

Spiderweb Weaving: STEAM Discussion Guide



Tomás Saraceno (Argentine, b. 1973), *Cosmic Filaments*, 2019. Dichroic filters, polyacrylic panels, stainless steel, polyester rope. University purchase with funds from the William T. Kemper Foundation and Art on Campus fund, 2019.

LEARNING OBJECTIVES

- Students will learn how the contemporary artist Tomás Saraceno combines scientific inquiry with artistic practice.
- Students will consider representations of spiders in popular culture and the importance of spiders in Earth's ecosystems.
- Students will develop basic weaving techniques and vocabulary while learning how orb-weaving spiders spin their webs and the multiple uses of webs.

COSMIC FILAMENTS

Tomás Saraceno is a contemporary artist who is fascinated by spiders and their webs. His experimental artistic practice combines art, architecture, and the natural sciences to expand ideas about life on Earth through large-scale artworks. For the past fifteen years, Saraceno has studied the various webs that different species of spiders create. Inspired by scientific studies that have shown how spiders' webs are part of their sensory and cognitive systems—meaning that webs allow spiders to feel and to process information—Saraceno considers spiders and their webs to be one unit, which he calls a “spider/web.”



Saraceno invented a machine that scans and digitizes spiderwebs and then developed a method of reconstructing spiderwebs as three-dimensional sculptures. He has also collaborated with scientists to study the mechanics of spider silk, which is both extraordinarily strong and extremely flexible, with the goal of inventing new materials inspired by its properties to use in architecture and structural design. Saraceno is also concerned with the protection of spiders and other invertebrate species that are essential to the health of Earth's ecosystems but have declining populations due to human impact. The artist invites us to pay more attention to spiders in our everyday environments, and instead of fearing them, to consider how these animals benefit humans and how we in turn can show care and respect for them.

Saraceno designed the installation *Cosmic Filaments* in 2019 for the lobby of the Mildred Lane Kemper Art Museum. The site-specific installation stretches across the ceiling and comprises iridescent three-dimensional geometric forms suspended in a network of ropes that replicate the strength, flexibility, and intricacies of a spiderweb. The multifaceted forms entrapped in the web both filter and reflect artificial and natural light, changing their appearance and one's perception of the lobby space throughout the day. The title of the installation invites us to think about the relationship between the vast universe and a small spiderweb. According to astronomers who study the structure of the universe, the cosmic web is formed from filament-like structures that resemble a complex, three-dimensional spiderweb, along which galaxies are arranged like shimmering pearls. This parallel between spiderwebs and the cosmic web first motivated Saraceno's foray into spider research and is visualized through this artwork.

MISSOURI LEARNING STANDARDS

Visual Art

VA:Cr2A: Artists and designers experiment with forms, structures, materials, concepts, media, and art-making approaches.

VA:Re7A: Individual aesthetic and empathetic awareness developed through engagement with art can lead to understanding and appreciation of self, others, the natural world, and constructed environments.

VA:Re7B: Visual imagery influences understanding of and responses to the world.

VA:Re8A: People gain insights into meanings of artworks by engaging in the process of art criticism.

VA:Cn11A: People develop ideas and understandings of society, culture, and history through their interactions with and analysis of art.

Science

3.LS3.B: Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving and finding mates.

3.LS3.C: Construct an argument with evidence that in a particular ecosystem some organisms can survive well, some survive less well, and some cannot.

4.LS1.D: Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

5.LS1.A.1: Compare and contrast major organs/organ systems that perform similar functions for animals belonging to different vertebrate classes.

ART TALK

Look

Invite students to look at *Cosmic Filaments* by Tomás Saraceno for one minute, viewing the installation from different perspectives. Encourage students to consider their first impressions and what thoughts and feelings arise as they practice close looking.

Describe

Invite students to share their observations and thoughts about the artwork. The open-ended questions below can guide students to construct their own interpretations:

What do you notice?

Does this artwork remind you of anything you've seen in nature?

What do you see that makes you say that?

What do you wonder about this artwork?

Paraphrase students' responses, noting connections, supporting the generation of multiple interpretations, and inviting further questions.

Next, share with students some information about the artist and artwork. Invite students to think about how this new information expands their initial impressions of the artwork.

Analyze

Share this quotation from Tomás Saraceno with your students and ask them to discuss its meaning in small groups or with a partner:

Over thousands of years of cohabitation, spider/webs have figured differently in the collective human imaginary—sometimes as tricksters or oracles, but seldom as companion species whose futures are interconnected with our own. Our images and representations matter: they condition our affective relations to other species, influencing what we value—what we depend upon and consider worth caring for. If we rewrite our images of spider/webs as kin, what new forms of interspecies relations and practices of care might emerge?

After discussing the meaning of this passage, ask students to brainstorm examples of spiders appearing in books, movies, and tv shows. Ask students to discuss how spiders are represented in these examples (positively or negatively), what messages these representations send about spiders, and to what extent these images of spiders impact the way we think of them.

VOCABULARY

arachnid: an arthropod of the class *Arachnida*, such as a spider or scorpion

arthropod: an invertebrate animal of the large phylum *Arthropoda*, such as an insect, spider, or crustacean

ecosystem: a biological community of interacting organisms and their physical environment

insect: a small arthropod animal that has six legs, three body segments, and generally one or two pairs of wings

installation art: large-scale, mixed-media constructions, often designed for a specific place or for a temporary period of time

invertebrate: an animal lacking a backbone, such as an arthropod or mollusk. Invertebrates constitute 95% of animal species.

loom: an apparatus for making fabric by weaving yarn or thread

organism: an individual animal, plant, or single-celled life form

spider: an eight-legged predatory arachnid with an unsegmented body consisting of a fused head and thorax and a rounded abdomen

spinneret: an organ by which a spider or caterpillar spins a silky thread for its web or cocoon

species: a group of similar organisms that are able to reproduce

warp and weft: the two basic components in weaving to turn thread or yarn into fabric; the lengthwise warp yarns are held stationary in tension on a frame or loom, while the weft is drawn through and inserted over and under the warp

weaving: the craft or action of forming fabric by interlacing threads

web: a network of fine threads constructed by a spider from fluid secreted by its spinnerets, used to catch its prey

RESOURCES

More information about Saraceno's ongoing spider research and related projects can be found through the artist's website: <https://arachnophilia.net>

More spider facts and information about spider species can be found through the Missouri Department of Conservation website: <https://mdc.mo.gov/wildlife/wildlife-facts/insect-spider-and-kin-facts/spider-facts>

ACTIVITY SHEET: SPIDERWEB WEAVING

Act like an orb-weaving spider and create your own spiderweb while learning the art of weaving.



Spiders spin webs to climb, to live in, to catch their prey, to protect themselves, and to create egg sacs. Different spiders spin their webs in different ways. **Orb-weaving spiders** spin spiral-shaped webs. Missouri is home to several species of orb-weaving spiders, which build their webs wherever structures are present for support and where flying insects commonly pass through, such as in gardens, fields, and forests.

To build its web, an orb-weaving spider first constructs radial supports out of strong dragline silk, resembling spokes on a bicycle wheel. These supports provide a structure for the web and connect it to tree branches, rocks, or buildings. The spider then completes the web by spiraling sticky silk thread around the web supports that will allow it to catch insects.



Pictured here is the marbled orbweaver (*Araneus marmoreus*), one of several species of orb-weaving spiders found in Missouri. It is sometimes called the “pumpkin spider” because its rounded abdomen can appear bright orange.

Five Facts from the Missouri Department of Conservation:

1. Flying insects are orb-weaving spiders’ principal prey. Once caught in the sticky strands of the web, they are bitten and tied up by the spider, which later eats them. Orb-weaving spiders control populations of flying insects, many of which are pests.
2. Orb-weaving spiders are great recyclers. Many eat and rebuild their webs each day. Webs are built at dusk and used for trapping prey during the night. At dawn, the spider eats the strands and recycles the nutrients in making the next web.
3. Orb-weaving spiders don’t bite people unless they are threatened, and their bites are not dangerous to humans.
4. Outside their webs and hiding places these delicate creatures are quite vulnerable to predation. Their egg sacs also provide important winter food for many birds.
5. Spider silk is stronger than a thread of steel of the same weight.

INSTRUCTIONS

Step 1: Create your circle loom

First transform your paper plate into a circular loom. Cut 21 notches that are ½-inch to 1-inch in length around the rim of the plate. It is important for your loom to have an **odd number** of notches.

Step 2: Warp your loom



Take a piece of thin, strong yarn to make the **warp threads** on your loom. The warp threads provide a structure on which to weave, and they hold your weaving securely on the loom. The warp threads are like an orb-weaving spider's radial web supports made of sturdy dragline silk.

Put the tail end of the yarn in the notch at the top of your plate. There should be a short tail about the length of your finger in the back while the rest of the yarn hangs in the front. Bring the length of yarn straight down the front dividing the plate in half and insert the yarn into the bottom notch. Cross the long length of yarn on the underside of the plate and pull it through the notch to the right of the top notch where you started. Then bring the yarn back down across the front of the plate and through the notch to the left of the bottom notch, creating a narrow X.

Repeat this pattern, rotating the plate, until you have warp threads in all the notches and they look like spokes on a bicycle wheel. To finish the warp, bring the remaining piece of yarn to the center where all the warp threads intersect and loop it over and under the center star, tying a knot. Trim the yarn end to a few inches in length.

Step 3: Weave your web

Now that you have the structure of warp threads in place, you can start weaving **weft threads** in a spiral to create your web. These weft threads are like the sticky silk that spiders use to catch their prey. Pick another color of yarn and tie it to the loose end of warp thread at the center of the loom with a double knot. Weave the yarn over and under the warp threads in a circular spiral following the pattern “over one, under one.” Gently pull on the yarn to tighten your weaving.

Bring different patterns and textures into your weaving. Here are some ideas to get started:

- Try other weaving patterns like “over three, under one” or “under three, over one.”
- Thread beads onto the weft thread while weaving to trap them like insects in your web.
- Alternate colors by cutting your weft thread and tying on yarn in a different color.
- Loop the weft thread around the warp threads to create a different kind of pattern.



Step 4: Finish your spiderweb weaving

When you are happy with the appearance of your spiderweb weaving, secure your weaving by pulling the tail end of your weft thread through one of the notches in the rim of the plate. Trim the thread and tape it to the back of the plate.

What are three similarities between your weaving and the web of an orb-weaving spider?

- 1.
- 2.
- 3.