

## Chapter 17: Real-World Galaxy Classification

### Student Worksheet

#### **Objective:**

Classify galaxies from Hubble images and Sloan Digital Sky Survey images using Galaxy Zoo.

#### **Engage:**

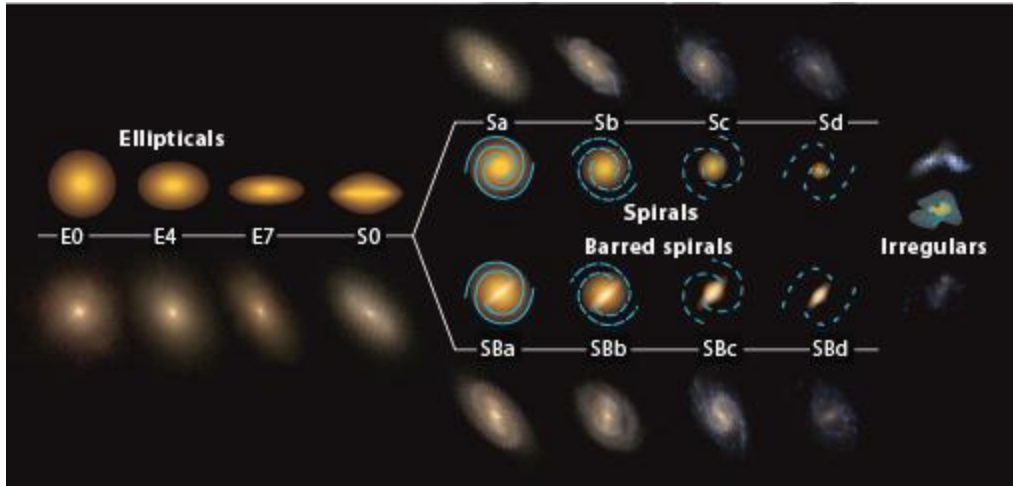
Choose one of the following groups and write it on a piece of paper:

- automobiles
- trees
- cities
- life on Earth
- food
- human dwellings

For the group you chose, identify and write down four categories to best subdivide the group. For example, a category like *books* could be subdivided into textbooks, children's books, fiction books, and non-fiction books. After you have finished, switch papers with a partner. How would you change their categories? How would they change yours?

#### **Introduction:**

Edwin Hubble did a great deal to further human understanding of galaxies. One of his contributions is the Hubble Tuning Fork, a tool astronomers use to classify galaxies. Figure 1 below displays this tuning fork tool.



**Figure 1** The Hubble Tuning Fork Diagram

Notice that Hubble's galaxy groupings include 4 main groups: Ellipticals, Spirals, Barred Spirals, and Irregulars. The groupings he came up with do a good job of helping astronomers organize galaxies, although today the distinctions of spiral and barred spiral are not seen as very important.

In this activity you will do real galaxy classification to help astronomers understand more about galaxy formation and evolution. The Sloan Digital Sky Survey and the Hubble Space Telescope have taken many images in which there are millions of galaxies to be classified. Computers are not good galaxy classifiers even though it is not a very difficult task. Humans are still needed to do this important job. The program Galaxy Zoo puts humans like you to work doing real astronomical galaxy classification.

### **Your Task:**

Classify at least 40 galaxies on Galaxy Zoo.

### **Procedure:**

1. Go to the galaxy zoo website. Simply search under *galaxy zoo*.
2. Click the *science* link on the banner at the top of the page. Read about the science behind Galaxy Zoo.
3. Begin to classify galaxies by pressing the *classify* link. After you classify a few galaxies you will be asked to set up a profile. All you need to supply is your email address. Setting up a profile will let you keep track of the number of galaxies you have classified and the sources of the images.

4. You may be asked to take a quiz along the way. Go ahead and take it. You will probably find you do pretty well. Galaxy zoo gives these quizzes to see how well the users of the site know astronomy.
5. Once you have classified 40 galaxies, answer the conclusion questions below. Click on the profile link to see your classification statistics.

**Conclusion:**

1. Of the 40 galaxies you classified, how many of the images came from Hubble? How many came from SDSS?
2. What was the most common galaxy type you classified – spiral, elliptical, or irregular?
3. What do you think Galaxy Zoo does to make sure the classifications given by untrained, non-professionals are accurate? [HINT: Poke around the Galaxy Zoo site links at the top of the home page to answer this question.]
4. What were some of the obstacles you faced in this activity?

**Extend:**

- How are spiral galaxies thought to change as time goes on?
- Explain some distribution trends concerning types of galaxies and where they are found.
- The Milky Way is part of a cluster of galaxies called the Local Group. The Local Group is part of a larger super cluster. What other galaxy clusters form the local super cluster?
- Galaxy Zoo has a partner site called Zooniverse. On that site there are many appealing projects using real data for you to explore. Choose a project!