

# EYEGAZE: CONNECTING ASSESSMENT AND INTERVENTION

HELIX – STATE COLLEGE, PA  
NOVEMBER 13, 2018

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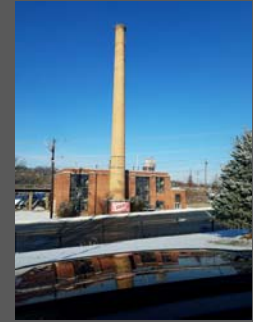
## ASHA DISCLOSURES

- Financial Disclosure: I am an employee of ATW, Inc. ATW, Inc has a financial relationship with the Prentke Romich Company and Saltillo Corporation.
- I am a paid consultant to Prentke Romich Company for Product Development and Support.
- Non-Financial Disclosure: I am a member of ASHA Div 12.
- Co Author of the ALP for AAC.

# Hello!

I'm Chip Clarke, MS, CCC/SLP

- Owner of Assistive Technology Works for 20 years.
- Have been consulting with PRC on access related technologies and eye gaze for over 10 years.
- I have over-compensated for failing high school shop by owning a company that rehabilitates historic commercial buildings. Working on my 5<sup>th</sup> major commercial project.



## BEFORE AND AFTER



## THE NEXT PROJECT



ASK  
QUESTIONS!!!



Even though we are a big group, please ask questions.



I'll do my best to get you an answer or a resource.



If it can't be effectively answered, please email me at:



[cclarke@assistivetechworks.com](mailto:cclarke@assistivetechworks.com)

WHAT WAS YOUR EASIEST  
EYE TRACKING CASE

- Describe what made the case easy.
  - What made it easy?
  - Did you have immediate successes? Why?
  - What was the implementation – home use, school, work, etc.?

MOST DIFFICULT EYE  
TRACKING CASE

- Describe your most difficult eye tracking case.
  - What made it difficult?
  - What were the challenges?
  - How did you integrate with the classroom?

## 4 CASES

PEDIATRIC – COMMUNICATION

ADULT ACQUIRED

PEDIATRIC – LANGUAGE USE

ADULT PROGRESSIVE  
NEUROLOGICAL

## MEANINGFUL

When working with eye tracking, every interaction needs to be a meaningful one.

- No matter if it is an adult or child.
- Regardless of the level of skill you are learning:
  - A basic interaction to generate an effect
  - A selection in a grid of core words and messages
  - A mouse click in windows to choose a link in Facebook
- Every selection must have meaning to learn.

## ACSSS IS 2 THINGS...

• MOVEMENT

• SELECTION

## EYE GAZE AND MOTOR PLANNING

Look around  
the room.

Pick 5  
objects.

Without  
moving your  
head, look at  
each object  
one at a  
time.

Repeat this 2-3  
times.



Uncomfortable?  
Forced?  
Strained?  
Not natural?

*The eye does not like to be controlled. The eye wants to move freely using a combination of fixations, quick movements, and slow movements as the various things we see throughout our day change before us.*



When we think about something specific we want to see, the eye very naturally not only looks at the desired object, but constantly looks around it, never in one place for much more than a second at a time.



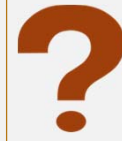
The eye also reacts to a wide variety of stimuli: movement, sound, touch, light, even your thoughts can all cause involuntary movements that occur in a somewhat consistent form.



Even with tasks that we perform on a daily basis – such as reading or driving – result in near automatic responses by the eye.

**The eye is always moving.**

The human eye is naturally motor planned and develops those motor plans with little direct thought by the individual.



How do we control something that is always moving?

Learning to control technology with your eyes is a learning process.

**For some, it is very short.** In a matter of only a few minutes or seconds, someone can learn how to fixate on a target, make a selection, and interact with a user interface in the same way we use a mouse or touch screen.

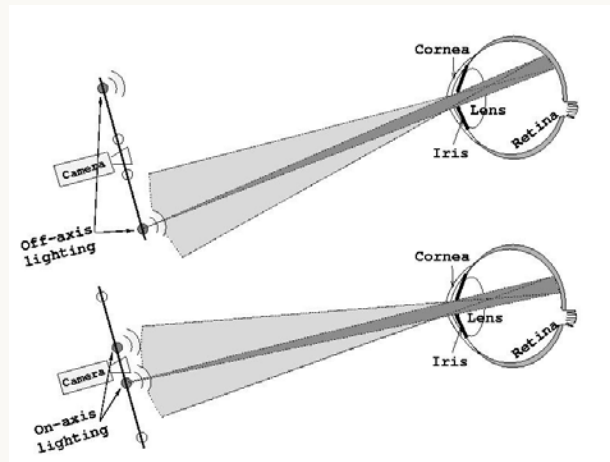
**For others this can be a bit of a challenge** as it is with any activity that requires motor coordination. They need to develop the motor skills necessary to direct the eye to a target and hold their gaze until a selection has been made.

There are individual learning differences

## HOW DOES IT WORK

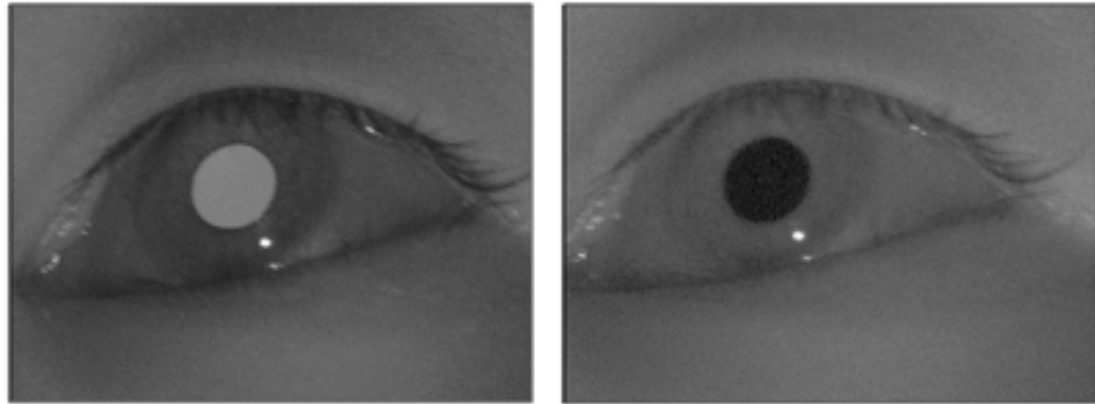
- Dark Pupil vs Bright Pupil

**NuEye is a Dark Pupil system.**



MOIRMOTO, 1999

## DARK PUPIL VS BRIGHT PUPIL



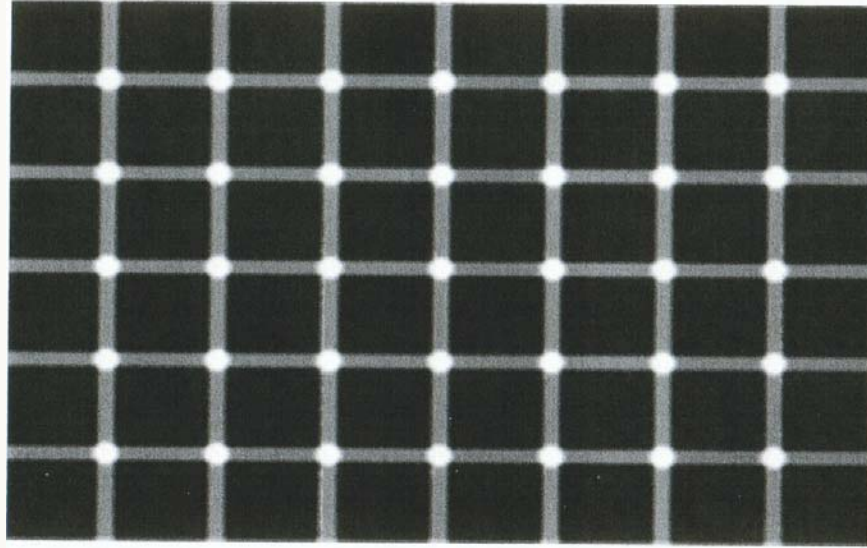
MOIRMOTO, 1999

## EYE TRACKERS AND METHOD OF TRACKING

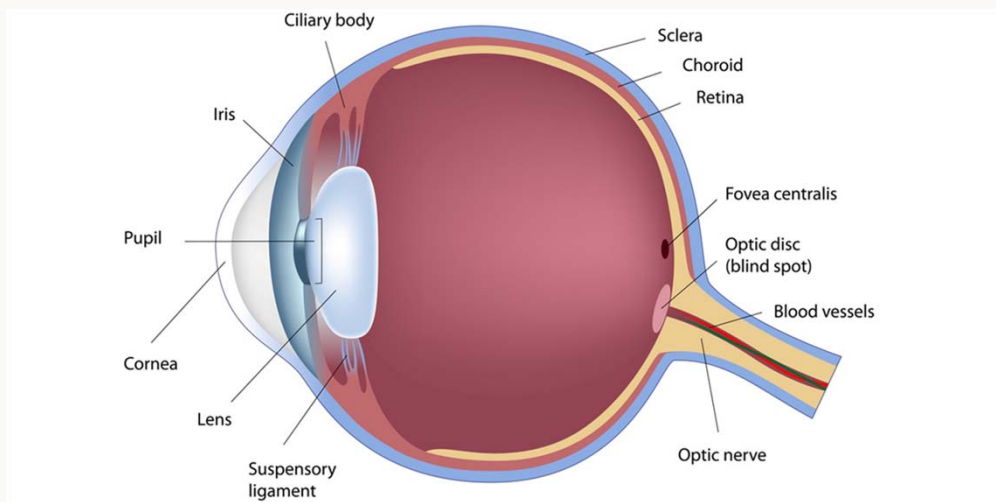
- Common Eye Trackers in US
  - Eye Tech Digital – Dark Pupil
  - NuEye/MyGaze – Dark Pupil
  - LC Technologies – Bright Pupil
  - Tobii – Combination of Dark and Bright Pupil
- Lesser Known Eye Trackers in US
  - IrisBond – Dark pupil
  - Alea – Dark Pupil



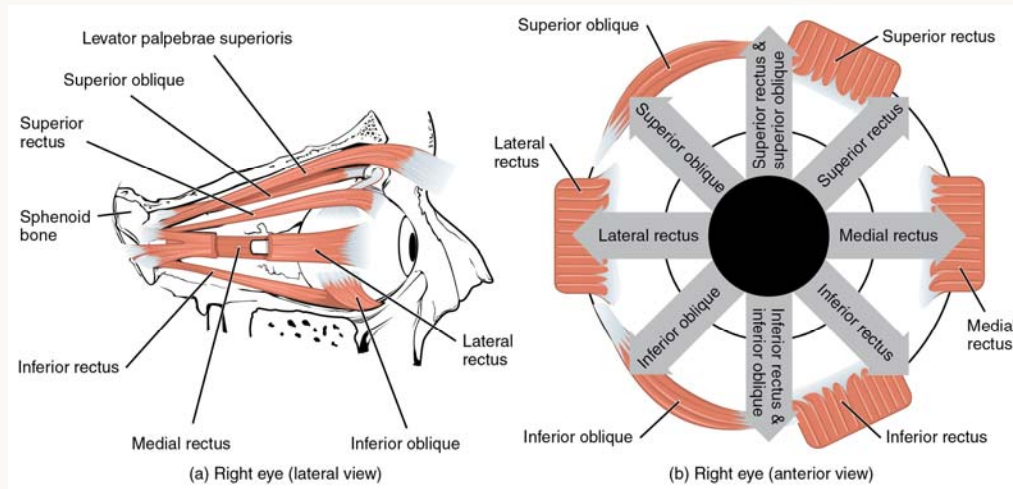
# FOVEAL VISION



# THE EYE



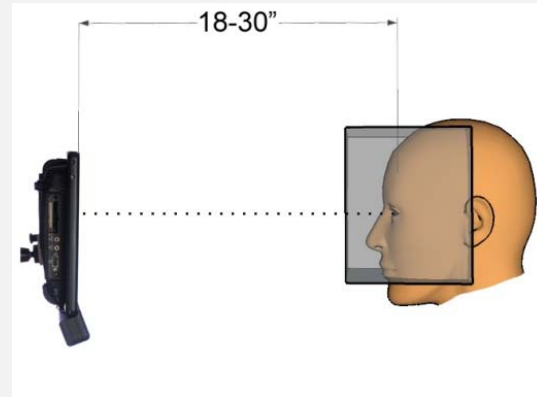
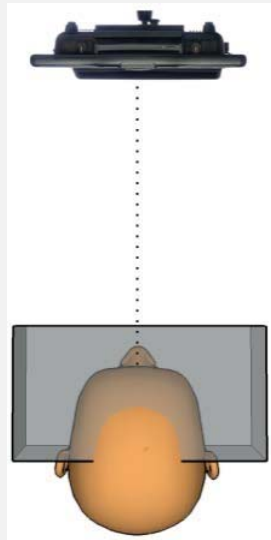
## MUSCLES OF THE EYE



## GETTING STARTED: SETTING UP THE DEVICE

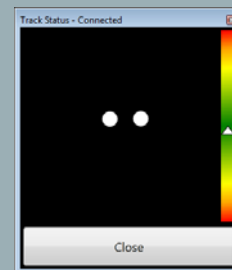
- As Simple as 1 – 2 – 3
  - 1. Alignment – of the user and the device.
  - 2. Calibrate – the user to the device.
  - 3. Use – access the software.

## POSITIONING



## TRACK STATUS BOX

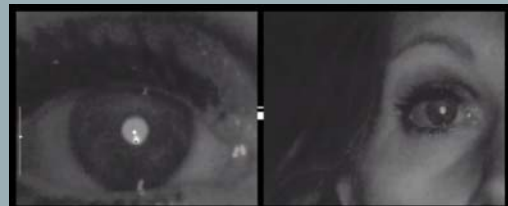
TOBII



Look at impact of glasses and lenses

Potential Issues with eyes

Positioning feedback.



EyeGaze Edge

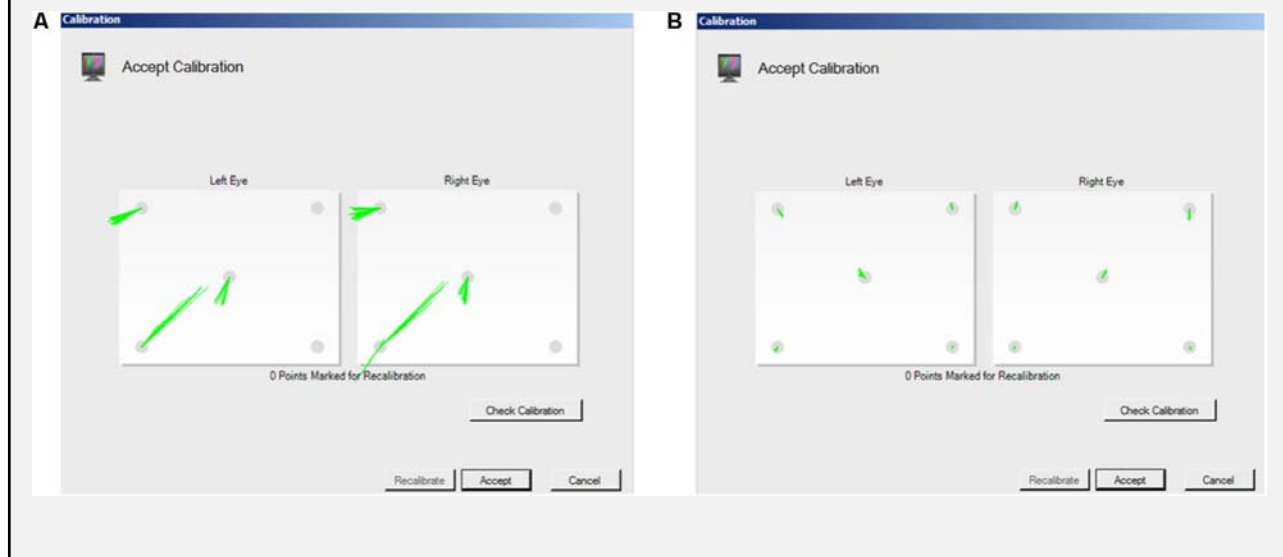
## CALIBRATION

- Setting up the calibration.
- Target
- Number of targets
- Speed of calibration
- Sounds/Feedback
- Background



## CALIBRATION FEEDBACK

- What do those lines and numbers mean.

# TOBII CALIBRATION RESULTS



NUEYE



Accuracy Data (Left)  
DevX: 0.23  
DevY: 0.17  
Accuracy Data (Right)  
DevX: 0.17  
DevY: 0.25

SELECTION

- Dwell
- Blink
- Switch

## CUSTOMIZING THE INTERACTION

Cursor and Pointer Feedback

Speed and Smoothing

- Avoiding or managing Midas Effect
- Moving Cursor vs Collapsing Point
- Highlighting (edge vs entire key)
- Cursor Speed and Smoothing

## EYEGAZE LEARNING CURVE



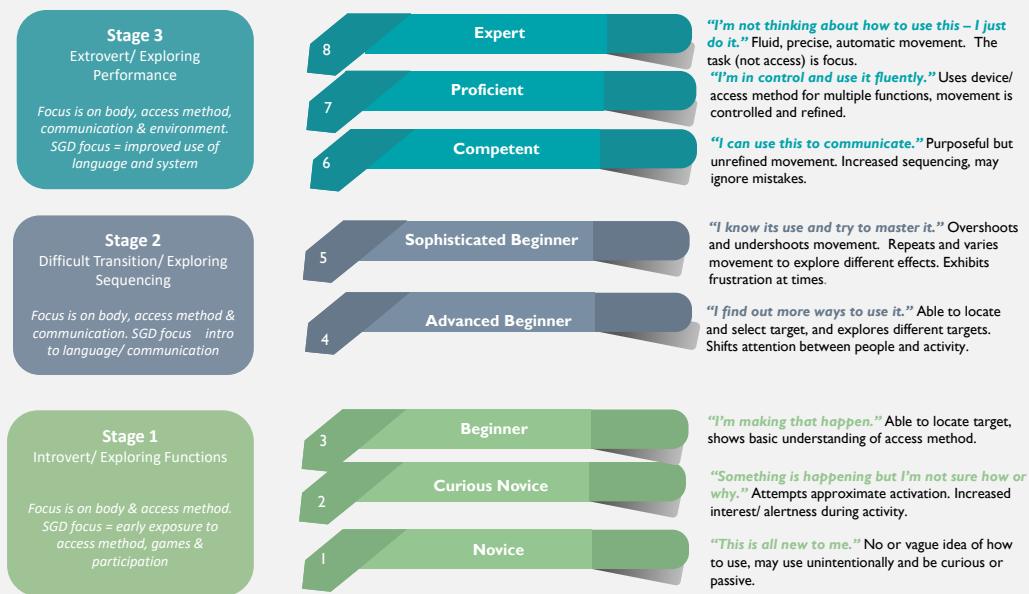
<http://www.callscotland.org.uk/common-assets/cm-files/posters/eye-gaze-software-curve.pdf>

- 1. Sensory: Mouse Over Games
- 2. Early Eye Tracking: Cause and Effect
- 3. Exploration: Targeting – Single Left Click
- 4. Choosing: Dwell Select Click and Drag
- 5. Turn Taking: Click and Drag Scrolling
- 6. Communication: Mouse and Keyboard Functions
- 7. Computer Access and Distance Communication: Mouse and Keyboard Functions

## EYEGAZE LEARNING IS A PROGRESSION

- It is a progression of learning from:
  - Internalizing the use of the eye for control
  - Applying it to basic communication/language
  - Refining it for greater control and multi-tasking
- However: If the individual experiences changes in physiology, cognition or a change in function of the system, they can move up and down in this progression.
- All access learning follows this progression – but that is a different presentation.

## The Assessment of Learning Process (ALP) for AAC Access






STAGE	PHASE	Activity & Movement with AAC Device	Understanding of AAC device use	Attention	Social interaction	Expressions / emotions
3 Explore Performance Extrovert- Focus on body, tools, environment & occupation	8	Uses tool for multiple activities in various settings. Effortless tool-use for interaction & communication. Movements automatic, fluid, precise.	Integrated tool use Tool use is sub-conscious/ automatic. Consciousness is focused on interaction and communication in the actual situation and occupation.	Attention regulation is well established/ sustained	Consistently/simultaneously interacts with tool, environment and social partners	Depends on the occupation involving interaction/ communication
	7	Controlled, smooth tool use for interaction and communication. Refinement of movement fluency. Uses full scope of communication device.	Complete awareness of tool use; Refines choices and correcting mistakes	Shares attention on multiple items Generally focused	Open to multiple interactions at once; Uses tool to facilitate social interaction	Happiness Satisfaction
	6	Uses tool in a goal-directed way for interaction and conveying messages. Movements are purposeful, but coarse and unrefined.	Competent tool use; Conscious of how to respond to interaction and create own messages. May ignore mistakes	Focus on goal; Can focus on many items, but easily disrupted	Consecutive interactions one after the other; tool use interrupts social interaction	Serious Contented Laugh Excited
2 Explore Sequencing Difficult transition Focus on body, tools & environment	5	Puts chains of acts/effects together (sequencing) Knows the message, focuses on how to say it. Repeated, varied, eager movements when experimenting to find best pattern. May appear to be stuck/ plateauing.	Aware of the AAC device's expanded use for communication & language; Searches patterns for linking effects into meaningful expressions. May be reluctant/ unwilling to follow directives.	Active concentration; Two channeled shared attention	Engages partner in interaction, communication on object, or other person.	Eager Smile Serious Frustration
	4	Builds chains of acts/effects (early sequencing) Explores more effects & ways to approach the tools for choosing output. Able to find and select targets. Intentional, cautious movements.	Conscious that the tool can be used to interact with the environment/ communicate. Aware of variations and choice of effect/output.	Attentive; Spontaneously shifts between two foci (e.g., environment and task) for attention	Involves others in interaction; May indicate need for help	Serious Smile Sometimes laugh
1 Explore Functions Introvert- Focus on body & tools	3	Acts to get anticipated effect with intent Activates tool/s; Distinct targeted movements; Able to find a target, and may select	Basic tool use Conscious of cause-effect relationships. Anticipates a specific effect/output	Alert. One focus for attention but able to shift att'n when prompted.	Initiates interaction Keeps and responds to eye-contact Facial signaling	Serious Contented Smile
	2	Attempts approximate activation; Explores all parts of the tool/s without clear purpose or intent; Diffuse vague multi-directed movements; May try various body parts to get effect	Awareness that something happens at activation but not conscious of where, when and how	Increased alertness; One focus for attention	Responds to interaction; Some eye-contact; Behavioral mirroring	Contented Curious Anxious Angry
	1	Excited interest – look, touch, or Non-act; or Rejecting behaviors	No or vague idea of how to use the AAC device for interaction and communication	Alert/ curious; or Non-focused/ passive; or Distractible	Limited interaction with others	Content Anxious

### ALP APPLIED (EYE TRACKING)

ALP TRANSITIONS	DESCRIPTORS	
Transition from 1 to 2	Building Attention	PARTICIPATION
Transition from 2 to 3	Effect to Cause/Effect	
Transition from 3 to 4	Cause/ Effect to Targeting	COMMUNICATION
Transition from 4 to 5	Targeting to Early Sequencing	LANGUAGE
Transition from 5 to 6	Sequential Movement to Application	
Transition from 6 to 7	Function to Refinement (Independent correction of errors)	
Transition from 7 to 8	Multitasking	

ALP APPLIED – EYE TRACKING	
ALP TRANSITIONS	ACTIVITY TYPE
Transition from 1 to 2 (Building Attention)	Movement; Mouse-over screen with visual and auditory stimulus; Video watching; Error-free activities.
Transition from 2 to 3 (Effect to Cause/Effect)	1 to 2 targets with clear reward/stimulus; preference driven activities; Prior stage activities can be used but presented at smaller size; Games with multiple, but isolated targets.
Transition from 3 to 4 (Cause/ Effect to Targeting)	Adding targets- 8 to 24 locations; Early purposeful activation for communication; Increase number of targets or complexity of background (figure ground discrimination).
Transition from 4 to 5 (Targeting to Early Sequencing)	More than 1 step required, or early navigation to complete target selection; adjust timing and fixation for selection with greater precision; increase cognitive load of games.
Transition from 5 to 6 (Sequential Movement to Application)	Implementation of language system, but regulate amount of content; Refine timing and fixation for selection with greater precision; Increase cognitive load of chosen games.
Transition from 6 to 7 (Function to Refinement)	Full implementation of language/communication system. Games require multiple steps or selections to complete activity
Transition from 7 to 8 (Multitasking)	Application outside of language system e.g., Mouse control.

If you increase the number of targets, the communicator may move back down the scale as they learn to use new grid size.



ALP APPLIED (EYE TRACKING)	
ALP TRANSITIONS	DESCRIPTORS
Transition from 1 to 2	Attention
Transition from 2 to 3	Building Cause and Effect
Transition from 3 to 4	Cause and Effect and early targeting
Transition from 4 to 5	Early sequencing of movements
Transition from 5 to 6	Purposeful and controlled sequential movements
Transition from 6 to 7	Independent correction of errors
Transition from 7 to 8	Mastery and Multitasking

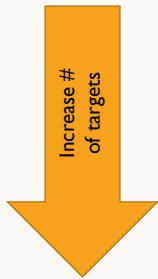
PARTICIPATION

COMMUNICATION

LANGUAGE

ALP APPLIED – EYE TRACKING

If you increase the number of targets, the communicator may move back down the scale as they learn to use new grid size.



ALP TRANSITIONS	ACTIVITY TYPE
Transition from 1 to 2 (Building Attention to Effect)	Movement, Mouse Over screen with visual and auditory stimulus, Video Error Free activities.
Transition from 2 to 3 (Effect to Cause/Effect)	1 to 2 targets with clear reward/stimulus, preference driven, Prior activities can be used but presented at smaller size. Games with multiple, but isolated targets.
Transition from 3 to 4 (C/E to Targeting)	Adding Targets displayed at 8 to 24 locations. Early purposeful activation or communication. Increase number of targets or complexity of background (figure ground discrimination).
Transition from 4 to 5 (Targeting to Early sequencing)	More than 1 step required or navigation to complete target selection. Timing and fixation for selection with greater precision. Increase cognitive load of chosen games.
Transition from 5 to 6 (Sequential Movement to Application)	Implementation of language system. Regulate amount of content. Timing and fixation for selection with greater precision. Increase cognitive load of chosen games.
Transition from 6 to 7 (Function to Refinement)	Full implementation of language/communication system. Games require multiple steps or selections to complete activity with grn
Transition from 7 to 8 (Multitasking)	Application outside of language system e.g., Mouse control.

ALP APPLIED (EYE TRACKING)

ALP TRANSITIONS	GOALS
Transition from 1 to 2 (Building Attention)	By (insert date here) the communicator will increase their time attending to the screen in a 1:1 setting while viewing high interest stimuli (e.g., videos, animations, or moving still images, etc.) with verbal and visual prompting by (%age) in 3/5 attempts. Data will be recorded on separate score sheet and reported 5x/month.
Transition from 2 to 3 (Effect to Cause/Effect)	What kind of goals would you create?

QUESTIONS AND WRAP UP

THANK YOU!

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