Chapter 3:

Sensation and Perception

Perception Expectancy

- Do expectations affect our perception of the world around us?

How we perceive the world is a function of our past experiences, culture, and biological makeup.

For example, as Americans, when we look at a highway, we expect to see cars, trucks, etc. NOT airplanes. Someone from a different country with different experiences and history may not have any idea what to expect and thus be surprised when they see cars go driving by. **As a car driver you are more likely to not see a motorcycle and hit it, than you are to not see a car and hit it, because your brain is not looking for motorcycles, it is looking for cars.**

Another example - you may look at a painting and not really understand the message the artist is trying to convey. But, if someone tells you about it, you might begin to see things in the painting that you were unable to see before.

This is called Psychophysics, defined as ***the study of how physical stimuli are translated into psychological experience*****.**

Perception Expectancy

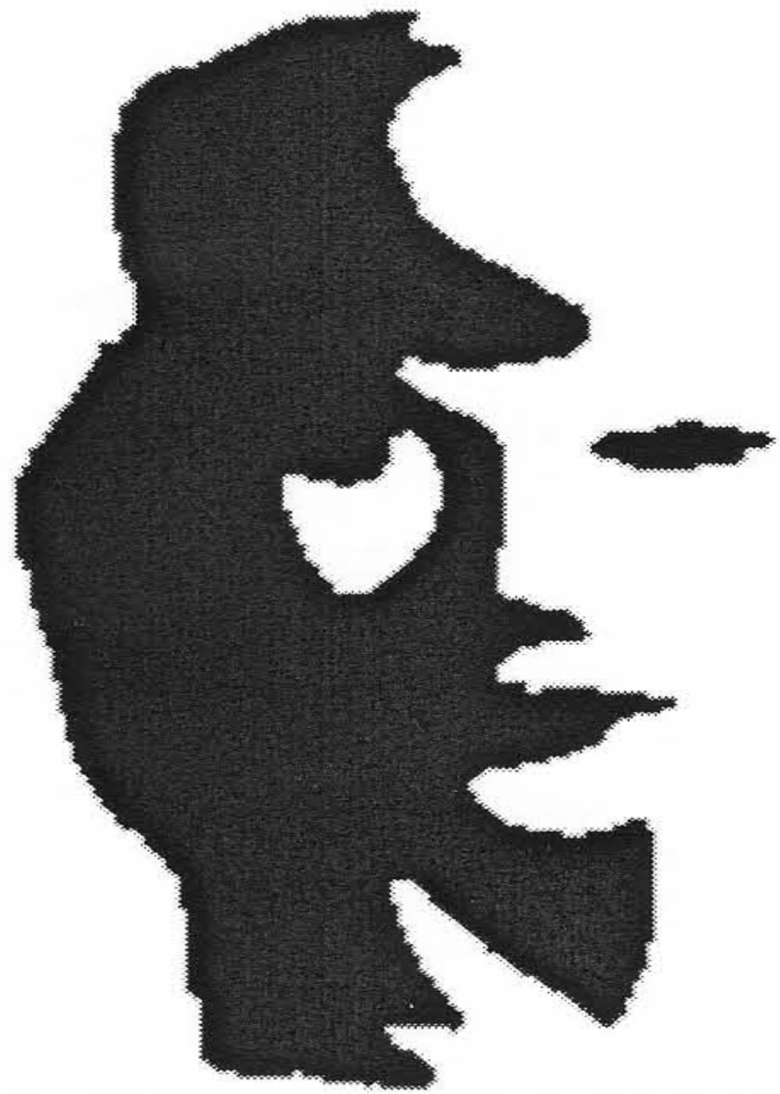
Our Experiences, assumptions and expectations give us a **perceptional set** that greatly influences what we perceive and interpret…do we see what we expect to see?

Perception Expectancy

Three groups

Write down the first thing you see when looking at the image (while the other two groups wait outside).

Each group will look at the image and write while others wait outside.



Perception Expectancy

1st group wrote down what they saw and were not told anything

2nd group was given same instructions but I said the word “saxophone” before they viewed the image

3rd group was given same instructions but I said the phrase “a woman’s face” before they viewed the image

Perception Expectancy

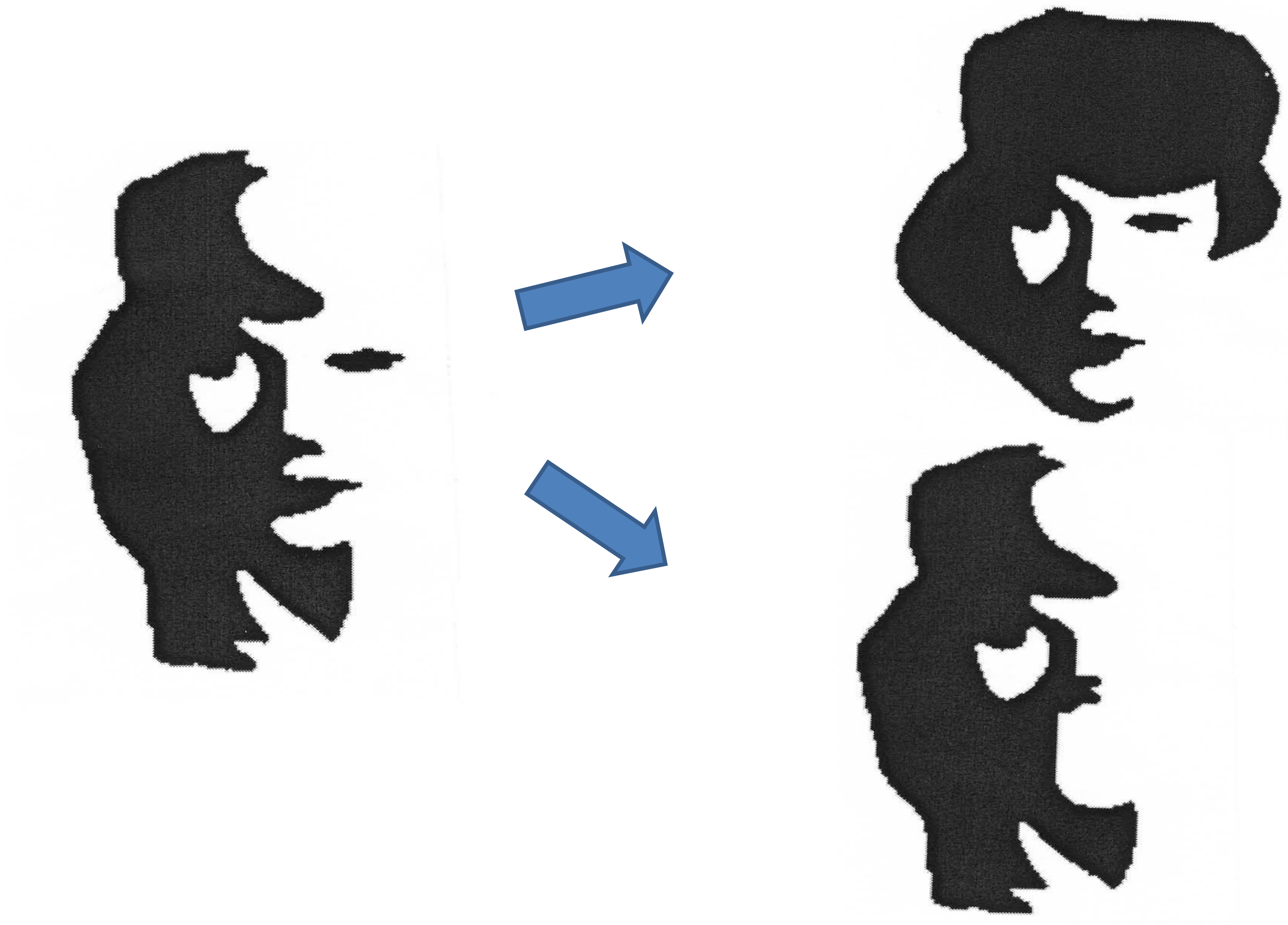
Results?

Which group saw the woman’s face vs. the sax player first?

Your experiences and expectations influence how you perceive the world around you.

Would you get the same results if groups were *shown* a picture before you saw the image?

(see next slide)



Perception and Constancies

Perception - the method by which the sensations experienced at any given moment are interpreted and organized in some meaningful fashion.

Shape constancy - the tendency to interpret the shape of an object as being constant, even when its shape changes on the retina.

Size constancy - the tendency to interpret an object as always being the same actual size, regardless of its distance.

Brightness constancy – the tendency to perceive the apparent brightness of an object as the same even when the light conditions change.

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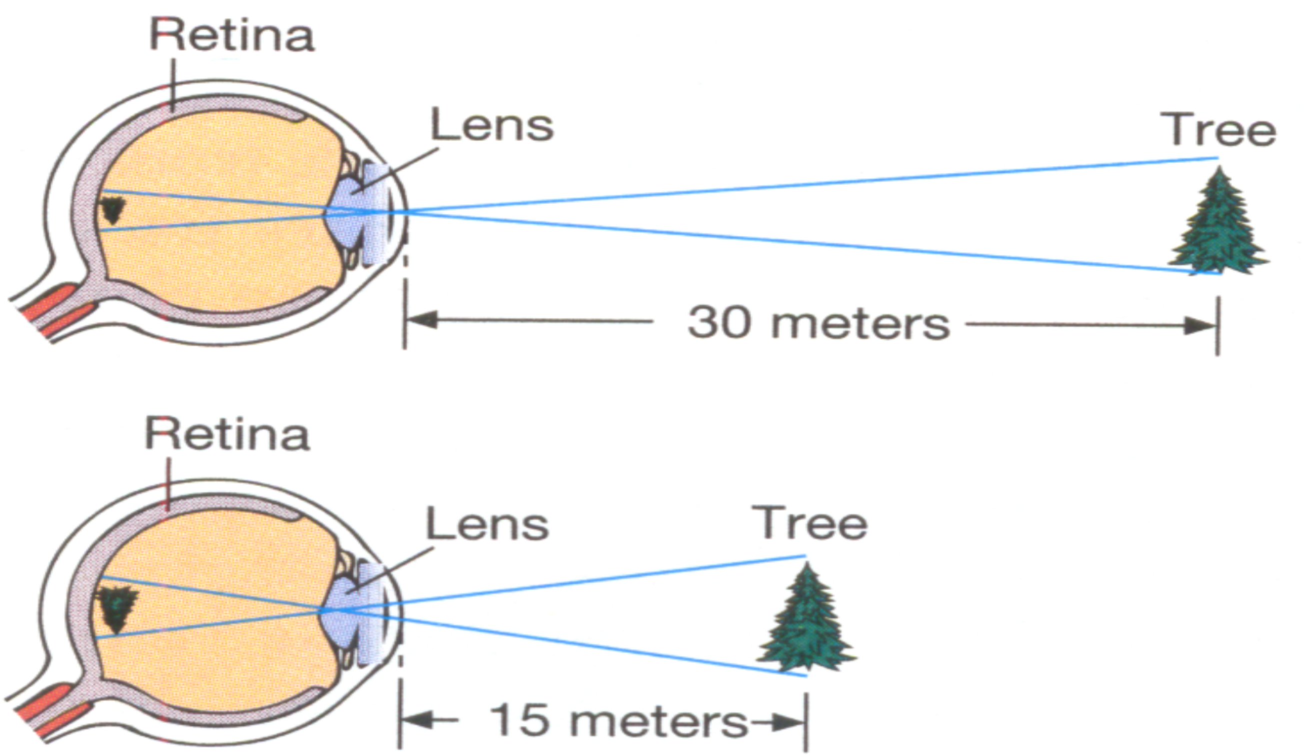
Size Constancy

The tendency to interpret an object as always having the same physical dimensions, regardless of its distance from the viewer.

Size Constancy

The size of an image on your retina gets LARGER or SMALLER as you move CLOSER to or FARTHER AWAY from an object



Size Constancy

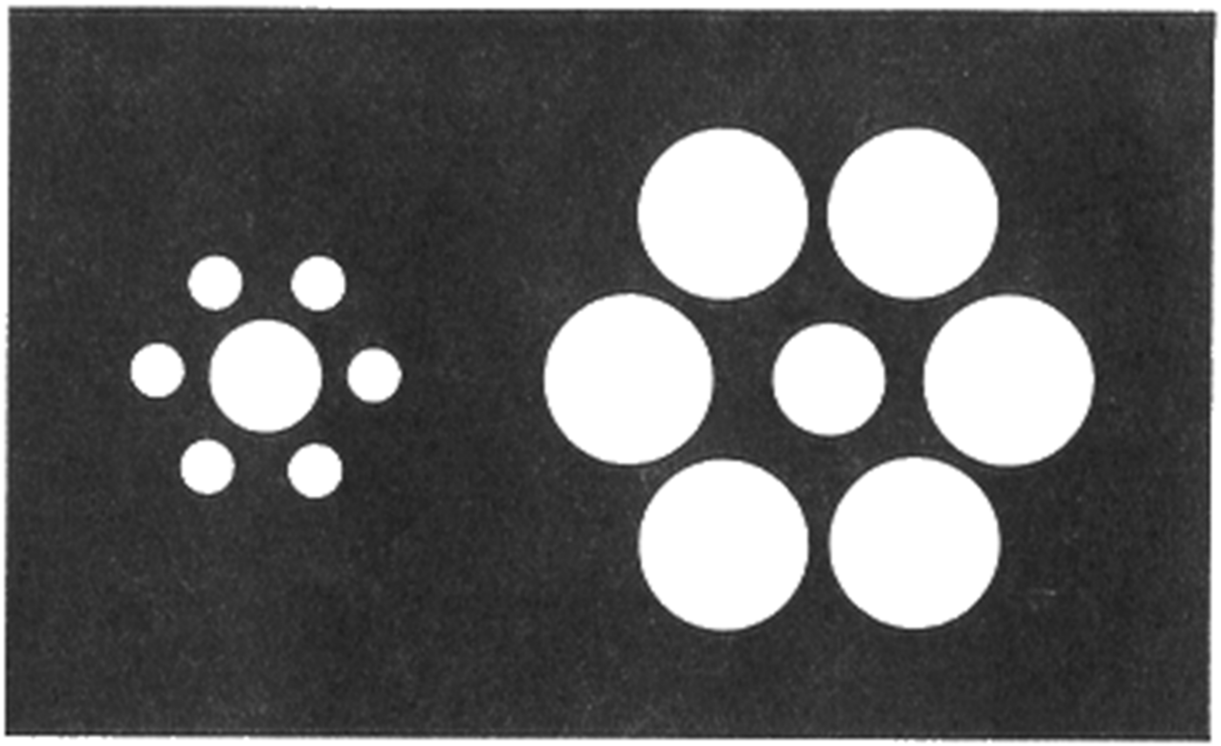
Due to our ability of our visual perception system, we recognize that objects remain constant in size regardless of the distance from the observer or the size of the image on our retina. **3 things make this happen**:

1. Previous experience with the true sizes of objects
2. The distance between the object and the person
3. The presence of surrounding objects

Size Constancy

As an object moves AWAY from the viewer, its perceived size does not change in relation to the that of the objects around it…this is why knowing the size of surrounding objects helps us determine a perceived object’s distance from us, as well as its actual size…we judge an object’s size by comparing it with surrounding objects.

Size Constancy



From the Optical Illusion Book (See Credits)

Size Constancy

The center circles are actually both the same size, yet they appear to different because of their relationship to the surrounding circles. Our brain perceives the circle surrounded by larger circles as smaller, because it is smaller in relation to the surrounding circles. The opposite is true for the circle surrounded by smaller circles.

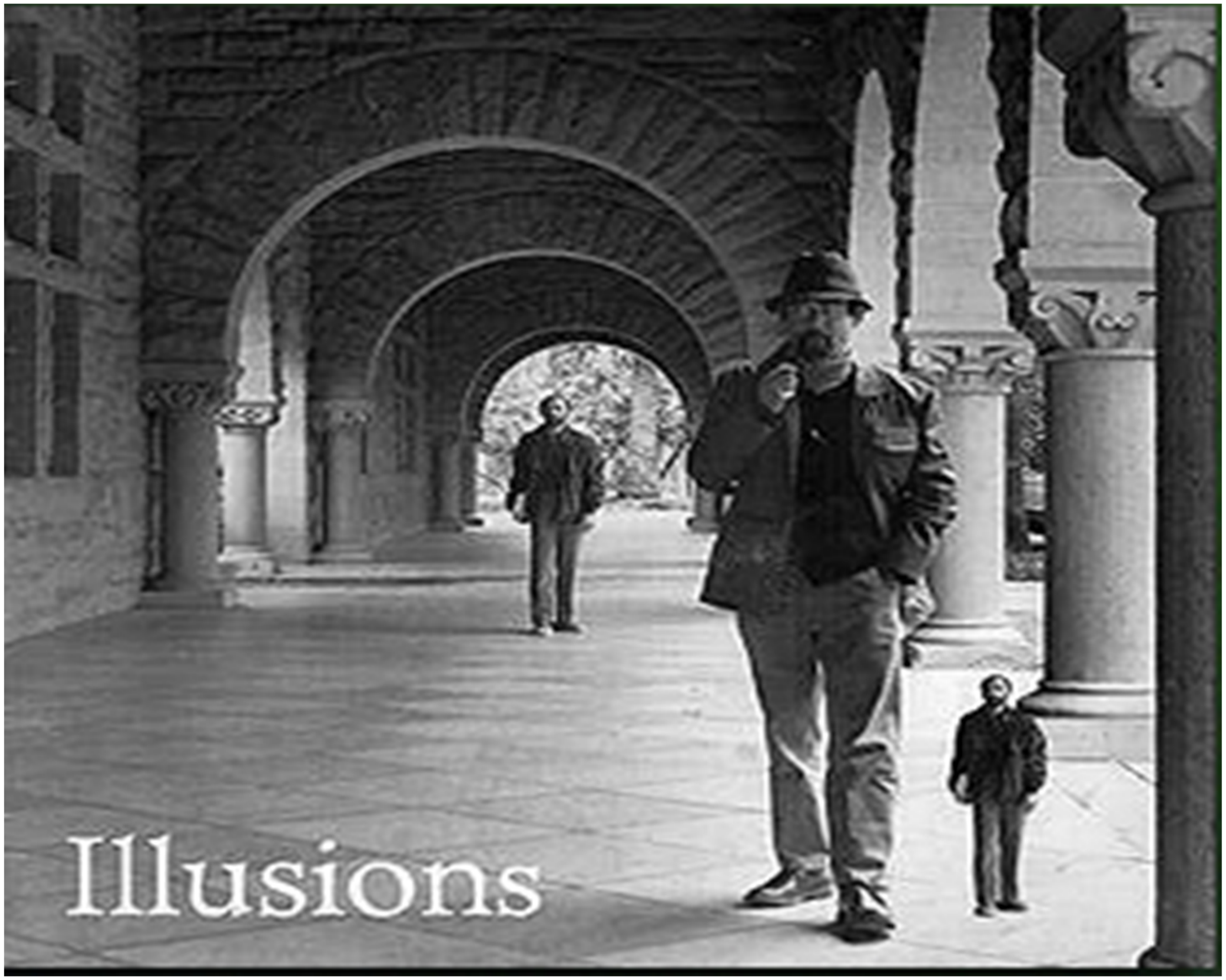
Size Constancy

Size Constancy

Take a look at the prior slide. Both images of the person are the same size, but you perceive the one in back to be bigger. This is because your mind sees the hallway and decides that the back person is farther away that the front person, so your mind adjusts the size of the person to make up for the increased distance. This phenomenon is called **size constancy**.

Size constancy is happening all the time. If you look down the street and see a sports car about 50 feet away, and behind it, about 100 feet away is a big SUV, you know that the SUV is bigger, even though it produces a smaller image on your eye, due to your experiences and prior knowledge

Size Constancy Illusion



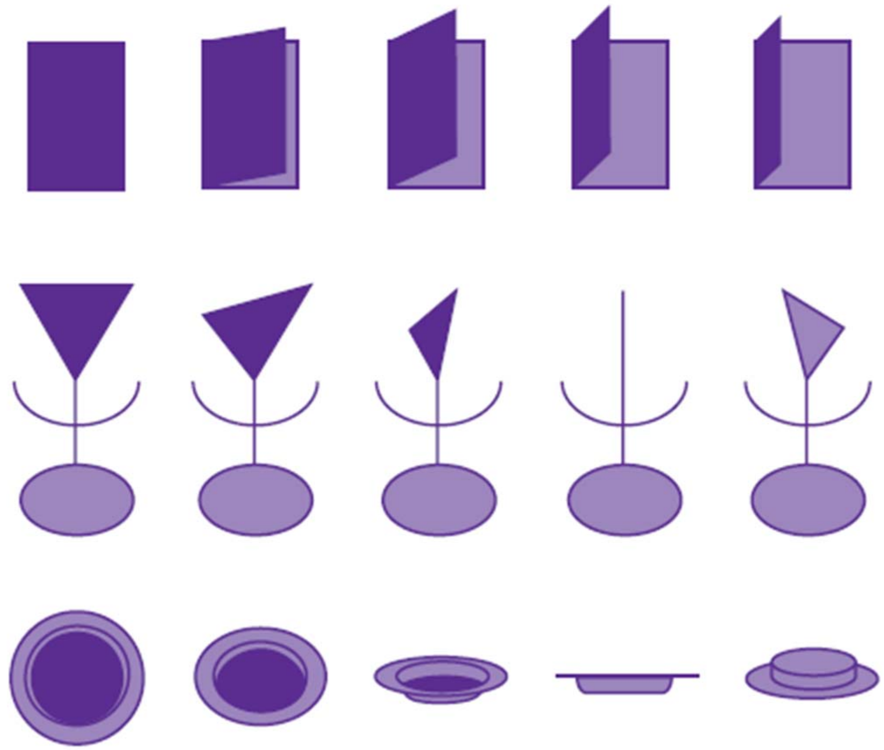
Size Constancy Illusion

Size Constancy

Try this interactive site that shows/explains size constancy:

http://science.howstuffworks.com/question491.htm

Figure 3.14 Shape Constancy



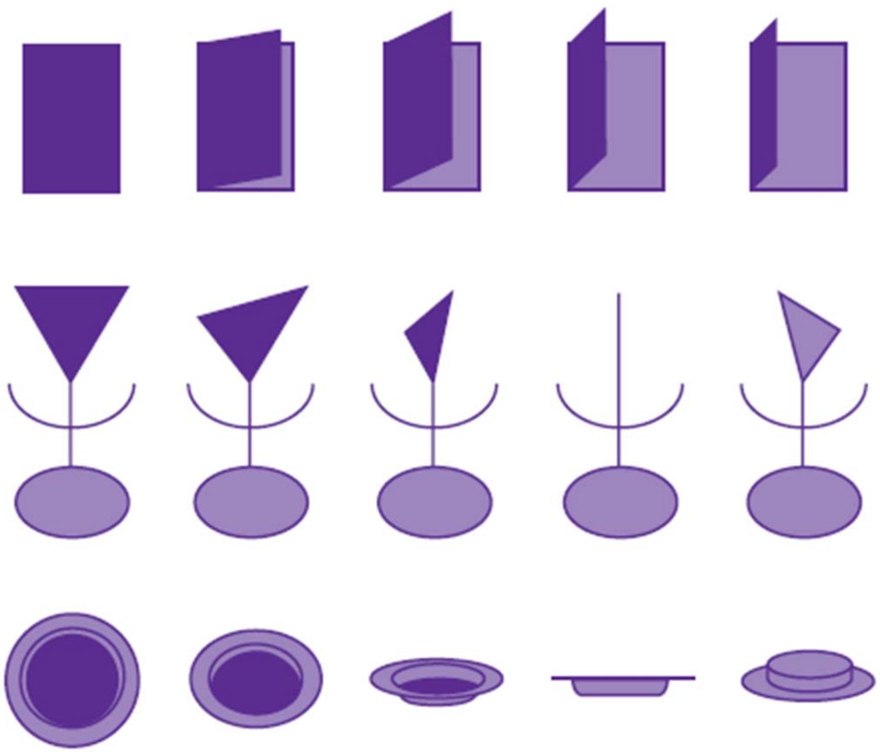


Figure 3.14 Shape Constancy

Three examples of shape constancy are shown here. The opening door is actually many different shapes, yet we still see it as basically a rectangular door. We do the same thing with a triangle and a circle—although when we look at them from different angles they cast differently shaped images on our retina, we experience them as a triangle and a circle because of shape constancy.

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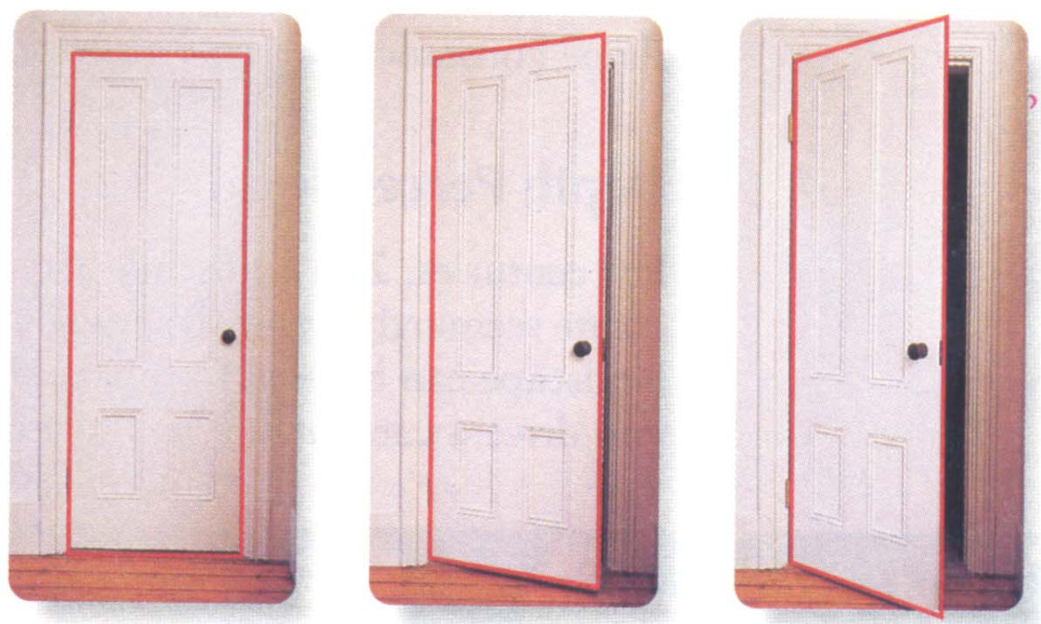
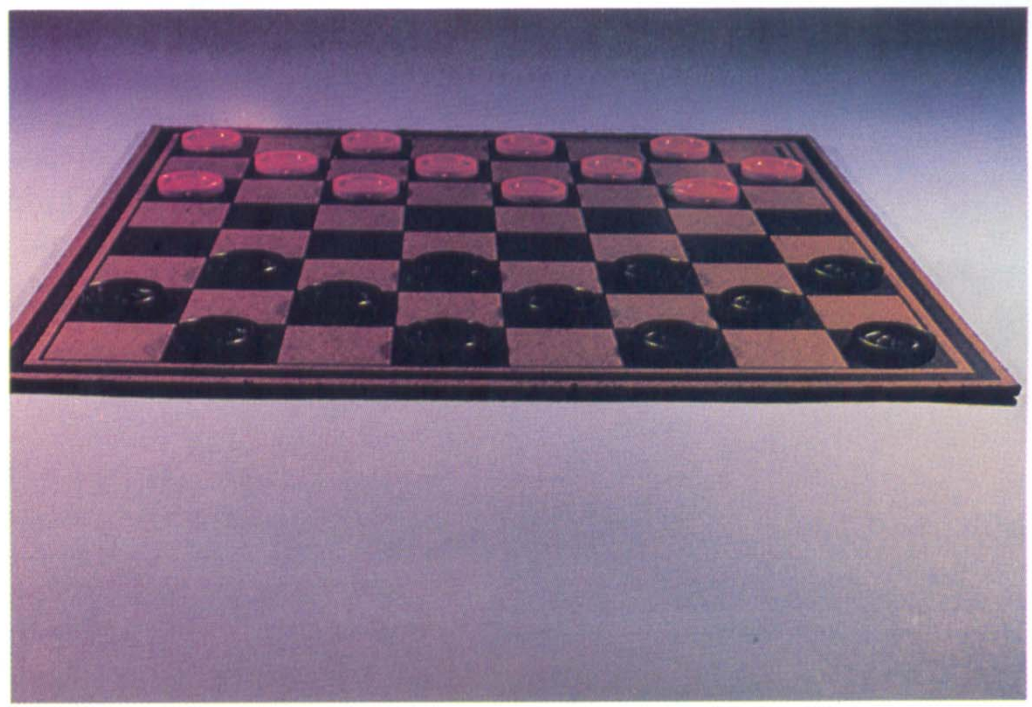
Shape Constancy

The ability of our Visual Perceptual System to recognize a shape despite changes in its orientation or the angle from which it is viewed.



Shape Constancy

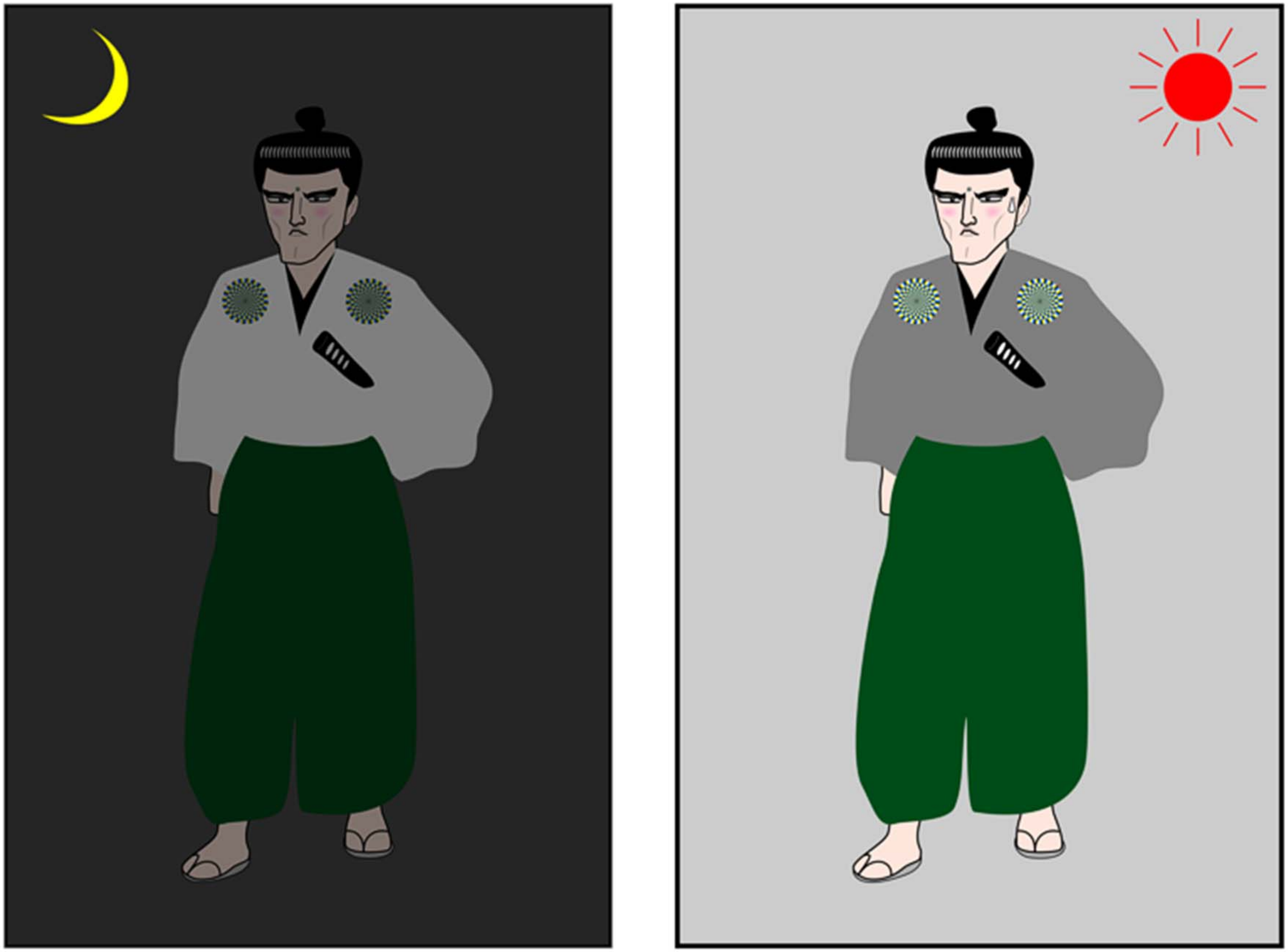
A very different view of the same checkerboard; in both images the checkers are perceived as round and the board as square



Brightness Constancy

Under this form of perceptual constancy, a piece of paper looks white in both the noonday sun and under moonlight, even though there is less light being reflected off the paper under moonlight.

Brightness Constancy



Gestalt Principles

- Figure–ground - the tendency to perceive objects, or figures, as existing on a background.

- Reversible figures - visual illusions in which the figure and ground can be reversed.

Figure 3.16 Figure–Ground Illusion

Figure 3.16 Figure–Ground Illusion

What do you see when you look at this picture? Is it a wine goblet? Or two faces looking at each other? This is an example in which the figure and the ground seem to "switch" each time you look at the picture.

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Gestalt Principles

- Similarity - the tendency to perceive things that look similar to each other as being part of the same group.
- Proximity - the tendency to perceive objects that are close to each other as part of the same grouping.
- Closure - the tendency to complete figures that are incomplete.
- Continuity - the tendency to perceive things as simply as possible with a continuous pattern rather than with a complex, broken-up pattern.
- Contiguity - the tendency to perceive two things that happen close together in time as being related.

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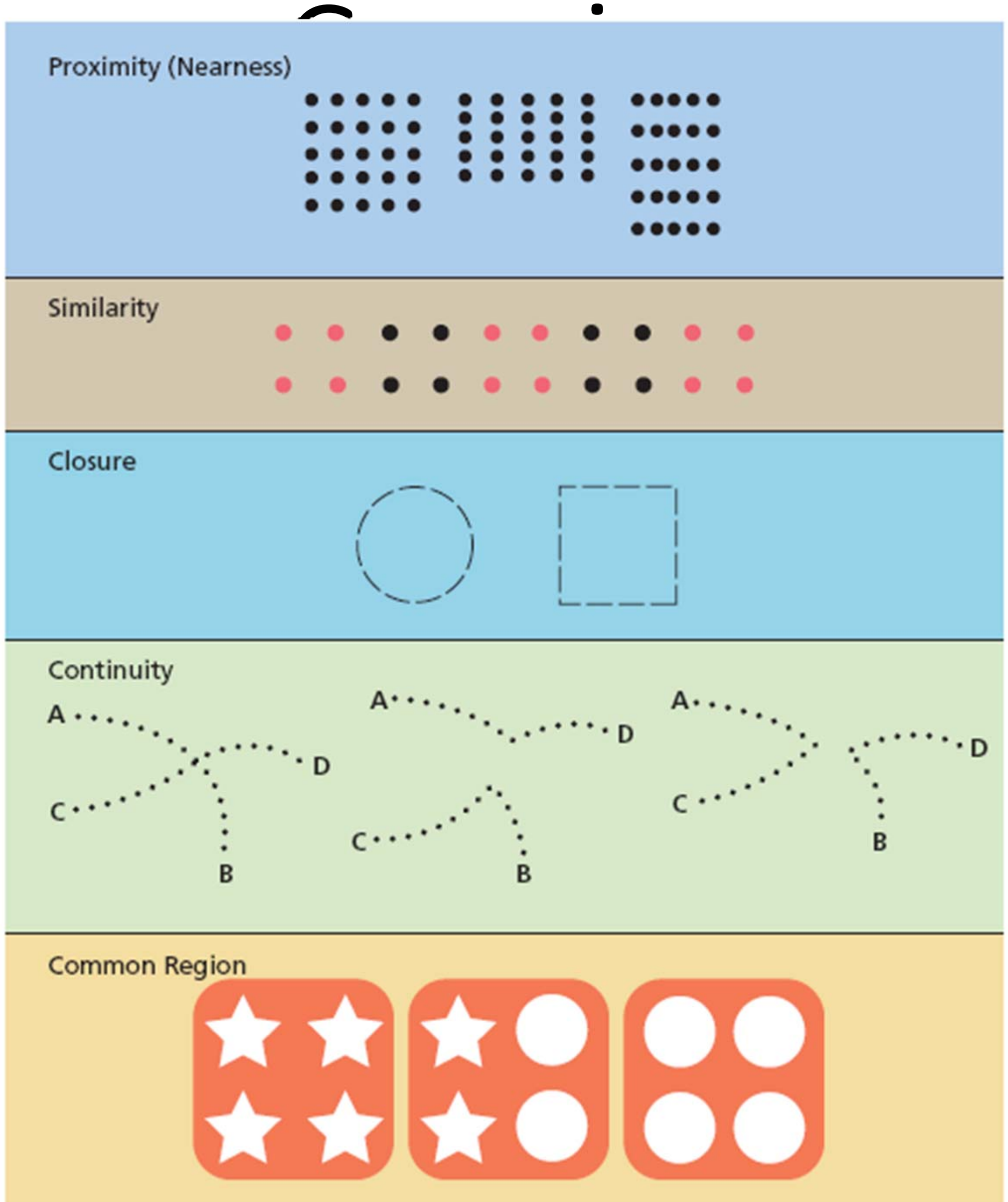
Figure 3.17 Gestalt Principles of



LO 3.9 Gestalt principles of perception
AP Organizing & integrating sensation

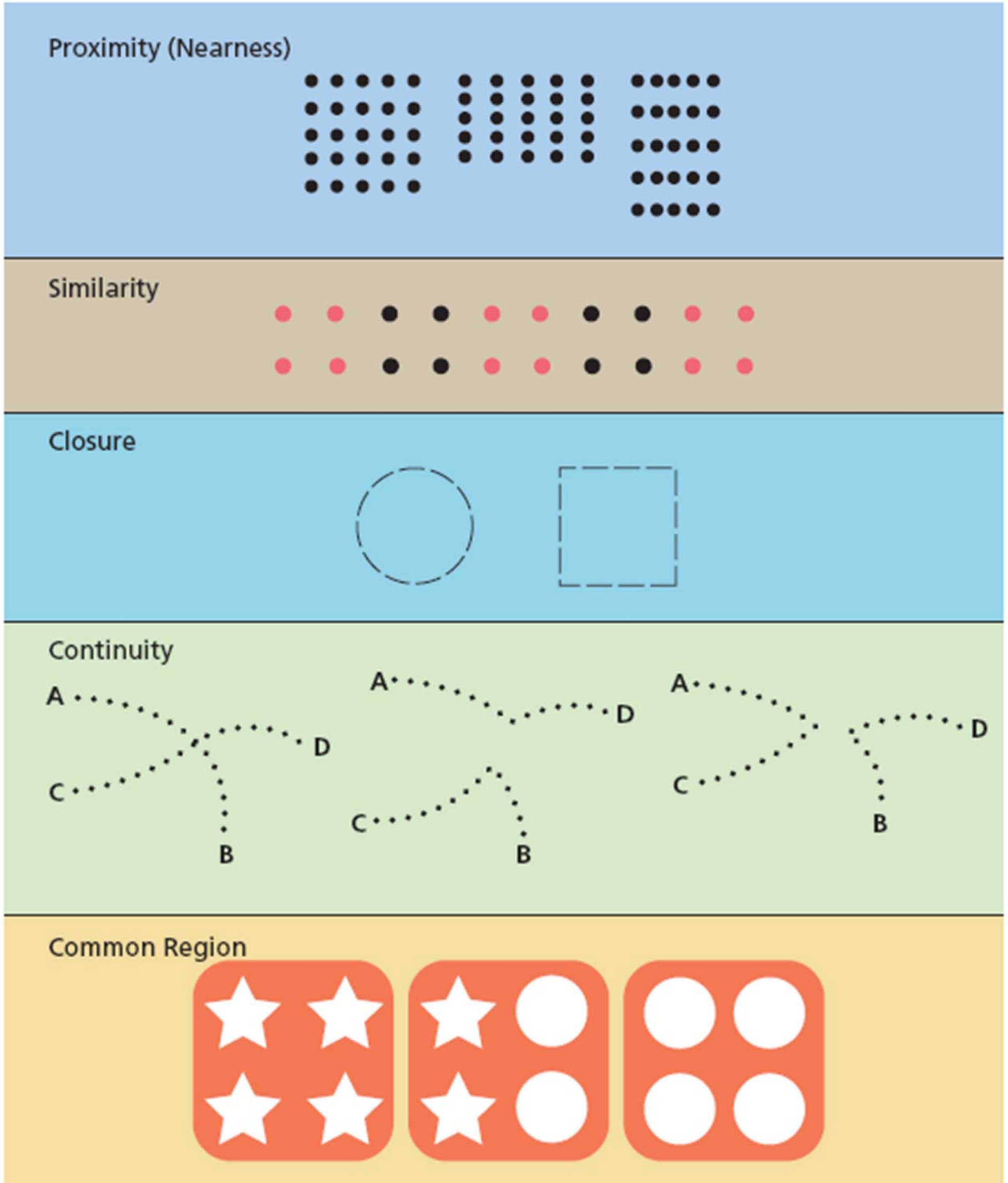


Figure 3.17 Gestalt Principles of Grouping

The Gestalt principles of grouping are shown here. These are the human tendency to organize isolated stimuli into groups on the basis of five characteristics: proximity, similarity, closure, continuity, and common region.

Proximity: The dots on the left can be seen as horizontal or vertical rows—neither organization dominates. But just by changing the proximity of certain dots, as in the other two examples, we experience the dots as vertical columns (middle) or horizontal rows (right).

Similarity: The similarity of color here makes you perceive these dots as forming black squares and color squares rather than two rows of black and colored dots.

Closure: Even though the lines are broken, we still see these figures as a circle and a square—an example of how we tend to "close" or "fill in" missing parts from what we know of the whole.

Continuity: Because of continuity, we are much more likely to see the figure on the left as being made up of two lines, A to B and C to D, than we are to see it as a figure made up of lines A to D and C to B or A to C and B to D.

Common Region: Similarity would suggest that people see two groups, stars and circles. But the colored backgrounds define a visible common region, and the tendency is to perceive three different groups.

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Examples of Pictorial Depth Cues


a.


c.


b.


d.

Development of Perception

- Depth perception - the ability to perceive the world in three dimensions.
- Studies of depth perception
  - Visual cliff experiment

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Factors that Influence Perception

- Perceptual set (perceptual expectancy) - the tendency to perceive things a certain way because previous experiences or expectations influence those perceptions.

- Top-down processing - the use of preexisting knowledge to organize individual features into a unified whole. (door)

- Bottom-up processing - the analysis of the smaller features to build up to a complete perception. (sound)

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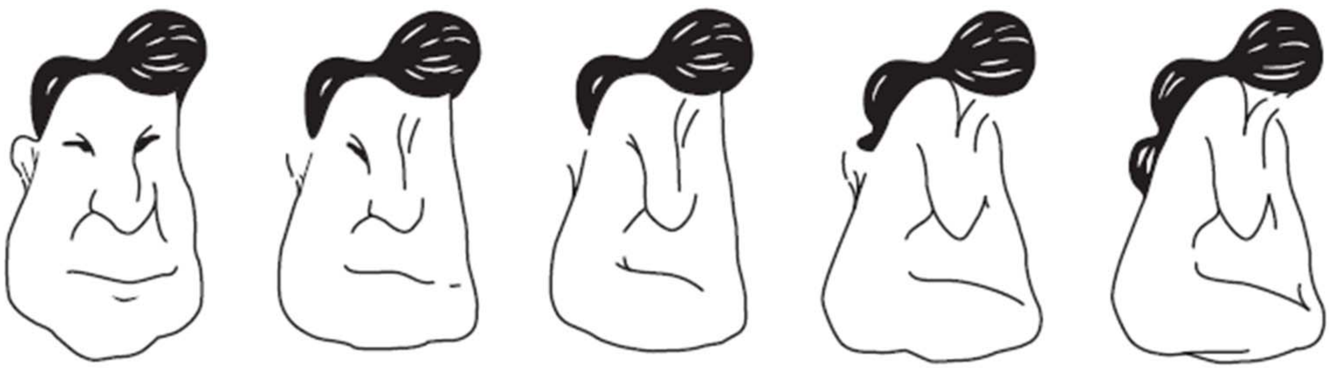
Figure 3.22 Perceptual Set



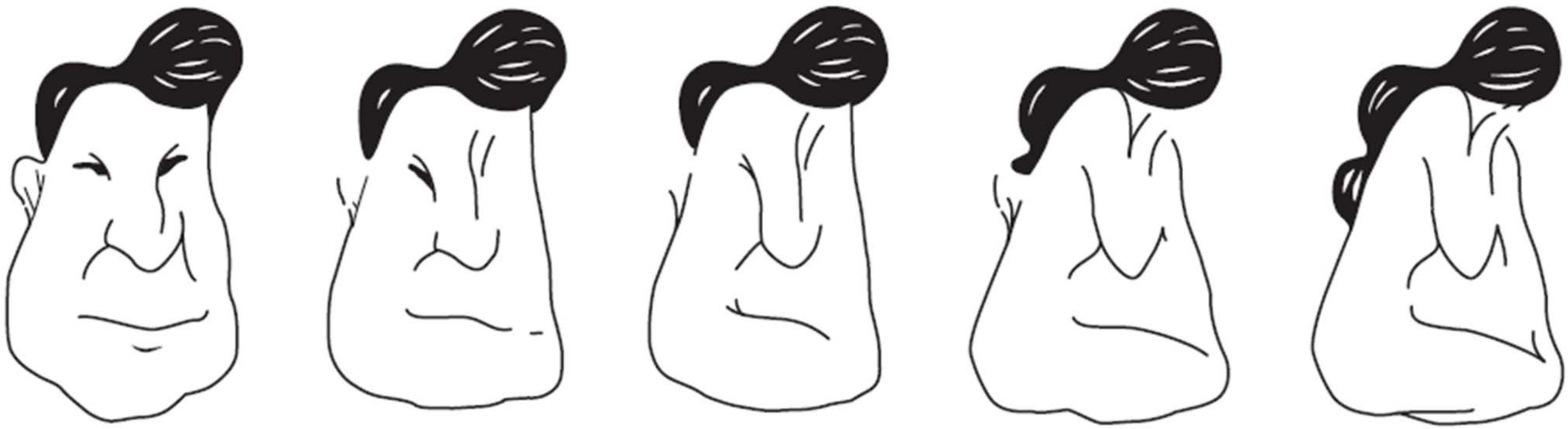


Figure 3.22 Perceptual Set

Look at the drawing in the middle. What do you see? Now look at the drawings on each end. Would you have interpreted the middle drawing differently if you had looked at the drawing of the man or the sitting woman first?

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Sensation

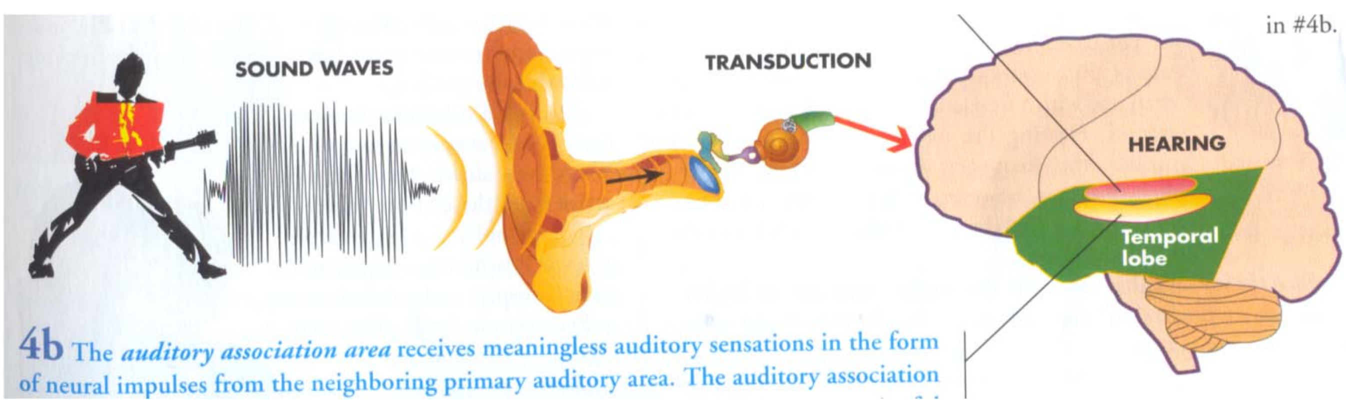
Sensation - the activation of special receptors in the various sense organs allowing outside stimuli to become neural signals to the brain:

Eyes, Nose, Ears, Skin, Tongue/Taste Buds, each gather information about your environment

A ***stimulus*** is an energy pattern (such as light, sound, pressure, temperature) which is registered by the sense organs

Sensation

Sensation and **Perception** are linked to form the entire process through which we gain sensory input, convert it to electrochemical energy, and interpret the info so it makes sense…organization, form, and meaning



Sensation

<u>Gathering info about the world takes 2 steps</u>

1. Electrical signals reach the brain where they are turned into Sensations

into sensations.

Sensations are relatively meaningless bits of information (left figure) that result when the brain processes electrical signals that come from the sense organs.

Table 2.1 Neurotransmitters and Their Functions

NEUROTRANSMITTERS	FUNCTIONS
Acetylcholine	Excitatory or inhibitory; involved in arousal, attention, memory and controls muscle contractions.
Serotonin	Excitatory or inhibitory; involved in mood, sleep, and appetite.
GABA (gamma-aminobutyric acid)	Major inhibitory neurotransmitter; involved in sleep and inhibits movement.
Glutamate	Major excitatory neurotransmitter; involved in learning, memory formation, and nervous system development.
Norepinephrine	Mainly excitatory; involved in arousal and mood.
Dopamine	Excitatory or inhibitory; involved in control of movement and sensations of pleasure.
Endorphins	Inhibitory neural regulators; involved in pain relief.

Sensory Receptors

Sensory Receptors - specialized forms of neurons- cells that make up the nervous system; instead of receiving Neurotransmitters from other cells, they are stimulated by different kinds of energy (stimuli/stimulus):

The receptors in your eyes (Sight) are triggered by light

The receptors in your ears (Sound) are triggered by vibrations.

The receptors in your skin (Touch) are triggered by pressure or temperature

The receptors in your Nose and Mouth (Smell + Taste) are triggered by chemical substances

Sensory Thresholds

Weber's Law of ***Just Noticeable Difference*** (jnd) a.k.a. *Difference Threshold*:

Minimum amount of stimulation required to tell the *difference* between two stimuli.

Weber's Law of jnd can be applied to different senses: the brightness of light, the weight of objects, the length of lines

Our sensory systems are good at detecting changes in our surroundings, but we do better when the initial value of the stimulus is *weak* rather than *strong*

Sensory Thresholds

Links to test Weber's Law of *just noticeable difference (jnd)*:

http://highered.mcgraw-hill.com/sites/007312387x/student_view0/perception5/weber_s_law__/

http://media.pearsoncmg.com/ph/hss/shared_hss_assets/psychology/livepsych_experiments/weberexperiment.html

Weber's Just Noticable Difference

Weber's Law of *Just Noticeable Difference* (jnd) a.k.a. *Difference Threshold*:

Outcome:

Our sensory systems are good at detecting changes in our surroundings, but we do better *in detecting differences* when the initial value of the stimulus is *weak* rather than *strong: (soft tones vs. loud tones, weak [less concentrated] smells vs. strong [greater concentration] smells), etc.*

Absolute Thresholds

Absolute threshold - the smallest amount or lowest level of energy needed for a person to consciously *detect* a stimulus 50 percent of the time it is present. (Remember that jnd is detecting a *difference between two stimuli)*

Table 3.1 Examples of Absolute Thresholds

SENSE	THRESHOLD
Sight	A candle flame at 30 miles on a clear, dark night
Hearing	The tick of a watch 20 feet away in a quiet room
Smell	One drop of perfume diffused throughout a three-room apartment
Taste	1 teaspoon of sugar in 2 gallons of water
Touch	A bee's wing falling on the cheek from 1 centimeter above

Absolute Thresholds

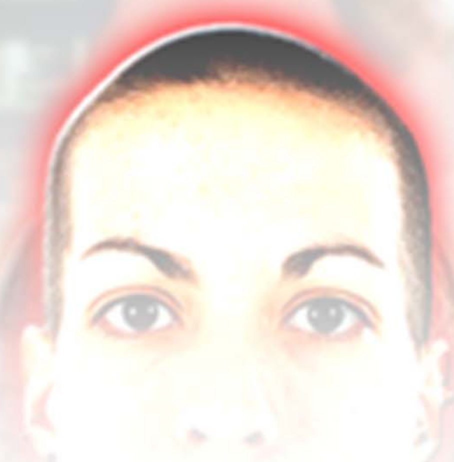
Another example:

How much salt must be added to a glass of water before a change in taste can be detected in at least half of the taste tests?

Habituation & Sensory Adaptation

- Habituation – **brain stops attending to constant, unchanging stimuli (cognitive)**

- Sensory adaptation – **sensory receptors less response to consta**



◀ Does sensory adaptation mean that if I stare at something long enough, it will disappear?

Habituation and Sensory Adaptation

Habituation - Tendency of the brain to stop attending to constant, unchanging information.

Our brains are only really interested in changes in information and our brains “ignore” *conscious attention* to stimuli that does not change.

Example: Not “hearing” the air conditioner until the sound changes (stops, increases, decreases)

This is how our brains deal with unchanging information in our environments

Habituation and Sensory Adaptation

Sensory Adaptation - Tendency of sensory receptor cells to become less responsive to a stimulus that is unchanging.

Example: Walking into someone's house you get a certain smell, but after awhile, the smell "goes away"

The difference between Habituation and Sensory Adaptation:

Habituation: Your sensory receptors are still responding to the stimulation but the lower centers of your brain are not sending signals from those sensory receptors to the brain's cortex for interpretation.

Sensory Adaptation: ***The receptor cells themselves*** become less responsive to an unchanging stimulus and no longer send signals to the brain for interpretation .

Habituation and Sensory Adaptation

So when do you/your receptors use Habituation vs. Sensory Adaptation?

Habituation

IS ACCESSABLE TO CONSCIOUS CONTROL

Example: You can decide to become aware of a background conversation

Sensory Adaptation

IS NOT ACCESSABLE TO CONSCIOUS CONTROL

Example: You cannot choose when to adapt to a smell or a temperature

Habituation and Sensory Adaptation

So if Sensory Adaptation, The tendency of sensory receptor cells to become less responsive to a stimulus that is unchanging, is "true" then explain why unchanging things we stare at for long periods of time do not disappear?

If I put tape on your arm after awhile you would not feel it; you don't constantly feel your clothes because your skin (touch) adapts. So do your ears (sound), nose (smell), and mouth (taste)- so why not your eyes(vision)?

Habituation and Sensory Adaptation

Sandpaper Experiment

Touch: After rubbing your index fingers gently over the sandpaper paper a few times, you rated its coarseness on a scale from 1 (*very soft*) to 7 (*very coarse*).

After a minute or two, you rubbed the same finger over the paper and again rated its coarseness.

Your senses should have adapted to the coarseness and thus the ratings for the second time should be lower.

Habituation and Sensory Adaptation

Unchanging things we stare at for long periods of time do not disappear because of *Microsaccades* - constant tiny movement of the eyes that prevents sensory adaptation to visual stimuli (we do not consciously notice this)

Activity: Temperature Adaptation

Place one hand in a bowl of ice water and the other hand in a bowl of hot water for about 30 seconds-1 minute. Then take both hands and place them in lukewarm water.

When placed in the lukewarm water, the hand that was in the ice water will feel warm and the hand that was in the hot water will feel cold.

Why does it happen?

It's because all of our senses are relative. They don't measure an absolute temperature or an absolute brightness of light; they make their measurements relative to the things around it.

In the case of this experiment, the temperature sensors on your hands measure the temperature of the water relative to the temperature of your hand. If the water is warmer than your hand, it feels warm, and if it is colder than your hand, it feels cold: the receptors that got used to the hot water, send signals to the brain that sense the lukewarm water as cold; and the receptors that got used to the cold water sense the lukewarm water as hot and send that signal to the brain.

Sensory Adaptation

Some sense organs adapt quickly…some more slowly…depends on the intensity of the stimulation…

Will your senses eventually adapt to any stimulation despite intensity level?

Yes or No and Why???

Adaptation

Your sense organs WILL NOT adapt to intense forms of stimulation if the stimulation will cause physical damage…extreme heat or cold on your skin for example…or…

Sensation and Perception: Touch

Will various parts of your body be more sensitive to pressure than others? Which parts are more sensitive and why?

James Motiff

Split into pairs; one person keeps eyes closed while the other places from 1-4 fingers lightly on the following areas:

1. Back 2. Neck 3.Leg 4. Shoulder 5. Forearm 6. Face 7. Hand

The person with the eyes closed should guess how many fingers are being used when they feel the touch- so make sure that your fingers all touch your partner at the same time.

Each group should keep a chart of all seven areas noting correct guesses by body part (1. Back- wrong, 2. Neck- correct…), so that you end up with 14 total guesses, 7 per person.

Sensation and Perception: Touch

John Fisher

In pairs of two; use one hairpin per each pair of students. One student should pry the hairpin apart (so that its prongs are roughly an inch apart) and press the hairpin against the back of their partner's forearm.

1. Record how many points you feel (each person should record their results)

Next, bend the prongs inward so that they are only about 1/16 of an inch apart and place it this time on their partner's index finger tip.

2. Record how many points you feel (each person should record their results)

Next, drag the hairpin (with prongs one inch apart) slowly from the crease of your partners elbow down to the finger tips.

3. Record the feeling/sensation regarding the distance between the prongs from elbow-pit to fingertip

Sensation and Perception: Touch

Chute and Schatz

1. Student volunteer will close their eyes and hold out one of their hands. I will touch the tip of the pen to each of the three middle fingers (i.e., ignoring the thumb and the pinky), and after each touch the student volunteer should report which finger was touched. I will repeat this about 7-10 times, varying which finger gets touched and record the results (we will label the fingers 1-5 starting with pinky finger).

2. The student volunteer should then lose their shoes and socks and I will repeat the demonstration, this time touching the three middle toes (i.e., ignoring the big toe and the littlest toe) 7-10 times, varying which toe gets touched. We will record which toe was touched by the pen tip on each trial (we will label the toes 1-5 starting with pinky toe).

Where were student volunteer guesses most accurate and why?

Sensation and Perception: Touch

Although the skin senses in general are remarkably sensitive, various parts of the body differ greatly in their sensitivity to pressure. In addition, not all our body locations receive the same attention from the brain: the differences lies in neural organization. The brain does not allocate space for tactile analysis based on the size of the body part but on the number of receptors that body part has.

The sensorimotor strip (is dedicated much more heavily to the fingers, which receive a lot more stimulation, do a lot more work, and are a lot more important to a variety of tasks than are the toes.

As well, larger portions of the cerebral cortex are devoted to body areas that, for adaptive reasons, show greater sensitivity; for example, crucial human features such as the mouth, face, and fingers are much more sensitive than are important, but less central, features such as the legs, feet, and back.

Receptors in our skin are unevenly scattered; one of the sparsest concentrations is in the middle of your back while the highest concentrations exist in your fingertips and then your face.

Sensation and Perception: Motor/Sensory Homunculus

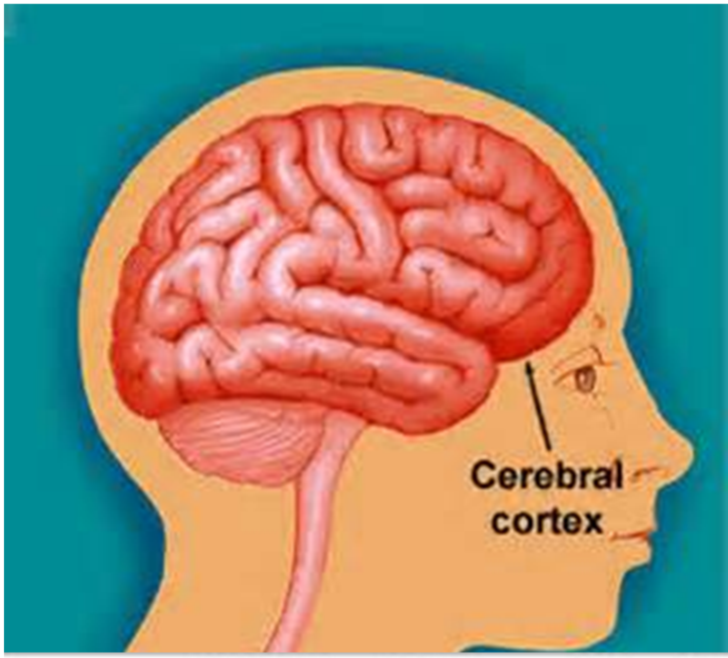
Homunculus visualizes the connection between different body parts and areas in brain hemispheres. The motor cortex located on the left side of the brain controls movement on the right side of the body.

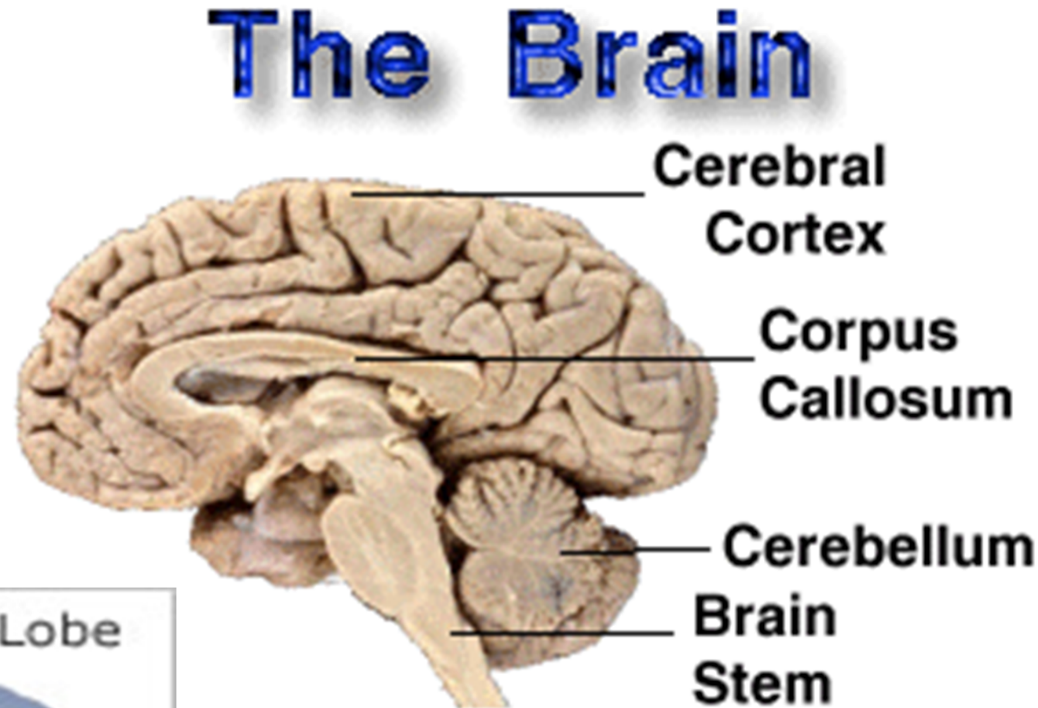
Body on the left side is the *motor homunculus*. The bigger the body parts in this picture are, more brainpower there is dedicated to controlling them. Positions of motor areas for these body parts can be seen on the top in the right hemisphere (left side of brain control the right side of the body and vise versa). To compare different areas, you may click on different parts of the picture.

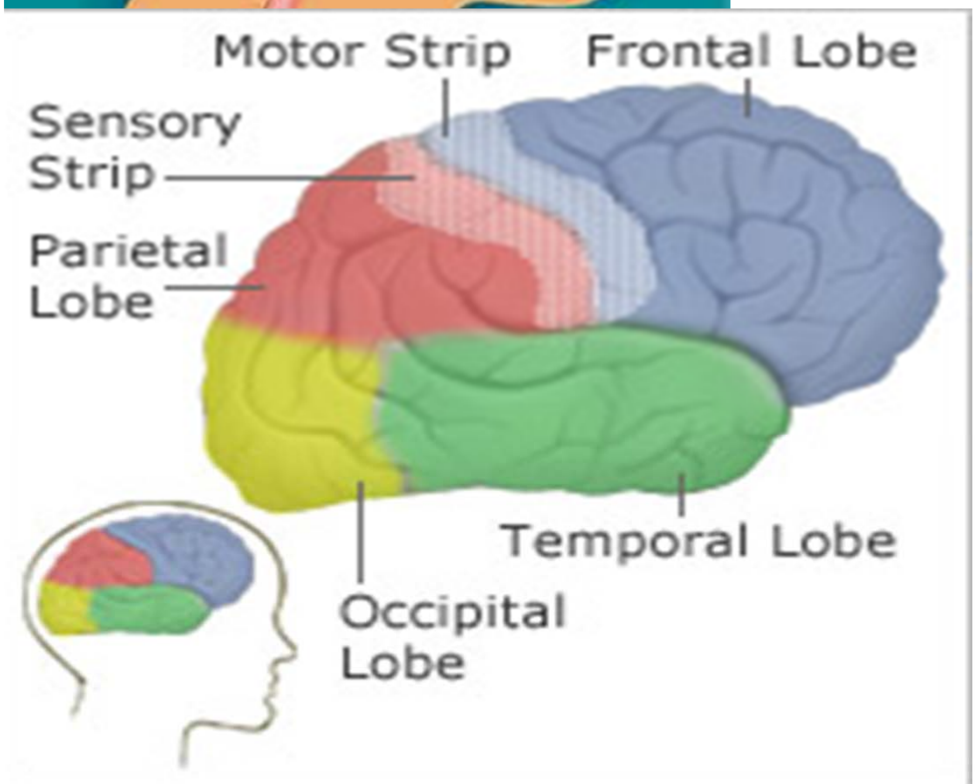
The body half on the right is *sensory homunculus*. It is similar to the motor homunculus except that it tell how much brain power is dedicated for sensing different body parts.

Click here →

homunculus.jar







Brain Probe

http://www.pbs.org/wgbh/aso/tryit/brain/probe.html