Visual Plasticity- Prism Goggles

What is plasticity? The brain's ability to adapt to environmental changes or a new experience is called plasticity.

Ideas:
1. When you change the information that your brain receives, you make mistakes.

2. *Given new information, the brain learns and adjusts your behavior*

The prism goggles use Fresnel Lenses, which bend light the light entering the eye to produce a 15 degree shift in the visual field.

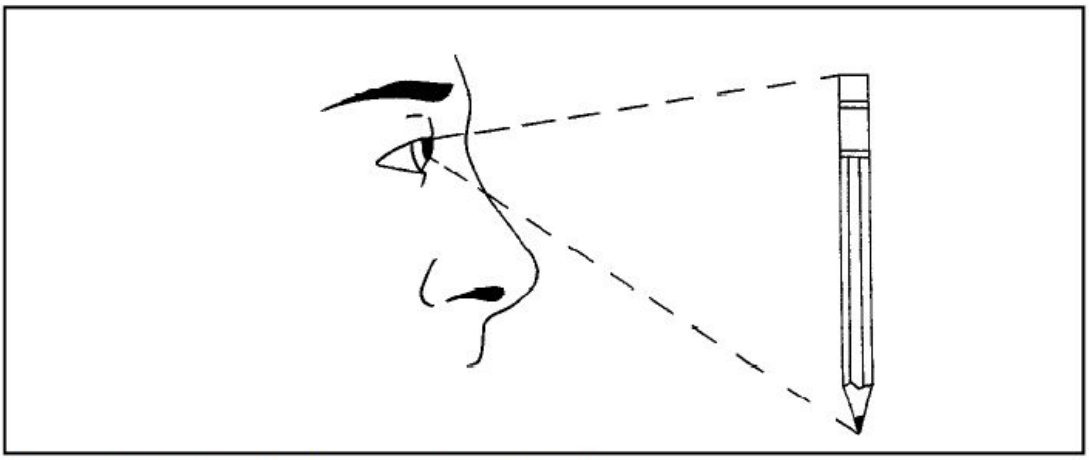


Figure 5a. Individual's view of pencil without prism goggles.

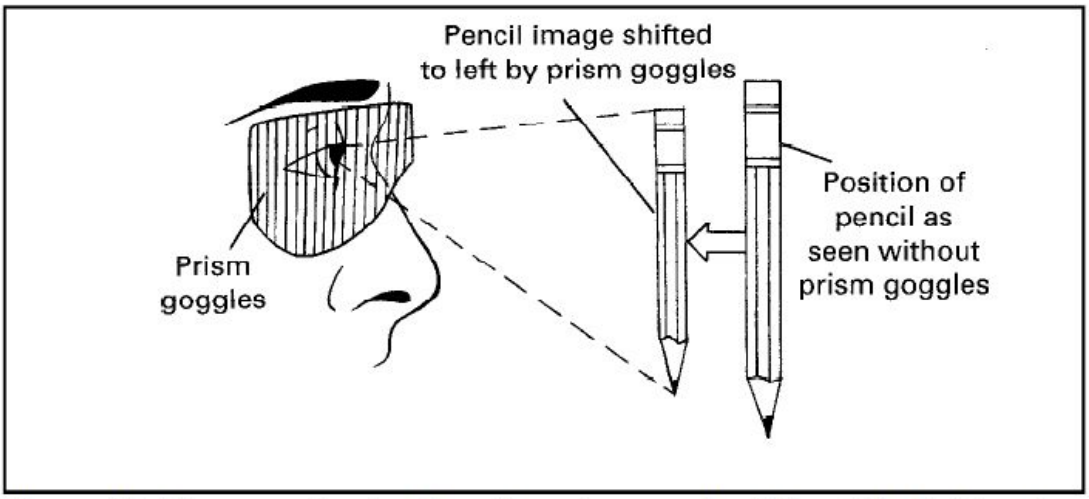


Figure 5b. Diagram showing how the prism goggles diffract the light and the individual sees the pencil to the left of the original position.

Prism Goggles Procedure:

1. Ask the participant if they know what brain plasticity is?
   Discuss Ideas 1 and 2 . Ask if they want to experience brain plasticity.

2. Ask the thrower to fit the prism goggles to their face so that he/she can take them on and off quickly and easily during the activity. Once the goggles are fitted appropriately the thrower can wear them on the top of his or her head/forehead until it is time to place them over the eyes. **The goggles will work over glasses.

3. Without goggles, ask the thrower to overhand toss beanbags at the target. Continue until the thrower is able to hit the target regularly – adjust the distance from the target to increase success if necessary. ** The thrower can also toss underhand but should throw the same way throughout the test.

4. Ask the thrower to put on the prism goggles and begin throwing beanbags at the target. The thrower should initially have trouble hitting the target. Let the thrower continue until he/she has returned to baseline and is successfully hitting the target again.

5. Ask the thrower to very quickly remove the prism goggles and immediately begin throwing beanbags at the target again. Just like before, the thrower should initially have trouble hitting the target.

Note: if there is a delay between taking off the goggles and the first toss, they will return to baseline before the plasticity is demonstrated. After a couple of tosses they will again be successful at hitting the target – more plasticity!

Handout adapted from:
http://students.washington.edu/nbout/extras/LessonPlans.html, Bob Melton, Edmond Memorial High School, Edmond, OK

Note: We can collect data for this activity. 1) Count the number of tosses it takes for a person to regularly hit the target without the goggles on. 2) Count the number of tosses it takes for a person to hit the target with the goggles on. 3) Measure how far off the throw is when goggles are removed or Count the number of tosses it takes a person to readjust when goggles are removed.

Follow up questions for Prism Goggles:

1. What did the goggles do to what you were seeing?

The prism goggles actually bend the light that they are seeing so that everything they see appears to be slightly shifted, even though it hasn't really moved. This means that what your brain was thinking it saw was different from what was actually there.

The visual displacement caused by the prism goggles forces the first toss of the beanbag to be aimed at a target that seems to be straight ahead. In reality, it has deviated in a direction opposite to the displacement.

2. What happened when you threw the ball after you put on the goggles?

After putting the prism goggles on, people generally miss the target for throws 1-5 but then they start hitting the target. What's happening? Your eyes see things, but your brain interprets what you see. You use both your vision and your body's "position sense" to help you move around in the world and know where things are. The brain used the experience of missing the target to adjust how you throw at the target.

Individuals vary in their rate of adaptation. Some may adapt after only one throw.

3. **What happened when you threw the ball after you took off the goggles?**

The first toss a person throws after removing the goggles will deviate from the target the same amount as the person compensated when throwing while wearing the goggles.

During the learning trials, adaptation/plasticity in the neural pathways incorporates a correction factor to ensure that the target is hit as the beanbags are tossed. The correction factor is remembered when the goggles are removed.

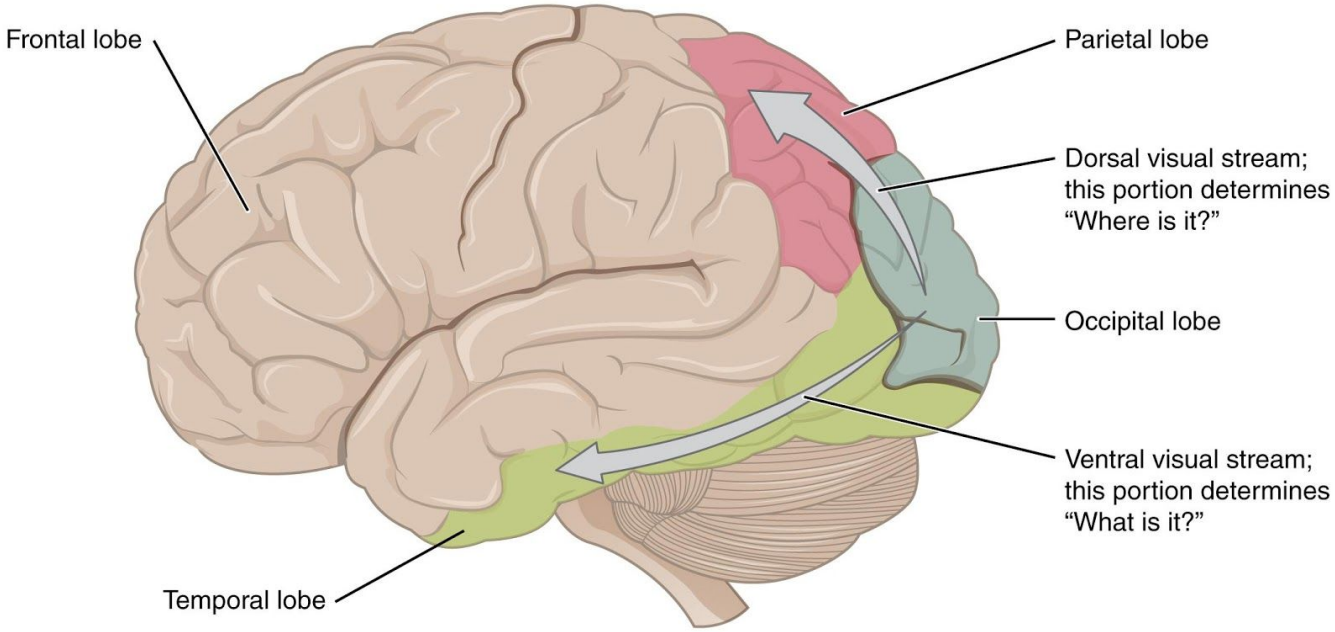
4. What does this experience tell you about how your brain works?

Although the activity is "remembered" for only a short period of time, the plasticity

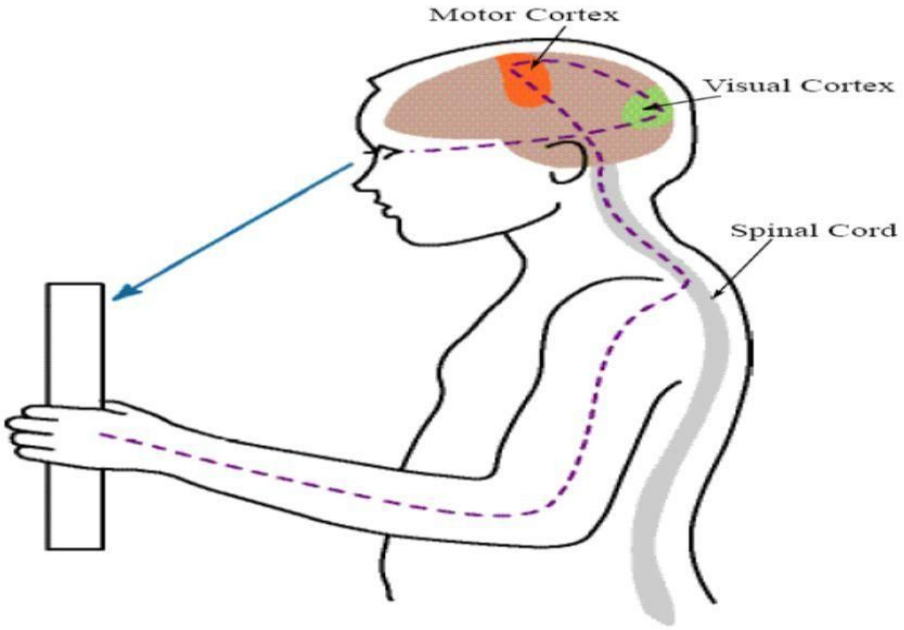
that has been demonstrated is thought to underlie memory and learning and is considered to be a generalized property of many portions of the central nervous system

Neurons in different parts of the brain are responsive to different aspects of the stimulus (= do different things).

What versus Where:



Neural Circuitry for using visual info to move hand:


Motor Cortex
Visual Cortex
Spinal Cord