

Jill Compher
Colleyville Heritage High School

Biopsychological Doman - Standard Area: Sensation and Perception

Content Standards

After concluding this unit, students understand:

- The processes of sensation and perception
- The capabilities and limitations of sensory processes
- The interaction of the person and the environment in determining perception

DAY 1: Threshold and Adaptation (48-minute class period)

National Content Standard 1: The processes of sensation and perception

Students are able to (performance standards): 1.1 Explain the concepts of threshold and adaptation
Activities: <ul style="list-style-type: none">• Sensory Adaptation pink paper activity• Febreze NOTICEables activity
TERMS: <u>Content to cover before, during and after the activities:</u> psychophysics, absolute threshold, difference threshold, Weber's Constant, jnd, Fechner's Law, sensory adaptation, habituation, olfaction, olfactory bulb and all anatomy of the nose

Day 2: Interaction of the Senses (48-minute class period)

Content Standard 1: The processes of sensation and perception

Students are able to (performance standards): 1.2 Discuss the processes of sensation and perception and how they interact
Activities: <ul style="list-style-type: none">• Interaction of gustation and olfaction activity• Interaction of vision and audition activity (JFK)
TERMS: <u>Content to cover before, during and after the activities:</u> Gustation, taste qualities, sweet, sour, salty, bitter, umami, chemical senses, taste cells, taste buds, audition, anatomy of the ear, auditory theory, deafness, soundwaves, sinewaves (vision, transduction and visual anatomy covered on previous class period)

DAY 1: Threshold and Adaptation

Objective:

National Content Standard 1: The processes of sensation and perception

Students are able to (performance standards):

1.1 Explain the concepts of threshold and adaptation

Essential Question:

How do threshold and adaptation impact our perception of the world around us?

Timeline:

(1) 48-minute class period. Use this activity after teaching thresholds at the beginning of the Sensation chapter.

Supplies:

Febreze NOTICEables product (or use the YouTube commercial)

One sheet of bright pink paper per student (one class set)

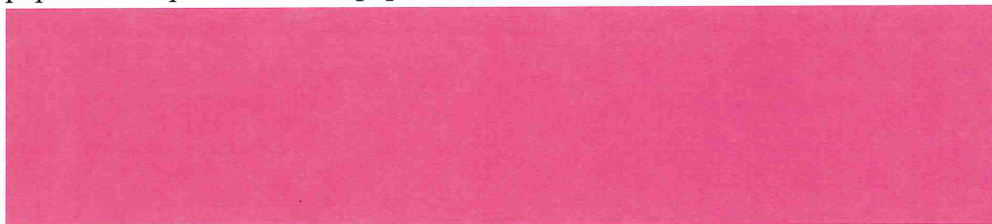
Introduction:

The previous class period, students were introduced to the psychological terminology for the 5 senses, transduction and the idea that we are limited in our understanding of the world by the raw data our 5 sense organs can bring in. The concepts in psychophysics and transduction were connected to the real world in relation to radios, microwave ovens, dimmer switches for Weber's Law, etc.

At the beginning of class, we will discuss Sensory Adaption and Habituation. The Bright Light! Activity serves as the demonstration to anchor learning.

Activity 1: Bright light!

1. Have students turn their pink sheet of paper landscape and cover one half of their pink paper with a piece of white paper.



2. Students should look in the center of pink side for around 30 seconds. Give them encouragement along the way. Their eyes will "get used" to the bright paper because it is unchanging stimuli (sensory adaptation). Extend to afterimages of green on the white board.
3. After 30 seconds, pull off the white paper. There should seem to be a line down the pink paper where one side looks brighter than the other.

Activity 2: Febreze NOTICEables

Introduction: I use this activity to anchor the concept of Olfaction and extend prior learning on sensory adaptation. Complete the activity prior to the content discussion.

1. Have your Febreze NOTICEable plugged in prior to class and have a discussion about the smell in the classroom. If you have students who can't be around smells, show the commercial for the product.

2. Show the YouTube Febreze NOTICEables commercial to the class.

3. Students: You are the director of marketing for Proctor & Gamble. You have to make a pitch to the board of directors to fund your new product called Febreze NOTICEables. Show the board a mock commercial you created. Explain to the board using psychological terminology how you can offer a money back guarantee as well as why they should fund your new product. Make sure to compare how the "other products" works differently than your revolutionary new product. Write down your pitch.

(The device is continuously alternating scents preventing sensory adaptation.)

Activity Follow-up: Teach students the anatomy of the nose and the idea of chemical senses.

Closing: We don't see with our eyes, smell with our nose or hear with our ears, etc. The way raw data our sense organs bring in enable our brain to perceive the world around us.



DAY 2: Interaction of the Senses

Objective:

Content Standard 1: The processes of sensation and perception

Students are able to (performance standards):

- 1.1 Discuss the processes of sensation and perception and how they interact
 - Interaction of vision and audition activity (see JFK activity page)
 - Interaction of gustation and olfaction

Timeline: (1) 48-minute class period.

Essential Question: How does the interaction of our senses change our perception of the world around us?

Introduction: Complete Activity 1 as a learning anchor for the concept of gustation prior to content discussion.

Activity 1: Interaction of Gustation and Olfaction

Supplies:

Mini muffin cups

2 jelly bellies per student

Many teachers use the pear, apple, potato and onion method to demonstrate the interaction of taste and smell. I find this method to be much easier to prepare for 150 students!

1. Have 2 jelly bellies in a mini muffin cup for each student prepared before classes begin. A paper box lid is a great way to contain all of the samples.
2. Student will hold their noses until they talk funny. Demonstrate this!
3. They start chewing both samples at the same time while holding their noses.
4. After a minute, have students unplug their noses.

Closing: Students had no way to prepare for the strange mix of flavors in their mouths and are in shock that they couldn't taste the wacky flavor mixture while holding their noses. Our ability to taste (gustation) is connected to our nose (olfaction). Dispel the myth that there aren't sections of the tongue for the various taste qualities and give an overview of the anatomy of the tongue, taste cells and taste buds. Connect to the concept of Olfaction from yesterday.

Activity 2: Interaction of Audition and Vision (see attached JFK activity sheet)

Introduction: Complete Activity 2 as an anchor to connect learning to Audition and the interaction of Vision and Audition.

Supplies: spinning chair & blindfold

It is helpful to have a picture of JFK Jr. as well as what instrument trained pilots look at in a cockpit.

Activity: See attached JFK Jr. Activity Sheet

Discussion: Discuss the anatomy of the ear and auditory transduction. A helium balloon can also be used to demonstrate physical movement, fluid in the ears moving and the bending of hair cells (balloon moving the opposite direction while walking forward). If time allows, continue with Auditory theories and deafness.

Closing: Our perception of the world is limited based on the raw data eyes and ears can bring in and relies heavily on our senses working in conjunction with one another. We need both our eyes and ears working together to accurately perceive our surrounding and our bodies relationship to the environment.

Day 2: activity 2

Content Standard 1: The processes of sensation and perception

Students are able to (performance standards):

1.1 Discuss the processes of sensation and perception and how they interact

SENSATION/PERCEPTION: WHAT PROBABLY KILLED JFK JR.

Objectives: Students will understand the physiology of balance and motion and will apply this knowledge to explain why perception of motion may sometimes be inaccurate.

Vocabulary

Vestibular System

Semicircular canals

lateral

posterior

superior

Hair cells

Auditory nerve

Vertigo

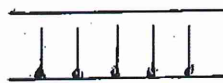


No motion - hair cells
send no message



Initial motion
Hair cells are bent,
send motion signal

Fluid accelerates
slower than SCC



Continued motion -
fluid catches up to the speed
of the SCC - sensation is
no motion



Deceleration - fluid continues
faster than SCC, sensation is
motion in the opposite direction

Equipment needed:

Stool that spins - preferably with foot and armrests (and no squeaks)

Blindfold(s) - a roll of paper towels works fine

Remind audience to remain silent. Their noise may give away direction or motion

Have the student on the stool hold onto the seat or armrests for security

Have a reliable student stand close as a spotter (in addition to yourself)

Instruct the student on the stool to give **constant information** about their motion:
"turning left", "still turning left", "slowing down", "stopped", etc.

Slowly spin the student at a steady speed until they report "slowing" or "stopped" - then stop the motion. Remove the blindfold when the student is reporting an error in perception.

For a wilder "ride", have the student tilt their head forward and to the side while turning. When they report an error in perception, stop the chair and have them straighten their head. Get ready to catch them and remove the blindfold. They may feel very unstable.

Explain that without visual reference, we can easily become confused as to direction of motion or even the existence of motion at all. This is why pilots **must** trust their instruments when there are no visual references in the clouds or at night. The same confusion can also occur when in deep water.

Don Kreider
Longview High School

Sensation & Perception

Jill Compher Colleyville Heritage High School – Colleyville, TX

IV. Sensation and Perception (6-8%)

Everything that organisms know about the world is first encountered when stimuli in the environment activate sensory organs, initiating awareness of the external world. Perception involves the interpretation of the sensory inputs as a cognitive process.

AP students in psychology should be able to do the following:

- Discuss basic principles of sensory transduction, including absolute threshold, difference threshold, signal detection, and sensory adaptation.
- Describe sensory processes (e.g., hearing, vision, touch, taste, smell, vestibular, kinesthesia, pain), including the specific nature of energy transduction, relevant anatomical structures, and specialized pathways in the brain for each of the senses.
- Explain common sensory disorders (e.g., visual and hearing impairments).
- Describe general principles of organizing and integrating sensation to promote stable awareness of the external world (e.g., Gestalt principles, depth perception).
- Discuss how experience and culture can influence perceptual processes (e.g., perceptual set, context effects).
- Explain the role of top-down processing in producing vulnerability to illusion.
- Discuss the role of attention in behavior.
- Challenge common beliefs in parapsychological phenomena.
- Identify the major historical figures in sensation and perception (e.g., Gustav Fechner, David Hubel, Ernst Weber, Torsten Wiesel).

Sensation & Perception (6-8%)

- **Sensation**
 - The stimulation of sensory receptors and the transmission of sensory information to the central nervous system
- **Perception**
 - The process by which sensations are organized into an inner representation of the world

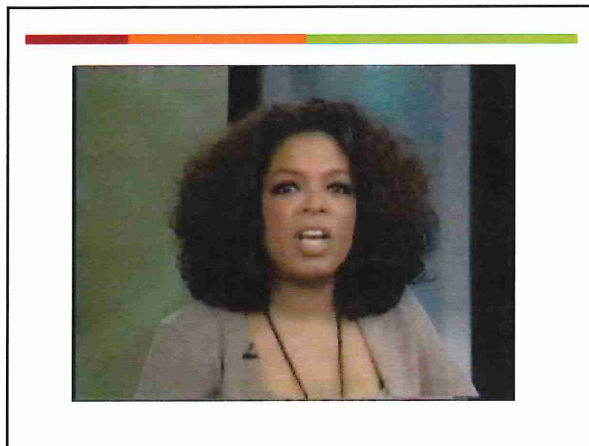
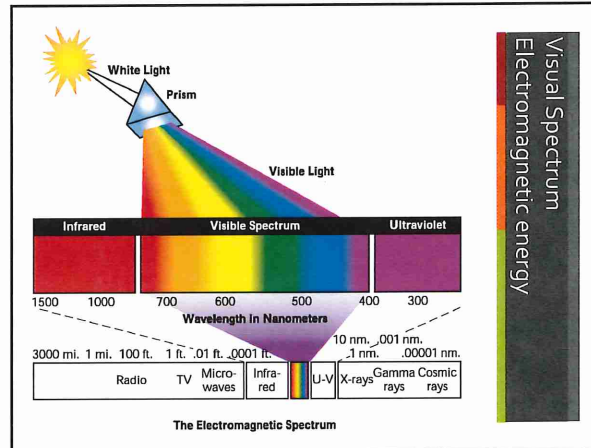
Sensation – Processes whereby stimuli from the environment is brought into the body by one or more of the 5 senses.

Perception – process whereby the raw data sent from the 5 senses is organized and interpreted and responded to by the brain.

SENSE	Environmental Stimuli	Organ
Touch		
Smell	Gas from substances from environment	
Taste		
Sight		
Hear	— sound waves	Basilar membrane of the Organ of Corti on part of the chamber of the cochlea

Sensation – Processes whereby stimuli from the environment is brought into the body by one or more of the 5 senses.			Perception – process whereby the raw data sent from the 5 senses is organized and interpreted and responded to by the brain.		
SENSATION					
SENSE	Environmental Stimuli	Organ			
Touch – TACTILE:	temp, pressure, touch	skin			
Smell – OLFACTORY	chemical from environment Gas from substances	nose epithelium of olfactory bulb			
Taste – GUSTATORY	chemicals	tongue Taste cells on taste buds			
Sight – VISUAL	Light waves in the form of electromagnetic Energy – visible light	eye rods & cones on retina Photoreceptor cells			
Hear – AUDITORY	soundwaves – sinewaves Expansion / compression of air	ear Basilar membrane of the Organ of Corti on part of the chamber of the cochlea			

Chart credit: Kay Minter - Westwood High School



Psychophysics

- **Absolute threshold**
 - Minimal amount of energy that can produce a sensation
 - Method of constant stimuli
- **Difference threshold**
 - Minimal amount of intensity required between 2 sources of energy so that they are perceived as different
- **Weber's constant (law)** – size of the jnd is a constant proportion of the size of the initial stimulus. (1/60th)
 - 1st quantitative law in psychology
- **Just noticeable difference (jnd)**
- **Fechner's law** – magnitude of a sensory experience is proportional to the number of JNDs that is stimulus is above the absolute threshold

Psychophysics

- **Sensory adaptation** – gradual decline in sensitivity to a stimulus – constant unchanging stimulation
 - Bad smell in the house – eventually you don't smell it anymore
- **Habituation** – decrease in responsivity at the neural level due to repeated stimulation. Any change in the stimulus brings a different *perception*.

"seeing"

- **Accommodation** – lens changing shape to focus on an object
- **Convergence** – eyeballs rotating in their sockets to get the same image on the fovea of each eye

Vision

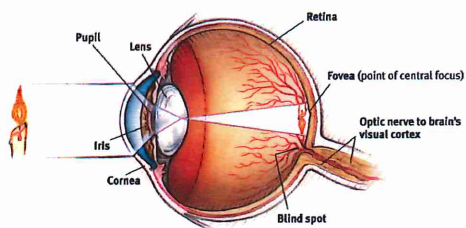


Image from Myers 8th edition – current classroom edition

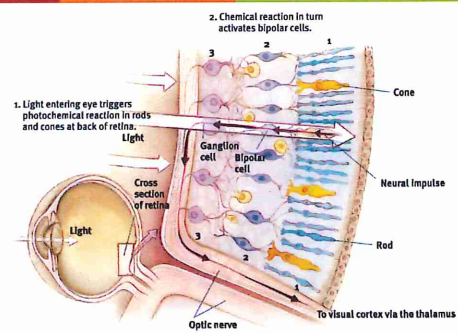


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Color Vision

- **Trichromatic theory (Young-Hemholtz)**
 - Red, green, blue
 - The eye has three groups of receptors sensitive to wavelengths associated with red, green, and blue.
- **Opponent-process theory**
 - Red-green, Blue-yellow, Intensity
 - Receptors make antagonistic responses to three pairs of colors.
 - Only theory that explains afterimages and color blindness
- Conclusion: Both theories are necessary to explain color perception.

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Additive & Subtractive Color

Additive

Subtractive

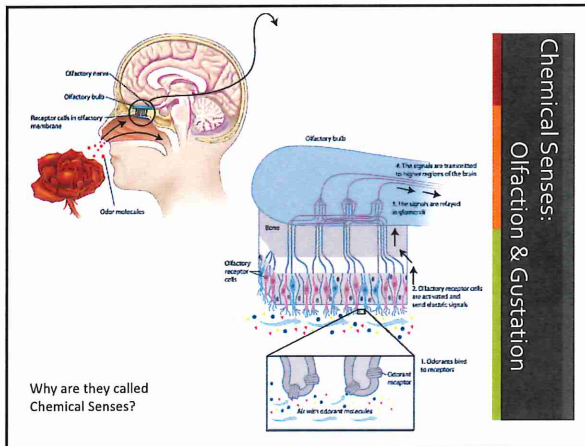
Color Blindness

- **Trichromat**
 - Normal color vision
- **Monochromat**
 - Black and white only
- **Dichromat**
 - Red-green or blue-yellow

Light Waves

Vary in: **Which affects perception of:**

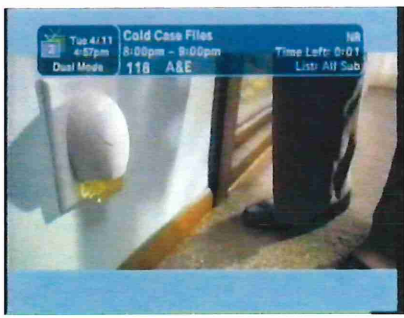
Amplitude	Brightness
Wavelength	Color (hue)
Purity	Saturation



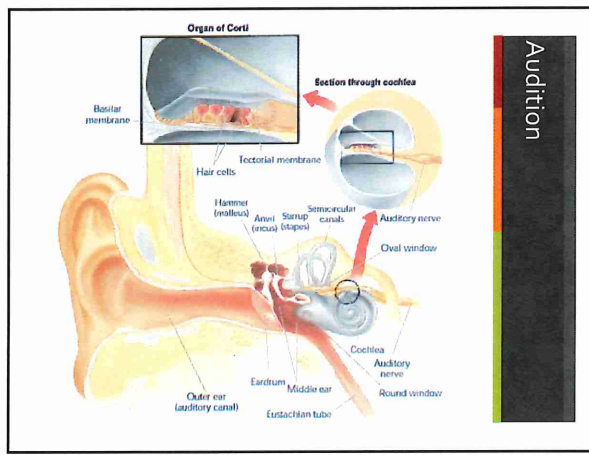
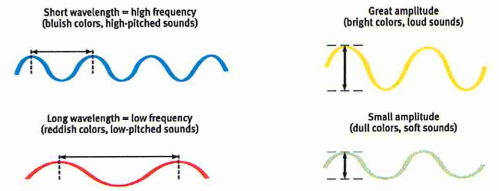
Febreze NOTICEables

- You are the director of marketing for Proctor & Gamble. You have to make a pitch to the board of directors to fund you new product called Febreze NOTICEables.
- Explain to the board using psychological principles how you can offer a money back guarantee as well as why they should fund your new product.

Febreze NOTICEables



Vision & Audition Perception



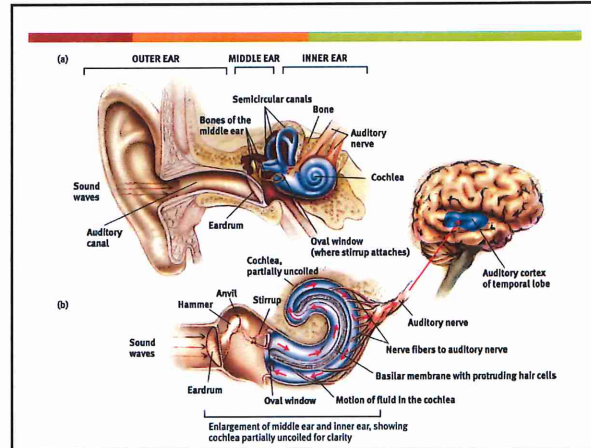
Audition



Cockpit 747

Sound waves

Vary in:	Which affects perception of:
Amplitude	Loudness
Wavelength	Pitch
Purity	Timbre



Connection: Audition & Vision

Fluid →

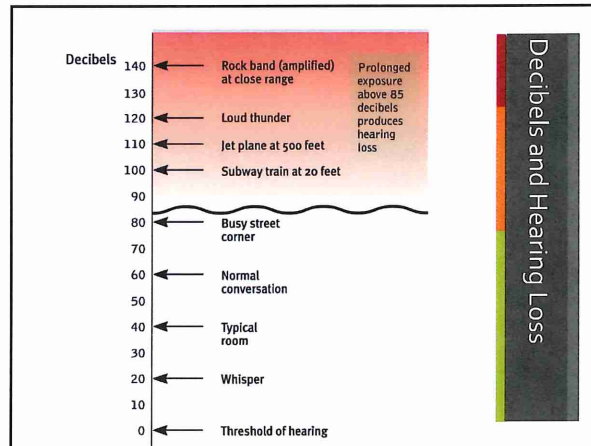
No motion - hair cells send no message

Fluid accelerates slower than SCC

Initial motion
Hair cells are bent, send motion signal

← Continued motion - fluid catches up to the speed of the SCC - sensation is no motion

Deceleration - fluid continues faster than SCC, sensation is motion in the opposite direction



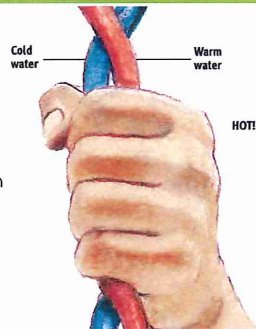
Auditory Theories

- **Pitch and loudness**
 - Hertz
 - Decibels
- Locating sounds
- Perception of loudness and pitch
 - **Place theory**
 - Perception of pitch depends on the portion of the basilar membrane vibrated.
 - **Frequency theory**
 - holds that perception of pitch depends on the basilar membrane's rate of vibration.

Deafness

- **Conductive deafness** – damage to the mechanical system that conducts sound waves to the cochlea.
 - Less common
- **Sensorimotor deafness** – damage to the cochlea's receptor cells or to the auditory nerves (nerve deafness) – illness, age, prolonged exposure

Tactile



- Temperature, Pressure and Pain
- Temperature = Warm and Cold

Other Senses

- **Kinesthesia**
 - The sense that informs us about the positions and motion of parts of our bodies
 - Receptors in ligaments, tendons & joints
- **Vestibular sense**
 - The sense that informs us about our bodies' position relative to gravity
 - Receptors in semicircular canals

Top-down / Bottom-up Processing



Top

bottom

bottom

bottom

Top-down & Bottom-up Processing

Perceptual Constancies

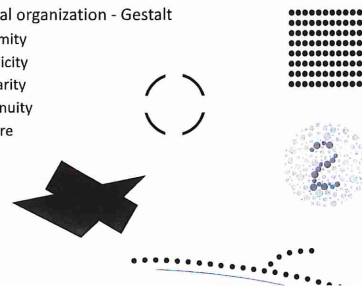
- Size constancy
- Color constancy
- Brightness constancy
- Shape constancy



Visual Perception

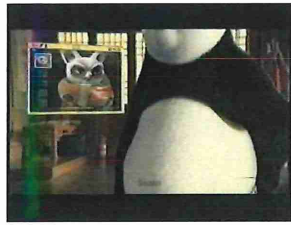
➤ Perceptual organization - Gestalt

- Proximity
- Simplicity
- Similarity
- Continuity
- Closure



Perception of Movement

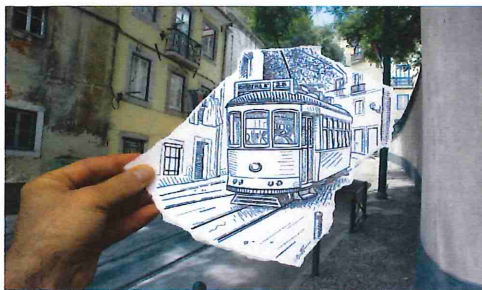
- **Autokinetic effect** – stationary point of light in a dark room as moving
- **Stroboscopic motion** – stationary images presented in rapid succession
- **Phi phenomenon** – sequential presentation of visual stimuli



Depth Perception

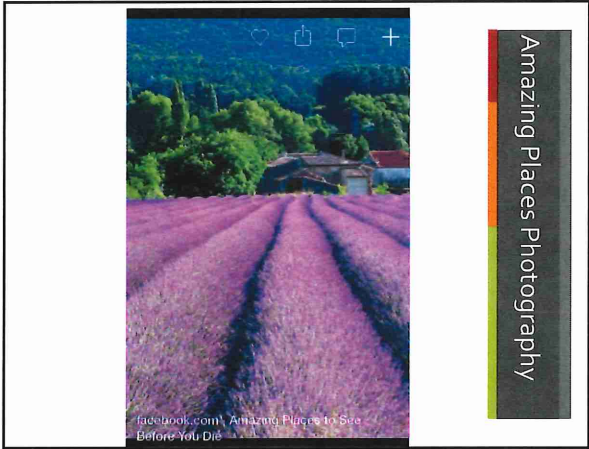
- **Monocular cues**
 - **Relative size** – we assume objects are the same size – The object with the smaller image on the retina is perceived as farther away
 - **Interposition** – object that overlap seem closer
 - **Light and shadow** – nearer objects reflect more light – darker objects seem farther away
 - **Texture gradient** – Close: rough/coarse Far: smooth
 - **Linear Perspective** – Parallel lines recede and appear to converge with distance

Ben Hein: *Pencil vs. Camera*

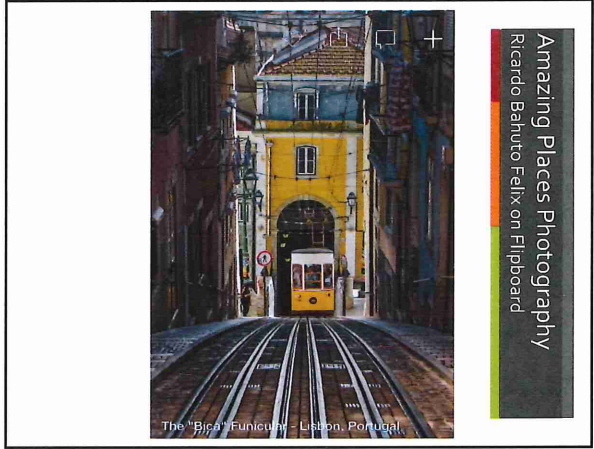


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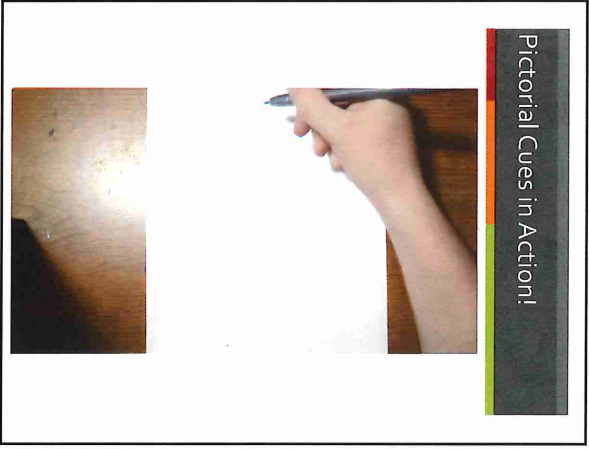




Amazing Places Photography



Amazing Places Photography
Ricardo Bahuto Felix on Flipboard



Pictorial Cues in Action!