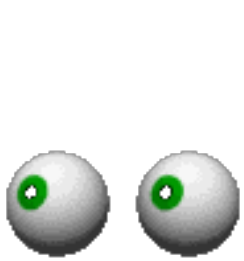
Sensation and Perception





Sensation - your window to the world; taking in information

Perception - interpreting what comes in your window; interpreting/understanding information taken in

crash course

Weber's Law

Khan Academy

- Computes the Just Noticeable Difference.
- The change needed is proportional to the original intensity of the stimulus.
- The more intense the stimulus the more change is needed to notice the difference.

Weber's Law:

- **Example**: When you are in a noisy environment you must shout to be heard while a whisper works in a quiet room.

I don't think this guy understands Weber's Law!

Weber's Law aims to explain:

1. The difference between two thresholds
2. The just noticeable difference between multiple thresholds
3. How we adapt to our surroundings
4. The sensory abilities of people are the same
5. Show the relationship between sensation and perception

Absolute Threshold

Do you hear anything?

- **The *minimum* stimulation needed to detect a stimulus 50% of the time.**

Difference Threshold
(Just Notable/Noticeable Difference)

The smallest amount of change needed to detect a change in a stimulus

The LORD is my shepherd;
I shall not want.
He maketh me to lie down
in green pastures:
he leadeth me
beside the still waters.
He restoreth my soul:
he leadeth me
in the paths of righteousness
for his name's sake.
Yea, though I walk through the valley
of the shadow of death,
I will fear no evil:
for thou art with me;
thy rod and thy staff
they comfort me.
Thou preparest a table before me
in the presence of mine enemies:
thou anointest my head with oil,
my cup runneth over.
Surely goodness and mercy
shall follow me
all the days of my life:
and I will dwell
in the house of the LORD
for ever.

Why does signal detection theory appear to be more credible than absolute threshold theory?

1. It explains that people can have different abilities depending on the situation
2. It allows for human error
3. Absolute threshold may only apply to younger people
4. All of the above

Subliminal Messages

- Stimuli below our absolute threshold.
  - Only detected 49% of the time
  - **Example**: If a person turns up your IPOD just a hair, you probably will not hear the difference (even though there is one)
- Do Subliminal Messages work?
  - Evidence suggests minimal influence
  - Probably a placebo effect

A Letter from College

Dear Mom,

$chool is really great. I am making lot$ of friend$ and $tudying very hard. With all my $tuff, I $imply can't think of anything I need, $o if you would like, you can just $end me a card, a$ I would love to hear from you.

Love,

$u$an

P.$. Thank$ for $ending the $weater!

Dear Susan,

I kNOw that astroNOmy, ecoNOmics, and oceaNOgraphy are eNOugh to keep even an hoNOr student busy. Do NOt forget that the pursuit of kNOwledge is a NOble task, and you can never study eNOugh.

Love,

Mom

P.S. Thanks for your NOte!!

Signal Detection Theory

khanacademy pt 1

- predicts how and when we detect the presence of a stimulus
- assumes that "absolute threshold" is dependent on context/situation
- says that detection depends on experience, expectations, motivation, fatigue

Sensory Adaptation

khanacademy

- The diminished sensitivity as a consequence of constant stimulation
- Think about a hot tub – when you first get in, you think it is really hot. But after a few minutes it feels normal.

Sensory Transduction

- transforming stimulus energy into neural impulses
  - In vision, light waves are transformed into neural impulses and messages from the eye to the thalamus and then to other parts of the brain.
  - In hearing, sound waves are transformed into neural impulses and messages from the ear to the auditory cortex of the temporal lobe.

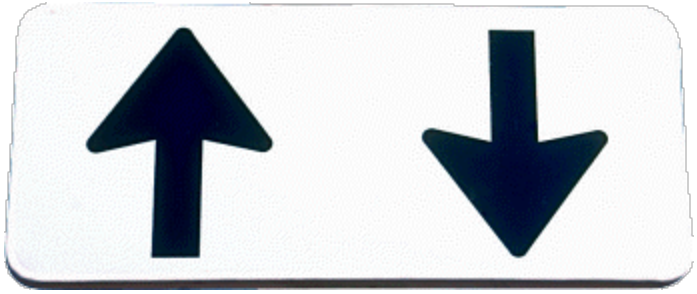
Remember the characters from Sky High? They could change from their physical, bodily form into something else altogether.

Click the image above to watch the characters transform.

Attention: Bottom-up Processing and Top-down Processing

Khan Academy

- **Bottom-up processing** is the processing of sensory information as it enters the sensory structures and travels to the brain



- **Example**: Send raw experience to brain for analysis.
- **Top-down processing** is the brain's use of existing knowledge, beliefs, and expectations to interpret the sensory stimulation
- **Example**: "big chunk" – make sense of situation based on what you already know.

A child seeing shoes with shoelaces for the first time instead of Velcro would be using this type of processing to understand her situation.

1. Bottom –up processing
2. Top-down processing
3. Both bottom-up and top-down processing
4. None of the above

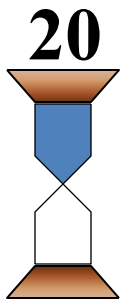
Vision

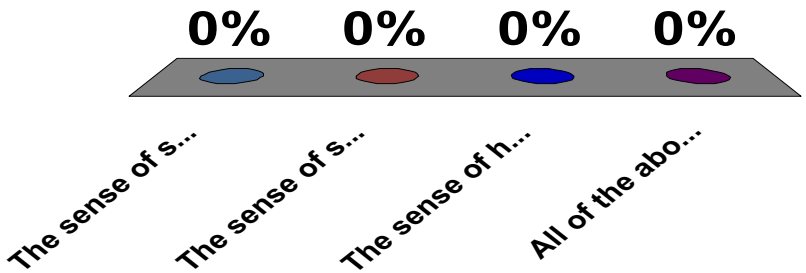
khanacademy

- Our most "dominating" sense
- Visual capture

During the process of visual capture, why does your sense of sight dominate over your other senses?

1. The sense of sight is the most powerful of the senses
2. The sense of sight is the most evolved of the senses
3. The sense of hearing is overloaded
4. All of the above



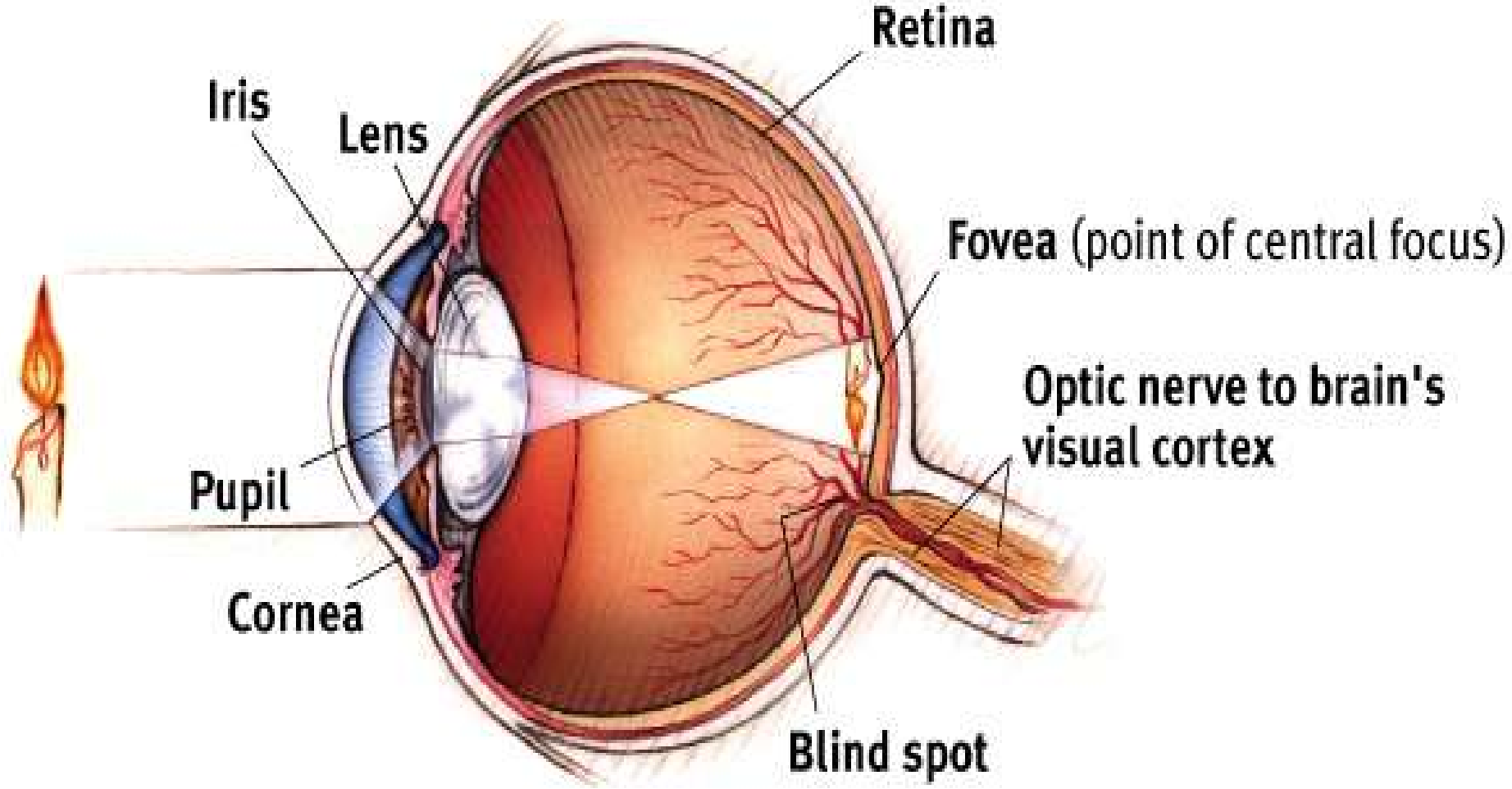


1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30										18

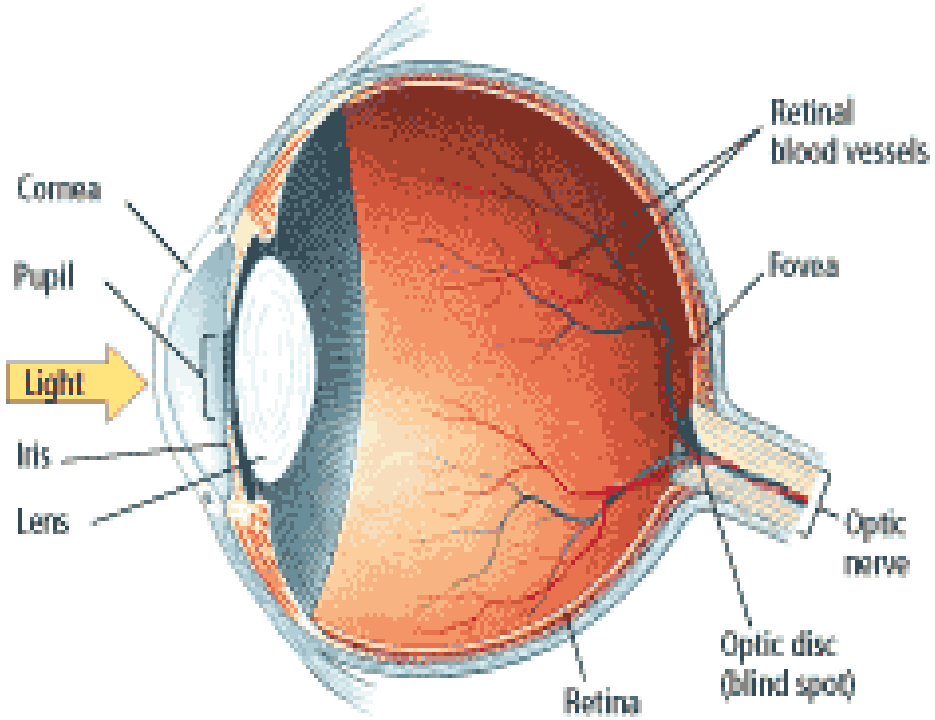
Phase One: Getting the light in the eye

rods and cones

fovea



An Eye on the World



- Cornea
  - Protects eye and bends light toward lens.
- Lens
  - Focuses on objects by changing shape.
- Iris
  - Controls amount of light that gets into eye.
- Pupil
  - Widens or dilates to let in more light.

An Eye on the World

- Retina
  - Neural tissue lining the back of the eyeball's interior, which contains the receptors for vision.
- Rods
  - Visual receptors that respond to dim light.
- Cones
  - Visual receptors involved in color vision.
  - Most humans have 3 types of cones.

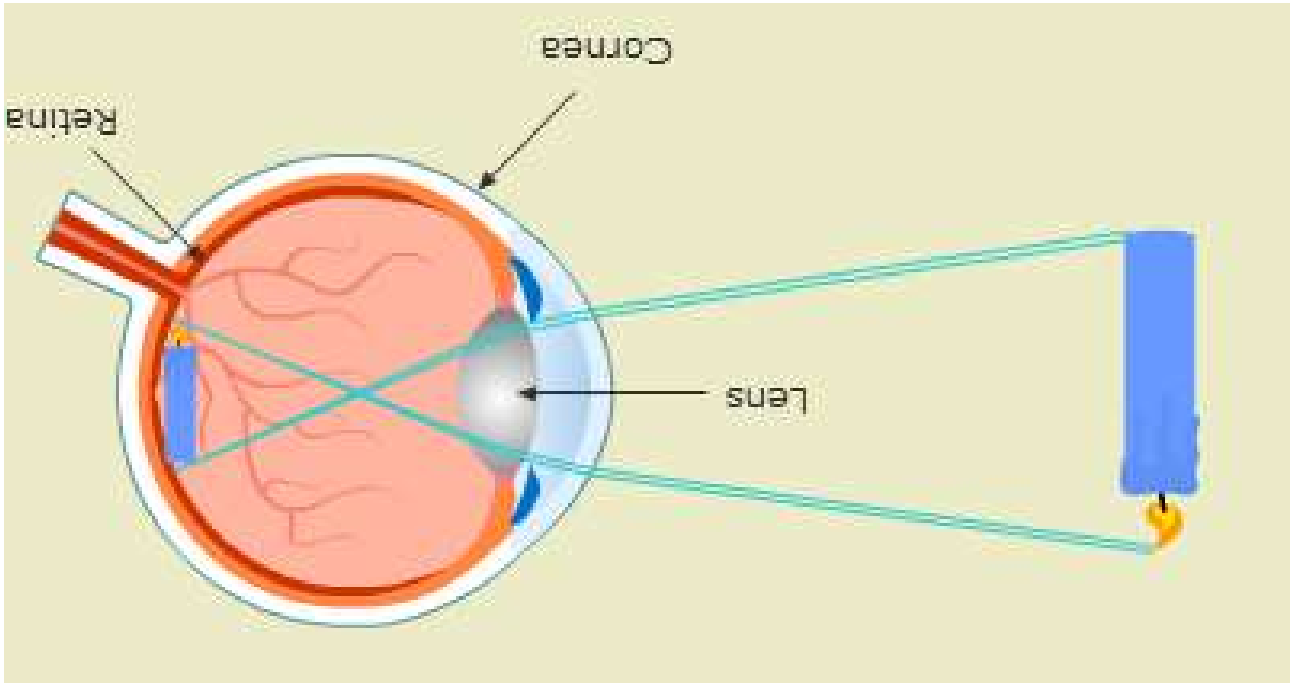
Near and Far Sightedness:

- Near and Far sighted people both have issues with the curvature of their cornea and/or lens and how the image is focuses on the retina
- **Near sighted** – too much curvature of the cornea and/or lens so nearby objects are seen more clearly than distant objects
- **Far sighted** – too little curvature of the cornea and/or lens so distant objects are seen more clearly than nearby ones
- Astigmatism – an irregularity in the shape of the cornea and/or lens which distorts and blurs the image at the retina

More about the eye:

- Many types of neurons help to transmit the images that you “see”
- Ganglion cells converge to form the optic nerve of each eye
- Where the optic nerve exits the retina, there are no rods or cones – this is your blind spot
- You also have special neurons called **feature detectors** that help you to distinguish contours, orientation, and basic shape
- Feature detectors are what is fooled by optical illusions

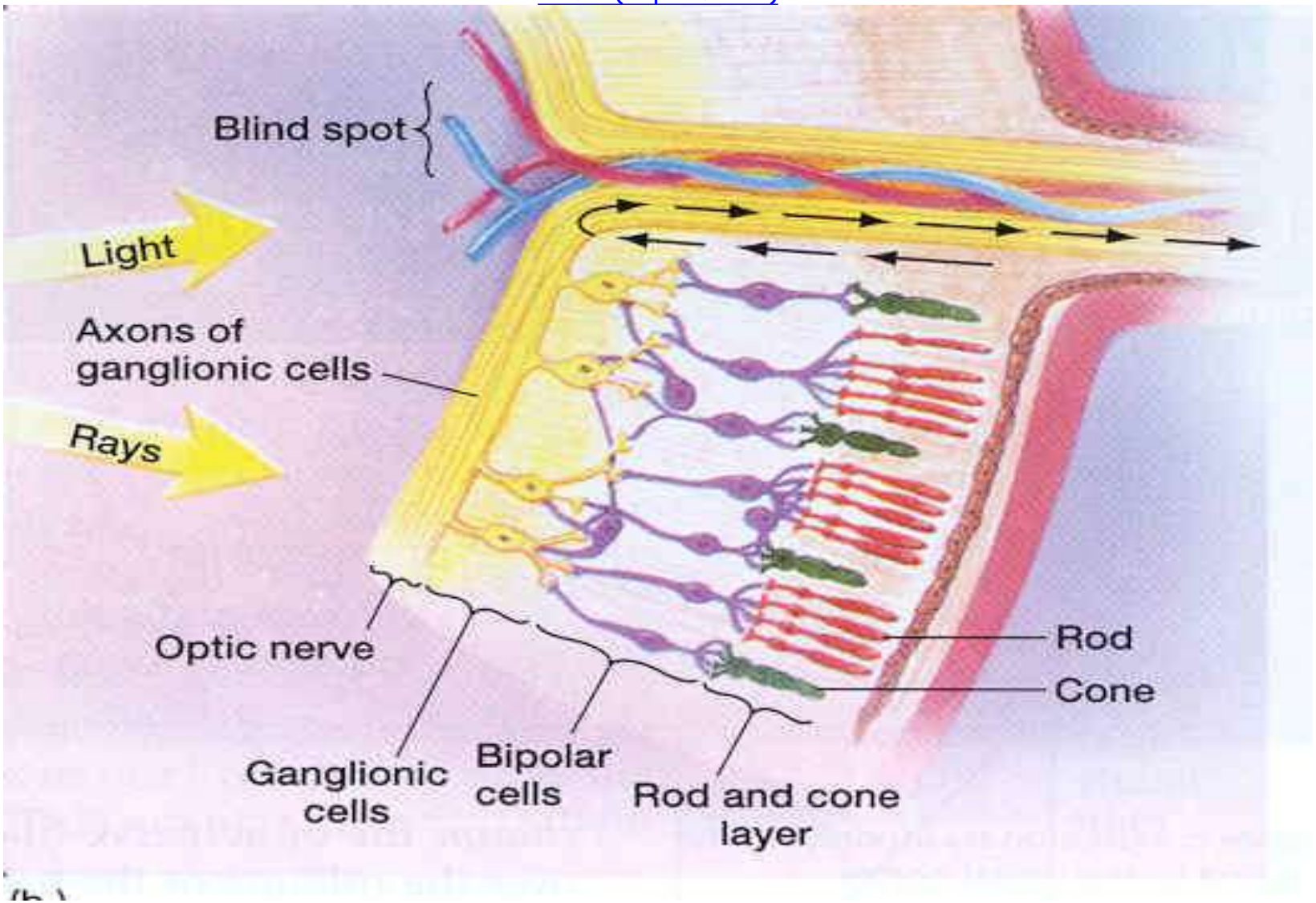
Upside down



How do we see?

Phase Two: Transduction

Cones (explain rods)



Phase Three: In the Brain

parallel processing.feature detectors

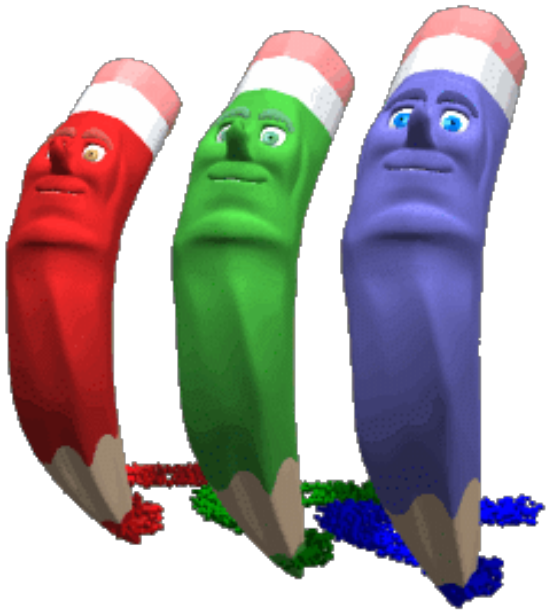
We have specific cells that see the lines, motion, curves and other features of this turkey. These cells are called feature detectors.

- Goes to the Visual Cortex located in the Occipital Lobe of the Cerebral Cortex
- Feature Detectors
- Parallel Processing

Color Vision

Two Major Theories

Trichromatic Theory (Young-Helmholtz Theory)



Three types of cones:

- Red
- Blue
- Green

- These three types of cones can make millions of combinations of colors.
- Does not explain afterimages or color blindness well.

Opponent-Process theory

The sensory receptors come in pairs.

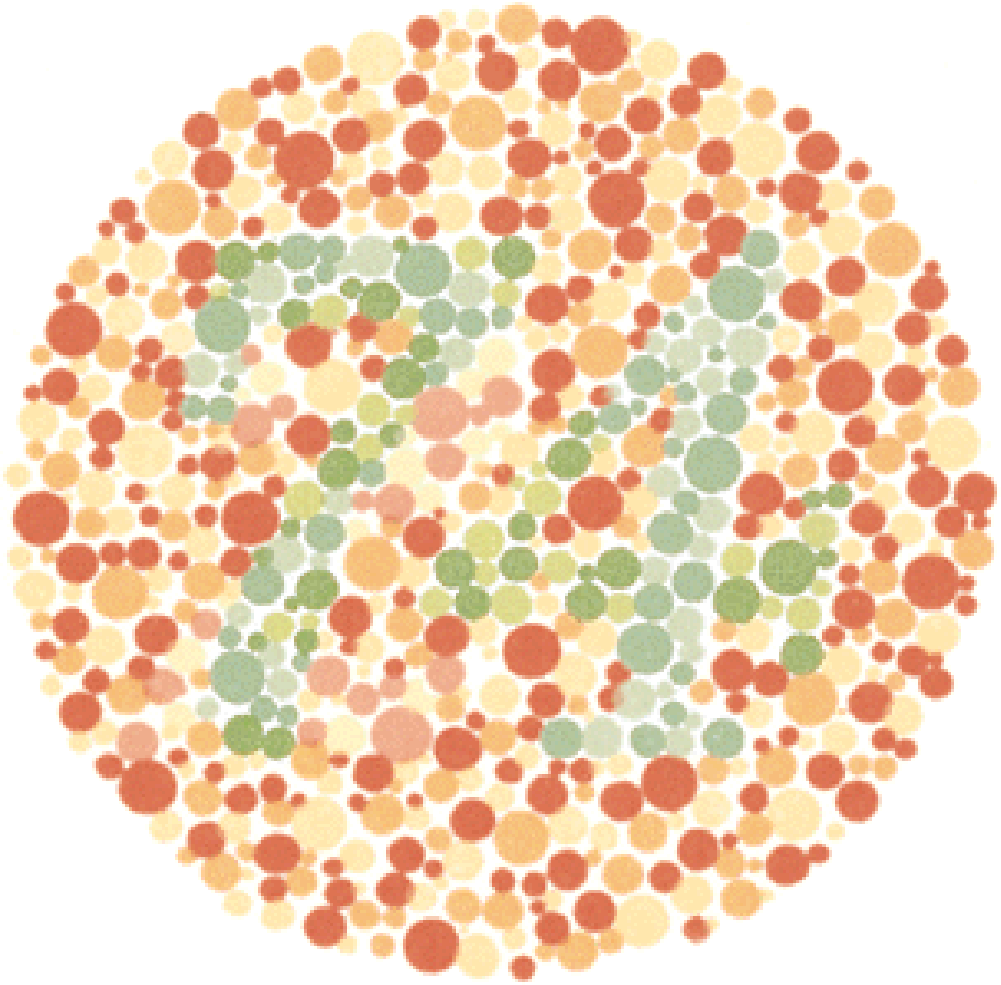
- Red/Green
- Yellow/Blue
  /White
- If one color is stimulated, the other is inhibited.

Why is her top green?

The **black** trousers **absorb all** the different wavelengths of light falling on it. **No** colours are **reflected** into our eyes making the trousers appear black.

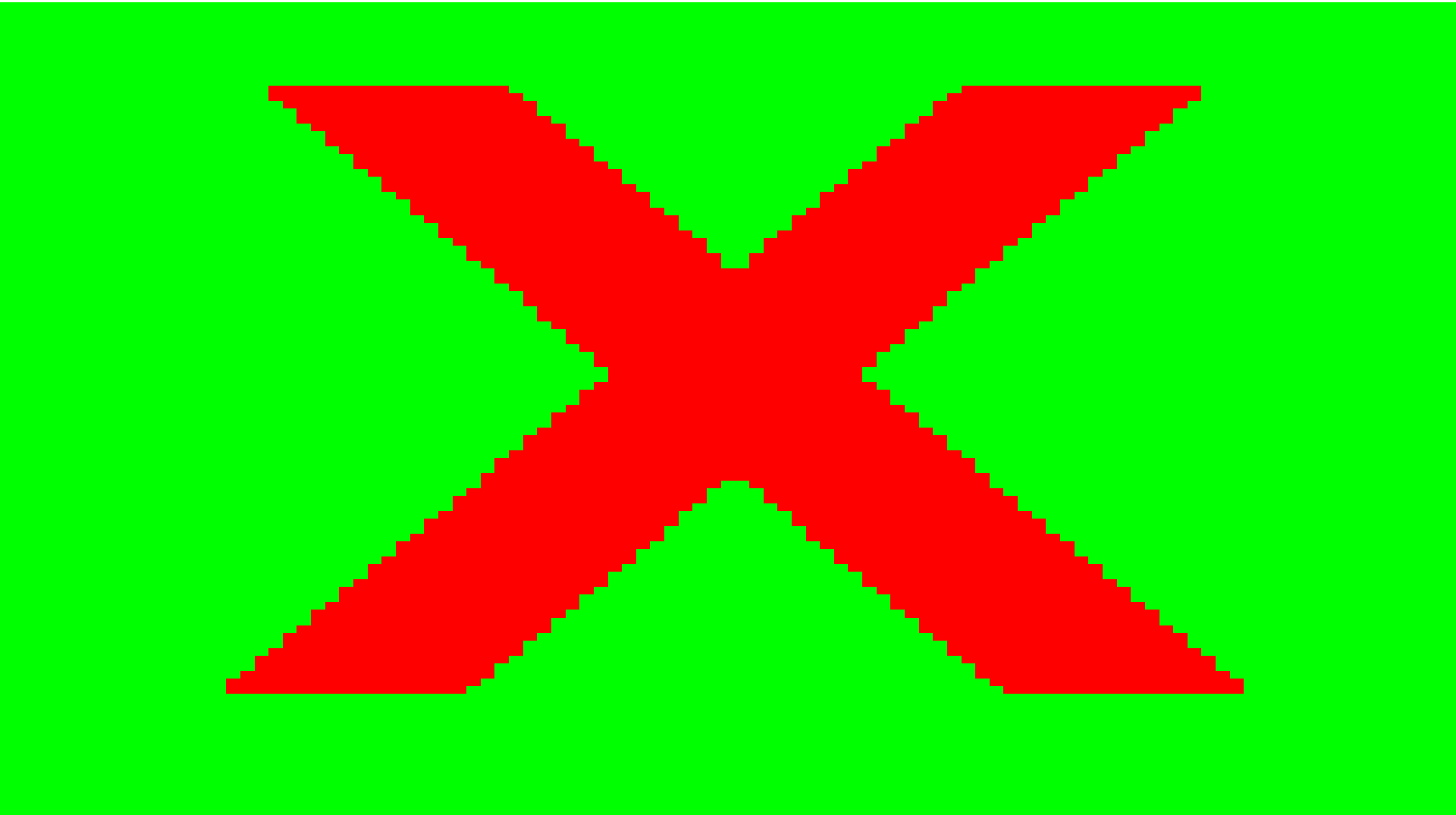
The **green** top will **absorb** all the different wavelengths of light falling on it, except for the **green** light which is **reflected** into our eyes making the top appear green.

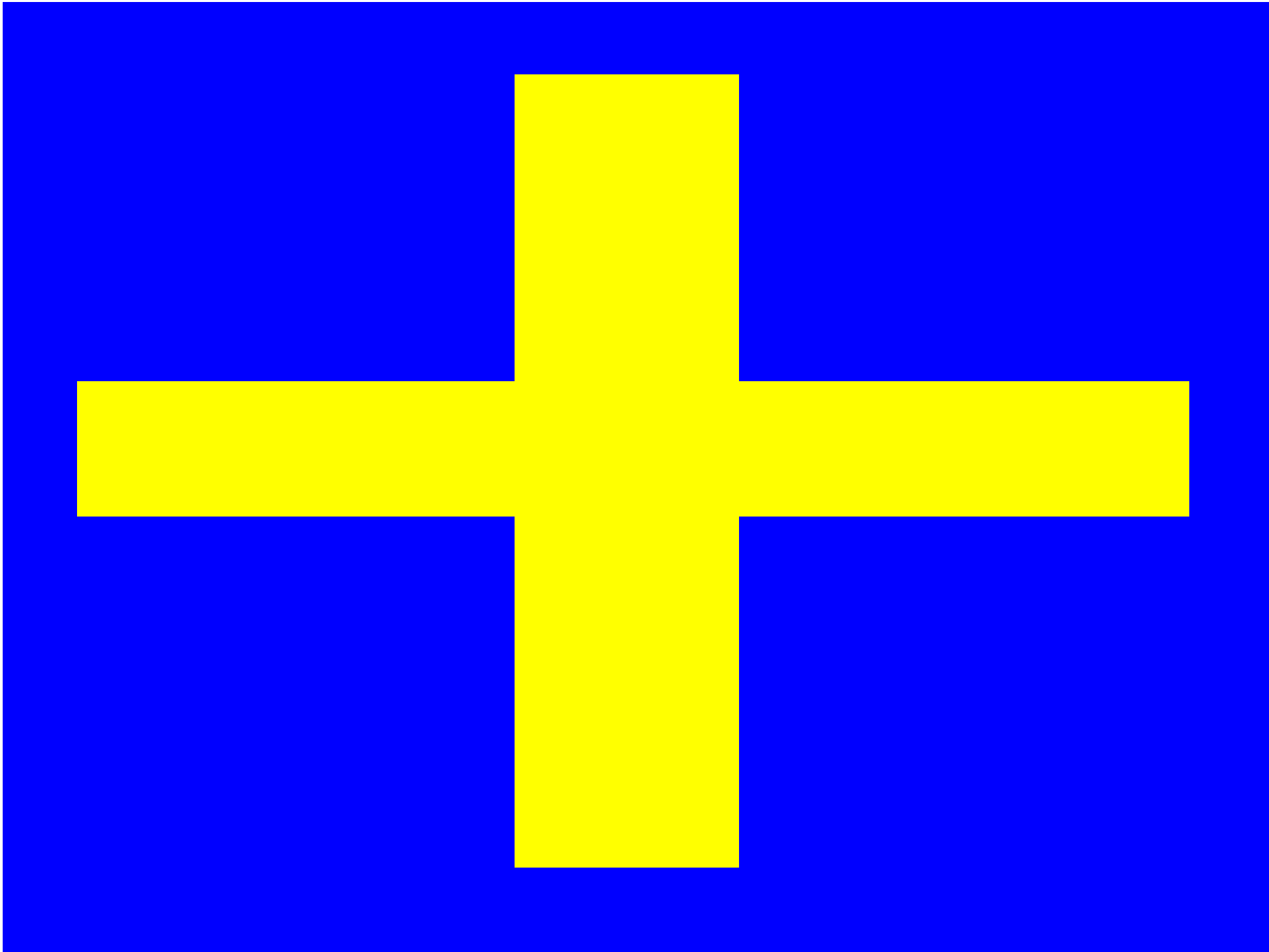
Color-Deficient Vision



- People who suffer red-green blindness have trouble perceiving the number within the design

Afterimages

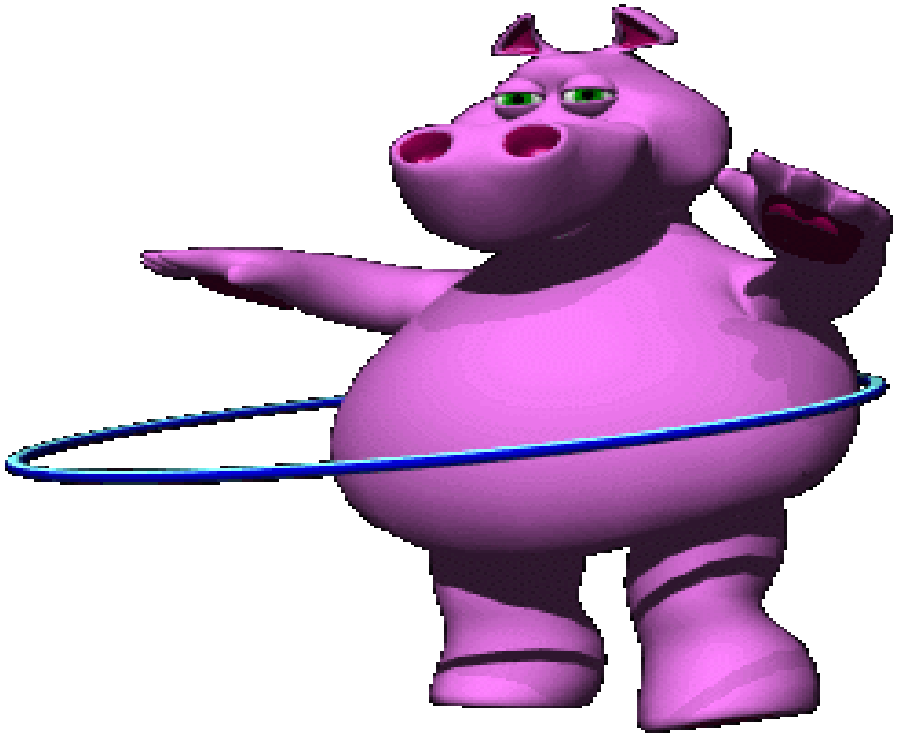




Opponent Process- Afterimage Effect

Parallel Processing

- The processing of several aspects of an object simultaneously.



Color Motion Form Depth

Hearing

crash course

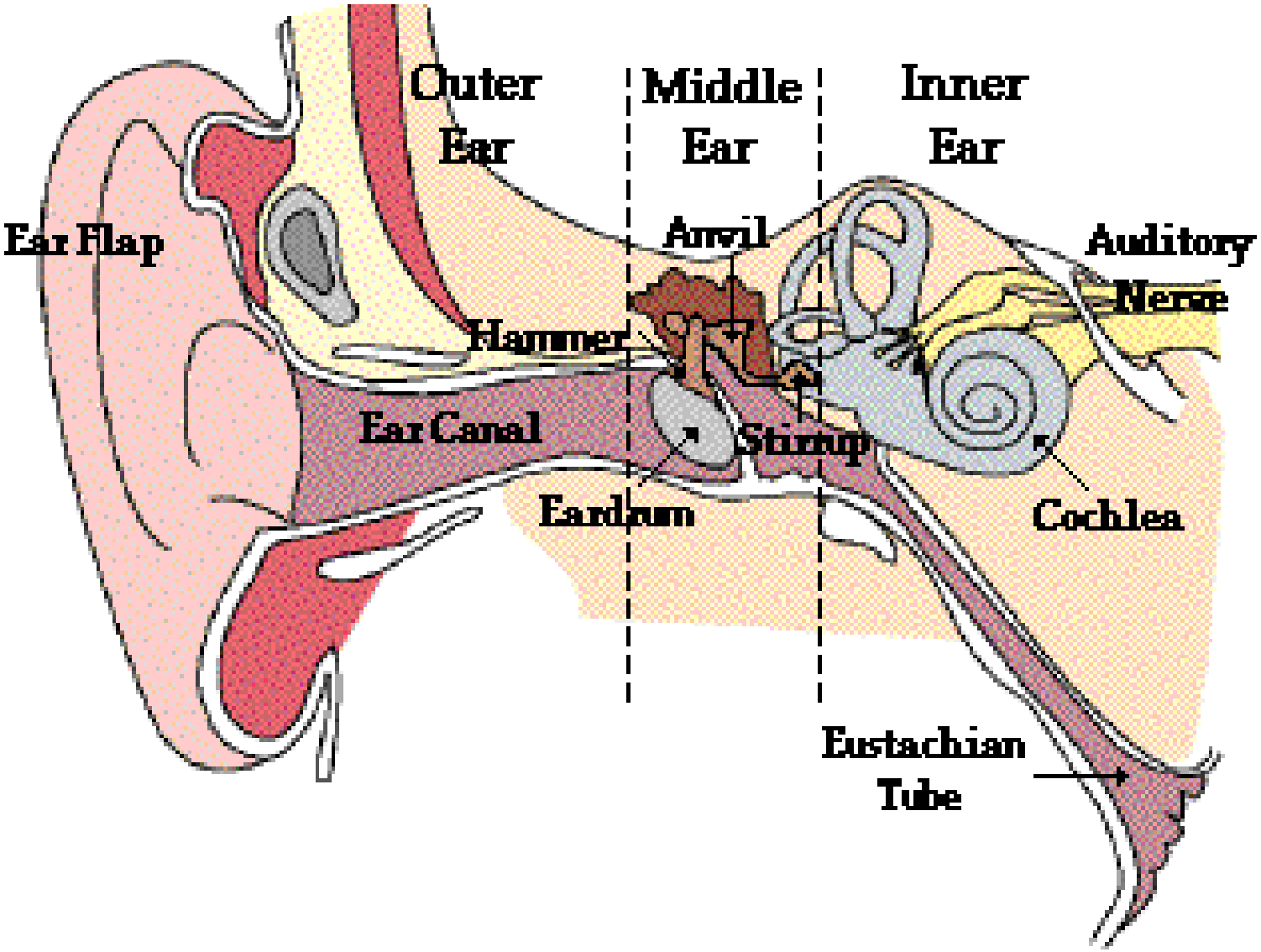
Our auditory sense

Hearing 101:

- Sight will always been our most used sense, though hearing is a close second
- Hearing (**audition**) is most helpful for language transmission
- So, how does the process of hearing work?
- Let's find out!

The Ear

khanacademy. Pt1
pt 2



Transduction in the ear

- Sound waves hit the **eardrum** then **anvil** then **hammer** then **stirrup** then **oval window**.
- Everything is just vibrating.
- Then the **cochlea** vibrates.
- The **cochlea** is lined with mucus called **basilar membrane**.
- In **basilar membrane** there are hair cells.
- When hair cells vibrate they turn vibrations into neural impulses.
- Sent then to thalamus up auditory nerve.

It is all about the vibrations!!!

The process by which sensory information is converted into neural energy is called:

0%	1. Conversion
0%	2. Emersion
0%	3. Emersion
100%	4. Transduction
0%	5. Transformation

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30										42

Determining Pitch:

- Ever hear of someone with perfect pitch?
- **Place Theory** – The position on the basilar membrane at which waves reach their peak depends on the frequency of a tone. (structure)
- **Frequency Theory** – The rate of the neural impulse traveling up the auditory nerve matches the frequency of a tone, enabling you to sense it's pitch. (neural)

Deafness

khanacademy.cochlear implant

Conduction Deafness

Something goes wrong with the mechanical/vibration process in hearing.

Hearing aids to help.

Nerve (Sensorineural) Deafness

The hair cells in the cochlea get damaged.

Loud noises can cause this type of deafness.

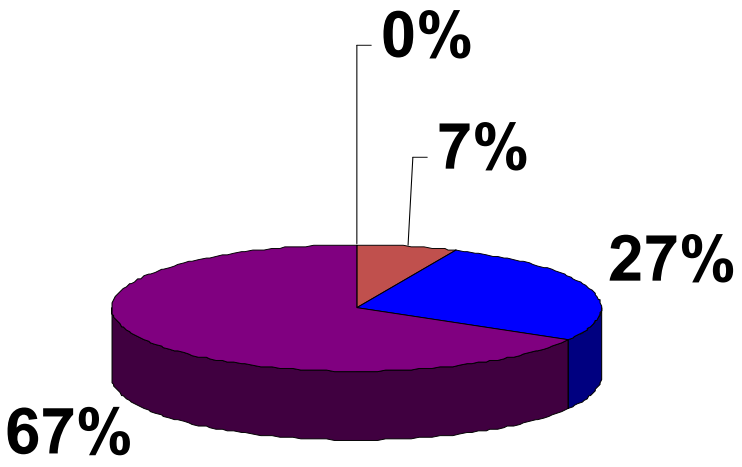
NO WAY to replace the hairs.

Cochlear implant is possible.

https://www.youtube.com/watch?v=HTzTt1VnHRM

Seventy-five-year-old Claude has difficulty hearing high-pitched sounds. Most likely his hearing problem involves:

1. His eardrum
2. His auditory canal
3. The bones of his middle ear
4. The hair cells of his inner ear ✓



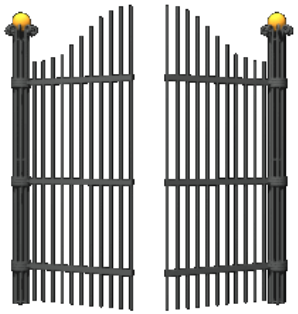
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30										

His eardrum
His auditory canal
The bones of his ...
The hair cells of...

Touch

khanacademy

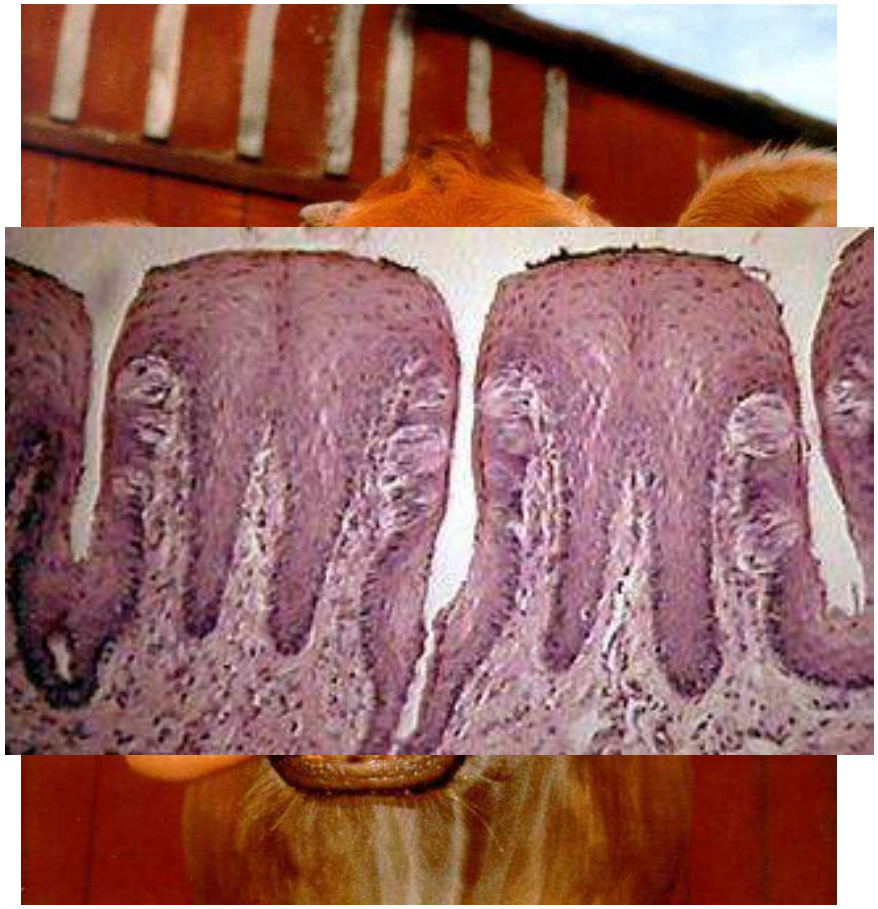
- Sensory receptors are located in our skin
- "Gate-Control Theory" of Pain
  - spinal cord blocks or allows pain signals to pass to brain
  - small nerve fibers "open" the gate
  - large nerve fibers "close" the gate



Taste

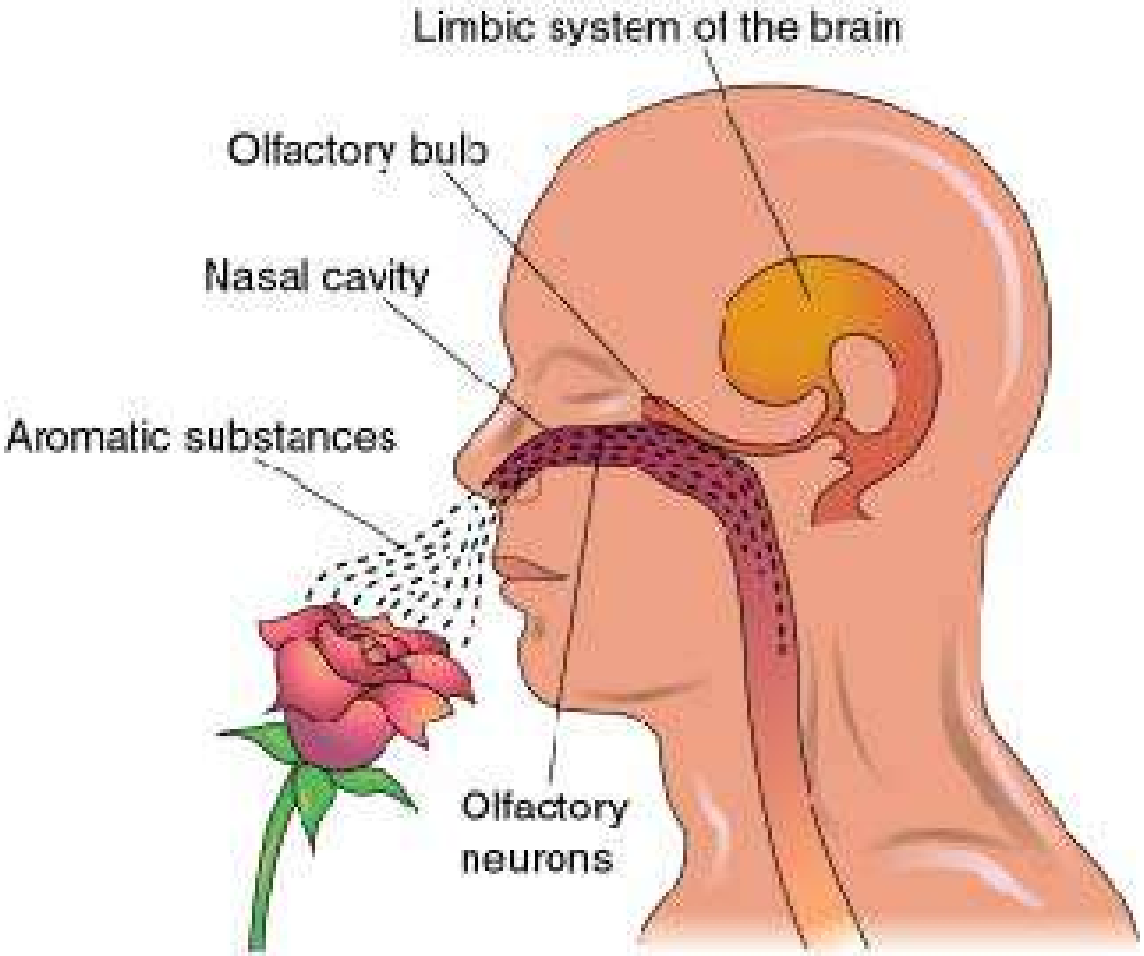
khanacademy

- We have bumps on our tongue called **papillae**.
- Taste buds are located on the papillae (they are actually all over the mouth).
- Sweet, salty, sour, bitter, and umami .
- **Sensory Interaction** – principle that one sense influences others (i.e. – taste & smell)



Olfactory System

Why are smells often involved with emotions?



Kinesthetic Sense

khanacademy

- tells us where our body parts are
- uses receptors located in our muscles, joints, and tendons

You would use kinesthesis to touch the button to make copies of your buttocks.

Vestibular Sense

- tells us where our body is oriented in space.
- our sense of balance.
- located in our semicircular canals and vestibular sacs of the inner ear.

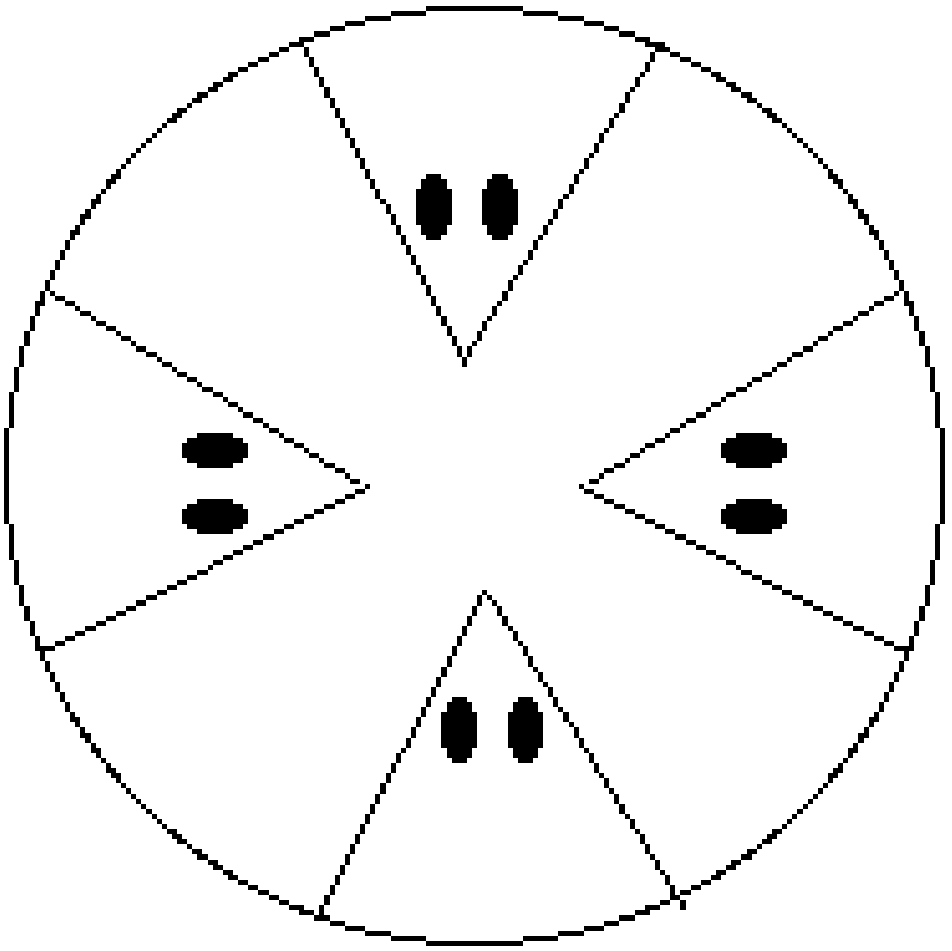
- Vision – Seeing – Visual
- Audition – Hearing – Auditory
- Olfaction – Smelling – Olfactory
- Gustation – Tasting – Gustatory

Perceptual Organization

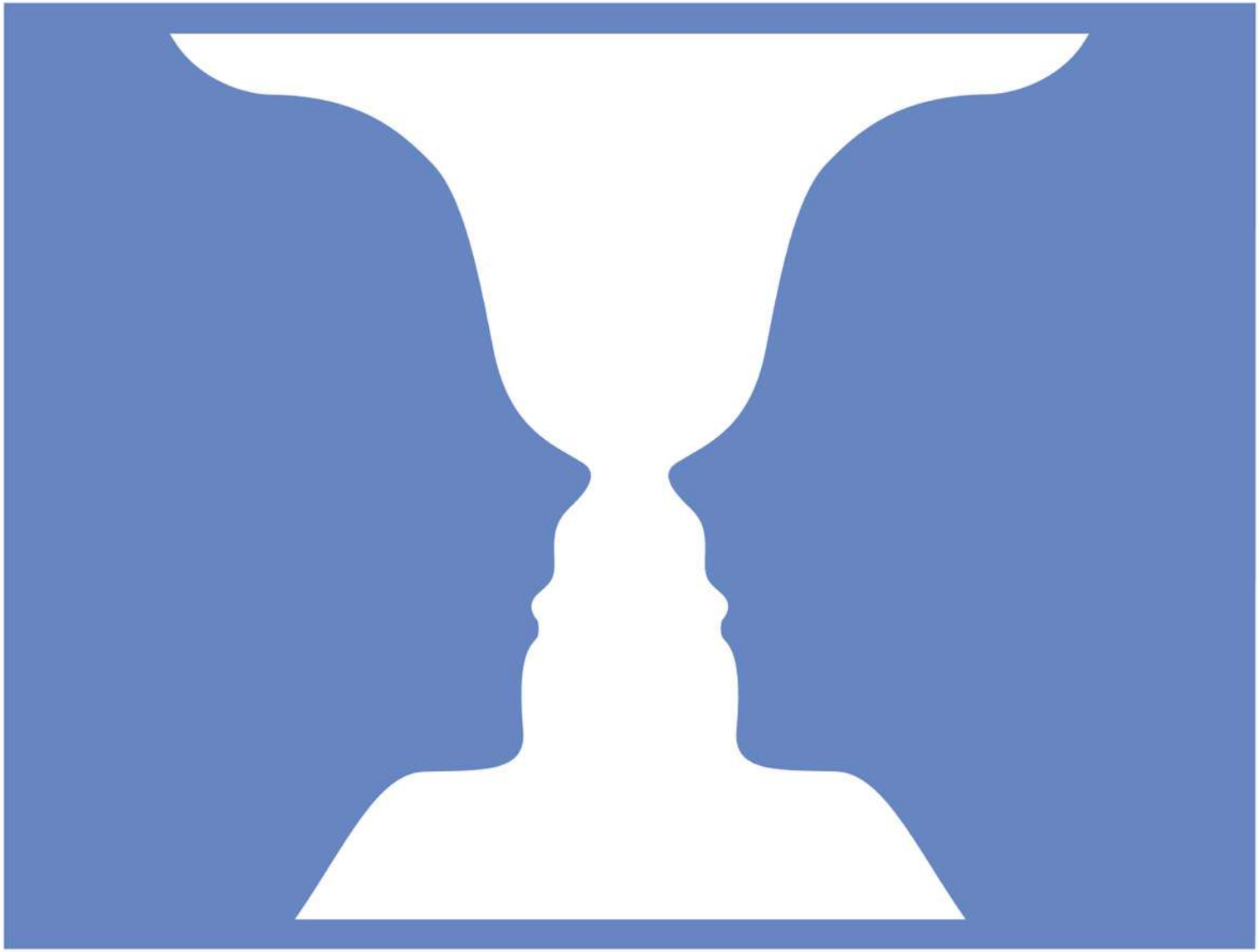
Gestalt means “organized whole”

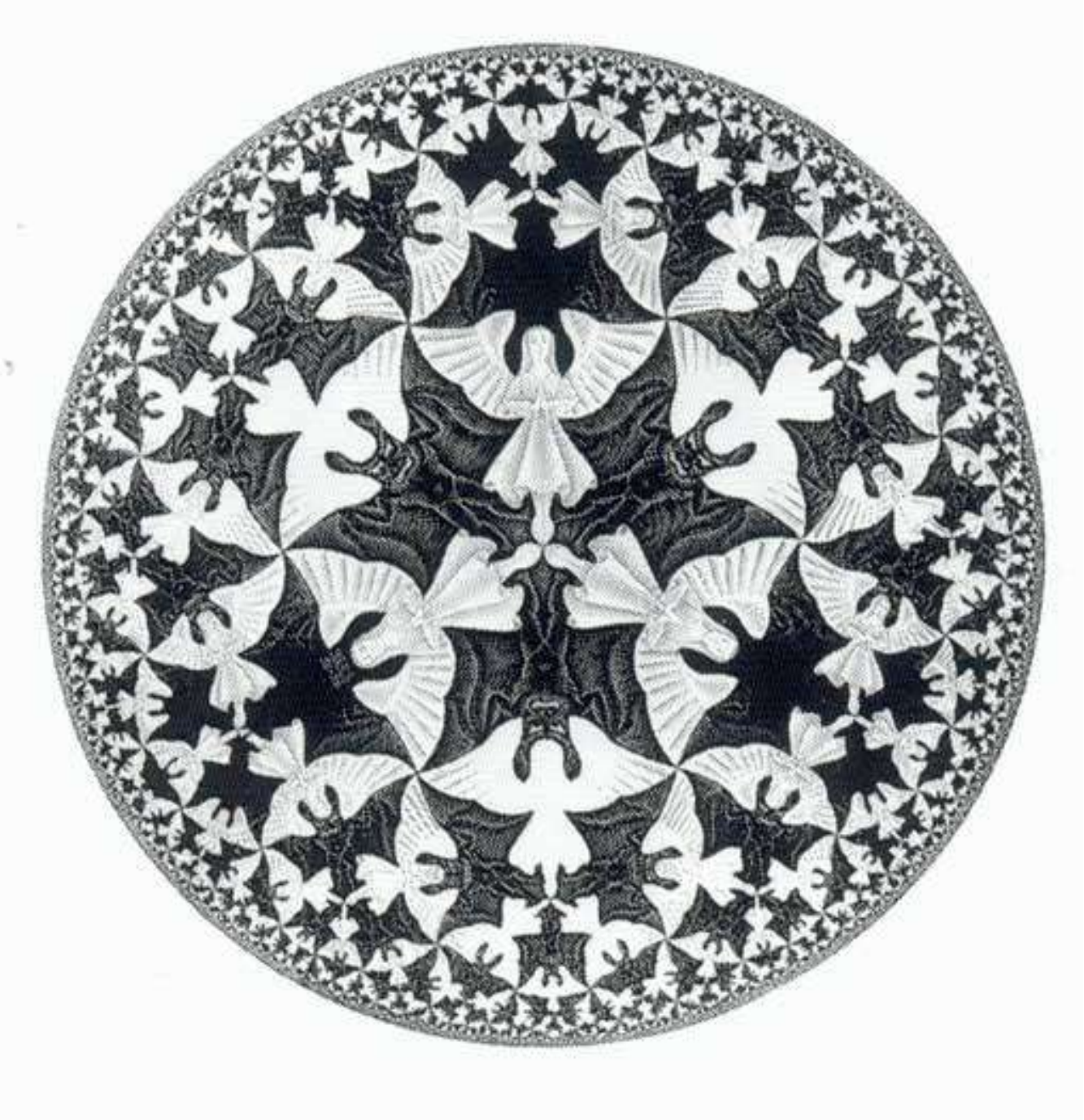
- Gestalt psychologists believe that the organized whole is greater than the sum of its individual pieces of sensory information.
- **Example**: When you see this arrow sign on the highway it appears that the arrow “moves” - you perceive the lights a one unit, not individual parts.
- This is called the **Phi Phenomenon** –
- http://www.yorku.ca/eye/balls.htm

Figure and Ground:



- What do you see?
- How about three ghosts looking down at you?
- This diagram shows the difference between figure and ground.
- The dots are figures and the white background is the ground.
- Gestalt psychologists look at how we focus on either the figure or the ground and how our brains can be fooled.

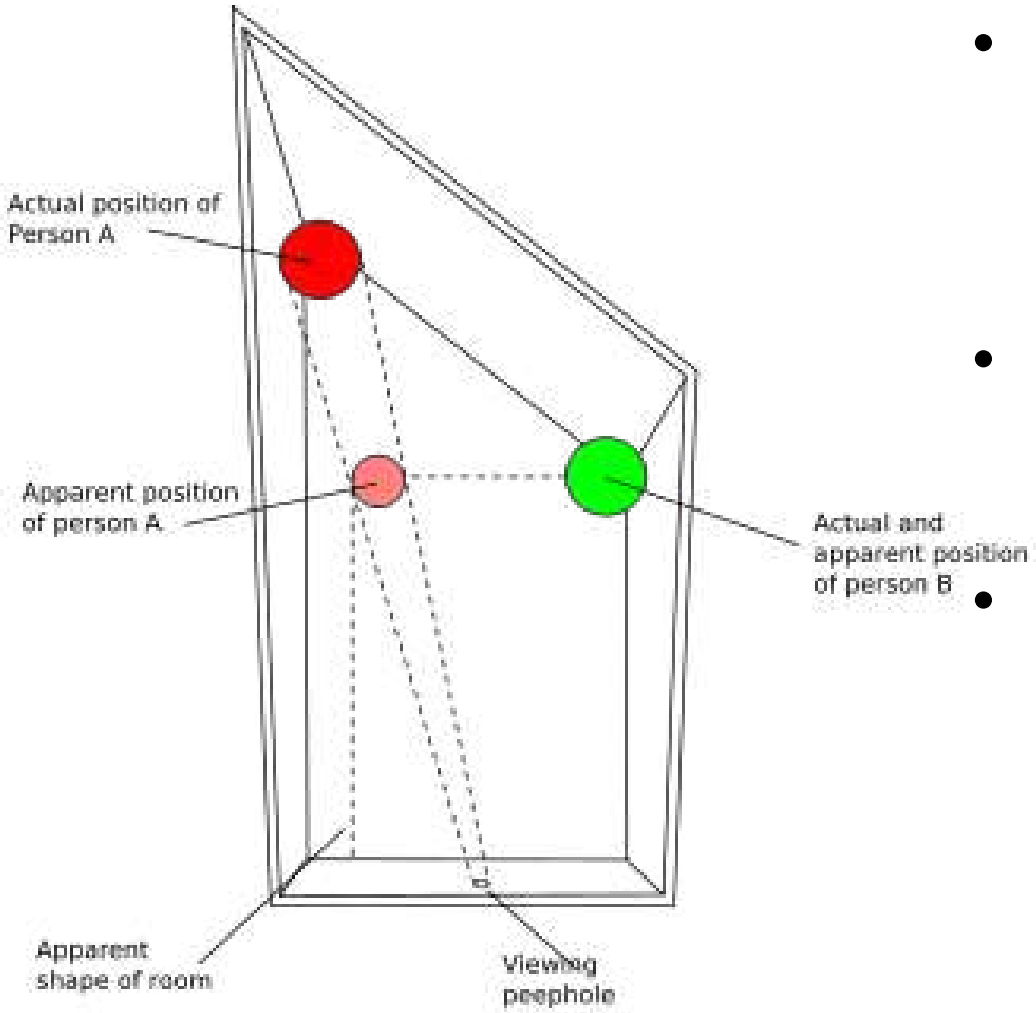




Depth Perception:

- **Depth Perception** – The ability to judge the distance of objects (babies are not good at this)
- We use cues to tell us how far or near objects are from us
- **Binocular Cues:**
- Each eye has a slightly different view of what you are seeing (**retinal disparity**) – Thumbs up!
- Retinal Disparity decreases with distance
- With both eyes open your brain fuses the images (depth perception)
- **Convergence** – look at the tip of your nose with both eyes)
- The closer the object the more convergence

The Ames Room

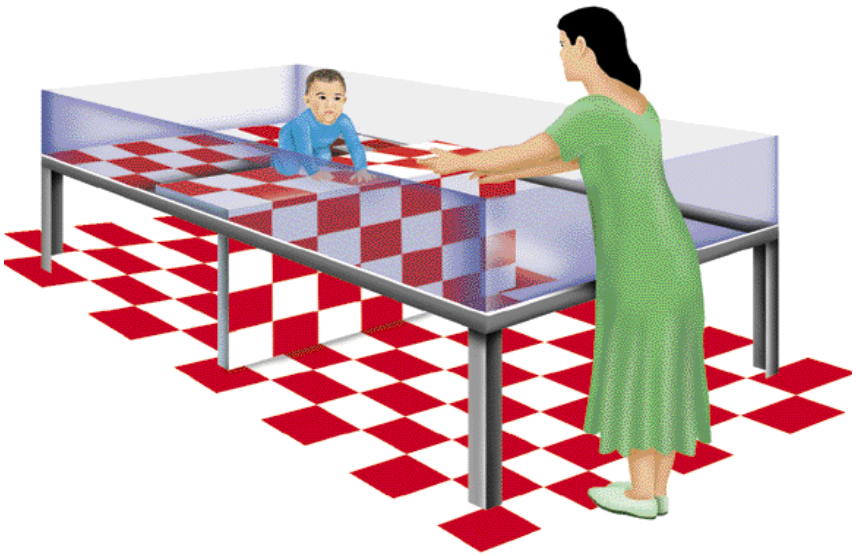


- A specially-built room that makes people seem to change size as they move around in it
- The room is not a rectangle, as viewers assume it is
- The room must be viewed from the correct angle for the illusion to work.

Depth Perception:

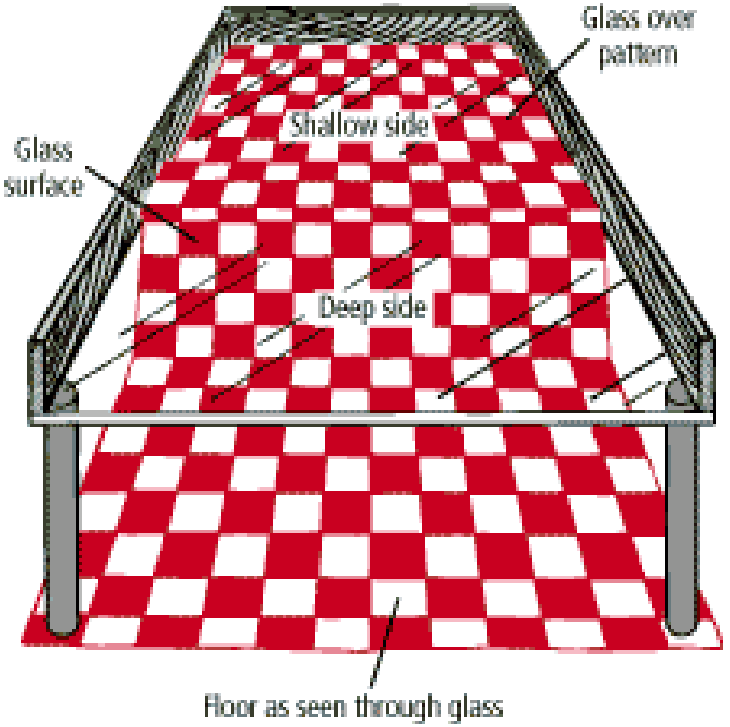
- **Monocular cues** – Involve the image that each individual eye picks up
- Examples:
- **Motion Parallax** – Closer objects seem to be moving faster than those further away - Driving in a car (distance of objects and speed at which they appear to move)
- **Relative Clarity** – Closer objects appear sharper than more distant, hazy objects (road signs)
- **Linear Perspective** – Parallel lines seem to converge in the distance (Ponzo illusion)

The Visual Cliff



- Glass surface, with checkerboard underneath at different heights
  - Visual illusion of a cliff
  - Baby can't fall
- Mom stands across the gap
- Babies show increased attention over deep side at age 2 months, but aren't afraid until about the age they can crawl (Gibson & Walk, 1960)
- http://vimeo.com/77934

The Visual Cliff

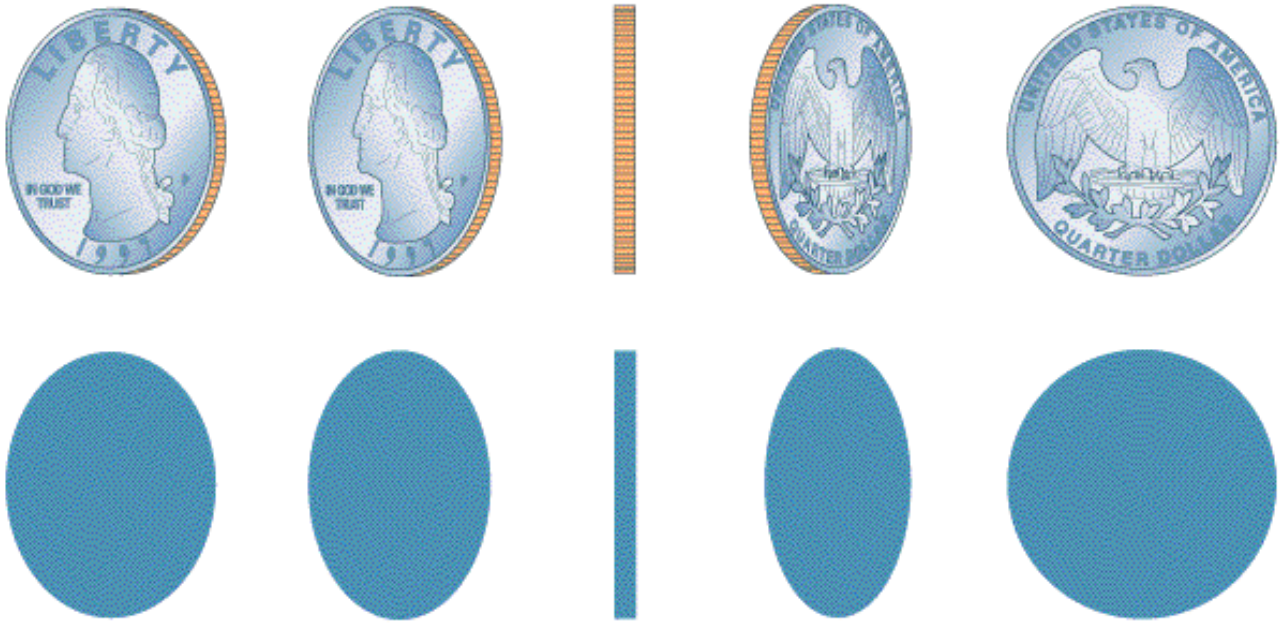


Perceptual Constancy:

- **Perceptual Constancy** – Images "grow" as they approach you even though you know they are the same size (hallway example)
- Example - **Shape Constancy** – object appears to retain normal shape even when viewed from different angles
- We do this with brightness and size as well
- This allows us to identify objects regardless of what our viewing angle is

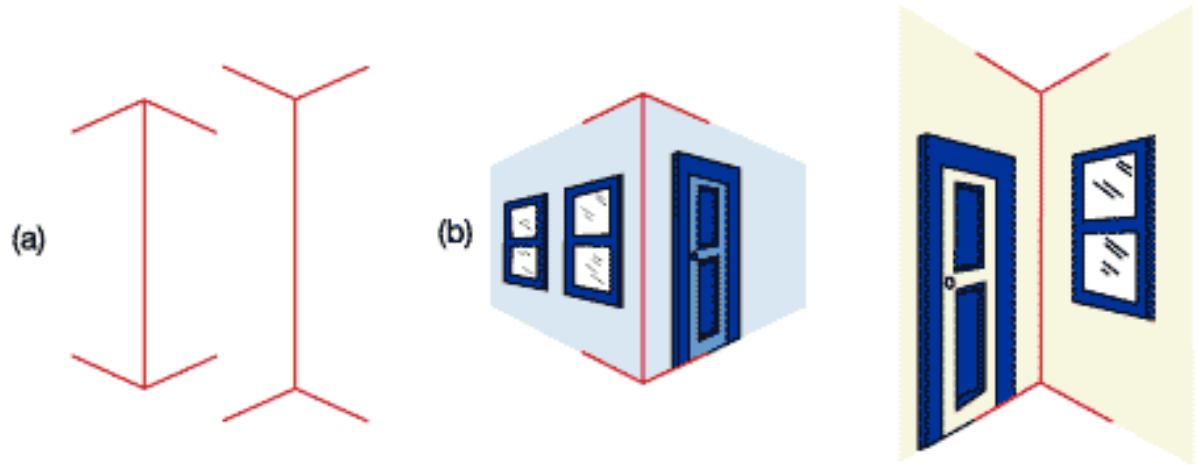
Shape Constancy

- Even though these images cast shadows of different shapes, we still see the quarter as round



Perceptual Set

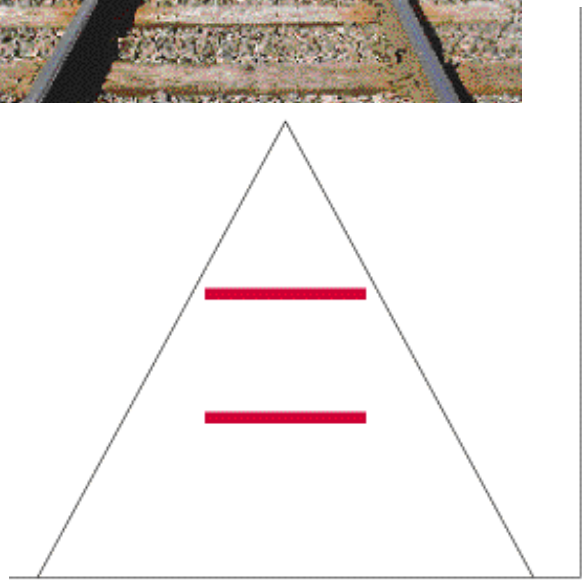
- What you see in the center figures depends on the order in which you look at the figures:
  - If you scan from the left, see an old woman
  - If you scan from the right, see a woman's figure



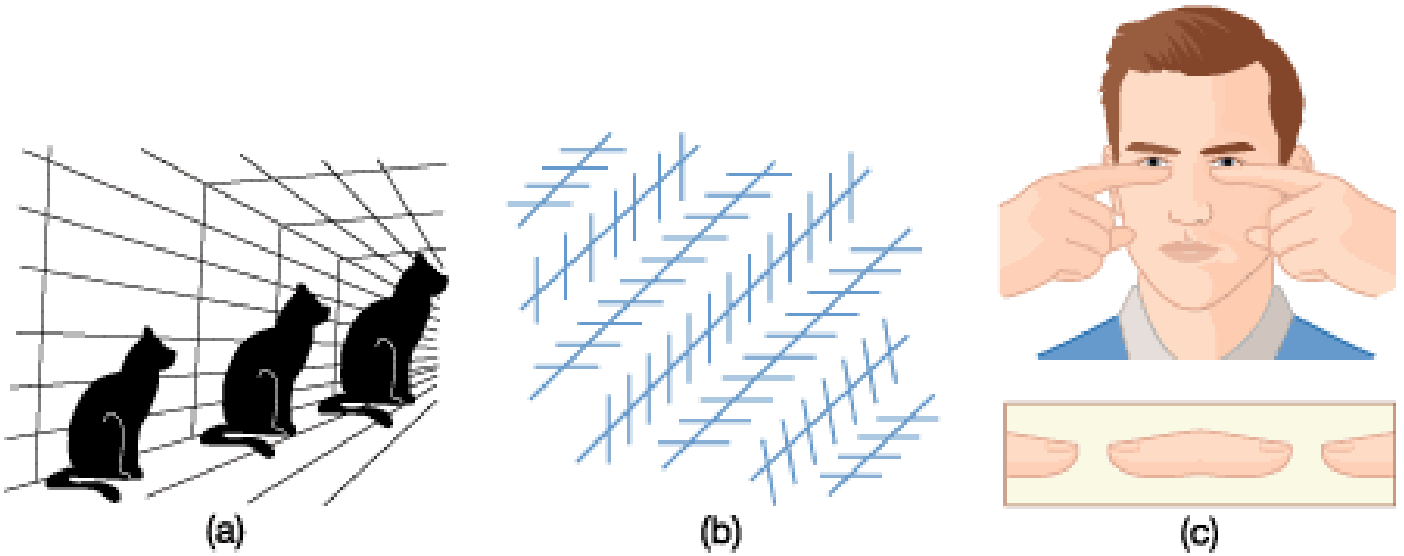
- Illusions are valuable in understanding perception because they are systematic errors.
  - Illusions provide hints about perceptual strategies.
- In the Muller-Lyer illusion (above) we tend to perceive the line on the right as slightly longer than the one on the left.

The Ponzo Illusion

- Linear perspective provides context
- Side lines seem to converge
- Top line seems farther away
  - But the retinal images of the red lines are equal!



Fooling the Eye



- The cats in (a) are the same size
- The diagonal lines in (b) are parallel
- You can create a “floating fingertip frankfurter” by holding hands as shown, 5-10” in front of face.

Julian Beever


Popular-Pics .com
HOTEL

Great Optical Illusion Website:

- http://www.michaelbach.de/ot/

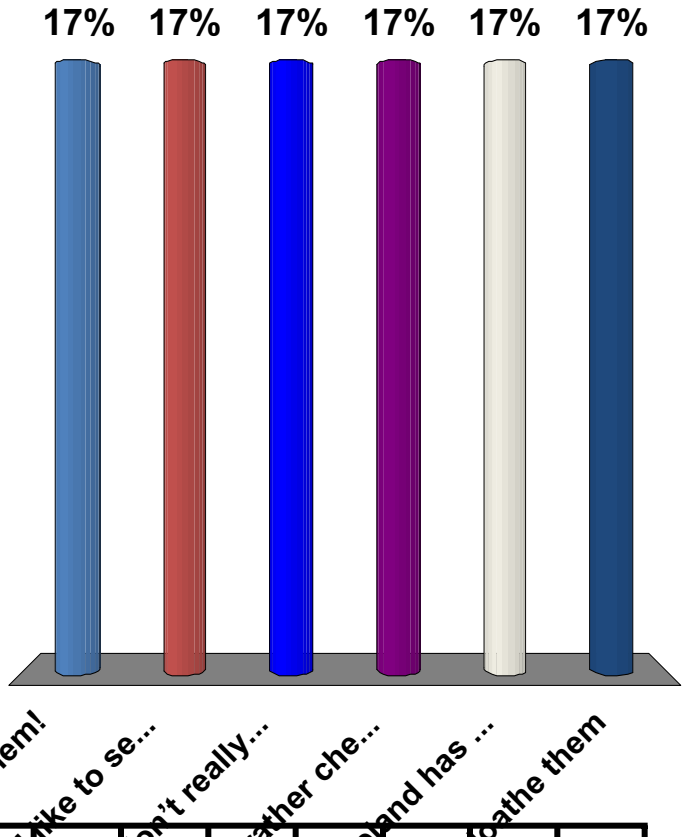
Lesson Five: Objectives

- **By the end of this lesson, I will be able to:**
- 1. Describe sensory processes (e.g., hearing, vision, touch, taste, smell, vestibular, kinesthesis, pain), including the specific nature of energy transduction, relevant anatomical structures, and specialized pathways in the brain for each of the senses.

This is how I feel about the Cleveland Browns:

1. I love them!
2. I'd like to see them win
3. I don't really cheer for them
4. I'd rather cheer for the Steelers
5. Cleveland has a football team?
6. I loathe them

20



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30										73

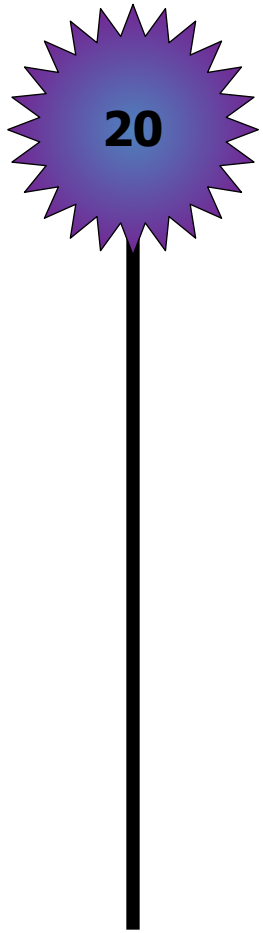
Your sense of Touch:

- **Touch** – the sensitivity to pressure on the skin
- **Somotosensation** – general term used for the four classifications of tactile sensations:
- 1. Touch/pressure
- 2. Warmth
- 3. Cold
- 4. Pain

How does your sense of touch work?

- Transduction!
- Transduction of mechanical energy of pressure/touch and heat energy of warmth/cold occurs at sensory receptors located all over the body just below the skin's surface.
- Lips and fingertips have a greater concentration of sensory receptors.
- Neural fibers carry the sensory information to your spinal cord.
- Then, the info travels up your spinal cord → medulla → thalamus → parietal lobes.

How are your sense of touch and sense of hearing similar?



0%
1. They both have a long process of transmission

0%
2. They both involve transduction

0%
3. They can be unreliable

0%
4. Both 1 and 3

0%
5. None of the above

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30										76

Pain:

- **Why is pain important**? – it alerts you to injury and often prevents further damage.
- Relief from pain results in secretion of endorphins.
- The experience of pain is extremely variable (pain threshold – Lance)

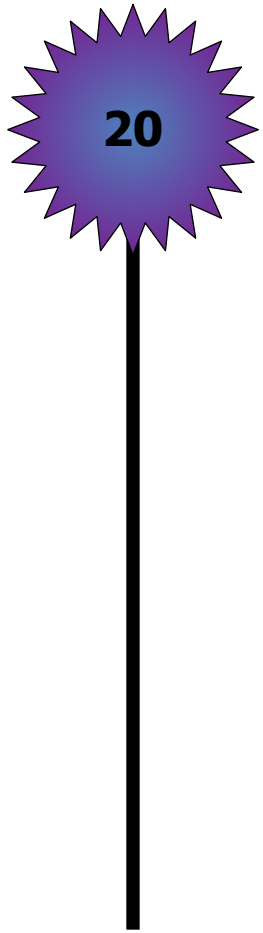
Pain: Part 2

- **Gate-control theory** (Ronald Melzack) – You have a "gate" within your spinal cord that allows you to experience pain.
- Anxiety, depression, and focusing on the pain keep the "gate" open.
- So…if you keep yourself calm, happy, and don't think about it, your perception of pain will be lower than others.

Body Senses: Kinesthesis

- The body senses of kinesthesis and the vestibular system help us to make sense of the positioning of our bodies in our environments.
- **Kinesthesis** – The system that enables you to sense the position and movement of individual parts of your body.
- Sensory receptors for kinesthesis are nerve endings in your muscles, tendons, and joints.

The theory that best accounts for the experience of pain is:



0% 1. The opponent-process theory

0% 2. Weber's law

0% 3. The trichromatic theory

0% 4. The direct perception theory

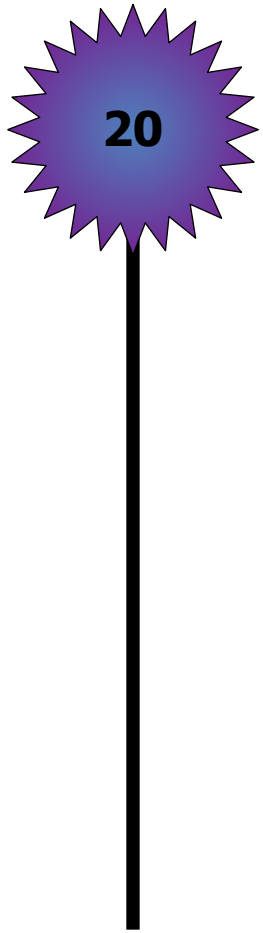
0% 5. The gate control theory

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30										81

Vestibular System (sense):

- **Vestibular System** (sense) – your sense of equilibrium or body orientation.
- How it works:
- Your inner ear has semicircular canals at right angles to each other
- Hair-like receptor cells are stimulated by acceleration caused when you turn your head and the vestibular sacs respond to linear movements.
- Then these calculations are sent to the eye and then the brain for processing.

Receptors for kinesthesis are located in the:



0% 1. Retina

0% 2. Joints

0% 3. Semicircular canals

0% 4. Olfactory epithelium

0% 5. Taste buds

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30										83

Lesson Objectives

- **By the end of this lesson, I will be able to:**
- 1. Describe sensory processes (e.g., hearing, vision, touch, taste, smell, vestibular, kinesthesis, pain), including the specific nature of energy transduction, relevant anatomical structures, and specialized pathways in the brain for each of the senses.

Sense of Smell and Taste:

- **Gustation** – sense of taste
- **Olfaction** – sense of smell
- Both are chemical senses – stimuli are molecules
- We have developed adaptations using these senses for survival (smell of smoke, taste of rotten food)

Sense of Taste:

This pic was titled: “I relish the hamburger bed”

- Taste receptor cells are most concentrated on the tongue in **taste buds** – the roof of your mouth and the opening of the throat also help with taste
- Everyone has a different number of taste buds
- You have five types of taste receptors:
- Sweet, salty, sour, bitter, and umami (savory / flavor)
- Our tongues also have receptor cells that detect touch, pain, cold, and warmth
- The sensory interaction of taste, temperature, texture, and smell determine flavor

Cultural differences:

- Each culture consumes different foods (sometimes drastically different!)
- The United States consumes (by far) the most dairy, meat, and egg products of any country in the world.
- The United States also has (by far) the highest rates of diabetes, heart disease, cancer, and osteoporosis of any country in the world.
- Could it be our food choices? – think of what “American” food looks like

Sense of Smell:

- Odor molecules go high into your nasal cavity and nasal pharynx (links your nose and mouth)
- These odors bind to olfactory receptor sites triggering an action potential.
- Sensory information about smell is then transmitted to the hypothalamus and hippocampus (memory of smells), then to the amygdala to identify any emotional response.


Discovery
EDUCATION