Architecture Unboxed

Creative Learning
Teacher Resource

Architecture meets Nature
Notes for Teachers

In this creative workshop students will learn how to draw and think like an architect and how Sydney Opera House architect Jørn Utzon inspired a legacy of design thinking in architecture, cities and public space.

The workshops can be delivered alongside a tour of the House exploring First Nations perspectives, the architectural practice of Jørn Utzon and his collaborators, as well as the contemporary uses of the site as a world-class performing arts venue.

The following Creative Learning Notes contain video links and suggested activities to build on an excursion to *Architecture Unboxed* in the Centre for Creativity.

We recommend using this resource as a starting point, to adapt content in a way that suits the learning needs of your students.

Architecture meets Nature
Workshop Overview

Student’s learn how to draw and think like an architect in this interactive workshop that explores Sydney Opera House’s architect’s Jørn Utzon’s legacy of design thinking, and the impact of architecture on people, cities and public space.

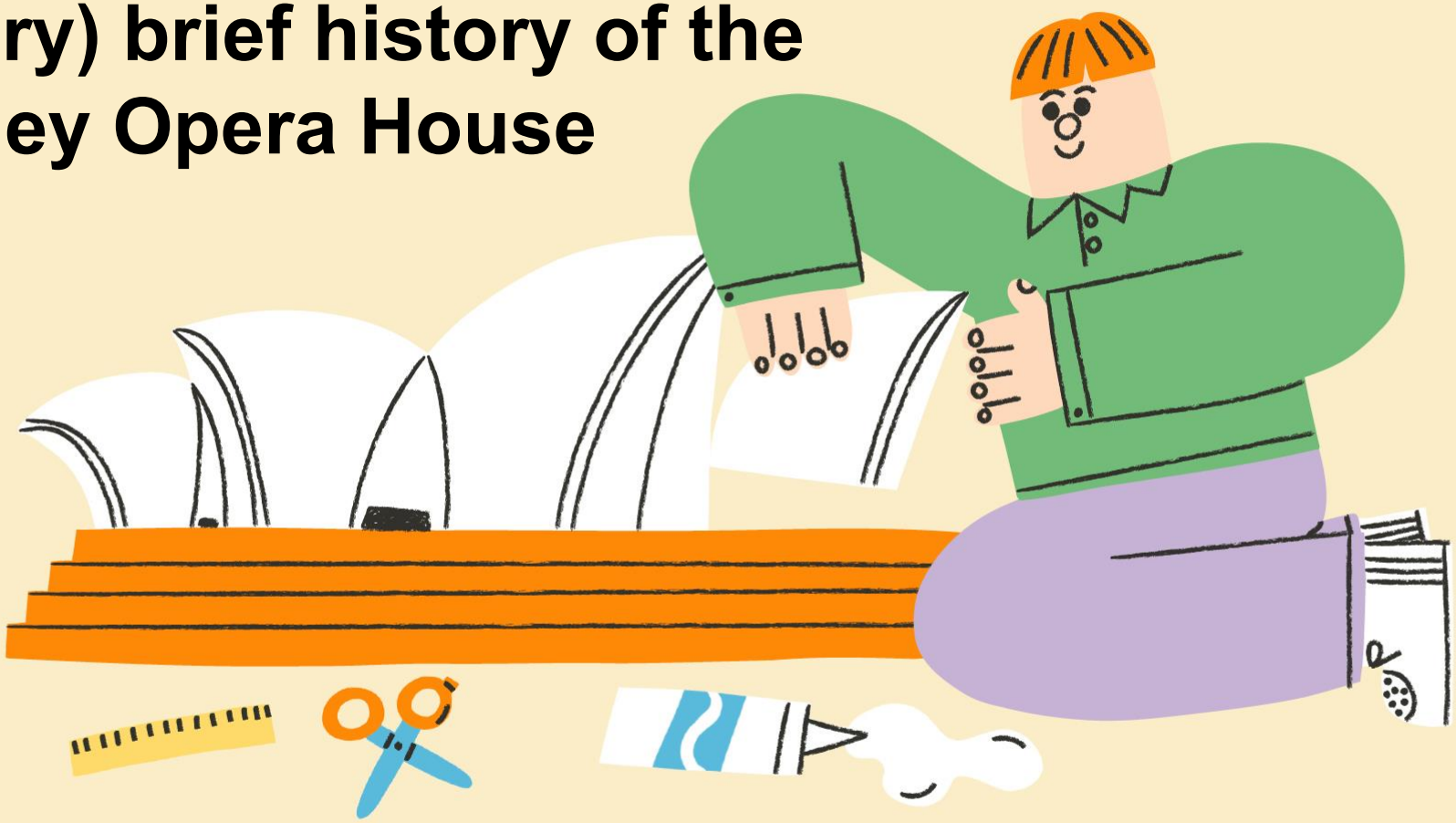
Designed by the Danish architect Jørn Utzon, the Sydney Opera House is a unique and innovative building that represents a breakthrough in modern architecture. From conception to completion, the building tested the limits of engineering, construction and design. The iconic sail-like structures have made it a symbol of Sydney and modern Australia as a whole, and is now a World Heritage-listed masterpiece.

This workshop explores Utzon’s unique legacy of design thinking, and the impact of how architecture can change the way people live in cities and experience public space.

Architecture meets Nature
Students will

- Learn about the Sydney Opera House and its impact on architecture across the world.
- Use found objects and recycled materials to test design thinking, inspire new prototypes for architecture, and express abstract ideas for what a building can be.
- Understand design thinking through the Utzon Design Principles, such as inspiration from nature and the human experience.
- Consider how to develop ideas individually and as a group, and be inspired to develop a portfolio and take their major works to the next level.
- Learn how architects draw and approach problem solving.

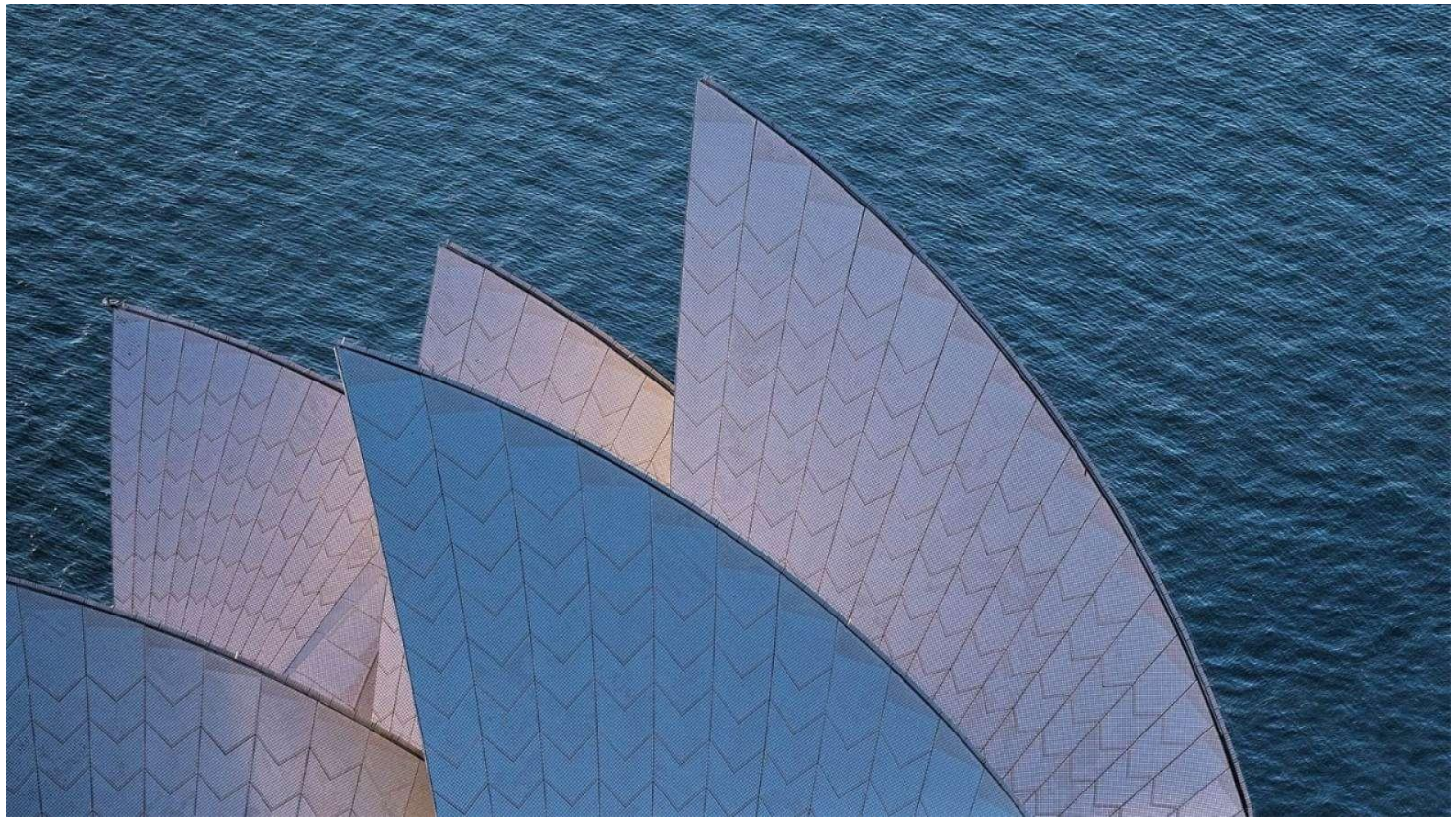
A (very) brief history of the Sydney Opera House



The Sydney Opera House was designed for performing arts and cultural experiences

The Opera House is a World Heritage-listed masterpiece of ‘human creative genius’ that belongs to all Australians.

It is the Country’s number one tourist destination and its busiest performing arts centre, welcoming more than 10.9 million visitors a year on site and hosting more than 1,800 performances attended by more than 1.4 million people.

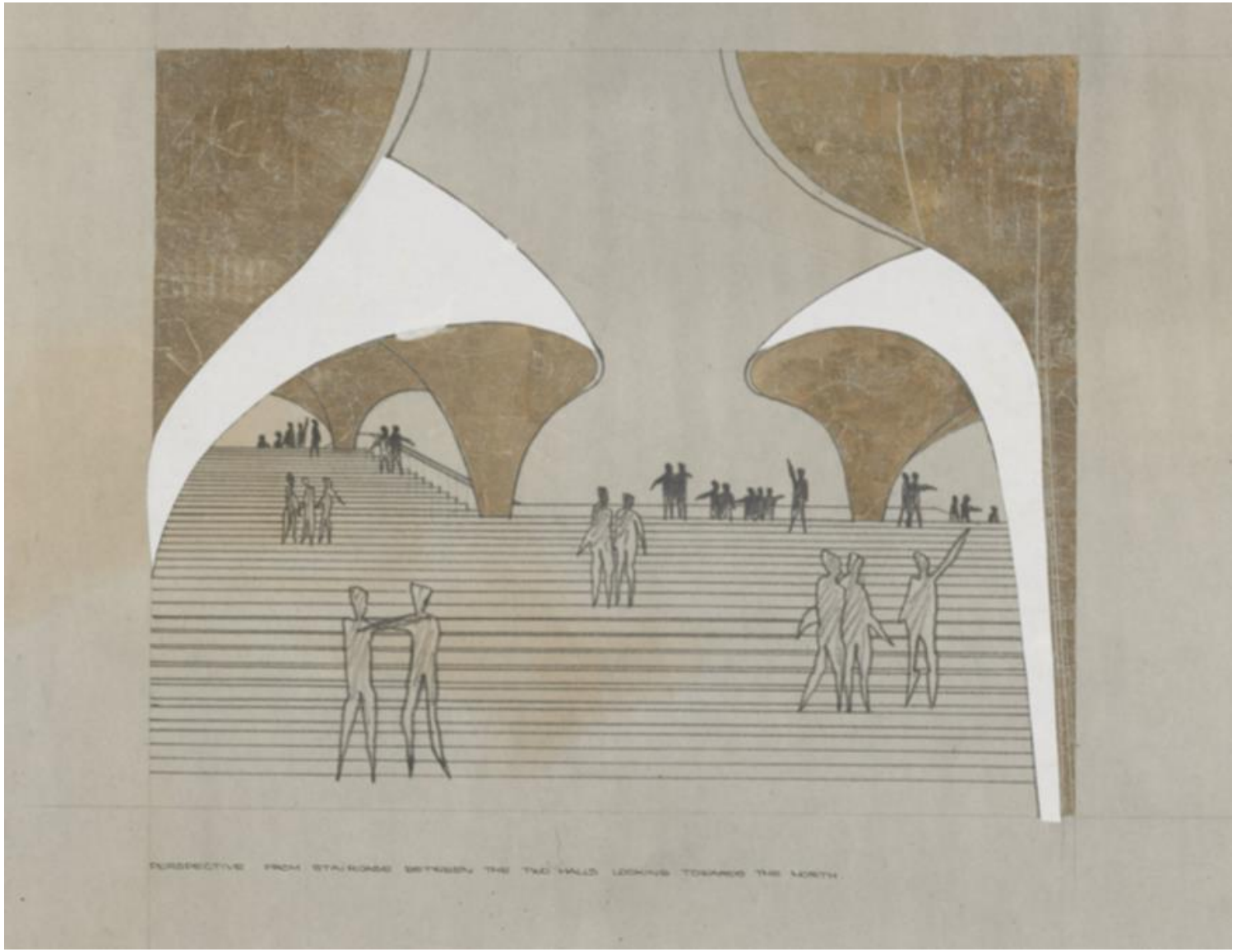


Jørn Utzon is a Danish architect who designed the Opera House

His design was received in 1957, there were 223 entries from 28 countries.

Utzon was announced the winner, receiving £5,000 for his design. His drawing presented an idea in a unique and unconventional way, and used gold leaf, pencil and white paper.

The Opera House was completed and opened in October 1973.



The Spherical Solution is the name of the mathematical and engineering principle used to help build the roof of the Opera House

To work out how to build the shells, the engineers at Arup & Partners needed to express the shell shapes mathematically. Asked by the engineers in 1958 to define the curves of the roof, Utzon took a plastic ruler, bent it against a table and simply traced the curves.

A sphere has a single, constant form which can be simply and easily repeated, which are the ‘sail’ or ‘shell’ shapes of the final roof design.

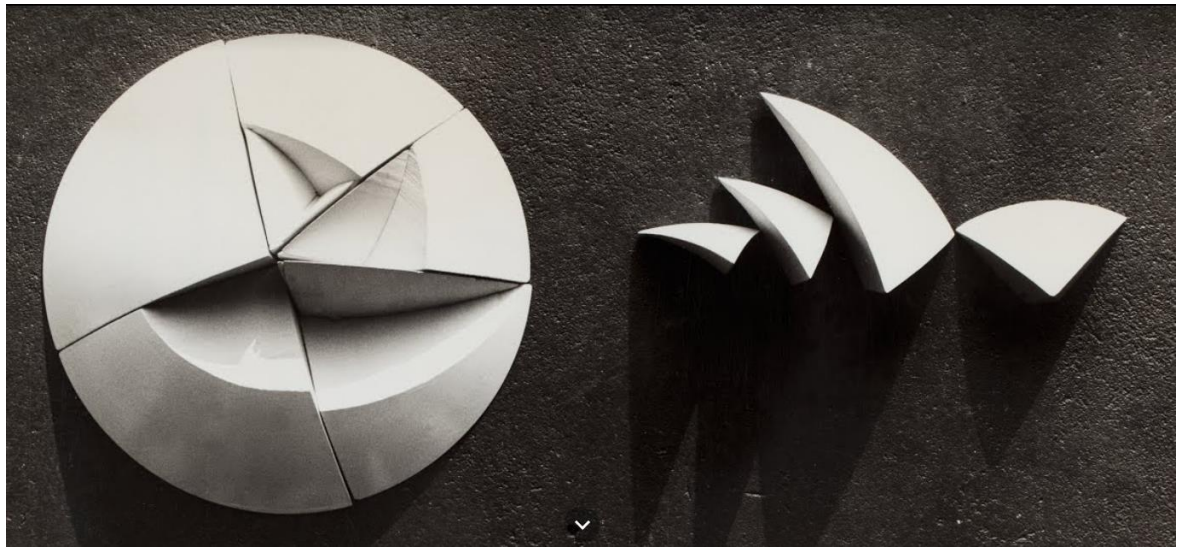
This drawing by Jorn Utzon shows the thinking behind the development of how this design solution was created – and how the natural world and organic forms can inspire building design

The Spherical Solution as a three-dimensional model

This is where the popular myths comes from – that Utzon was inspired to use a sphere when he had a eureka moment while peeling an orange – it perfectly described the thin shell structure of the roof.

By finding the parts of a sphere that best suited the existing shapes of the shells, each new form could be extracted.

Teaching point: Learn more about the types of physical and digital models created for the Sydney Opera House here.



Teaching points:
A glossary of built environment roles and careers

- **Architect:** someone who designs buildings and communicates their ideas with sketches, technical drawings (hand-drawn or using computer aided software) as well as models and prototypes.
- **Engineer:** someone who uses design processes to solve technical problems, improve systems of working and increase how efficiently something can be produced – like a machine or structure.
- **Builder:** a person who has technical knowledge of a range of materials and uses these to construct buildings or other structures
- **Project Manager:** a person who makes sure big projects (like building the Opera House) can stay within budget, makes sure certain standards are achieved and that projects meet their deadlines.

A comprehensive sustainable buildings glossary can be found here

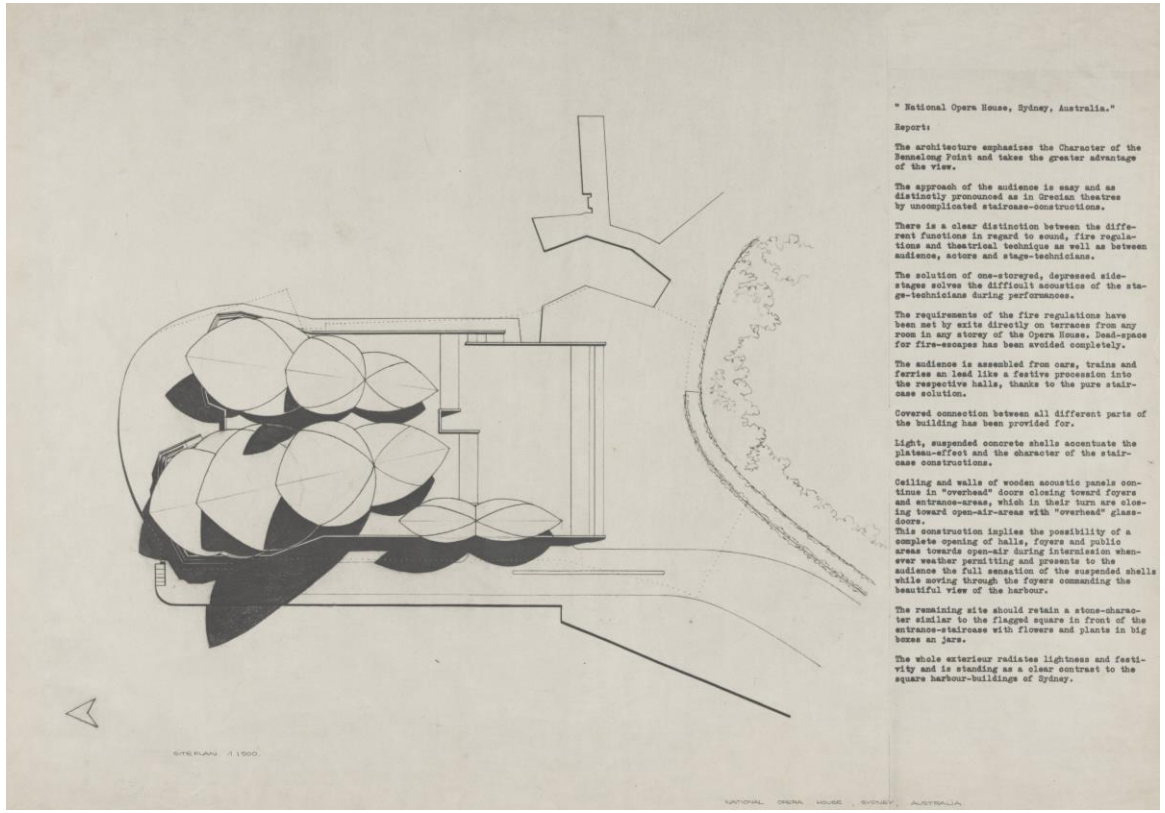
Teaching point: ask students to list what skills, knowledge and interests they have that might align with the different roles listed here.

- Put students in groups with different abilities and ask them to discuss how they might need to collaborate or compromise when working together to develop a design.

The Utzon Design Principles
Overview

*It had a fantastic site, with a beautiful and demanding position on Bennelong Point…I was convinced that a new building in such a position as to be seen from all sides, had to be a large sculptural building. (*Jorn Utzon)

The *Utzon Design Principles* form a document prepared by architects Jørn Utzon and Richard Johnson outlining Utzon's vision for the Sydney Opera House, its setting and his comments on its future. It is the first critical step in the process of establishing a reference point for the conservation of the building.

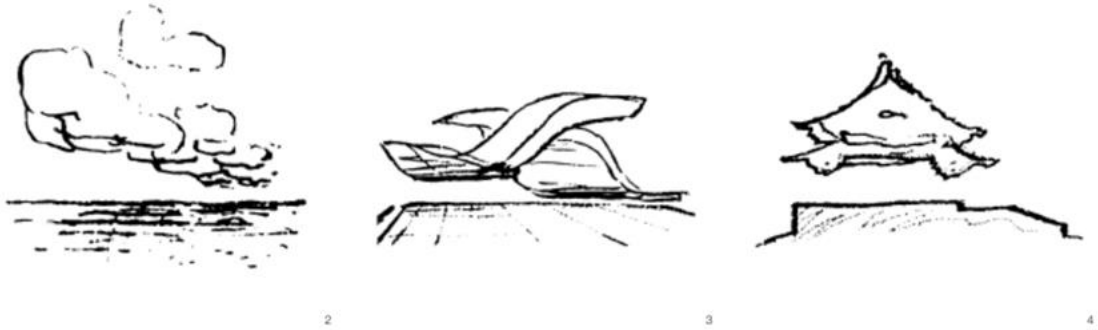


Vision, design and conservation

Sydney Opera House Utzon design principles

Utzon was inspired by organic shapes, nature's colours especially at sunrise and sunset, naval charts and headlands, reflection of sunlight, clouds and birds wings.

Utzon was also interested in how inspiration from nature connected with an experience of the building for the people who visit. Things like bringing joy, feeling like you're in another world, being in a festive mood, feeling detached from the city and how to also create moments of rest.



Teaching points:

- In small groups, research one of the Utzon Design Principles (link above) and present your findings to the class.
- Identify in images and on maps of the Opera House where you might find these Design Principles expressed on the building itself
- Analyse a building in your local area. In what ways does that building relate to Utzon's key design ideas?

Activities for the classroom

The Utzon Design Principles
Prototypes and prefabrication

Building the Opera House was incredibly difficult. Using expertise from design, engineering and computer science, Utzon's plans were able to come to life. Following a long process of trial and error, Utzon and his team problem-solved the design with many sketches, models and prototypes.

The Opera House even commenced building when the working drawings had not yet been completed or finalised. Once builders and engineers were happy with the prototype, a mould or blueprint of the final sections could be made replicated. From this, all the required pieces could be produced and pre-made (or prefabricated) quickly and easily.

Teaching point
Sketching and prototyping

- Brainstorm a list of architects in Sydney, and around the world
- Select one and research their design practice and process, including
  - how they sketch ideas,
  - what technical drawings they produce,
  - how they prototype and make models,
  - if they work alone or with a team, and
  - key projects they've worked on
- Recreate a simple model or prototype from one of their projects. You can use pencils, graphic pens, colour, paper and found materials
- Describe this process of replicating a design, and why it's important to sketch and prototype designs

Teaching point

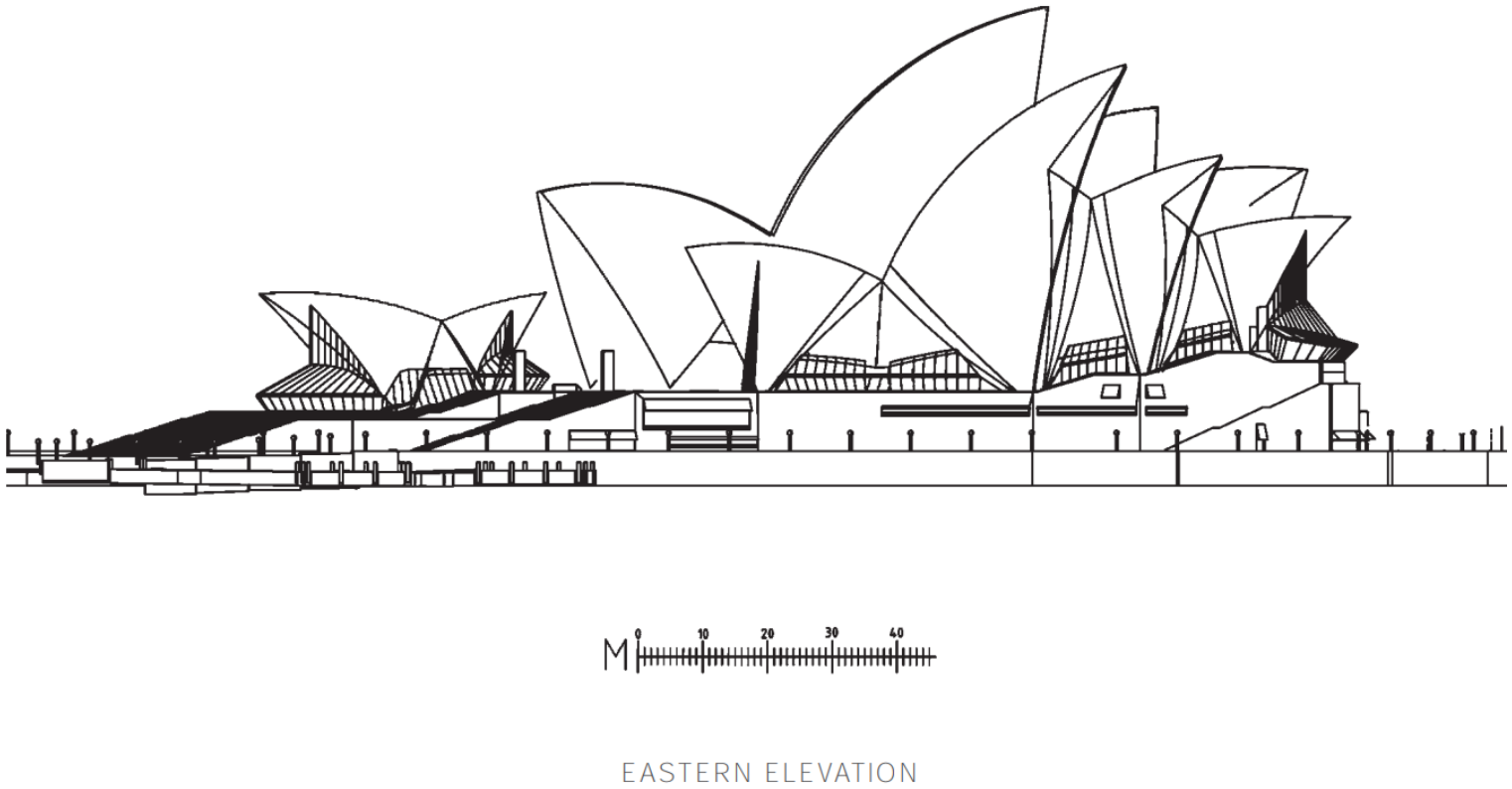
Architecture is everything

- Collect items from around your house or classroom – maybe something from your pencil case, kitchen drawer or recycling bin
- Place a scale human figure (you can buy these online or make small cardboard figures) near this object
- Now look.
  - How does the figure look in this new landscape?
  - How can you imagine them walking through, sitting near, or doing things in this new environment?
- Draw a perspective and elevation drawing of your object and person. If this was a new building
  - What would it be used for?
  - Where would it be in the city?
  - How would it fit into its environment?

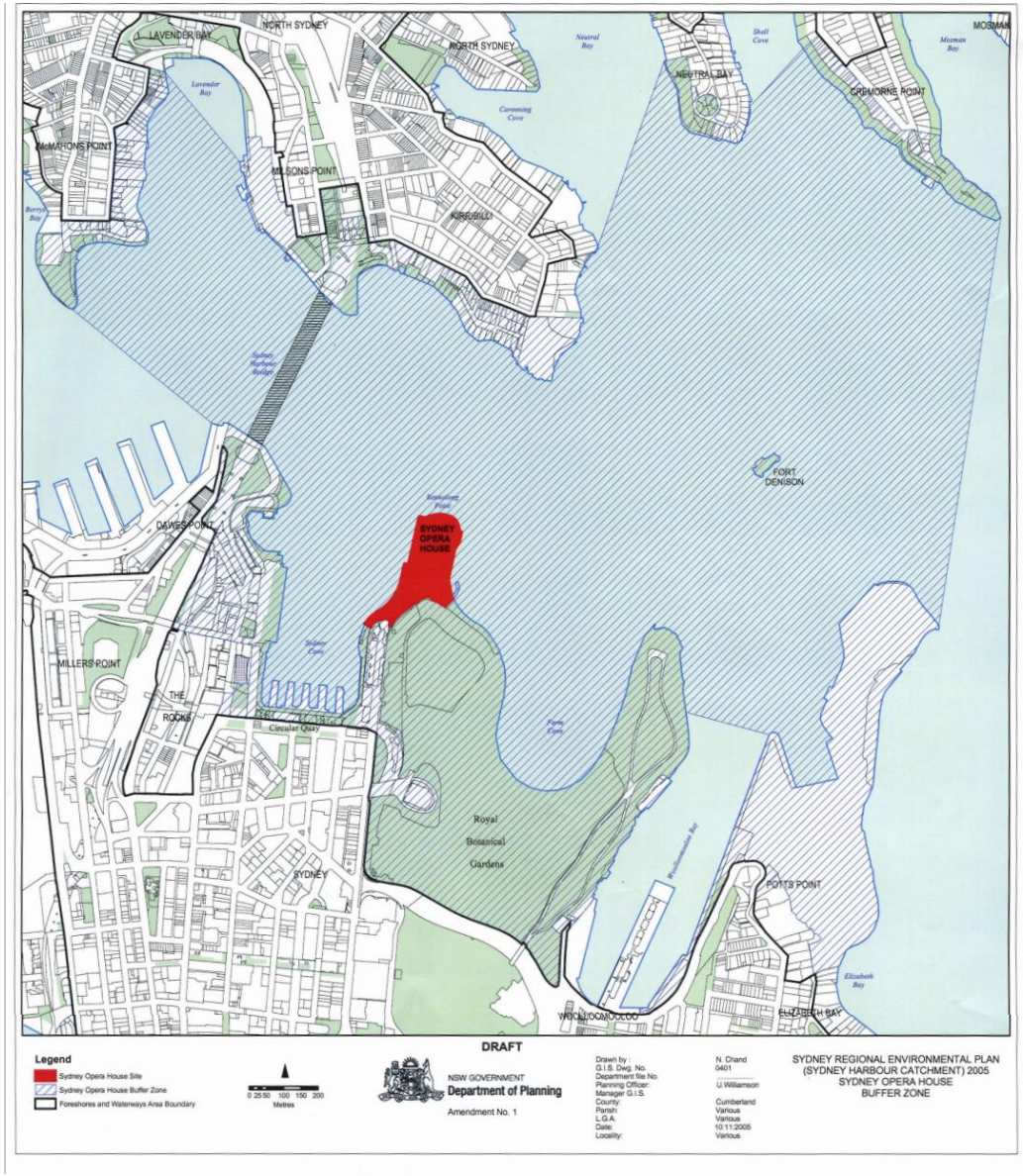
Teaching point
UNESCO Heritage Listing research

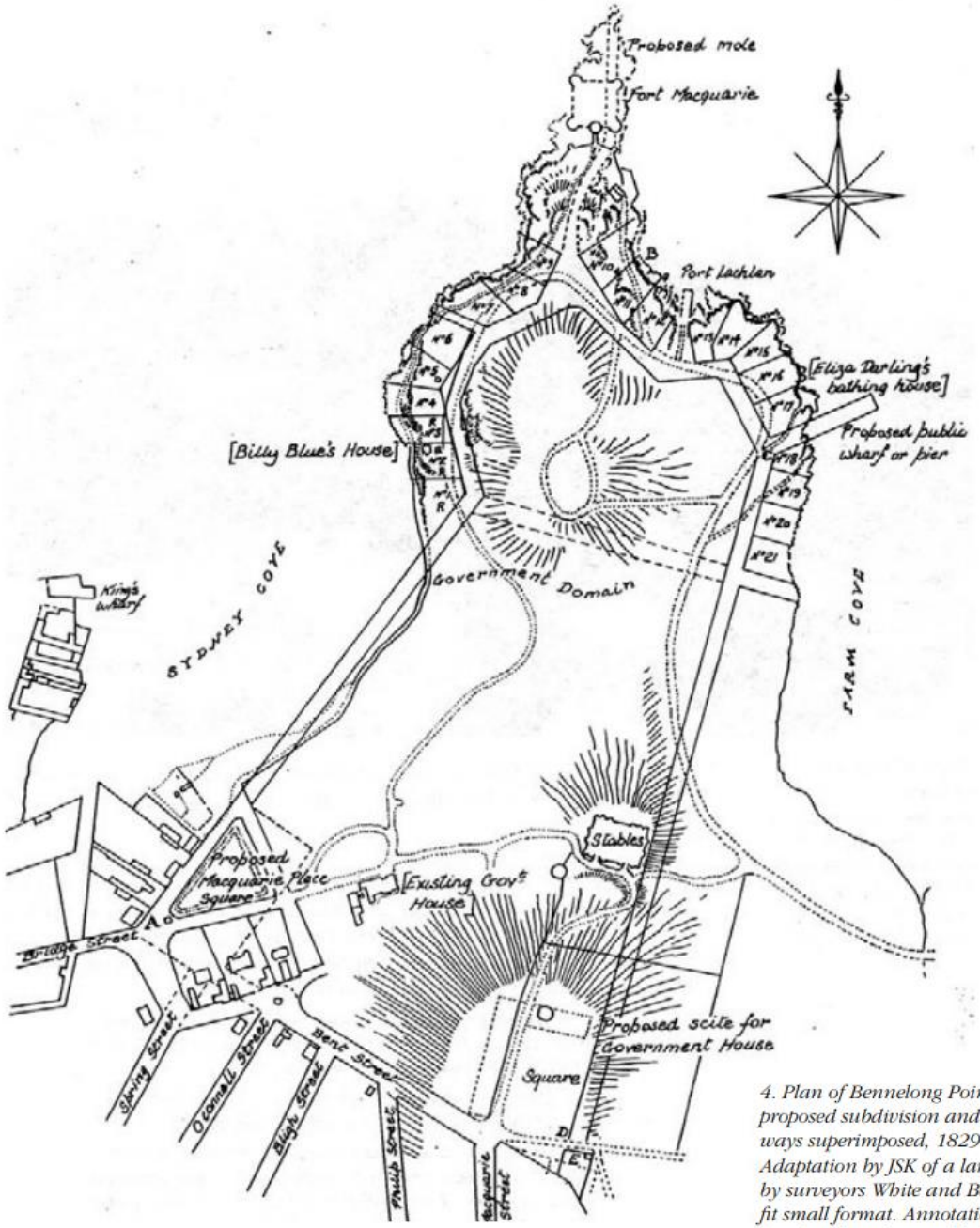
The Sydney Opera House was recognized as a World Heritage listed site in 2007.

- Summarise the key features and reasons why the Opera House gained this significance.
- Create a collage using images, drawings and maps found in this listing alongside your research
- Essay: What impact has Utzon and the Sydney Opera House had on other architects and global architecture? Select an architect or site to compare in your response.



Images taken from whc.unesco.org/uploads/nominations/166rev.pdf





4. Plan of Bennelong Point with proposed subdivision and road-ways superimposed, 1829. Adaptation by JSK of a large plan by surveyors White and Benn to fit small format. Annotations in brackets have been added.

Images taken from whc.unesco.org/uploads/nominations/166rev.pdf

Curriculum connections and further research

Curriculum Links
Connecting with the classroom

Visual Arts (Stage 5 – 6)

- VA5-AMC-01 makes and refines artworks to represent different ideas informed by an understanding of Artworld concepts and their relationships
- VA5-CHC-01analyses and interprets Artworld concepts and their relationships in Art critical and historical studies
- P2: explores the roles and relationships between the concepts of artist, artwork, world and audience
- P10: explores ways in which significant art histories, critical narratives and other documentary accounts of the visual arts can be constructed
- H10: constructs a body of significant art histories, critical narratives and other documentary accounts of representation in the visual arts

Modern History (Stage 6)

- MH11-5 examines the significance of historical features, people, ideas, movements, events and developments of the modern world
- MH12-5 assesses the significance of historical features, people, ideas, movements, events and developments of the modern world
- MH11-8 plans and conducts historical investigations and presents reasoned conclusions, using relevant evidence from a range of sources

Curriculum Links
Connecting with the classroom

Mathematics (Stage 5 – 6)

– MA5-NLI-C-02 identifies and compares features of parabolas and exponential curves in various contexts
– MA5-NLI-P-01 interprets and compares non-linear relationships and their transformations, both algebraically and graphically

Engineering (Stage 5, from 2027)

– EGT5-EVL-01 investigates and evaluates engineering systems and solutions
– EGT5-IVT-01 explains engineering practices and the influence of technologies used in engineering industries
– EGT5-ENV-01 analyses relationships between engineering design, production and sustainability

Industrial Technology (Stage 6)

– H1.3 identifies important historical developments in the focus area industry
– P7.2 identifies the impact of existing, new and emerging technologies of one related industry on society and the environment
– H7.2 analyses the impact of existing, new and emerging technologies of the focus industry on society and the environment

Design and Technology (Stage 6)

– P1.1 examines design theory and practice, and considers the factors affecting designing and producing in design projects
– H1.1 critically analyses the factors affecting design and the development and success of design projects H1.2 relates the practices and processes of designers and producers to the major design project
– H3.1 analyses the factors that influence innovation and the success of innovation

Get in touch

Got questions? Contact us with any enquiries about our education programs for schools via phone or email.

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