DEPTH PERCEPTION

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Learning Objectives:

Attendees will be able to ...
1. Explain what the primary cue to depth perception is (vs. monocular cues)
2. Identify at least three of the five monocular cues to depth perception
3. Understand how to administer the Randot (or Titmus) Stereo Fly test

Intro & Overview of DEPTH PERCEPTION**

- Five Monocular Cues to depth perception
- One Binocular Cue to depth perception
- Testing
  - RANDOT (or TITMUS) Stereo Fly test
  - Test distance, order of tests, using ‘special’ glasses
  - Suppression test FIRST!
  - Gross Stereopsis test next...
  - Fine Stereopsis evaluation (kids vs. adults)

Five MONOCULAR Cues

Even with only ONE EYE, you have ‘depth perception’! How?

Your brain uses these “cues” to judge depth...

1. Magnification (Relative Size)
2. Confluence of Parallel Lines to a Point (Linear Perspective)
3. Interposition of Shadows (Overlay)
4. Distant Haze
5. Parallax

Five MONOCULAR Cues (cont.)

Magnification (Relative Size)

- When two similar objects are in your field of view (FOV) but one ‘looks’ smaller, we perceive it as being farther away than the bigger one.

Magnification (Relative Size) cont.

- This applies to two-dimensional images (i.e., drawings & paintings) as well...

TWO-DIMENSIONAL DRAWING (RELATIVE SIZE)
Five MONOCULAR Cues (cont.)

Confluence of Parallel Lines to a Point (*Linear Perspective*)

- Lines that are parallel (like, railroad tracks) seem to converge at some ‘vanishing point’ in distance
- Painters use this to give an impression of depth

Interposition of Shadows (Overlay)

- Shadows on an object (or cast by an object onto another location) can provide us with clues on depth (distance) of the things being viewed

Distant Haze

- Blue-gray mistiness of objects far away

Distant Haze (cont.)

Blue-gray mistiness
**Five MONOCULAR Cues (cont.)**

**Motion Parallax**
As you move past objects, your eye picks a place to focus
- Objects **CLOSE** to you seem to **move fast** & go “backwards”
- Objects **FAR** from your focal point seem to **move slow** & go with you

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**One BINOCULAR Cue**

- **STEREOPSIS!**
  - How is Stereopsis achieved?
    - Two eyes aligned so the macula of each eye is receiving the same image in the same spot - w/approximately the same clarity; results in **“BINOCULAR” vision** yet brain sees one object
    - Binocular vision will result in STEREOPSIS, where a person has **3D-like depth perception**
    - Stereopsis occurs due to **binocular disparity** due to the **two eyes’ different positions on the head**
    - This gives **precise depth perception**, versus trying to use ‘**monocular cues**’, which aren’t as accurate

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**Stereopsis (cont.)**

DOUBLE (diplopia)

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**One BINOCULAR Cue – Stereopsis (cont.)**

- The disparity (displacement) of an image on the retina – when compared to the object’s location on the other retina – gives us STEREOPSIS

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**One BINOCULAR Cue – Stereopsis (cont.)**

Degrees, minutes, & seconds of arc – making sense of it!
- A **complete circle** has **360 degrees** in it
- Each **DEGREE** has **60 minutes** in it (& **3,600 seconds**!)
- Each **MINUTE** has **60 seconds** in it
 Degrees, minutes, & seconds of arc

One BINOCULAR Cue – Stereopsis (cont.)

- A person with “normal” binocular vision & relatively equal & good visual acuity (VA) in each eye will have STEREOPSIS
- With STEREOPSIS, the human eye (& brain) can easily tell differences in degrees of arc, minutes of arc, & even seconds of arc

The RANDOT (or TITMUS) Stereo Fly Test

- Test parameters:
  – Test Distance? 16 inches (40 cm)
  – Patient wears Rx...or not? Do they need the Rx to see clearly at 16”? Then they wear the Rx for the test!
- The Test Glasses – MUST WEAR THEM! (Cross polarized filters @ work)

The RANDOT (or TITMUS) Stereo Fly Test (cont.)

- Suppression test first (2.25% of Pt’s are “amblyopic”)
  – “What is in the SQUARE? What is in the CIRCLE?”

The RANDOT (or TITMUS) Stereo Fly Test (cont.)

- Gross Stereopsis = fly wings
- “Pinch the flies wings”; should pinch ABOVE the booklet (not hitting or touching the booklet)

The RANDOT (or TITMUS) Stereo Fly Test (cont.)

- Flies wings represent 59’ (minutes) of arc
- That indicates “gross” stereopsis is present; a good sign!
The RANDOT (or TITMUS) Stereo Fly Test (cont.)

**Fine Stereopsis**

- Adult? Graded Circle test (800” to 40” seconds of arc)
- Child? Animal test (400” to 100” seconds of arc)

**The RANDOT (or TITMUS) Stereo Fly Test (cont.)**

- If Pt ‘gives up’ or misses two answers in a row, test is done
- Score the last correct answer using the instruction booklet to see what the ‘value’ was for that object or circle
- For example, if a CHILD gets all the symbols or animal figures correct (rows A, B, & C) that would be 100” (seconds) of arc
- If an ADULT gets all 9 of the sets of circles correct, that would be 40” (seconds) of arc

**The RANDOT (or TITMUS) Stereo Fly Test (cont.)**

- Record the ‘score’ in **seconds of arc**
- The inch sign (“”) is how we say **seconds of arc** in the eye world
- Test booklet has an ‘answer sheet’ that will tell you what each circle or animal represents (in **seconds of arc**)

**DEPTH PERCEPTION:**
**Summary & Conclusion**

*This past hour you learned enough to be able to...*

1. Explain what the primary cue to depth perception is (vs. monocular cues)
2. Identify at least three of the five monocular cues to depth perception
3. Understand how to administer the Randot (or Titmus) Stereo Fly test