

Vortex Cannon Interactive Exhibit

DESIGN, BUILD, AND PLAY GUIDE



A vortex cannon can help learners *feel* science, turning abstract ideas like air pressure and fluid motion into something playful and memorable. Built from a large plastic barrel, bungee cord, and tarp, the cannon releases a quick burst of air that forms a spinning, donut-shaped vortex that can travel far while holding its shape. The vortices can ruffle hair, knock over cups, or disturb papers. If a fog machine is used, the vortex rings can even be made visible.

This oversized, hands-on tool makes invisible air movement tangible. It is a playful way to explore fluid dynamics, pressure, and motion with an impressive “whoosh” that delights learners of all ages. It’s perfect for family events, STEAM nights, or interactive exploration spaces. This guide includes construction tips, facilitation ideas, related resources, and options for smaller handheld versions.

Building the Vortex Cannon

The air vortex cannon design is made from a trash can with an optional base. The body of the air cannon is composed of a plastic cylindrical trash can.

Materials

The materials and tools listed for use are not exclusive. Substitutes can be made based on what you have and what tools you are familiar with.

Air Vortex Cannon

Item	Qty.
Plastic cylindrical 20-32 gallon trash can The trash can size can be of your choosing, based on your need, including storage, transportation, use, and handling.	1
Heavy-duty 6' x 8' plastic tarp	1
30" bungee cord	1
50 yards of Gorilla Duct Tape	1
46mm wood, round cabinet knob	1
3/16" Eye Hook #6 (2" long) *You can use a smaller (easier to bend) eye hook if you prefer.	1

Tools

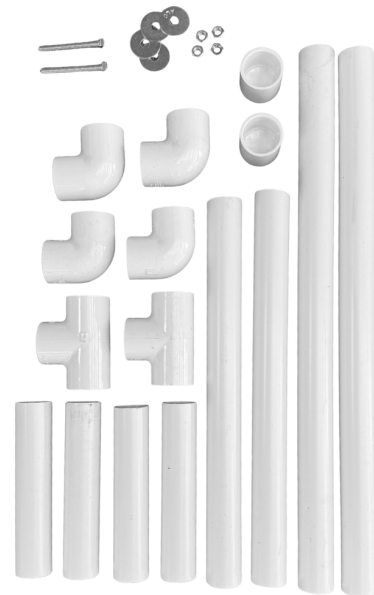
- Bench vise
- Drill
- Hacksaw
- Rotary tool / Oscillating multi-tool
- Sand paper
- Scissors
- Permanent marker
- PVC glue
- 4"-high bowl



Vortex Cannon Stand (Optional)

At a hardware store you can purchase a 10-foot section of 2" Schedule 40 PVC Pipe. From this piece, you can cut all the pieces you need for the stand.

Item	Qty.
1 ¼" Schedule 40 PVC Pipe	10ft Length
1 ¼" Schedule 40 PVC "Ts"	2
1 ¼" Schedule 40 PVC Elbows	4
1 ¼" Schedule 40 PVC Caps	2
3/8" bolts (3" long)	2
3/8" nuts	4
3/8" washers	4
Light duty swivel caster	4



The exact dimensions of your stand might be different depending on the size of your trash can. You can use a hack saw to easily make the following cuts in the 1 ¼" PVC. Below are suggestions:

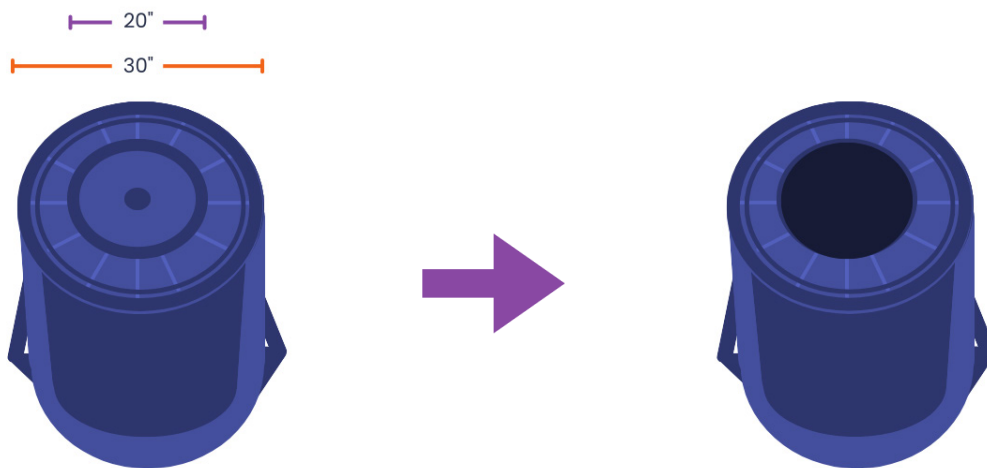
2 pieces	25" long	vertical stanchions
2 pieces	18" long	base sides without "T"s
4 pieces	8" long	base sides with "T"s

Instructions

Assembling the Air Vortex

Step 1

Flip the trash can over and set it on a level surface. The bottom of the can should be facing up. Using a cutting tool (i.e., rotating cutting tool, oscillating multi-tool, or a hacksaw), cut a circular hole in the bottom of the trash can. The hole should be centered and approximately $\frac{2}{3}$ of the diameter of the bottom of the trash can. For example, if the trash can has a diameter of 30 inches, then $\frac{2}{3}$ would be 20 inches ($30 \times \frac{2}{3} = 20$). You can also use the natural circular ridges on the bottom of the trash can to guide your cut.

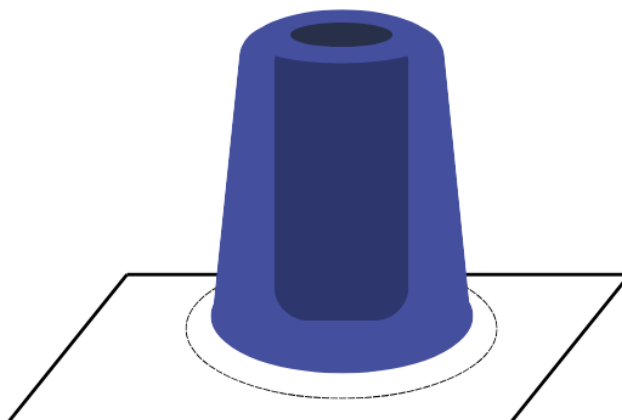


Step 2

Use sandpaper to smooth off any rough edges around the cut.

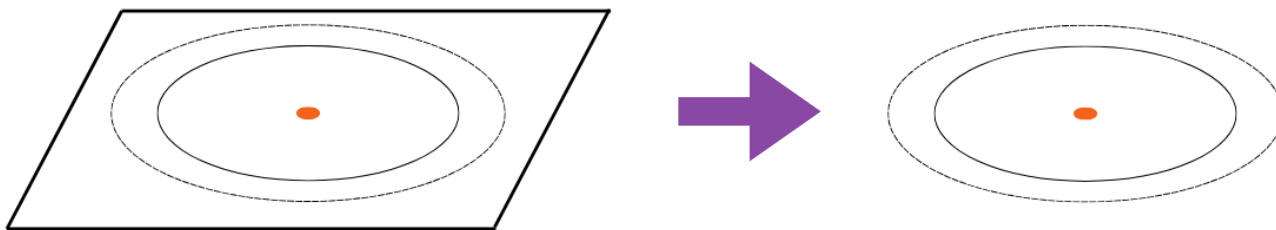
Step 3

Spread the tarp on a flat surface. Place the trash can top down on a corner of the tarp. Using a marker, trace around the trash can circumference on the tarp.



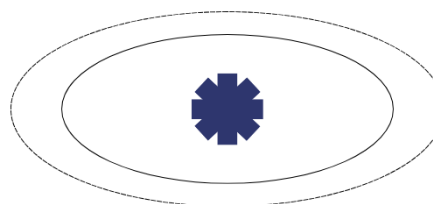
Step 4

Set aside the trash can. Find the center of the circle you traced on the tarp, then mark it. Use a yardstick to add 4 inches to the circumference around the circle, then use the marker to draw a larger, concentric circle on the tarp. Carefully cut out the larger circle from the tarp.



Step 5

Keeping track of the center point of your tarp circle, use 4" strips of Gorilla tape to strengthen the tarp around the center point from several different directions. Do this on both sides of the tarp. This is the point of attachment of the knob or handle.



Step 6

Use a sharp point (e.g., a nail) to punch a hole through the center point of the tarp circle.

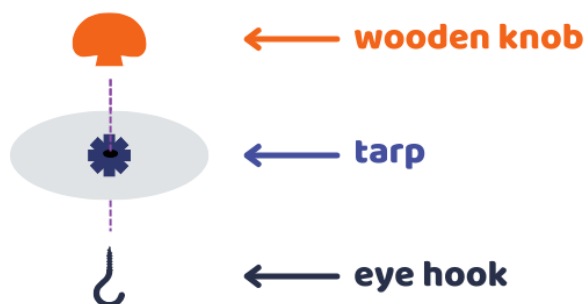


Step 7

Secure the #6 eye hook in a vise and pry open the loop just enough to insert the bungee cord. Once the cord is in place, use the vise to close the loop tightly so the bungee cord is securely held inside.

Step 8

Place the wooden knob on one side of the circle tarp and the #6 eye hook on the other side. Push the screw point of the eye hook through the center of the circle tarp and into the round wooden knob. Keeping the two pieces as perpendicular as possible, screw the eye hook into the wooden knob with the circle tarp trapped in between the two.

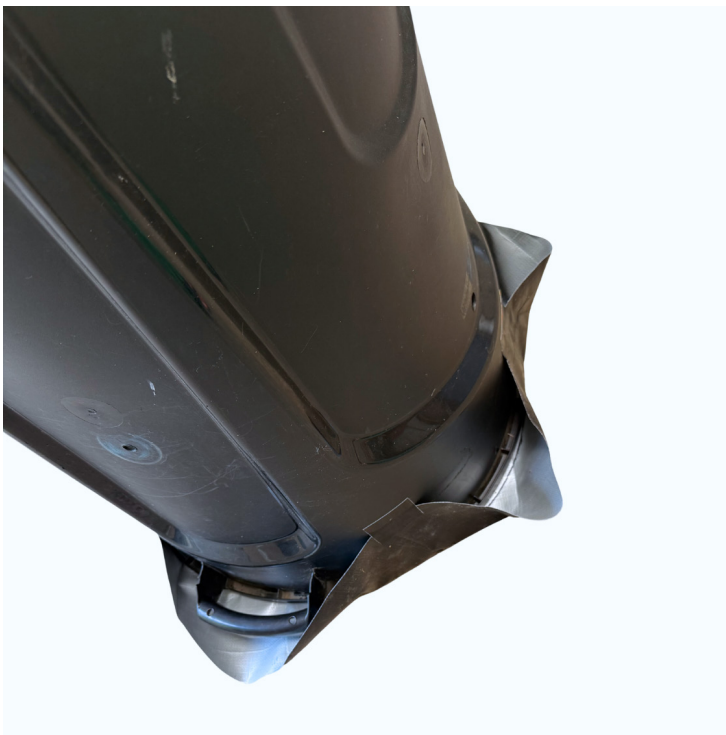


Step 9

Set a small 4-inch-high bowl on a level surface. Place the round wooden knob attached to the tarp into the bowl. Spread the circle tarp out with the wooden knob side facing down in the bowl and the bungee cord facing up.

Step 10

Place the trash can centered on top of the tarp circle. From the top view, make sure the eye hook in the tarp is in the center of the trash can opening. Carefully fold the excess of tarp up against the outside of the trash can and loosely tape the excess in place against the outside of the can in four equally spaced places around the perimeter. Use Gorilla tape to roughly hold the tarp in place.



Step 11

Carefully lay the trash can on its side. Using Gorilla tape, secure the edge of the tarp to the outside rim of the trash can, working in six-inch sections at a time. Do not stretch the tarp tightly like a drum; instead, leave a slight amount of slack across the opening, which is necessary for the cannon to function properly (this is where the 4" bowl comes into play). As you tape, you may need to fold or overlap the tarp. When working around the handles, make small cuts in the tarp as needed so it can wrap neatly around them and lay flat.

Step 12

Use a drill to place two 1/8" holes 180 degrees apart just inside the edge of the large hole you created originally in the bottom of the trash can. You should be able to slip the wire hooks from the bungee cord through each of these holes and pinch or tape closed so that the bungee cord is now stretched and the tarp at the back of the cannon is now under tension and "pulled in" or concave.

Vortex Cannon Stand (Optional)

The air vortex cannon can be used without a cradle, either being held or set on a table or a box. The exact size and shape of your stand is adjustable depending on your needs but is also dependent on the particular size of air cannon you decide to build.

Note before you begin: Once all the pieces are cut, use a bit of sand paper or steel wool to clean off all the edges of burrs and excess material. PVC is a bit electrostatic so it does help if you can blow all pieces clean and rest the pieces on a clean towel.

These pieces will eventually be glued together with PVC primer and glue but to begin with it is always good to "fit" all the pieces together to be sure the whole is exactly what you want or if any changes need to be made before permanently glueing the stand together.

Step 13

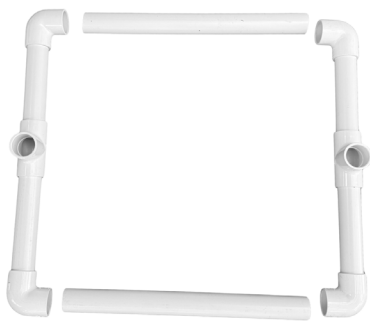
Take one of the 18" long pieces of 2" PVC pipe and add an elbow piece to each end. Both elbows pointed in the same direction. Repeat for the second 18" piece.

Step 14

Take two 6" long pieces of 2" PVC pipe and attach a "T" piece in between the two. Repeat to create another duplicate piece.

Step 15

Take the pieces created in Steps 14 and 15 then add elbow pieces on all four ends. Make sure the elbows are pointed the same way and the "T" pieces have the opening pointed upwards or perpendicular to the elbows laying flat on the level surface.



Step 16

Combine all four pieces you have built up to this point into a flat rectangle with the "T" pieces on opposite sides from each other.

Step 17

Take the 24" pieces and place them vertically into the "T"s.

Step 18

Add the end caps to the top of the 24" vertical pieces.



Stand Adjustments

Height Measurement

Place the trash can horizontally between the vertical spars and examine the height placement. Think about the size of the child that will be using the air cannon.

- How easy is it to reach the pull knob?
- How easy is it to see over the top of the air cannon?

One thing to consider is adding wheels or casters to the stand for mobility which will add an additional 4" to the height of the vortex air cannon.

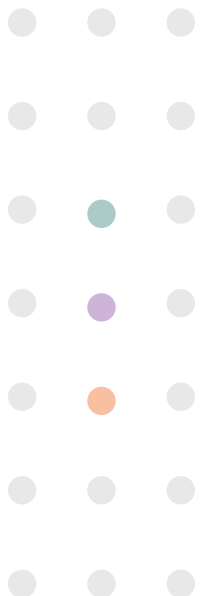
Width Measurement

Trash cans have a variety of diameters, which makes building a uniform stand difficult. What you want is for the barrel of the air cannon to be horizontally balanced when bolted between the vertical braces of the stand. Depending on the width of the trash can you are using you may have to adjust the final width of the PVC stand so that the final vertical braces are indeed in a vertical position and holding the trash can securely in between.

Now drill a 3/8" hole at the top of each of the two vertical PVC pipes just below the caps at the height you want to mount the air cannon.

You now want to drill two corresponding holes in the air cannon side wall 180 degrees apart to be able to use both bolts to mount the air cannon which will allow the barrel to pivot up and down. Again you want to "balance" the barrel of the air cannon between the vertical stays. This probably means the holes in the barrel of the air cannon will be not in the middle but closer to the heavier or 'tarp end' of the air cannon.

The vortex air cannon and stand are purposely made to be very light in weight so that it is easy to move. But if you would like you can purchase 4 caster wheels at a hardware store or online and mount each on the corner of the stand so the air cannon can be "rolled" around from place to place. The larger the wheels, the easier the stand will roll.



Set Up

Preparing the ideal environment for the Vortex Cannon exhibit requires careful consideration of space, materials, and technology to ensure a playful, educational, and safe experience. This section outlines the steps for setting up the exhibit, focusing on the spatial layout and material safety to accommodate the curiosity and creativity of children and caregivers within a welcoming and inclusive setting.

Space

Ensure there is ample space around the vortex cannon and launch area so children and caregivers can move and interact comfortably, with room for at least three participants at a time. Allow a minimum of five feet between the vortex cannon and any objects you want the air vortex to move.

Ideally, the space is near and visible from high-traffic areas in your broader space to welcome participants.

This exhibit is well-situated to succeed both in indoor and outdoor environments. However, when considering an outdoor setup, special attention must be given to protecting the exhibit from natural elements.

Safety and Accessibility

Provide tactile versions of instructions and prompts for participants with sight needs. Clear expectations should be shared so children and caregivers know to provide space around the cannon and not occupy space between the cannon and the objects.

Sustainability and Maintenance

Schedule regular maintenance checks to ensure the components of the vortex cannon function correctly. Provide guidelines for cleaning and sanitizing the exhibit area to ensure a safe play environment.

If the exhibit is installed outdoors, you might include weather-resistant covers or temporary enclosures that safeguard the vortex cannon from animals and environmental debris, ensuring the exhibit remains clean, safe, and inviting for every child's interaction.

Cultural and Linguistic Inclusivity

Ensure all materials, prompts, and signage are multilingual and accessible to children and caregivers with sensorimotor needs. Adapt the exhibit to reflect the cultural diversity of the community, incorporating stories and materials that resonate with different backgrounds.



Before You Launch Your Exhibit

Experience as a Learner

Facilitators and designers should engage with the exhibit from a child's perspective as well as from an adult caregiver's perspective, assessing the sensory experience, emotional engagement, and ease of interaction. Adjustments should be made based on these insights to enhance the exhibit's accessibility and engagement, including ways to support more co-play and co-engagement between adults and children.

Facilitation

Getting started

Encourage the adults of the space to lean on their sense of exploration and welcome a more inquiry play experience. They should guide children through the exhibit, encouraging exploration of inquiry and cause and effect. There is no special training needed to support a wonderful and delightful experience for participants! Phases 1 and 2 are recommended to last about a 2 week duration for exploration.

This exhibit works fine without any active facilitation – as in, there doesn't need to be an educator or staff member directing the experience. The experience can be successfully self-guided. Allow the participants to freely explore the vortex cannon and stories at their own pace.

Phase 1: Explore the Vortex Cannon

Prompts:

- What do you notice?
- How do you think the vortex cannon works?
- How do materials move and interact together?

Tip

Use signage in the most relevant languages to the community and verbal prompts to facilitate play and discussion.



Background

For deeper exploration, it may help if facilitators have an understanding of how a vortex cannon works:

Vortex ring:

A vortex cannon creates a fast-moving ring of spinning air called a vortex ring which can travel a significant distance from its source. The science behind it relies on a pressure pulse and air flow differences at the outer edge of the rim of the vortex cannon.

Pressure pulse:

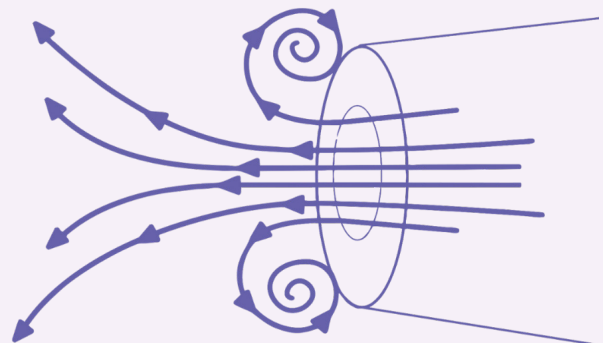
When the tarp snaps inward at the back of the plastic barrel, it rapidly compresses the volume of air inside. This sudden compression creates a brief, powerful pulse of high-pressure air that rushes toward the opening.

Air ring:

As the air pulse exits the round opening, the edges of the hole slow the air at the rim down because of friction, while the air in the center moves faster. This speed difference causes the air to curl and roll into a spinning donut shape.

Stabilized vortex ring:

Once formed, the spinning ring of air pulls itself forward. Its rotation keeps the structure stable, allowing it to travel a long distance without breaking apart—like a smoke ring made of clear air. The rotating air creates a low-pressure center that helps the ring hold its shape, and the motion continues until friction with the surrounding air gradually slows the ring down enough so it dissipates.



Phase 2: Add a Target

Target Examples:

- Windchimes to make sound
- Crepe paper
- Stacked or balanced cups (foam work best)
- Small toys that have wheels (such as cars)
- Paper plates
- Hanging mylar strips

Prompts to explore variables:

- Change the cannon's distance from material. What happens?
- Change the angle you launch from. What do you notice?



Phase 3: Create Your Own Handheld Vortex Cannon



A fun activity to do at home is to create a small cup-sized vortex cannon using commonly found materials. The coherent ring of air that is formed can travel a significant distance and has a force that is surprising.

Materials:

- 9 oz disposable cup
- 12" balloon
- Paper
- Scissors
- Utility knife

Instructions

Step 1

Turn the cup over so the bottom is facing up and the rim is resting on a flat, stable surface.

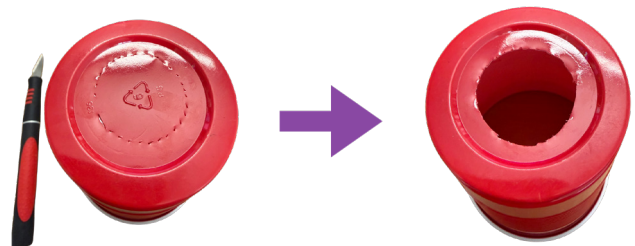


Step 2

Cut a paper circle with a diameter approximately $\frac{2}{3}$ the size of the bottom of the cup. Place the paper circle centered on the bottom of the cup.

Step 3

Using an Exacto knife, carefully poke a series of tiny holes around the diameter of the paper circle. Carefully use the Exacto knife to cut the hole out of the bottom of the cup similar to using the holes in a "dot-to-dot" circle pattern. Smooth or trim any ragged edges around the perimeter.



Step 4

Flip the cup over upright with the cut circle opening on the flat surface. Stretch out the uninflated balloon to make the rubber more pliable. Carefully cut the neck off of the balloon. Set aside the tail portion.



Step 5

Note: this step works best with two people. One person to hold the cup steady. A second person uses two hands to stretch out the balloon bulb large enough to cover the rim of the cup. The balloon should form a tight diaphragm over the rim of the cup much like the head of a drum.



How to Use Your Handheld Vortex Cannon

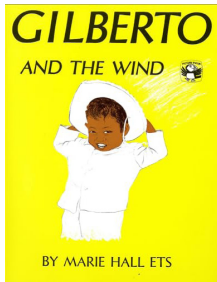
Hold the cup in one hand and then carefully pinch the center of the rubber diaphragm with the other hand. Pull back slightly on the diaphragm and then quickly let go. The rubber balloon will snap back, quickly compressing the air in the cup's chamber. This creates a pulse of air that will exit through the smaller opening and create the vortex ring. This coherent pulse of air can travel a significant distance without dissipating and carry a surprising amount of force. One word of warning is that the vortex ring is small and very directional so you can easily miss your target and think something might be wrong with your cannon.

One suggestion is to set up tissue paper targets and start with the handheld cannon several inches away from the target and test it out. Once satisfied with your aim, take a step back and try again. Continue this process and see how far you can stand from the target and still be able to see it move. You might be surprised at the result.



Literature

Here is a curated selection of children's books that support the exhibit's theme – air movement. Some of them are available in English and Spanish. You can display the books near the exhibit and make them available for families to engage with alongside the activity. You might also consider a special read-aloud time during a family event, followed by exhibit explorations!



Gilberto and the Wind

by Marie Hall Ets
(Available in English & Spanish)



Wind

by Carol Thompson
(Available in English & Spanish)



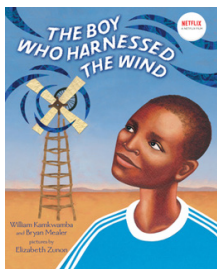
I Face the Wind

by Vicki Cobb



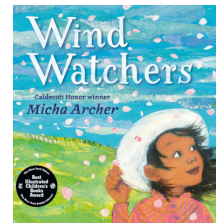
Wind is a Dance

by Debra Kempf Shumaker



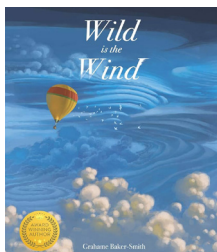
The Boy who Harnessed the Wind: Picture Book Edition

by William Kamkwamba
(Available in English & Spanish)



Wind Watchers

by Micha Archer
(Available in English & Spanish)



Wild is the Wind

by Grahame Baker-Smith

Observation & Feedback

Implement observation and feedback collection methods to gauge the exhibit's impact on emotional literacy and social interaction. Consider digital feedback stations or facilitated discussion groups post-interaction to gather insights from caretakers and children.

As you observe, you may reflect on the following questions:

- How are people engaging with the exhibit?
- What do they seem to especially enjoy about it?
- What aspects might be frustrating?
- How are adults and caregivers engaging alongside children?
- How could the exhibit encourage more co-play between children and family members?
- What materials seem to be working well?
- What are some other materials you might consider using?
- Are there any other adaptations needed based on your observations?

