

Spring 2024

## The Visual Sense

- The visual senses are stimulated by electromagnetic energy at wavelengths ( $\lambda$ ) between 360 nm to 760 nm (nm stands for nanometer or 10<sup>-9</sup> meters).
- Accordingly, energy in this bandwidth is called light. Since the velocity (v) of light is constant in a vacuum at (3\*10<sup>8</sup>) meters per second, the frequency of this energy (f) follows the physical relationship:

$$v = f \lambda$$

## The Visual Sense

- The sun and other heavenly bodies are natural sources of light. Artificial lighting, including incandescent and fluorescent lamps, is another important source.
- Light reflecting off objects in the environment contains large amounts of information. Vision is a complex activity in which this information is extracted.
- As the first step in this process, light must impinge upon our receptors of luminous energy within the eyes—that is, light must enter the eyes through the cornea, and then go through the anterior chamber, the lens, and vitreous humor before landing on the retina in the back of the eye.
- This information is then processed in several steps, beginning at the retina, and ultimately within the visual cortex of the brain.

# How The Eye Works



- The eye is roughly a sphere of about 2.5 cm in diameter. The outer layer, or sclera, sometimes known as the whites of the eye, covers around 85% of the outer eye surface.
- The cornea is located at the very front of the eye. The cornea is about 1 mm thick and consists of five transparent layers. Since the cornea protrudes from the eyeball, it creates what is called the corneal bulge.
- Directly behind the cornea lies the anterior chamber, which is filled with a saline solution called the aqueous humor.
- At the rear of this chamber are the iris and the lens.

- The iris is composed of nearly totally opaque (not transparent) layers, which are connected to muscles that open and close the iris to change the size of the eye's pupil from about 3 mm to about 6.5 mm.
- These actions by the iris control the amount of light entering the eyes by opening the pupil to its largest diameter when light levels are low, and closing the pupil to its smallest diameter when light levels are high.
- It takes about 3 to 4 seconds for these changes to occur. Both pupils respond even if only one eye is exposed to a brighter light.

- The lens, a flattened sphere of translucent (hey only let some light through) tissue, is located immediately behind the iris. The muscles of the eye connect to the lens. Consequently, the shape and cross section of the lens can be controlled to change the focal length of the eye. This process allows near objects to be clearly focused on the retina and is referred to as visual accommodation.
- The large interior or posterior chamber of the eye located behind the lens is filled with vitreous humor (a saline solution). This liquid is kept at a positive pressure to maintain the spherical shape of the eyeball.
- The retina is located on the back inside wall of the eye. It contains an outer layer of pigmented cells that protect the photoreceptors beneath.





## Visual Ergonomics

#### ■ Visual ergonomics covers these areas:

- In the visual environment as a lighting condition, lighting design
- Visual display workstation design
- Determination of visual demanding work and other tasks
- Ensuring visual comfort and safety
- Visual corrections to ensure clarity of vision at work
- Visual fatigue management
- Assistive tools where required, assistive technology specially for visually impaired people
- Designing environment in public places to ensure safety in places as stairs.
- Designing of Human-Machine Interfaces(HMI) in vehicles and equipment

# **Visual Ergonomics**

- Various professionals unify to apply visual ergonomics theory and apply the method to balance between the visual demand and worker's visual ability
- Various aspects of the visual environment as effective lighting quality and quantity, glare/reflection free workplace, adequate viewing angle of monitors, proper working distance, contrast; target size; viewing time; angular size; task illuminance should be considered.
- Required modifications and improvements done in these aspects help in improving visual ability, reducing errors by enhancing visual performance and better task visibility.
- The visual performance, safety, comfort of the worker as well as work productivity is enhanced.

# Visual Ergonomics in Design

- Place your digital devices straight and directly in front of you while working or leisure activities
- Follow 20-20-20 rule: Take A 20 seconds Break Every 20 minutes, Look at something 20 feet away
- Place your digital device slight lower to eye level approximately 15-20 degrees (make sure your neck / head is not flexed forward too much)
- Blink more often to avoid dry eyes
- Maintain an ideal workstation design and a correct upright position

# Visual Ergonomics in Design

- Make changes to your digital devices' font size large enough which can be read comfortably
- Make sure the light source is directed at the level of target/work and not directly onto the eyes
- Adjust brightness and contrast of your devices' screen according to your comfort