


Sensation and Perception

Chapter 5

Feb 21-3:24 PM

Sensation and Perception

- ▶ How do people navigate through the world?
 - Sensation: Receive signals from the environment.
 - Perception: Organizing and interpreting these signals.
- ▶ Sometimes, we don't immediately perceive what we sense



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An Overview of Sensation to Perception

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Threshold

- Detecting vs. not detecting
- Can you hear it, taste it, see it or not?
- Ex. Grade school hearing test

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Absolute threshold

- Smallest amount of energy that will produce a sensation
- 50% of the time
- Ex. Eye chart determines vision



<http://www.noiseaddicts.com/2009/03/can-you-hear-this-hearing-test/>

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


▶ The lowest level of stimulation that can be detected 50% of the time

Light intensity	Percentage stimuli detected
150	0
160	~10
170	~30
180	50 (Threshold)
190	~80
200	100

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Absolute Thresholds – The Five Senses

Sense	Absolute Threshold	
Vision	A candle flame from 30 miles away	
Hearing	A mosquito buzzing from 10 feet away	
Smell	One drop of perfume in a six-room Apartment	
Taste	One tsp of sugar in two gallons of water	
Touch	The wing of a fly falling on your cheek from 1cm.	

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Difference threshold

- Smallest change in a stimulus that produces a noticeable difference
- Just noticeably different
 - Ex. 3 lb package in empty vs. full backpack
 - Ex. Darkroom, turn on light, appears bright

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Weber's law

- Larger or stronger a stimulus, larger the change required for observer to notice
 - Ex. Yell in empty stadium vs. packer game

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Sensory adaptation

- Adapt to constant level of stimuli
- Get used to new level, respond only to change
 - Ex. Eyes in a movie theater
- Without adaptation, senses would be bombarded

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Senses

- Vision
- Hearing
- Smell
- Taste
- Touch
- Temperature
- Pain
- Vestibular
- kinesthesia

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Kinesthesia

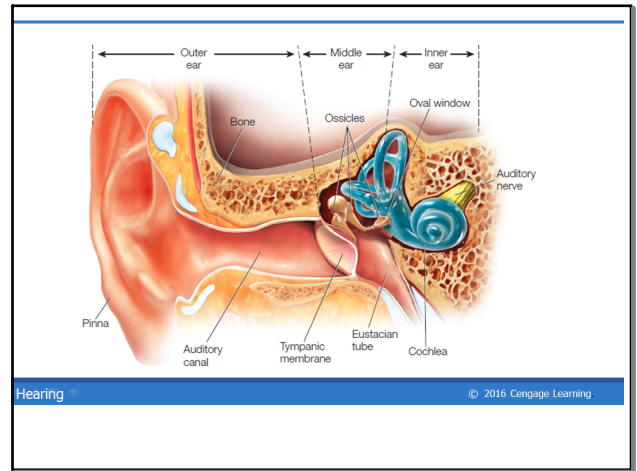
- Movement and body position
- Without, movements would be jerky
- 1st affected by alcohol
- Ex. Touch nose, heel toe

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Vestibular

- Motion and balance
- Utricle – detects linear motion
- Semicircular canal – rotary regulated by inner ear
- Rollercoaster fun or sickening
- Overstimulation causes dizziness
- located in ear, but linked to vision

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Vestibular nystagmus

- Eyes go through a rotary spasm after spinning
- 2nd sense affected by alcohol
- Horizontal gaze nystagmus
- Vertical gaze nystagmus
- video

<http://www.optuab.edu/emweb/Nystagmus.htm>

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Motion sickness

- Disagreement between vision and vestibular sense
- Plane – vestibular feels speed, but eyes see nothing
- Car – vestibular feels speed, but eyes see different
- Boat – unpredictable rates

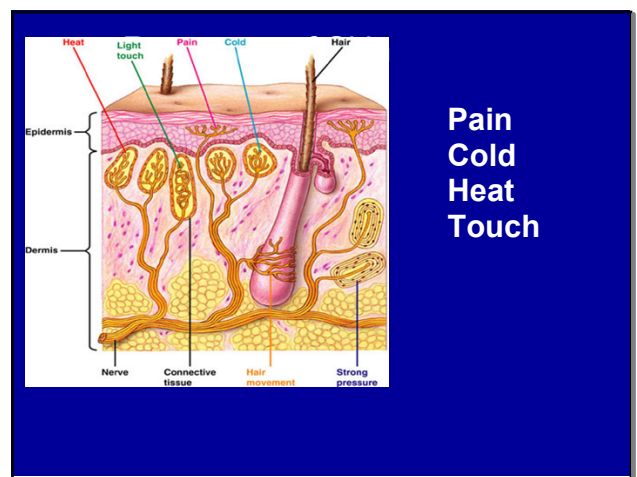
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Somatosensation

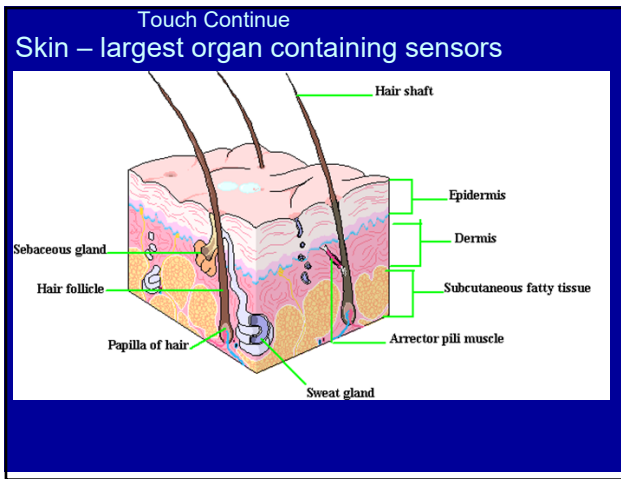
- ▶ Bodily sensations coming from skin, muscles, and joints.
 - Processed by your brain's somatosensory cortex.

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Layers of Skin

- Epidermis – 5 layers but outermost has dead skin, no receptors
- Dermis – contain variety of receptors including hair follicles
- Fatty layer – Subcutaneous
- Highly sensitive to touch

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Touch

- Receptor – mechanical sensors send electric signals to the somatosensory cortex

F-3: Motor and Somatosensory Cortex

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- Nerve ending in finger send info along spinal cord
- The neurons travel up the spinal cord then form synapses with neurons in the thalamus (magenta circle)
- The thalamus organizes info and sends to sensory cortex (blue)

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- Interprets the information as pain
- Sends info to motor cortex (orange)
- Motor cortex (orange) sends info. back to the thalamus (green pathway)
- Thalamus organizes incoming info. and sends

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Hair receptors

- Nerve endings wrapped around the base of each hair follicle
- Adaptation – when hair remains bent
- Free nerve endings – give info. about temperature and pain

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Temperature

- Stimulus – change in temperature on skin
- Receptor – skin and hair follicles
- Thermoadaptation
- Short-term – bathtub
- Long-term – go to Florida in winter

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Pain

- Caused by
- Tissue damage
- Attentional state
- Doing something else, don't notice
- Emotional state
- When afraid, hurts more
- Receptor – send nerve impulses to the somatosensory and limbic area of the brain (hippocampus - memory and amygdala - fight/flight/anger)
- Endorphins – natural painkiller

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Pain contined

- Pain tolerance – ability to handle pain
- Referred pain – pain in an area away from the source
- Ex. Headache may stem from backpain

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The Gate Control Theory of Pain

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The Visual Stimulus – Light

- ▶ Light travels in waves with two important properties
 - Wavelength, perceived as color
 - Amplitude, perceived as brightness

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The Anatomy of the Eye

Vision © 2016 Cengage Learning

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Blind spot - area where the optic nerve crosses over the retina. No rods or cones

Glaucoma - caused by an overproduction of tear ducts
Marijuana can be a cure

Color - unable to see color in peripheral

After image - caused by overstimulation of cones, receptor gets tired and do not work as well

Color blindness - faulty cones, more prevalent in males

Nov 23-7:31 AM

The Sound Stimulus – Sound Waves

- ▶ Sound waves have different amplitudes and frequencies
 - Amplitude is encoded as loudness or intensity
 - Frequency is encoded as pitch

Hearing © 2016 Cengage Learning

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Exposure to Sound

- ▶ Loudness of sound is measured in decibels
 - A whisper: ~ 20 dB
 - Normal conversation: ~ 60 dB
 - iPod with standard earbuds: 100 dB
 - Threshold of pain: 130 dB

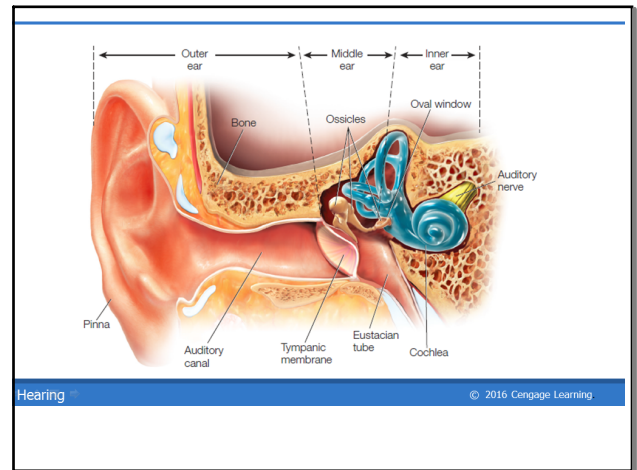
Typical Decibel Level	Dangerous Time Exposure
180	Hearing loss certain
170	
160	Any exposure dangerous
150	
140	Immediate danger
130	
120	Less than 8 hours
110	
100	More than 8 hours
90	

Extremely loud

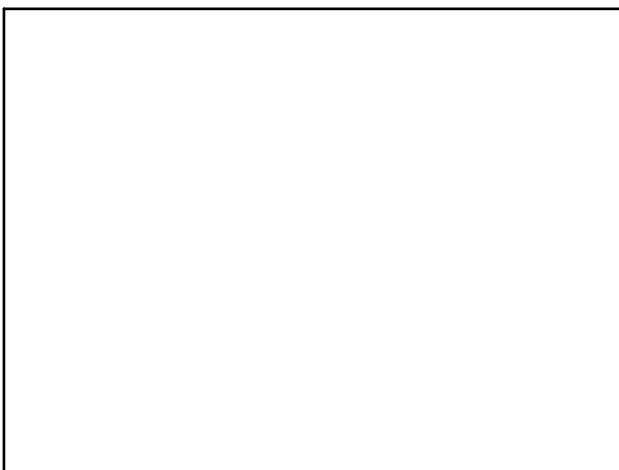
Very loud

Hearing © 2016 Cengage Learning

Sep 25-8:21 AM



Sep 25-8:20 AM



Oct 12-8:24 AM



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Oct 12-8:24 AM



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Auditory anatomy

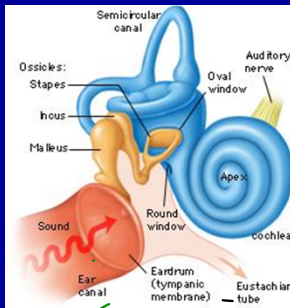
- Outer ear
- Pinna – cartilage covered with skin on both sides of your head “ears”
- External auditory canal
- Nothing smaller than an elbow should enter
- Contains wax and hair to keep dirt out



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Middle ear

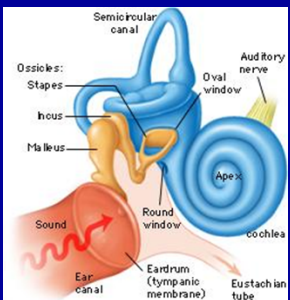
- Ear drum – vibrates messages to the fluid of the cochlea



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Middle ear

- Ability to freeze
- Eustachian tube –
- Equalizes pressure



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- Pick up vibrations from oval window
- Organs of inner ear (sits on basilar membrane)
- tectorial membrane - stiff membrane that moves against the hair cells to produce sound
- Ears ringing – permanent hearing loss
- Semicircular canal – controls balance

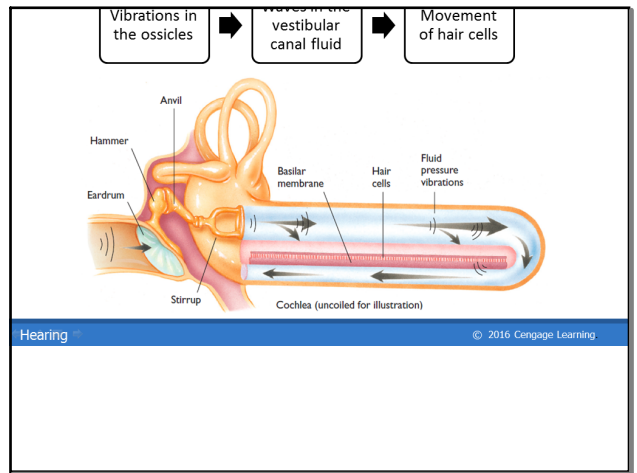
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After 120 decibels of noise – equivalent of rock concert

- Healthy
- Damaged

<http://concise.britannica.com/ebc/art-529>

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Sep 25-8:20 AM

Vestibular Sense – The Inner Ear

- ▶ Sensitive to position, acceleration, and rotational movements

Labels: Vestibular nerve, Facial nerve, Cochlear nerve, Cochlea, Utricle, Saccule, Semicircular canals

Hearing © 2016 Cengage Learning

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Sensory Prosthetics – Bypassing Transducers

- ▶ What happens when the sensory organs do not work – when there is no way for the external energy to be transduced?

Labels: Actual image, Cameras, Visual cortex, Electrodes, Perceived image

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- ▶ Bypass hair cells and stimulate the auditory nerves directly

Labels: Skin, External coil, Internal coil, Receiver circuitry, Cochlea, Eardrum, Electrode to cochlea, To microphone and sound processor

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Smell

Labels: Olfactory nerve, Olfactory bulb, Receptor cells, Tongue

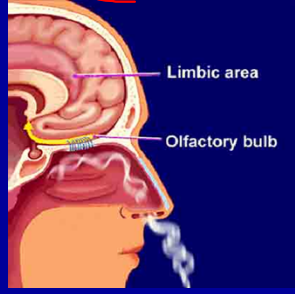
Olfactory Nerve → Olfactory Bulb → Frontal Lobe

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Smell

- Receptor – olfactory epithelium



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Smell and memory

- Transduction -Transforms chemical reaction into a nerve impulse
- Nerves from the olfactory bulb make connections with the limbic system
- The limbic system contains the hypothalamus, the hippocampus, and the amygdala
- Responsible for our emotions and in the formation of memories.

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Loss of smell

- Virus destroys receptors
- Damage to the neurons

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Functions of smell

- Potential danger
- Fire, gas, spoiled food
- Memory
- Choosing a mate
- Pheromones

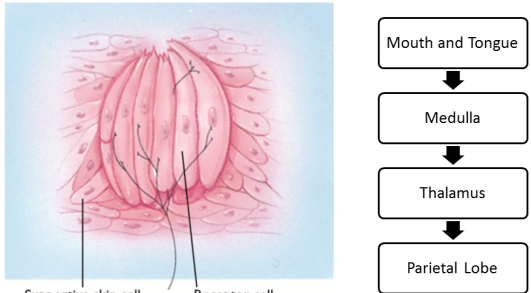
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Adaptation of smell

- Short-term
- Leave room, come back and it smells
- Long-term
- Significant odors in your life
- People with B.O. can't smell themselves

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Taste



Supportive skin cell of the tongue Receptor cell

Mouth and Tongue
↓
Medulla
↓
Thalamus
↓
Parietal Lobe

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Taste

- Stimulus – chemicals of the substance mixing with saliva
- Receptors – taste buds
- Sweet
- Salty
- Sour
- Bitter
- Umami – meaty-cheese taste
- Parmesan cheese, fish, meat

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Taste buds

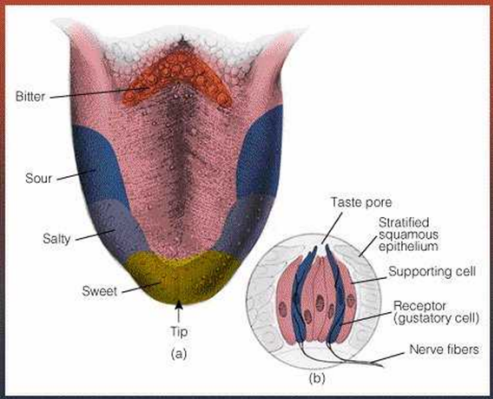


Couple of drops of blue food coloring

<http://biology.about.com/library/organs/blpathodigest2.htm?terms=digestive+system+activity>

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Taste buds



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Taste Buds Experiment

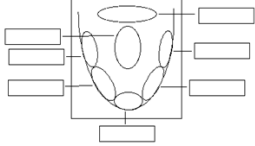
Name: _____ Date: _____

1. Put a check in the box where you "taste" each food.

	Tip	Back	Edges
Lemon Juice (Sour)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coffee (Bitter)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sugar (Sweet)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Salt (Salty)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Label where you "taste" flavors on your tongue.

Your Tongue!



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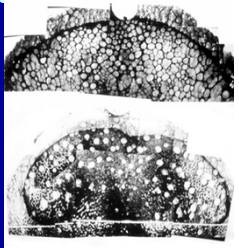
Other factors for Taste

- Smell
- Temperature
- Texture
- Appearance
- Color

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Taste Continued

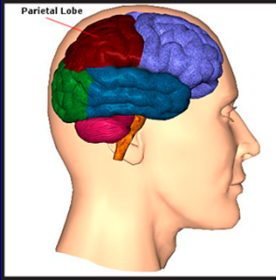
- If one changes, all change in opposite direction
- Ex. Drink orange juice after brushing teeth
- Taste loss
- Smoking
- Age – lose 30% by age



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- Amount inherited – 500-10,000
- Sends messages to the parietal lobe

Taste buds



(Handwritten red scribble)

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<http://www.youtube.com/watch?NR=1&feature=endscreen&v=CWyrp3hu4KE>

Color Blind Test

Mar 8-1:20 PM

Tri-color theory - we have 3 cones

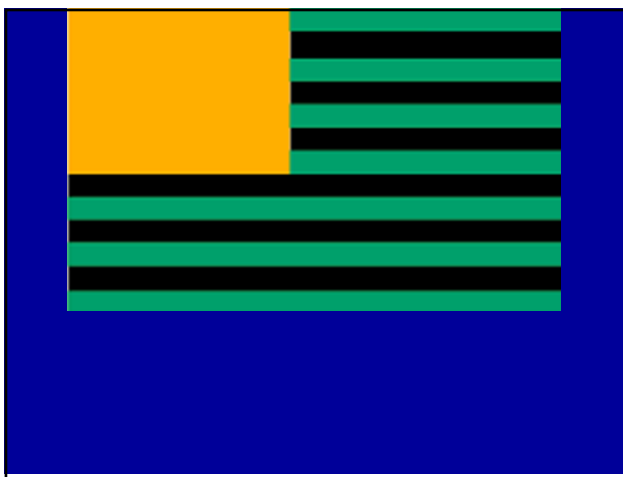
- black/white
- red/green
- blue/yellow

After image due to over stimulation of 1 end of the cone

Mar 8-12:15 PM

After image - when we overstimulate one end of the cone, then take away the stimulus, you will see opposite end of the cone color

Oct 23-10:09 AM



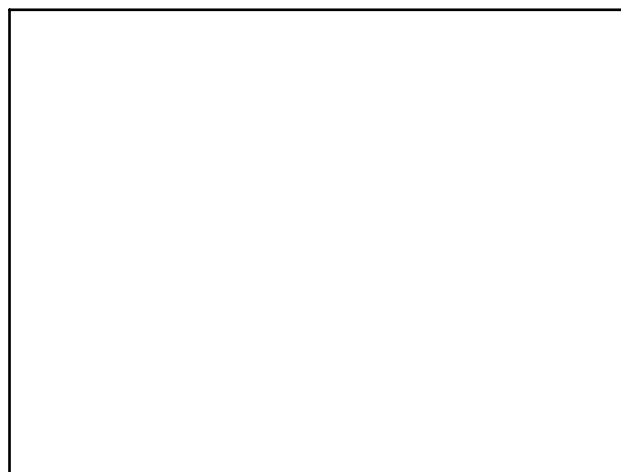
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Oct 25-8:47 AM



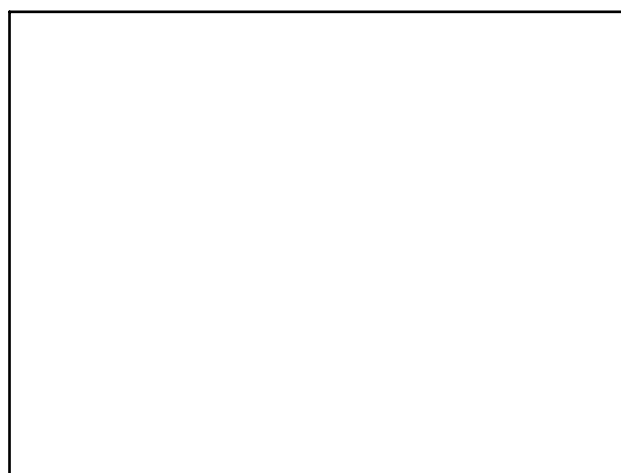
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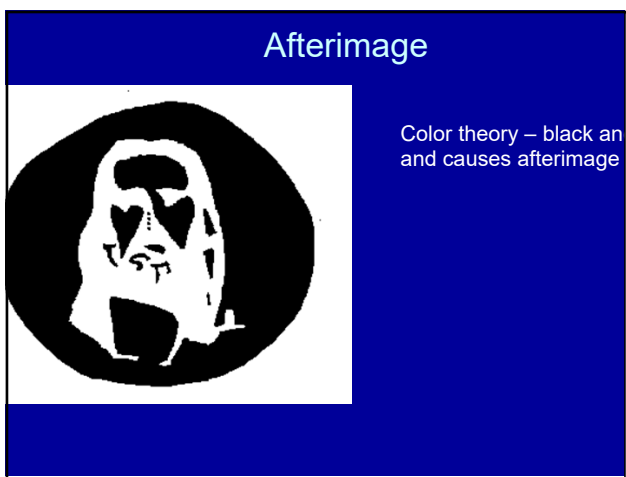
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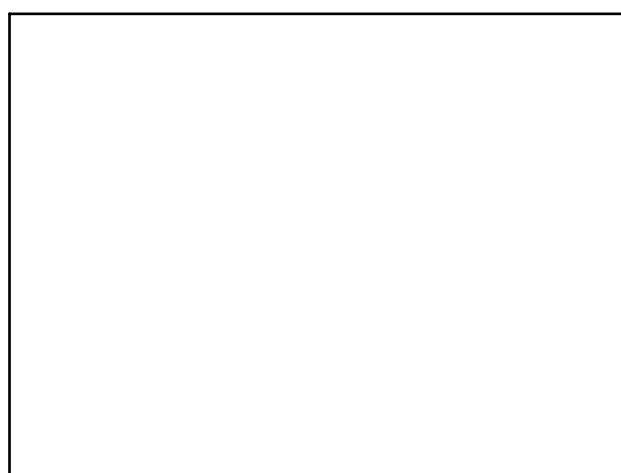


Oct 25-8:49 AM

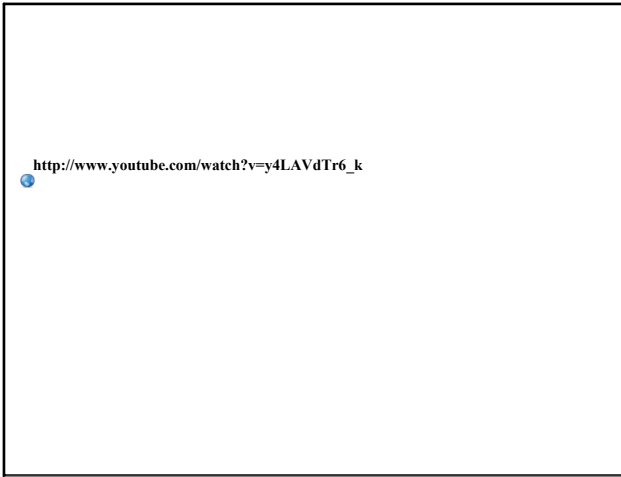


Color theory – black and white causes afterimage

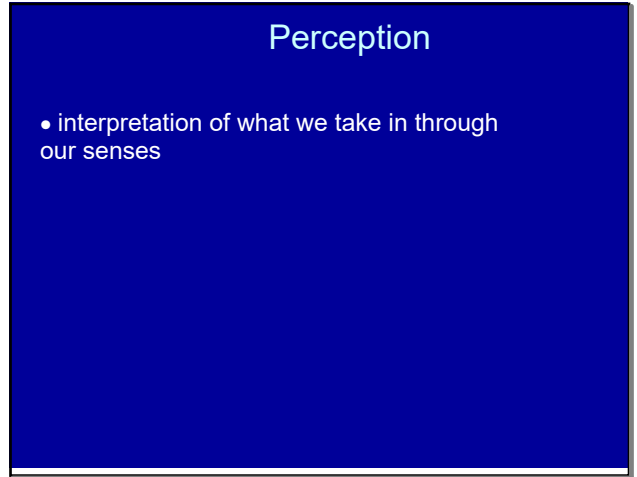
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Oct 25-7:48 AM



Mar 8-3:11 PM



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Types of Information Processing

- ▶ Do you see a B or a 13?
 - Top-down processing
 - Bottom-up processing

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Top down process - look at big picture

stroop effect

FINISHED FILES ARE THE RESULT OF YEARS OF SCIENTIFIC STUDY COMBINED WITH THE EXPERIENCE OF YEARS...

Source: <https://www.physicsforums.com/threads/count-the-letters.96510/>

I enduo't b'vicee tabt I culod asufachy useddamned wabt I was rdnaieg. Uning the kindleblire p'woser of the human mind, accoedring to r'esearch at C'mahngale Un'ersiv'ity, it d'oesn't m'atter in w'hat ord'er the l'etters in a w'ord are, the s'olely i'm'portant thing is tabt the first and last l'etter be in the r'ight p'lace. The rest can be a taofl m'ises and you can still read it w'houit a p'roblem. This is b'ecause the human mind does not read ev'ery l'etter by itslef, but the w'ord as a w'hole. Aazrring, huh? Y'ach and I aw'lyas t'ghuot slelmg' was sp'orant!! See if y'our fr'einds can read this too.

Oct 23-7:59 AM

bottom up processing - look at details first
then the big picture
ex. books vs. face

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Gestalt Principles

- ▶ We are born with a number of built-in tendencies to organize incoming sensory information in certain ways
 - This simplifies the problem of recognizing objects


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Perceptual Organization




Similarity



Proximity



Continuity



Closure

[Similarity](#)

[Proximity](#)

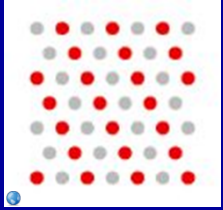
[Continuity](#)

[Closure](#)

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Similarity


- Objects that look similar appear to go together




[Back](#)

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▶ Similarity



▶ Proximity

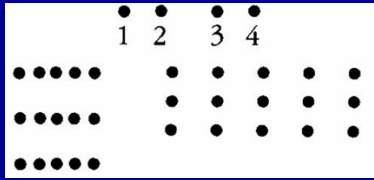


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Proximity

- Objects that are close together appear to go together

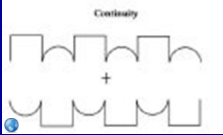


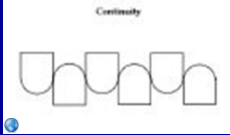
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Continuity

- Lines are seen as following the smoothest path

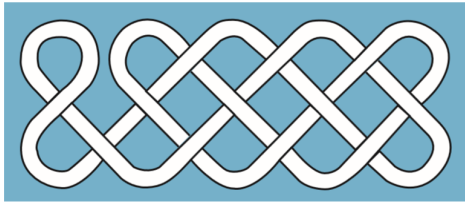




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▶ The tendency towards simplicity and continuity



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- The Gestalt principle of continuity says that we perceive points forming a smooth line as belonging to the same object. If you follow this knot, you will see that it is actually formed by two objects, but our initial perception is of a single form.

Sep 25-8:30 AM

Closure

- We tend to ignore gaps and fill in the missing lines

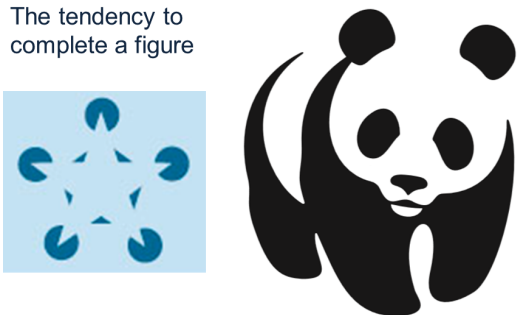


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Gestalt Principles – Closure

- ▶ The tendency to complete a figure




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Figure-Ground

- Puts the visual scene into a **figure** that we look at and a **ground** which is everything else and forms the background




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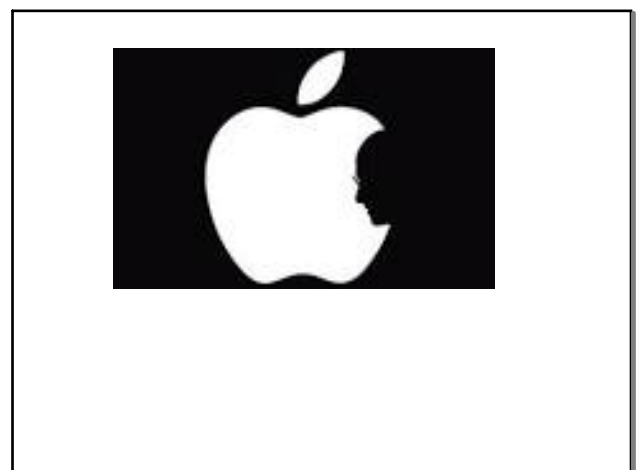
Gestalt Principles – Figure-Ground

- ▶ When we perceive a stimulus, we visually pull the figure part of the stimulus forward while visually pushing backward the background

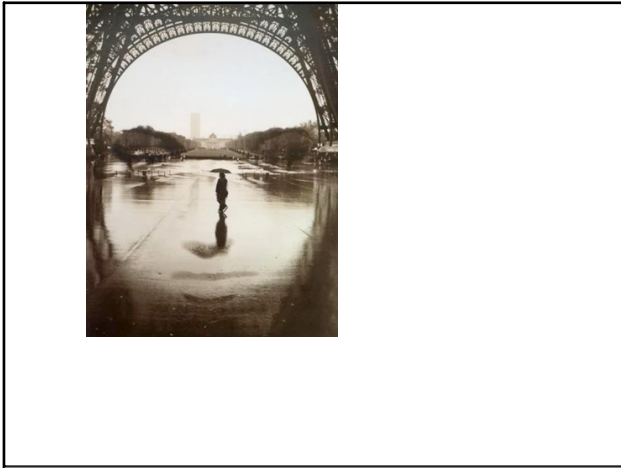


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Oct 31-11:38 AM



Nov 1-10:56 AM



Nov 1-10:26 AM

Constancy

- Size
- Shape
- Brightness
- Color

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Size Constancy

- Ability to see objects further away as same size

Illusions

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Shape Constancy

Feb 21-3:24 PM

Color constancy


- The ability to see color regardless of changing conditions.

(a) (b) (c) (d)

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Brightness Constancy

- ability to see objects as having the same brightness even though light may change their immediate sensory properties



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Depth Perception

- Monocular cues – need only one eye
- Binocular cues – need 2 eyes

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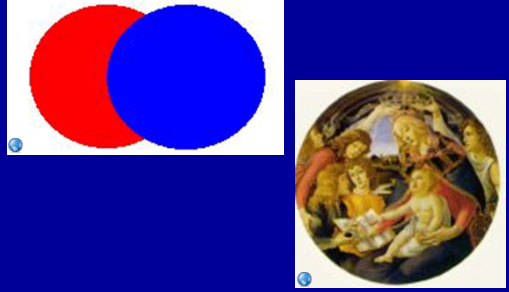
Monocular cues

- Interposition
- Linear perspective
- Elevation
- Texture gradient
- Motion parallax

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Interposition

- One object appears to be blocking another



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Monocular Cues – Interposition (overlapping)




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Linear Perspective

- Visual field appears to come to a point



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Elevation

- Objects further away appear to get higher

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Texture gradient

- Objects closer have more detail than objects further away

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Monocular Cues – Light and Shadow, and Texture Gradient

▶ Light and Shadow

▶ Texture Gradient

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Sep 25-8:25 AM

Motion Parallax

- Objects close to us seem to move faster than objects further away
- Ex. Fingers vs. board
- Ex. Plane vs. car

<http://psych.hanover.edu/Krantz/MotionParallax/MotionParallax.html>

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Binocular Cues

- **Retinal Disparity**
- Images on the retina are in different places on the eye
- Close one eye and pencil
- **Convergence**
- as objects get farther from our face they converge
- Pencil move toward face

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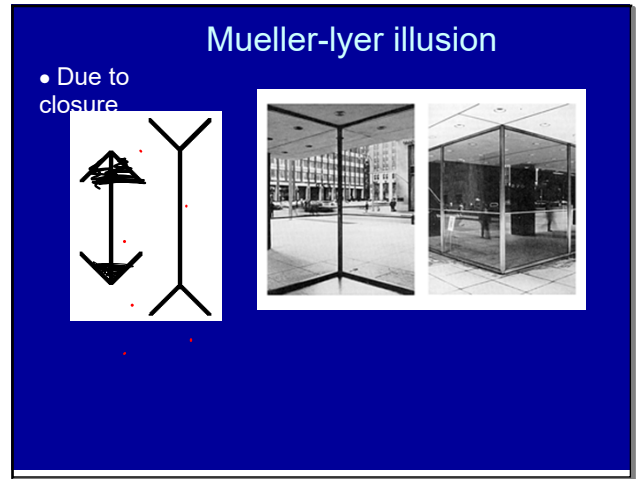
Illusions

- Phenomenon which what you see is not actually what is present
- Moon illusion
- Horizontal-vertical illusion
- Mueller-lyer
- Ponzo
- Paggendorff
- Hering

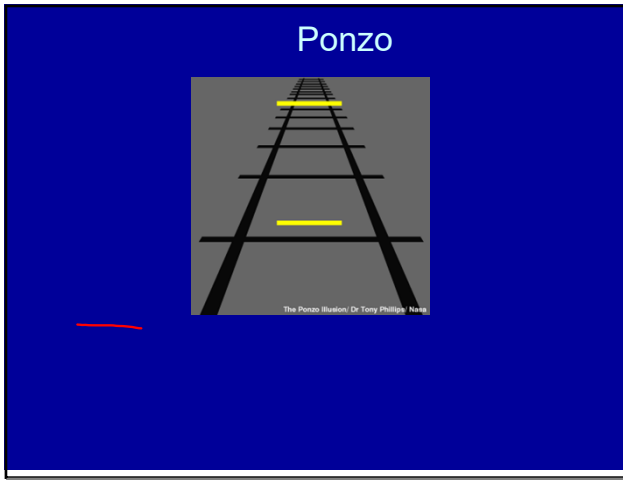
Feb 21-3:24 PM



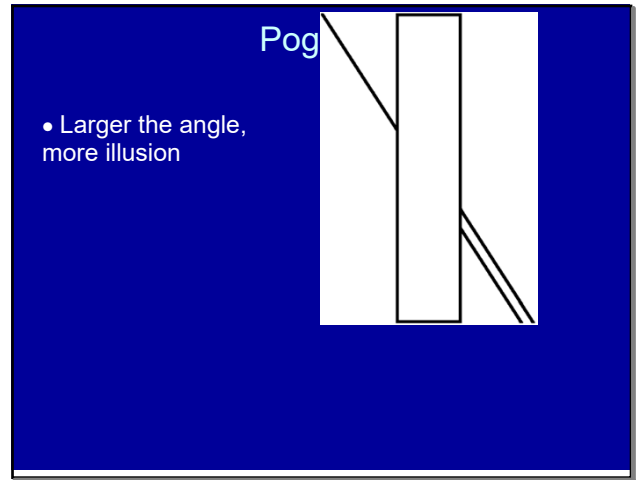
Feb 21-3:24 PM



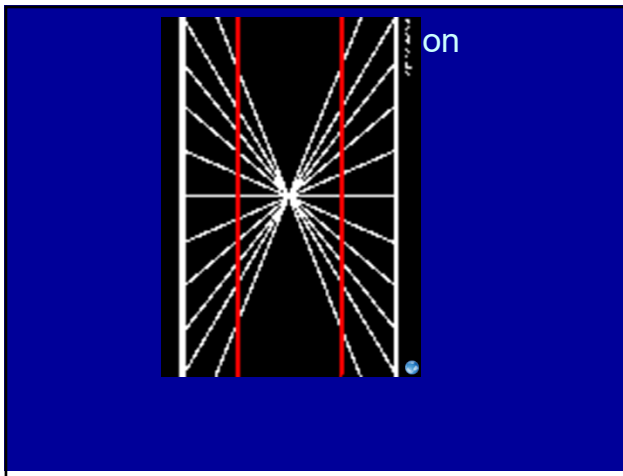
Feb 21-3:24 PM



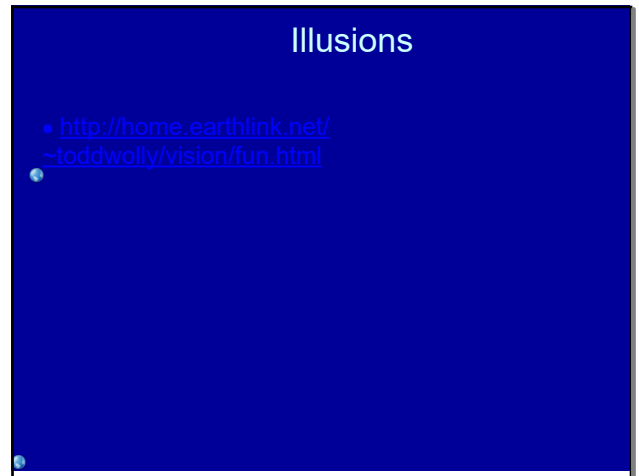
Feb 21-3:24 PM



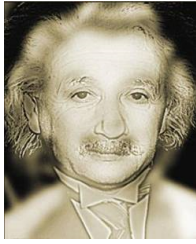
Feb 21-3:24 PM



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Feb 21-3:24 PM



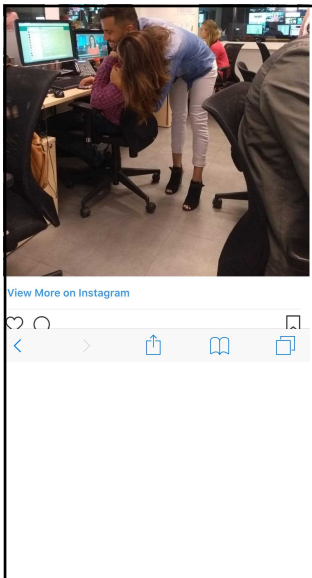
When you look at this picture you see it's Albert Einstein..

But if you stand 15 feet away it will become Marilyn Monroe..Now what do you think of the reliability of eyewitness testimony?

Mar 18-12:43 PM



Oct 30-8:26 AM



Oct 24-8:29 AM