

Sensation and Perception

Unit 2: Biopsychology

Sensation and Perception

Sensation and Perception are one continuous, ongoing process that allow us to experience and interpret the world.

Sensation - process that occurs when our sensory receptors receive stimulus from the environment.

Perception - organization and interpretation of sensory information into meaningful representations.

Sensation

Any aspect or change in the environment to which an organism responds is called a ***stimulus***.

Our senses detect physical changes in the environment such as heat, light, sound, and physical pressure.

ex) Our skin notes changes in heat and pressure.

Sensation

Psychophysics is the study of relationships between sensory experiences and the physical stimuli that cause them.

Psychologists interested in psychophysics seek to answer questions like:

How does changing a light's intensity affect our perception of its brightness?

Threshold

In order to establish laws about how people sense the external world, psychologists first try to determine how much of a stimulus is necessary for a person to sense it at all.

Absolute Threshold - the weakest amount of a stimuli required to produce a sensation.

ABSOLUTE THRESHOLD FOR THE 5 SENSES

Vision seeing a candle flame 30 miles away.

Hearing hear a watch ticking 20 feet away.

Taste taste 1 teaspoon of sugar dissolved in 2 gallons of water.

Smell smell 1 drop of perfume in a 3-room house.

Touch feel a bee's wing fall a distance of 1 cm onto your cheek.

Threshold

Another way psychologists study and measure sensation is by noting the difference we can perceive between two stimuli.

Difference Threshold - the minimum amount of difference a person can detect between two stimuli half the time.

Could be the *just noticeable difference (JND)* in the intensity of a stimuli such as the weight of a backpack.

Threshold

Weber's Law - the larger or stronger a stimulus, the larger the change required for a person to notice that anything has happened to it.

ex) If I add 10lbs to your empty backpack you will notice a big change. If I add 10lbs to your backpack when it's already full with 100lbs of weight, the noted difference will seem much smaller.

Sensory Adaptation

The senses are tuned to pick up change. They are most responsive to increases, decreases, and new events rather than continuous or ongoing stimuli.

ex) Adapting to a dark room, cold water, bad smells, the pressure of clothing.

Try it! move your watch/ring/bracelet to the other hand.

Signal-Detection Theory

Signal-Detection Theory - Study of the relationship between motivation, sensitivity, and decision making in detecting the presence or absence of a stimulus.

Detection Thresholds involve recognizing some stimulus against the background of competing stimuli.

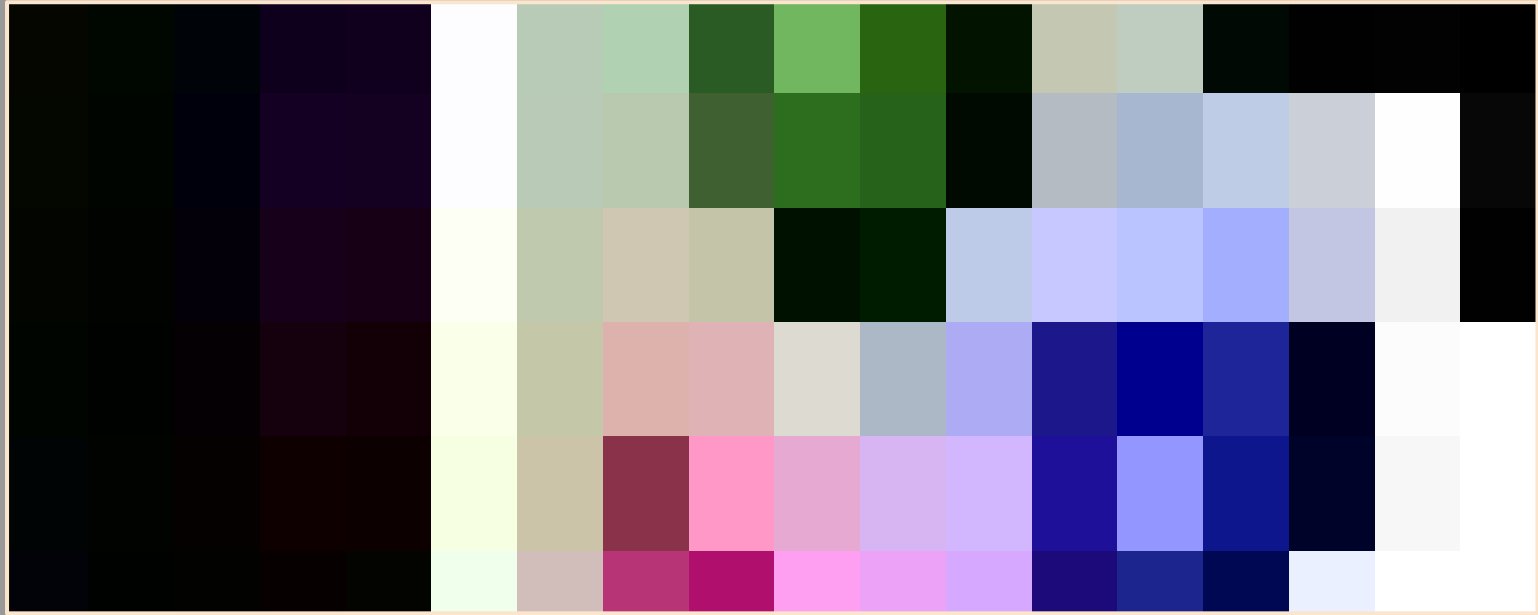


Figure 8.3 - sensation depends on change and contrast in an environment

Signal-Detection Theory

Psychologists have identified two different types of processing stimuli (or signals).

1. **Preattentive Process** - extracting information automatically and simultaneously when presented with stimuli
2. **Attentive Process** - procedure that considers only one part of the stimuli presented at a time.

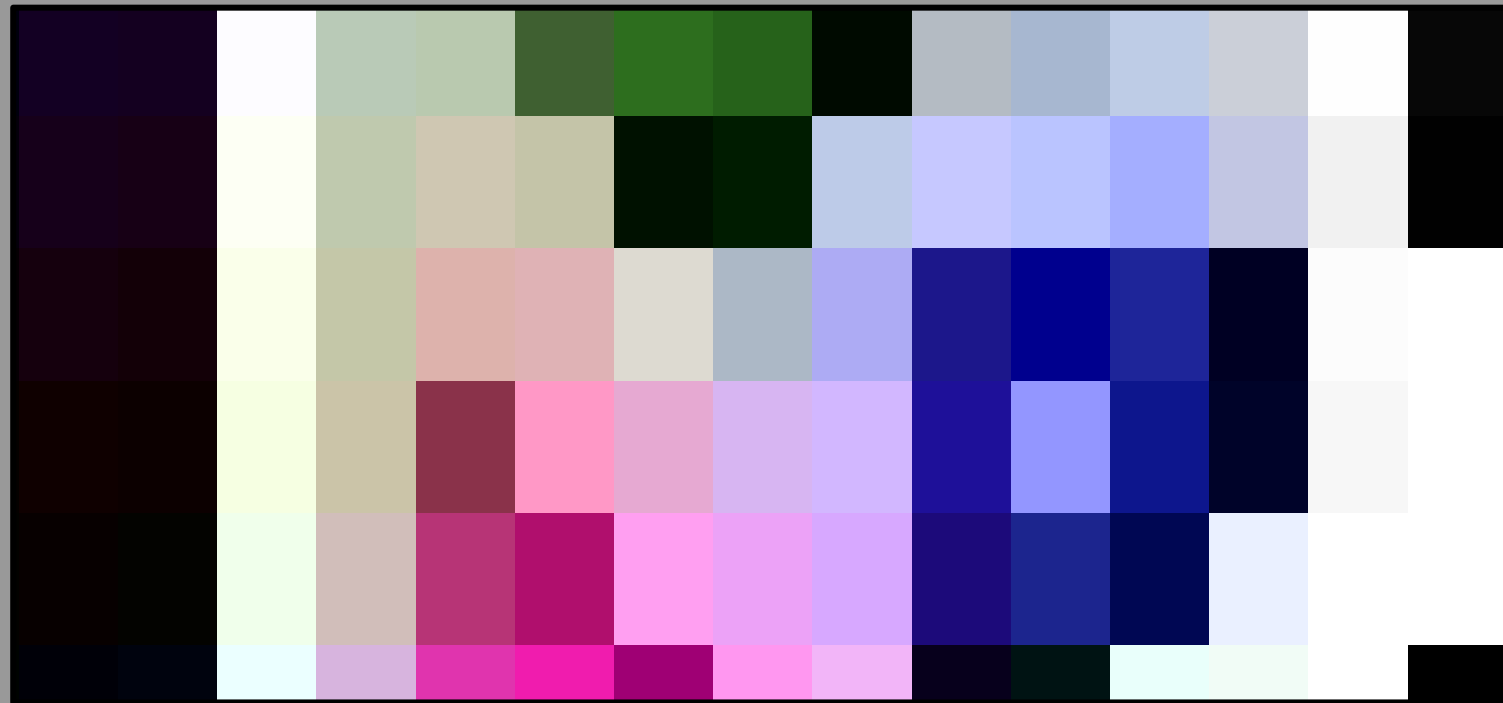


Figure 8.4

Signal-Detection Theory

Psychologists have reformed the concept of *absolute threshold* over time to account for the environmental factors that can affect signal detection.

Signal-Detection Theory is now based on the idea that stimuli must be detected in the presence of other, competing stimuli which can interfere.

ex) ***Preattentive processing*** acts as an interference when trying to read the colour of the words in Figure b and slows you down.

RECALL

- Stimulus - any aspect/change to the environment to which an organism responds.
- Threshold - the minimum amount or just noticeable difference required to produce a sensation.
- Signal-Detection Theory - considers the relationship between sensation and the external factors that affect it in predicting whether a stimulus will be detected.

Selective Attention

Our detection of stimuli is also affected by our conscious focus on things we deem important.

The senses take in 11,000,000 bits of information per second. We process about 40.

Selective Attention - the focusing of conscious awareness on a particular stimulus.

ex) Cocktail Party Effect, Mothers and crying babies



Selective Attention at Work

Selective Attention

Unfortunately, this process can also lead to ***Inattentional Blindness***, failing to see visible objects when our attention is directed elsewhere.



Another example of Inattentional Blindness

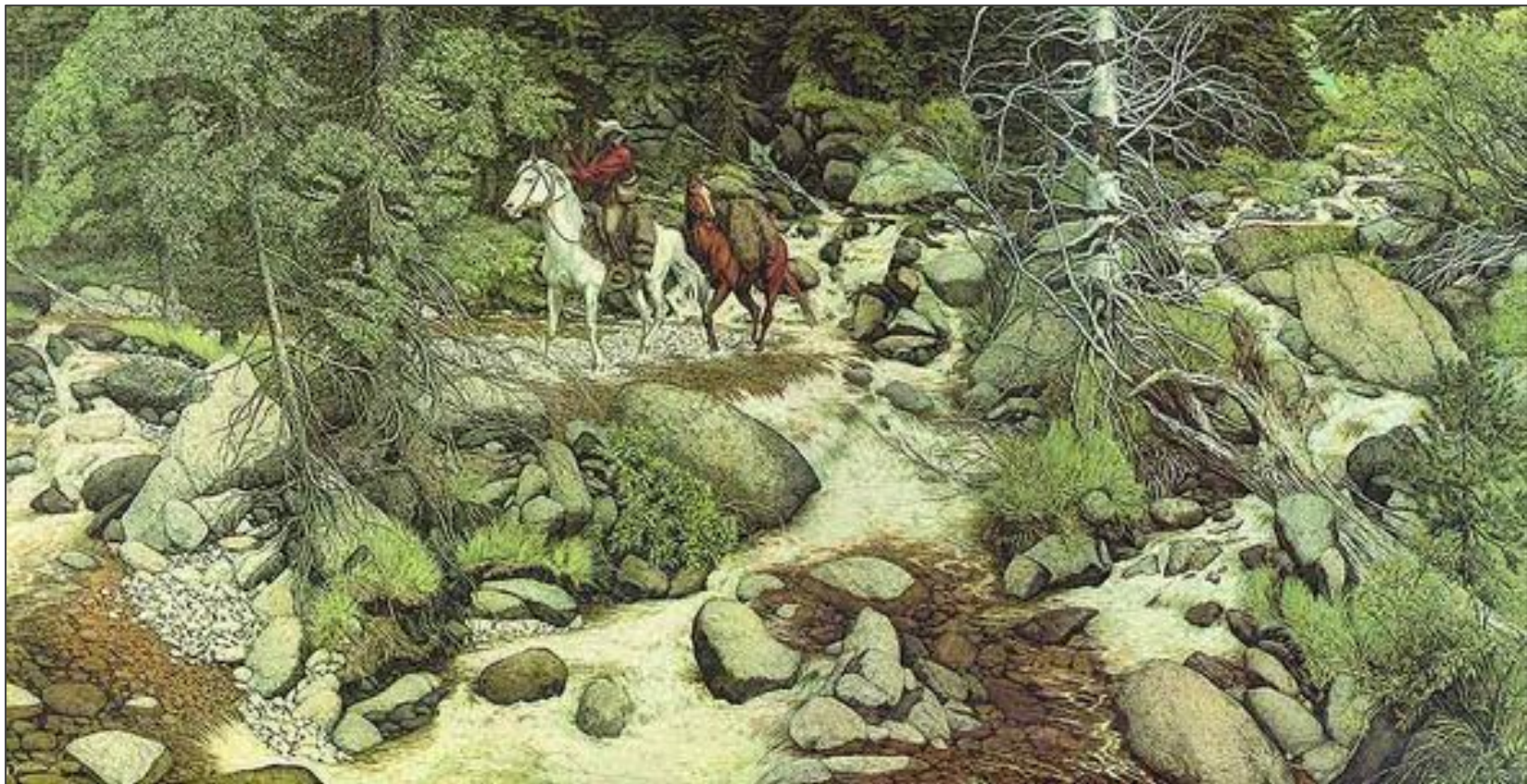


Why does this happen?

Analyzing Sensory Information

Bottom-Up Processing - analysis that begins with the sensory receptors and works up to the brain's integration of sensory information.

Top-Down Processing - information processing guided by higher level mental processes, as when we construct perceptions drawing on our experience and expectations.



Use bottom-up and top-down processing to explain how you interpret the painting.

Assignment

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1. What is the difference between sensation and perception?
2. Define and explain with an example *Weber's Law*.
3. Describe a situation in which you might use bottom-up processing.
4. What is *selective attention*? What are the pros and cons?

The Senses

Sensation and Perception

The Human Senses

Sense	Stimulus	Sense Organ	Receptor	Sensation
Sight	light waves	Eye	Rods and cones of retina	Colors, patterns, textures, motion, depth in space
Hearing	sound waves	Ear	Hair cells located in inner ear	Noises, tones
Skin Sensations	external contact	Skin	Nerve endings in skin	Touch, pain, warmth, cold
Smell	volatile substances	Nose	Hair cells of olfactory membrane	Odors (musky, flowery, burnt, minty)
Taste	soluble substances	Tounge	Taste buds of tongue	Flavors (sweet, sour, salty, bitter)
Vestibular Sense	mechanical and gravitational forces	Inner Ear	Hair cells of semicircular canals and vestibule	Spatial movement, gravitational pull
Kinesthesia	body movement	Muscles, Joints, Tendons	Nerve fibers in muscles, tendons, and joints	Movement and position of body parts

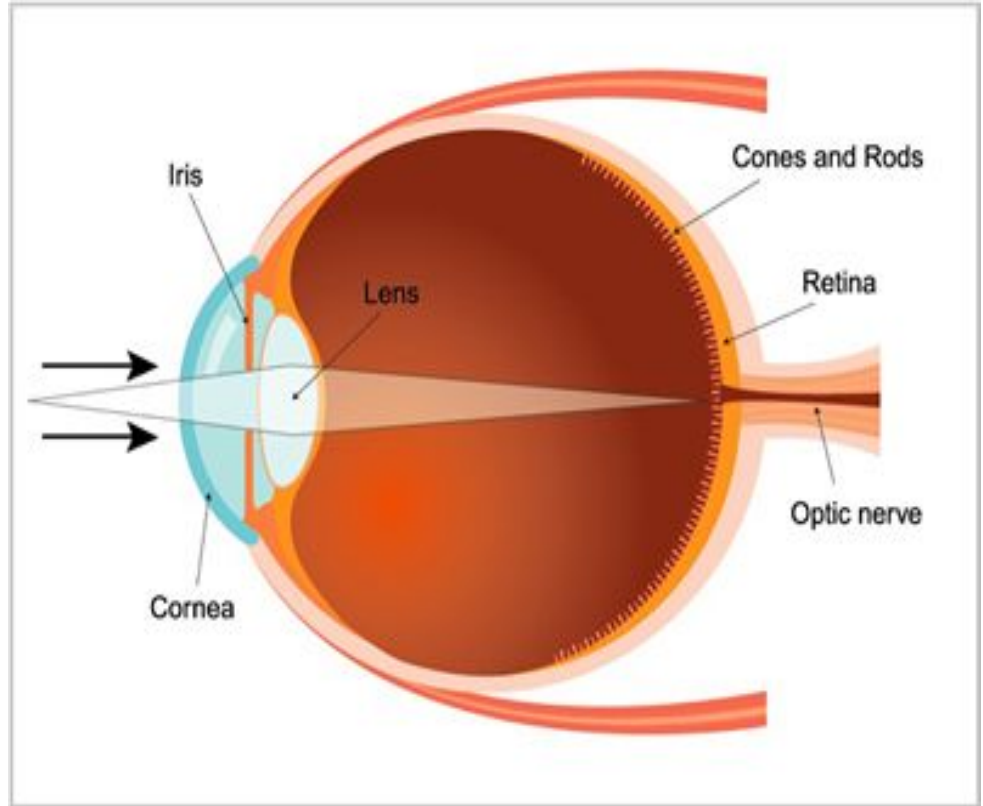
Vision

The Human Eye

— — —

Light enters the eye through the **pupil** and reaches the **lense** which focuses light on the retina.

The retina contains **rods and cones** that are responsible for changing light energy into neural impulses that travel along the **optic nerve** to the brain's occipital lobe.



Vision

Pupil	The opening in the iris that regulates the amount of light entering the eye.
Lense	A flexible, elastic, transparent structure in the eye that changes shape to focus light on the retina.
Retina	The innermost coating of the back of the eye, containing the light-sensitive receptor cells (rods and cones).
Rods and Cones	Cells responsible for changing light energy into neuronal impulses which travel to the brain via the optic nerve.
Optic Nerve	The nerve that carries the impulses from the retina to the brain.

Light and Colour

Light is a form of electromagnetic radiation.

Visible light represents a small portion of the ***electromagnetic spectrum*** which also includes radio waves, microwaves, infrared, ultraviolet, X Rays, and gamma rays.

Light and Colour

Cones

- 6-7 million in the eyes
- Require more light to respond
- Sensitive to colour

Rods

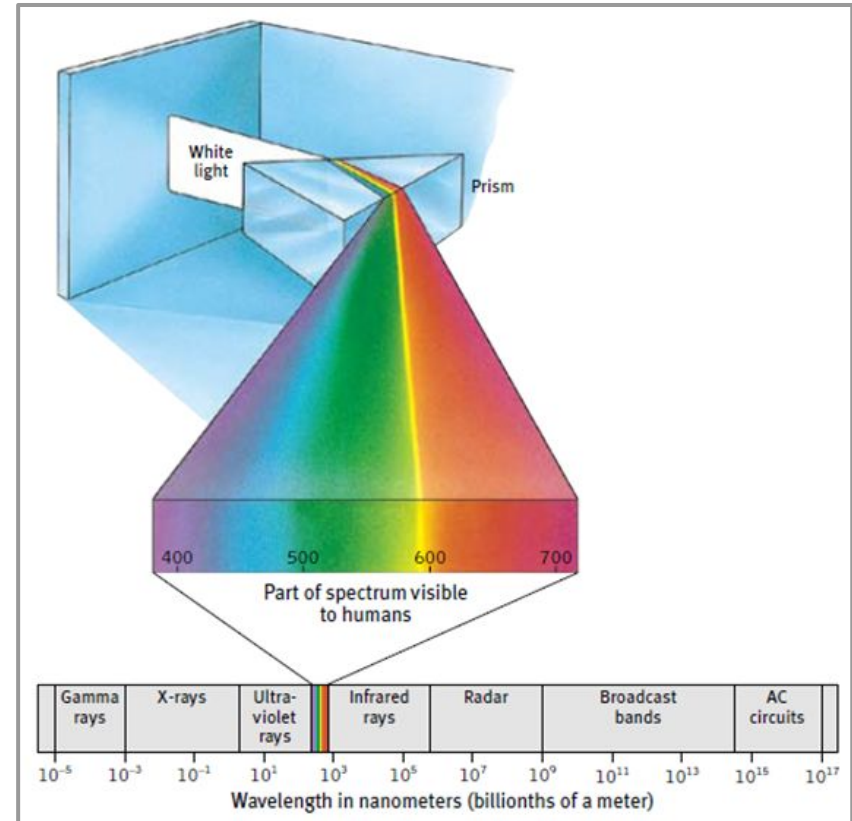
- 75-150 million in the eyes
- Receptive to dimmer light
- Basis for night vision; can see black, white and grey

Light and Colour

Passing sunlight through a prism breaks the light into a rainbow of colours.

Each colour is made up of light of different *wavelengths*.

Other objects will absorb and reflect light. The object's colour depends, in part, on the light that reaches our eye. Light that the object *reflects*.



Physical Properties of Waves

Short wavelength = high frequency
(bluish colors)



Long wavelength = low frequency
(reddish colors)



Great amplitude
(bright colors)



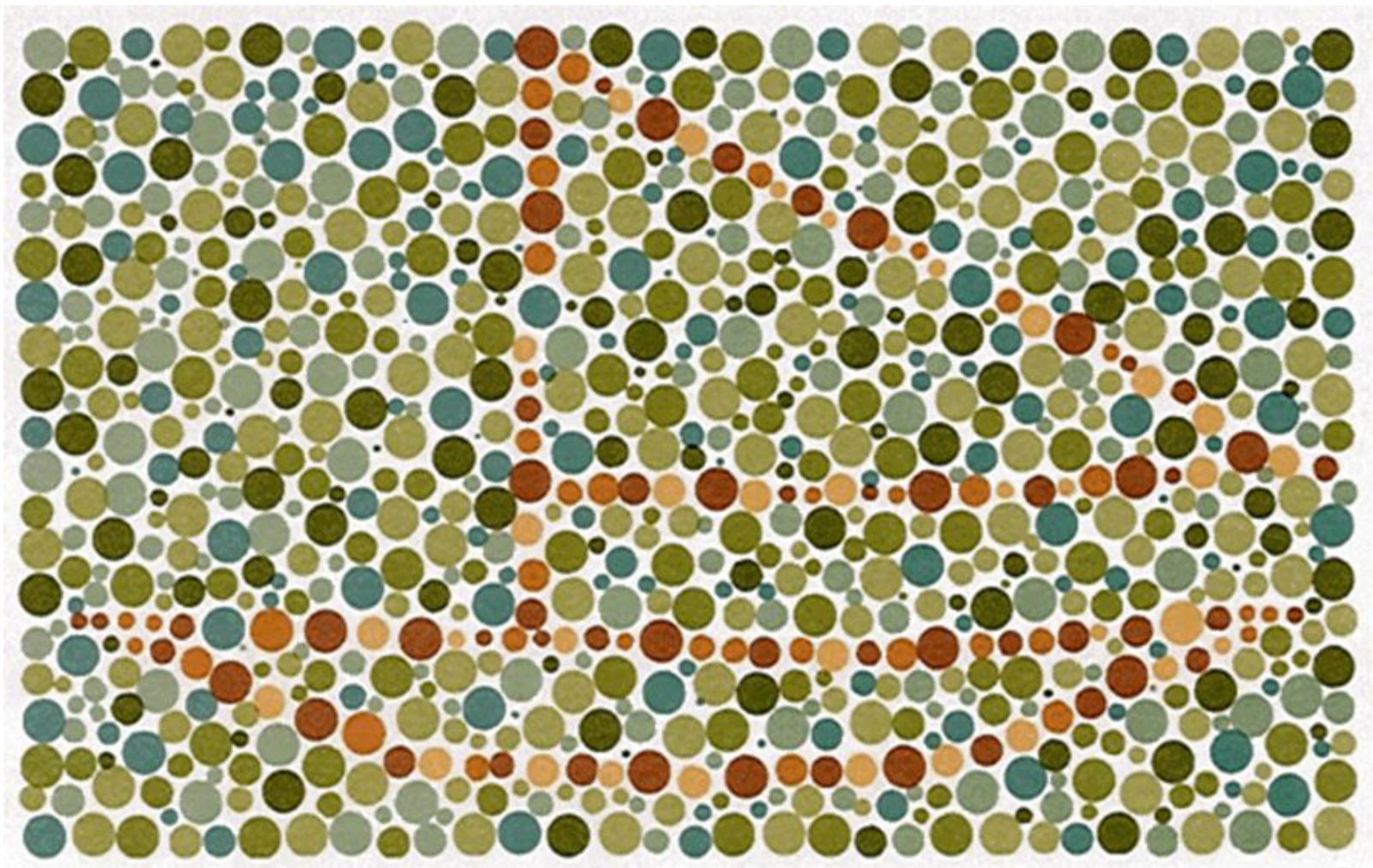
Small amplitude
(dull colors)



Light and Colour

Colour Deficiency occurs when some or all of a person's cones do not function properly. Most colour-deficient people see *some* colours but may have trouble distinguishing between two.

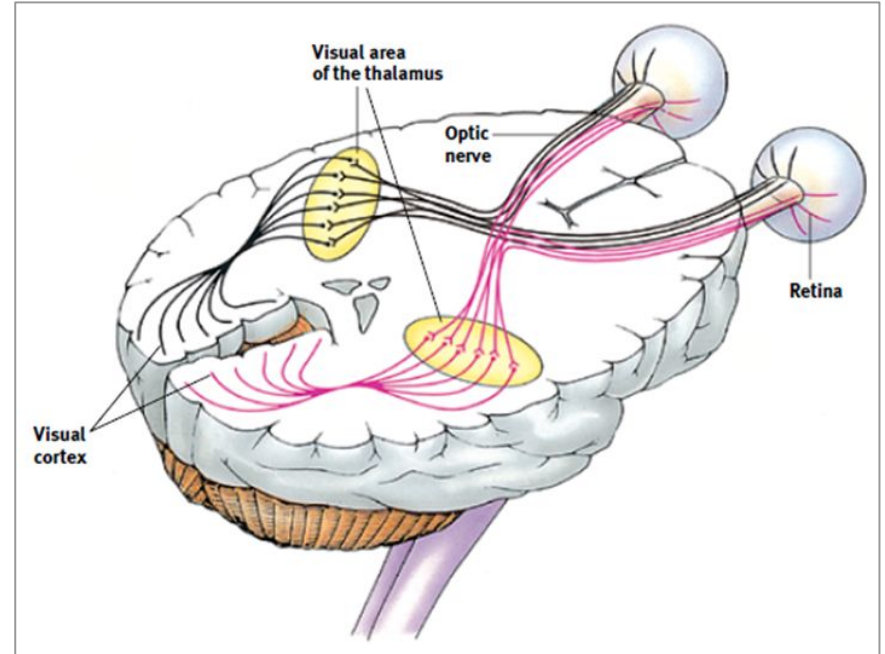
Affects about 8% of men and less than 1% of women. It is a hereditary gene carried in the genes of women with normal vision.



Pathways from the Optic Nerve to the Brain

The retina has some optic nerves that will help to encode and analyze sensory information

After processing through the rods and cones the information travels to the vision centers in the brain in the ***occipital lobe***.



Visual Processing

Binocular Fusion - the process of combining the images received from the two eyes into a single, fused image. This process prevents us from seeing double (one image from each eye).

Parallel Processing - the processing many aspects of a problem (vision/images) simultaneously.



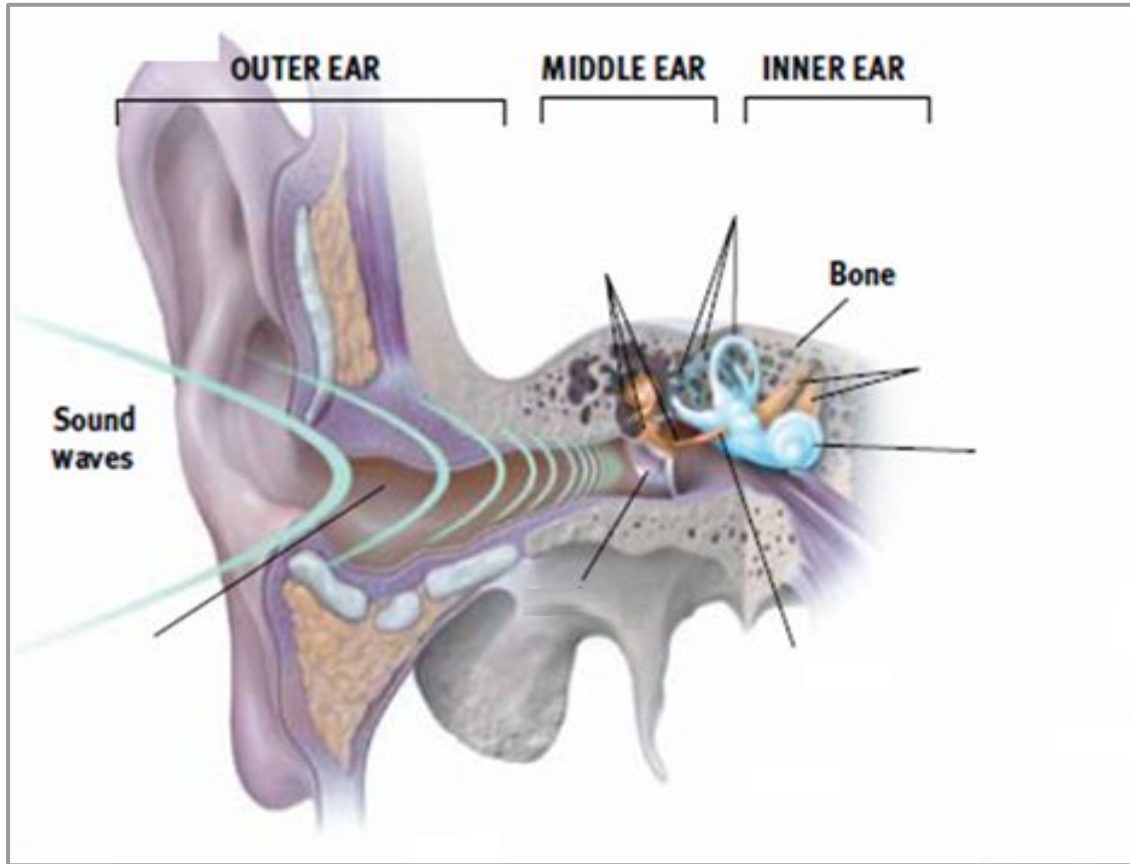
Hearing

Hearing

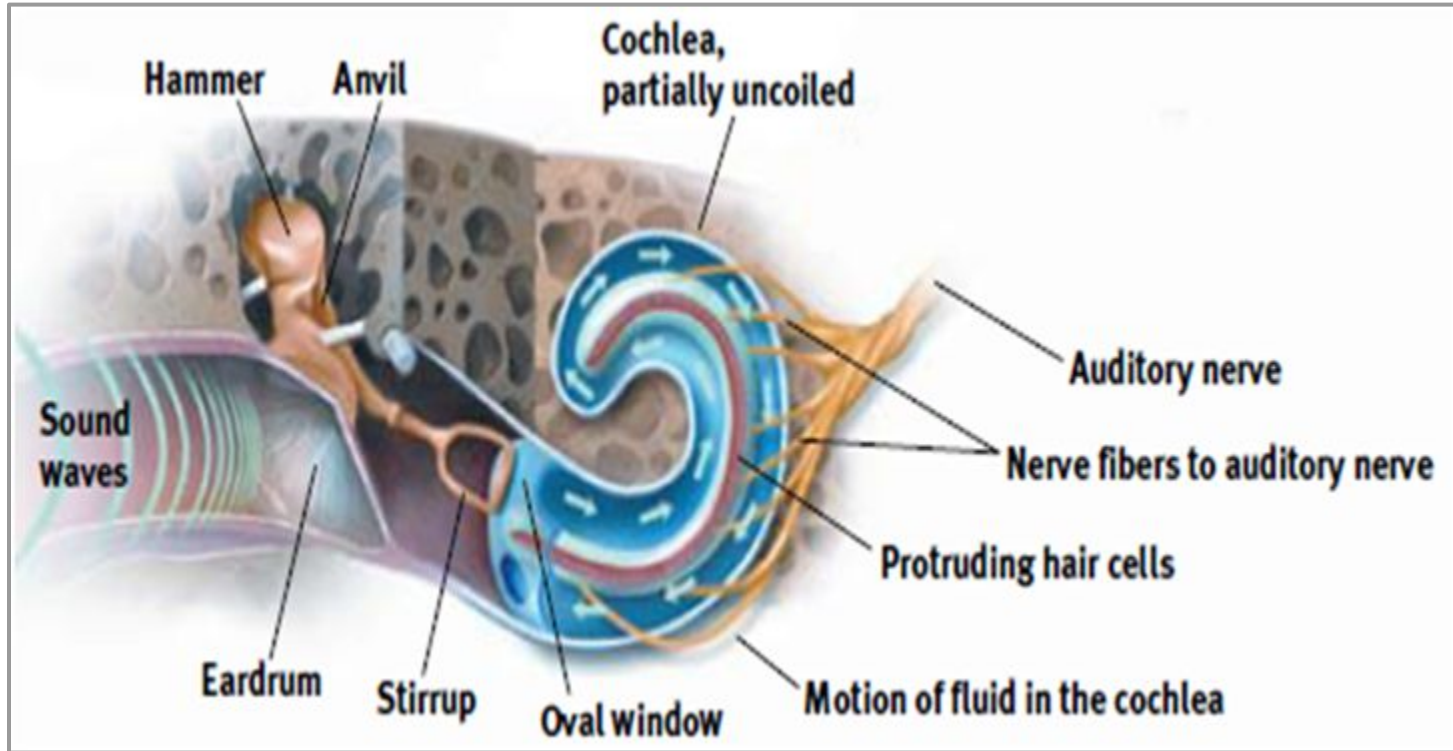
Soundwaves from the air pass through the ***auditory canal*** and cause the ***eardrum*** to vibrate.

These vibrations move through the bones of the middle ear and connect to the ***cochlea***.

There the vibrations are picked up by hairlike nerve fibers and trigger nerve impulses which travel to the brain via the ***auditory nerve***.



Structure of the Ear



Structure of the Ear

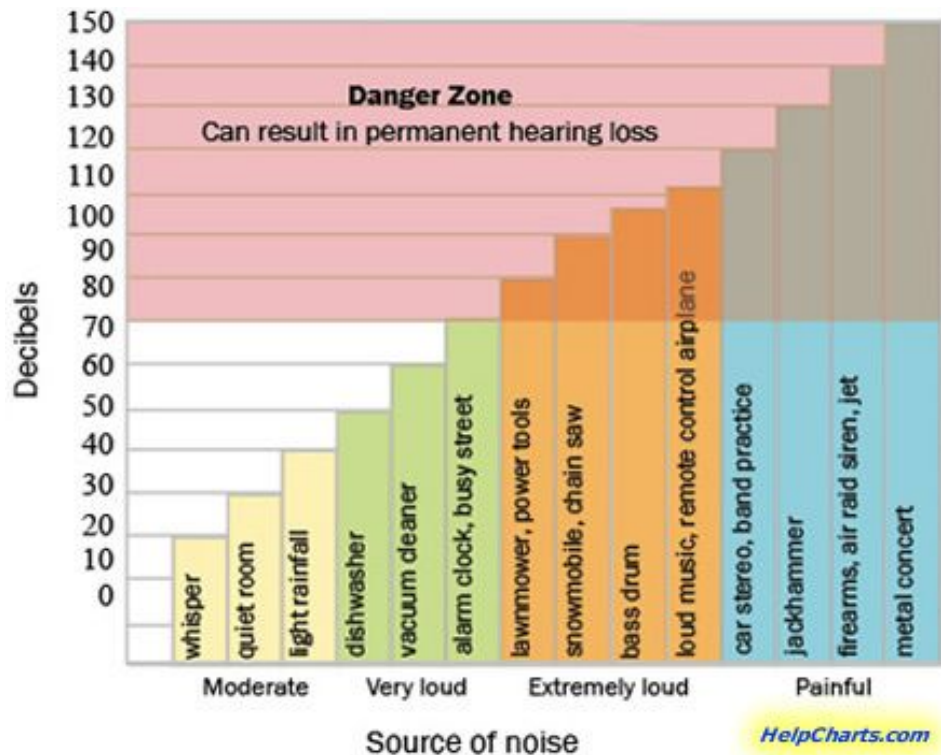
Hearing

Eardrum	Tight membrane that vibrates when struck by sound waves.
Bones of the Middle Ear	The Hammer, anvil, and stirrup which vibrate with the eardrum
Oval Window	Where the stirrup connects to the cochlea.
Cochlea	A coiled, bony ,fluid-filled tube in the inner ear through which sound waves trigger nerve impulses.
Auditory Nerve	Nerve which sends the auditory message to the brain via the thalamus.

Perceiving Loudness

Determined by the amplitude (height) of sound waves.

Measured in decibels (0 to 140).
Any one sound over 110 decibels or
any persistent sounds over 80
decibels can damage hearing.



Perceiving Pitch

Depends on sound wave frequency or the rate of vibration of the medium transmitting the sounds.

- Low frequencies = deep bass sounds
- High frequencies = shrill, squeaks

Your brain reads pitch by monitoring the rate of the neural impulses traveling up the auditory nerve.

Locating Sounds

Our ears work together to locate the sources of sounds based on the intensity and speed of transmission.

If you hear a sound on your right side - your right ear receives a more intense sound and receives the sound slightly sooner than your left ear.

These differences tell us where the sound is coming from.

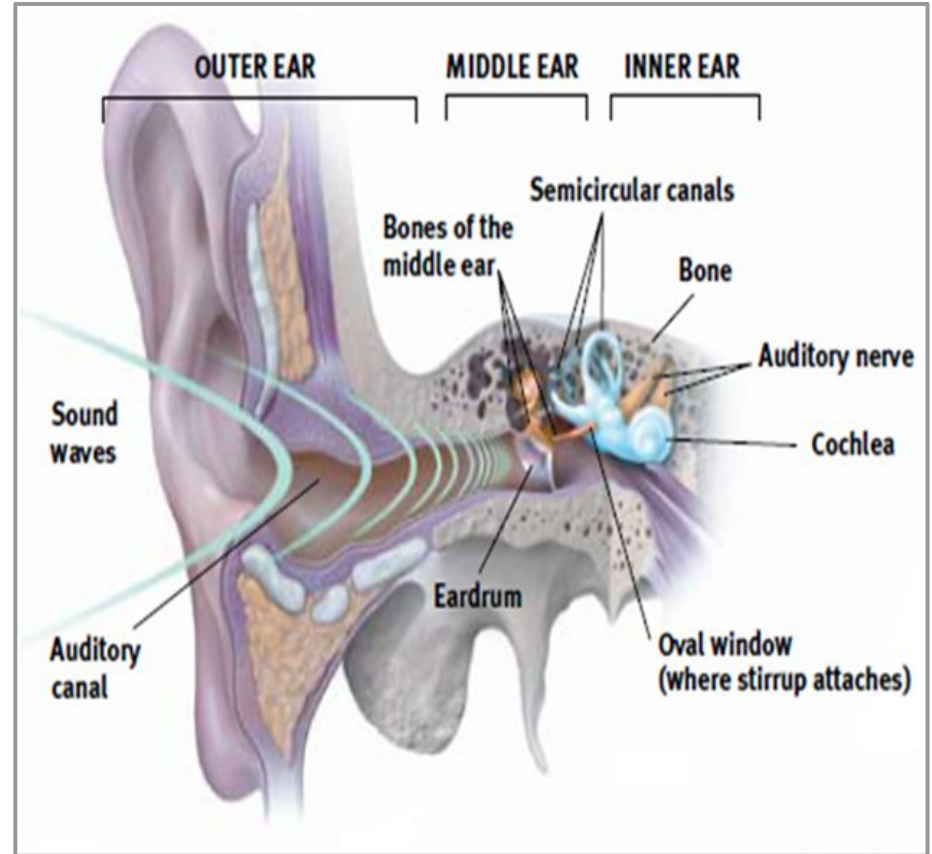
Balance

Vestibular System

The body's sense of movement, position, and balance is regulated by the **vestibular system** inside the inner ear.

Deep in the ear are 3 semicircular canals full of fluid. Hair cells project into the fluid and bend as the fluid moves inside the cells (as the body moves)

Overstimulation of vestibular responses can lead to dizziness and motion sickness.



Touch

The Skin Senses

Receptors on the skin are responsible for providing the brain with at least four kinds of information about the environment:

1. pressure
2. pain
3. warmth
4. cold

The Skin Senses

Sensitivity to pressure varies across different areas of the body. Fingertips are much more sensitive than say your legs or torso.

To create a sensation of hot or cold the stimulus must have a temperature greater or less than the temperature of the skin in the sensing area.

ex) Hot tub on a warm day vs. cold day

Pain

Pain is your body's way of telling you something is wrong. It makes it possible to prevent damage to your body and spring into immediate action when the body is in danger.

It can be caused by many kinds of stimuli - scratches, punctures, pressure, heat, and cold can all produce pain.

What would happen if you could not feel pain?

<https://www.youtube.com/watch?v=n6iOUW523BE>

Pain

Gate Control Theory - the theory that the spinal cord contains a neurological “gate” that blocks pain signals or allows them to pass on to the brain.

The “gate” is opened by the activity of pain signals travelling up nerve fibers and is closed by activity in larger fibers or by information coming from the brain.

ex) Rubbing your stubbed toe, ‘playing through pain’

Biological influences:

- activity in spinal cord's large and small fibers
- genetic differences in endorphin production
- the brain's interpretation of CNS activity



Psychological influences:

- attention to pain
- learning based on experience
- expectations



Social-cultural influences:

- presence of others
- empathy for others' pain
- cultural expectations



Personal
experience
of pain

Biopsychological Approach to Pain

Smell and Taste: The Chemical Senses

Smell and Taste

Called the ***chemical senses*** because their receptors are sensitive to chemical molecules rather than to light or sound waves.

Smell = gas molecules come in contact with smell receptors in your nose, relayed through ***olfactory nerve***

Taste = liquid chemical come in contact with taste buds, relayed along with ***texture and temperature*** information.

Smell and Taste

Four primary taste experiences. Combinations of these make up what we would call *flavour*.

1. Sour
2. Salty
3. Bitter
4. Sweet

Fun-ish Fact: Much of what we taste is actually produced by the sense of smell!

Exit Slip

*To hand in before you
leave class*

1. Use a flowchart to describe the pathway of sound.
2. With a partner: Cover your eyes for 20–30 seconds then uncover them. What happens to your partner's pupils? How can you explain this?

Perception

Sensation and Perception

Perception

Perception - The organization of sensory information into meaningful experiences.

The brain receives information from the senses and organizes and interprets it into meaningful experiences unconsciously.

Principles of Perceptual Organization

Gestalt - the experience that comes from organizing bits and pieces of information into meaningful wholes. *Gestalt* is a German word meaning “pattern” or “configuration”.

Some principles people use in organizing such patterns are: *proximity, similarity, continuity, simplicity, and closure.*

Examples

Proximity

When we see a number of similar objects, we tend to perceive them as groups or sets of those that are close to each other.



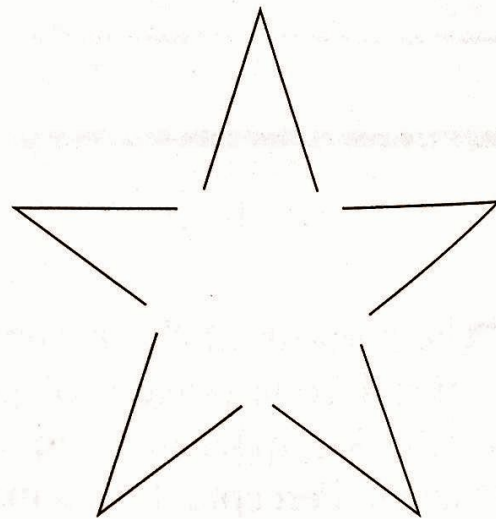
Similarity

When similar and dissimilar objects are mingled, we see the similar objects as groups.



Closure

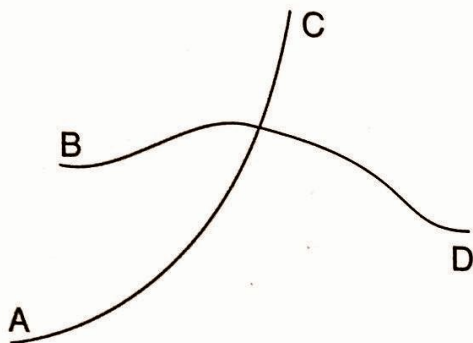
When we see a familiar pattern or shape with some missing parts, we fill in the gaps.



We see a star instead of five Vs.

Continuity

We tend to see continuous patterns, not disrupted ones.



Two curves or two pointed shapes?

Simplicity

We see the simplest shapes possible.

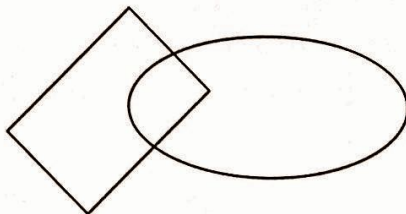
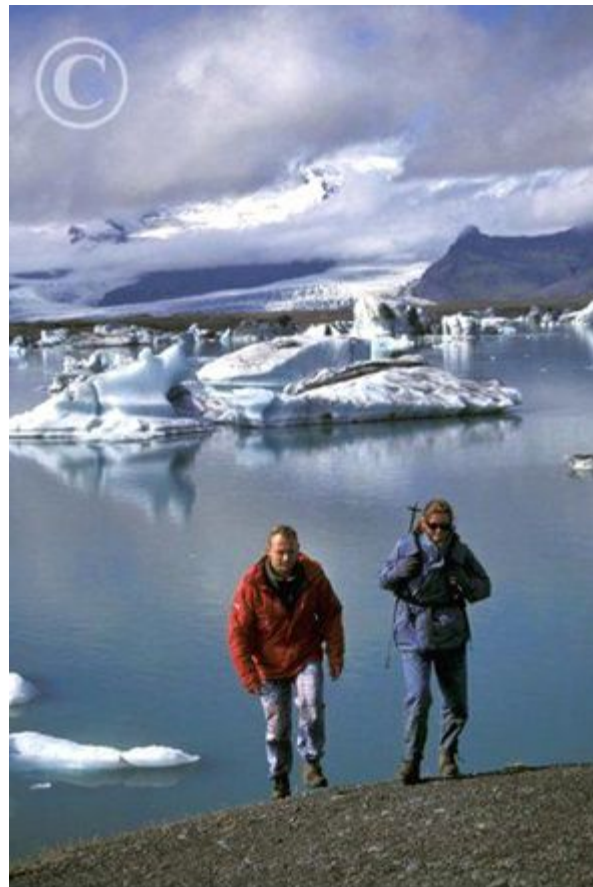


Figure-Ground Perception

The ability to discriminate properly between a figure and its background.

More difficult when something is two-dimensional.



u12966428 [RF] © www.visualphotos.com

Perceptual Interference

Largely an automatic process that involves filling in gaps in what our senses tell us.

ex) Knowing the road continues even though you can't see it.



Learning to Perceive

Perceiving is learned in infancy through active involvement in one's environment.

ex) People who are born blind and have their sight restored have a hard time distinguishing shapes/colors

Learning to perceive is influenced by our needs, beliefs, and expectations.

ex) Infants perception of faces over time

- <1 month smile at objects the size of a human face
- 20 weeks smile at a drawing of a face or mask
- 28 weeks more likely to smile at females over males
- 30 weeks smile at familiar faces
- 7-8 months recognize different people

Depth Perception

Depth Perception - The ability to recognize distances and three-dimensionality. Also develops in infancy.



Depth Cues

Monocular Depth Cues - used to perceive distance and depth, can be used with a single eye.

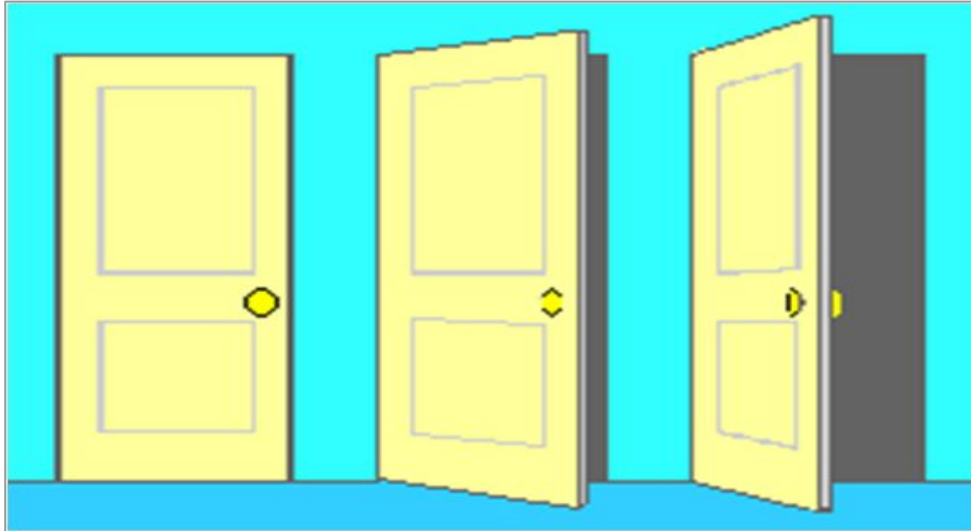
- *Relative Height* - objects farther away appear higher on our plane of view
- *Interposition* - overlapping of images
- *Light and Shadows* - information about shape and size

Binocular Depth Cues - relies on the movement of both eyes.

- *Convergence* - eyes turn inward to look at nearby objects
- *Retinal Disparity* - comparison of different images received by each retina.

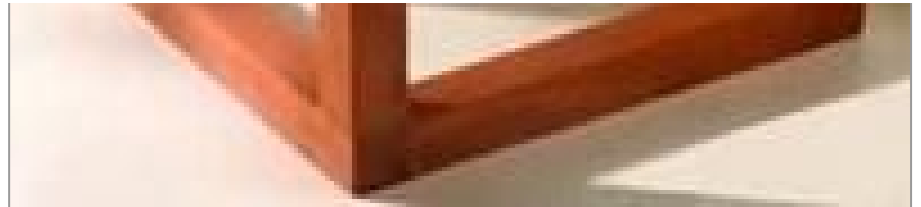
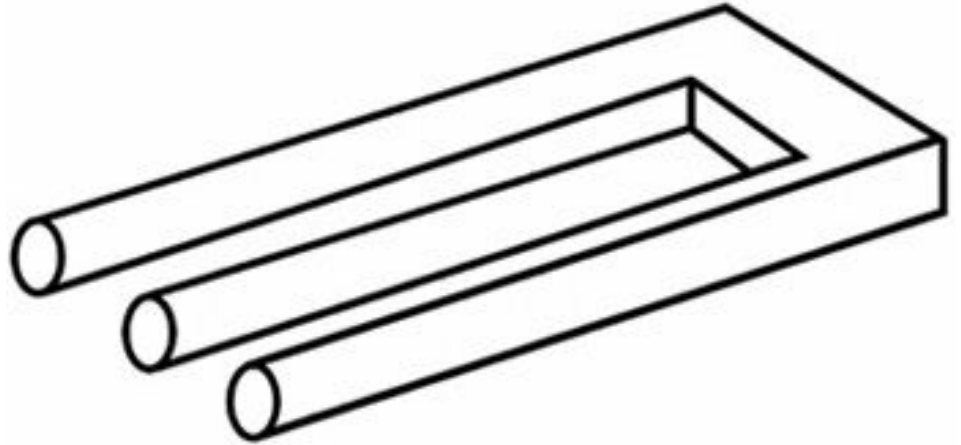
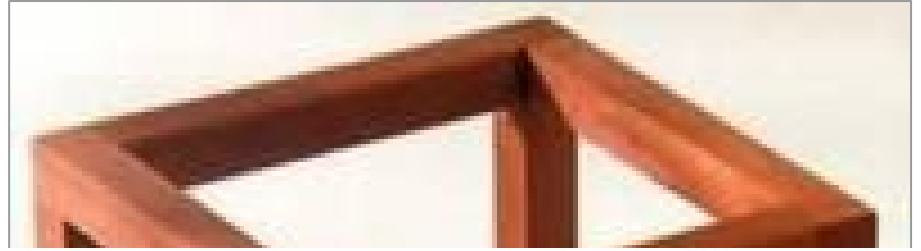
Constancy

The tendency to perceive certain objects the same way regardless of changing angles, distance, or lighting.



Illusions

Incorrect perceptions.
Illusions have helped us
learn about how our
sensory and perceptual
systems work by studying
the errors people make.



The Room

