



Grasping Experiment

Background

Normal activity on Earth such as walking, standing, sitting, and working with the hands requires the brain to interpret and integrate information from all the body's senses (touch, hearing, sight, etc.). Once the brain processes this information, it gives feedback to the body on how limbs are positioned, how the entire body is oriented (up or down, right or left), and which muscles should be moved to re-orient the body.

In the free-fall environment of space, the inner ears, muscles, joints, and skin cannot rely on gravity as a constant indicator of position and orientation. In order to produce correct responses, the brain must rearrange the relationships among the signals from these sensory systems when it processes the information. This rearrangement requires a period of adaptation. Before the body adapts, astronauts can get the illusion that their body or their environment is moving when both are stationary. When they return to Earth they may experience these problems again, since their body must readjust to the sensation of gravity. The length of recovery time is related to the duration of the mission.

Class Discussion

- Ask students to describe their experiences on roller coasters and/or their experiences on "virtual roller coasters."
- When you are in free fall things appear to have no weight because they are falling at the same rate as you are.

This activity helps students understand the adaptations that astronauts must undergo in their microgravity environment.

Grasping Experiment

Purpose:

1. To simulate the difficulty that astronauts experience when grasping objects in microgravity.
2. To measure reaction time under different conditions and the time it takes to re-adapt to their original environment.

In this activity students are not measuring reaction time directly but the distance the

metre stick falls which is related to reaction time.

Materials:

For each group:

- two grasping devices - one with foam and one without foam.
- 2 strips of single corrugated cardboard (20 cm by 3 cm)
- 4 pieces of sandpaper (3 cm by 3 cm)
- 1 piece of foam rubber (3 X 4 X 4 cm)
- glue
- 1 metre stick

Assembling the Grasping Devices



1. Fold one strip of the cardboard in half.
2. Glue one piece of sandpaper to each end of the inside ends of the cardboard.
3. Glue the foam midway between the fold and the open ends.
4. Assemble another grasping device without the foam.

What To Do

1. After explaining the experiment, ask the class, as a group, to develop a hypothesis for each trial.
2. Using the grasping device without the foam first, grasp the device between your index finger and thumb in the centre of the cardboard strip as if grasping tweezers. Set the grasping device so that the ends are 3 cm apart.
3. Rest your grasping hand over the edge of a desk or table.
4. Have your partner position the metre stick as shown in the diagram.



5. Align the top of the grasping device with the 10 cm mark on the metre stick. Keep your eyes on the 10 cm mark. Do not move your arm.

6. Catch the metre stick in the grasping device. Record the measurement at the place where you held the grasping device.
7. Repeat ten times. Record measurements and calculate the average.
8. Repeat the above steps using the grasping device with the foam. Record the measurements.
9. Repeat the above steps again using the grasping device without the foam.
10. Compare the results.
11. Repeat the activity with your non-dominant hand and compare results.
12. Repeat the activity when you are tired or fatigued, possibly after a period of physical exercise.

For Discussion

1. Invite groups to present the results of their trials. Were the results of the hypotheses as they expected?
2. Discuss with the students the following questions:
 - What signals is your brain transmitting between the time the metre stick is dropped and the time you catch it?
 - How were your reactions different when you made the transition between the two different tools?
3. Ask students to relate these results to the difficulties astronauts have performing daily tasks in the Spacelab.
4. How might these findings apply to astronauts adapting to microgravity?
5. How might this apply to training our astronauts?