COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

Science of Psychology

PSY W1001 Section 2
MW 8:40-9:55 Fall 2012

Monday, September 24

Sensation and Perception

Announcements

- Experimental Participation
  - If you will not or cannot participate in experiments please contact me by the end of this week.
    - Details are posted on Courseworks
- Technical difficulties
  - All short answer questions submitted by 5pm tonight will receive full credit
    - Grading notes
- Any questions from last lecture?

What do we need to do with all this stuff?

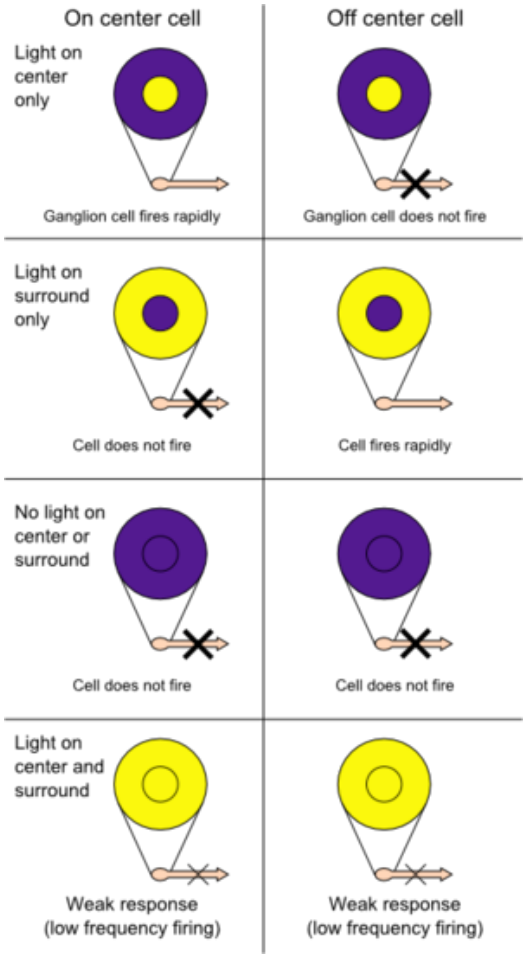
- Making sense of our environment

- What changes?
- What remains the same?

- The effort of perception
  - Taking advantage of the properties of the environment.

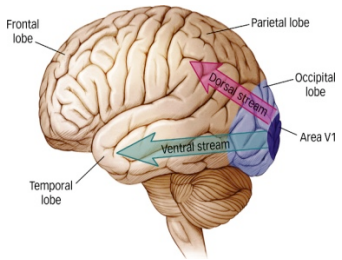
Color Perception

- Brain organization and color
  - Trichromatic theory
  - Opponent Process theory
    - Image after-effects
- Which theory is correct?
  - It depends on where you look
    - Retina vs. Center-surround receptive fields



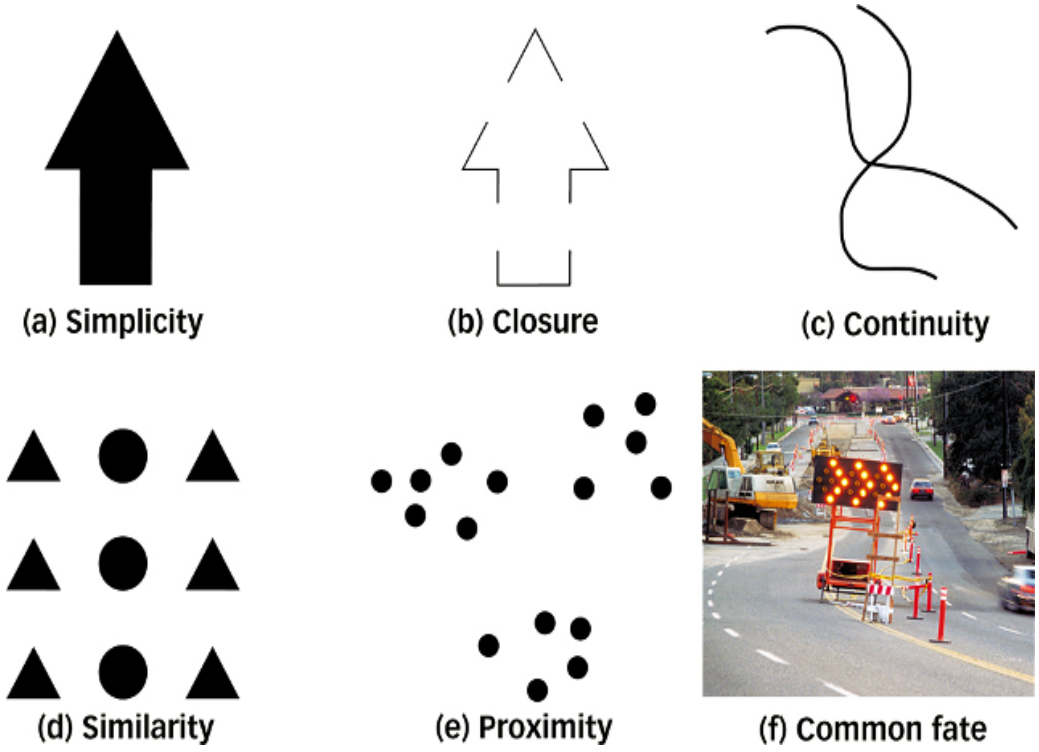
Recognizing Objects by Sight

- Visual-form agnosia
  - The importance of object recognition
    - without it, all information would require effortful processing
- Motion Blindness
- Feature detectors
  - modular view (specialized cells?)
    - Hand cells
  - distributed representation (pattern of activity)
    - Patterns of brain activation

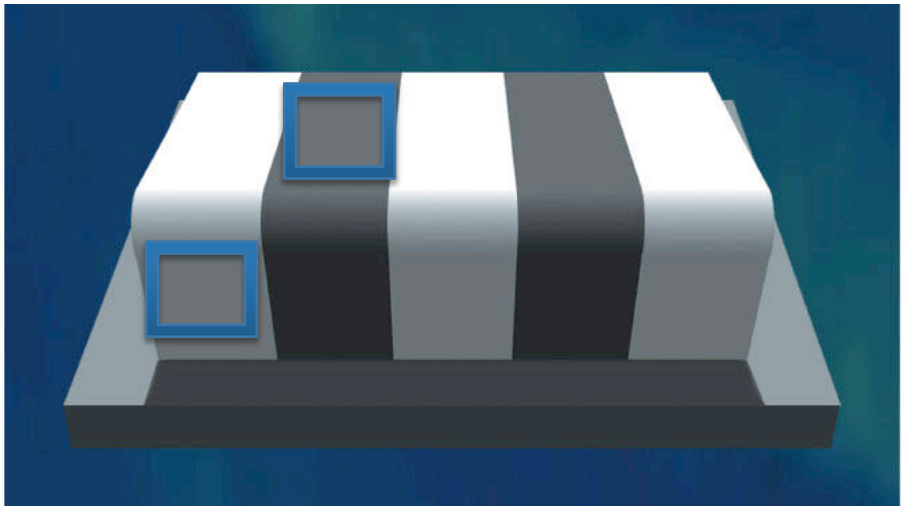


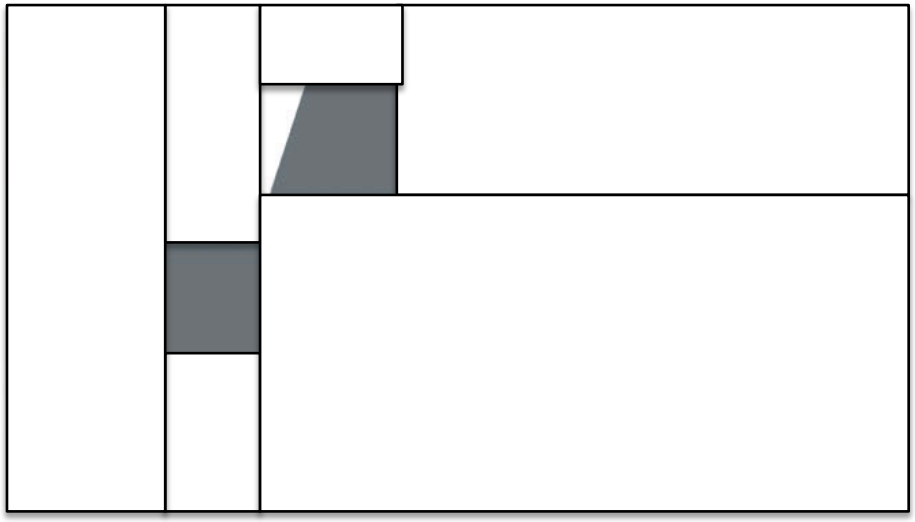
Principles of Perceptual Organization

- Before object recognition can occur, grouping of images must occur
- Gestalt perceptual grouping rules



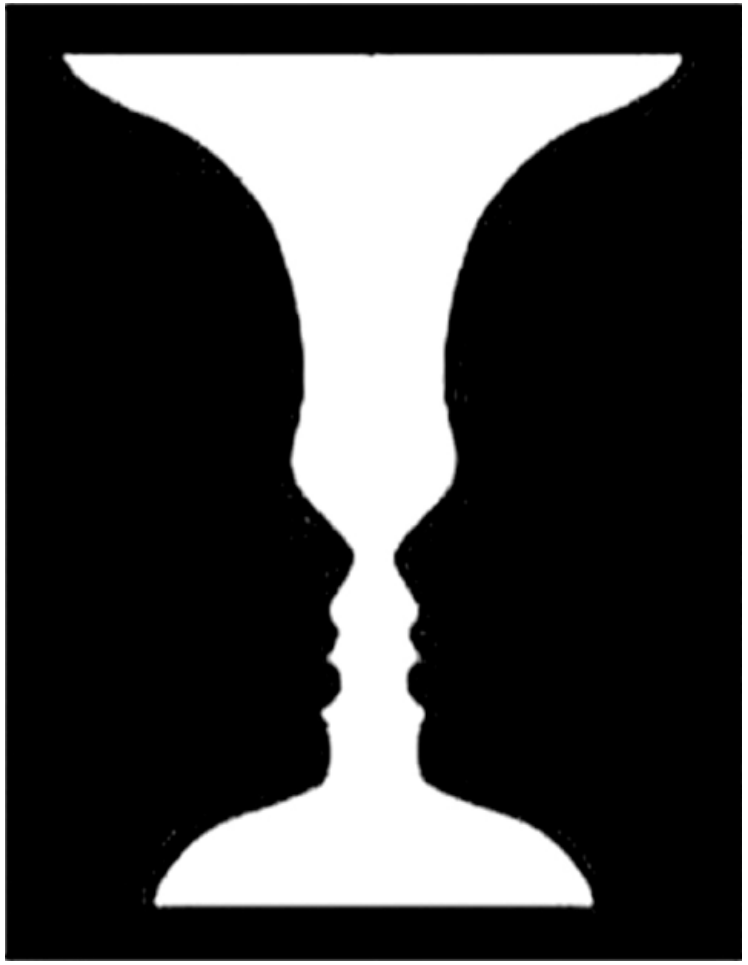
Perception of Constancy





Principles of Perceptual Organization

- Grouping involves visually separating an object from its surroundings
- Separating "figure" from "ground"
  - size
  - edge assignment



Perceiving Depth and Size

- Monocular cues to depth
  - Linear perspective (a)
  - Texture gradient (b)
  - Interposition (c)
  - Relative height in the image (d)

(a)

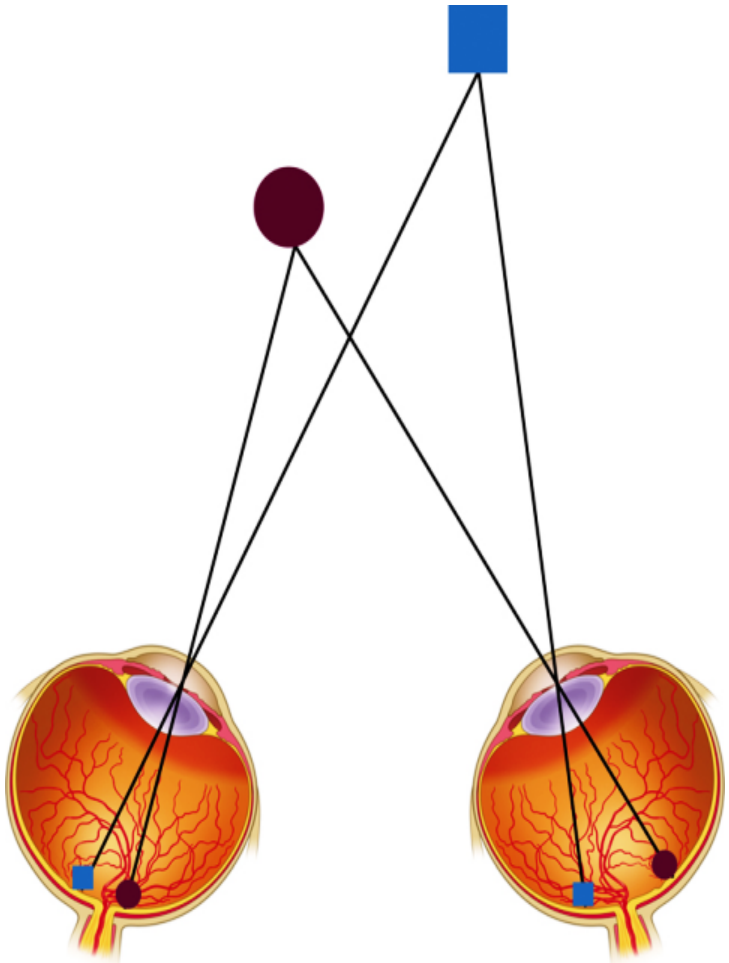
(b)

(c)

(d)

Perceiving Depth and Size

- Binocular depth cues
  - binocular disparity
  - having space between the eyes means that each eye registers a slightly different view of the world
  - the difference in these views provides the brain with important and direct information about depth

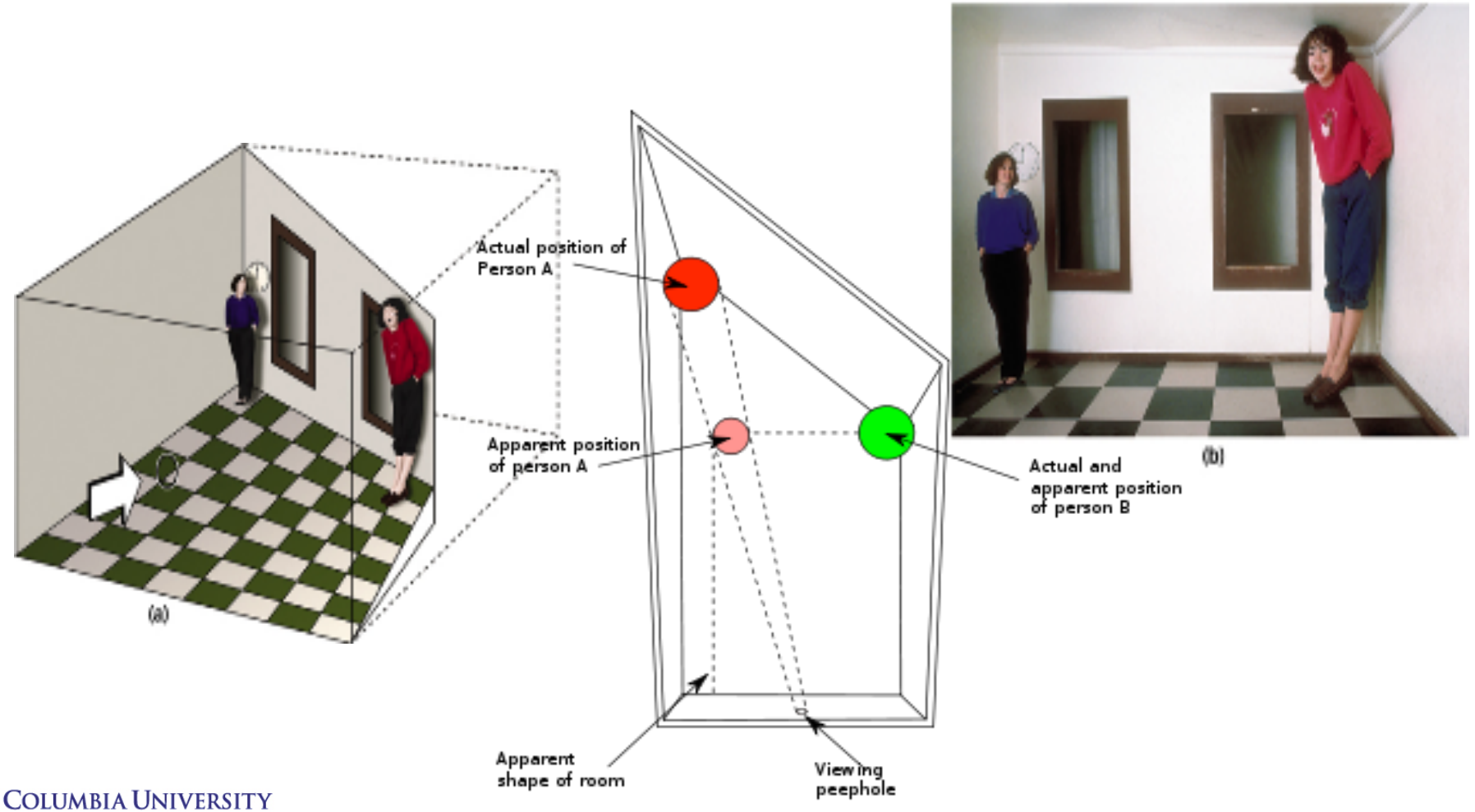


Illusions as Evidence

- What can visual illusions tell us about sensation vs. perception?
  - What are the common properties
  - "Rules" of perception

Illusions of Depth and Size

- Ames Room



Perceiving Motion

- Waterfall effect
  - Demonstration

- Apparent motion
  - Demonstration

Perception is not the same as sensation

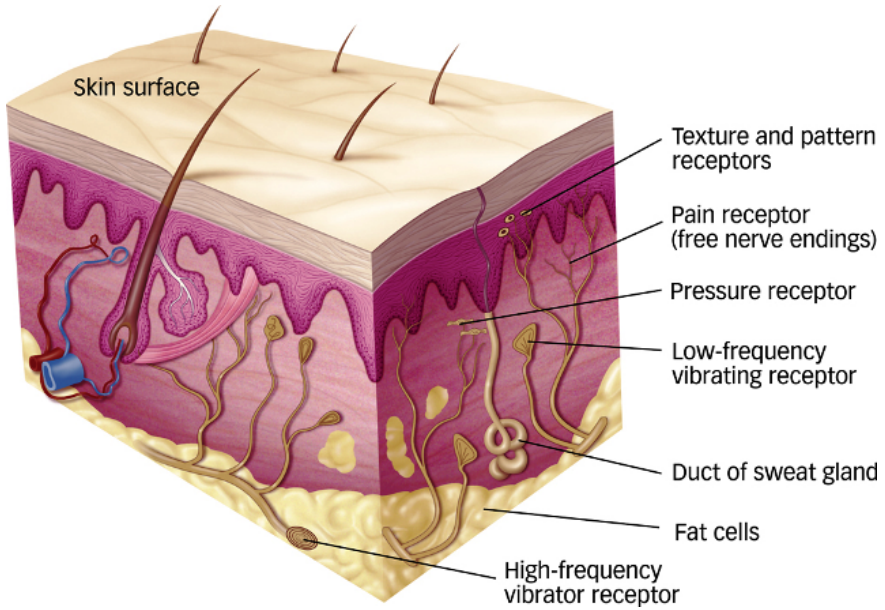
- Sensation is the conversion of the energy
- Perception is the interpretation for use in our world

- Shortcuts for perception
- Errors can result

- Does it matter?

Pain

- Adaptive necessity of pain
- Mechanism:
  - A-delta fibers (fast acting pain)
  - C fibers (longer lasting pain)
- Referred pain
  - Convergence in the Spinal Cord

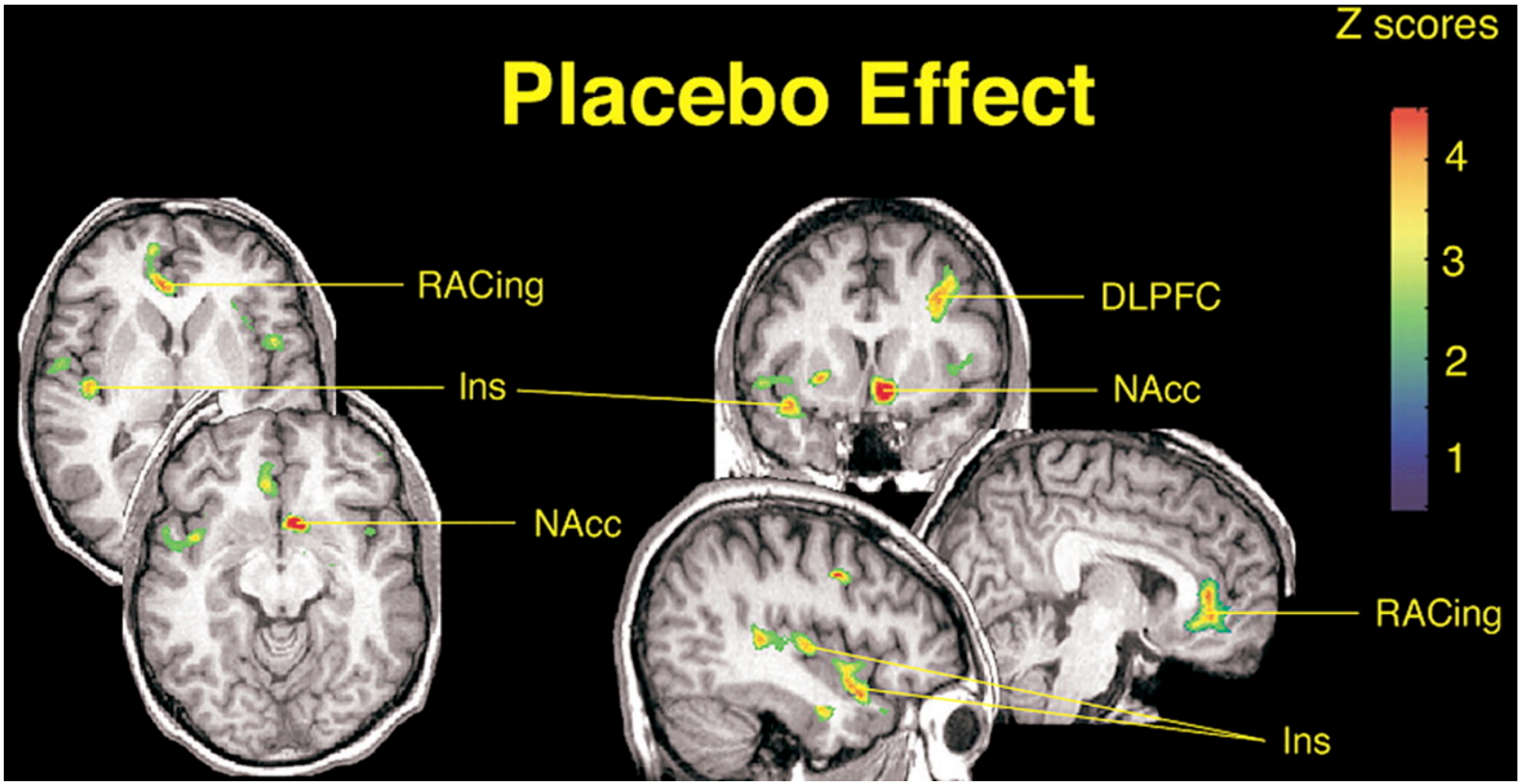


Placebo Effects

Or, how to remove a wasp stinger from the hand of a 4 year old when you're in the woods with no topical anesthetic……

Is the placebo effect all in your head?

Yes, it's all in your head!



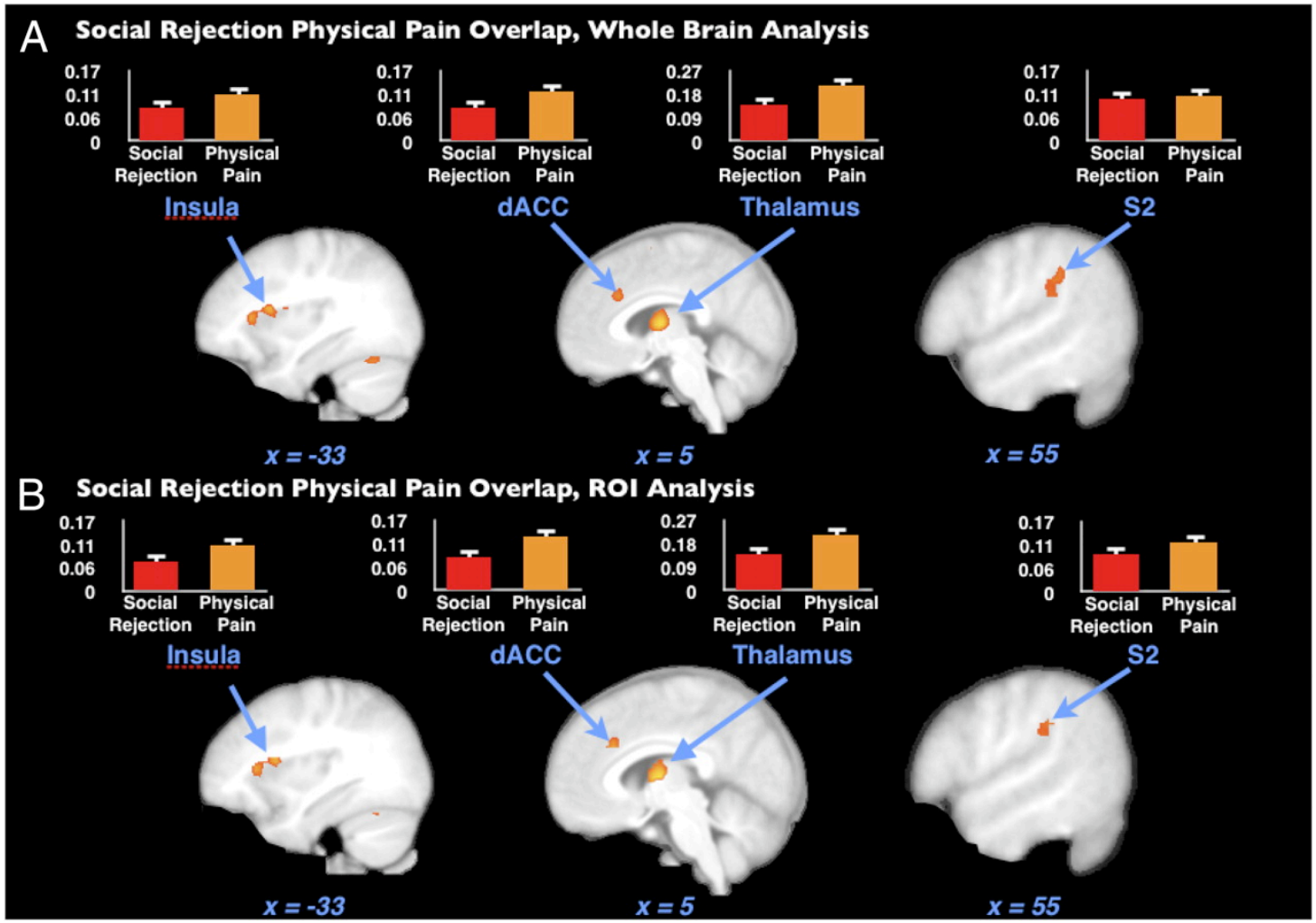
Benedetti F et al. J. Neurosci. 2005;25:10390-10402

The Pain of a Broken Heart

Time course of Social Rejection and Physical Pain trials.

Kross E et al. PNAS 2011;108:6270-6275

Neural overlap between social rejection and physical pain

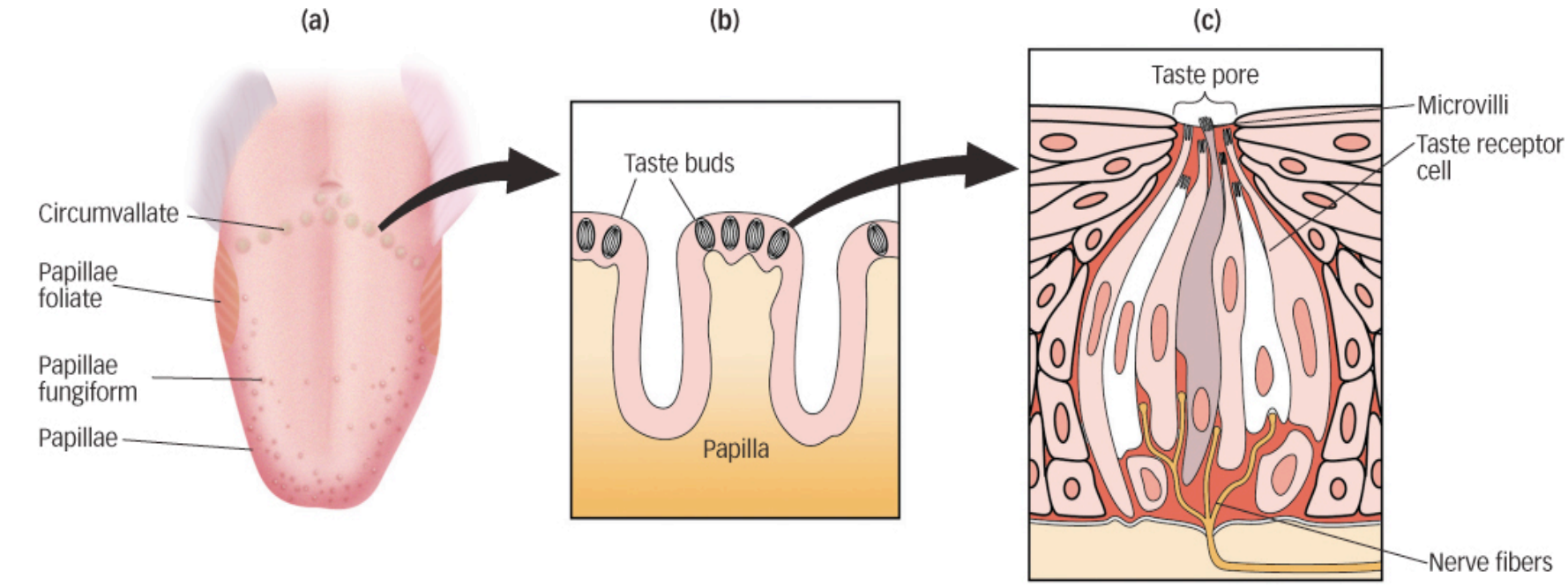


Kross E et al. PNAS 2011;108:6270-6275

Taste

- Identifying things that are "bad" for you
- Taste buds (5 different types)
  - salt
  - sour
  - bitter
  - sweet
  - umami (savory)
  - each contains several types of taste receptors (microvilli) that react with tastant molecules in food
- Flavor is the combination of smell and taste experiences.

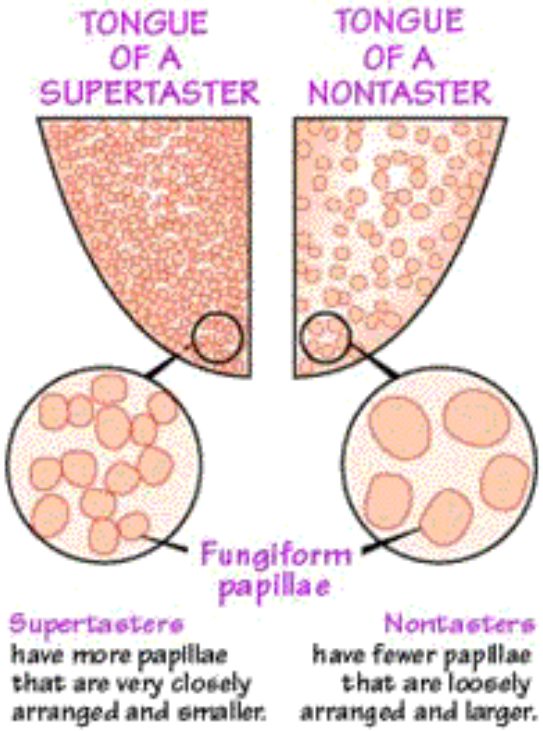
A Taste Bud

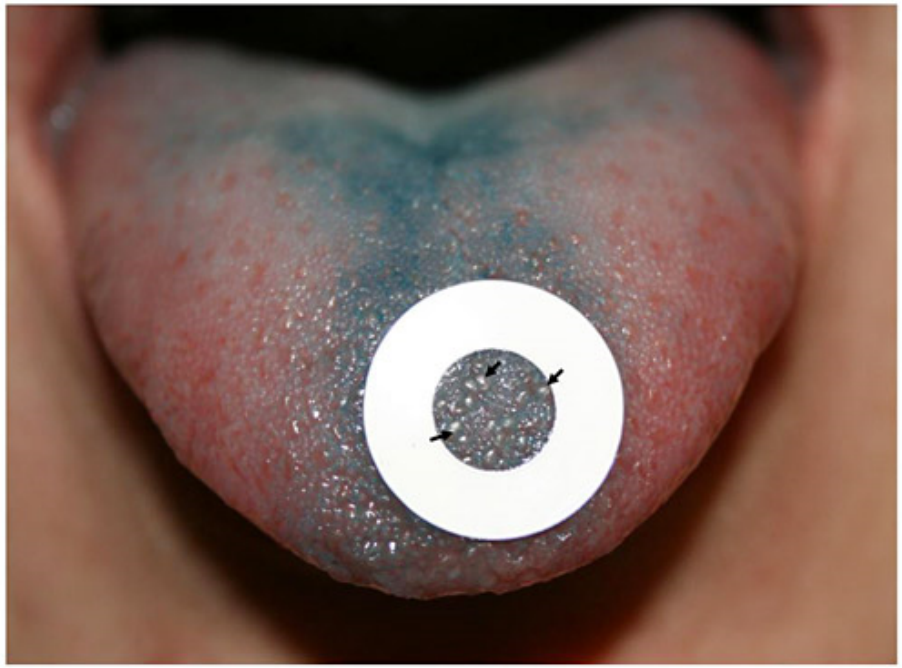

(a)
(b)
(c)
Circumvallate
Papillae foliate
Papillae fungiform
Papillae
Taste buds
Papilla
Taste pore
Microvilli
Taste receptor cell
Nerve fibers

Taste Perception

- Bartoshuk
  - How can we measure taste?
  - Tasters vs. Supertasters
    - Video

Tasters vs. Supertasters





Tasters vs. Super Tasters

- How can you measure this scientifically?

- Observation:
  - Some individuals have more taste receptors than others and are sensitive to more flavorants.

- Question: Do these individuals have more sensitivity to tastes in general?

Observations and results

- Procedure:
  - Groups of tasters and supertasters
  - Rate the perceived sweetness of Coca-Cola

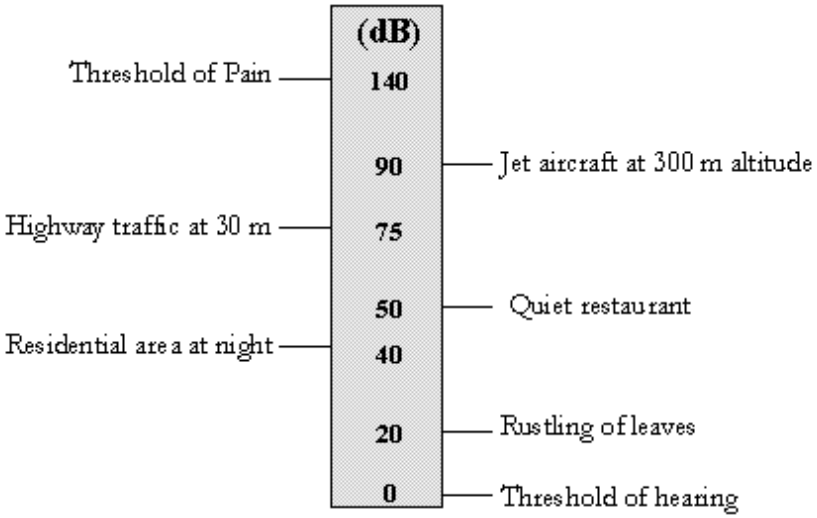
- Hypothesis:
  - Supertasters will find the Coca-Cola sweeter than non-tasters
- Results
  - Both groups rate the taste as "moderately sweet"

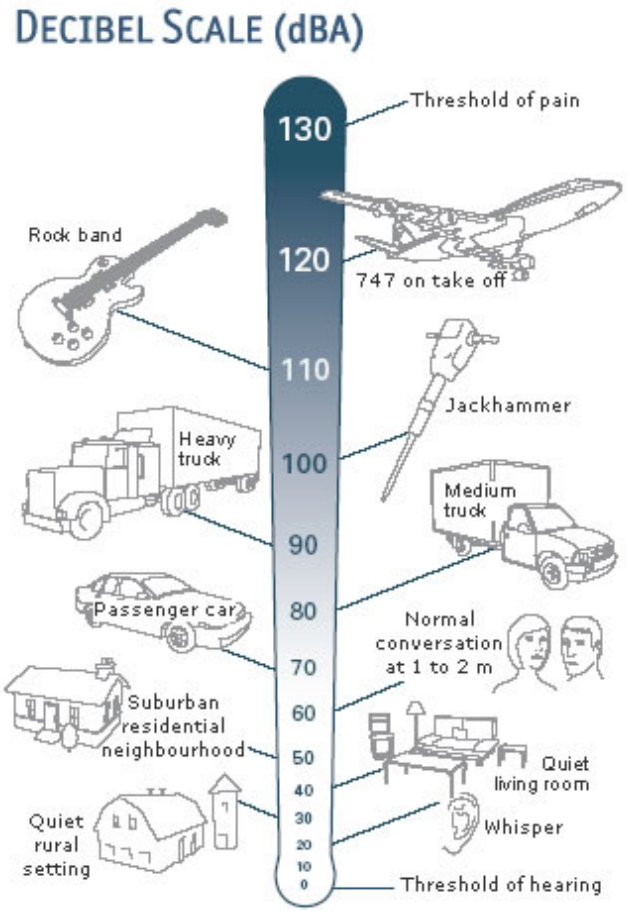
HUH?!?

The Measurement Issue

- How sweet is it?
  - The measurement issue
  - Historical Background
  - Magnitude matching
    - How loud does that taste

Magnitude Matching

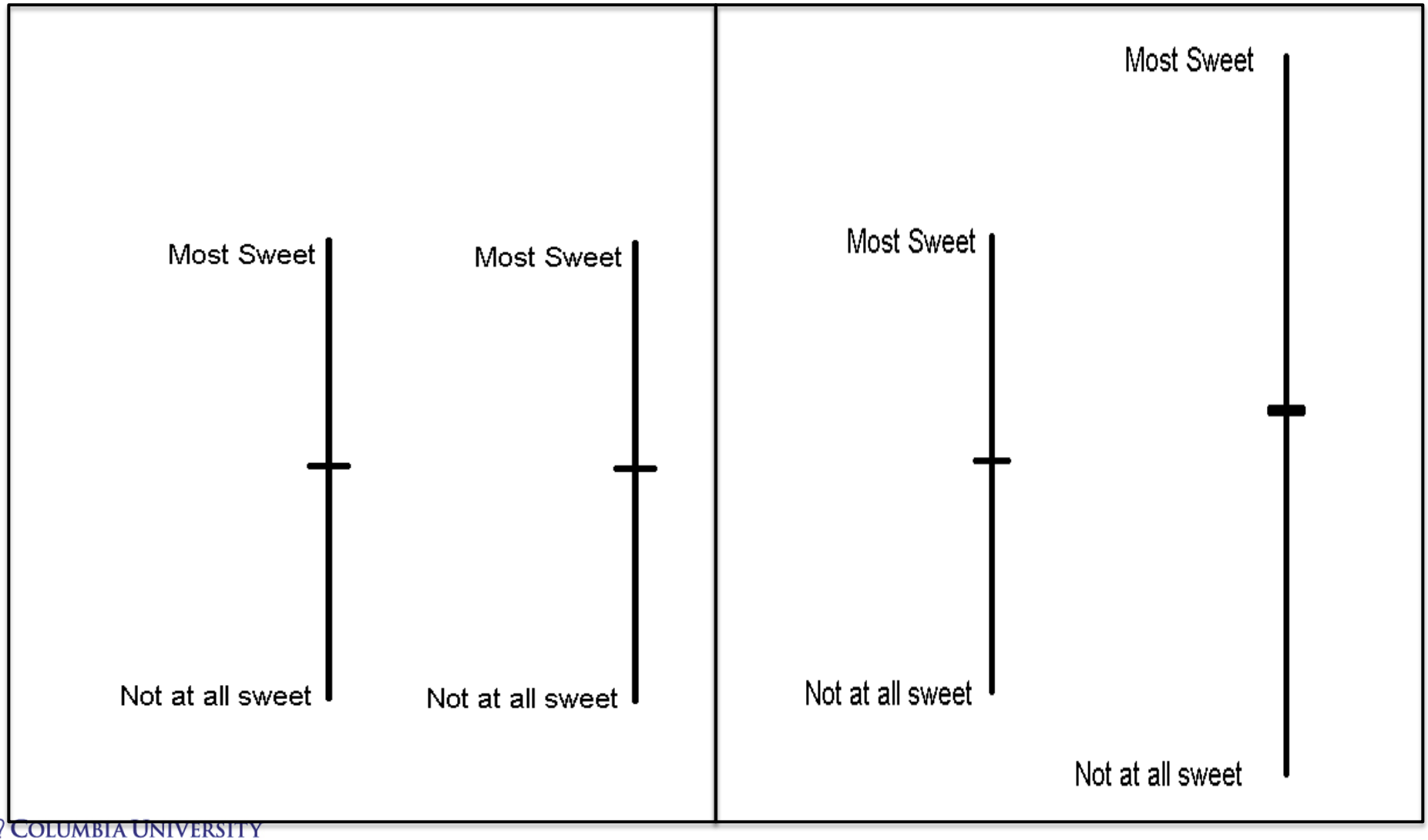




Measurement Problems

- Magnitude Matching
  - How loud is that taste?
- Test:
  - Participants consist of tasters and super-tasters
  - Participants rate the sweetness of Coca-Cola on a scale from 0 sweetness to Maximum Sweetness
  - Participants are asked to adjust the volume of a tone to match their sensation of sweetness in the drink
- Results
  - Tasters and Supertasters rate sweetness as moderate – no difference between groups
  - Tasters rate the "volume" of sweetness at 80 dB
  - Supertasters rate the "volume" of sweetness at 90 dB (double the volume)

The Perception Question – How to measure



Characteristics of Supertasters

- Sensitivity to taste
- Fats
- Vegetables

- Health Implications
  - Benefits
  - Risks

Study Questions 1

- Explain how image aftereffects cannot be explained by the trichromatic theory of color perception, but can be explained by the opponent process theory.
- What is a receptive field?
- What is visual form agnosia? How can agnosias like form agnosia and motion agnosia tell us about how information is processed in the brain?
- Describe the difference between an on-center and off-center receptive field.
- What happens when you shine a spot of light on the center of the receptive field? On the edge of the receptive field? Over the entire receptive field?
- What are the principle of perceptual organization?
- What is the difference between "figure" and "ground" and how does this tell us something about perception?
- Discuss how the ideas of figure and ground are important for perceptual processing of a visual stimulus

Study Questions 2

- What is the difference between image-based object recognition and parts-based recognition?
- How can we perceive depth using only one eye?
- How can we perceive depth based on motion?
- How can we perceive depth using cues that depend on both eyes?
- Use the Ames Room as an example to explain how misperception of size can occur.
- What does the waterfall effect demonstrate about motion perception?
- What is the McGurk effect? How does expectation play in to our perception of the world?
- A central theme in our discussion of sensation and perception is the difference between the sensory signal and our perceptual experience. Be prepared for a question asking for several examples of how our sensation is different from our perception.
- What can perceptual illusions teach us about the nature of sensation vs. perception? Be prepared to answer a question like this, identifying the illusions discussed in lecture and how each contributes to our understanding of how we perceive the world around us.

Study Questions 3

- What is a placebo effect? Is a placebo real pain relief? Why or why not?
- What are the two different fibers involved in sending pain information? Explain the main difference between them.
- Was I lying to my son when I told him the "magic medicine" would take away some of the pain of a wasp sting? Use the placebo effect in your answer to this question.
- Is the placebo effect "real" meaning is there an actual change in pain perception based on belief? What evidence supports your answer?
- People who experience a loss speak about the emotional experience as one that is "painful". What evidence suggests that "painful" emotional experiences are similar to pain?
- What is the physiological difference between tasters and supertasters?
- Supertasters have the same perception of the sweetness of Coke as taster and nontasters. Supertasters perceive the taste of Coke as sweeter than tasters and non-tasters. Explain how both of these statements are true, and how magnitude matching is used to study perception.
- What are the health implications of being a supertaster?