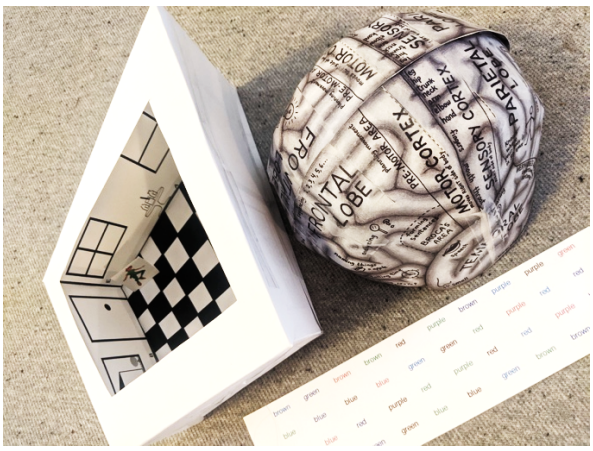
Materials needed:

Brain Hat
Ames Room Model
Transparent Tape
Scissors
Stroop Effect card
3 Bowls
Warm, Room Temp, and Cold Water



"*The brain is the last and grandest biological frontier, the most complex thing we have yet discovered in our universe. It contains hundreds of billions of cells interlinked through trillions of connections.* ***The brain boggles the mind***." – Dr. James Watson

Illusions provide a window into how your brain makes sense of the world.
Here are five classic examples to try!

Stroop Effect

Try this experiment on yourself, a family member, or a friend! Get out the card in your kit with the colored words. Read aloud the correct **COLOR** of all of the words as quickly as you can. First try the side where the color and name match (**RED** say **"red"**), then the side where they don't match (**RED** say **"blue"**). *You can time the trials with a stopwatch app, or simply notice if one is easier or harder.*

Many people find this challenging! Neurologists call this **interference** – where the processing of one stimulus (written words, which are often read automatically) makes it difficult to process a second stimulus (color). When different parts of your brain are involved and the information is in conflict, it gets confusing!

Ames Room

Is it possible to make a room where objects appear bigger or smaller than they really are? That is the Ames Room illusion! Your brain constructs its understanding of reality from visual cues and your experience in the world. Most rooms that we occupy are square or rectangular. If the lines in the floor tile appear to be parallel and the windows appear to be the same size it is generally safe to assume that they actually are. As straight lines travel away from us they converge in space towards a vanishing point – this is called perspective. The Ames Room uses perspective cues to trick your brain into thinking that a trapezoidal room, with one back corner much farther away and a slanted ceiling, is a normal shaped room. When identical figures are placed in the back corners of the Ames Room the figure that is closer appears to be *much larger!*

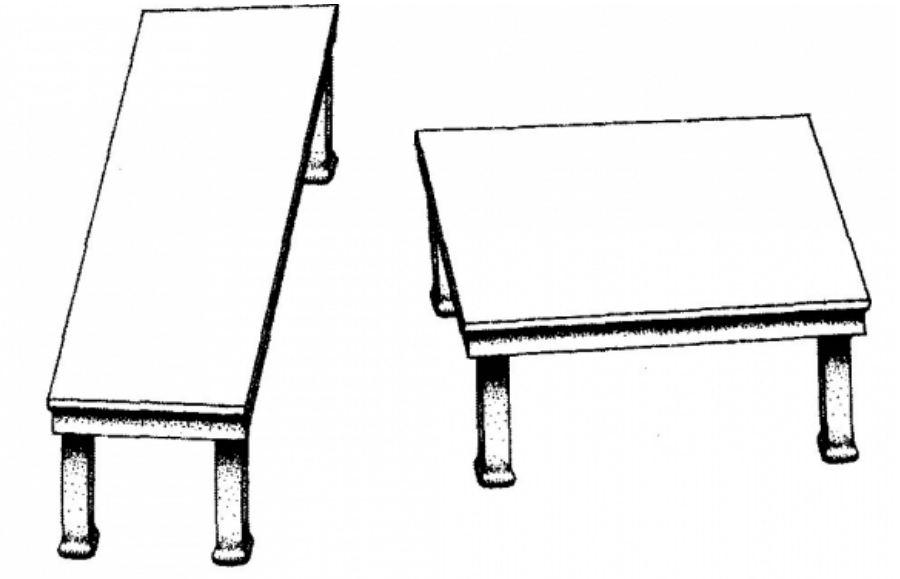
To see if this illusion really works, **cut out and assemble your mini-Ames Room and try it out**! Put two *identical* objects in the far corners and peer through the peep hole in the front (or take a picture with your phone camera). Do they look like they are different sized objects in a square room?
Video Instructions for this project:
https://www.rigb.org/families/experimental/small-or-far-away

Shepard Table Illusion

Compare these two tables. Which one would be easier to get through a narrow door? How do the size and shape of the table tops compare? Measure them and find out!

How is this possible?? Can you apply what you learned about the Ames Room to explain it?

(created by Stanford psychologist Roger Shepard 1990)



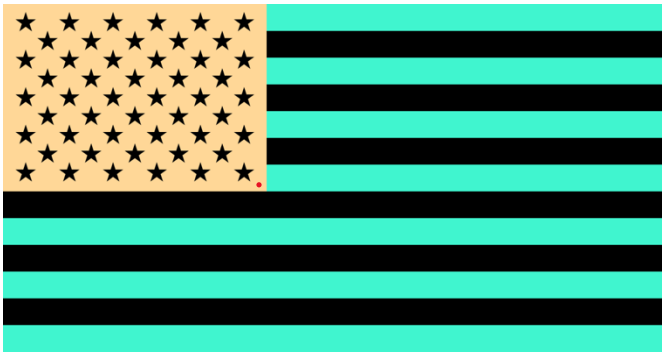
Tactile Illusion

Here's an interesting experiment! Get 3 bowls or pots large enough to immerse your hand in. Fill the first bowl with ice cold water, the one in the middle with room temperature water, and the third bowl with warm water from the tap. *Make sure the water is not too hot.* If you experience any discomfort take your hand out and try cooler water.

COLD **ROOM TEMP** **WARM**

Place your left hand in the cold water and your right hand in the warm water. Rate how cold or hot the water is. After a minute or two notice again – does the cold water feel as cold as it did at first? What about the hot water? Do you think the actual temperate changed very much in that minute or two…..or was it your perception that changed? Finally, take both hands out and put them in the room temperature water. What temperature does it feel like? Concentrate on one hand, and then the other. Do they agree?

When you first put your hands in the water your neurons fired a lot, sending strong *Hot!* and *Cold!* signals to your brain. After a little while something interesting happens! The nerves slow down their firing rate, even though the stimulus is the same. This is called **sensory adaptation**. This allows our brain to focus on *changes* in the environment. It is more efficient and allows the brain to be alert for new input.

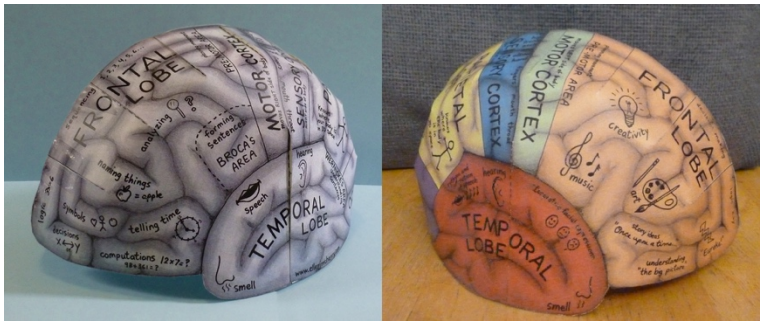


After Images

Sensory adaptation can make you see colors that aren't really there! Find the tiny red dot in the lower corner of the star field of the flag. Focus on it as you count to 30, then look at a white background. Do you see an after-image? What colors? One explanation is that the neurons in your retina (the back of your eye) became less responsive to the orange and green because they were constant. Those colors were then "subtracted" from the white background, resulting in the opposite colors being perceived.

Your BRAIN

This kit contains two paper halves (hemispheres) of a human brain that you can study and turn into a hat! Wear it to your next class or meeting and surprise people :)



<u>To make a 3-D brain hat</u>: Cut the solid lines (the line that the arrows are pointing to). Tuck the flaps under and tape on the outside with clear tape. Test the fit as you go and adjust the amount of overlap as needed. When both halves are done, tape together in the middle on the inside. Tape the Cerebellum in the back under the Occipital Lobe.
https://ellenjmchenry.com/brain-hemisphere-hat/

You use your brain every day, even while you are asleep – but how much do you really know about it? The largest part of your brain is called the **Cerebrum** and it allows you to do a wide range of things: talk, reason, have emotions, learn, control your movements, and interpret hearing, vision, and touch. Can you find the areas of your brain related to: *Logic and Math*? *Smell*? *Naming things*? *Sensing your fingers? Forming sentences*? *Creativity*? *Knowing where your body is in 3-D space*? The two halves of your brain are connected in the middle by the **corpus callosum**, a band of 200 million nerve fibers. While each side is dominant for certain tasks, they do work together.

Notice that there are four main lobes in the Cerebrum: **Frontal**, **Parietal**, **Occipital**, and **Temporal**. Can you find any patterns in what the lobes do?

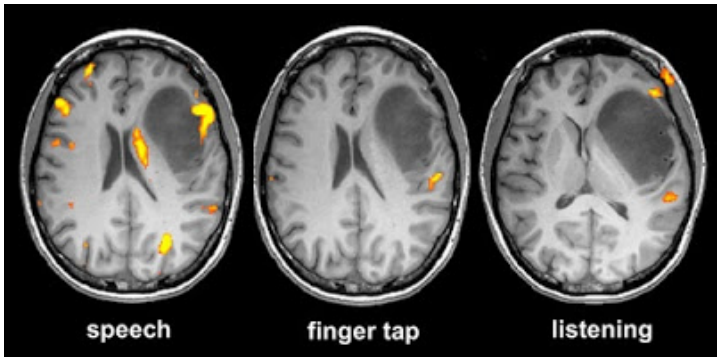
When you type on a keyboard or ride a bike you are using your **Cerebellum**. The Cerebellum is the part of your brain tucked underneath the cerebrum. It coordinates precision and timing of movement. Your **Brain Stem** (not included) connects your brain to your spinal cord and controls important basic functions like breathing and heart beats.

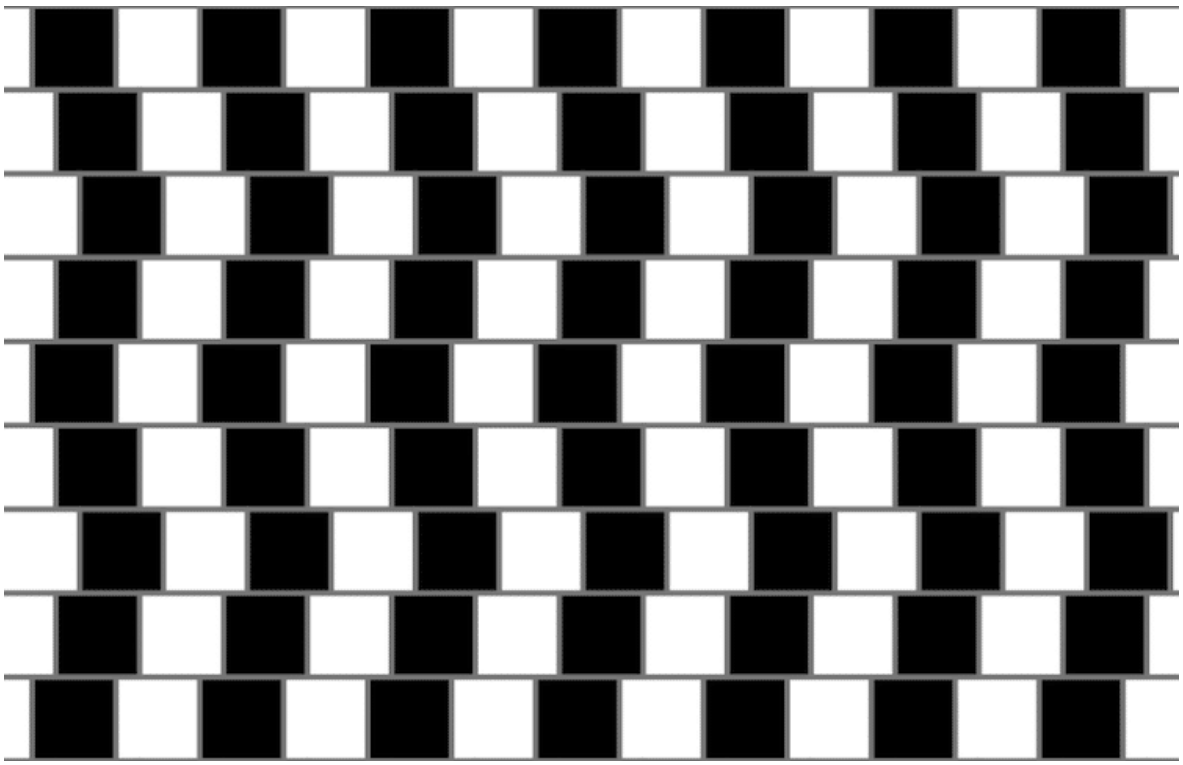
This activity is a reminder of **how important your brain is**! To help keep your brain healthy: wear a helmet when doing sports, drive carefully, get regular exercise and enough sleep, and try to have a healthy and low-stress lifestyle.

If you like to invent and create, maybe you can design a better helmet! Scientists have studied woodpeckers, long-horned rams, and hedgehogs to find clues to protecting the brain from injury. Where do you think the secret lies?

Brain Science

How do scientists study the brain? 200 years ago most information came from studying people who had experienced brain injuries in different parts of the brain. Now neurologists can study brain activity in anyone in amazing detail. When an area of your brain is very active, more blood flows to that location to supply oxygen to the neurons. An MRI machine uses a huge electromagnet to detect differences in the blood flow. In these scans the bright areas show different areas of brain activity during speech, finger tapping, and listening. What parts of your brain do you think are active right now?





Café wall illusion: Believe it or not, these lines are all straight, and parallel!