

Searching for Symmetry and Scale

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SUMMARY

In this activity children will look at several drawings of a building to learn about symmetry and scale.

WHY

Children can build vocabulary and communication skills by describing and interpreting the things they see. The ability to understand and ask questions about pictures and objects will also help them to become better researchers.

TIME

- 10–20 minutes

RECOMMENDED AGE GROUP

This activity will work best with children in kindergarten through 2nd grade.

CHALLENGE WORDS

- **floorplan:** a drawing that shows a space from above and is usually drawn to scale.
- **scale:** the size of a picture, plan, or model of something compared to the size of the thing itself.
- **symmetry:** match in size, shape, and relative position of parts on opposite sides of a dividing line, creating a sense of balance.

GET READY

- Read *Julia Morgan Built a Castle* together. The book tells the story of Julia Morgan, one of America's earliest women architects. Morgan designed almost 800 buildings during her career, including William Randolph Hearst's castle in California. For tips on reading this book together, check out the [Guided Reading Activity](http://americanhistory.si.edu/ourstory/pdf/architect/architect_reading.pdf) (http://americanhistory.si.edu/ourstory/pdf/architect/architect_reading.pdf).
- Read the *Step Back in Time* sheets.



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YOU NEED

- *Step Back in Time* sheets (*attached*)
- *ThinkAbout* sheets (*attached*)
- *Julia Morgan Built a Castle* book (*optional*)
- Rectangular hand mirror (*optional*)

More information at <http://americanhistory.si.edu/ourstory/activities/architect/>.



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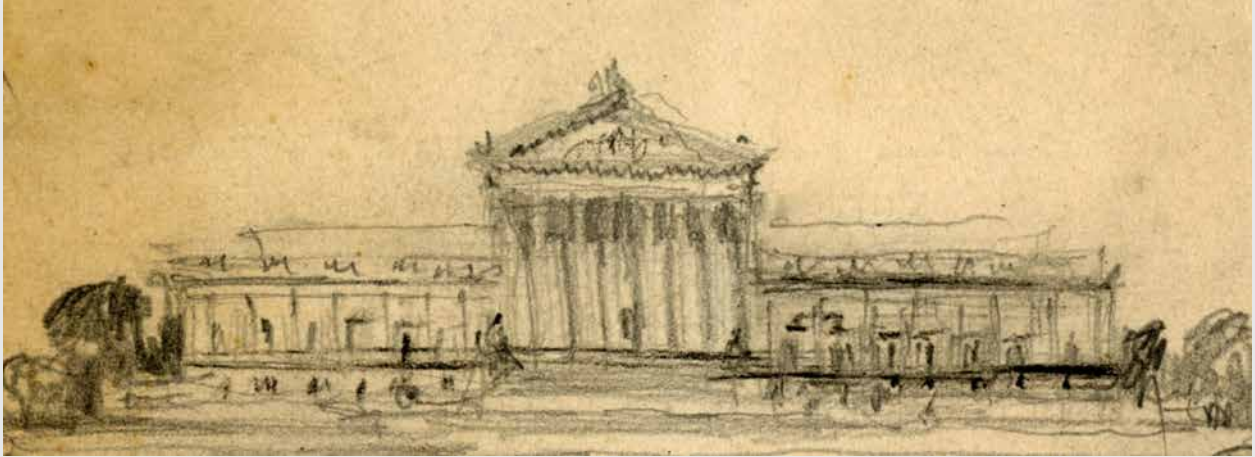
The Supreme Court of the United States was built between 1932 and 1935. Cass Gilbert, the architect, designed it to be just as impressive as the Capitol and congressional buildings that are its neighbors. To learn more about the Supreme Court building, visit <http://www.supremecourt.gov/about/courtbuilding.aspx>. [Image courtesy Architect of the Capitol]

1. Look closely at this picture of the building today. Name all of the different things that you see (doors, windows, steps, roof parts, columns, etc.).
2. Looking especially at the columns, fountains, and flag poles, count how many of each item you can see in this picture.
3. Do you notice that most of the numbers are even? That is because the architect of this building chose to use symmetry in his design. If a design has symmetry, that means you can draw a line through the center of the design and both sides will match. Buildings with symmetry tend to look like they are balanced.

Tip There are many other building elements (large windows, small windows, roof parts, etc.) that can also be found in even numbers. The angle that the picture makes these matches less obvious.

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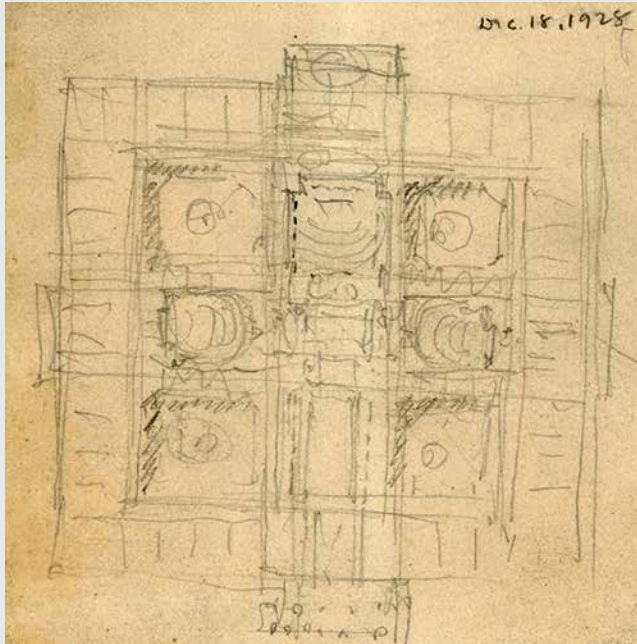
Sketch by Cass Gilbert [Image courtesy Archives Center, National Museum of American History]

4. Look at this drawing of the building from the Archives Center at the National Museum of American History. Can you see where you could draw a line to make two matching halves? Find out if you guessed right by checking:
 - a. Fold the paper in half. If both sides match, you identified the line of symmetry.
 - b. Place a rectangle-shaped hand mirror along the line of symmetry. Tilt the mirror at an angle to the table and look at both the image in the mirror and at your paper. If both sides match, you found the line of symmetry.

5. In either this drawing or the picture from the page before, can you see any smaller parts of the building that have symmetry? For example, could you draw a line down the middle of one of the windows and see the same thing on both sides?

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Floorplan sketch by Cass Gilbert. The bottom of the drawing represents the front of the building. The four shaded squares are courtyards. The courtroom is just above the center of the drawing, with curving lines to represent rows of seats. [Image courtesy Archives Center, National Museum of American History]

6. The architect also used symmetry in designing the floorplan of the building. This is what the building looks like from above. There are two lines of symmetry in this view of the building. Can you see both of them?

Tip For an extra challenge, fold one of the drawings in half and try to draw the missing half of the building just by looking at its matching half.

7. Look around for more buildings and other objects that use symmetry. Decide how many lines of symmetry each object has.
8. Look back in the book *Julia Morgan Built a Castle*. Can you find symmetry in any of the buildings in the book's pictures?

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Sketch by Cass Gilbert [Image courtesy Archives Center, National Museum of American History]

Architects make their drawings of buildings much smaller than the buildings themselves will be. Can you imagine how much paper it would take to draw a building the size of the building itself?

Tip One floor of the Supreme Court is 304 feet by 385 feet.

In finished architectural drawings, architects are very precise and use exact measurements to show what they want the finished building to look like. To show the measurements on a piece of paper, they use scale. When we say scale here, we mean that the architect sets up a system where one small measurement on the paper (like 1 inch) represents a much larger measurement in the real building (like 3 feet).

In this drawing, we don't see an exact scale, but we have a clue about scale by looking at the trees.

How tall do you think one of these trees might be?

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Sketch by Cass Gilbert [Image courtesy Archives Center, National Museum of American History]

From your guess at the tree's height, you can guess other measurements of the building:

- How many floors do you think the building has inside?
- If you turned the tree sideways, about how long would the building be?
- About how high are the windows in this building?

Trees vary, so it would be impossible for a builder to look at this drawing and make the building correctly.

Try it out! Can you draw something in your home (such as a wall of a room or a large dresser) using scale? Will you use measurements to make an exact scale, or use an object to make give a hint about the scale?

Look for scale in real life. Take a look at a map to see exact scale. What is one inch on the map equal to in real life?

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For more information, visit the National Museum of American History website <http://americanhistory.si.edu/ourstory/activities/architect>.

Architects are people who design buildings. They study math, science, and art to help them design buildings that are strong, useful, and beautiful.

An architect thinks about the place where the building will stand to make sure it will survive the weather and will be sturdy in the ground. The architect also decides the exact measurements for each part of the building to make sure everything will fit together correctly and to decide how much of each building material to buy.



A sketch of the Supreme Court of the United States, by its architect Cass Gilbert [Archives Center, National Museum of American History]

A strong building is only part of the challenge for an architect. He or she will also make sure that the building will be conveniently arranged for the people who will live or work there. To make the building beautiful, the architect will also think about decorations, patterns, and materials that will look beautiful to the people who use the building and see it from outside.

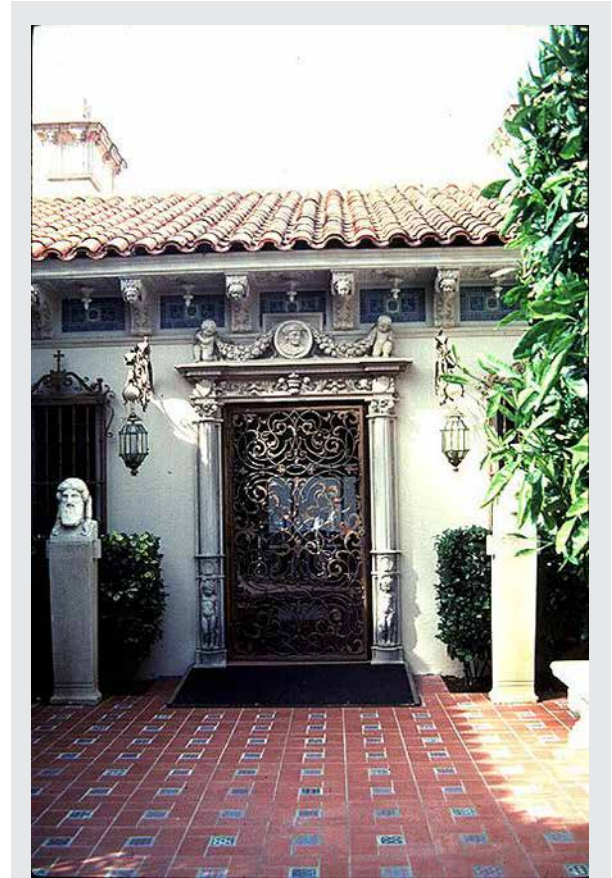
To share their plan for the building, architects make many drawings on paper and sometimes make small models out of cardboard. The architects will then show the papers and models to the people who will use the building. Sometimes architects redo their plans over and over again to make sure they are perfect, because construction workers use those paper plans to make the real building out of materials like stone, metal, wood, plaster, and glass.

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About Julia Morgan:

Until around 1900, almost all architects were men. Women were not admitted to architectural school. However, Julia Morgan and other great women architects have helped change this tradition and now both women and men can become architects.



Photograph of one of the entrances to Hearst Castle, by Eleanor C. Weller [Archives of American Gardens, Smithsonian Institution]

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Searching for Symmetry and Scale

Teacher Guide

OBJECTIVES

The students will be better able to:

- Identify symmetry.
- Interpret scale in real-world and historical images.

STUDENT PERFORMANCE CRITERIA

- Provides reasonable estimates of the scale of the building using the tree as a unit of measure.
- Accurately identifies examples of symmetry and lines of symmetry.

STANDARDS

NCHS History Standards

K-4 Historical Thinking Standards

- 2H: Draw upon the visual data presented in photographs, paintings, cartoons, and architectural drawings.

Common Core Math Standards

CCSS.Math.Content.K.CC.B.5 Count to answer “how many?” questions

CCSS.Math.Content.K.G.A.1 Describe objects in the environment using names of shapes, and describe the relative positions of these objects

CCSS.Math.Content.2.MD.D.9 Generate measurement data

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