Mirror Tracing & Beanbag Toss

Outreach Activity

I. Overview
These are simple tasks in which students begin to see that the brain is capable of adjusting for new inputs and can compensate and develop strategies for completing a new and difficult task.

In the Mirror Tracing activity, students are first asked to trace the outline of a shape. They can do this quickly, but then are asked to repeat the same task but this time only being able to look through a mirror. They repeat the task several times using the mirror and make inferences about how their brain is learning as they become quicker and more accurate in completing the task.

In the Beanbag Toss activity, students are first asked to simply toss six beanbags, one at a time, into a target container. They then repeat the same task but this time they are asked to put on prism goggles which distort their visual perception. They repeat the task several times while wearing the vision distorting goggles and make inferences about how their brain is learning as they become more accurate in completing the task.

II. Learning Objectives
- New tasks can be difficult and require the brain to adjust to new inputs and re-figure how to successfully complete a task.
- Learning physically changes the brain as neurons form new connections.

III. Adaptations/Accommodations

Safety

Mirror Tracing
Make certain the mirrors are set up safely so they are not prone to falling and/or breaking. Ask students to be careful as they use the mirrors and do the task.

Beanbag Toss
For the Beanbag Toss, give clear instructions to students that they absolutely should not throw beanbags at another person or across the room. They should ONLY try to throw it into the target container.

Students should not be allowed to wander while wearing the prism goggles. Their vision will be distorted, so they could accidently hurt themselves or someone around them if not careful.
IV. Timeframe for activity

Mirror Tracing: 30 minutes

Beanbag Toss: 30 minutes

V. Advance prep and materials

Activity: Mirror Tracing

Materials:
- Mirrors (6)
- Stands (6)
- Stopwatch (6)
- Folder/Cardboard sheet (6)
- Different colored pencils (4 colors/24 total pencils)

Preparation:
- Set up 6 stations, each with: 1 mirror, 1 stand, 1 stopwatch, 1 folder or cardboard sheet, 4 pencils (1 gray, 1 red, 1 blue, 1 green)

Activity: Beanbag Toss

Materials:
- Beanbags (36)
- Target containers (6)
- Prism goggles (12)
- Colored tape
- Colored pencils (4 colors/24 total pencils)

Preparation:
- Set up 6 stations, each with: 1 target container, 6 beanbags (3 of each color), 2 prism goggles, 4 pencils (1 gray, 1 red, 1 blue, 1 green) and a strip of tape on the floor to mark where students should stand when tossing.

VI. Resources and references

Facilitator resources
- http://neuron.illinois.edu/
- http://neuron.illinois.edu/games/mirror-tracing-game-intro
VII. Activity Implementation

Activity: Mirror Tracing
Before beginning, get the attention of all the students in order to give instructions. Explain to students that they will be doing a fun activity where the main goal is to trace the outline of a shape while looking through a mirror—it’s harder than it looks! Students should have fun and enjoy this game-like activity, but must also be very respectful of each other and of the materials so that everyone can have a good time and also learn something.

Give students further instructions by explaining what materials they will find at each station and what they will be doing for the activity. At each station they should have: a mirror, a stand, a cardboard sheet, a stopwatch and color pencils. Once they get to their station, they will each take turns doing the activity. For each trial the roles of each group member will be the following:

- Person 1: Hold the folder so that Person 3 cannot see the paper or their hand as they draw (when looking at the mirror).
- Person 2: Time each of Person 3’s trials and make sure they write it down in their booklet. (Person 2 may also have to hold up the mirror)
- Person 3:
  1. Using a GRAY pencil, trace the shape while staying within the two lines as fast as you can. Record the time.
  2. Now position the page so that you can see the reflection in the mirror. Using a RED pencil, trace the shape again, but this time only looking at it through the mirror. Record the time.
  3. Repeat tracing the shape in the mirror with the BLUE and GREEN pencil, recording your times for each trial.
  4. Try another shape beginning again with Step 1. Record times for each trial.

Demonstrate how to do this for the students (can use students as volunteers to be part of your group) by having the three people alternate doing the first trial. For the first round, all students in the group should have a chance to trace an outline of the same shape without a mirror. Then, they all take a turn outlining that same shape with the mirror. They should all repeat tracing with the mirror with the same shape two more times. They should always be recording the time and approximate accuracy for each trial. Before letting students begin, check to make sure students understand what they are supposed to do.
Have the students work in groups of 3 at each station. Each of the students will alternate taking on one of the roles. Each student should be recording their own times in the following table in the booklet:

<table>
<thead>
<tr>
<th>SHAPE</th>
<th>Gray pencil (no mirror)</th>
<th>Red pencil (mirror)</th>
<th>Blue pencil (mirror)</th>
<th>Green pencil (mirror)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-pointed star</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-pointed star</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As the students do the activity, walk around and talk to each group for a few minutes at a time. Ask them questions about what they are doing so they stay engaged in the activity and are thinking about what they are doing. The following are a sample of many questions you could ask the students:

- Is it harder or easier with the mirror?
- What strategies are you using to do this?
- Was it equally hard for everyone in your group? Why might this be?
- Point out a part on the shape where you see a lot of color and ask: What happened here? Did you get stuck? Why do you think this part was hard? Were you able to get past it? How?
- Which shape is hardest? Why do you think that is?
- Do you think about this when you’re combing your hair in the morning? Is that easy or hard? Why? What makes this different?

It may also be necessary to remind them to keep recording things in their booklet. Students can also fill out the question in the booklet which asks: What do you notice is happening to the amount of time you take to do this and your accuracy level?

Increases in speed and accuracy as they repeat this task shows that they are actually learning how to successfully complete a new task. Their brain is actually changing (brain plasticity) as they make adjustments to their strategies and learn how to do this new task successfully.

A few minutes before the time is up for this station, ask students to clean up their station and check to make sure all the materials are at each station. Also, ask the students to check to see that each of them has their own book before they move to the next activity.

**Activity: Beanbag Toss**

Before beginning, get the attention of all the students in order to give instructions. Explain to students that they will be doing a fun activity where the main goal is to stand at the designated spot and toss beanbags into the box (target container). Students should have fun and enjoy this game-like activity, but must also be very respectful of each other and of the materials so that everyone can have a good
time and also learn something. At no point should anyone throw a beanbag at another person or at anything other than into the target container. They will not be allowed to participate if they do this.

Give students further instructions by explaining what materials they will find at each station and what they will be doing for the activity. At each station they should have: a set of 6 beanbags, 2 pairs of goggles, a target container, and pencils. Once they get to their station, they will each take turns doing the activity. For each trial the roles of each group member will be the following:

- Person 1: Toss the beanbags, one by one, into the target box
- Person 2: Stand next to Person 1 and hand them one beanbag at a time
- Person 3: In Person 1’s booklet, record where the beanbags are falling; indicate the order by numbers (using the correct color)

Demonstrate how to do this for the students (can use students as volunteers to be part of your group) by doing one trial. For the first round, all students in the group should have a chance to throw the beanbags into the box without wearing goggles. Then, they all take a turn tossing while wearing a pair of goggles. Remind students that they shouldn’t tell each other how things appeared when they put the goggles on because then their partners will have an edge. They should all repeat this with the same set of goggles two more times. They should always be recording where the bags landed before picking them up. Check to make sure students understand what they are supposed to do before letting them begin.

Let students begin the activity by asking them to get in groups of three and go to one of the stations. Walk around to make sure students are on task and completing the activity as instructed. It may also be necessary to remind them to keep recording things in their booklet. Once students have settled into the activity, spend a few minutes talking to each group about what they are doing and what kinds of observations they are making about what’s happening. Ask them questions such as the following:

- What happened when you put on the goggles?
- What kinds of strategies did you use to get the beanbags in the box?
- Do you think if you did this a lot of times, you would get better at it?
- What do you think is happening in your brain right now?
- Point out something they were doing and ask (for example): I saw you leaning over sideways to get the beanbag in the box, can you tell me why you were doing that?
- Look at what students are drawing in their booklets and ask them to make observations about any patterns they see.

Students’ accuracy with the beanbag toss will generally increase with the number of repetitions. Explain to students that this shows that they are actually learning how to successfully complete a new task. They are coming up with new strategies and their brain is actually changing (brain plasticity) as they make adjustments to their strategies and learn how to do this new task successfully.
A few minutes before the time is up for this station, ask students to clean up their station and check to make sure all the materials are at each station. Also, ask the students to check to see that each of them has their own book before they move to the next activity.

**Additional Activities**

If there is extra time in this station, have students look at optical illusions or work through some of the brain teasers. They could also do the Stroop test which can be found in their booklet. First, ask the students to simply read the words. This should be fairly easy to do. Their second task is to say the color the word is written in (rather than reading the word). The students will find that this is much more difficult to do! This effect can be partially explained if you think about whether you read more often or you name colors more often. Since people are always reading text around them, reading becomes more automatized. Naming colors, however, is not practiced often and, therefore, is less automatic.