Architecture Unboxed

Creative Learning
Teacher Resource



Resource Overview

This learning resource can be used for Primary and Secondary students and supports multidisciplinary learning across Visual Arts, History, Mathematics, Engineering, Design and Technology.

This resource includes discussion questions and activities designed for the classroom but can be adapted to suit the needs of your students and teaching context.

Workshop Overview
General capabilities and cross-curriculum priorities

Creative and Critical Thinking

Students are invited to draw think like architects, using found objects to prototype ideas and express abstract concepts about what a building can be.

Problem-solving

Students explore how architects approach problem solving through drawing and modelmaking. The Opera House itself overcame many design challenges and tested the limits of engineering, construction, and design.

Sustainability

Students work with found and recycled materials, embedding sustainable practice into the making process.
The workshop focuses on environmental design, connection to the built environment, and how architecture can respond to its ecological and social context.

Ethical Understanding

Students consider how architecture can shape communities – exploring responsibility to people, culture, and environment through global perspectives in placemaking.

Workshop Overview

What students can expect – sensory elements

Touch

- Direct handling of found objects and recycled materials
- Drawing with pencils, pens, and other writing tools
- Cutting, shaping, and assembling 3D prototypes
- Varied textures: cardboard, fabric, plastic, natural materials

Sight

- Architectural images and drawings
- Bright, well-lit workshop space
- Colourful and varied materials displayed
- Visual demonstrations by facilitator before making begins

Sound

- Facilitated group discussions
- Collaborative making activity
- No amplified music or loud sound events during the workshop
- Enclosed indoor space at the Centre for Creativity

Movement

- Mix of seated and standing activities
- Moving between workstations during the making phase
- 90-minute session – no break built in

Glossary

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, 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 (very) brief history of the Sydney Opera House



Tubowgule
Now known as Bennelong Point

The Gadigal people in Warrang/Warrane (Sydney Cove) call the place around the Opera House ‘Tubowgule’ – meaning the knowledge water.

Tubowgule was a point located at the end of a long, wide ridge and surrounded by rocky shoals that mostly covered at high tide.

The Gadigal believe that the coming together of the saltwater (from the Pacific Ocean) and freshwater (from the Parramatta River) creates a surge of energy and nutrients – making the Sydney Harbour an ideal spot for fishing, eating, meeting and sharing stories.



Tubowgule
Now known as Bennelong Point

Being close to the harbour, cove, freshwater creek and mud flats, the area was rich in resources. This included oysters, mussels, fish, possums, wallabies, kangaroos and many edible plants.

Aboriginal people gathered and ate these foods over thousands of years, leaving behind shells and animal bones that formed 'middens' around Sydney Harbour



Whispers, 2023, Megan Cope, Sydney Opera House.
This was an art installation of a midden made of 85,000 repurposed oyster shell waste and other natural and recycled materials.

The Sydney Opera House
A building nobody thought was possible

In 1956, the NSW government held an international competition for a new performing arts centre on Tubowgule, now known as Bennelong Point.

Over 220 entries arrived from 32 countries, and the winner was a Danish architect named Jørn Utzon.

Today, the Opera House is a World Heritage-listed building and the country's number one tourist destination.

It welcomes more than 10.9 million visitors a year and hosts more than 1,800 performances attended by more than 1.4 million people.



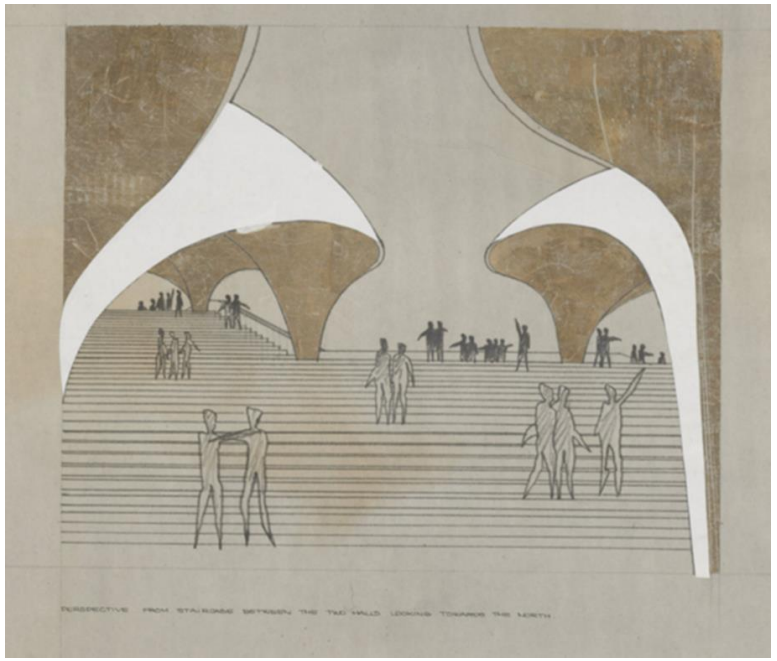
Jørn Utzon

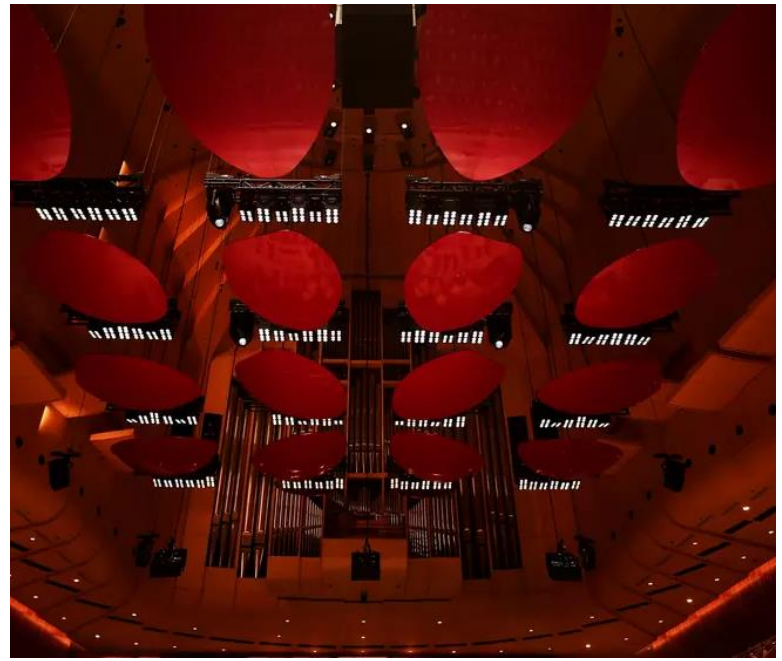
The vision: shells, sails and nature

When designing the Opera House, Jørn Utzon was inspired by nature. The way an orange peels apart, the curve of a nautilus shell, the wings of a bird, the colours of the sunrise, and the sunset.

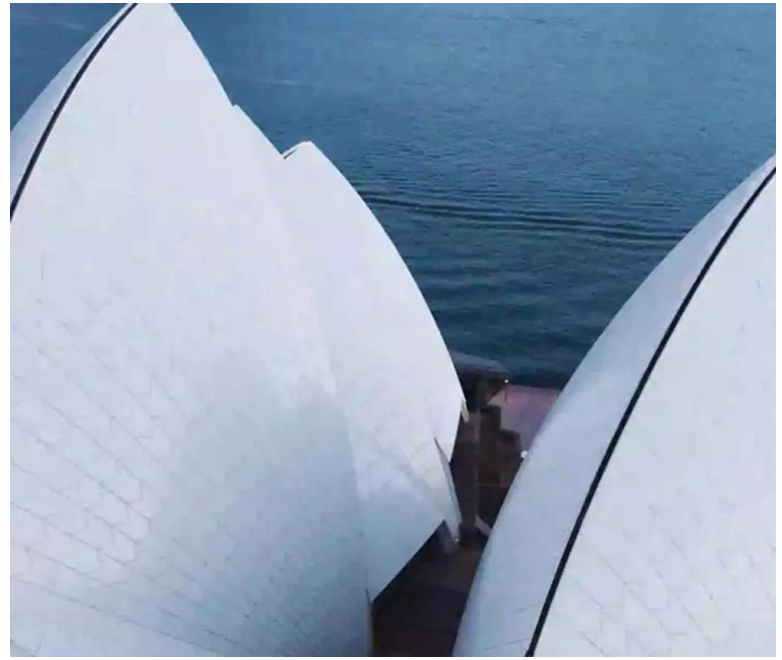
Utzon was also interested in how designs inspired by nature can shape the visitor experience.

He wanted the building to bring joy, transport people to another world, offer a sense of detachment from the city, and create moments of rest.









Jørn Utzon
The engineering problem

Utzon's iconic 'shell' roof forms grew from a single geometric principle – a striking idea on paper, but nobody knew how to actually build them.

To work out how to build the shells, the engineers at Arup & Partners needed to express the shapes mathematically.

In 1958, when they asked Utzon to define the curves of the roof, he took a plastic ruler, bent it against a table, and simply traced the curves



This drawing by Jørn Utzon shows the thinking behind the design's development, and how the natural world and organic forms can inspire a building.

Jørn Utzon
The Spherical Solution

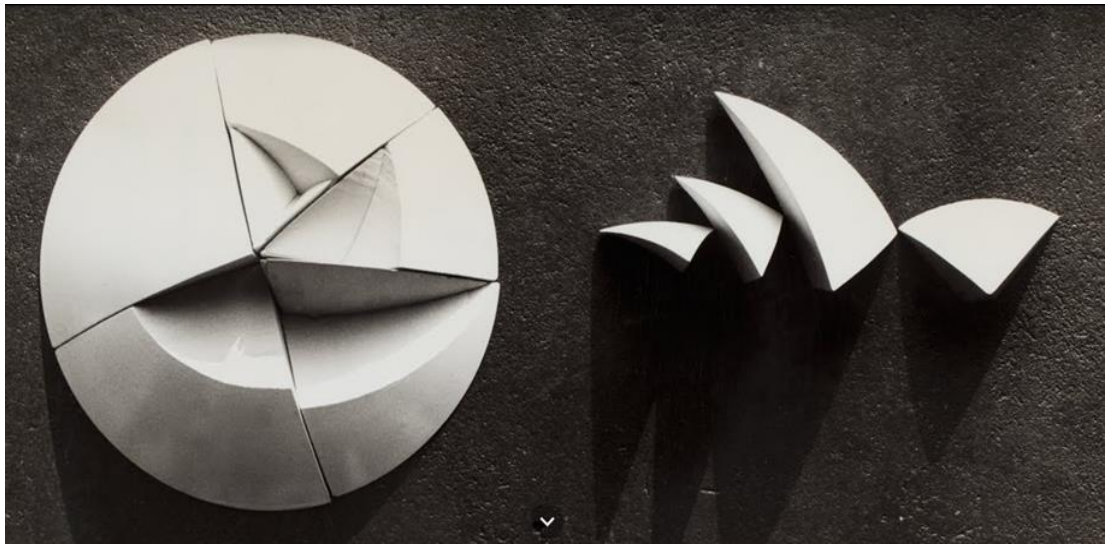
In 1961, Utzon had a breakthrough idea: what if every shell roof was cut from the same sphere?

No matter where you slice a sphere, the curve is the same shape.

That meant Utzon didn't need to design a different curve for each shell. He could cut them all from one sphere, like cutting different-sized wedges from one orange.

The shells could be different sizes, but they'd all share the same curve, which made them possible to build and made the whole roof feel like one connected family of shapes.

With help from designers, engineers and computer experts, Utzon and the team finally worked out how to turn this idea into a real building.



Jørn Utzon
Prototypes and prefabrication

Building the Opera House was incredibly difficult. Through a long process of trial and error, Utzon and his team worked through the design with sketches, models and prototypes.

Construction actually began before the working drawings were finished. Once builders and engineers were happy with a prototype, they could make a mould, or blueprint, of the final sections.

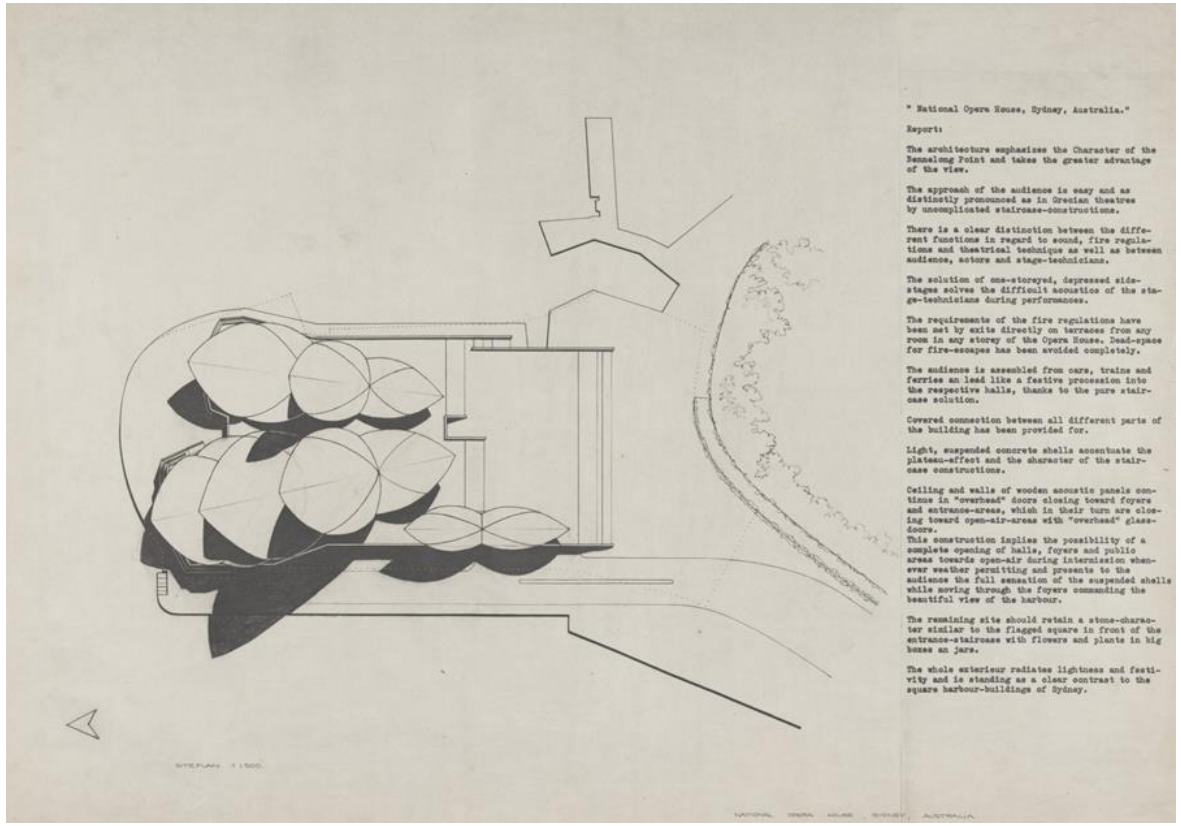
From there, all the pieces needed could be produced quickly and easily – a process called prefabrication.



Jørn Utzon
The Utzon Design Principles

The Utzon Design Principles are a document prepared by architects Jørn Utzon and Richard Johnson.

They outline Utzon's vision for the Sydney Opera House, its setting, and his thoughts on its future.



" National Opera House, Sydney, Australia."

Report:

The architecture emphasizes the Character of the Bennelong Point and takes the greater advantage of the view.

The approach of the audience is easy and as distinctly pronounced as in Grecian theatres by uncomplicated staircase-constructions.

There is a clear distinction between the different functions in regard to sound, fire regulations and theatrical technique as well as between audience, actors and stage-technicians.

The solution of one-storeyed, depressed side-stages solves the difficult acoustics of the stage-technicians during performances.

The requirements of the fire regulations have been met by exits directly on terraces from any room in any storey of the Opera House. Dead-space for fire-escapes has been avoided completely.

The audience is assembled from cars, trains and ferries an lead like a festive procession into the respective halls, thanks to the pure staircase solution.

Covered connection between all different parts of the building has been provided for.

Light, suspended concrete shells accentuate the plateau-effect and the character of the staircase constructions.

Ceiling and walls of wooden acoustic panels continue in "overhead" doors closing toward foyers and entrance-areas, which in their turn are closing toward open-air-areas with "overhead" glass-doors.
This construction implies the possibility of a complete opening of halls, foyers and public areas towards open-air during intermission whenever weather permitting and presents to the audience the full sensation of the suspended shells while moving through the foyers commanding the beautiful view of the harbour.

The remaining site should retain a stone-character similar to the flagged square in front of the entrance-staircase with flowers and plants in big boxes an jars.

The whole exterieur radiates lightness and festivity and is standing as a clear contrast to the square harbour-buildings of Sydney.

Activities



Discussion Questions
Primary students

What makes the Sydney Opera House look different from other buildings you have seen? What does it remind you of?

Jørn Utzon was inspired by nature, things like birds' wings, orange peels, clouds, and sunrises. Can you think of something in nature that could inspire a building design?

What is the difference between an architect, an engineer, and a builder? Why do they all need to work together?

How does it feel to visit a special building or place?

Why do you think the design of a space can change how you feel?

Activity 1

Collect household or classrooms – something from a pencil case, kitchen drawer, or recycling bin.

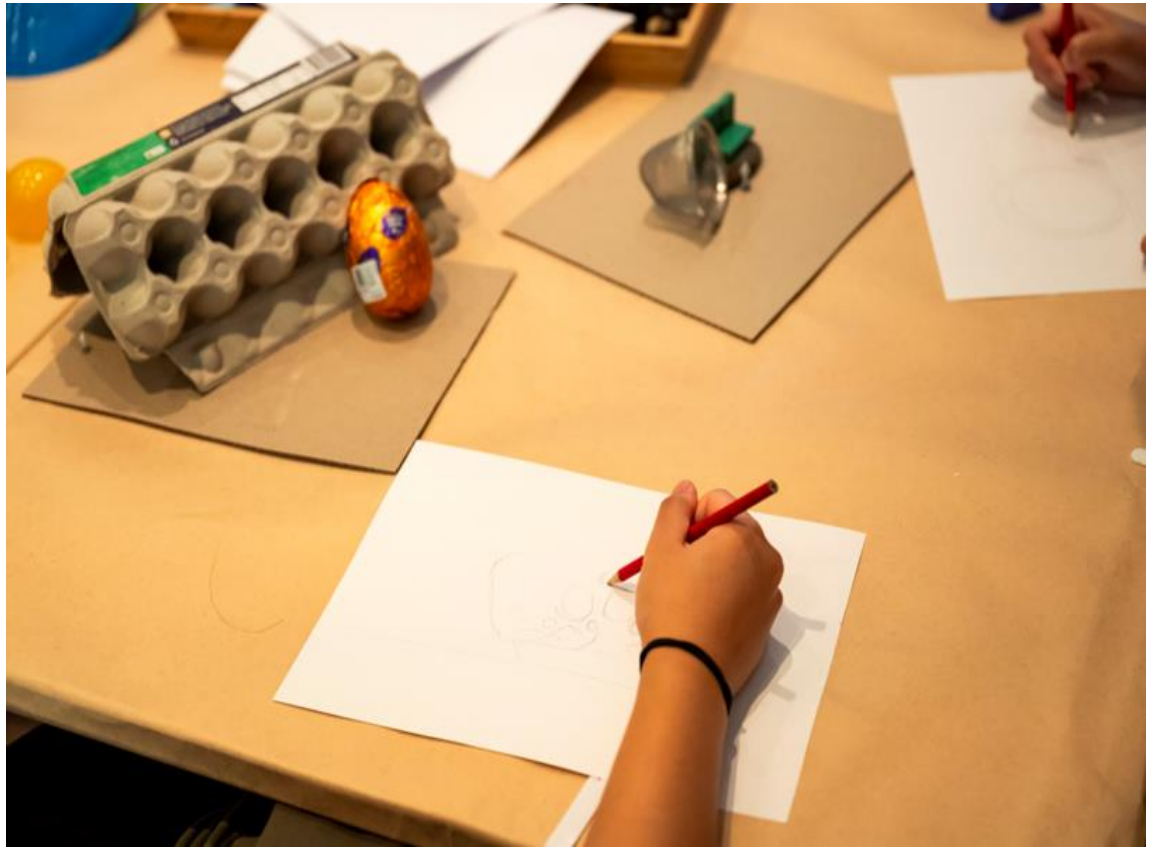
Place a scale human figure (these can be purchased online or made from cardboard) near the object.

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 the 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?



Activity 2

Brainstorm a list of architects in Sydney and around the world. Select one and research their design practice and process including:

How they sketch and what technical drawings they have produced	How they prototype and make models	If they work alone or with a team	Key projects that they have 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.

Discussion Questions
Secondary students

Why do you think that Utzon's entry might have won the design for the Opera House?

Why might the emotional experience of a building be important to the design?

The Opera House sits on Bennelong Point, also known as Tubowgule, a site of deep significance to First Nations people. How should architects and designers engage with the cultural history of a place when designing on it?

The spherical solution used geometry to solve a construction problem. Can you think of other examples where mathematical principles have shaped the form of a building or structure?

Activity

The Sydney Opera House was recognised as a World Heritage listed site in 2007. Using this as a case study, students will:

Research

Explore the key features and reasons why the Opera House gained this significance.

Create

Make a collage using images, drawings and maps found in this listing alongside your research

Write

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.



Reflection



Exit Questions
Primary students

What is one thing about the Opera House that surprised you today?

What does an architect actually do?

Explain it to someone in the classroom.

Did your design turn out the way you imagined it at the start?

What changed, and why?

Can you think of a building in your neighbourhood or town that was inspired by nature?

What does it remind you of?

Exit Questions
Secondary students

What is one thing about the Opera House that surprised you today?

The Opera House changed how Sydney is seen by the rest of the world.

Can you think of another building, locally or globally, that has done something similar for its city?

If you were commissioned to design a landmark building for Sydney or your own suburb:

What problem would you want it to solve, and what feeling would you want it to create?

Which role in the design and construction process – architect, engineer, builder, do you think you'd be most drawn to, and why?

Key Learning Areas Curriculum Map – NSW Syllabus Outcomes

Architecture Unboxed Workshop – Stage 5–6

Visual Arts
Stage 5 – 6 (Yr 9 – 12)

VA5-AMC-01

Makes and refines artworks to represent different ideas informed by an understanding of Artworld concepts and their relationships

VA5-CHC-01

Analyses and interprets Artworld concepts and their relationships in Art critical and historical studies

P2

Explores the roles and relationships between artist, artwork, world and audience

P10

Explores ways in which significant art histories and critical narratives can be constructed

H10

Constructs a body of significant art histories, critical narratives and documentary accounts of representation

Modern History
Stage 6 (Yr 11 – 12)

MH11-5

Examines the significance of historical features, people, ideas, movements, events and developments

VA5-CHC-01

Assesses the significance of historical features, people, ideas, movements, events and developments

MH11-8

Plans and conducts historical investigations and presents reasoned conclusions using relevant evidence

Mathematics
Stage 5 (Yr 9 – 10)

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, algebraically and graphically

Engineering
Stage 5 (Yr 9 – 10)

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

Design and Technology
Stage 5 (Yr 9 – 10)

DIT5-EVL-01

Develops and evaluates innovative design solutions using quality principles and design processes

DIT5-COM-01

Communicates ideas, concepts, processes and solutions for design and production

DIT5-WOR-01

Evaluates the responsibilities of designers and factors affecting their work

Design and Technology
Stage 6 (Yr 11 – 12)

P1.1

Examines design theory and practice and the factors affecting designing and producing in design projects

P4.1

Uses design processes in the development and production of design solutions to meet identified needs and opportunities

P4.3

Evaluates the processes and outcomes of designing and producing

H1.1

Critically analyses the factors affecting design and the development and success of design projects

H2.2

Evaluates the impact of design and innovation on society and the environment

H3.2

Uses creative and innovative approaches in designing and producing