**Title:** How do the Shape, Size, and Distance among Objects affect the way we Interpret Things?

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**Subject(s):** Science, Technology

**Topic(s):** Space Science, Astronomy, Eclipses

**Grade/Level:** 7-8

**Objective:**
By the end of this lesson, students will be able to:

- understand the difference between an object's actual size and its apparent size.
- explain why total solar eclipses appear to look as they do.
- appreciate the unique relationship among the Sun, Earth, and Moon as evidenced by eclipses.

**Summary of Lesson:**
The students will perform experiments investigating an object's actual size compared to its apparent size, involving distance and perspective. The students will use the knowledge gained from these experiments to explain why a total solar eclipse and an annular eclipse appear the way they do from Earth.

**Time Allotment:** 35-45 minutes

**Procedures/Instructions:**

| LESSON PLAN | ACTIVITIES/STRATEGIES |
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| Activity 1: (5 Minutes)<br>(Anticipatory Set – "Hook")<br><br>Videotape Showing a Total | Students should be told that they are about to view a short videotape and that they should try to identify what is occurring in the videotape they are watching. Any videotape with a 20 second – 2-minute segment of a total solar eclipse can be |

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| Eclipse<br><br><br><u>Activity 2: (5 Minutes)</u><br>(Pre-assessment)<br>Discussion and questions in order to identify the event on the videotape.<br><br><br><u>Activity 3: (15 Minutes)</u><br>(Guided cooperative small group learning activity)<br><br><br>Student small-group experiments:<br>- Model same-size objects to appear different in size.<br>- Model different-size objects to appear the same size. | shown to the students. (Many total solar eclipse videotapes can be found on a variety of websites.)<br><br>After viewing the videotape the teacher should assess the current knowledge of the students in regard to eclipses and the phases of the Moon. There may be some students who might not even recognize the event on the videotape as an eclipse.<br><br>With guidance from the teacher the students should perform a series of experiments to investigate how "actual size" differs from "apparent size." The students should be divided into small groups where each group has access to a table, at least two small spheres and two large spheres. Each group should follow the procedural steps below:<br><br>Step 1: Place the two small spheres (tennis balls) in front of you on the table and make sure that they are the same size.<br><br>Step 2: Put one of the small spheres about 25 – 40 cm from one end of the table. This sphere will be called ball number 1.<br><br>Step 3: Place the other small sphere about 200 cm from the same end of the table as ball number 1. This sphere will be called ball number 2.<br><br>Step 4: Kneel down at the end of the table closest to ball number 1, so that the top of the table is at eye-level. Close one eye, and look down the top of the table at ball number 1 and ball number 2 with the other eye.<br><br>Step 5: Answer the following questions:<br>Do the two balls/spheres appear or look the same size now? |

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| | Which ball appears or looks bigger (number 1 or number 2)?<br>Which ball appears or looks smaller (number 1 or number 2)?<br><br>Step 6: While looking down the top of the table with one eye closed, move your head a little to the right or left so that ball number 1 is in front of ball number 2.<br><br>Step 7: Answer the following question:<br>Can you make ball number 1 completely block out ball number 2? (Make minor adjustments in distance to either ball if needed in order to accomplish this step.)<br><br>Step 8: Take ball number 2 off the table and replace it with one of the larger spheres (volleyball).<br><br>Step 9: Kneel down at the end of the table, close one eye, and look down the top of the table at ball number 1 and the volleyball.<br><br>Step 10: Answer the following question:<br>Do ball number 1 and the volleyball appear or look the same size?<br><br>Step 11: Move ball number 1 or the volleyball a little so that when you look at them from the end of the table they appear or look the same size.<br><br>Step 12: Answer the following questions:<br>Are the Sun and the Moon the same actual size?<br>Which one is bigger?<br>Which one is smaller?<br><br>Step 13: Look at a picture of a total solar eclipse and answer the following questions: |

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| | Can you see the Sun?<br>Can you see the Moon?<br>Do the Sun and the Moon (or what you can see of them) appear or look to be the same size?<br>Do you think the Moon is closer to the Earth or do you think the Sun is closer to the Earth?<br>Why?<br><br>Step 14: Look at a picture of an annular solar eclipse and answer the following questions:<br>Can you see the Sun?<br>Can you see the Moon?<br>Do the Sun and the Moon (or what you can see of them) appear or look to be the same size?<br>Why do you think the picture of the total solar eclipse is different from the picture of the annular solar eclipse?<br>Can things that are the <u>same actual size</u> appear or <u>look different in size</u>?<br>Can things that are <u>different in actual size</u> appear or <u>look the same size</u>?<br><br>Step15: If there is time, see if you can make other objects that are the same actual size appear or look different in size. See if you can make other objects that are different in actual size appear or look the same size. |
| <u>Activity 3: (5 Minutes)</u><br>(Instructional Input/Discussion)<br><br>Teacher-led discussion/lecture:<br>- Review concepts relating to "actual" vs. "apparent" size as | Through discussion and lecture the teacher should begin to have the students formulate theories about how an eclipse occurs, and why it looks the way it does. The discussion should involve the relative motions, relative sizes, and relative distances of the Sun, Earth, and Moon. The different types of solar eclipses can be reviewed and the phenomena of partial eclipses and all forms of lunar eclipses can be introduced as well. |

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| uncovered by the students' experiments. Connect those concepts to the total solar eclipses and to the Essential Concepts and Questions. | |

**Instructional Materials:**

- Several tables 2 – 3 meters in length
- Several small spheres that are identical in size (e.g., tennis balls)
- Several large spheres that are identical in size (e.g., volleyballs)
- Total Solar Eclipse video (see Additional Resources for examples)
- Total Solar Eclipse pictures (see Additional Resources for examples)
- Annular Solar Eclipse pictures (see Additional Resources for examples)

**Additional Resources (Web Links, File Attachments):**

Websites with videotapes and photographs of eclipses:
http://www.mreclipse.com/SEphoto/SEvideo.html
http://www.mthurricane.com/solar.htm
http://www.astropix.com/HTML/SHOWCASE/TOTAL1.HTM
http://antwrp.gsfc.nasa.gov/apod/image/9808/annulareclipse_staiger_big.jpg
http://www.astronomy.com/asy/objects/images/annular_eclipse_1000.jpg

General information about eclipses:
http://www.mreclipse.com/Special/SEprimer.html
http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html

**National Science or Mathematics Standards:**
Science

Unifying Concepts and Processes
CONTENT STANDARD: K-12
As a result of activities in grades K-12, all students should develop understanding and abilities aligned with the following concepts and processes

- Evidence, models, and explanation

Science as Inquiry

CONTENT STANDARD A:
As a result of activities in grades 5-8, all students should develop

- Understanding about scientific inquiry

Earth and Space Science
CONTENT STANDARD D:
As a result of activities in grades 5-8, all students should develop an understanding of

- Earth in the solar system

Science and Technology
CONTENT STANDARD E:
As a result of activities in grades 5-8, all students should develop

- Understandings about science and technology

History and Nature of Science
CONTENT STANDARD G:
As a result of activities in grades 5-8, all students should develop understanding of

- Nature of science

**Assessment Plan:**
Students will be able to show their evidence of understanding about the concept of "actual" size and "apparent" size by performing experiments where objects that are identical in size are made to appear different in size and where objects that are different in size are made to appear the same size. Students will answer some questions relating to their experiments and the teacher will be able to assess the students' understanding of the Essential and Unit Questions through a student-teacher discussion at the end of the lesson.