administration

Although directions for administration are listed separately by scoring category, it is important to understand that when presenting an object, most objects and characteristics are multi-dimensional (most pom-poms are a single color and shiny and you present them at a certain distance). Meaning that there is overlap, therefore be cognizant of all characteristics throughout administration, even when specifically evaluating for a single characteristic. At any time throughout evaluation, observe for color preference, latency, difficulties with complexity, visually guided reach, need for movement, visual fields, distance, light gazing, and novelty. Reflexes can be assessed independently.

Example 1: When observing a lower functioning child for color preference, you present him with a single-colored, blue light-up stick. You notice that he only looks at it in his right superior visual field, with all other light and sound distractions in the environment reduced. So with that one object, you may be able to identify the following:

- Preferred color: blue
- Complexity: needs reduced sensory distractions within the environment
- Latency: needs increased time to react (up to a full minute), latency may vary in different visual fields
- Visual field preference: Unable to track, only sees it in the upper right field
- Visually-guided reach: Does not reach
- Movement: was the object shiny or moving

As you advance through objects, such as shining a light on a sparkly pom-pom, further consider each of these characteristics even though your main focus might by on the specific color of the object you are using.

Color Preference

Characteristic	0	.25	.5	.75	1
Color	Attends to a single, preferred color	Preferred color dominates, additional 1-2 colors may also elicit /promote visual attention	-Highly saturated colors, fluorescent colors promote visual attention -Specific color preference is fading -Color highlighting of salient 3-D or 2-D features is necessary	Color highlighting of materials or environment is occasionally necessary	Color is no more important for visual attention than for other individuals of the same age

Suggestions for Evaluation of Color Preference

Begin with a single colored object of child's preferred color (if they have one). If not, try red, blue, and yellow. If child can equally attend to each of these colors, try green, orange, and purple. Observe for differences in single colored objects in eliciting and maintaining the child's visual attention. Compare single colored, brightly lit objects to same colored dull objects.

Need for Movement

Characteristic	0	.25	.5	.75	1
Movement	Attends only to objects that are moving or that have reflective properties May notice ceiling fan	Movement is necessary to elicit attention and almost always necessary to maintain visual attention May be distracted by unintended movement at near	Movement is necessary to elicit attention but not to sustain visual attention May begin to notice the movement of people at distances up to 8-10 feet away May be distracted by unintended movement at distances up to 8 feet away	Movement occasionally necessary to elicit visual attention May be distracted by unintended movement at distances up to 20 feet away	Movement is not necessary to elicit or hold visual attention Movement will alert the individual but not "captivate"

Suggestions for Evaluation of Need for Movement

Start with using reflective/shiny objects such as pom-pom, slinky, reflective beads, etc. to observe child's visual behaviors such as visual attention (sustained, fleeting), ability to track, and ability to see at varying distances. Next, present with objects that are not shiny/reflective but are moving and observe the same visual behaviors. Note any differences.
Within this characteristic also note differences in visual behavior considering color preference, distance, and visual latency (to objects with movement qualities vs. non-moving qualities).

Visual Latency

Characteristic	0	.25	.5	.75	1
Latency	Prolonged periods of latency each time an object is presented or each time the individual attempts to visually regard a target	Latency is frequent but slightly decreases during periods of consistent viewing	Latency occurs about half of the time the individual is attempting to visually attend Latency may be a sign of visual fatigue or over stimulation	Latency occurs primarily when the individual is hungry, tired, overstimulated, post seizure. Latency occurs rarely	No latency in visual response. The individual visually regards a target without delay

Suggestions for Evaluation of Visual Latency

Carefully observe latency throughout evaluation. If latency is present initially, continue offering same object or like-object to determine if latency decreases after a "warm-up" period of repeated viewing. If latency is not initially present, compare amount of latency at end of session compared to beginning of session to see if fatigue impacts child's latency.
Within this characteristic also note if latency varies based on color, complexity, distance, and/or movement. Also ask caregiver about latency in different environments, time of day or during learning/school work. If the caregiver reports a "warm-up time" is needed, ask about how long it typically is. If caregiver brought along a preferred object or toy from home, compare latency of this toy to a new toy. Observe differences in fixations between a very familiar toy and new toy, including how frequently he/she looks away for processing.

Visual Field Preferences

Characteristic	0	.25	.5	.75	1
Fields (right, left lateral fields + superior and inferior fields)	Localization toward a target in one specific lateral field	Localization or brief fixations in original "preferred" field of view + emerging or actual visual attention in one additional lateral field	Visual fixations occur in two lateral fields + emerging or actual visual fixation in one additional lateral field	Visual fixations occur and are stable in three visual field positions. Lower visual field function may be atypical	Visual fixations occur in right, left, superior, and inferior visual fields

Suggestions for Evaluation of Visual Field Preference

If it is documented (or caregiver reports) that the child has a preferred visual field, begin by offering preferred objects within this field to allow child to warm up to visual activities. Once child has demonstrated increased visual fixation in preferred visual field, advance to opposite lateral field and allow for delay time for child to track and/or locate the object in that field. Move the object slowly.
If child does not demonstrate a lateral preferred visual field, challenge the lower, upper and central visual field. Additionally, ask caregiver/patient about frequent tripping over objects on the ground or difficulty with curbs or changes of terrain during mobility.
Within this characteristic also note differences in visual behavior considering color preference, distance, movement, and visual latency (to objects with movement qualities vs. non-moving qualities).
Other ocular considerations: A child may have a visual field cut, but if they have learned to turn their head and move their body to incorporate vision within this field regularly, then they have integrated all visual fields into their routine and can still score a 1 in this category.

Difficulty with Complexity-object

Characteristic	0	.25	.5	.75	1
Complexity-object	Visual attention/brief localizations on single-color objects	Localizations or brief fixations on objects that have two color surfaces	Visual fixations occur (and object discrimination or recognition) on objects that have 3-4 colors/pattern on the surface 2-dimensional images may be introduced on backlit surface	Visual fixations (and object recognition or identification) on objects/images that have 4+ colors/patterns on surface 2-dimensional images without backlighting are now accessible	Visual fixation and discrimination recognition, identification of the target is commensurate with the age of the individual

Suggestions for Evaluation of Complexity-object

Consider the objects the child is able to visually fixate and focus on (and note the complexity of the object). If child is not demonstrating visual curiosity at beginning of session, begin with single colored, potentially light up objects. If child is visual curious, advance to objects with two colors and then multi-color/pattern. Introduce 2-dimensional objects and observe for fixations with and without backlighting. Present both pictures with familiar characters and unfamiliar characters. Start with low complexity (1 color object on solid background). Move toward an object with a couple colors on a solid background, a person/animal doing something, and then a picture that has scenery in it.

Observe for differences in visual behavior with single colored objects, multi (2-3) colored objects, 3-d familiar and non-familiar objects, and familiar and non-familiar pictures with and without backlighting.

Difficulty with complexity-array

Characteristic	0	.25	.5	.75	1
Complexity-array	Visual attention, brief localizations occur only when the object is presented against a black background in a room with reduced light	Visual localizations or brief fixations occur when objects are presented against a black background in a naturally lit or near naturally lit room	Visual fixations occur on objects presented against backgrounds with 2-3 color pattern backgrounds Simple 2-dimensional images detected against a background of 3-4 additional elements	Visual fixations occur on 3-dimensional targets against highly patterned backgrounds Two-dimensional target images detected against a background of up to 20 additional elements	Targets are located against any background commensurate with the age of the individual

Suggestions for Evaluation of Complexity-array

Consider complexity of the evaluation environment and background when scoring this characteristic. If child cannot fixate with lights on, reduce complexity of background by turning off lights and use light up toys or use a black trifold with lighting coming from behind the child. When placing objects onto the table, start with one object at a time. As the child progresses, put several objects onto the table and note any changes in visual behaviors. If child is succeeding with visual curiosity and participation, challenge complexity using:

- Placemats and fruit loops or small colored beads
- Spot it!
- Complexity Cards

Difficulty with complexity-sensory

Characteristic	0	.25	.5	.75	1
Complexity-sensory	Visual attention, brief localizations occur only when the object is presented in a room with no visual, auditory, or other sensory input	Visual localizations or brief fixations occur even when low intensity, familiar sounds or other single sensory inputs are present	Visual fixations occur even when average intensity familiar or novel sensory inputs exist. At times, more than one sensory input may be tolerated without loss of visual attention	Visual fixations occur even when multiple, competing familiar sensory inputs exist. Visual attention or the ability to locate a single target may be compromised when the individual is in a novel setting with multiple, competing sensory inputs	Visual attention, location, or fixation of a target occurs commensurate with the age of the individual

Suggestions for Evaluation of Complexity-sensory

Observe how the child's visual behaviors respond to competing sensory input. Challenge visual attention, fixations, and tracking with primary light sources on and off, varying background noise that child is familiar with and unfamiliar with (parent/sibling voice, music, hallway noise, etc), and visual input that makes noise. Note if the child can activate a cause and effect toy and/or iPad while maintaining visual attention. Consider changing treatment spaces from a quiet, private room to a busy room with background noise to further challenge the child's visual processing with competing sensory input.

If child can successfully complete tasks within a controlled environment and he/she is physically able, set up a hide and seek game in a more busy room or louder gym. Show them three items, one being single colored, the second having 2-colors, and the third item with increased complexity. Have the child turn around while you hide the three items in plain sight. Place the first item 15-20 feet away on a plain table or in front of a simple background, place the second item 10-15 feet away in front of a more complex environment, and place the third, most complex item, 5-10 feet away in the most complex environment. Have the child turn around and point to the three items from where he/she is standing.

Difficulty with complexity-faces

Characteristic	0	.25	.5	.75	1
Complexity-faces	No visual attention on faces	Brief attention or localization in the direction of a familiar face. May be reported as "looking through" rather than looking at a person's face	Brief fixations on the faces of familiar people (especially parents) Brief eye to contact with own mirror image	Eye to eye contact with most people. May be less attention to the faces of new or unfamiliar people Typical responses to mirror image	Visual attention (with eye to eye contact) on the human face is present in all social interactions.

Suggestions for Evaluation of Complexity-faces

Start by considering caregiver report to determine if child can localize on a familiar face, look at self in mirror, or make eye contact. Observe if child can direct attention to your face or make eye contact at the start of the session and by the end of the session.

Light Gazing

Characteristic	0	.25	.5	.75	1
Light	Visual attention only on lights or objects with strong lighted properties Unable to re-direct visual attention away from primary sources of light Does not defend by closing eyes to direct input of intense light	Visual localization or fixation primarily begins with attention to lighted properties of objects. May orient to primary sources of light but can be redirected to other targets when environmental lighting is reduced or adjusted May defend by closing eyes briefly or latently to direct input of intense light Visual attention occurs with objects paired with light	May be distracted by primary sources of light but is able to redirect attention without changing environmental light Visual fixations occur with 2-dimensional materials presented on lighted surface (lightbox or tablet device) Defends by closing eyes to direct, intense light	Attention on primary sources of light occurs only when the individual is tired, stressed, over-stimulated, or ill Backlighting supports visual discrimination, recognition, or identification of 2-dimensional materials (single image or array of images)	Responses to light are commensurate with the age of the individual and the task.

Suggestions for Evaluation of Light Gazing

Determine the child is able to attend to activities while the primary light source is on or if adaptations to lighting are required. Note if child requires light to be paired with objects to elicit visual attention. If child is able to fixate on non-lit 3-D objects, challenge their ability to look at 2-D objects with backlighting and without backlighting. Determine if child reverts back to light gazing at primary light sources when fatigued at end of session.

Difficulties with Distance Viewing

Characteristic	0	.25	.5	.75	1
Distance	Visually localizes on targets presented within 12" of face	Visually localizes or briefly fixates on targets presented within 2-3 feet	Visually locates and fixates on any target at distances up to 6 feet. Occasional visual attention on large moving targets (including people) may occur at 10 feet	Visually locates and fixates on a specific target in a familiar or novel setting at distances up to 10 feet May demonstrate visual attention on large moving targets at distances as great as 15-20 feet	Visual attention at distances commensurate with the age of the individual

Suggestions for Evaluation of Distance Viewing

To start, present objects 6-12 inches away from the child face, then move back to 3 feet, 6-10 feet, and 15-20 feet to determine how far away the child can see. Determine if movement is required to elicit visual attention at each distance. Once you determine how far away the child can visually locate a 3D object, check to see if they can visually locate a 2D object. If the child is able, have the either verbalize what they are seeing or pick out the picture that matches the picture they are viewing from a distance. Challenge distance vision with the CVI Distance Pictures binder.
Within this characteristic also note differences in visual behavior considering color preference, movement, complexity and visual latency (to objects with movement qualities vs. non-moving qualities).

Abnormal Reflexes

Characteristic	0	.25	.5	.75	1
Reflexes	No blink to touch at the bridge of the nose or the visual threat	Intermittent or latent blink to touch at the bridge of the nose. No blink in response to the visual threat	Blink to touch at the bridge of the nose consistently present. No blink in response to the visual threat	Blink to touch at the bridge of the nose consistently present Intermittent or latent blink to the visual threat	Blink to touch at the bridge of the nose consistently present. Blink to the visual threat present commensurate with the age of the individual

Suggestions for Evaluation of Abnormal Reflexes

Test reflexes while child's eyes are open and visually attending to something. Check for blink reflex when touching your finger tip to the bridge of the nose and when bringing your hand or an object quickly towards their face. Take note of whether the blink is present, absent, delayed and/or consistent/inconsistently present.

Difficulty with Visual Novelty

Characteristic	0	.25	.5	.75	1
Novelty	Visual attention, brief localization occurs with highly familiar objects No visual curiosity	Visual localization, brief fixations with objects that are visually similar to the original familiar objects No visual curiosity	Visual fixations on familiar objects, objects that are visually similar to familiar objects, and with novel objects after several exposures to the new object Visual attention may occur with novel 3 dimensional or some 2 dimensional materials but the individual is unable to "interpret" the visual display Occasional visual curiosity occurs in novel environments	New objects or images are visually discriminated, recognized, or identified based on salient, defining features Visual curiosity occurs in most new environments	Visual novelty supports visual attention/alerting response commensurate with the age of the individual

Suggestions for Evaluation of Visual Novelty

If parent brought a preferred, familiar toy from home, compare child's visual response to the familiar toy, something with similar characteristics in clinic, and a new object. Observe for any visual curiosity with non-familiar objects. Present the child with familiar and non-familiar 2-D pictures of characters, animals, or objects. Consider what visual attention would look like for a typical child of that age.

Within this characteristic also note differences in visual behavior considering color preference, distance, movement, complexity and visual latency (to objects with movement qualities vs. non-moving qualities).

List specific items within your evaluation that were easier and harder for the child to fixate on and the visual behaviors that went along with those toys, such as becoming guarded or upset with new toys. Specify in evaluation how many of the toys were brand new for the child that day and how many toys a child is able to have in his/her work space. This will allow you to compare visual behaviors with the same toys in future evaluations.

Further scoring recommendations: A child might score a .5 if he/she is able to visually engage with 2 new items. A child might score a .75 if he/she can visually engage at 6-8 new items. A child does not have to look and reach or play with toys to score well on this item.

Absence of Visually Guided Reach

Characteristic	0	.25	.5	.75	1
Visually Guided Reach	Look and reach always completed as separate actions; look-look away-reach	Look and reach may rarely occur as a single action if full support of CVI conditions (black background, object paired with light, movement, and no additional sensory input).	Look and reach occur as a single action when background is controlled and/or the target is 3 dimensional + shiny or moving	Look and reach occur as a single action more than 75% of the time. Look-look away-reach primarily occurs when materials are highly novel or highly complex.	Visually direct reach occurs commensurate with the age of the individual If upper-extremity motor limitations, look + reach occur together even if motor planning requires additional time

Suggestions for Evaluation of Visually Guided Reach

Throughout the evaluation, observe if child is able to look and reach simultaneously. Consider environmental characteristics and complexity of object when child is able to look and reach. For high functioning kids, utilize tools that challenge eye-hand coordination such as peg board, beads, Connect 4, and 3-d Oreo puzzle.
Within this characteristic also note differences in visual behavior considering color preference, complexity, distance, movement, and visual latency (to objects with movement qualities vs. non-moving qualities).
It is important to carefully consider a child's potential motor impairments when scoring this item. A child may be unable to physically move his/her arm but can still score in this item. Observe any attempts at an intentional shoulder driven pattern while looking at the same time. Intentional Swats, uncoordinated reaches, and attempts forward while keeping focus on objects and toys can count as visually guided reach. Consider positioning when scoring this item. A child might have to be fully supported in side lying to have the ability to demonstrate visually guided reach. Be cautious to indicate in the evaluation that visually guided reach is not present for a child with motor impairments.

Appendix B

Cortical Visual Impairment Knowing Note

Cortical Visual Impairment (CVI)

Cortical Visual Impairment is the leading cause of visual impairment for children under the age of 18. Children with CVI can have an eye exam that appears normal but their functional vision does not present as normal. They often have difficulty using their vision during every day activities. CVI is not caused by damage to the eye itself, but rather involves damage to the parts of the brain where visual processing occurs. Children with CVI might look at an item but may not attribute meaning to that item or process what they are seeing. This could lead to a child with CVI having difficulties with looking while reaching during play, looking at teachers, other children or even familiar adults, engaging with new toys and new play environments, completing schoolwork or reading.

How is CVI diagnosed?

CVI is diagnosed by an ophthalmologist/optometrist. A diagnosis is based on parent interview, clinical observations, medical history, the results of the child's eye exam and the child's score on a functional vision assessment called the CVI Range.

What is the CVI Range?

The CVI Range is a functional vision assessment completed at CCHMC by a trained occupational therapist. The CVI Range helps us understand how a child uses their vision in everyday activities including dressing, playing, learning, etc. A child is rated on ten characteristics related to CVI such as color preference, difficulties with complexity, and need for movement. Scores range from 0-10; a lower score indicates more severe visual difficulties and a higher score indicates a less severe visual difficulty. Once a score is obtained, it will place a child into one of three phases:

- **Phase one:** Children are learning to use their vision.
- **Phase two:** Children are learning to use their vision to make something happen (touch a toy to make a sound or reach out for a cookie).
- **Phase three:** Children are learning to be visually curious in all environments and while completing all tasks.

The therapists use information described by your child's CVI Range score and phase to guide treatment planning, recommend CVI strategies to support your child's visual participation, and track your child's visual development.

Why is it important to understand my child's functional vision?

Vision of children diagnosed with CVI can improve with the appropriate intervention. Our goal is help your child use his/her vision during every activity and to help your child become as independent as

possible. Once your child receives a CVI Range score, you and your child can work with an occupational therapist to identify meaningful goals and implement treatment strategies that match your child's unique visual needs. The occupational therapist will offer individual guidance to encourage your child's use of functional vision with recommendations for toys, activities to practice at home, modifications for school, and environment adaptations. Our occupational therapists will collaborate with teachers, orientation and mobility specialists and teachers of the visually impaired in order to assure your child's success.

Questions:

Contact the Division of Occupational Therapy and Physical Therapy (OTPT) at: (513) 636-4651