

Balancing Acts

This lesson for grades 4–8 emphasizes connections between art and engineering by giving students first-hand experience using processes of design, trial, and revision to solve problems.



Left: Eduardo Chillida (Spanish, 1924–2002), *Rumor de limites #4 (Rumor of Limits #4)*, 1960. Iron, 38 1/8 x 38 1/8 x 26 1/4". Gift of Mr. And Mrs. Richard K. Weil, 1962. © Artists Rights Society (ARS), New York / VEGAP, Madrid.

Right: Alexander Calder (American, 1907–1976), *Bayonets Menacing a Flower*, 1945. Painted sheet metal and wire, 45 x 51 x 18 1/2". University purchase, McMillian Fund, 1946. © Calder Foundation, New York / Artists Rights Society (ARS), New York.

LEARNING OBJECTIVES

- Students will discover similarities between how artists and engineers design solutions to problems through experimentation while creating balanced standing mobile sculptures.
- Students will explore paper construction techniques and approaches to creating three-dimensional art.
- Students will practice problem-solving skills and embrace alternative possibilities through the creative process.

MISSOURI LEARNING STANDARDS

Science

ETS1.A Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost.

ETS1.B Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

ETS1.C Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Visual Arts

VACr1A4 Brainstorm multiple approaches to a creative art or design problem.

VACr2A4 Explore and invent art-making techniques and approaches.

VACr3A4 Revise artwork in progress on the basis of insights gained through peer discussion.

SOCIAL AND EMOTIONAL LEARNING COMPETENCIES*

Self-Awareness

- Demonstrating a growth mindset

Relationship Skills

- Practicing teamwork and collaborative problem-solving

*Adapted from CASEL's SEL framework: <https://casel.org/sel-framework/>

PART I: RUMOR OF LIMITS #4



Eduardo Chillida (1924–2002) was a Spanish Basque sculptor known for creating abstract works made from metal and wood that investigate space and borders. Chillida was born in San Sebastián and studied architecture at the University of Madrid from 1943 to 1947 before moving to Paris in 1948 to study sculpture. When he returned to Basque country in 1951, Chillida installed a forge in his studio and created his first abstract sculpture in iron with the help of local blacksmiths. He subsequently began to work

predominantly in iron, wood, and steel, materials mined in the Basque region that he saw as representing his homeland’s traditions and landscape. For *Rumor of Limits #4* Chillida transformed a sheet of iron—an extremely heavy and hard material—into a three-dimensional sculpture with a sense of movement and lightness by cutting and bending the heated metal. The sculpture is part of the *Rumor of Limits* series that the artist created over the course of a decade to explore what he called “inner space.” Chillida also made engravings, drawings, and collages throughout his career, and his explorations of form and line using paper informed many of his notable sculptures.

Materials

- 8.5 x 11–inch sheets of cardstock
- Scissors
- Staplers

Steps

- Introduce the lesson by asking students to brainstorm as a class in response to the questions “What does an engineer do?” and “What does an artist do?” List their responses on chart paper. Tell students that in this lesson they will combine art and engineering by creating sculptures that respond creatively to design problems.

- Invite students to look at *Rumor of Limits #4* by Eduardo Chillida, walking around the sculpture to observe it from different angles.
- Pose questions to prompt students' close looking and analysis of the sculpture. Encourage students to ground their ideas about the sculpture in their visual observations. Share information about the sculpture and artist in response to students' questions.
 - *What do you notice about this sculpture?*
 - *What material do you think it is made of, and how do you think the artist sculpted it?*
 - *What do you notice about how this sculpture achieves balance?*
- Tell students that like this artist, they are going to explore different ways of transforming a flat sheet of material into a three-dimensional sculpture that balances on the ground.
 - **Design problem:** Create a visually interesting three-dimensional sculpture that stands on the ground without falling over. Materials are limited to a single sheet of cardstock, scissors, and a stapler. Additionally, the cardstock should be kept intact as a whole sheet and not cut up into smaller pieces.
- Show a sample sculpture and ask students to brainstorm ways of manipulating the cardstock by tearing, cutting, folding, rolling, crumpling, weaving, and stapling.
- Give students 5–10 minutes to create their sculptures.
- Ask students to arrange their sculptures around the room to create a class sculpture park. Invite them to reflect on their design process and the variety of design solutions in the classroom:
 - *What similarities and differences do you notice among the sculptures?*
 - *What are some different ways that the sculptures achieve balance?*
 - *What challenges did you encounter while creating your sculpture, and what changes did you make to your design to address those challenges?*

PART II: *BAYONETS MENACING A FLOWER*



Alexander Calder (1898–1976) was an American artist whose sculptures explore movement and balance. Calder originally set out to be an engineer, earning a degree in mechanical engineering from the Stevens Institute of Technology in 1919. In 1923 he decided to become an artist and enrolled in the Art Students League in New York. Calder began making kinetic sculptures in 1931. Many of his early kinetic sculptures used motors to create movement, but he soon abandoned the motors when he realized that he could make hanging sculptures that moved in response to air currents. Calder's suspended sculptures that are set in motion by currents of air are called "mobiles," and his stationary sculptures that stand on the ground are called "stabiles."

Calder's exploration of physical movement in sculpture inspired many other artists, including Eduardo Chillida, who created his monumental hanging sculpture *Homenaje a Calder (Homage to Calder)* in 1979. Both artists were represented by the same gallery, Galerie Maeght, and came to know and appreciate one another.

In addition to mobiles and stabiles, Calder also created a third category of sculptures, called "standing mobiles," that combine the stationary structure of the stabile with the kinetic elements of the mobile. *Bayonets Menacing a Flower* is an example of a standing mobile. The stationary structure is composed of spiky pieces of sheet metal bolted together into a three-dimensional form, while the mobile component consists of a long wire suspending small disks of metal on either end that balances on a small notch in the sheet metal.

Materials

- Completed sculptures from part I
- Wire
- Scissors
- Beads in different sizes

Steps

- Invite students to look at *Bayonets Menacing a Flower* by Alexander Calder, walking around the sculpture to observe it from different angles.
- Pose questions to prompt students' close looking and analysis of the sculpture. Encourage students to ground their ideas about the sculpture in their visual observations. Share information about the sculpture and artist in response to students' questions.
 - *What do you notice about this sculpture?*
 - *What materials do you think it is made of, and how do you think the artist sculpted it?*
 - *What do you notice about how this sculpture achieves balance?*
- Tell students that like this artist, they are going to explore how they can add a mobile component to a stationary sculpture while maintaining its balance to create a standing mobile.
 - **Design problem:** Add a mobile component to your standing sculpture from part I while maintaining its balance. The mobile component will be made of wire and will suspend beads of different sizes on either end. The mobile component should balance on the standing sculpture and the standing sculpture should not tip over.
- Provide a demonstration of the design problem by adding a mobile component to your sample sculpture from part I. Emphasize that there are multiple ways to approach this design problem, and that trial and error and revision are parts of the process.
- Give students 10 minutes to work on their standing mobiles.
- Ask students to test the balance and sturdiness of their standing mobiles with a tip test and wind test by gently nudging and blowing on their sculptures. Have students think with a partner about how to increase their sculptures' balance and stability and then give them 5 more minutes to revise their work.
- Ask students to arrange their sculptures around the room to create a class sculpture park. Invite students to reflect on their design process and the variety of design solutions in the classroom:
 - *What similarities and differences do you notice among the sculptures?*
 - *How do the sculptures achieve balance?*
 - *What challenges did you encounter while creating your sculpture, and what changes did you make to your design to address those challenges?*
- Revisit the class list from the beginning of the lesson ("What does an engineer do?" "What does an artist do?"). Ask students if they would like to add anything new to the list and to reflect on the similarities between how artists and engineers approach problem-solving.

VOCABULARY

Basques: a Southwestern European ethnic group with a shared language and culture

kinetic: relating to or resulting from movement

mobile: a suspended sculpture that is set in motion by air currents or motors

sculpture: three-dimensional art

stabile: a freestanding stationary sculpture

standing mobile: a sculpture that combines the stationary structure of a stabile with the kinetic elements of a mobile

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