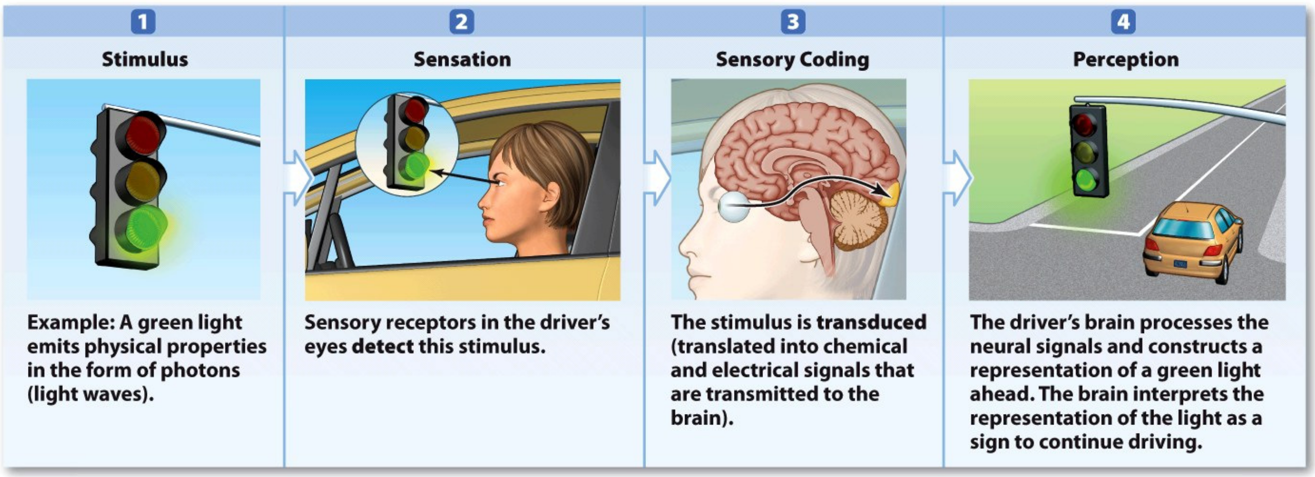
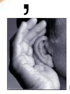
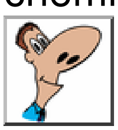
# What is the difference between sensation and perception?

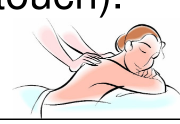



*Psychological Science*, 4/e Figure 4.2


## Sensation:

The process of detecting a stimulus, such as

- light waves (vision) ,
- sound waves (hearing) ,
- chemical molecules (smell  and taste ),
- heat or pressure (touch).

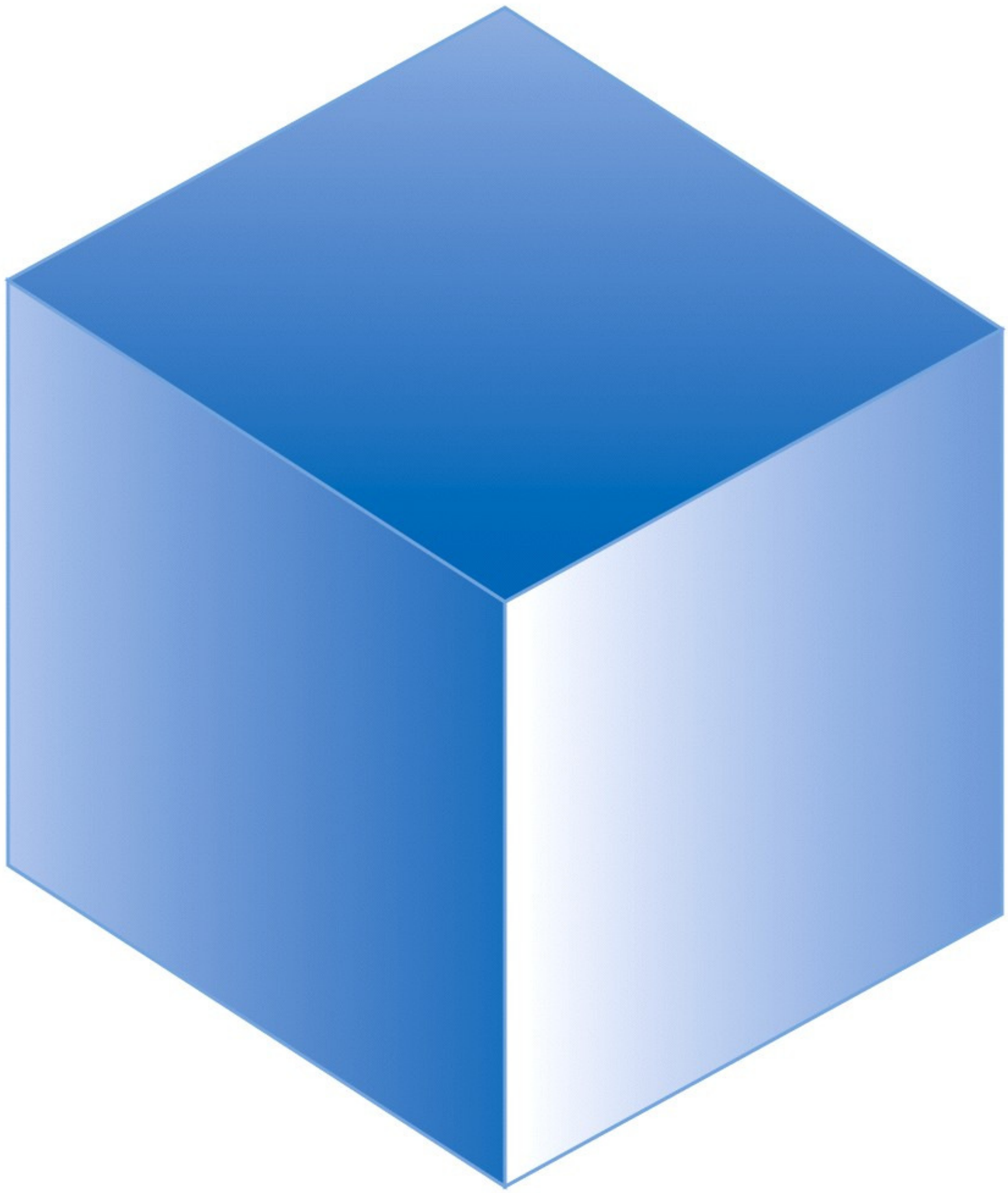


## Perception:

The process of integrating, organizing and interpreting sensations.

You might want to think of sensation and perception as two ends of a continuum. There is no clear dividing line between sensation and perception. Where sensation ends and perception begins is difficult to determine.

# How many right angles do people perceive?



# How many right angles are there?

# The Basic Senses and What They Detect

TABLE 4.1

**Transduction**

The five senses convert physical energy from the world into neural energy, which is sent to the brain.

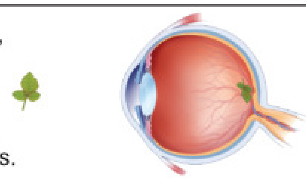
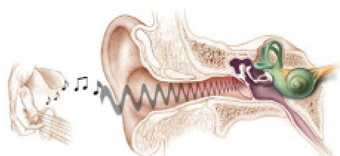
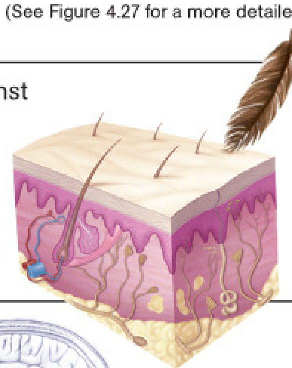
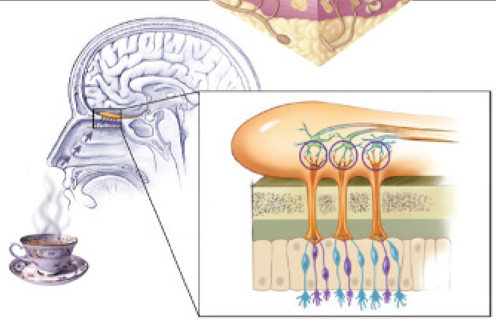
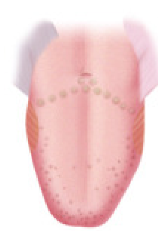
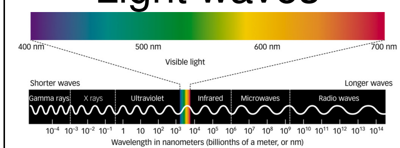
| Sense | Sensory Input | Conversion into Neural Energy |
|---|---|---|
| Vision | Light reflected from surfaces, for example from a leaf, provides the eyes with information about the shape, color, and positions of objects. |  (See Figure 4.4 for a more detailed view.) |
| Audition (hearing) | Vibrations (from a guitar string, perhaps) cause changes in air pressure that move through space to the listener's ears. |  (See Figure 4.27 for a more detailed view.) |
| Touch | Pressure of a surface against the skin signals its shape, texture, and temperature. (See Figure 4.30 for a more detailed view.) |  |
| Taste and Smell | Molecules dispersed in the air or dissolved in saliva reveal the identity of substances that we may or may not want to eat. |  (See Figures 4.31 and 4.33 for more detailed views.)  |

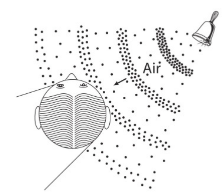
Image source: Psychology (2011), Schacter et al.

What do we detect?

Light waves




pressure waves



# <u>Sensory Processes</u>

There are some basic concepts that psychologists use when talking about the sensitivity of the senses (pages 230-234)

- <u>Sensory adaptation:</u> Diminished sensitivity as a consequence of constant stimulation (page 234).




<u>Sensory adaptation:</u> The decline in sensitivity of the basic senses to a constant stimulus. Therefore, a stronger stimulus is required to activate the senses (another definition).

<u>Smell: Touch</u>


<u>Hearing:</u>


# Sensory Adaptation

## How does sensory adaptation help us understand the world around us?

Image source: unknown

# Sensory Adaptation

## How does sensory adaptation help us understand the world around us?

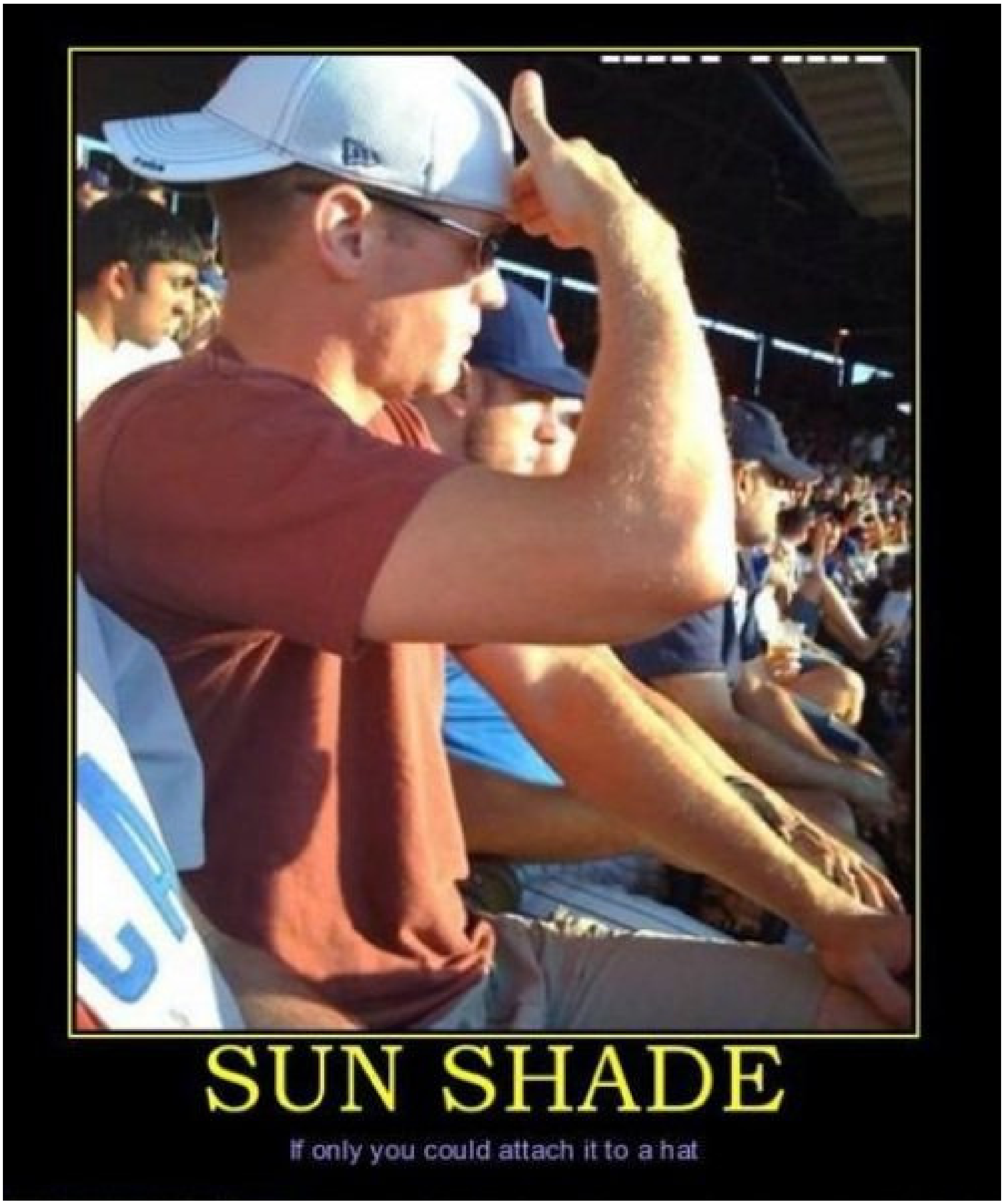



Image source: unknown

# Sensitive are the Senses?

The absolute threshold is the [*average*] smallest possible strength that can be detected half the time.

TABLE 4.2

**Approximate Sensory Thresholds**

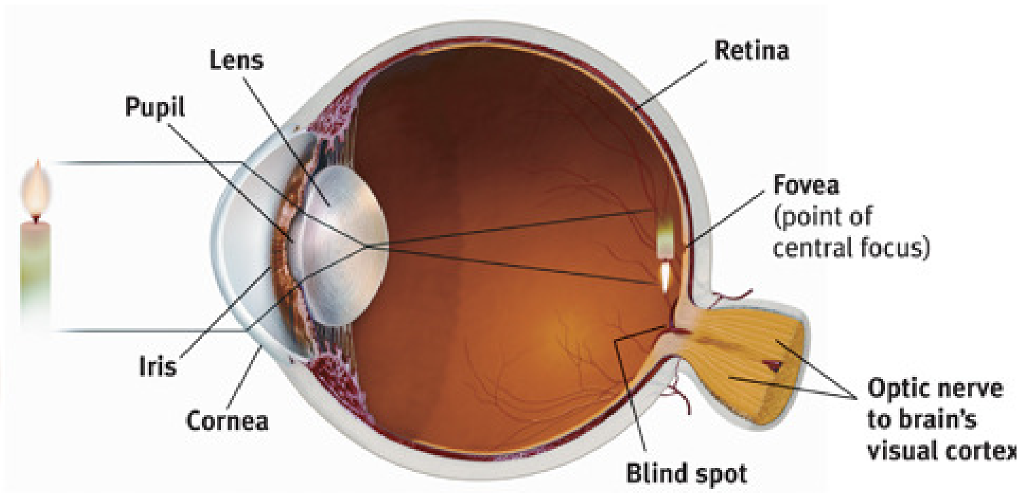
| **Sense** | **Absolute Threshold** | |
|---|---|---|
| Vision | A candle flame 30 miles away on a clear, dark night |  JANOS MISETA FEATUREPICS |
| Hearing | A clock's tick 20 feet away when all is quiet |  RAINFORESTAUSTRALIA ISTOCKPHOTO |
| Touch | A fly's wing falling on the cheek from 1 centimeter away |  TYLER OLSON FEATUREPICS |
| Smell | A single drop of perfume diffused through an area equivalent to the volume of six rooms |  MARCO ANDRAS EST AGEFOTOSTOCK |
| Taste | A teaspoon of sugar dissolved in two gallons of water |  FOODFOLIO ALAMY |

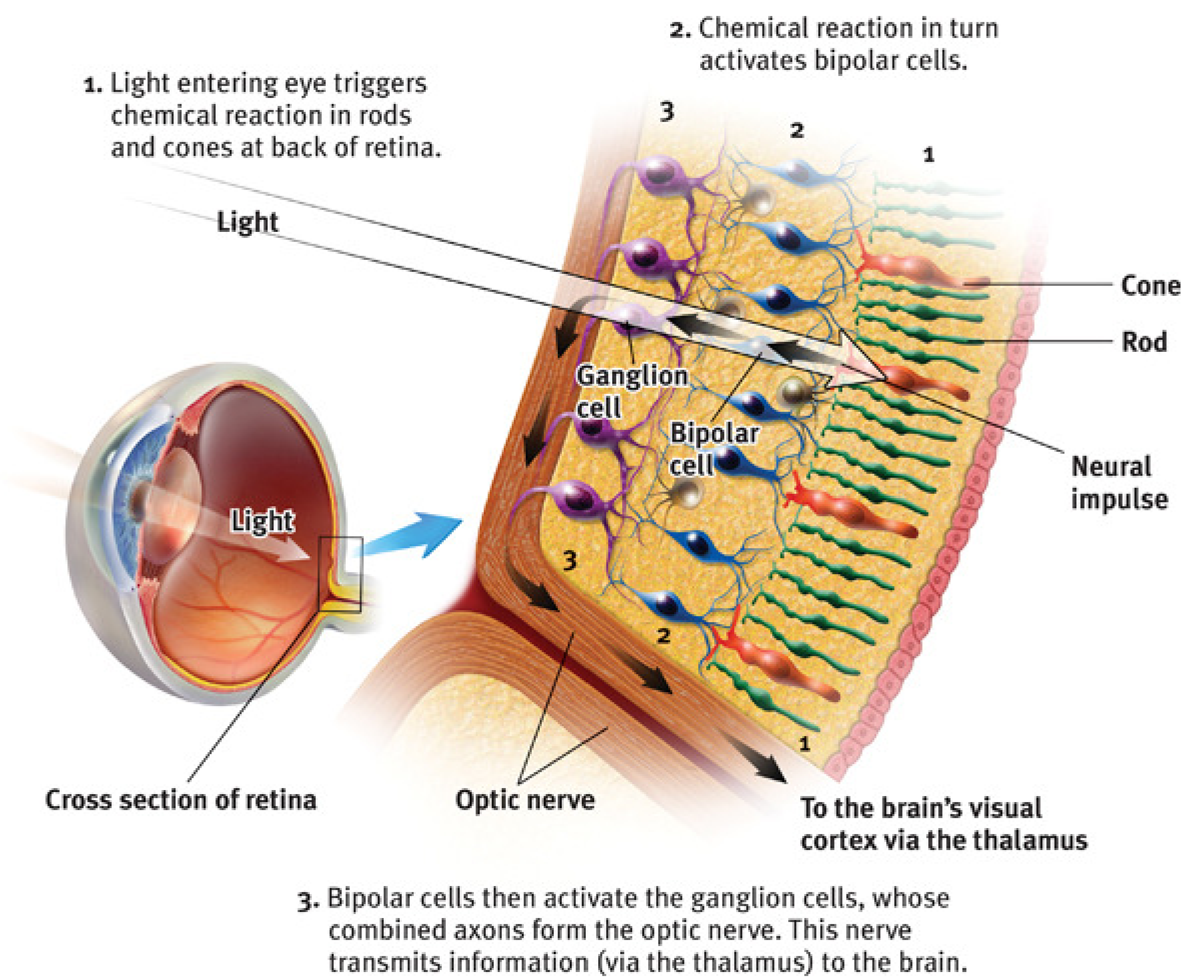
*Source:* Adapted from Galanter (1962).

Image source: Psychology (2011), Schacter et al.

# How we see

Pascal Goetgheluck/Science Source

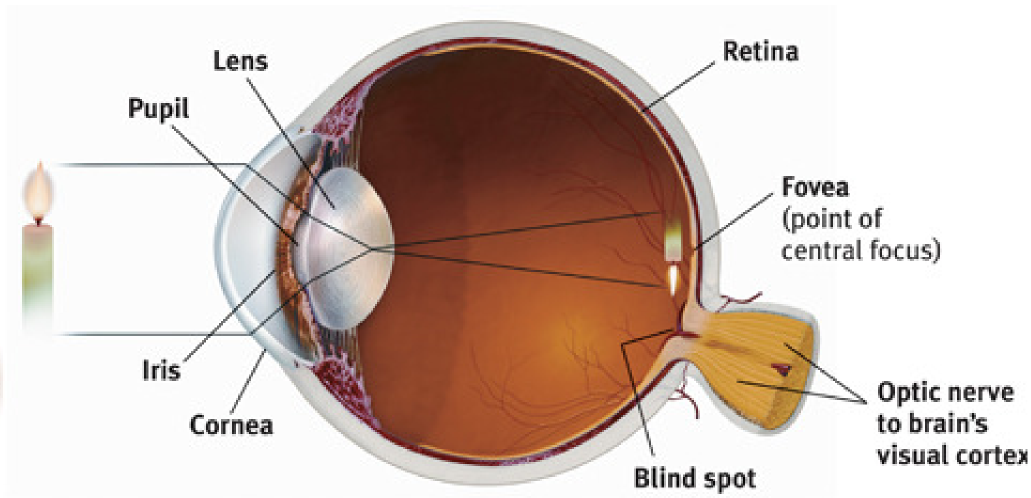


Organizing information. You should read the section on rods and cones and organize the information in two columns.

| Rods | Cones |
|---|---|
| • Long and thin with blunt ends | • short and fatter with ends that taper to a point |
| • estimated at 125 million | • estimated at 7 million |
| • max sensitivity in about 30 minutes | • adapt to light in about five minutes |
| • primarily for night vision | • primarily for color vision |
| • there are no rods in fovea, but more prevalent in the peripheral areas of the retina | • cones are concentrated in the fovea, and less common in the periphery |
| • more sensitive to light—about 1000 time better | • specialized for seeing fine details and vision in bright light. |

# The blind spot

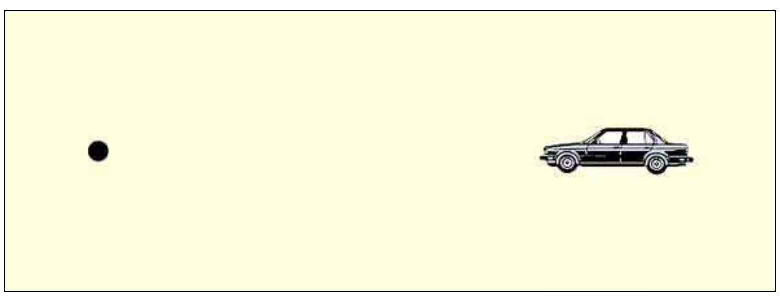
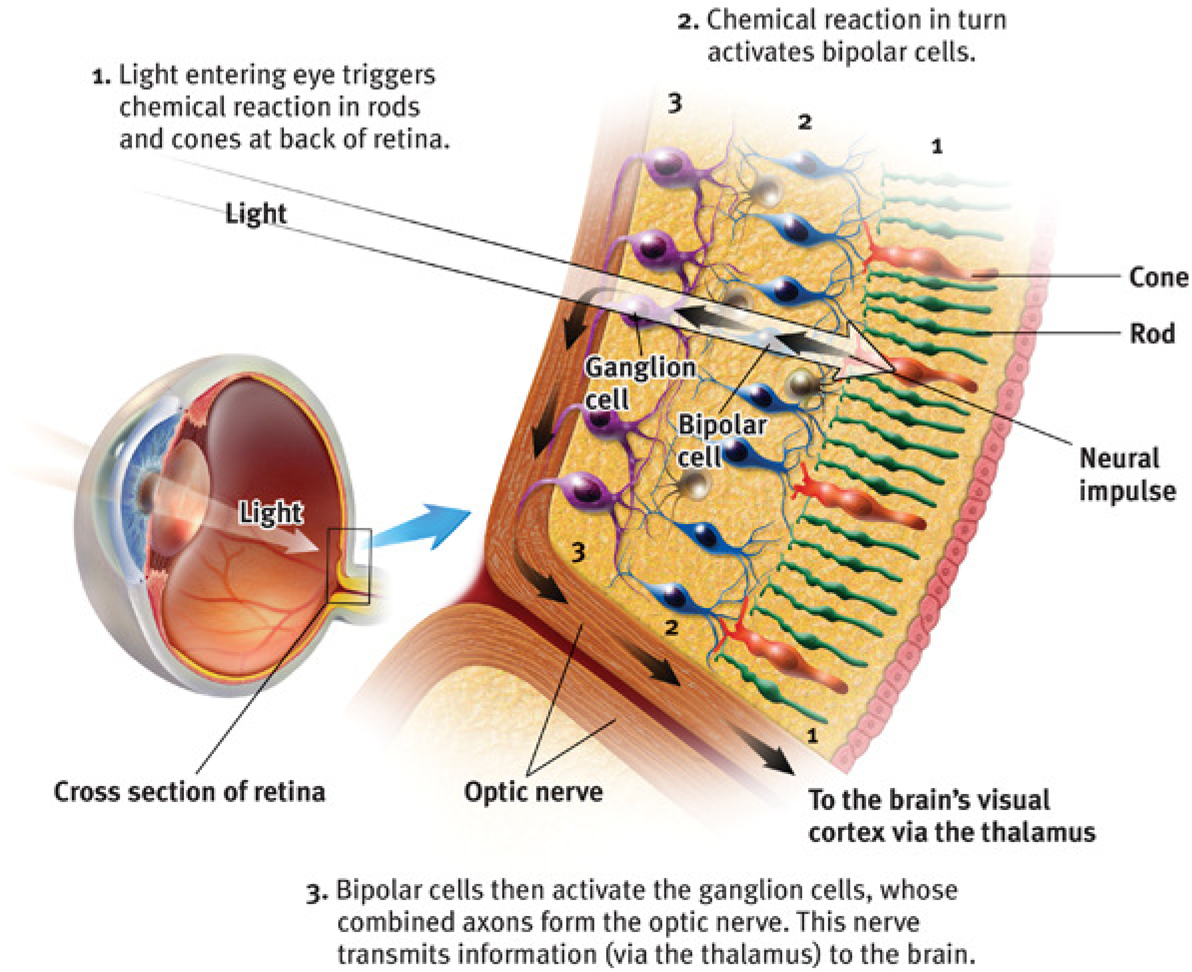



Image source: Psychology (    ), Myers

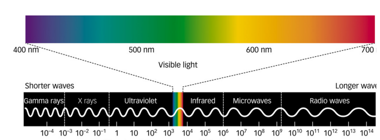
Put the black dot about 12" in front of your right eye. Using only your right eye (close the left eye), stare at the black dot and move the image forward and back until the car disappears

# Young-Helmholtz Trichromatic Theory




<u>Cones</u> are responsible for color perception. According to the theory, there are three types of cones in the <u>fovea</u> that are very sensitive to certain wavelengths of light and not very sensitive to the other wavelengths of light.

- **Blue light** (short wavelength, S cones)
- **Green light** (medium wavelength, M cones)
- **Red light** (long wavelength, L cones)

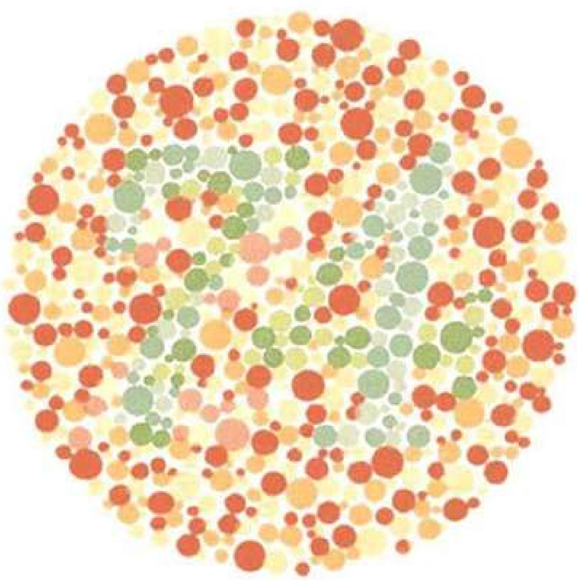
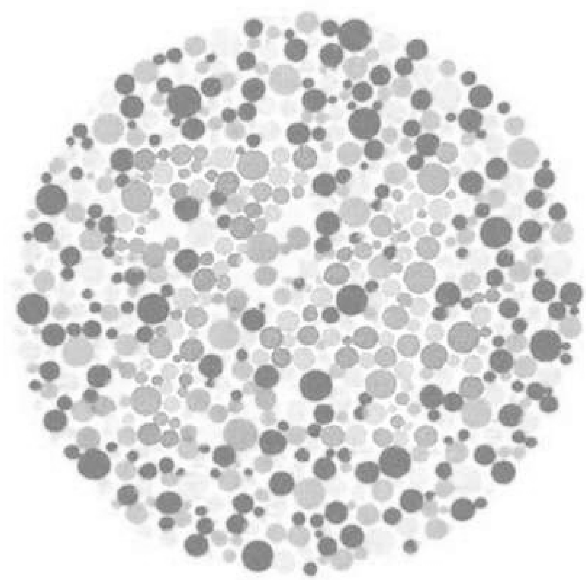



The perception of other colors (such as yellow) is the stimulation of a combination of <u>cones</u> (**green** and **red**).

# <u>The Trichromatic Theory</u>

<u>What does the trichromatic theory of color perception explain?</u>

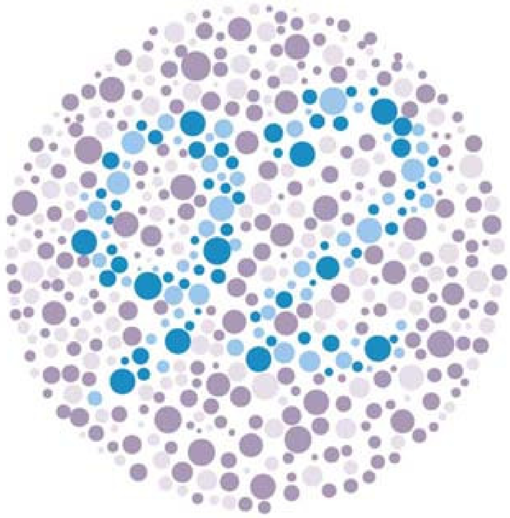
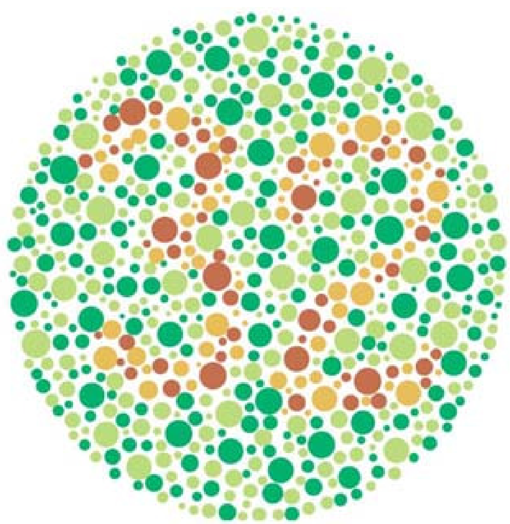
People with red/green color blindness cannot distinguish between the two colors because their red and green cones are sensitive to the same color. Technically, this should be called <u>color deficiency</u>, but is commonly called being color blind (about 8% for men, and ½% for women).

| | |
|---|---|
|  |  |
| • **Blue sensitive**<br>• **Green sensitive**<br>• **Red sensitive** | • **Blue sensitive**<br>• **Green or Red sensitive**<br>• **Green or Red sensitive** |

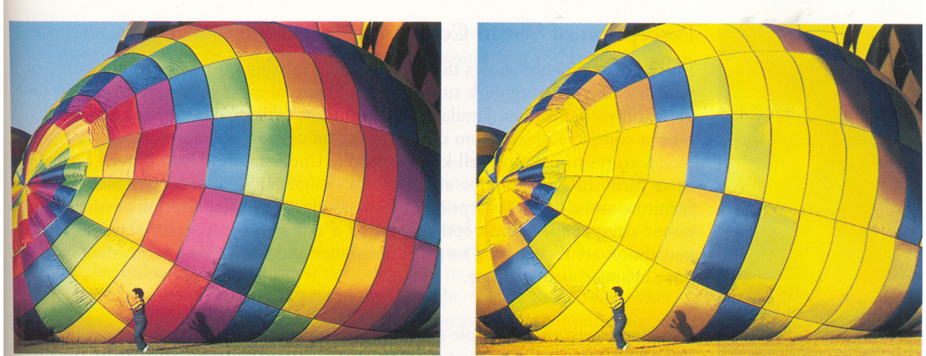
<u>Image source</u>: Psychology (2009), Hockenbury and Hockenbury

True color blind people see the world in shades of gray, and are rare (about 1 out of 1,000,000 people).

# Color Perception

<table>
<tr><td rowspan="2"><br><br></td><td>The top image tests for blue-yellow color blindness</td></tr>
<tr><td>The bottom image tests for red-green color blindness</td></tr>
</table>

# Color Perception



*Color blindness, the inability to see certain colors, is a hereditary condition in which the proteins of one or more cones either do not function or are inadequate in number. The balloons on the right are shown as they might appear to a dichromat with a red-green deficiency.*

• **FIGURE 5.13** Color blindness and color weakness. *(a)* Photograph illustrates normal color vision. *(b)* Photograph is printed in blue and yellow and gives an impression of what a red-green color-blind person sees. *(c)* Photograph simulates total color blindness. If you are totally color-blind, all three photos will look nearly identical.

Image source: Psychology, Lefton
Image source: Psychology, Coon
Image source: Psychology, Schacter et. al.

# The Opponent Process Theory

The trichromatic theory cannot explain an afterimage such as seeing a faint red, white and blue flag after staring at a yellow/green flag.

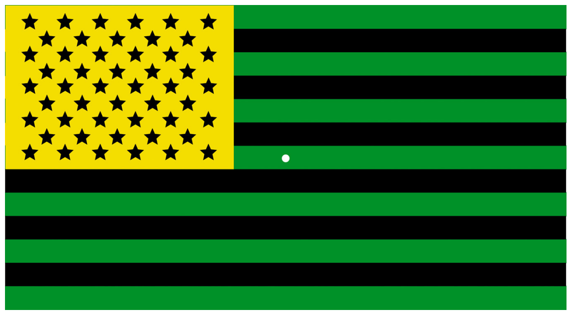


Image source: Hockenbury and Hockenbury

According to the opponent process theory, there are three types of color sensitive neurons that are sensitive to a certain pair of colors:

| | | | |
|---|---|---|---|
| 1. red / green | red / green | red / green | red / green |
| 2. blue / yellow | blue / yellow | blue / yellow | blue / yellow |
| **3. white / black** | white / **black** | white / **black** | white / **black** |

One single receptor can only be activated to a single color, while the other color is inhibited (blue can be activated, while the yellow is inhibited). With multiple receptors, some receptors can be sensitive to blue, while others can be sensitive to yellow.

All color perceptions are a combination of these receptors. For example,

- **Orange** = **red**/green + blue/**yellow**
- **Purple** = **red**/green + **blue**/yellow

## How does the opponent process explain an afterimage?

Afterimages are explained when it is combined with the general principle of sensory adaptation—the weakening of the sensitivity of your senses when they become adapted to a stimulus.

| | | |
|---|---|---|
| Before staring at the “yellow/green” flag | Normal<br>**Yellow**<br>**Green**<br>**Black** | sensitivity<br>/ **Blue**<br>/ **Red**<br>/ **White** |
| Staring at the “yellow/green” flag<br> | Reduced sensitivity<br>**Yellow**<br>**Green**<br>**Black** | Normal sensitivity<br>/ **Blue**<br>/ **Red**<br>/ **White** |
| Looking at a white background that reflects all colors of light | **RedOrangeYellowGreenBlueIndigoViolet** | |
|  | **RedOrangeYellowGreenBlueIndigoViolet** | |

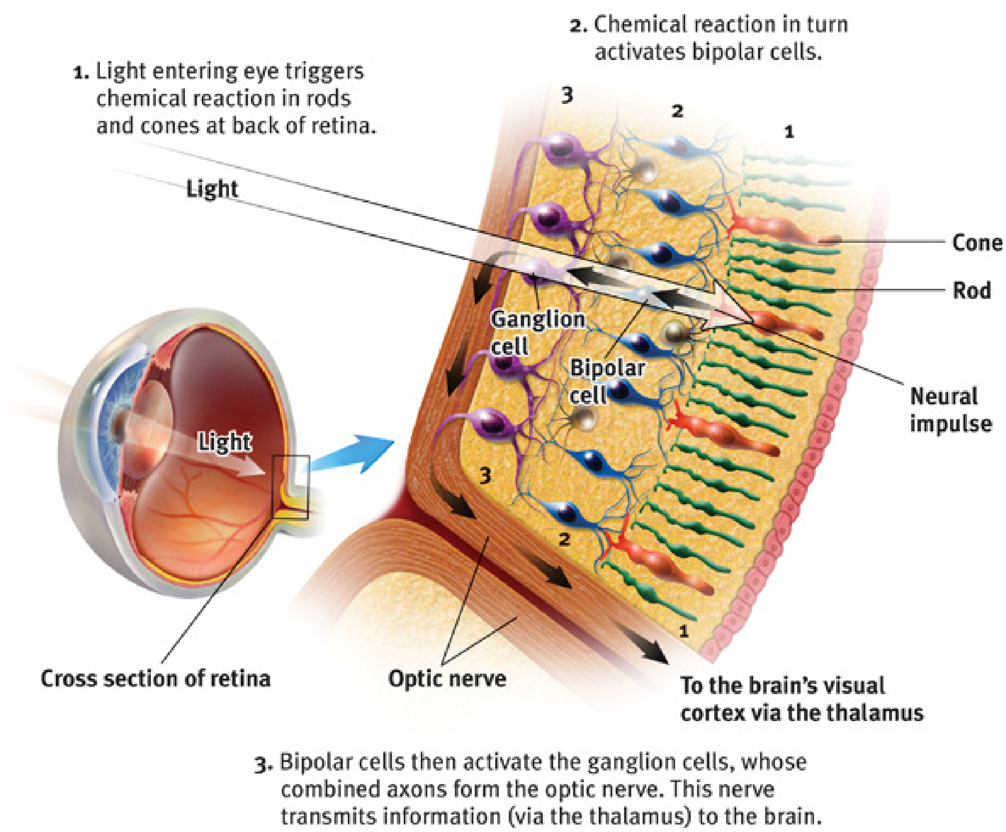
Since the red and blue receptors are sensitive, they will activate and accentuate those colors when you look at a white background, producing a weak afterimage of a red, white and blue flag.

# What theory of color vision is "right", they both can't be right?

What theory of color perception explains how we perceive color?

This is the wrong question to ask about color perception. Both theories explain color perception, but at a different level of color perception.

- The trichromatic theory primarily explains perception within the structure of the eye (the cones and retina) before being transmitted to the brain via the optic nerve.
- The opponent-process theory explains perception within the ganglion cells, thalamus and visual cortex.



Why is understanding the process of color perception important for understanding psychology, science, and perhaps life in general.

- No one theory explains complex behavior—it involves multiple processes.
- Sometimes asking the wrong/right question is important for understanding the world around you. The question that is given to you may be the “wrong” question.
- Even though they “appear” to be inconsistent, the two theories are consistent.  Science needs to be internally consistent

Where will you see this again?

- Motivation and Emotion
- Personality

# Perception

In order to make sense of information; we use two basic processes to help us perceive the world. These two processes work together and complement each other.

## Bottom-Up Processing

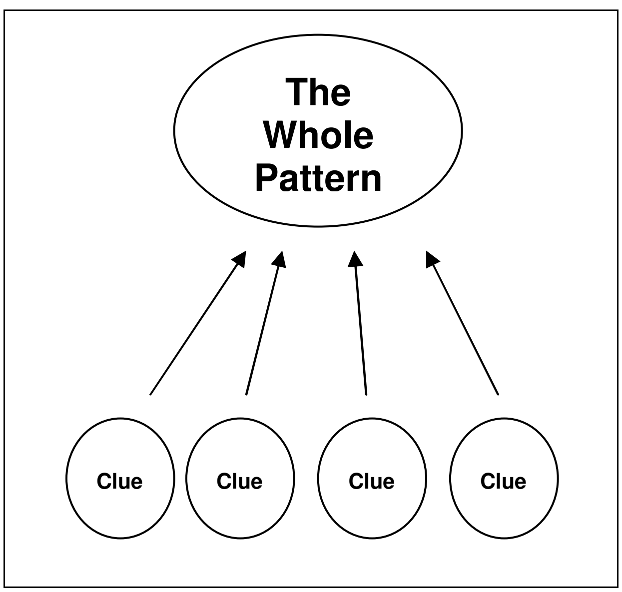
Perception based on the physical features of the stimulus.

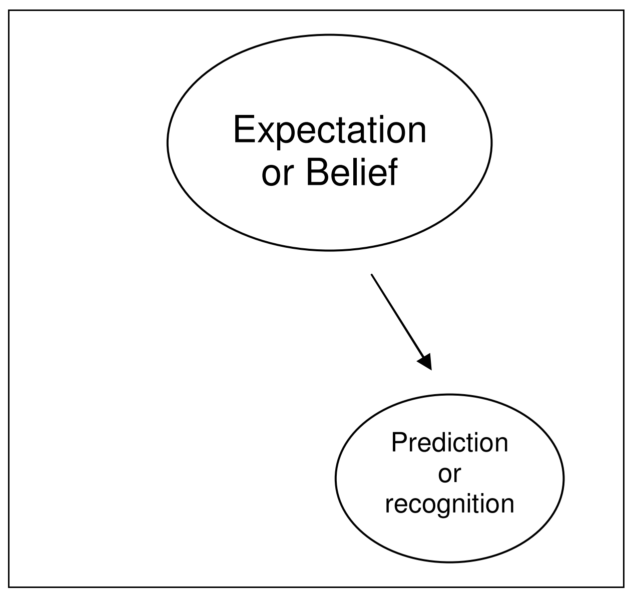
analysis moves from the parts to the whole; also called data-driven processing.

## Top-Down Processing

How knowledge, expectations, or past experiences shape the interpretation of sensory information.

analysis that moves from the whole to the parts; also called conceptually driven processing.




Most information processing involves **both** top-down and bottom-up processing.

In order to determine the whether the processes is top-down or bottom-up, we have to look at the thinking process.

| **You use bottom-up processing when…** | **You use top-down processing when…** |
|---|---|
| • recognizing a pattern from the known parts and pieces without the picture of what the puzzle looks like. | • recognizing a new part or piece of a puzzle from a known pattern. |
| • identifying the picture of a jigsaw puzzle as you assemble it piece by piece. | • searching for pieces to fit a known picture in a jigsaw puzzle. |
| • TWA 800 crash: no one knew the reason why the airplane exploded: to discover the cause, they had to reassemble the pieces of the wreckage | • Alaska Airlines flight out of Los Angeles was “flying upside down”. It was hypothesized that the jack screw in the rudder failed. |
| • If you display the symptoms:<br>    • Fever<br>    • Swollen glands<br>    • Sore throat<br>    • Red throat | • If you have strep throat, then the throat swab test should be positive<br>• If you have strep throat, then you should see white specks in the throat |
| • A person walks in with a green shirt, blue, green, yellow, red, green, black, green, green hat<br><br>What is going on? | • If today is St. Patrick’s Day, then what should you see? |
| • “Car Talk” | • “Car Talk” |