

## ACCESSIBLE ASTRONOMY: HOW TO ADAPT ACTIVITIES FOR BLIND AND VISUALLY IMPAIRED LEARNERS USING LOW COST MATERIALS

N. Grice<sup>1</sup>

### ABSTRACT

In the past, astronomy was considered to be primarily a visual subject. But times have changed, and the field of astronomy education has evolved to include other senses such as sight, sound and touch. Multisensory themes and methods of instruction have attracted new audiences to learn about topics in STEM. In this paper, I share my experiences in developing adaptations of activities for the Big Astronomy Outreach Toolkit. I begin by exploring examples and strategies of how inexpensive materials can be used to modify or sometimes expand upon activities through universal design, with the goal of reducing or eliminating barriers to participation.

### RESUMEN

En el pasado, la astronomía era considerada principalmente un tema visual. Pero los tiempos han cambiado y el campo de la educación astronómica ha evolucionado para incluir otros sentidos como la vista, el oído y el tacto. Los temas multisensoriales y los métodos de instrucción han atraído a nuevas audiencias para aprender sobre temas en STEM. En este artículo, comparto mis experiencias en el desarrollo de adaptaciones de actividades para el Big Astronomy Outreach Toolkit. Comienzo explorando ejemplos y estrategias de cómo se pueden usar materiales económicos para modificar o, a veces, ampliar actividades a través del diseño universal, con el objetivo de reducir o eliminar las barreras a la participación.

*Key Words:* inclusive astronomy — STEM

### 1. CONSIDERATIONS FOR MAKING TACTILE MATERIALS

The theme of this conference is “Astronomy Beyond the Common Senses for Accessibility and Inclusion”. First, consider the five common human senses: vision, touch, hearing, smell and taste. You can use touch to help a tactile learner visualize an image. This is the power of the tactile image. When you are creating a tactile image, it is important to consider the specific goals and needs of your tactile project and be able to answer these questions.

1. What is the goal of the tactile image? Are you attempting to make an exact copy of an entire print image, a section of a print image or a general representation of a print image?
2. Who is the audience? Are you making a tactile image or model for young children, students, adults or families? Is the learner blind or do they have low vision?
3. Under what conditions will the tactile image or model be used? Will it be outside in humid conditions or indoors? Will it be used under classroom supervision or as informal learning through outreach?

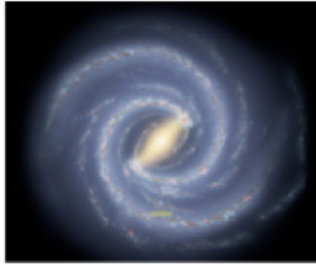
4. How many times will the tactile image or model be used and how many people will use it? Does it need to be used one time for one student or many times for many learners?

The answers to these questions will determine whether a tactile image or model must be created or if a verbal description is satisfactory. If a tactile image or model is to be created, the answers will help you plan for how sturdy it must be for the conditions where you will use it. Tactile images and models can be constructed with low cost materials. General supplies to use include scissors, puff paint, Velcro dots, a Sharpie (permanent) marker, ruler, tape and glue. Other supplies to consider for creating textures include rough glitter paper, textured foam paper, Velcro strips, rubber shelf liner and smooth foam paper. To create connections between sections of tactile images or models, consider yarn, pipe cleaners, glitter glue, beads, brass fasteners and string.

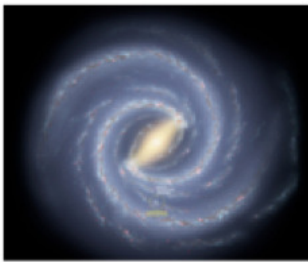
### 2. EXAMPLE OF ACCESSIBLE MODIFICATIONS CREATED WITH LOW COST MATERIALS

“Big Astronomy: People, Places, Discoveries” is an international project, funded by the National Science Foundation, which brings together astronomy

<sup>1</sup>You Can Do Astronomy, LCC, New Britain, CT, USA (noreen@youcandoastronomy.com).



**The completed tactile foam galaxy**



**The completed tactile laminated galaxy**

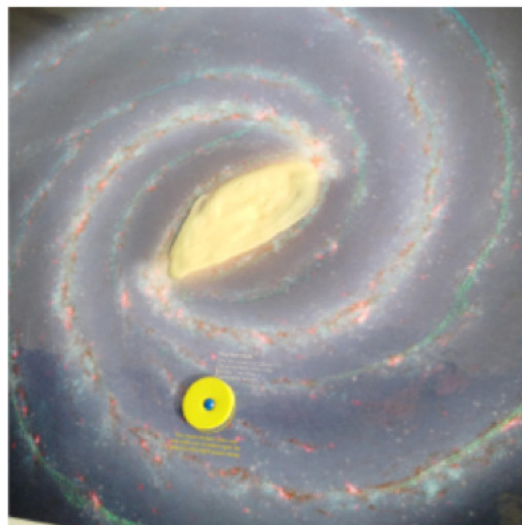


Fig. 1. Tactile foam galaxy model (upper panels) and laminated tactile galaxy model (lower panels).

education organizations in the United States and observatories in Chile (Big Astronomy 2021a). The project includes a planetarium show that highlights the astronomical research being conducted in Chile by astronomers and engineers, and an informal education toolkit to get students excited about careers in STEM (Science, Technology, Engineering and Math).

The Big Astronomy informal education toolkit, developed by the Astronomical Society of the Pacific (ASP) contains six activities that relate to the Big Astronomy project. However, the activities were not accessible to blind and visually impaired learners, and I was asked to develop accessible modified versions of these activities (Big Astronomy 2021b). I used low cost materials to create modifications for the activities entitled, Visualize Our Galaxy; Clues to the Cosmos; Good Light, Good Night; Dark Sky Wheel and Legends in the Sky.

The following gives you an example of the steps to take should you wish to try one of the activities:

Look at the activity called Visualize our Galaxy. The original Big Astronomy activity uses an umbrella ([bit.ly/galaxyumbrella](http://bit.ly/galaxyumbrella)) with an artists rendering of the Milky Way Galaxy to visually demonstrate its size and scale. There is a circle added to a spiral arm of the Galaxy. In the center of that circle is the location of our solar system and the diameter of the circle represents the stars that are visible to the unaided eye on Earth.

The activity description on the Big Astronomy website contains “Notes for the Presenter”. On that page under “Materials (and Sources)” there is a link ([bit.ly/bigastro](http://bit.ly/bigastro)) to download a flat version of the same (umbrella) image of the Milky Way Galaxy. You will use that image to make two different accessible models of the Milky Way.

For the first tactile model, you will make a tactile foam galaxy using inexpensive materials you can purchase from your local dollar store (Fig. 1). You will need a sheet of 8" × 10" black felt with an adhesive backing, a sheet of smooth foam paper with an adhesive backing, a sheet of glitter foam paper with an adhesive backing, 2 round foam stickers, and if possible a small brass fastener. Step 1 is to draw a model of the Milky Way Galaxy on the adhesive glitter page. Cut out the galaxy and place it on top of the felt page. Now draw and cut out the central bar of the Milky Way using the smooth adhesive foam paper. Attach the central bar in the center of the Milky Way.

Select one of the round stickers - make sure it will fit on a spiral arm - and place it where the circle is on the picture. Finally, poke the brass fastener through the round sticker and open the wings in the back of the image. When you have completed the model, the glitter foam will provide a scratchy texture for the spiral arms of the galaxy. The smooth foam, marking the barred center and location of our solar system, will have a good contrast in texture. Finally, the furry texture of the felt marks the background space in this image.

For the second tactile model (Fig. 1), you will make a tactile laminated galaxy, directly using the artists rendering of the galaxy as the base. You will need to print out an 11" × 17" copy of this image and laminate it. Then, use glitter fabric paint to trace out the spiral arms of the galaxy. Use slick (smooth) fabric paint to fill in its barred center. Use a foam sticker to indicate the limit of our naked eye view of stars and a brass fastener to mark the location of the solar system. Wait 24 hours for the fabric paint to dry before touching the picture.

Once the fabric paint has fully dried, the spiral arms will have a scratchy texture while the barred center and foam circle contrast with smooth textures. And since you used the image itself as the base, it is universally designed for both visual and tactile use.

### 3. SUMMARY

You have seen low cost supplies and two examples of Milky Way Galaxy models using these materials. In summary, always consider the needs of your tactile project before deciding which supplies to use and how sturdy your project needs to be. Consider the needs for your tactile project. What is the goal of the tactile image or model? Who is the audience? Under what conditions will the tactile image or model be used? How many times will it be used and by how many people? Given this knowledge, how will you make topics more accessible and inclusive using low cost materials?

### REFERENCES

- Big Astronomy Informal Activities with Accessible Adaptations, <https://www.bigastronomy.org/informal-activities/>
- Big Astronomy: Accessibility in Astronomy Outreach (panel discussion including Noreen Grice). <https://www.youtube.com/watch?v=oppivG2EulMVideo>