# ***Workshop:***
# The Optometrist's Guide to Strabismus:
## Reorganizing Space, Time and the Visual Process

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## Outline

- Diagnostics of Visual Projection
  - Cover Testing / Workshop, simultaneous prism
  - Brock Posture Board Campimetry/ Workshop, practice
  - MIT/Swirl as a diagnostic tool
- Therapeutics: Development of binocular processing
  - Biofeedback with MIT/Swirl
  - Flow chart
  - Workshop: Therapeutic coaching with the Swirl
- Building a 4-D Brain: Vision Therapy techniques for all binocularly-challenged patients: Supplementary Activities
  - Multi-sensory Integration Activities
  - Central-Peripheral Integration Activities
  - Visual Processing Development in computerized games
  - Visual Imagery: Visualization and Visual Memory Activities

## Goals of the Course

- Provide workshop opportunities to:
  - Practice presenting stimuli and interpreting projections with the Brock Posture Board.
  - Practice interpreting and manipulating image projections with the Slotnick Swirl for diagnostic as well as advanced therapeutic applications.
  - Explore a large variety of activities supporting *all* patients with binocular and oculomotor dysfunctions.
- Explore supplementary procedures which support the development of spatial organization and 4-dimensional thinking in patients with strabismus and other binocular dysfunctions.

## Diagnostics of Visual Projection

## Learning Objectives

LO's

Participants will be able to:

1. Illustrate cover testing with the simultaneous prism cover test, in order to preserve functional posture with minimal binocular disruption.
2. Recognize and appreciate the flick on cover testing as a pathognomonic indication of anomalous projection.
3. Practise presenting stimuli and interpreting projections with the Brock Posture Board.
4. Practise interpreting image projections with the Slotnick Swirl for diagnostic applications.

## THINKING IN 4 DIMENSIONS

- ADAPTATIONS for USING TWO EYES which do not point in the same direction:
  1. **Driver/Passenger**
  2. **Avoid Confusion**
  3. **Ignore the problem**
- Any of these solutions may be available, in whole or in part, to the *same* patient, at any time!

## Strabismic Processing Tools

1. **Driver/Passenger:** The visual direction of the "passenger" eye can be synced to the visual direction of the sighting/driving eye.
   - *~ Anomalous Projection*

## Strabismic Processing Tools

2. **Avoid Confusion:** The visual direction of the two foveae need to be "uncoupled" in the brain if both foveae are to be used.
   - *~ Parallel Processing*

## Strabismic Processing Tools

3. **Ignore the problem:** The fovea (or larger area!) of one eye may be **suppressed** as an alternative to remapping the visual direction of the non-favored eye.
   - *~ Suppression*

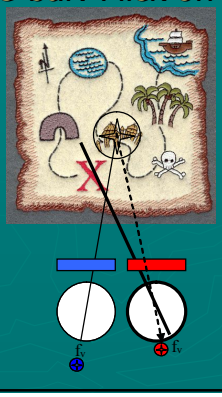
## Indications of AP

1. Cover Testing
   - Unilateral Cover Test vs Alternating Cover Test
   - Flick responses
2. Bagolini lenses (with Cover Test to confirm turn despite sensory fusion)
3. Posture Campimetry, central vs periph
4. Observations of projection (e.g. MIT)

## Indications of AP

- Cover Test
  - Unilateral CT
    - Simultaneous Prism CT
    - Flick responses
  - Alternating CT
  - Differences?
- *Demonstration*

## Clinical side-bar: Flick on Cover Test



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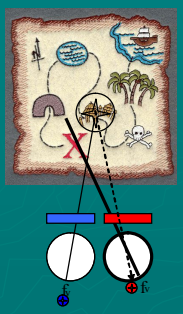
## Clinical side-bar: Flick on Cover Test

- *My interpretation:*
- The extra movement we see on Unilateral Cover Testing is caused by the patient switching between two alternative "maps" of space.
- The brain switches between these two perceptions coming through the pathway of the non-preferred eye, *depending on whether:*
  - *under **OU** or*
  - *under **monocular** conditions.*



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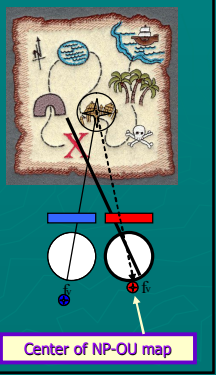
## Clinical side-bar: Flick on Cover Test

- *My interpretation:*
- One map is based on the perception of the non-preferred eye under OU conditions.
- This is the "NP-OU map."
- This map centers around the **retinal point which corresponds to the fovea of the preferred eye** when the eyes are under normal viewing conditions.

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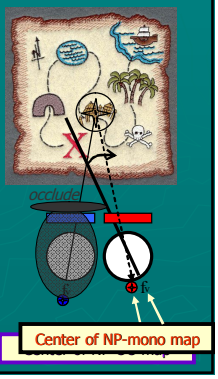
## Clinical side-bar: Flick on Cover Test

- *My interpretation:*
- The second map is based on the perception of the non-preferred eye under monocular viewing.
- This is the "NP-mono map."
- This map centers around the NP fixation point (whether CF or EF).




## Clinical side-bar: Flick on Cover Test

- On the initial covering of the preferred eye, the patient **first** views the target with the **center of the NP-OU map** … and then *re-fixates* to look at the point with the actual fovea (or EF point).

## Clinical side-bar: Flick on Cover Test

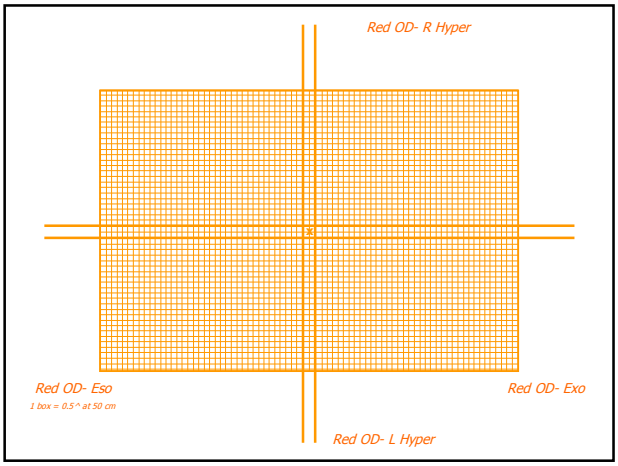
- This refixation occurs because when the NP eye first picks up fixation, the brain is calculating space relationships based on the preferred eye as the "driver," & the NP eye as the "passenger."
- Once the cover is in place, **the viewing condition has changed from binocular to monocular**, and the patient refixates:
  - The NP eye, now "driving alone," uses the preferred monocular fixation (may be either CF or EF).

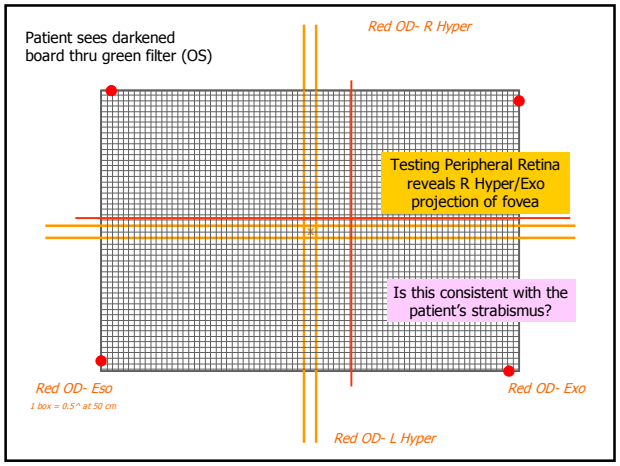
## Clinical side-bar: Flick on Cover Test

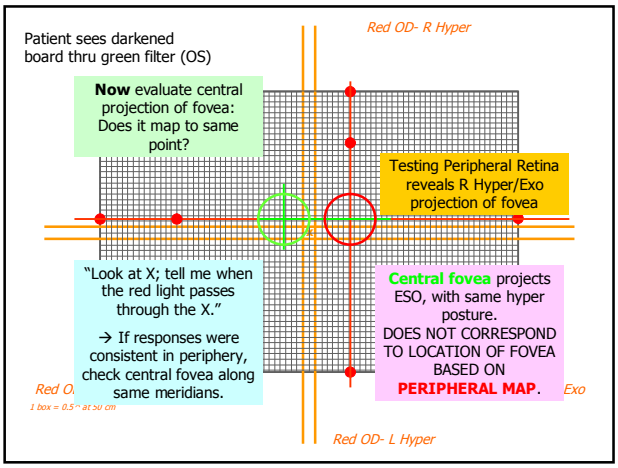
- If only the central part of the retina has AP, the flick may not appear on cover testing until the phoria is almost neutralized.
- The greater range of prism over which the patient demonstrates a flick response, the greater amount (area) of the retina which is anomalously adapted.

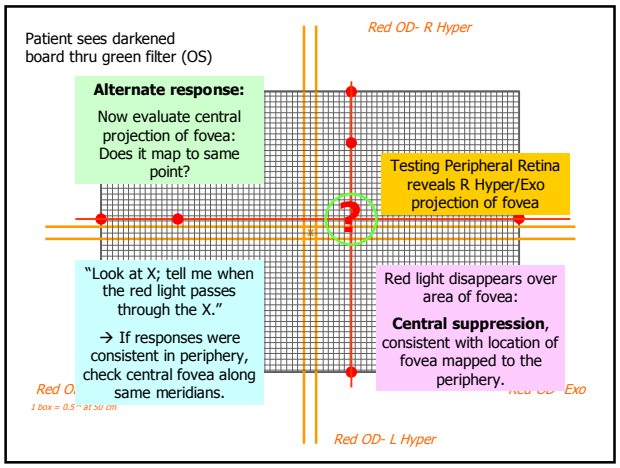
## Indications of AP

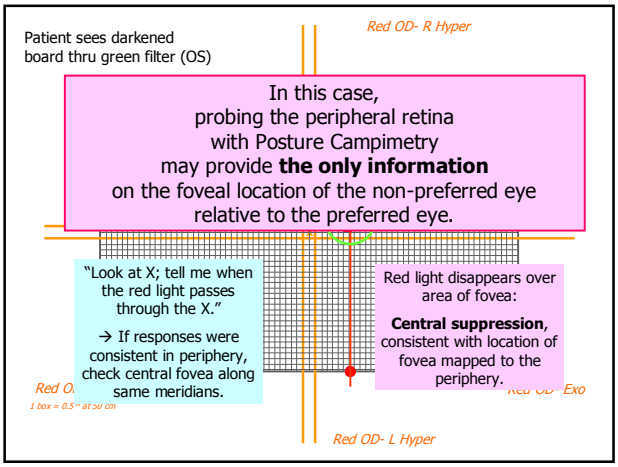
- Posture Campimetry *... details in handout*
  - Preferred eye – background- green filter
  - Non-Preferred eye – red light – red filter
    - Make the light "pin-point-small" with heavy tape
  - Campimetry = *mapping*
    - Map the location of the fovea of the non-preferred eye using peripheral retina (which is not likely to suppress)
    - **How does this compare to the location of the fovea when tested centrally?**
    - If X and dot are seen in the same location, cover test with motion confirms AP.
  - Peripheral Quadrant localization testing






## Supplement: Brock Posture Board Image Projection with two dissimilar images

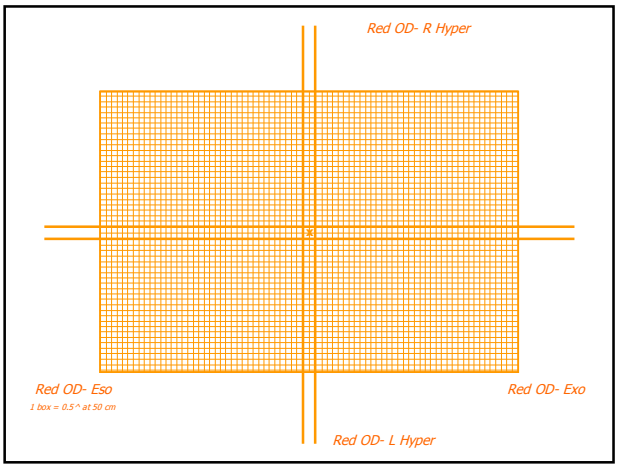
- With the Brock Posture Board, we view 2 dissimilar images. This is a different circumstance from viewing the (single) MIT with two different filters.
- When viewing the MIT with R/G glasses (red on OD), a large XT with NP will observe exo (crossed) diplopia (red to the left).
- If you were to *ask the XT patient* to *move* the red image to sit on top of the green image, they would have to move the image to their *RIGHT*.
- This is the circumstance created with the Brock Posture Board: You ask the patient to report when the red light is on the central X….

## Supplement: Brock Posture Board Image Projection with two dissimilar images

- With OS wearing green to see the "GROUND", OD sees red light ("FIGURE").
- If the patient is even slightly exo, they would move the right eye (red) image to the right of the X to correct the disparity, placing the red light on the X.
  - If the patient reports image overlap (light on X) when the right eye points to the right image and the left eye points to the left image, she has EXO posture (visual axes cross behind the board).
- If the patient is even slightly eso, they would move the right eye (red) image to the *left* of the X to correct the disparity, placing the red light on the X.
  - If the patient reports image overlap (light on X) when the right eye points to the left image and the left eye points to the right image, she has ESO posture (visual axes cross in front of the board).

## Supplement: Brock Posture Board Image Projection with two dissimilar images

- Remember, the Brock Posture Board does not tell you where the patient's eyes are aiming.
- Rather, it tells you where they PROJECT the image from one channel **relative to** the image from the other.
- If the patient does not know how to relate the information received through one eye to the information received through the other eye, ***they may not be able to tell you*** WHERE they see the red light.
  - They may actually report **seeing** the red light, but not knowing **where** it is.
  - They may report seeing it **in a different quadrant** from the area tested, or from where you would expect, based on cover testing!



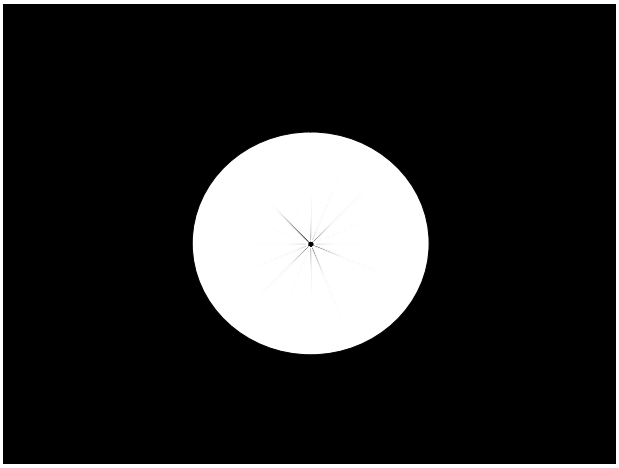

## Working with the patient on the MIT

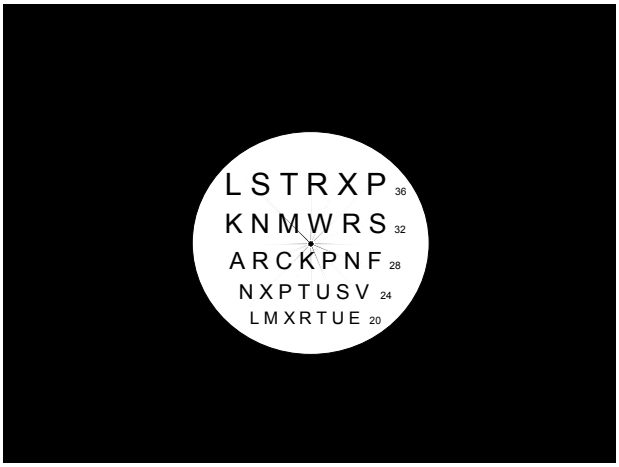
- Goal 1: SIMULTANEOUS PERCEPTION
- Goal 2: FLAT FUSION
- Goal 3: VERGENCE RANGES

## Let's Experiment!

- Red – Green glasses *or*
- Red – Blue glasses

- Place the RED on the **non-preferred eye**







## For Basic Binocular Training: This is the plan!

- Step 1: SP (if needed)
- Step 2: Flat fusion (many can start *here*)
- Step 3: Control over lustre (very empowering for your patients!)
- Step 4: Maintenance of OU perception **over a range**
  - **Ramp:** Dynamic movement forward/back along z-axis,
  - **Steps:** Use prism bar, or lollipop for small jump-ductions/ recoveries
- Step 5: Push beyond the present **threshold** (whether converging or diverging)
  - When instability begins, stop moving and try to recover lustre perception.
  - *Return to your starting position* rather than continue beyond first threshold.
  - On next attempt, use momentum to maintain range beyond previous threshold.
  - *Recommend working on **BO** (positive, voluntary effort) before **BI** ranges, regardless of the binocular posture, or presence/absence of strabismus.*

## For Basic Binocular Training: This is the plan!

- Step 1: SP (if needed)
- Step 2: Flat fusion (many can start *here*)
- **Only difference for compensated strabs:** Gradually reduce the prism compensation provided (over weeks/months) as they work through these 5 steps.
- Step 5: Push beyond the present **threshold** (whether converging or diverging)
  - When instability begins, stop moving and try to recover lustre perception.
  - *Return to your starting position* rather than continue beyond first threshold.
  - On next attempt, use momentum to maintain range beyond previous threshold.
  - *Recommend working on **BO** (positive, voluntary effort) before **BI** ranges, regardless of the binocular posture, or presence/absence of strabismus.*

## Working with the strabismic patient

- Dissociate the patient: R/B Filters
- Ask questions about what they are seeing
- Don't lead the patient: "Is the red one over here?"
- Give options, including:
  - Is the image on the right side, left side?
  - Higher, lower?
  - Does it switch back and forth across the sides?
  - Is it stable? Darting around?

Step 1/2

## Implementing the Strategy: How to establish flat fusion with MIT

First, help the patient to experience simultaneous perception:

- Use R/B glasses while viewing MIT
- Place Red filter over *turned* eye:
  - Increases relative strength of signal to strabismic eye
  - Provides sympathetic stimulation to the under-used pathway, according to the principles of syntonic phototherapy

Step 1/2

## Implementing the Strategy

- Use a prism bar(s) to try to gain superposition of the two images.
- Begin with OVERCORRECTING prism for the presenting turn.
  - Excess BO for ET; Excess BI for XT.
- Establish SP with NP.
- Gradually reduce the prism power.
- Record changes in perception with each step.
  - Images separated? Abutting? Overlapping? % overlap?

Step 1/2

## Implementing the Strategy

- If images *jump over* the superposition point, have patient view through the prism power which keeps the images closest (either eso or exo diplopia).
- With this level of prism correction, allow the patient to *simply observe* whether the separation continues to decrease or if it increases instead.
  ***Do not encourage active effort.***
- Patient also *observes* whether there is *any* overlap between the two images, and whether lustre response can be appreciated in overlapping areas.

Step 2

## Implementing the Strategy

- Once the images are superimposed (even partially), **allow viewing time**.
- Initial percept may be rapid alternation
- Lustre may take time.
  - It may help if you describe it so that the patient can identify it.

## Therapeutics: Development of binocular processing

## Learning Objectives

LO's

Participants will be able to:

1. Assess the effect of prolonged observation, using time with the experience to provide new opportunities for neural adaptation.
2. Practise manipulating image projections with the Slotnick Swirl, coaching patients to develop responsibility and control over their own binocular visual perception.
3. Facilitate simultaneous perception with over-compensating prism, moving images to under-utilized retinal areas for a slow, controlled approach to fusion which minimizes prism adaptation effects.
4. Evaluate decision-making junctures with the Slotnick Swirl, determining whether the patient is ready to build binocular fusion skills, or needs additional practice with simultaneous processing skills.

Step 3

## Refining the **Quality** of the Percept

- Guide the patient to alter the relative strength of the red or blue contribution to lustre:
  - Shoulder thrusts
  - Body Tensing
  - Touch the patient above the brow of the strabismic eye to increase the input through that channel
  - LEAVE **TIME** TO OBSERVE/PROCESS

Step 4

## Build binocular fusion ranges

- Step 4: Maintain OU lustre perception over a range
  - **Ramp:** Dynamic movement forward/back along z-axis,
  - **Steps:** Small jump-ductions/ recoveries
    - Prism bar
    - Lollipop prisms
  - *Work on **BO** (positive, voluntary effort) before **BI** ranges.*
  - *Regardless of the binocular posture,*
  - *Regardless of presence/absence of strabismus.*

Step 5

## Expand binocular fusion ranges

- Step 5: Push beyond the present fusion **threshold** (whether converging or diverging)
  - When instability begins, stop moving and try to **recover lustre perception**.
  - *Return to your starting position* rather than push beyond first threshold.
  - On ***next*** attempt, use **momentum** to maintain range beyond previous threshold.
- *Again, recommend working on **BO** (positive, voluntary effort) before **BI** ranges.*

## How to develop binocular image processing, Flat Fusion

- Flow chart, created as a support guide.

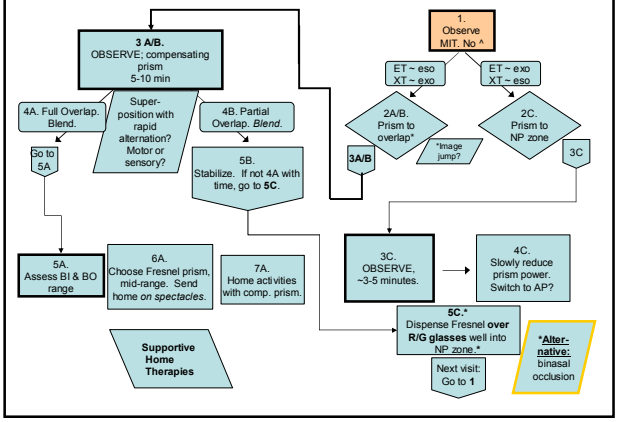
Decision Tree includes:

- Initial assessment with MIT/Swirl: **Diagnostic**
- Development of binocular processing over a vergence range with MIT/ Swirl: **Therapeutic**
- **Goal:** Binocular fusion with vergence ranges.

## Flow chart tracks: Overview

- A-Track: Patient demonstrates SP and attains FF with support; prepared to develop sensorimotor vergence ranges.
- C-Track: Patient has SP, but *AP interferes with sensorimotor fusion*.
- B-Track: Patient has SP but not establishing sensory fusion of full MIT/Swirl target.
  - More active decision-making and interpretation involved.

## FLOW CHART, overview



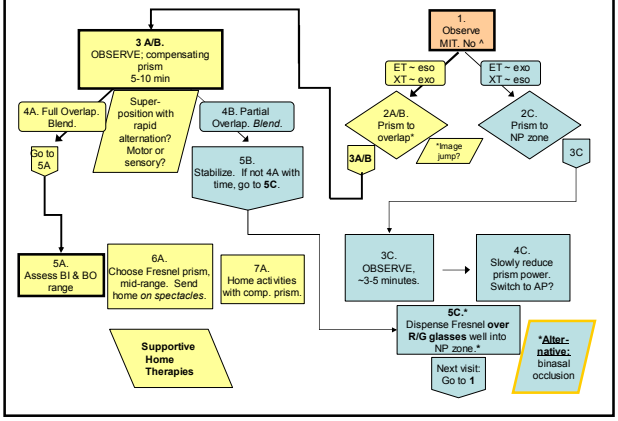

## Using the Flow Chart

- Observe.
- Decide.
- Observe… **leave time.**
- Decide… ready for next step?
  - If yes, move towards building binocular ranges
  - If no, move towards supporting simultaneous processing.

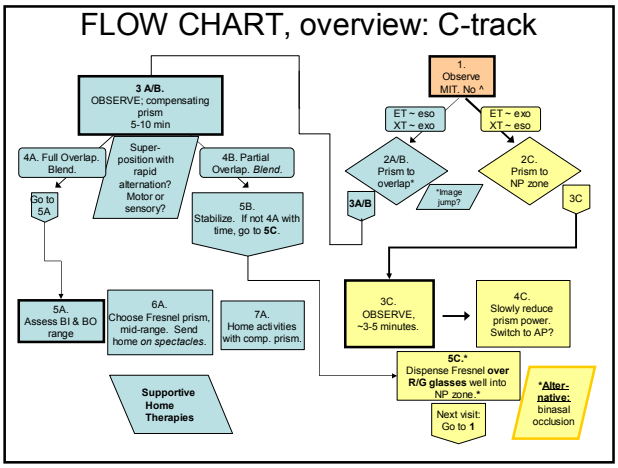
## Guiding Principles

1. OUR goal in therapy:
   Functional binocularity, with or without compensatory prism.
2. Train binocular flexibility,
   - both convergence and divergence,
   - and train with respect to accommodation.
3. Reduce dependence on motor supports (prism)

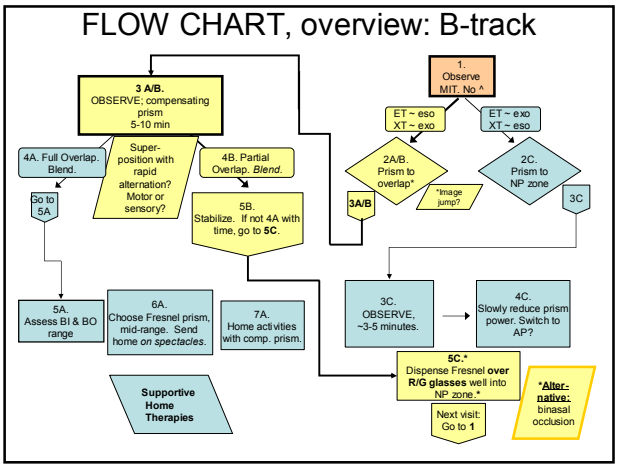
## FLOW CHART, overview: A-track




## FLOW CHART, overview: C-track




## FLOW CHART, overview: B-track



## A-track of Flow Chart: Patient achieves binocular alignment

1. "Relative" BI/BO ranges
2. Select Fresnel prism; decide when to decrease power

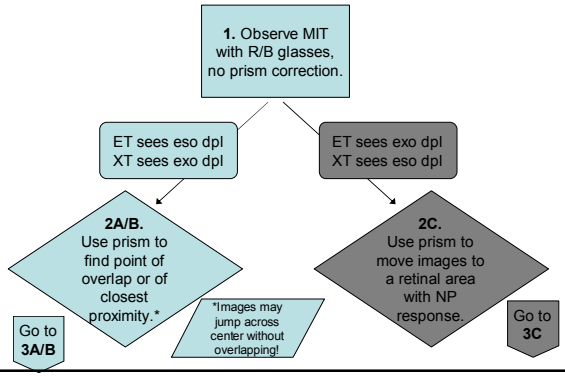
Next steps:

1. Reduce the compensation (decrease prism)
2. Stabilize and grind prism into Rx

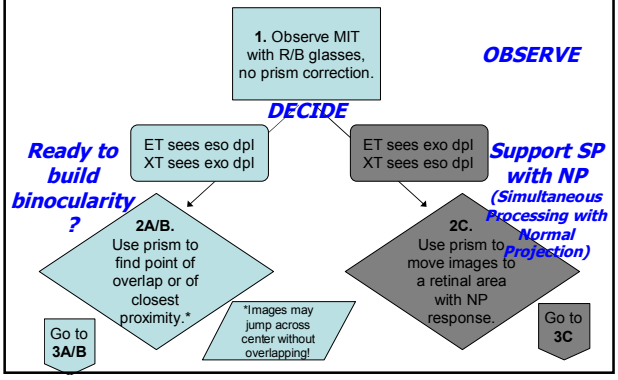
***OR***

1. Refer for surgery, as patient is now a good candidate for a successful outcome.
2. Continue Post-surgery VT to stabilize and assure success. BEGIN IMMEDIATELY (WITHIN 3-4 DAYS).
   - VT is necessary post-surgery because the neuro-muscular relationships have changed.

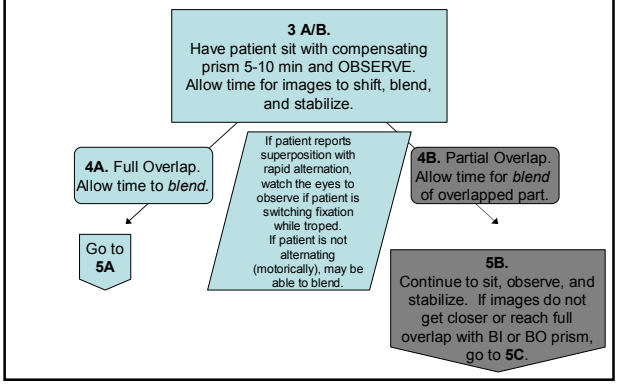
## FLOW CHART, Beginning



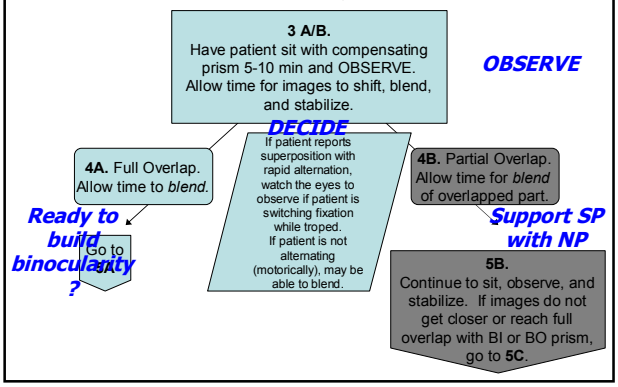

## FLOW CHART, Beginning



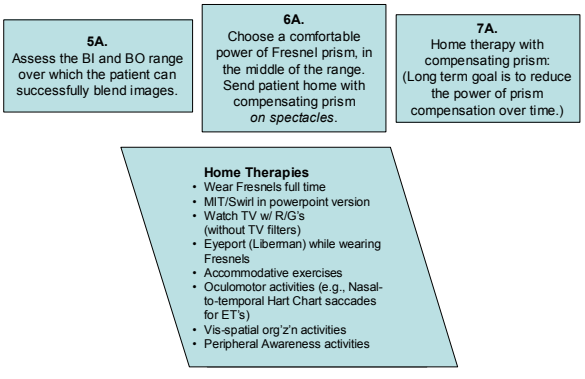

## FLOW CHART, A/B Track




## FLOW CHART, A/B Track




## FLOW CHART, End, A-track



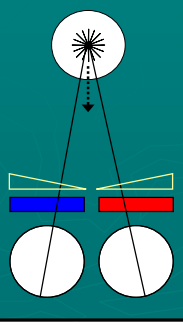
## When does AP interfere with the potential for continuous, functional binocular performance?

Patient viewing MIT with R/B glasses

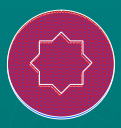
Introduce BO prism

Move image towards patient

**Before** the patient makes a motor fusion response, they are given the **STIMULUS TO CONVERGE**



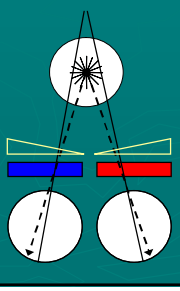
Perception



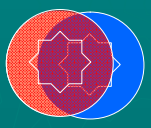
## When does AP interfere with the potential for continuous, functional binocular performance?

Patient viewing MIT with R/B glasses

**Before** the patient makes a motor fusion response, they are given the **STIMULUS TO CONVERGE**



Desired Perception



When BO^ is added, Visual axes directed *behind* new target position.

Temporal retina; nasal projection.

Should show exo diplopia (crossed disparity)

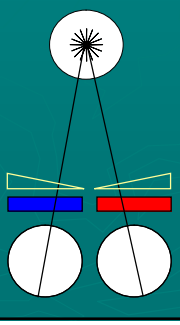
## When does AP interfere with the potential for continuous, functional binocular performance?

- What if there is a different perception???

## When does AP interfere with the potential for continuous, functional binocular performance?

Patient viewing MIT with R/B glasses

If the patient perceives a **sensory stimulus to DIVERGE** *(eso/ uncrossed dpl)* with a **motor requirement to CONVERGE**, there is a sensory/motor CONFLICT.



Perception with AP

The patient cannot maintain smooth and continuous fusion over a volume of space with a conflict between sensory and motor input.

## AP interfering with motor fusion

- When AP affects a large area of the retina (may occur with moderate turns, 20-35^), it may <u>interfere with the potential for MOTOR FUSION</u>.
  - AP creates an anomalous form of sensory fusion:
  - The cues to diverge (stimulate nasal retina) or converge (stimulate temporal retina) are *inconsistent* with the actual target location in space.

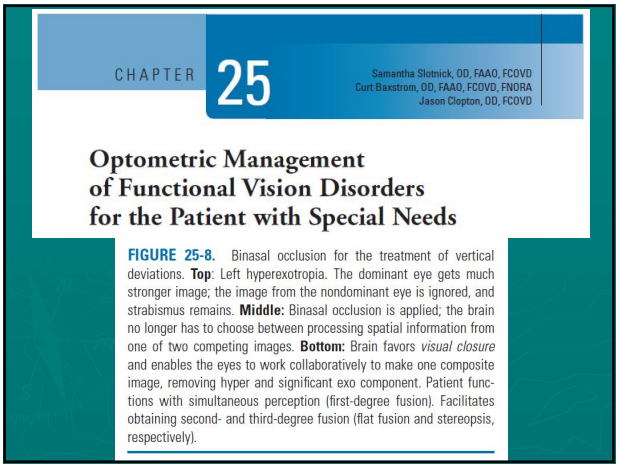
## IF Patient cannot yet achieve binocular function: C-track

- Disrupt the tendency for AP: **Return the patient to the "factory default setting."**

1. Utilize a part of the retina which is not anomalously projecting.
   1. Where to begin
   2. How to confirm this is an NP region.
2. Options for disrupting AP
   1. Binasal occlusion
   2. Overcorrecting prism
   3. Opposite prism
   4. Vertical diplopia

## Supplement: Binasal Occlusion

- For which cases?
  - Hyper: reduces vertical turn
  - Eso: encourages divergence
  - Exo: encourages convergence!
  - ABI: reduces the amount of binocular processing without losing visual field
- Where?
  - Always angle nasally downward/inward for convergence
  - For strabismus, slightly nasal to iris limbus
    - May reduce to cover plica, or vary symmetry between eyes
  - For information processing, caruncle/globe border may be sufficient.



CHAPTER 25

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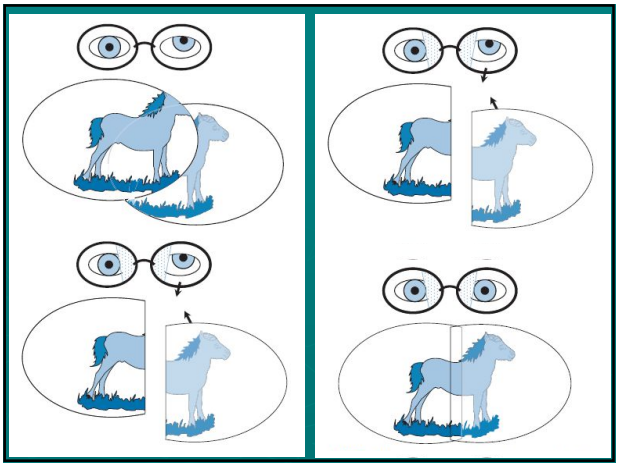
Jason Clopton, OD, FCOVD

Optometric Management of Functional Vision Disorders for the Patient with Special Needs

**FIGURE 25-8.** Binasal occlusion for the treatment of vertical deviations. **Top**: Left hyperexotropia. The dominant eye gets much stronger image; the image from the nondominant eye is ignored, and strabismus remains. **Middle:** Binasal occlusion is applied; the brain no longer has to choose between processing spatial information from one of two competing images. **Bottom:** Brain favors *visual closure* and enables the eyes to work collaboratively to make one composite image, removing hyper and significant exo component. Patient functions with simultaneous perception (first-degree fusion). Facilitates obtaining second- and third-degree fusion (flat fusion and stereopsis, respectively).



## Visual Input Activities: Safety

- Strabismic patients often ignore parts of their visual world in order to avoid confusion and to avoid diplopia.
- Sometimes, a patient will start to experience double vision in their typical ocular posture after non-alignment is brought to their awareness.
  - *X(T) patients (children) sometimes report diplopia after crossing their eyes (like their friends in school).*
  - *Once they learn to see double, they have trouble un-seeing double in their natural posture.*

## SAFETY FIRST

- It is the RESPONSIBILITY of the Optometrist to provide UNNATURAL settings in which to explore simultaneous perception.

- It IS RISKY to create diplopia awareness:
- You DO NOT WANT YOUR PATIENT to wind up with INTRACTABLE DIPLOPIA.

## SAFETY FIRST

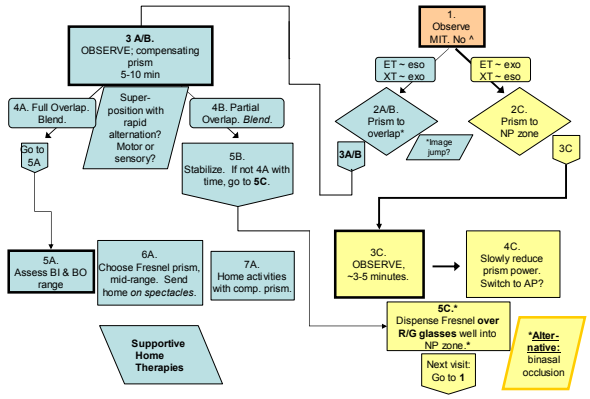
- You can PROTECT YOUR PATIENT by CONDUCTING ALL SIMULTANEOUS PERCEPTION ACTIVITIES WITH RED/GREEN (or RED/BLUE) **dissociating filters**.

- AVOID VERTICAL PRISM DISSOCIATION ACTIVITIES until your patient can demonstrate CONTINUOUS FLAT FUSION in their NATURAL ENVIRONMENT...
  OR: ADD RED/GREEN PROTECTION.

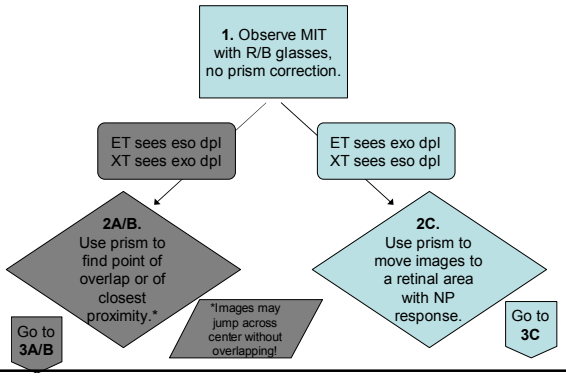
## SAFETY FIRST:
### PRESCRIBING is part of the Treatment!

- Please keep in mind that the decision to send a patient home with PRISMS and/or COLORED FILTERS is considered a **PRESCRIPTION**.
- The **MANAGING DOCTOR** is responsible for such prescriptions.
- Vision Therapists should not unilaterally decide to send a patient home with over-correcting prism, compensating prism, or even just red/green glasses.
- ***Any such decisions need to be made in partnership with the supervising O.D.***

## FLOW CHART, overview: C-track




## FLOW CHART, Beginning

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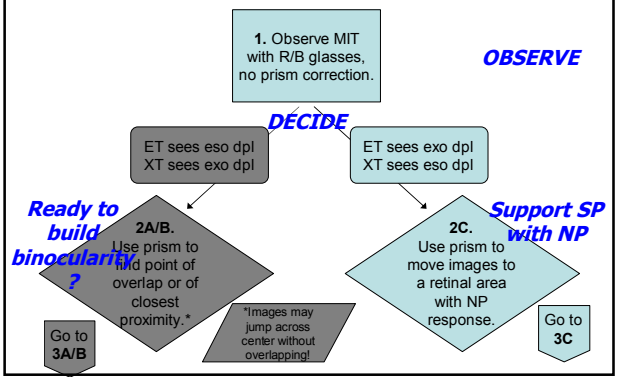
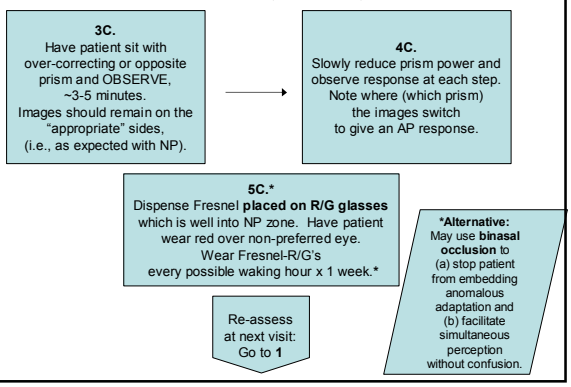
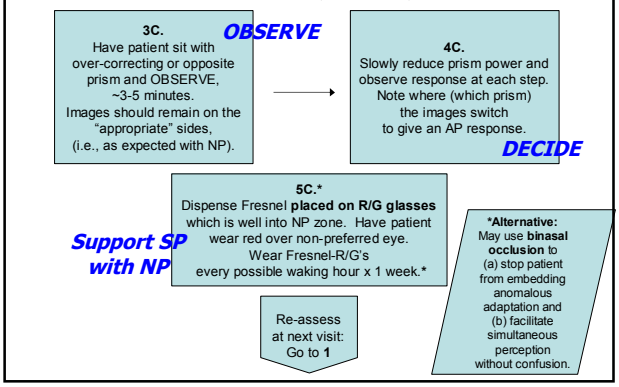



## FLOW CHART, End, C-track



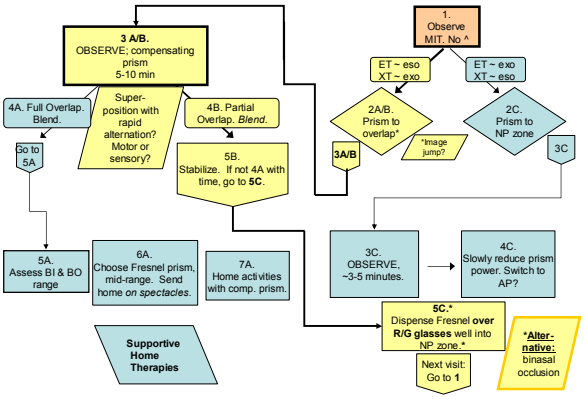

## FLOW CHART, End, C-track



## Patient demonstrates modified binocular function: B-track

- Partial image overlap on MIT; observes image blend.
- Positive prognosis, but further effort is required in achieving binocularity without sensory/motor conflict. Refer to C-track.
  - This step may respond very well to binasals!

## FLOW CHART, overview: B-track

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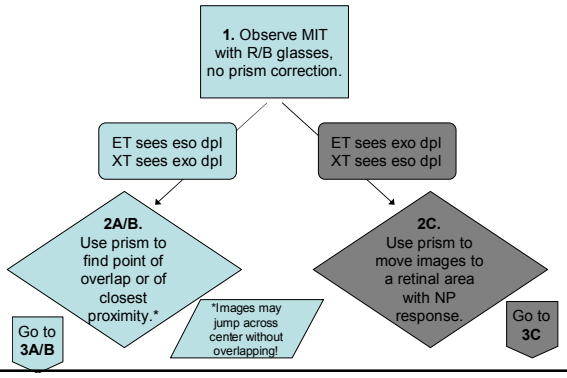


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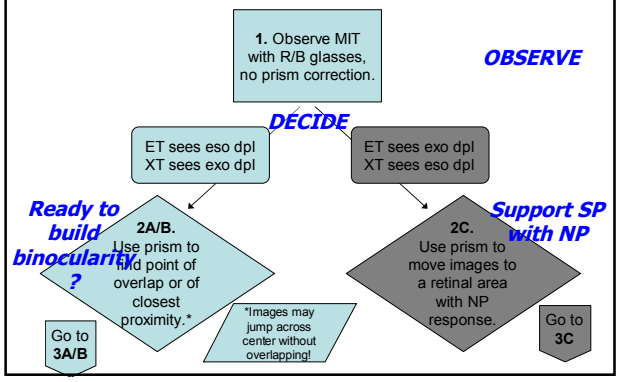
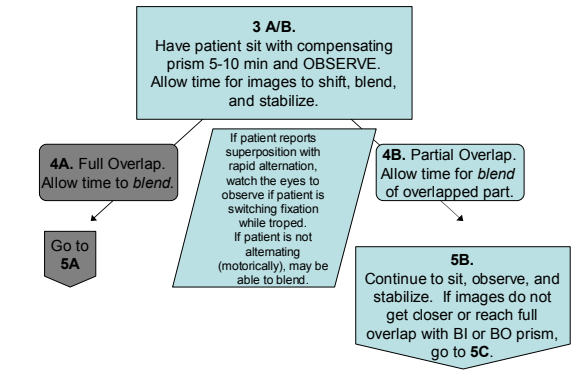
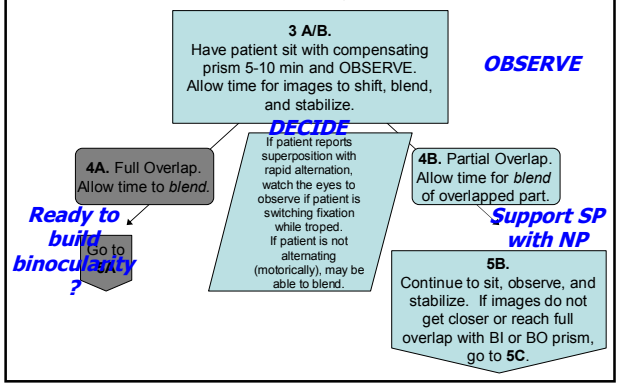
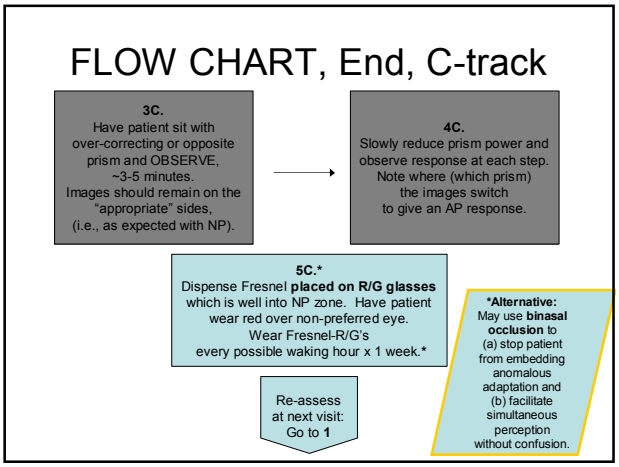


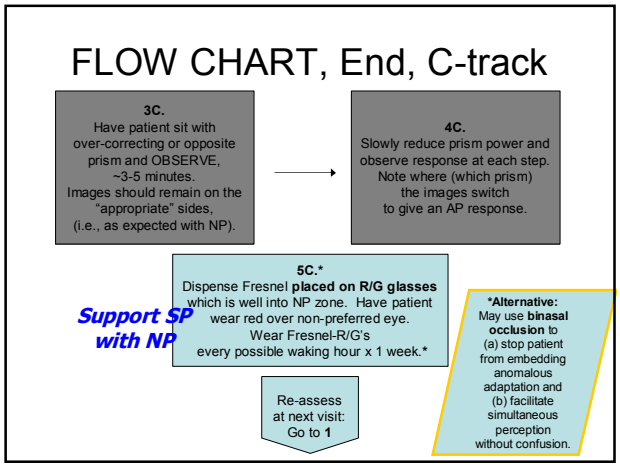

## FLOW CHART, A/B Track




## FLOW CHART, A/B Track






## Troubleshooting

1. My patient only sees one image
   - Ascertain which eye sees image;
   - Cover that eye to prompt viewing of other eye's image;
   - Use a prism to move other image closer to central field.
   - May need to try overcorrecting prism to push image to an under-stimulated area of the retina.
   - May need to create *image alternation*: Polarized filters to be used WITH red/green glasses.
     - Remember, it will NOT be possible to get blended images this way! This is just a stepping stone to 1° fusion (SP)!

## Troubleshooting

2. When I bring in the prism bar, the patient reports 2 blue circles and one red circle (or vice versa).
   - Check prism bar placement– likely viewing the image twice, both thru prism and external to prism. Eye is often not centered in the orbit!
   - May be seeing an extra reflection off one of the lens or filter surfaces– in which case the image is usually a different size, or distorted. Have the patient pay attention to the "most real" image.

## Troubleshooting

3. My patient has simultaneous perception, but she reports "exo" (crossed) diplopia despite having esotropia (or vice versa).
   - AP is interfering with the potential for binocularity: Need to disrupt this adaptation first.
   - If binasals x 1 week do not work…. Use overcorrecting prism (high BO for ET's, high BI for XT's) sufficient to see the "expected" orientation of diplopia;
   - Induce constant diplopia for patient for a full week. ALWAYS, ALWAYS use red/green (blue) glasses with diplopia therapy at home. This also helps the patient distinguish which image comes from which eye. Make sure patient can maintain the diplopia in real space (not just on MIT). Have patient walk around office with new prism in place.
   - Continually alter nature of the disruption if paradoxical percept persists (then try vertical diplopia… or high BI for ET's, high BO for XT's).
   - Use the red on the turned eye first, but you may reverse red and green to continue to confuse the patient's visual system.

## Clinical Thinking

Remember what you are after, clinically:

- You have a patient/ WHOLE person in front of you.
- You have observed their strabismus, and from cover testing, you know the direction of the turn, which eye they may favor
- The question on your mind: How does this person *function* like that?
- What adaptations are they making in order to process space?

## Clinical Thinking

- Which channel provides them with a "ground"? Is it stable/variable?
- Can they see with both eyes at the same time (SP)?
- Can they relate the information from one channel to the information from the other channel?
- Can they combine information from the two channels into a single, unified perception?
- Can they make a motor fusion response? Is there a range over which they can keep single, clear, binocular vision?
- Can they do so with NP, or only with AP?
- Do they avoid fusion?
- Can they gain control over their perceptions? …mind over matter!?

## Supplement: Lens Management 1

- Lenses are one of our best tools for altering the patient's visual input.

**When prescribing:**

- Consider what the lens does, optically:
  - Where are the images created?
  - Do they focus in the same image plane? or very close?
  - Will the OD and OS images be difficult to fuse on the Z-axis?

## Supplement: Lens Management 2

- Consider the refractive clarity:
  - Is a clear image supportive of binocular fusion?
  - Is the cyl necessary for binocular function? Does it add to the visual acuity? Quality?
  - Will a fully focused image on the non-preferred eye *necessitate suppression*, given the current eye-posture?
  - Will a fully focused image on the non-preferred eye *necessitate a change in suppression*, given the current eye-posture? (i.e., starting to suppress, modifying a suppression pattern, etc.)
  - Will a *defocused* image on the non-preferred eye *facilitate* binocular function?
  - *A monovision Rx may be an ideal interim step to binocular fusion!*
- *Revisit these questions periodically with your progress checks!*

# Building a 4-D Brain: Vision Therapy techniques for all binocularly-challenged patients

Supplementary Activities

## Learning Objectives

LO's

Participants will be able to:

1. Evaluate a large variety of activities supporting *all* patients with binocular and oculomotor dysfunctions.
2. Envision supplementary procedures which support the development of spatial organization and 4-dimensional thinking in patients with strabismus and other binocular dysfunctions.
3. Review and identify sensory integration opportunities within familiar vision therapy techniques, to elevate consciousness for real-life integration of visual input with other sensory inputs.

## Multi-sensory Integration Techniques

## Sensory Integration in VT: Examples

- VMI: "Ready Aim Fire," monocular, ipsi & contra hand
- Thumb-Pinky Vergence Rock
- Pointer and straw (or Menorah Explorah)
  - Hold straw parallel to facial plane; do not limit to primary gaze
- (R/G) Keystone Basic Binocular Series
  - Use tactile feedback, touching picture
- Bilateral integration: Chalkboard circles/ walking rail
- Gross motor: Marsden Ball/ Bunt ball (Discussed w looming)
- Ocular Proprioception/ Visual:
  - Monocular Lens Rock (Discussed under Monocular Depth cues)
- Vectograms: with tactile counterparts … or dual pointers
  - Visual/**TACTILE** feedback… Visual/**AUDITORY** feedback

## Thumb-Pinky Vergence Rock

- Thumb-Pinky Vergence Rock
  - Body organization and symmetry
  - Body localization/ extension
  - Body orientation
  - Ocular proprioception
  - Tactile feedback paired with ocular proprioception
  - Visual feedback via physiological diplopia

## Thumb-Pinky Vergence Rock

http://www.youtube.com/watch?v=JFHib67xVMs

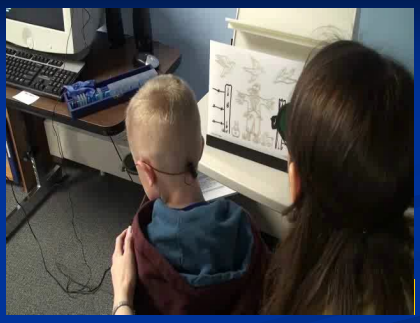
## Pointer/Straw or Menorah Explorah

- Hold straw parallel to facial plane, but do not limit to primary gaze
- With menorah, patient can work independently.
  - Use finger; aim vertically rather than horizontally
- Arm extension supports depth/distance awareness
- Phys dpl for visual biofeedback
- Tactile feedback on edge of candle-holder

## Menorah Explorah

## (R/G) Keystone Basic Binocular Series

- Use tactile feedback, touching picture
- Fingertip faces picture, glide over BI targets
- Fingertip faces upwards, seems to run into BO targets
- Feel as if finger slips behind some BO targets
- Visual/tactile mis-match is appreciated

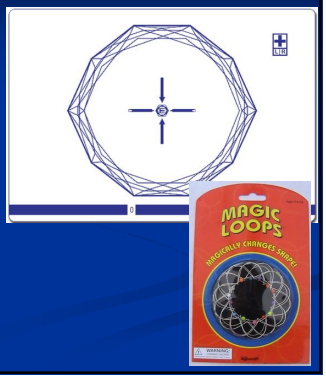


## Bilateral integration & Vision

- Chalkboard circles
  - Peripheral visual awareness synchronizes with movement of the body/ arms in space.
  - Visual feedback in the process improves image quality.
  - Also improves body organization and motor control.
- Walking Rail
  - Optic flow
  - Vision as a stabilizer for balance.
  - Increase peripheral awareness (figure/ground); beanbag drop.

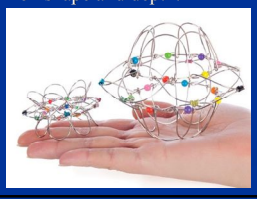
## Stereo-tactile and Stereopsis Integration

- Object manipulation is one of our first forms of "solid-seeing" (stereopsis).



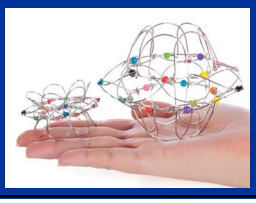

## Stereo-tactile and Stereopsis Integration

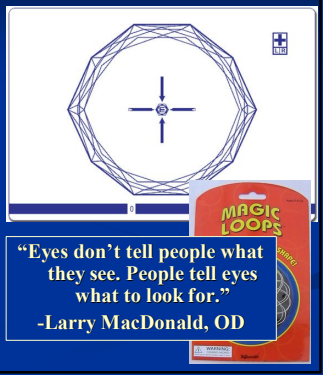
- As babies, we put objects in our mouths to learn about feel, texture, size, shape, etc.
- As we mature, we can use our palms, full of interacting sensors, to provide feedback on shape and depth.




## Stereo-tactile and Stereopsis Integration

- Reshape these "Magic Loops" to match the contour of the object in the vectogram. (**Gem**, right)
- Helps to push appreciation of stereopsis while holding the solid shape in hand.






**"Eyes don't tell people what they see. People tell eyes what to look for."**
**-Larry MacDonald, OD**

## Stereo-tactile and Stereopsis Integration

- Reshape these "Magic Loops" to match the contour of the object in the vectogram. (**Teddy**, right)
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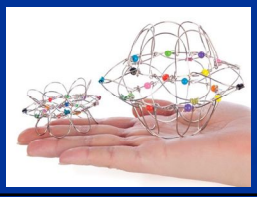
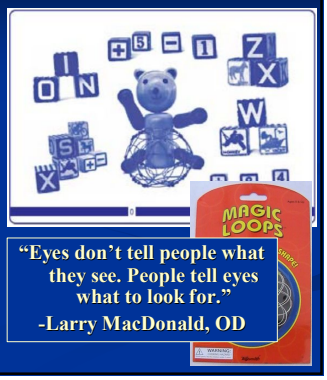





**"Eyes don't tell people what they see. People tell eyes what to look for."**
**-Larry MacDonald, OD**

## Visual-Auditory Integration

- Sound localization can be a powerful mode of spatial processing.
- Instead of localizing floating aspects of a vectogram image with one pointer, TRY USING TWO!

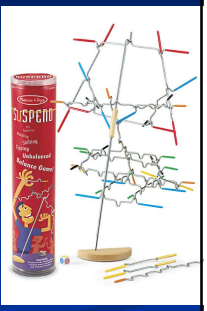
- Localize with one pointer, and then tap on it with a 2nd pointer.
- Provides tactile/ vibrational stimulation *along with* **auditory localization**!

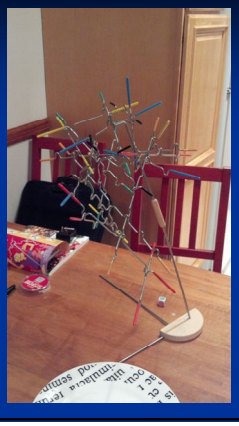
## Bonus Games and Activities

- Suspend
  - Understanding physics of balance
    - Fulcrum… series of fulcrums
    - Stick length ~ weight
    - De-stabilize / **Re**-stabilize
  - Shifting 3-D structure with each move, stimulates depth perception


## Bonus Games and Activities

- Suspend
  - Utilizes Sensory Integration:
    - Visual motor planning
    - Modulation of touch, placement
    - Eye-hand coordination
  - Different appearance from different vantages, encourages 4-D Thinking to process as a **solid** and plan the next move:
    - In order to create consistent, stable perspective of the structure, expand attention to include larger area of space.
  - Stimulates Central-Peripheral Integration:
    - Effect of placing or REMOVING a stick: Changes local and non-local areas of structure.



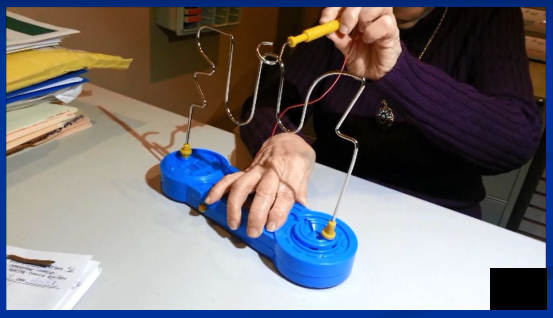
Video demo,
Using Suspend in VT:

Part 1: http://youtu.be/LqC2RLWUejo Part 2: http://youtu.be/lbS7fVBjlVU

Video demo,
Using Suspend in VT:

Part 1: http://youtu.be/LqC2RLWUejo Part 2: http://youtu.be/lbS7fVBjlVU

## Visually-guided Fine Motor Control: Buzz Game



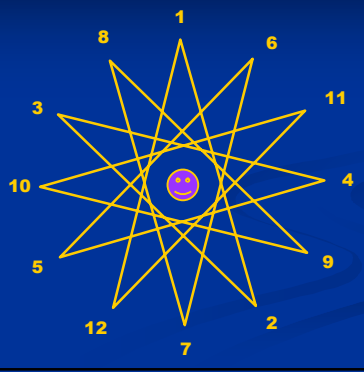
## Central-Peripheral Organization

- Develop visual-spatial organization skills in order to build an internal construct of their 4-D space/time world.
  - Enables them to use *top-down processing* to integrate their spatial perception with how the world is "supposed to look," facilitating the development of stereopsis.
- Stereopsis begins with the use of non-central retina.
- Simultaneously *seeing* center and periphery engages active use of peripheral retina.
- VT activities which build central-peripheral organization create the potential for stereoscopic vision.

## Central-Peripheral Integration Activities

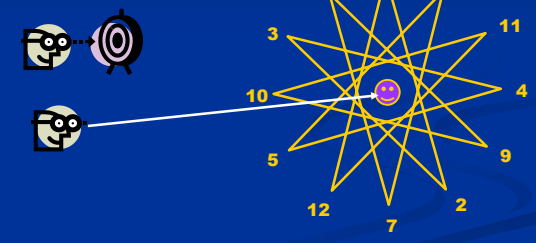
- Look Ready Touch Back (Schrock)
- Slotnick Scramble
- Eyeport (Liberman)
- Visual-spatial memory games
  - Simultaneous or sequential, with delay or distraction
- Side-by-Side Vectograms
  - relative depth – different vectos sliding by each other: Topper/Clown, Qts/Clown, Qts/ No.9
  - relative size – the same vecto (Clown/Clown)
- Vectos with pointer
  - Diplopia on pointer or image: inaccurate localization.
- Oculomotor:
  - Eye excursions: Greenwald ball track/ Hart chart (Nasal to temporal for ET's, Temporal to nasal for XT's)
  - Wayne Saccadic Fixator/ Accuvision board

## Look Ready Touch Back



## Look Ready Touch Back

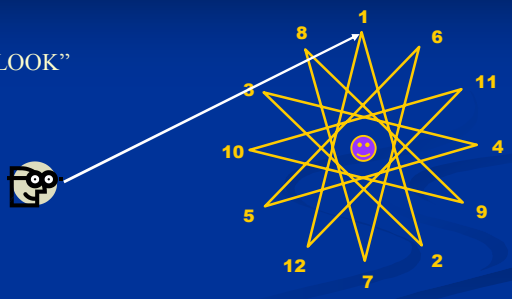
Eyes begin at center





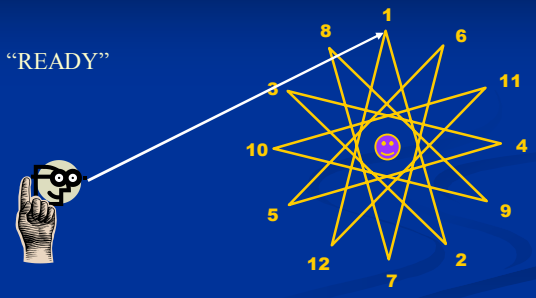

## Look Ready Touch Back

"LOOK"




## Look Ready Touch Back

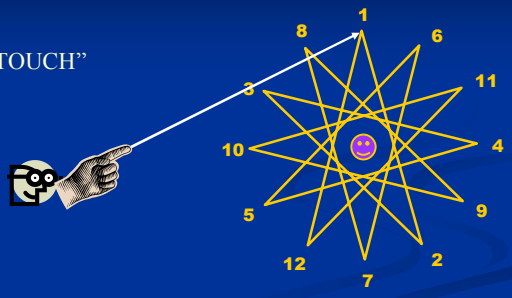
"READY"





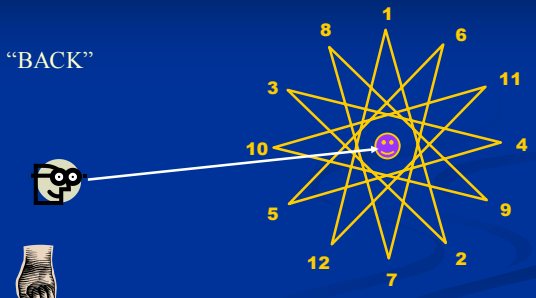

## Look Ready Touch Back

"TOUCH"




## Look Ready Touch Back

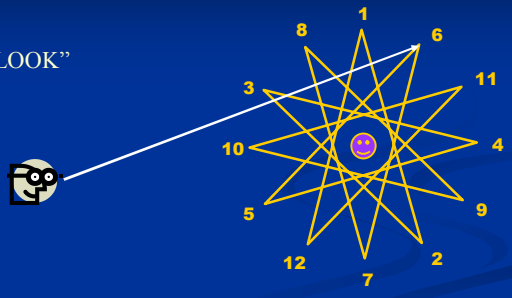
"BACK"





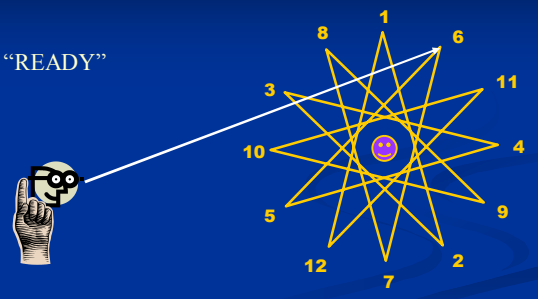

## Look Ready Touch Back

"LOOK"



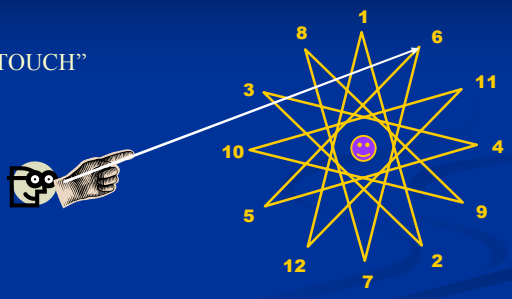
## Look Ready Touch Back

"READY"



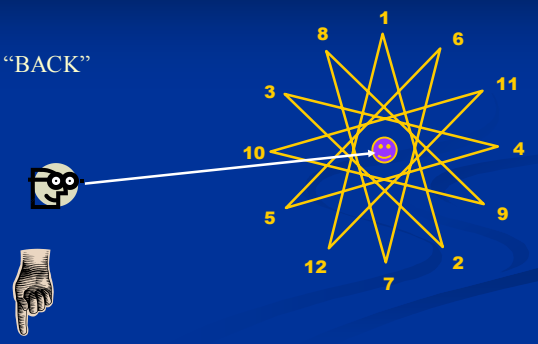

## Look Ready Touch Back

"TOUCH"



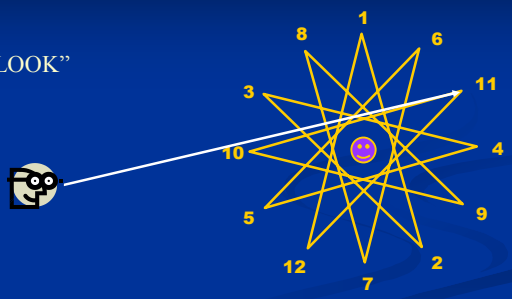

## Look Ready Touch Back

"BACK"



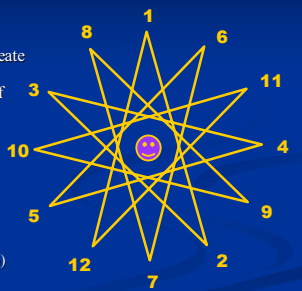

## Look Ready Touch Back

"LOOK"




## Look Ready Touch Back

- Metronome pulses @ 60 in the background
- Place on door edge or jamb to create 3-D plane challenge
- Monitor accuracy of touch (tip of star) in x, y and z planes
- Can use space fixator
- Step up through:
  - Dominant hand
  - RH CW, LH CCW
  - RH CCW, LH CW
  - Alternating hands
  - Ipsi/contra foot with touch
  - Change direction on cue (1 snap)
  - Change foot pairing on cue (2 snaps)
  - Change either direction or foot:
    - Be ready for either cue
  - Continue with distractions




## Slotnick Scramble

## Slotnick Scramble

- Visual-Vestibular Integration
- Central-Peripheral Integration
  - In Space
  - In *TIME*
- *Article in JBO*
  - *http://oepf.org/sites/default/files/journals/jbo-volume-21-issue-3/21-3%20Slotnick.pdf*

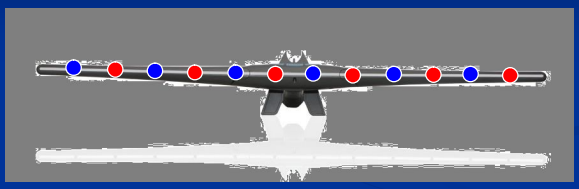
## Eyeport



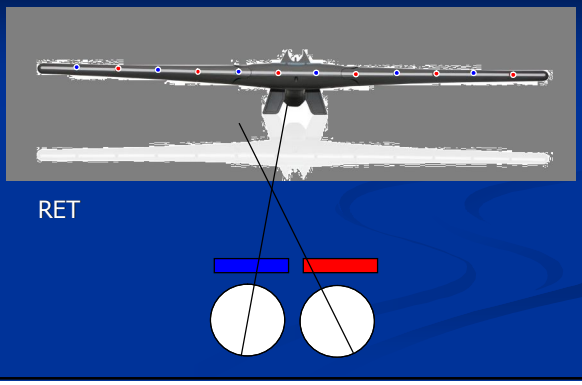
## Eyeport

- Oscillate between red/blue (Program 1)
- Reach-grasp-release between OD and OS
- Respond; Do not predict: Access peripheral retina
- Lights are at regular intervals
- Perception of asymmetric spacing between consecutive lights indicates eyes are not coincidently pointing on light (MFBF target)
  - red-to-blue vs
  - blue-to-red
  - Directional asymmetry L-to-R vs R-to-L, etc

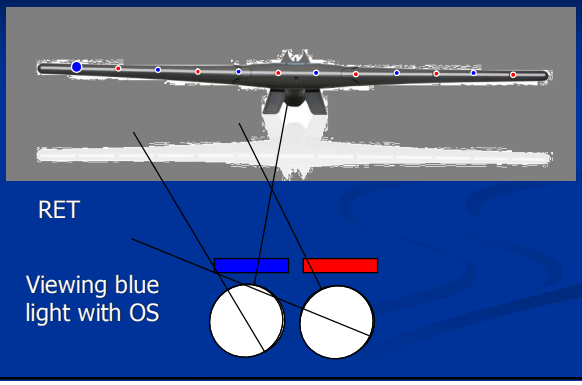
## Eyeport – consecutive (Program 1)



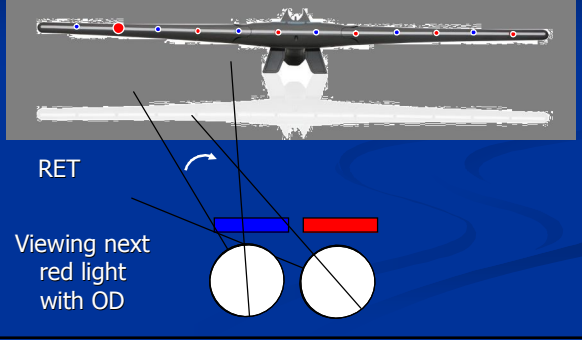
## Eyeport – consecutive (Program 1)




## Eyeport – consecutive (Program 1)



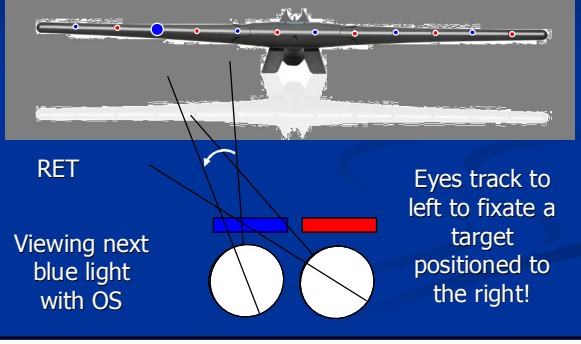
## Eyeport – consecutive (Program 1)



RET

Viewing next red light with OD

## Eyeport – consecutive (Program 1)

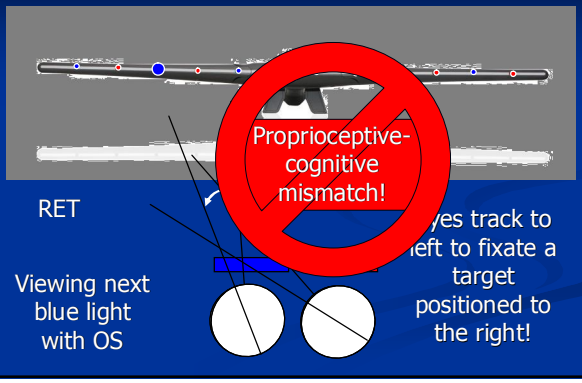


RET

Viewing next blue light with OS

Eyes track to left to fixate a target positioned to the right!

## Eyeport – consecutive (Program 1)

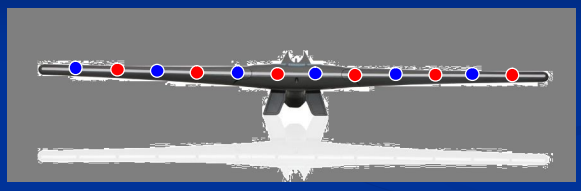



RET

Viewing next blue light with OS

yes track to left to fixate a target positioned to the right!

## Eyeport – Program 2

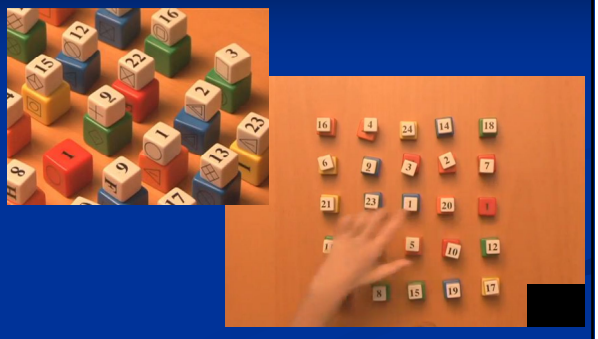


- Creates peripheral stimulation with varying degrees of eccentricity
- Staggers presentation to opposite eye/ same eye
- Staggers presentation to temporal retina/nasal retina

## Central-Peripheral Integration in Visual Processing/ Memory

- The advantage of vision is the ability to process a set of data simultaneously
- Any procedure which builds simultaneous visual processing supports the building of a 4-D brain.
- Central-Peripheral Integration activities help a patient learn to process detail as well as context (figure as well as ground) over a large area of space.
  - Multi-Matrix Game
  - Puzzle Art and Puzzle Art 3-D
  - www.Lumosity.com:
    - Birdwatching; Eagle Eye
    - Space Junk
    - Top Chimp
    - Memory Matrix
    - Monster Garden

## Multi-Matrix Game



http://www.youtube.com/watch?v=A1-2Vwas2_E

## Multi-Matrix Game

- Global Processing
- Central/Peripheral organization
- Bimanual integration and body awareness/extension
- 3-D pick-up and placement challenge
- Peripheral awareness
  - Figure/Ground
  - Visualize next number/shape/letter and find location in peripheral retina.
- Prime on the next *several* moves (4-D thinking and planning)
  - Visual-spatial memory and spatial organization
- Use **dots** to shift to **spatial thinking**/ pure visual processing
- Countless loading opportunities
  - #'s: Sums, differences;
  - Objects: visual memory; vestibular (card behind)

## Central-Peripheral Organization

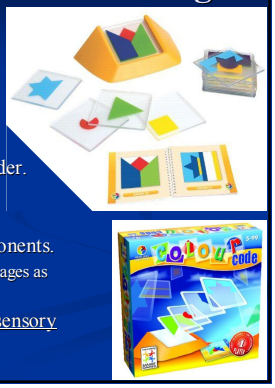
- Puzzle Art 3-D

## Puzzle Art 3-D

- Trains figure/ground and central/peripheral concepts
- Use with or without 3-D glasses
- 3-D glasses create differential placement of color by *diffraction*
- Creates relative BI and BO of ***color***
  - Vectograms and anaglyphs create BI/BO of *form*
- Can work on pattern matching via **stereo-contour**, not just on color patterns and form

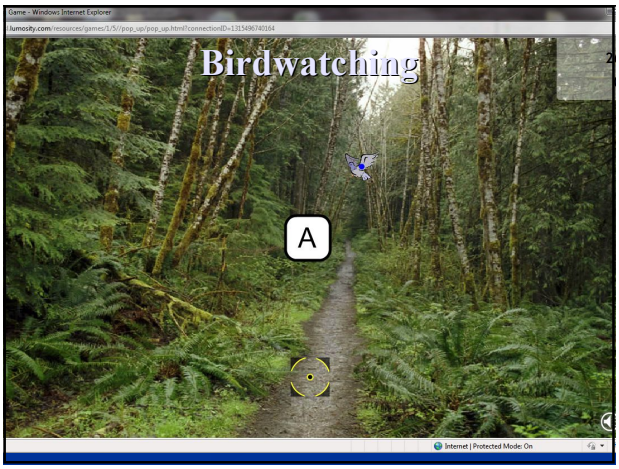
## 2-D Targets with 3-D Thinking

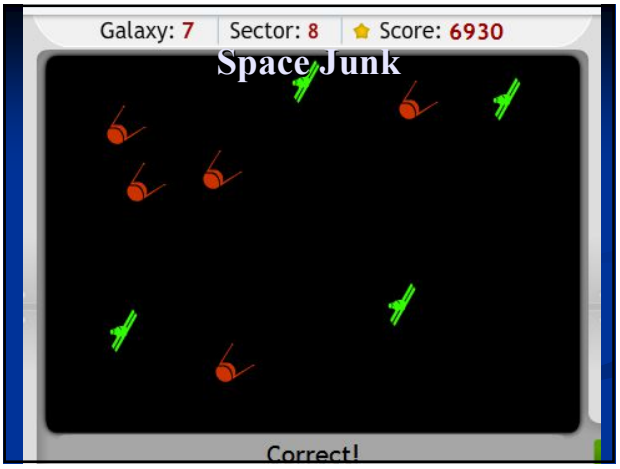
- Color Code
  - Utilizes Monocular Depth Cue: Occlusion
  - Given a flat image
  - Need to recreate the image using color plates in the appropriate order.
  - Trains patient to think in depth: Must tease apart a flat image into consecutively ordered components.
    - Teaches the mind to entertain flat images as separated in depth.
  - Tactile manipulation provides a sensory integration component.

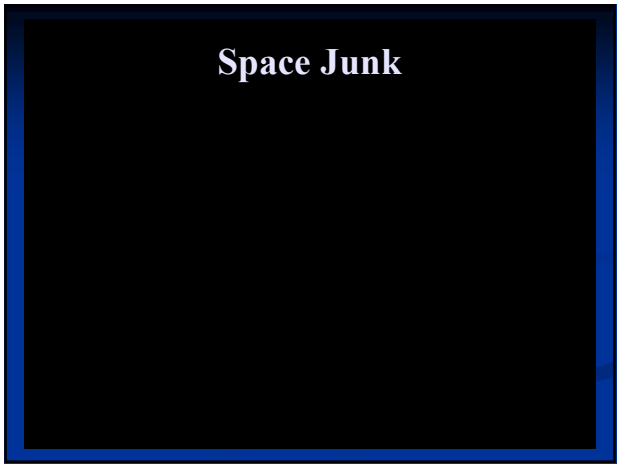



## Stimulate Simultaneous Processing: Supports Thinking in 4 Dimensions

- www.Lumosity.com
- Necessary to simultaneously process:
  - Center and periphery
  - Figure and ground
  - Part and whole
  - Spatial and sequential

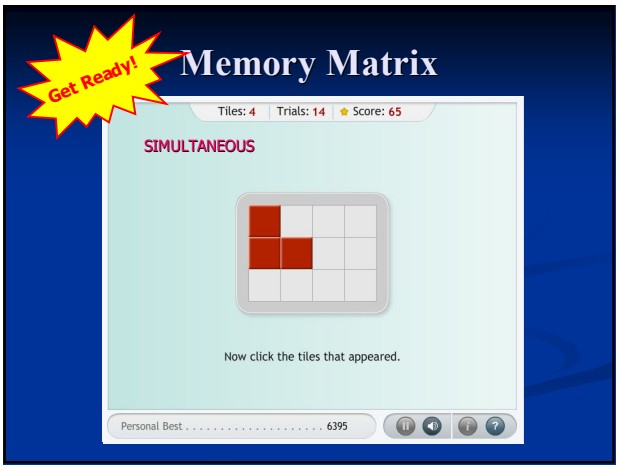


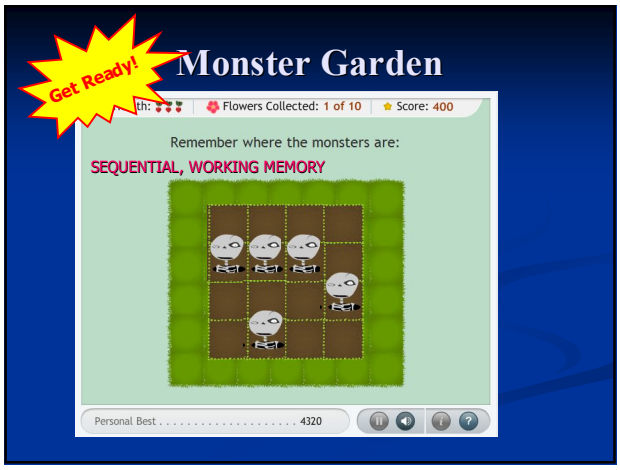

Galaxy: 7
Sector: 8
Score: 6930
Space Junk
Correct!

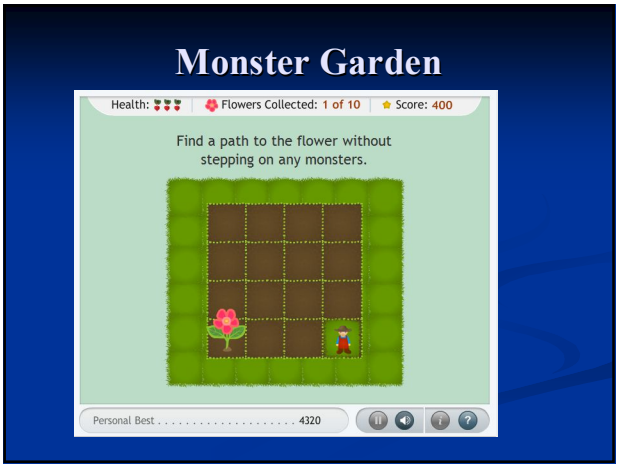

Space Junk

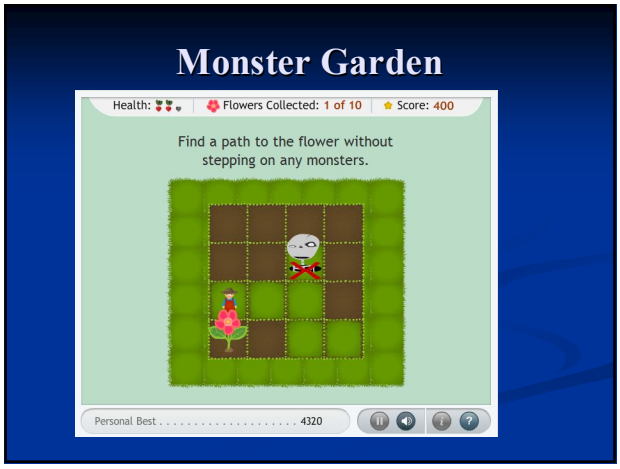

Get Ready!
Top Chimp
lumosity
Home
Courses
Games
Assessments
Brain Profile
5
4
7
2
3
1

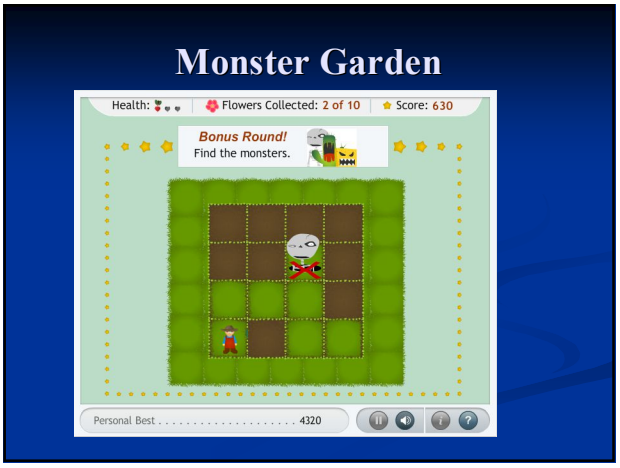

Top Chimp Demo
Your Opponent
VS
You
Bubbles
Start


Get Ready!
Memory Matrix
Tiles: 4
Trials: 14
Score: 65
SIMULTANEOUS
Now click the tiles that appeared.
Personal Best . . . . . 6395


Get Ready!
Monster Garden
Flowers Collected: 1 of 10
Score: 400
Remember where the monsters are:
SEQUENTIAL, WORKING MEMORY
Personal Best . . . . . 4320






## Summary

- The strabismic patient already has access to 4-Dimensional processing
- The goal of **perceptual therapy in strabismus** is to help **expand the 4-D construct** in the **space of the mind**
- Use top-down processing and discussion to help create the *potential* for 4-D spatial **thinking**
- **Goal**: **Visually-directed actions in a continuous, integrated space-world.**

## Summary

- Confirm and reinforce the **top-down scaffolding** with **4-dimensional bottom-up sensory experiences.**
- Use **monocular depth cues** to **reinforce** accuracy/ provide visual feedback on performance in binocular activities.
- Use **sensory integration** to marry other sensory experiences of depth with the ***visual*** sense of depth.
- Transfer depth appreciation from auditory, tactile and ocular proprioceptive senses to visual sense in **real space**.
- Build central-peripheral integration skills to **prepare the brain** for **simultaneous** and **stereoscopic processing** in all real-world arenas.

## Feedback Appreciated!

*Thank you*

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***www.DrSlotnick.com***