SOCIETY OF ARCHITECTURAL HISTORIANS
SAH ARCHIPEDIA
ROTUNDA

TITLE: THROUGH THE LOOKING GLASS: TRANSPARENCY IN MODERN ARCHITECTURE
SUBJECTS/TOPICS: AMERICAN HISTORY, ART, ARCHITECTURE, SOCIAL STUDIES
GRADE LEVEL: K-12
AUTHOR: KEVIN HOFMANN, M.S.ED.

BACKGROUND

Mesopotamian civilizations first began making small glass objects around 2500 BCE. Used as an architectural material first by the Romans, the production of glass declined in the fifth century only to return as a decorative artform (stained glass) in Renaissance ecclesiastical architecture. Towards the end of the 19th century, rolled plate glass replaced glassblowing, and business owners began using larger, clearer pieces of glass for their storefronts to sell goods. The development of steel framing, in addition to enabling the construction of taller buildings, forever freed the wall from its load-bearing conformity with structure. Soon, architects began specifying glass in both commercial and domestic settings in ways that promoted the use of natural light, offered uninterrupted views, and contributed to a building's legibility (i.e., form follows function). Analyzing the use of glass in modern architecture provides students an opportunity to examine the intersection among modern technology, economics, and culture.

CONTENT OBJECTIVES

Explore case studies of architectural glass and establish a chronology

Identify, define, and apply essential vocabulary and terminology associated with significant periods of development

Examine primary documents and connect the development of architectural glass to broader themes of technology, economics, and culture

Prompt students to consider the future of architectural glass as a key area of innovation regarding energy usage in contemporary architecture

This project is supported in part by an award from the National Endowment for the Humanities

Lesson Overview

This scaffolded lesson plan encourages students to connect the use of an architectural material—glass—with broader themes of history, technology, and culture. Students will examine primary documents in the form of images, videos, drawings, and written descriptions.

For grades K-3, students will use geometry and visual analysis. For grades 4-12, students will perform visual and/or textural analysis on a series of case studies covering significant periods of innovation. To demonstrate comprehension, students will be prompted to draw connections among the various cases through written narratives that should establish chronology, identify significant periods of development, and proffer relevant connections with outside knowledge about modern society.

The goal of this lesson is to present the development of architectural glass as an ongoing process with significant implications for both building performance (energy) and aesthetics. In the United States, buildings contribute to more than 40% of all energy use. The future of building science points towards increased conscientiousness concerning the thermal performance of walls and windows. An increased demand for technical knowledge has created a growing industry of architects who specialize in the use of glass curtain walls and facades. Furthermore, the historic preservation of old structures has also required architects to develop new techniques for replacing uninsulated glass with high-performing windows without undermining a structure's historic character. By completing this lesson, students will understand why designers and scientists continue to innovate with architectural glass all the while gaining valuable insight into contemporary architectural practice.

Essential Understanding

Analyzing the type, amount, and quality of glass used in a work of architecture offers insight regarding modern technology, economics, and culture.

Once an expensive and rare material reserved for ecclesiastical structures, architectural glass is now ubiquitous in commercial, institutional, and residential design.

As architects consider ways to improve the energy efficiency of buildings, the future innovation of architectural glass will have a direct impact on both the performance and aesthetic of contemporary design.

This project is supported in part by an award from the National Endowment for the Humanities

Content Standards

Kindergarten

CCSS.ELA-LITERACY.RL.K.7. With prompting and support, describe the relationship between illustrations and the story in which they appear.

CCSS.MATH.CONTENT.K.MD.A.2. Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.

Grades 1-3

CCSS.ELA-LITERACY.RI.3.3. Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

CCSS.MATH.CONTENT.3.G.A.1. Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.

CCSS.MATH.CONTENT.3.G.A.2. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.

Grades 4-5

CCSS.ELA-LITERACY.RI.5.1-5.6

CCSS.ELA-LITERACY.RI.5.9. Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

This project is supported in part by an award from the National Endowment for the Humanities

Content Standards, Continued

Grades 6-8

CCSS.ELA-LITERACY.RI.8.2. Determine a central idea of a text and analyze its development over the course of the text, including its relationship to supporting ideas; provide an objective summary of the text.

CCSS.ELA-LITERACY.RI.8.5. Analyze in detail the structure of a specific paragraph in a text, including the role of particular sentences in developing and refining a key concept.

CCSS.ELA-LITERACY.RI.8.7. Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea.

CCSS.ELA-LITERACY.RI.8.9. Analyze a case in which two or more texts provide conflicting information on the same topic and identify where the texts disagree on matters of fact or interpretation.

CCSS.ELA-LITERACY.W.8.9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

Grades 9-12

CCSS.ELA-LITERACY.W.11-12.2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

CCSS.ELA-LITERACY.W.11-12.3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

This project is supported in part by an award from the National Endowment for the Humanities

PREPARATION

First introduce students to SAH Archipedia (https://sah-archipedia.org/), an authoritative, online encyclopedia of the U.S. built environment organized by the Society of Architectural Historians and the University of Virginia Press. It contains histories, photographs, and maps for over 20,000 structures and places. These are mostly buildings, but as you explore SAH Archipedia you will also find landscapes, infrastructure, monuments, artwork, and more.

Introductory assignment: Have students explore the website and read the HISTORY and FAQ sections.

For the activities below, printed versions of building entries are advisable for the creation of several stations. Students will explore the following Building Sets (A, B, C, and D), which are grouped according to period/chronology, typology, and glass type.

A. PREMODERN GLASS

These examples of glass occur before the Industrial Revolution and the widespread use of rolled plate glass.

St. Luke's Church (1632-1685, 1890, 1950-1957), in Smithfield, VA https://sah-archipedia.org/buildings/VA-01-ST16

One of the oldest churches in North America, the description for St. Luke's provides significant detail regarding the use of glass and windows. Restored several times, analysis of glass type and period is used to date alterations to this structure.

Old Walpole Meetinghouse (1772, Samuel Woodward), in South Bristol, ME https://sah-archipedia.org/buildings/ME-01-015-0047

This Revolutionary War–era meetinghouse makes a compelling contrast to the previous, English medieval St. Luke's. Still, glass for the original windows was shipped from England, each of which cost the equivalent price of a cow.

Quincy Market (1824-1826, Alexander Paris; 1976-1978, Benjamin Thompson and Associates), Boston, MA https://sah-archipedia.org/buildings/MA-01-GC5

Students should examine the use of glass in Quincy Market's 1970s renovation and consider how the use of modern materials in historic structures alters our ability to "read" a building.

This project is supported in part by an award from the National Endowment for the Humanities

B. TURN OF THE CENTURY

With the invention of steel framing as well as other modern building techniques, use of glass becomes an integral part of civic, cultural, and commercial architecture.

American Management Corporation (1879; c. 1925, Sanders and Ginocchio), in Conway, AR https://sah-archipedia.org/buildings/AR-01-FA2

This early example of a converted department store features an upper floor lined entirely with prism glass. Connected to the development of the Little Rock and Fort Smith Railroad, this building is emblematic of the transition from traditional department store design to modern, industrial structures like the work of Albert Kahn (Detroit, Michigan) and Peter Behrens (Germany).

National Farmers' Bank of Owatonna (1907, Louis Sullivan), in Owatonna, MN https://sah-archipedia.org/buildings/MN-01-147-0070

One of Sullivan's "jewel boxes," the National Farmers' Bank extensively features decorative glass instead of traditional, temple-fronted facades found on Classical Revival buildings.

Maisel's Indian Trading Post (1937-1939, John Gaw Meem), in Albuquerque, NM https://sah-archipedia.org/buildings/NM-01-001-0098-07

Connected to the development of Route 66, Maisel's Indian Trading Post features a Carrara glass storefront, Art Deco flourishes, and a continuous frieze of Indian murals. This unique combination underscores the widespread use of commercial glass in nearly every region of the country by the late 1930s.

D. MODERNISM

Larger, clearer windows become a hallmark of modernism, particularly for skyscrapers and modern houses.

PSFS (1930, William Lescaze), in Philadelphia, PA https://sah-archipedia.org/buildings/PA-02-PH46

An exemplar pre-WWII modern skyscraper, this building entry for PSFS contains only one reference to the use of glass, but students should be able to examine images and additional materials to make observations about the industrial materials (stainless steel frames) and legibility (glass storefront base; continuous bands above for each floor).

Edith Farnsworth House (1946, Ludwig Mies Van Der Rohe), in Plano, IL https://sah-archipedia.org/buildings/IL-01-093-0028

The first residence included in this lesson plan, the Farnsworth House is notable in its use of floor-to-ceiling glass. Although not yet an SAH Archipedia entry, Philip Johnson's Glass House is also included for comparison.

General Motors Technical Center (1949, Eliel and Eero Saarinen), in Warren, MI https://sah-archipedia.org/buildings/MI-01-MB3

The GM Technical Center features leak-proof, neoprene-gasketed windows developed by GM engineers. It is situated in a Saarinen-designed suburban corporate campus.

C. Contemporary

As architects seek ways to make buildings more efficient users of energy, refined glass and window technologies are contributing to improved performance and enabling new architectural forms.

Glass Pavilion (2004), SANAA, in Toledo, OH https://sah-archipedia.org/buildings/OH-01-095-0097

For the Glass Pavilion, SANAA used more than 360 laminated Optiwhite UV-treated glass panels to form both the building's enclosure and interior spaces.

Center for Advanced Energy Studies (2005-2008), GSBS Architects, in Idaho Falls, ID https://sah-archipedia.org/buildings/ID-01-019-0058

This building uses less than two-thirds of the energy allowed by code. High-performance glazing, louvers, and passive lighting/heat all contribute to a reduced energy load.

Amazon Spheres (2012), Naramore, Bain, Brady and Johanson, in Seattle, WA https://sah-archipedia.org/buildings/WA-01-033-0073

These glass spheres contain vegetation, catwalks, and treehouses as a way to connect Amazon employees with the natural environment. Here, glass serves a cultural marker of one corporation's desire to convey an innovative, sleek, and transparent image.

ASSESSMENT

ASSESSMENTS FOR GRADES 6-8

Using the "search by material" function on Archipedia, find a building that you think uses glass as a "wall of light." Defend your choice.

Imagine you were to replace the glass in the project you identified with glass block: how might this change the structure, material, cultural significance, quality of light, history, and public perception of the building? Write a persuasive essay or present a case study that explains your thinking.

ASSESSMENTS FOR GRADES 9-12

Write a narrative about the use of glass in one of the provided Building Sets and your addition to that set. Review the provided examples of glass marketing and consider how these could be cited in your narrative. Introduce external citations and sources to connect this building set to larger themes of technology, economics, and culture.

Working in groups, create a digital or analog presentation connecting the use of glass in one of the provided Building Sets to larger themes of modern history. Be sure to cite outside sources to substantiate your claims.

Working individually or in groups, write, design, and create your own product brochure for the architectural glass of the future. Consider how this glass with both perform and look.

GUIDING QUESTIONS

What is architectural glass and what are significant periods of its development?

How has the use of architectural glass changed over time, and what physical characteristics can be studied to approximate the age and type of a piece of glass?

How is the development of architectural glass connected to history, culture, economics, and technology?

What is the future of architectural glass?

This project is supported in part by an award from the National Endowment for the Humanities

ACTIVITIES

Activity 1. Kindergarten

Begin by exploring the images in the building sets in the K-5 worksheet document. What do you notice?

1. Working in small groups, arrange the images according to:
    - Size (smallest to biggest)
    - Age (oldest to newest)
    - Color (darkest to clearest)
    - A characteristic of your choosing
2. Examine the image of the National Farmer's Bank on page 1 of the worksheet. Identify the shapes that you see.
3. Use the blank space on the worksheet to design your own window. Try to use some of Louis Sullivan's geometry in your window design.

As an extension activity, try to draw your design with correct scale (so that it fits in the provided space) and perspective (so that the design looks three-dimensional) on the facade of the bank.

Activity 2. Grades 1-3

1. Working in groups, study only the images of the twelve case studies in the K-5 worksheet document. Describe what you see—color, shape, size, etc. Then, guess the chronological order of the case studies and defend your reasoning.
2. Analyze the shapes you see: classify them as squares, rectangles, or rhombi.
3. Examine the image of the National Farmer's Bank on page 1 of the worksheet. Identify the shapes that you see. Then, use the blank space on the worksheet to design your own window. Try to use some of Louis Sullivan's geometry in your window design.
4. On page 2 of the worksheet, examine the glass block design and answer the following questions:
    - How many blocks are there?
    - What are two different ways to determine the total number of blocks?
    - Shade 1/4 of the blocks. How many should you shade? What about 1/3? Or 1/2?

Activity 3. Grades 4-5

As a class, select two projects per Building Set (see under Preparation, pages 5-7). Perform a close reading on one of the SAH Archipedia entries, discussing key words, themes, and important notes together.

Work in four groups, one per set. Half of each group should read the SAH Archipedia entries for the two buildings selected for that set.

As a class, agree on standard notes for each Building Set and discuss the evolution of architectural glass over time. What changes and continuities do you notice?

Now, turn to the case studies that you did not examine earlier in this activity. Try to identify which building set each case study belongs to, and defend your answer in writing or through a verbal presentation.

Activity 4. Grades 6-8

This activity is broken into four segments involving full class, small group, and individual activities.

As a Class: Creating a Timeline of Glass Innovation

Read the first section of *Building Walls of Light*, titled "A Very Short History of Glass," in the provided worksheet.

As you read, identify unknown words, key terms, important themes, and essential facts.

Annotate your worksheet, focusing on how to construct a timeline of glass innovation.

Working together, construct a rough timeline of the history of glass innovation.

Individually: Close Reading and Analysis

Read the remaining four sections (excluding the conclusion) of *Building Walls of Light*, annotating as you read.

Examine and answer the thinking questions for your assigned section (about 1/4 of the class will answer each set of questions).

In Groups: Thinking Questions and Group Presentations

Find the other members of your class who answered the same thinking questions as you.

Formulate group answers to the questions and create a poster or digital presentation to share your work.

Present your work to the class, making sure that every group member shares part of the presentation.

As a Class: Wrap-Up

Read the author's conclusion to *Building Walls of Light*.

Compare and contrast the findings made by you and your peers with those of the author.

Activity 5. Grades 9-12

The class will be divided into four groups to rotate among Building Sets A, B, C, and D. The Building Sets are available under the Preparation section of this lesson (pages 5-7).

Individually, read each SAH Archipedia entry, annotating the text and primary sources. Identify and define unknown vocabulary.

Use SAH Archipedia metadata to find an appropriate fourth building to be included in each Building Set. Focus on time period, materials, style, architect, etc.

In groups, compare annotations and share notes. Review the provided sales brochures for commercial glass and discuss how they can be incorporated into the narrative of the history of architectural glass.

SOCIETY OF ARCHITECTURAL HISTORIANS

SAH ARCHIPEDIA

ROTUNDA

KEY VOCABULARY

For more information on these terms, please reference the Getty Art and Architecture Thesaurus (http://www.getty.edu/research/tools/vocabularies/aat/index.html).

GLASS

architectural glass
art glass
Carrara structural glass (TM)
crown glass
cut glass
float glass
glass block
sheet glass
single strength window glass
spandrel glass
stained glass
structural glass
insulating glass
plate glass
structural steel
reinforced concrete
ribbon windows
clerestories

TYPOLOGY

residential structures
hotels
schools
museums
churches
meeting houses
markets
department stores
banks
commercial buildings
office complexes
research centers
corporate headquarters
greenhouses

STYLE

American Colonial
American Mannerist
Georgian
Greek Revival
Postmodern
Prairie School
Art Deco
International Style
Modernist
green design
environmental concept
sustainable architecture
high-tech