OVERVIEW OF TODAY'S LECTURE:
  ● Evaluation of Sensory Status
    ○ Fusion vs. Diplopia
    ○ Stereopsis
    ○ Suppression

Evaluation of Sensory Status
  ○ General Considerations
    ● Non-strabismic vs. strabismic patients
      ○ Stereopsis
      ○ Suppression
    ● Important when considering diagnosis, prognosis, & treatment.

Fusion
  ○ Motor fusion:

  ○ Sensory fusion:

Degrees of Fusion
  ○ First Degree
    ● AKA:

  ○ Second Degree
    ● AKA:

  ○ Third Degree
    ● AKA:
**Diplopia**

Physiologic Diplopia:
- The doubling of a nonfixated object.
- Physiologic suppression usually prevents the observation of diplopia.

Homonymous (uncrossed)
- When objects are beyond the point of bifixation.

Heteronymous (crossed)
- When objects are in front of the point of bifixation.

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**Pathologic Diplopia**
- Diplopia / doubling of a fixated object.
- Occurs in cases of strabismus w/o suppression.

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**Stereopsis**
- **Definition:**
  - The appreciation of relative depth due to retinal disparity.
  - “Barometer” of binocularity.

Figures 1-11 and 1-12 from Griffin & Grisham 2002
Types of Stereopsis
- Local (line or contour) stereopsis
  - Identical shape to each eye.
  - Disparity created by displacing one image slightly.
- Global stereopsis
  - No monocular shape to targets.
  - Each eye sees a random dot pattern.
  - The dots are displaced for one eye creating disparity.
  - Generally requires bifoveal fixation.

Clinical significance
- Constant strabismics generally do NOT have stereopsis.
- Some small angle strabismics may have some stereo:
  - Local possibly as good as 60-70 sec of arc
  - Global generally not perceived
- Non-strabismic BV problems:
  - Generally normal or only mildly reduced stereopsis.
- When stereopsis is worse than 50" local and/or 250" global the clinician must try to determine why.
- Also, when local is worse than 20-30" global should be checked as well.

Evaluation of Stereopsis
- "Real" Stereo Tests
  - Frisby
- Polarized Tests
  - Randot book
  - Random dot E
  - Random dot preschool
  - Lang 1 & 2
  - Vectographic slide
- Anaglyptic Tests
  - TNO

Frisby Stereo Test
- Near stereo test
- "Real" stereo
- Typically used with infants/toddlers
Randot Stereo Book
- Measures local & global stereo at near
- Circles
- Animals
- Shapes

Random Dot E Test (RDE)
- True random dot pattern
- Two alternative forced choice test
- Typically performed at 1.5m (168")

Random Dot Preschool Test
- True random dot patterns
- Near test
- Naming or matching

Lang 1 & 2 Tests
- Random dot figures; near test
- Do NOT need polarized glasses
- Uses parallel cylindrical strips

Vectographic slide
- Distance local stereo test
- Not performed routinely
- Primarily helpful when distance BV problem is diagnosed

TNO
- An anaglyphic (red/green) test
- Random dot shapes
- Near test

Causes of Abnormal Stereopsis
- Decreased VA
  - Uncorrected RE
  - Incorrect Rx
  - Imbalanced Rx
  - Amblyopia
  - Ocular pathology

- Abnormal eye alignment
  - Strabismus
  - High phoria

- Poor sensory fusion
  - Anisometropia
  - Aniseikonia
Suppression
○ Defined:
  ● A condition that exists during BINOCULAR vision when the image from one eye is not perceived under binocular viewing conditions.

  ● Attributed to cortical inhibition.

  ● Patients generally do NOT have symptoms related to suppression.

Suppression
○ Physiological:
  ● Naturally occurs for all things falling out of the singleness horopter.

○ Pathological:
  ● A sensory fusion anomaly caused by active cortical inhibition which is not subject to voluntary control.

Suppression
○ Associated with:
  ● Anisometropia
  ● Aniseikonia
  ● Amblyopia
  ● Poorly compensated heterophoria
  ● Monovision correction
  ● Strabismus

Suppression Characteristics:
1. Frequency:
   A. Constant: no awareness of the suppressed information.
   B. Intermittent: a slow on-off awareness of the suppressed information.

2. Size:
   A. Peripheral: > 5 degrees, approx 10pd.
   B. Central: > 1 degree (2pd), but < 5 degrees (10pd).
   C. Foveal: < 1 degree (2pd)

○ Size of suppression zone is affected by target parameters, presentation methods, and fluctuations in the patient’s visual system.
Suppression Characteristics Con’t:

3. Intensity: (AKA Depth)
   A. Deep
   B. Shallow

   o Central / foveal suppression is usually the deepest.
   o Peripheral suppression is usually more shallow, but can be very deep.
   o In general, suppression is less likely when conditions are more UNNATURAL.

4. Laterality:
   A. Unilateral (OD or OS)
   B. Alternating

Evaluation of Suppression
   o Worth Dot Test
   o Vectographic Slide
   o Randot Stereotest [R + L]
   o 4pd BO Test

Worth Dot Test
   o AKA: Worth 4 Dot Test
   o One of the most common tests of suppression.

   o Understanding Anaglyphic Filters:
     - Red filter passes red light
     - Green filter passes green light
     - R/G objects on white background
       - Red filter sees green objects
       - Green filter sees red objects
     - R/G objects on black background
       - Red filter sees red objects
       - Green filter sees green objects

   o Worth dot:
     - Red filter sees what?
       -
     - Green filter sees what?
       -

       - The white dot and the outside of the flashlight act as fusion locks.
Worth Dot Test
- General procedure (you will cover in lab in detail)

- Three possible Pt responses:
  - 4 dots
  - 2 dots OR 3 dots
  - 5 dots

Diagnosing Suppression:

Example 1
Worth 4 Dot Findings: Green over OS

<table>
<thead>
<tr>
<th></th>
<th>Near</th>
<th>Interm</th>
<th>Far</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lights on:</td>
<td>2 Red</td>
<td>2 Red</td>
<td>2 Red</td>
</tr>
<tr>
<td>Lights off:</td>
<td>2 Red</td>
<td>2 Red</td>
<td>2 Red</td>
</tr>
</tbody>
</table>

Diagnosis:

Diagnosing Suppression:
Example 2
Worth 4 Dot Findings: Green over OS

<table>
<thead>
<tr>
<th></th>
<th>Near</th>
<th>Interm</th>
<th>Far</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lights on:</td>
<td>2 R+2 G</td>
<td>2 R+2 G</td>
<td>2R or 3G</td>
</tr>
<tr>
<td>Lights off:</td>
<td>2 R+2 G</td>
<td>2 R+2 G</td>
<td>2R or 3G</td>
</tr>
</tbody>
</table>

Diagnosis:
Vectographic Slide
- Determine if all letters on VA chart are seen under binocular conditions.
- More natural than Worth dot.

Randot Stereo Book
- R + L
- Large targets, thus indicative of larger area of suppression
- More natural than Worth dot

4 BO Test
- Objective measure of small central suppression scotoma.
- Usually done if suspect microtropia or monofixation syndrome.
- Not typically used in non-strabismic pts.
- Look for versional, then fusional eye movements as a small amount of BO prism is introduced.
- More detail in lab.
- https://www.youtube.com/watch?v=OqnoN3CBrgA

Suppression and VT
- Binocular VT targets should contain suppression checks.

- Begin VT where pt suppresses the least.

- Suppression Breakers:
  - Awareness of the target
  - Pointing/touching the target
  - Flashing of the target
  - Flashing of the room lights
  - Blinking by the patient
  - Movement/wiggling of the target
  - Prism addition and removal
  - Changing target intensity, color, background, size