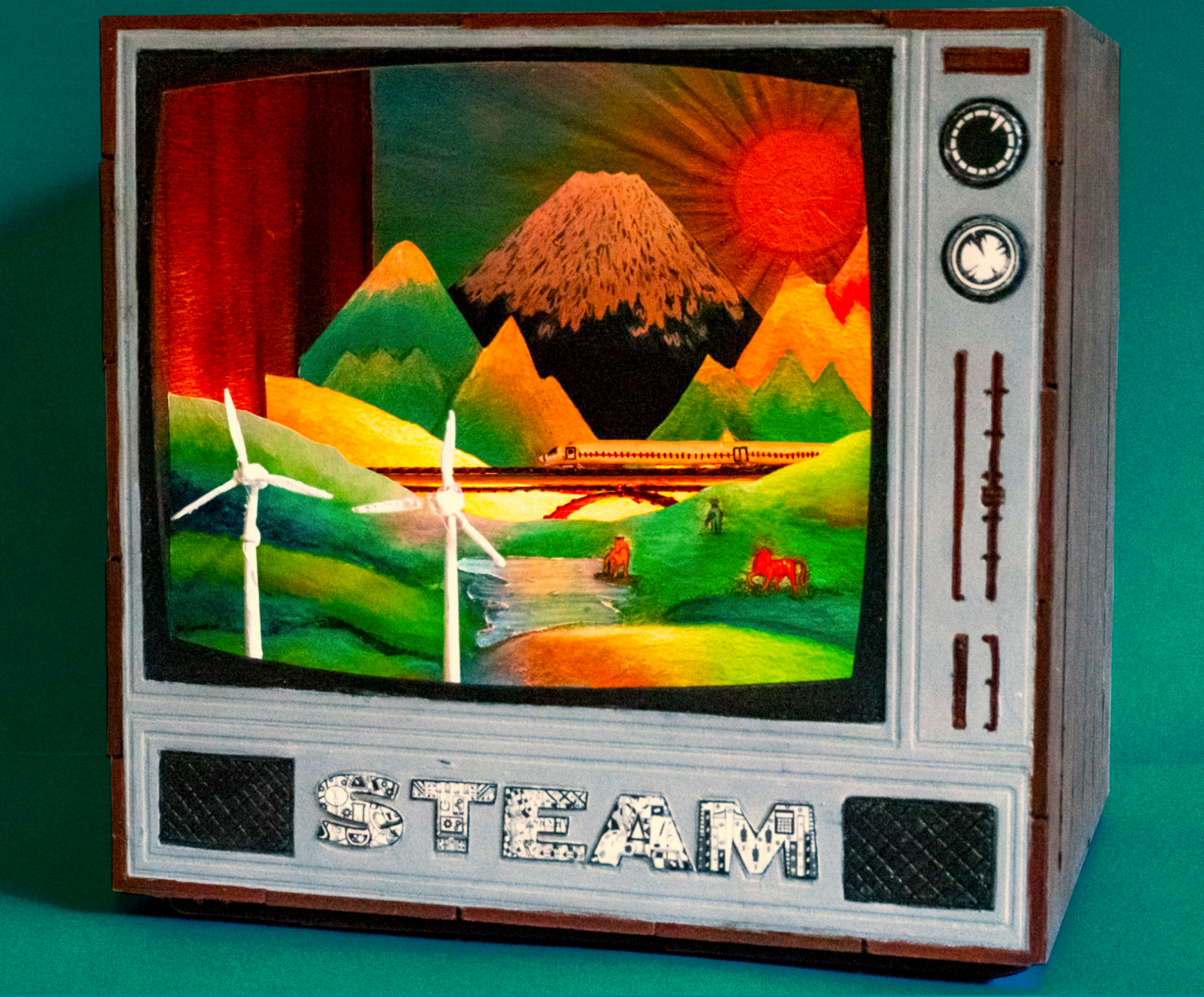
STEAM

TEACHING AND LEARNING THROUGH THE ARTS AND DESIGN

A Practical Guide for PK-12 Educators



Debrah C. Sickler-Voigt

An **Eye On Education** Book

ROUTLEDGE

Chapter 13

Janet Echelman

Illuminating the Built Environment

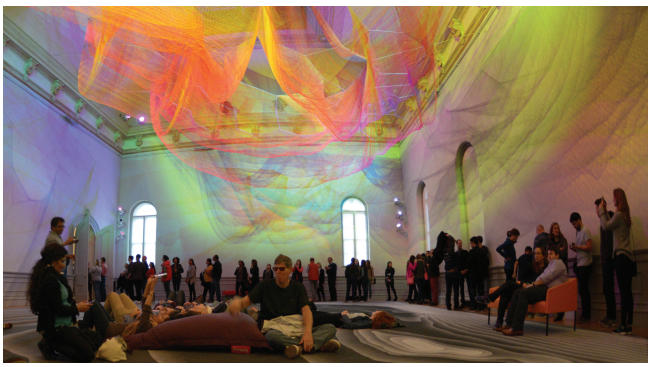


FIGURE 13.1 Janet Echelman, *1.8 Renwick*, 2015, knotted and braided fiber with programmable lighting above printed textile flooring.

Source: Smithsonian American Art Museum. © Janet Echelman.

Janet Echelman creates volumetric art installations formed from high-tech netting, some of which are 15 times stronger than steel by weight. Her airy installations move gracefully in the wind. As interactive designs, they encourage wonderment as audiences experience their changing colors and forms in motion (Smee, 2019). Echelman focuses on what she wants her art to become rather than concerning herself with obstacles that can arise from designing complex projects. Identifying her art as a collaborative effort, Echelman's team of experts includes engineers, architects, computer scientists, and lighting designers who bring her imaginative ideas to life. Echelman even had specialized software developed to produce her installations:

> It's allowed me to explore density, shape, and scale with the forces of gravity and wind—all within the context of the built environment. We can manipulate designs and see the results immediately. It's transformed my process. I couldn't create what I do now without it.
>
> (Tucker, 2015)

Echelman utilizes scientifically-engineered twine and rope fibers that withstand environmental stressors, including hurricane-force winds, harsh ultraviolet

DOI: 10.4324/9781003183693-17

rays, and ice. Based on the handmade and digital models Echelman and her team create, industrial braiding and looming factories manufacture the vast quantities of netting that her sculptures require and then hand trim and knot the netted panels to replicate the look of age-old crafting traditions (Smee, 2019). The draped and layered netting form produces a transparent and luminous feel.

Echelman (2022) generated the idea to use fishnet as art when she participated in a Fulbright Senior Lectureship in India. Her paints had not arrived in the mail, and she needed an alternative medium to prepare for an exhibition. Watching local fishermen, she perceived their nets as sculptural forms and collaborated with them to produce the artworks she needed. This experience changed her artistic direction and demonstrated that through imagination and problem solving she could create previously unimaginable works.

1.8 Renwick presents Echelman's response to the 2011 Japanese Tohoku earthquake's powerful force that redistributed the earth's mass, shifted the position of its axis, changed its rotation, and shortened the day by 1.8 millionths of a second (Figure 13.1; Smee, 2020). Echelman utilized recorded data from the National Oceanic and Atmospheric Administration and NASA about the earthquake and resulting tsunami to create her designs (Harvey, 2015). LED lights programmed in 30-minute sequences enhance *1.8 Renwick's* beauty and changing perceptions. Lavender and soft yellow-green colors flow onto the walls transforming them into a painted canvas that compliments the netting's golden yellows, orange, and purple hues. At other moments, the artwork's netted core glows like the morning sun and then fades into a deep sunset. Rich reds and fuchsias later saturate the room giving the feeling of jubilance. These radiating sequences of light cast shadows and unify the suspended sculpture with the 4,000 square-foot carpet beneath it made from netting materials that replicate the sea floor's topographical patterning produced by the tsunami (Harvey, 2015).

Teaching and Learning in the STEAM Artist's Studio 13.1 teaches about Echelman and her interactive installations. Its *STEAM Amplifiers* augment the lesson with content on sustainable-urban design, materials science and engineering, LED lighting, and aesthetic categories.

Teaching and Learning in the STEAM Artist's Studio 13.1

Introduce Janet Echelman and the importance of planning and communicating with clients and other stakeholders when creating interactive installations. Describe how Echelman makes sketches, creates miniature models, and uses three-dimensional computer models to form sculptures that have accurate proportions and billow with the wind.

Essential/Guiding Questions

1. Janet Echelman uses her imagination and wonderment to envision what her installations can become. Why is the artistic behavior of imagination and wonderment important to her planning process?
2. Echelman explained: "I might sketch 25 versions of an idea until it stops being an object to look at and becomes someplace I want to get lost in" (Smee, 2019). What qualities make people want to get lost in Echelman's installations?

Daily Learning Targets

As a design team, we can imagine and create an interactive art experience by modifying an actual space and/or forming a model.

- We can articulate the purpose and meanings of our interactive design.
- We can develop a clear plan of how people would interact with the space we designed.
- We can choose diverse media, including non-traditional media like repurposed netting and fabric, to produce our design.

National Core Arts Anchor Standards NVAS 1, 6, 8, and 11.
www.nationalartsstandards.org

Teaching for Students' Development

PK-12: (A) Ask students to identify the materials Echelman uses to create interactive installations and analyze their lighting changes and movements. (B) Explain how working in teams allows artists to achieve results that would be unattainable if working alone.

Early childhood: Young children are inspired by play and explorative experiences that stimulate their cognitive development. Invite students to act out the movements of Echelman's installations.

Middle childhood: Students can make predictions about how weather conditions like the wind influence the movements and appearances of Echelman's outdoor installations. Use class discussions and journals for students to articulate their thoughts.

Early adolescence: Middle school students have developed greater abilities to represent three-dimensional spaces in their art. Ask students to describe the qualities of Echelman's volumetric forms and make a sketch that demonstrates how her art shows volume.

Adolescence: High school students talk and write about art using technical vocabulary. Have students research and describe some of the technical innovations that drive Echelman's art installations.

STEAM AMPLIFIERS CHOICE #1—SUSTAINABLE URBAN DESIGN

Sustainable urban planning refers to the planning, development, management, and use of land in cities, towns, suburbs, and rural areas using environmentally sustainable materials and practices. As an interdisciplinary field, sustainable urban planning involves teams of experts that include architects, landscape architects, city planners, traffic engineers, environmental planners, and artists. The need for sustainable urban planning has increased with more people moving to urban environments. Urban planners form comprehensive plans regarding land usage, conservation, and social and economic sustainability while recognizing that communities best meet the needs of all people when they are inclusive, accessible, promote equity, and minimize humanity's imprint on the world. Urban designers meet with local planning authorities, citizens, and other stakeholders to learn their needs and work through possible constraints. Their designs incorporate plans to construct green buildings, replenish resources, use renewable energies and water sources, and protect living organisms. Sustainable urban development improves a community's health by providing access to green spaces, safe pedestrian zones and bike paths, and public transportation. Urban designers create mix-use spaces that reduce travel, as people can live, work, shop, and enjoy leisurely activities within close vicinities. Their designs include community centers and the arts. They plan for future growth and develop infrastructure strategies that foster community vibrancy and prevent the environmental degradation that arises when communities lack necessary resources.

FIGURE 13.2 Janet Echelman's *Bending Arc,* 2020, is an innovative installation that enhances the St. Pete Pier with its beauty, meaning, and wonderment.
Source: © Janet Echelman.

Urban designers identify a community's key locations, such as historic landmarks and natural spaces, to bring people together. Echelman designed *Bending Arc* (Figure 13.2), an installation on permanent display at the Pier District in St. Petersburg, Florida, which includes a museum, playground, beach, and solar car canopies that generate solar energy, reduce greenhouse gas emissions, and shade parked vehicles. *Bending Arc's* blue- and white-hued netting compliments the Florida sky during the day and glows bright fuchsia at night (Figure 13.3). Its title was inspired by Martin Luther King's speech that quoted abolitionist

FIGURE 13.3 Janet Echelman's *Bending Arc,* 2020, glows at night with bright fuchsia colors.
Source: © Janet Echelman.

Theodore Parker's statement "the arc of the moral universe is long, but it bends towards justice" (Smith, 2020). Echelman selected the quote in reference to the 1950s Supreme Court decision Alsup v. St. Petersburg that granted black community members equal access to segregated public pools. Echelman noted how *Bending Arc's* fluidity aligns with positive change and debuted during the George Floyd protests and calls for racial justice and civil rights for black and brown people: "I've been working on this piece for four years And I never would have guessed when the piece opened, it would open in such a pivotal time for social justice" (Smith, 2020).

STEAM AMPLIFIERS CHOICE #2—MATERIAL SCIENCE AND ENGINEERING

Materials science and engineering refers to the production and refinement of solid materials for industrial and personal use. It is an interdisciplinary field grounded in physics, chemistry, and engineering with the aim of making advanced materials from metals, ceramics, polymers, and composites (the combination of at least two different materials). Scientists and engineers study the properties and structures of materials, their relationships, and how they can be combined and processed to produce desired outcomes, including making new materials and improving existing ones so that they are lighter, smaller, stronger, and/or more cost-effective.

Advances in materials science and engineering have benefitted Echelman's work as she was able to substitute regular fishnet with stronger and lighter fibers, including a fiber created for NASA, to produce

FIGURE 13.4 Advanced materials enable Janet Echelman's installations to withstand various outdoor weather conditions. *As If It Were Already Here,* 2015, Boston.

Source: Studio Echelman, Photo: Bruce Petschek. (CC BY-SA 4.0), Wikimedia Commons.

larger sculptures that could withstand diverse weather conditions (Figure 13.4; Tucker, 2015). Studying materials science and engineering, students can also make connections to **nanotechnologies,** technologies that consist of tiny, lightweight parts—ones that make their mobile devices small and lightweight. They can investigate how humans have used metals and their applications in art. **Metallurgy** is the study of extracted metals and how they are modified for expanded uses. Students can examine how people combine metal with other metals and/or additional materials, such as silica and carbon, called **alloys**, to produce new metals.

STEAM AMPLIFIERS CHOICE #3—LED LIGHTING UP OUR LIVES

Lighting technologies have drastically changed since Thomas Edison's production of incandescent lightbulbs (see Chapter 2). Many people have switched to LED (light-emitting diode) lights due

to their high-energy efficiency rates and cost savings. LED lighting is produced when an electrical current, consisting of charged electrons and holes, passes through a solid diode semiconductor. A **semiconductor** is an electronic conductivity material produced with an insulator and metal conductors. LED lights come in many shapes, sizes, and colors. They play key roles in sustainable architecture, landscape design, the arts, and brighten everyday objects including computers, mobile devices, and traffic lights. *1.8 Renick's* programmed LED lighting adds visual appeal with its fluctuating colors and moving shadows that interact with the artwork's 51 miles of high-tech twine (Figure 13.5).

Building on their studies, students can discuss how advances in LED lighting technologies resulted from developments in materials science and engineering. They can compare LED lights with incandescent lightbulbs and discover how LED lights are illuminated by electrons in a semiconductor and incandescent lightbulbs emit light from a glass vacuum. Metal filament warmed inside causes the lightbulb to illuminate. Ninety percent of the heat needed to illuminate incandescent lightbulbs is wasted. LED lights use 75% less energy than incandescent lightbulbs and thereby reduce greenhouse gas emissions. LED lights save consumers money because they use less energy and last approximately 25,000 hours compared to incandescent lightbulbs that last only 1,000 hours.

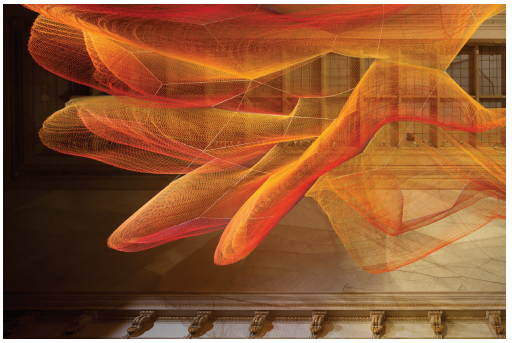


FIGURE 13.5 Programmed LED lighting adds to *1.8 Renwick's* aesthetic appeal.

Source: Smithsonian American Art Museum. © Janet Echelman.

STEAM AMPLIFIERS CHOICE #4—AESTHETIC CATEGORIES

Echelman's web page (2022) explains that "Echelman's work defies categorization, as it intersects Sculpture, Architecture, Urban Design, Material Science, Structural & Aeronautical Engineering, and Computer Science." This statement holds true for Echelman's transdisciplinary approach to design. Students can also learn how **aestheticians**, philosophers of art, categorize art using criteria. **Mimesis** is the aesthetic category that values art that looks realistic and/or ideal. **Formalism** focuses on an artist's proficient design skills using the elements and principles of art and applications of art media. **Expressionism**

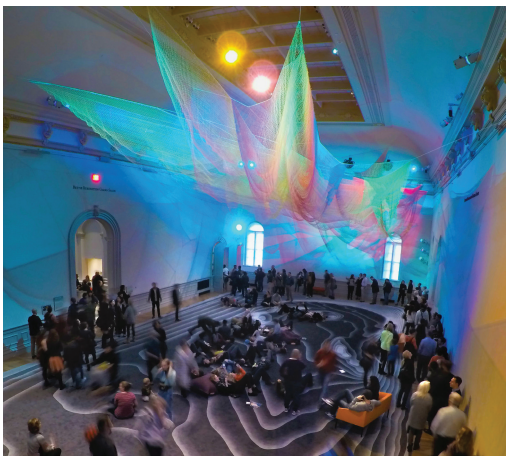


FIGURE 13.6 Janet Echelman's conceptual design for *1.8 Renwick* invokes audiences' emotional responses as it teaches about environmental phenomena.

Source: Smithsonian American Art Museum. © Janet Echelman.

appraises art for its ability to communicate emotions through its subject matter and/or an artist's expressive media applications. **Contextualism** centers on the stories and meanings that drive artworks, as related to social, historic, ethical, and/or political perspectives. **Instrumentalism**, an outgrowth of contextualism, identifies how artists produce artworks for purposes beyond artworks, with emphasis on content relating to social, gender, ethnic, religious, and/or political issues.

Students will learn that an individual artwork can be examined using one or more categories (Sickler-Voigt, 2020). For example, students can refer to conceptualism to discuss Echelman's ideas for using netting and lighting to create volumetric sculptures that change the dynamics of built environment spaces (Figure 13.6). Expressionism applies to Echelman's ability to produce emotional responses to her artworks given their fluctuating movements and harmonious and vibrant colors. Instrumentalism applies to Echelman's designs. *1.8 Renick* teaches about humanity's interconnections to the earth and its powerful forces. *Bending Arc* takes actions against discriminatory practices.

MOVING FULL STEAM AHEAD...

This chapter on Janet Echelman described her imaginative ideas for designing art installations using innovative materials in built environment spaces. It concludes Part IV of this book with its emphasis on the artistic behavior of imagination and wonderment. In the next chapter, we will learn about graphic designer Litha Soyizwapi and his acclaimed *GauRider app*. It begins Part V of this book that focuses on the artistic behavior of persistence.

References

Echelman, J. (2022). *Janet Echelman biography*. Janet Echelman https://www.echelman.com/about

Harvey, L. (2015, November 20). How one artist learned to sculpt the wind. *Smithsonian*. https://www.smithsonianmag.com/smithsonian-institution/how-one-artist-learned-sculpt-wind-180957064/

Sickler-Voigt, D. C. (2020). *Teaching and learning in art education: Cultivating students' potential from pre-K through high school*. Routledge.

Smee, S. (2019, April 04). In the studio with Janet Echelman. *The Washington Post*. https://www.washingtonpost.com/graphics/2019/entertainment/in-the-studio-with-artist-janet-echelman/

Smee, S. (2020, January 31). A hugely popular hit returns to the Renwick. *The Washington Post*. https://www.washingtonpost.com/entertainment/museums/a-hugely-popular-hit-returns-to-the-renwick/2020/01/30/8c5d9720-3d35-11ea-b90d-5652806c3b3a_story.html

Smith, L. (2020, July 20). This new aerial sculpture in Florida is gorgeous. It's also a haunting reminder of an ugly past. *Fast Company*. https://www.fastcompany.com/90529220/this-new-aerial-sculpture-in-florida-is-gorgeous-its-also-a-haunting-reminder-of-an-ugly-past

Tucker, D. (2015, Spring/Summer). Discovering the unknown: An interview with Janet Echelman. *Public Art Review*, *26*(2), 42–49.