

On the Ball

Activity 1: Grades 5-8 **Targeting an Action**

As you have learned, athletes use a "look-ahead" eye gaze to help target their physical action. Once the target--for instance, a basketball hoop--is locked in, the brain processes the apparent path of the object (in this case, the ball) to the target. This data is then used to interpolate the future path of the object. It also allows the brain to fine-tune its motor control over the muscle groups that will perform the intended action.



This activity page will offer:

- An introduction to how the brain infers the position of a moving target.
- A hands-on activity in which a student uses a "look-ahead" window to target a moving object.
- An opportunity to explore how variables affect the success of targeting of a moving object.

MATERIALS

- Scrap cardboard (for supports)
- Large cardboard rectangle (approximately 2 feet by 3 feet)
- Pencil (without point)
- Scissors
- Tape
- Marble
- Cardboard tube (toilet paper roll)

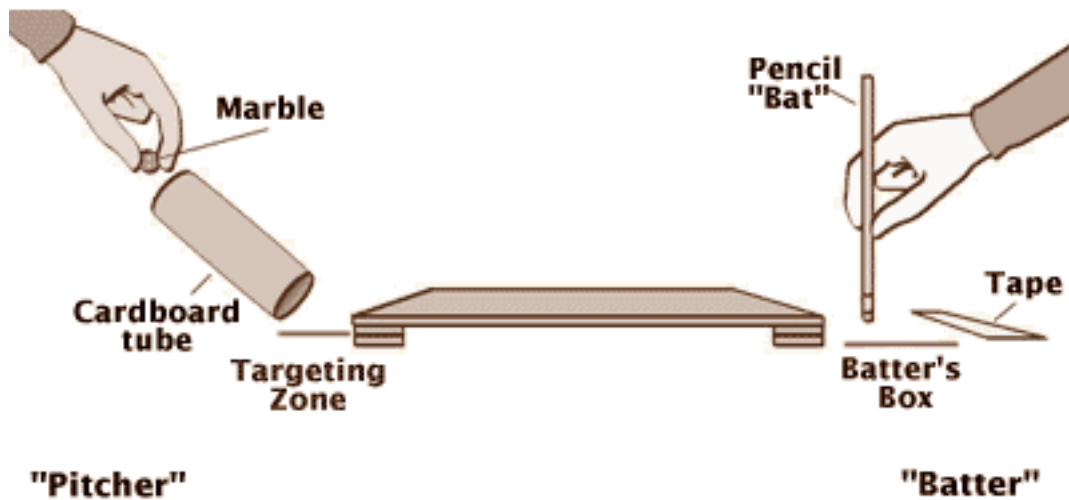
PROCEDURE

Part 1-Best Guess Positioning

In this activity, you will assemble an apparatus that will be used to explore how you aim at and successfully strike a moving target. A moving marble will be exposed for a short time before it disappears beneath a cardboard canopy.

During the time you observe the marble, your brain will analyze the movement of the marble and use that information to infer its trajectory. Using this "best guess" about the path of the marble, you are ready to strike the marble as it emerges from the canopy.

1. Working in teams of two, assemble four supports of scrap cardboard. Each of the four supports should be about the size of a child's wooden playing block. Use tape to secure the shape of each stack.
2. Obtain a rectangular section of cardboard (the larger, the better). This "canopy" can be cut from the side of a packing box.
3. Use tape to secure a support stack to each corner of the rectangle. The rectangle should be lifted several inches from the table's surface. Make sure that the rectangle does not sag in its center. If it does droop, you may need a sturdier section of cardboard or a smaller supported area.
4. A pitcher is positioned at one end of the rectangle. A batter is positioned at the opposite end.
5. The pitcher positions the cardboard tube so that a marble will roll through the tube and travel beneath the cardboard canopy. The tube should be positioned about six inches in front of the edge of the canopy.
6. At the batter's end, a section of tape is positioned on the desktop that is parallel to the edge of the cardboard rectangle. The tape should be set about an inch from the edge of the cardboard. This line defines the back limit of the batter's box--the hitting window.
7. The batter holds a pencil "bat" and can only hit the marble as it passes through this strike zone. Once the marble rolls beyond the hitting window it can no longer be hit.
8. Once the batter and pitcher become familiar with their tasks, it's time to explore the targeting zone. How might the speed of the moving marble affect accuracy? To find out vary the inclination of the cardboard tube.
9. Develop a strategy that would examine how looking at the marble before it rolls beneath the canopy affects the success of hitting the marble. How will doubling the distance between the release of the marble and the time that it passes under the canopy affect targeting? Is there a critical distance over which the movement of the marble must be observed?



QUESTIONS

1. What was the purpose of the taped rear limit to the batter's box?
2. How would a longer targeting zone affect the accuracy of hitting the moving marble? Make a prediction. Then, carry out an experiment that will test your prediction.
3. How did different inclination angles of the tube affect the movement of the marble?
4. How did different velocities affect the results?
5. Did extending the targeting window affect the targeting success? Explain.

EXTENSIONS

A Penny for Your Thoughts

Suppose the marble was replaced by a wobbling, rolling coin. Would this exchange produce different results? Does a coin require a longer observation window for successful targeting? Why or why not? Think about it. Then, design a strategy that would test the difference in successfully targeting the marble and the penny.

Bowling Alley

Do you bowl? If so, describe the moments prior to releasing the ball onto the alley. What thoughts are going through your head? Where are you looking? What are you thinking? Do you need to concentrate? If so, what factors are you thinking about before releasing the ball? Think about it. Does your planned release change as you are in the process of throwing the ball or do you get "locked" into this action while focusing on your target?

Scarf Catch

Have you ever juggled scarves? If not, why not give it a try? Unlike balls, scarves do not fall quickly when released. Instead, their wide surface reacts with air molecules. This slows their descent so that the scarves are more easily snatched during their fall. Once you learn this juggling technique, have

another student observe your eye movements as you try to keep the scarves aloft. Exchange positions and observe the eye movements of your partner.

Free Throws

With your instructor's approval, develop a strategy for inquiry that explores the targeting and movement processes associated with basketball free throws. Does the amount of time targeting the rim prior to the shot affect the accuracy? Will a lag time between targeting and shooting affect accuracy? Are there differences in the way males and females depend upon this targeting window?

Web Connection

Gaze Dead Straight for Dead Aim

<http://floridagolfmagazine.com/geoffmangum/Gaze.html>

This site presents an overview of targeting with specific reference to improving golf skills.

Targeting Aids: The Dots and Arrows

<http://www.bowlingindex.com/Instruction/strickt3.htm>

This site presents a guide to using visual aids to help target bowling pins.

The activities in this guide were contributed by Michael DiSpezio, a Massachusetts-based science writer and author of "Critical Thinking Puzzles" and "Awesome Experiments in Light & Sound" (Sterling Publishing Co., NY).

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Questions

1. What was the purpose of the taped rear limit to the batter's box?
(You needed to insure that all of the targeting was performed prior to the ball rolling out of view.)
2. How would a longer targeting zone affect the accuracy of hitting the moving marble? Make a prediction. Then, carry out an experiment that will test your prediction.
(The longer the zone, the more accurate the targeting. However, there is probably a distance in which increases don't affect the accuracy).
3. How did different inclination angles of the tube affect the movement of the marble?
(The steeper the angle, the higher the marble's velocity.)
4. How did different velocities affect the results?
(Accept all reasonable responses. Often there will be a marble speed at which the most targeting success was achieved.)
5. Did extending the targeting window affect the targeting success? Explain.
(Yes, if the targeting window was extended, there was more time to analyze the movement of the marble and predict the trajectory with greater accuracy.)

CURRICULUM LINKS

General Science :

Observation and Inference

NATIONAL SCIENCE STANDARDS (Grades 5-8)

Science as Inquiry- Content Standard A

Students will learn to formulate questions, design an investigation, execute this investigation, interpret the data and use the evidence to generate explanations.