

Storm King Art Center Teacher Resource



Edgy Engineering

How did they do that? Experience the effects of cutting-edge sculpture in outdoor spaces and consider the role that structure and problem-solving play in art making and installation. Recommended for grades 6-12.

Dear Teachers,

We are delighted to welcome you to Storm King Art Center, a 500-acre outdoor museum located in New York's Hudson Valley, where visitors experience large-scale sculpture and site-specific commissions under open sky.

This resource is designed to help you prepare to explore the theme of "Edgy Engineering" with your students at Storm King. By approaching visits through a thematic lens, we hope to engage learners in focused close looking, activities, and conversation—providing a solid foundation as students construct connections throughout their experience.

Whether you have chosen a guided tour or will be facilitating your own visit, this resource offers pre-visit ideas to prepare for your trip, tips and tools for onsite engagement, and post-visit activity prompts for continued exploration.

During a guided visit, your educator might build the experience around a particular sub-theme related to Engineering (ex: structural support, kinetic sculptures). Please be in touch at least two weeks before your program if you have specific interests.

While you may not see all artworks in this packet during a guided program, we invite you to visit additional artworks after your tour if time allows. The artworks in this packet are situated within one mile of the School Group arrival area.

If you have additional questions about your upcoming visit, please contact us at: groups@stormkingartcenter.org

We look forward to welcoming you and your students soon!

Sincerely,
The Storm King Learning and Engagement Team

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Cover Image: Menashe Kadishman (Israeli, 1932–2015), *Suspended*, 1977. Weathering steel, 23 ft. x 33 ft. x 48 in. (701 cm x 10.1 m x 121.9 cm). Gift of Muriel and Philip I. Berman, Allentown, PA. © Menashe Kadishman

Pre-Visit

INTRODUCTION TO STORM KING ART CENTER

Storm King Art Center is a 500-acre outdoor museum where visitors experience large-scale sculpture under open sky. **We strongly recommend you download our free digital guide on the Bloomberg Connects app,** via the QR code here. You'll find photos, videos, audio recordings, maps, suggested routes, activities for children and families, and more. Use the app to plan your visit, then easily access helpful insights onsite. Afterward, use it in the classroom to dive deeper into your favorite works. You and your students can also learn more about Storm King's [environmental stewardship](#), collection, and community connections in this brief [video](#) featuring Storm King President John P. Stern.



INTRODUCTION TO THE THEME “EDGY ENGINEERING”

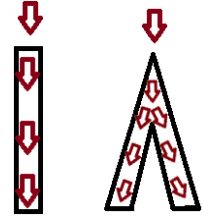
Engineers apply science and math to solve problems and create structures and objects. Invite students to participate in one or more hands-on engineering challenges to help introduce ideas they might explore at Storm King. Here are links to engineering challenges using [toothpicks](#), [straws](#), [clay](#), and [newspaper](#). Some concepts that you might discuss include:

Structural Engineering: This branch of Civil Engineering focuses on designing and analyzing structures, such as buildings or bridges. Structural Engineers consider various forces that put stress on different members, or parts, of a structure and make sure that structure will remain stable. Ask students to list different types of structures they've seen in their neighborhood or while travelling (tunnels, pavilions, sculptures, buildings). What are some things the structures have in common, and what are some differences in their designs?

Compression: Compression happens when forces press inward on an object. Students can experience compression in their own bodies by placing both of their palms flat against one another and pushing their arms in. Pressing down hard on a desk with metal legs can demonstrate that many metals remain strong under compression. If students roll up a sheet of paper and compress both ends, it may remain sturdy for a while, but will eventually buckle under too much compression.

Tension: Tension occurs when forces pull on an object. Students can experience tension in their bodies by curling the fingers of each hand around one another and pulling their arms apart. A string is an example of something that can withstand much tension, even though it is easily compressed. Pulling on both ends of a rolled-up sheet of paper will demonstrate that it has a stronger tensile strength than compressive strength.

Load Path: Engineers design structures that transfer forces and move stress from areas of weakness to an area of strength. A load, or force, moves through a structure's members down to its foundation. The path that it takes is called a load path. If a force, like a weight or gravity, acts on a vertical beam, the load takes a path straight down. If a force acts on a triangular shape, the load is distributed down each member to the foundation.



ART & ENGINEERING

When creating a sculpture, artists often have to think like or work with engineers. They choose materials, design structures, and consider forces that might act on the sculpture. Because Storm King is an outdoor museum, sculptures will be exposed to different forces than they would inside of a gallery.

Ask students what forces they think might affect an outdoor sculpture. Sculptures have to support their own mass as it is acted on by gravity. Outdoor sculptures are also subjected to forces like wind, snow and ice, and even geological events like earthquakes or erosion. Some sculptures remain static, and some have dynamic, or moving, members. In addition to considering the shapes and ideas they want to express, artists must be sure their sculptures remain stable.

OBSERVE AND DISCUSS

Project or print an image of Martin Puryear's sculpture [Lookout](#) (page 6). Ask students what they notice about the structure. What forces might be acting on it, and how might it remain stable? What do students wonder about the artwork?

Share Storm King's [video](#) about Martin Puryear's process. They might take notes about ideas that interest them as they watch. Ask students to discuss with a partner: What are some ideas the artist talked about in the video? What did you learn about how *Lookout* is engineered and constructed? Martin Puryear said, "*Lookout* is a testament to building and making." He cites inspiration such as bottle kilns in the UK, vaulted ceilings in Mali, and the history of brick making in the Hudson Valley. How is *Lookout* similar to other structures students have experienced in their built environment? How is it different?

In addition to considering engineering choices, ask students what *Lookout* makes them think about. Martin Puryear created an immersive space that visitors can explore from inside and outside. Why do students think an artist might choose to create sculpture people can interact with? What are they looking forward to about exploring the artwork in person?

At Storm King, students will explore sculptures that interact with forces, landscapes, and ideas. During their visit, they can continue to notice and discuss relationships between art and engineering.

Artwork Images and Information



George Rickey (American, 1907–2002), *Five Open Squares Gyratory Gyratory*, 1981. Stainless steel, 9 ft. 4 in. x 72 in. x 42 in. (284.5 x 182.9 x 106.7 cm). Gift of the artist and of Joan O. Stern by exchange. Art © Estate of George Rickey/ Licensed by VAGA, New York, NY

[Five Open Squares Gyratory Gyratory \(1981\) by George Rickey](#)

Other kinds of movement, including gyratory, or a full rotation around a work's central stem, emerged in Rickey's work in the early 1970s, along with a frame-like, elongated, open rectangle. The open square elements of *Five Open Squares Gyratory Gyratory* are sensitively calibrated so that they move with the slightest breeze, continually transforming the piece's configuration. While the squares rotate independently, they remain connected, creating an ongoing dialogue between unpredictable motion and prescribed order. Looking through the open squares, viewers will sense that the landscape itself is constantly shifting.

Media: Audio recording and photos available on our digital guide on Bloomberg Connects; Storm King Art Center's [Facebook video](#) of *Five Open Squares Gyratory Gyratory* in motion; [Artist page](#) featuring links to all of George Rickey's sculptures at Storm King



Martin Puryear (American, b. 1941) *Lookout*, 2023. Brick, concrete, and cobblestone. Storm King's commission and exhibition by Martin Puryear are made possible by generous major support from Janet Benton and David Schunter, Bloomberg Philanthropies, Roberta and Steven Denning, Bridgett and Bruce Evans, Glenstone Foundation, Ellsworth Kelly Foundation, Ohnell Family Foundation, the Hazen Polsky Foundation, Thomas A. and Georgina T. Russo, and Margaret VB Wurtele. Lead support is provided by Agnes Gund, Barbara Bluhm-Kaul and Don Kaul, The Ronald and Jo Carole Lauder Foundation and Matthew Marks Gallery. Support is also provided by Robert Lehman Foundation and Sidney E. Frank Foundation and supported in part by Allison Berg, Jennifer Brorsen and Richard DeMartini, Andrew L. and Gayle Shaw Camden, Tommy and Dathel Coleman, Martha Gabbert, Debby and Rocco Landesman, and the Ralph E. Ogden Foundation. This project is supported in part by an award from the National Endowment for the Arts.

[Lookout \(2023\) by Martin Puryear](#)

Martin Puryear's *Lookout*—Storm King's newest site-specific commission—is a structure created from layers of red clay bricks laid using thin-shell masonry techniques. Rather than straight lines and vertical walls, however, the work curves inward and upward, opening to allow entry from one side while producing a swelling form on the opposite end. The twenty-foot-tall sculpture is shaped by a series of nine segments: at the open end, the first of these segments emerges visually and structurally as an arch, set perpendicular to the ground plane. Each successive segment is set against its neighbor at an increasingly acute angle, sweeping upward until the bricks of the final segment are laid in the form of a dome at the summit of the artwork.

Lookout marks the artist's first use brick as a material, recognizing brickmaking as a once-primary industry in the Hudson Valley and referencing the vernacular structures that dot the local landscape. The work emerges from Puryear's exploration of traditional masonry forms, including the daring techniques of Nubian vault-building without formwork that the artist witnessed in Mali; classical Roman arches and domes; the curved and tapered forms of bottle kilns at the ceramics factories of Stoke-on-Trent, in England; and the curved entablatures of the Squadron A Armory on the Upper East Side of Manhattan, which seem to defy gravity. To achieve this ambitious and unconventional use of the material, Puryear worked closely with several trusted collaborators, including structural engineers, architects specializing in Guastavino vaults, kiln-builders, and expert brick- and stonemasons.

Inside, Puryear uses the work's form and setting to encourage a heightened sense of presence. Facing southwest, the masonry arch frames a sweeping view of Storm King's landscape, with the contours of Schunnemunk Mountain in the far distance. The brick surface is punctuated by a constellation of ninety circular openings created by tubes of fiberglass-reinforced concrete in varying sizes. The tubes, or oculi, act as apertures, creating pinhole vignettes of the surrounding trees and sky. The "sweet spot," indicated by the paving pattern, enables visitors to see out of all of the oculi at once.

Puryear describes the title of the work, *Lookout*, as simultaneously "a physical place, an invitation to observe and engage with the natural world, and a warning."

Media: Photos available on our digital guide on Bloomberg Connects; [Exhibition video](#) on the Storm King website; [Exhibition website](#) for Storm King Art Center's 2023 exhibition *Martin Puryear: Process and Scale*



Menashe Kadishman (Israeli, 1932–2015), *Suspended*, 1977. Weathering steel, 23 ft. x 33 ft. x 48 in. (701 cm x 10.1 m x 121.9 cm). Gift of Muriel and Philip I. Berman, Allentown, PA. © Menashe Kadishman

[Suspended \(1977\) by Menashe Kadishman](#)

The two simple forms of Menashe Kadishman's *Suspended* engage in a gravity-defying balance that belies expectation. Seen from a distance, atop one of two adjacent hilltops, the sculpture's balancing act is surprising. Viewed up close, the massive scale of the steel work becomes apparent and its structural viability even more difficult to comprehend. With no visible evidence of the engineering holding the sculpture up, *Suspended* prompts contemplation of the relationship between its two conjoined, towering masses, coupled with questions about what lies below ground. Rich and rusted, the patina of the weathered steel wraps the stark geometric shapes in a skin-like sheath.

After working with sculptors in his native Israel, Kadishman went to London in 1959, where he came under the influence of Anthony Caro at Saint Martin's School of Art. By the mid-1960s, he had established an international reputation for suspended sculptures that were gestural and full of dynamic tension. In some of his best-known works from this period, Kadishman attached glass or plastic sheets to wood or metal forms so that the mass seemed to float freely in space. *Suspended* represents his interest in such perceptual ambiguities.

Media: Audio recording and photos available on our digital guide on Bloomberg Connects



Kenneth Snelson (American, 1927–2016), *Free Ride Home*, 1974. Aluminum and stainless steel, 30 ft. x 60 ft. x 60 ft. (914.4 cm x 18.3 m x 18.3 m). Gift of the Ralph E. Ogden Foundation. © The Estate of Kenneth Snelson, courtesy Marlborough Gallery, New York

[Free Ride Home \(1974\) by Kenneth Snelson](#)

When conceiving of *Free Ride Home*, Kenneth Snelson first created a small maquette of metal tubes and knotted strings, envisioning what it would be like to walk under and through its silvery linear forms. “I began by thinking of a sculpture that would soar overhead,” Snelson noted. “I started with a central core and then developed it in three directions with three arches. One of the arches began to take on a descending fast plunge. It reminded me of the shape of a bucking horse. So, *Free Ride Home*, the name of a racehorse, became the name of the sculpture.”

Touching the ground at just three points, the creatively engineered sculpture is fashioned from a network of stainless-steel cables knotted to aluminum tubes. Installing at Storm King in the spring of 1975, a crew of just four raised the entire structure in under an hour. *Free Ride Home* is a prime example of Snelson’s play with organic forms constrained by internal structural tension, a push-pull system he invented in 1948. In this system, inspired by anatomy, cables function like muscles and the aluminum tubes like bones.

Media: Audio recording and photos available on our digital guide on Bloomberg Connects; [Archival Images](#) of the installation of Kenneth Snelson’s *Free Ride Home*

During Your Visit to Storm King

GENERAL INFORMATION

PLEASE FULLY READ YOUR GROUP CONFIRMATION LETTER for complete details about arrival, lunch, chaperones, trams, tours, and weather. Additional information about Group Visits can be found at <https://stormking.org/groups/> or by contacting groups@stormkingartcenter.org

PREPARE TO BE OUTDOORS: Storm King is a 500-acre outdoor sculpture museum. Keep in mind that your group will be outside for your entire visit to Storm King, rain or shine. We recommend dressing in layers and wearing comfortable shoes for lots of walking. It's a good idea to bring a refillable water bottle, sunscreen, bug spray, and weather-appropriate attire.

HELP US PROTECT THE SCULPTURES: Touching, walking on, or climbing on most of the works of art at Storm King is prohibited. The sunscreen, hand lotion, bug spray, and even natural oils on your hands damage the surface of the sculptures. You might not think one touch matters but remember, about 200,000 people visit Storm King every year. Thousands of touches add up to lots of damage. Always refrain from climbing artworks for your own safety and the safety of others.



INTERACTIVE ARTWORKS: Artworks which visitors may touch are designated on the map and on the grounds with a hand icon, pictured at left.

RESPECT WILDLIFE: All kinds of animals and plants make their home at Storm King – be good guests by giving them plenty of space. Do not enter our long and native grass fields and please refrain from climbing trees.

TERRAIN: The Art Center's grounds comprise varied terrain including rolling meadows, hills, wooded areas, paved paths, and gravel paths. During guided tours, please be prepared to cover up to one mile on grass.

ACCESSIBILITY: Storm King Art Center is committed to offering a rich experience of art and landscape to every visitor. **Please let us know in advance if anyone in your group has accessibility needs.** Level, paved pathways traverse many parts of the Art Center; however, some areas may only be accessed via steep terrain, unpaved pathways, or mown grass. The visitor map indicates paved and unpaved paths and steep areas (where slope exceeds that of a wheelchair-accessible ramp, or 12.5%). [Learn more.](#)

TIME: We recommend planning at least 3 hours for your visit. Guided tours are usually 45-60 minutes. If your visit is self-guided, or you have time before or after your tour, you may have lunch at a designated picnic area and explore the grounds on your own.

MATERIALS: You may choose to bring pencils and sketchbooks or notebooks for students to draw and write during the self-guided portion of your visit. Check out the digital guide on Bloomberg Connects and the tips and techniques for onsite engagement document on p. 14 for more inspiration.

MAP: Access an up-to-date map of Storm King on our [“Plan Your Visit” webpage](#), or pick up a map when you arrive at the Art Center. The digital guide on Bloomberg Connects features a live map.

MISCELLANEOUS:

- Ball playing and other recreational items and sports are not permitted.
- Indoor galleries are located in the Museum Building on Museum Hill. We ask that you limit the number of students inside the galleries at one time to 10.
- Roadways are used by pedestrians and Storm King staff, trams, personal vehicles, and rented bicycles. Please use caution.
- Carry in, carry out. Be sure that all trash and recycling makes it into bins. If you have lunch at Storm King, tidy up after yourself to make sure the next hungry visitors can enjoy the area too.
- Storm King reserves the right to refuse entry or to eject any group for misconduct at any time. Groups that are asked to leave the site or that cause damage to the site may be prohibited from visiting in the future.

EDGY ENGINEERING

Continue exploring the theme of engineering. If you are on a self-guided visit, or have time before or after your tour, walk the grounds. What do students notice about structures, balance, and support in each sculpture?

Visit some or all of the artworks featured in this resource packet:



Artwork: *Five Open Squares Gyrotory Gyrotory* (1981) by George Rickey

Location: North Woods; see map on page 16

Engagement: Ask students to identify which parts of this sculpture are static, or still, and which parts are dynamic, or movable. Invite students to take three photos of the sculpture from the same spot and compare the composition in each photo. Explore Rickey's other moving sculptures nearby. Do students have a favorite? Why?



Artwork: *Suspended* (1977) by Menashe Kadishman

Location: North Woods; see map on page 14

Engagement: Ask students to list questions that this sculpture inspires. What forces might be acting on this sculpture? What kinds of underground materials and structures do they think might support this sculpture? Invite them to draw ideas about what it might look like underground.



Artwork: *Lookout* (2023) by Martin Puryear

Location: North Woods; see map on page 16

Engagement: Ask students to walk around and enter the sculpture. Invite them to stand on the central stone circle within the form and to look up and around them. What does the form remind the students of? What processes might have been used to create this sculpture? How might this curved form be structurally supported? Invite students to sketch what they see through the apertures.



Artwork: *Free Ride Home* (1974) by Kenneth Snelson

Location: Museum Hill; see map on page 16

Engagement: Where do students notice tension in this piece? The artist named this sculpture after a racehorse. How do they think the sculpture might relate to a moving horse?

“EDGY ENGINEERING” ARTWORK LOCATIONS

#127 Martin Puryear,
Lookout

#113 Menashe Kadishman,
Suspended

#230: Kenneth Snelson,
Free Ride Home



#120: George Rickey,
Five Open Squares
Gyratory Gyratory

Artworks featured in this resource packet are located within 1 mile of the main entrance.

This route includes paved paths, grass, and some steeper, unpaved paths.

For more information about accessibility, or to request alternative suggestions for this theme, please contact groups@stormkingartcenter.org

TIPS AND TECHNIQUES FOR STUDENT ENGAGEMENT AT STORM KING

EXPLORE PERSPECTIVE. View sculptures and vistas from afar, close up, above, and below. Move around and through artworks to experience them from different angles. Invite students to create a rectangle with their hands to use as a viewfinder, “zooming in” on details and “cropping” views. Try photographing the same artwork or area from multiple perspectives. Ask students to imagine or draw what something might look like from a bird’s-eye view or a worm’s-eye view.

ASK OPEN-ENDED QUESTIONS. Engage students in conversation by asking open-ended questions such as: What do you notice? What does this make you think of? What do you wonder? What artworks or areas do you like the most? Why?

ENGAGE YOUR SENSES. Take the time to slow down and breathe deeply. What scents do you notice? What sounds do you hear? Invite students to create a six-word poem or story inspired by their sensory experiences. In addition to feeling the tickle of breezes and grass blades, we invite visitors to interact with sculptures marked on the map with a hand icon.

EMBRACE THE LANDSCAPE. Enjoy cloud gazing, downhill rolling, and creature and critter watching. Please engage with the land safely and respectfully.

SKETCH. Ask students to try capturing sculptures and vistas with single-line contour drawings, challenging them to create quick sketches without lifting their pencil from the page. Try drawing the same artwork or area from multiple angles. Zoom in on details. Experiment with mark making to capture different textures and create compositions featuring both sculpture and landscape.

GET MOVING! Encourage students to explore ideas with their bodies. They might physically recreate shapes they observe or respond to art and nature through dance and movement.

CONSIDER TITLES. The digital guide and Storm King [website](#) can provide additional information about each artwork, and many works have nearby placards listing the artist and title. You might add an additional layer to group conversations by considering how a title might relate to an artwork.

TUNE INTO THE AUDIO GUIDE. Accessible on Storm King’s digital guide on the free Bloomberg Connects App. Make the most of your visit with audio and video commentary by artists and Storm King staff. Artwork lookup numbers can be found on the map and on the label next to each artwork. Download the Bloomberg Connects App via the QR code below.



Post-Visit

REFLECT

Ask students to individually journal or talk with a partner about their visit to Storm King. What are some sculptures and ideas they explored? What engineering concepts did they notice in the artwork?

PROBLEM SOLVING

Print or project images of Kenneth Snelson's [Free Ride Home](#) (page 9) and George Rickey's [Five Open Squares Gyrotory Gyrotory](#) (page 5). You can also share Storm King Art Center's [Facebook video](#) of George Rickey's sculpture in motion.

In partners or groups, ask students to discuss some problems they think each artist had to solve in order to create those sculptures. You might want to share relevant information about each sculpture (pages 5 & 9) to support students' conversations.

ART & ENGINEERING CHALLENGE

Prompt for students: How will you create a stable, small-scale sculpture that has both static and dynamic parts? This means your sculpture should stand on its own and have at least one still part and at least one part that is moveable.

Some questions students might consider:

- What materials will you choose to build with? Why?
- How will you create a stable form that can stand on its own?
- What parts will move? What forces will make them move (wind, a push, etc)?
- Will the shapes/forms in your sculpture relate to any ideas? For example, Kenneth Snelson's *Free Ride Home* is abstract, but he related it to the movement of a race horse.
- Would you like to sketch some ideas before building?

Materials might include: paper, clay, wire, aluminum foil, string, toothpicks, rubber bands, paper clips, tape. You might choose to pose the challenge that tape cannot be used to hold sculptures to a desk, to increase the challenge of creating structural stability.

Experimentation: First, lead students in an inquiry with the materials. What are different ways that they can transform each material (ex: roll, bend, etc.)? Are some materials stronger when compressed? Are some stronger in tension? How might they effectively join materials, or make certain materials balance and stand on their own?

Process: As students work on their sculptures, check in with them, and encourage them to talk with partners to problem solve.

Reflection: Invite students to share their completed creations with the class or do a "gallery walk" around the room to explore one another's sculptures. Ask students to share a problem or challenge they encountered during their sculpture design or construction, and their process for solving it.

Resources

Storm King Art Center Collection

<https://collections.stormking.org/index.php/About/collection>

John P. Stern Oral History

<https://collections.stormking.org/Detail/oralhistory/4867>

Martin Puryear Exhibition website and video

<https://collections.stormking.org/Detail/occurrences/204>

Archival Images of the installation of Kenneth Snelson's *Free Ride Home*

https://collections.stormking.org/Browse/archival/facet/rel_entity_facet/id/120

George Rickey artist page

<https://collections.stormking.org/Detail/entities/73>

Storm King Art Center's Facebook video of *Five Open Squares Gyrotory Gyrotory* in motion

<https://www.facebook.com/StormKingArtCenter/videos/10154151653312332/?v=10154151653312332>

Storm King Art Center Groups

<https://stormking.org/groups/>

Exploratorium Science Explorer: Geodesic Gumdrops

https://www.exploratorium.edu/science_explorer/geo_gumdrops.html

Exploratorium Guide to Scale and Structure: Straws and Pins--Building Out

<https://www.exploratorium.edu/structures/strawspins.html>

Exploratorium Guide to Scale and Structure: Clay Bridges

<https://www.exploratorium.edu/structures/claybridges.html>

Exploratorium Guide to Scale and Structure: Newspaper Bridges

<https://www.exploratorium.edu/structures/newspaper.html>