



رقم المحاضرة الثانية

SYNOPTOPHORE

Grades of Binocular Vision

جامعة ساوة

كلية التقنيات الصحية والطبية

قسم تقنيات البصريات

المرحلة الرابعة

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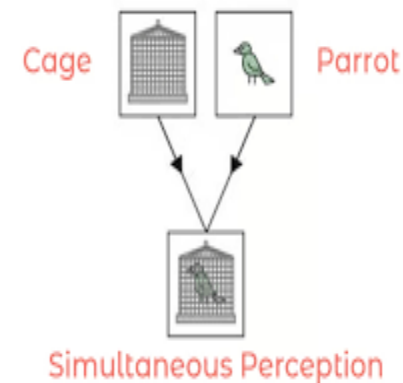
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Binocular vision is the ability to use both eyes together to create a single, clear, and cohesive image. It has different levels or grades based on the complexity and level of integration between the two eyes. **These grades** are essential for understanding how the eyes work together to achieve depth perception and clarity of vision. **The three main grades of binocular vision are:**

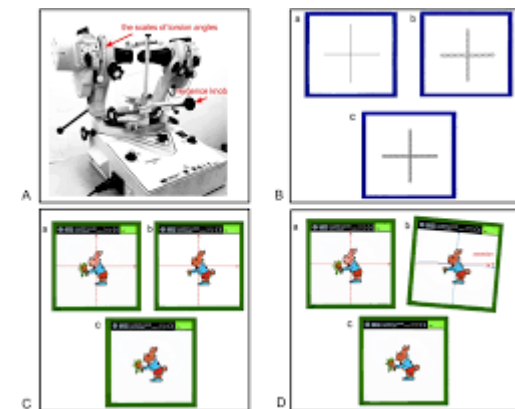
1. Simultaneous Perception

- This is the **basic level** of binocular vision, where both eyes can perceive images at the same time.
- The images from both eyes may not yet be fused into a single image; however, the brain can still detect visual information from both eyes simultaneously.
- There is no depth perception at this stage, and the images may still appear double.



2. Fusion

- In this grade, the brain **merges the two images** from both eyes into one single, unified image.
- **Fusion can occur at different levels:**



1-Motor fusion: Refers to the coordination of the eye muscles to align the eyes so that the images fall on corresponding retinal points.

2-Sensory fusion: The process by which the brain combines the two images into one.

- This is a critical level for eliminating double vision (diplopia) and is a higher function than simultaneous perception.

3. Stereopsis (Stereoscopic Vision)

- This is the **highest level** of binocular vision.
- Stereopsis enables **depth perception** and the ability to perceive the three-dimensional structure of objects.
- The slight differences in images seen by each eye (due to their horizontal separation) are interpreted by the brain, allowing us to judge distances and perceive depth.
- Stereopsis is crucial for tasks like **driving, sports**, and any activity requiring depth judgment.

These three grades form the foundation of how our binocular vision system works, from **basic image detection to full depth perception.**

Binocular Vision

- **Definition:** The ability of both eyes to work together to produce a single, clear, and three-dimensional image.
- **Importance:** Provides **depth perception and a wider field of view.**

Grades of Binocular Vision

- Binocular vision can be categorized into three main grades:
- 1- Simultaneous Perception,
- 2- Fusion,
- 3- Stereopsis.
- **Progression:** The grades represent increasingly complex integration between the eyes.

Grade 1 – Simultaneous Perception

- **Definition:** The ability to perceive two images from both eyes at the same time.
- **How It Works:** Each eye sends its image to the brain, but they are not yet fused into a single image.
- **Clinical Relevance:** Patients who lack simultaneous perception may experience **monocular vision** (using one eye) or **double vision (diplopia).**

- **Examples:** A person can see with both eyes, but images appear doubled or misaligned.

Grade 2 – Fusion

- **Definition:** The ability of the brain to merge the images from both eyes into a single, coherent image.
- **Motor Fusion:** Refers to eye movements that adjust the position of the eyes so that they are properly aligned.
- **Sensory Fusion:** The brain's ability to combine the images once the eyes are aligned.
- **Clinical Relevance:** Fusion is essential for eliminating double vision. **Fusion problems** may lead to **strabismus** (eye misalignment) or **amblyopia** (lazy eye).
- **Examples:** Fusion enables clear vision while reading or focusing on distant objects.

Grade 3 – Stereopsis (Stereoscopic Vision)

- **Definition:** The highest level of binocular vision, responsible for depth perception.
- **How It Works:** Each eye sees a slightly different view, and the brain uses these differences (binocular disparity) to calculate depth.

- **Clinical Relevance:** People lacking stereopsis may struggle with tasks requiring depth perception, like driving or playing sports. **Stereopsis is often tested using 3D vision charts.**
 - **Examples:** Activities requiring accurate depth judgments, such as catching a ball, threading a needle, or driving.
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Simultaneous Perception in Everyday Life

- **Example:** A person looking at two objects simultaneously sees both, but they may not overlap correctly in the brain (may appear doubled).

Fusion in Everyday Life

- **Example:** A child learning to read uses motor fusion to align both eyes on a single word, then sensory fusion to combine the two images into one clear picture.

Stereopsis in Everyday Life

- **Example:** Catching a ball, walking down stairs, or parking a car requires depth perception, which is a function of stereopsis.

Importance of Testing Binocular Vision

- **Why Test It:** Proper binocular vision is crucial for activities like reading, sports, and navigating the environment.
- **Testing Methods:**
 - **Synoptophore:** Used to measure fusion and stereopsis.
 - **Stereotests:** Like the Titmus Fly Test or Randot Stereotest for assessing stereopsis.



Common Disorders of Binocular Vision

- **Strabismus:** Misalignment of the eyes can disrupt fusion and stereopsis.
- **Amblyopia:** "Lazy eye" where one eye's input is reduced, affecting binocular integration.
- **Diplopia:** Double vision due to a failure in achieving fusion.

Treatment and Management of Binocular Vision Issues

- **Vision Therapy:** Exercises to improve fusion and stereopsis.
- **Prism Lenses:** To help correct alignment issues.
- **Surgical Options:** For severe cases like strabismus.