

## 2.4 Communication with the Outside World Study Guide by Hisrich

### 2.4.a. How do humans communicate with the world around them?

Humans take in information using their senses (sight, hearing, touch, taste & smell) & send out information using their ability to speak or using body language or movement.

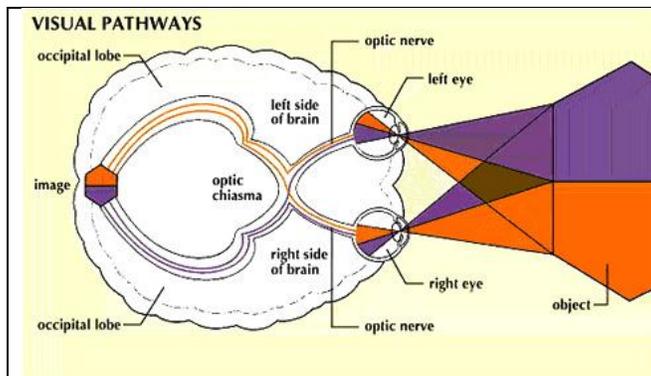
### 2.4.b. How does the power of sight allow humans to communicate with the outside world?

>80% of the data that we take in comes from our power of sight. Sight lets us take in 180° of images, perceive 1 million different colors, adjust what we see based on level of light & focus close up or miles away. Our vision is more detailed than any digital camera.

### 2.4.c. How is light focused by the eye?

Eye part	Analogy	What it does
cornea	front window of eye	bends light rays so they can pass through pupil keeps foreign particles out of eye where <b>refraction</b> (light bending) mostly occurs
<b>aqueous humor</b> ("water-like")	air in a basketball	gives nutrients to eye and maintains pressure
iris	shutter of camera	can enlarge or shrink to allow more or less light into eye
pupil	keyhole into dark room	opening in the iris, grows or shrinks based on light levels
lens	lens in camera	shortens and lengthens width to focus light rays ( <b>accommodation</b> )
<b>vitreous humor</b> ("having nature of giving life")	air in a basketball	let's light pass through while helping eye keep its shape
retina	film on camera	captures light rays & processes them w/ millions of nerve endings send light impulses through >1 million nerve fibers to optic nerve

### 2.4.d. How do the eye and the brain work together to process what we see? 2.4.i. How does the eye perceive depth, color and optical illusions?



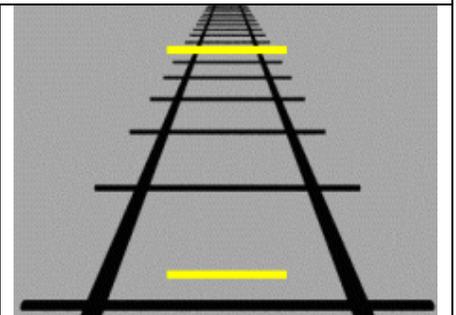
Messages from the retina pass into the optic nerve and are carried to the visual cortex in the occipital lobe. There the image is flipped over and gaps (such as the **blind spot** where the optic nerve meets the retina) are filled in. Our visual database (built during childhood) helps us interpret images.

The **retina** is

- >95% **rods** (found all over retina & used for seeing B/W, peripheral vision & low light viewing)
- <5% **cones** (for **COLOR PERCEPTION**, concentrated in fovea, tiny spot with detailed vision)

**DEPTH PERCEPTION** → Depends on **retina**: The visual database contains information about size of objects from previous experience & gauges size based on that. Moving the head from side to side allows you to see how far objects move (less movement means farther away). Comparing the image from one eye to the combined images tells retina how far away something is.

**OPTICAL ILLUSIONS** → These are examples of "visual deception" & trick the brain by using arrangement of images, color effects & light source impact to mislead the brain.



**2.4.e. How does what we see impact other human body systems?**

Most of what we do is in response to what we see. From basic movements like walking (using skeletal and muscular system) to emotional responses to what we see (limbic system & endocrine responses), our sight guides our actions in many ways.

**2.4.f. What is visual perception?**

Visual perception is the combination of what we see and how we interpret it. Sight without a visual database is useless (no sense can be made) and a visual database without sight is also useless (no input). Examples→

Color perception  
**Depth perception**

Visual acuity  
Peripheral vision

**2.4.g. What does it mean to have 20/20 vision?**

20/20 is considered “normal” visual acuity (not PERFECT). It means that at 20 feet you can see what humans should see at 20 feet away.

WORSE→If your vision is 20/200 (like mine), it means that you have to be 20 ft away to see something a human SHOULD be able to interpret from 200 feet away. Pretty bad!

BETTER→It’s possible to have vision that’s better than 20/20. 20/15 vision means that from 20 ft away, you can see what most people have to be 15 ft away to see.

**2.4.j. How does an error in the structure or function of the eye relate to disease or dysfunction? 2.4.k. How is life impacted by a vision disorder? 2.4.h. How can corrective lenses be used to refocus light and resolve myopia and hyperopia?**

Disorder	What’s happening	Effect	Intervention
<b>Astigmatism</b> (“ <i>condition of being without a point</i> ”)	Rays don’t meet at focal point because of deformation of lens	Blurry/imperfect image	glasses or contacts with a cylinder curve turn 2 focal points into 1
<b>Hyperopia</b> (“ <i>over seeing</i> ”)	Image comes to focus BEHIND RETINA→more common with age	<u>Far-sightedness</u> →Vision ok for distant objects, blurry up close	Bifocals (there’s a small plus lens in them that moves the image forward) OR glasses with a full plus lens
<b>Myopia</b> (“ <i>muscle eye</i> ”)	Image comes to focus IN FRONT OF RETINA	<u>Near-sightedness</u> →Vision ok up close, blurry for distant objects (near-sighted)	A minus lens moves the image farther back
Non-flexible lens	The lens cannot perform accommodation (changing shape) to focus light, occurs mostly with age	Blurry vision	The lens can be dissolved, extracted & replaced by an artificial lens
Malformed cornea	Cornea is shaped wrong	Blurry vision	Corneal replacement (mostly from cadavers)
Cataracts	The lens is becoming blurry	Blurry vision	Same as for non-flexible lens
Crossed eyes	The eyes do not focus together	Double vision	Lenses move the image to match the “wayward” eye, correcting double vision

Source: <http://science.howstuffworks.com/innovation/everyday-innovations/lens2.htm>

**2.4.l. What are the tests and procedures in a routine eye exam?**

visual acuity test	Read the Snellen chart from across the room to measure clarity of view (acuity)
automated perimetry	Push a button when you see a flash to measure peripheral vision
refraction assessment	Look through Phoropter to determine which lens works best for each eye
slit-lamp examination	Slit lamp focuses intense light on eye to determine abnormalities
indirect ophthalmoscopy	Doctor holds eye open & examines with bright light (shows great detail and 3 dimensions)
applanation tonometry	Measures pressure needed to flatten part of cornea, tests for glaucoma

Source: <http://www.mayoclinic.com/health/eye-exam/MY00245>