

Mirror Neurons

Standard(s):

9.1.1.1.2 Science is a way of knowing about the natural world and is characterized by empirical criteria, logical argument and skeptical review.

9.1.1.2.1, 9.1.1.2.2 & 9.1.1.2.3 Scientific inquiry uses multiple interrelated processes to investigate and explain the natural world.

9.4.1.1.1 & 9.4.1.1.2 Organisms use the interaction of cellular processes as well as tissues and organ systems to maintain homeostasis.

Objectives:

1. Students will describe the importance of emotions and mirror neurons on social survival and homeostasis.
2. Students will build observational skills for recognizing accurate emotional states in social situations.

Included Resources

1. Lesson Plan
2. Facial Expression Pictures
3. Student Data Collection WS

Type of Activity: Station lab or Classroom demo

Duration: 1-2, 55 min class periods

Timing in relation to Nobel Conference:

- Pre-conference activity
 During conference activity
 Post-conference activity



http://newscrash.blogspot.com/2009/12/trends-updates_06.html

Tied to Nobel Conference:

Speaker: Vilayanur Ramachandran, Director of the Center for Brain and Cognition and Professor, Psychology Department and Neuroscience Program at the University of California, San Diego.

V.S. “Rama” Ramachandran is most recognized for his research in the area of visual perception and behavioral neurology. He is credited with exploiting so-called mirror neurons in the development of therapies for phantom limb pain.

Teacher Tips:

1. View videos prior to using in class to ensure they are appropriate for your class.
2. Check your technology availability. Do you have enough devices for individual groups to view the videos (station lab) or will this need to be a classroom demo.

3. Mirror Neurons are a special class of neurons "...that fire not only when an individual performs actions, but also when the individual observes someone else make the same movement..." (Society for Neuroscience, 2011).
4. Mirror neurons have expanded areas of research including the development of empathy for others, autism, schizophrenia, evolution of language, and therapies for helping stroke victims regain lost movement (Society for Neuroscience, 2011).

Recommended Prior Student Knowledge:

1. Neuron anatomy
 - a. dendrites
 - b. cell body
 - c. axon
 - d. myelin sheath
 - e. node
 - f. axon terminal
 - g. synapse/synaptic clef
 - h. neurotransmitters
2. Types of Neurons
 - a. Interneuron
 - b. Motoneuron
 - c. Sensoryneuron
3. Lobes of the Brain
4. Central nervous system
5. Peripheral nervous system

Concepts, Connections, and Terms addressed in activity:

1. Mirror Neuron
2. Emotions
3. Empathy

Materials:

1. Pictures of faces displaying the basic emotions. (available below)
 - a. Emotion 1: Anger
 - b. Emotion 2: Disgust
 - c. Emotion 3: Happy
 - d. Emotion 4: Neutral
 - e. Emotion 5: Sad
 - f. Emotion 6: Scared
 - g. Emotion 7: Surprised

2. Evoking Videos
 - a. **Video 1:** happy ukulele boy - www.youtube.com/watch?v=ErMWX--UJZ4
 - b. **Video 2:** happy baby laughing - www.youtube.com/watch?v=5P6UU6m3cqk
 - c. **Video 3:** surprising basketball blooper - www.youtube.com/watch?v=kHz8-1UFaKQ
 - d. **Video 4:** scary commercial - www.youtube.com/watch?v=Gkmj5aiLM5g
 - e. **Video 5:** disgusting beetle eating - www.youtube.com/watch?v=Uj9CysSSps&NR=1
 - f. **Video 6:** sad commercial - www.youtube.com/watch?v=dpf2hsZGsJM&feature=related
 - g. **Video 7:** scary commercial - www.youtube.com/watch?v=Y4Zn9LR5D1M
 - h. **Video 8:** funny dreaming dog - http://www.youtube.com/watch?v=z2BgiH_CtIA
3. Access to computer/media files (computers, MP3, iTouch, iPhone, etc)
4. Projector source (for use as classroom demo)
5. Ear-phones
6. Optional – webcam (for projecting reaction of viewer during Part 2: Classroom Demo)

Procedure:

Part 1: Station Lab and Classroom Demo

1. To begin the activity, show students pictures (at the end of this document) of faces displaying the basic emotions.
2. Ask students to identify the emotion and explain what clues led them to that conclusion. Reiterate student thoughts to begin to build a vocabulary for talking about emotions.
3. Discuss with students how they are able to recognize emotional responses and why these are important.
4. Have students list all of the emotional states they can. Narrow down the list to 4-8 “primary” emotions that correspond to a facial expression.
5. Describe the facial expressions associated with each emotion. Be as detailed as possible with the descriptions, e.g. corners of mouth go up, inside of eyebrows go down, etc.

Part 2: Station Lab (*for use in small groups of students*)

1. Assemble the class into groups of three.
2. One student from each group will sit down so they can fully see the video. Ensure they are the only ones that can see and hear the video clip. These students are the *viewers*.
3. The other students will split into two groups: *primary observers* and *secondary observers*.

4. Primary observers watch the viewer from their group in such a way that they can fully see the viewer's face but not see the screen. These observers will document on the student data collection sheet the changes in the viewer's facial expression and label what they see with one of the listed emotions from step 2.
5. Secondary observers watch the primary observers in such a way that they can fully see the primary observers' faces but not the screen or the primary viewer's face. These observers will document the changes in the primary observer's facial expression and label what they see with one of the listed emotions from step 2.
6. If there are any groups of two this secondary observer will be omitted.
7. After all the data is collected, have the small groups discuss their individual results. Then bring the class back together to discuss results as a group. Discuss what the data shows.
8. If time allows, rotate viewer → primary observer → secondary observer and repeat exercise with a different video.

Part 2: Classroom Demo (*for use with large groups of students*)

1. One student will sit down so they can fully see the video. Ensure they are the only one that can see and hear the video clip while making sure the class can see facial expressions (possible use of webcam). This student is the *viewer*.
2. The rest of the students are considered *primary observers*.
3. Primary observers watch the viewer in such a way that they can fully see the viewer's face but not see the video. These observers will document the changes in the viewer's facial expression and label what they see with one of the listed emotions from step 1.
4. After all the data is collected, have the small groups discuss their individual results. Then bring the class back together to discuss results as a group. Discuss what the data shows.
5. If time allows, have a different student rotate to being the viewer and repeat exercise with different video.

Part 3: Video Nova: Mirror Neuron

1. Watch the following Nova clip on Mirror Neuron - <http://www.pbs.org/wgbh/nova/body/mirror-neurons.html>
2. Discuss events or situations in which your body uses the mirror neuron system.

Assessment:

1. Student data collection WS (separate attachment)
2. Group/class data table
3. Are there any patterns in the data on the emotions being expressed? Why would these occur?
4. Why did emotions expressed by the primary observer mimic those expressed by the viewer even though the primary observer did not look at the screen? Why would such a behavior be beneficial?
5. Are there similarities in the emotions expressed in response to any one video? Can some of the listed emotions be combined in a single category?

Extension:

1. Try **Part 2: Station Lab** with the primary viewers holding a pencil in their teeth. What happens to their ability to express emotions? Why do you think this happens?
2. Brainstorm with your group and briefly describe an experiment that could test this phenomenon more accurately. Make a list of things you need to consider before testing. Try to be as complete as possible. Hint: How could you use a camera or a fun house mirror? How does your experiment test brain function?
3. Have students create a Facebook dialogue (or texting dialogue) that expresses some message without the use of any methods of expressing emotion (emoticons, bolding letters, exclamation points, etc). Then have students add “emotion” to their dialogue or situation.

This document is a modification of the Brain U Lesson: Mirroring Emotions. Special thanks to Janet Dubinsky and all of those involved with the Brain U program for their work in developing this lesson.

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Emotion 1: _____



Emotion 2: _____



Emotion 3: _____



Emotion 4: _____



Emotion 5: _____



Emotion 6: _____



Emotion 7: _____

Name: _____

Mirror Neuron Student Data Collection

Video 1
Detailed Observations:

Video 2
Detailed Observations:

Video 3
Detailed Observations:

Emotions Expressed:

Emotions Expressed:

Emotions Expressed:

Small Group Consensus:

Video 1 – Emotions Expressed

Video 2 – Emotions Expressed

Video 3 – Emotions Expressed

Mirror Neuron Student Data Collection

Conclusion Questions

1. Are there any patterns in the data on the emotions being expressed? Why would these occur?
2. Why did emotions expressed by the primary observer mimic those expressed by the viewer even though the primary observer did not look at the screen? Why would such a behavior be beneficial?
3. Are there similarities in the emotions expressed in response to any one video? Can some of the listed emotions be combined in a single category?
4. Why is it advantageous for humans to have mirror systems? In what ways would you be different if your mirror neuron system did not work properly?
5. How do social media sources (Facebook, Google+, MySpace, etc.) affect the mirror neuron systems? What are some consequences for interactions that are solely through social media?
6. How do you determine emotion through using social media sources?