L-Università ta' Malta
Faculty for the
Built Environment

BEN2102 Occ B
Design Workshop
Semester 2
2024/2025

Algorithmic Design Processes in Architecture

Tutors: Dr Irina Miodragovic Vella, Perit Sean Buttigieg, Dr Nathan Vella
Start: Friday, 13th February 2026
Submission and reviews: Friday, 27th March 2026
Length: 7 weeks

Aim and Scope

The design workshop introduces students to **computational thinking, parametric design, and geometric exploration** as tools for architectural design. The focus is not on how architectural form looks, but on **how it is generated**. Students are asked to think of architecture as a system shaped by a set of connected parameters rather than as a fixed object.

The workshop aims to **develop a design process** that responds to sun exposure, programme, material behaviour, fabrication limits, and assembly logic. Geometry plays a central role in organising, testing, and evaluating these factors. Students are encouraged to explore geometry in an experimental but controlled way, understanding how simple geometric rules can produce complex outcomes and how design decisions affect performance, structure, and construction.

Rather than producing a single final shape, students will develop a **rule-based system** that can generate and test multiple design variations. The approach builds a foundation for computational thinking necessary for parametric design.

Source: https://www.facebook.com/photo/?fbid=3307632325921640&set=a.3149660118385529

Brief

Students work in pairs to develop a shading façade screen for the University of Malta Library. The project focuses on designing a process, not only a final form. The façade system should respond to the building's context through clear geometric logic. The design process must address the following key parameters:

A. **Sun Exposure:** Study how the building is exposed to the sun. Design a shading system that reduces overheating while allowing useful daylight, and show how the façade responds to different sun conditions.
B. **Building Programme:** Consider how different library spaces are used and how much light or shade they require. Adjust the façade geometry to suit these different needs.
C. **Views and Day–Night Conditions:** Consider how the façade performs during the day and at night. Study how the building appears when the interior is lit after dark.
D. **Geometry and Form:** Design the shading screen as a continuous, non-flat surface. Explore dynamic and unconventional forms that go beyond standard flat façades, while remaining logical and buildable.
E. **Structure:** Propose a clear structural concept that shows how loads are transferred through the shading system.
F. **Materials, Fabrication, and Assembly:** Select suitable materials based on geometry and performance. Consider how the screen would be fabricated, assembled, and installed on the building. Demonstrate a basic understanding of construction order and connections at an architectural level.

Source: https://www.facebook.com/photo/?fbid=1731084083571002&set=a.457254750953948

Site Analysis

To respond to the brief and its key parameters, students must analyse the University of Malta Library building and its surroundings. All findings must be communicated through clear, well-labelled diagrams, rather than text-heavy descriptions. **The site analysis should directly support the design process that follows.**

A. **Sun Exposure and Building Programme Analysis:** explains façade performance and the building's appearance during the day and night. Using the unrolled facade elevation diagram and map:
   - Sun exposure, identifying areas of high, medium, and low exposure.
   - Natural lighting requirements derived from the building programme, indicating zones requiring high, medium, or low levels of natural light.
   - A combined diagram synthesising sun exposure and interior lighting requirements, showing the required degree of light modulation, categorised as high, medium, or low.
   - Areas with interior artificial lighting based on building use, identifying zones of strong, moderate, or minimal nighttime illumination.

B. **Views Analysis:** explains how the building is perceived;
   - From close range.
   - From a distance, within its wider campus context.

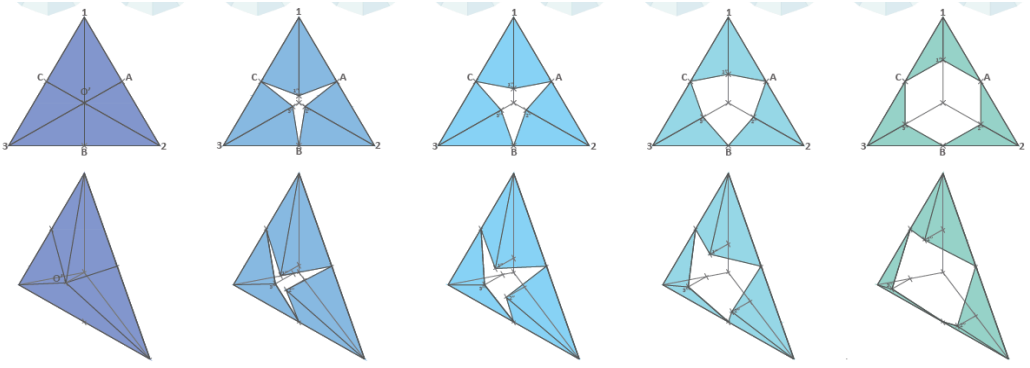
C. **Structural and Material Analysis:** develops an understanding of the existing building by identifying:
   - The main structural elements of the building and the materials used.
   - Suitable structural points on the façades where a shading screen could be safely attached.

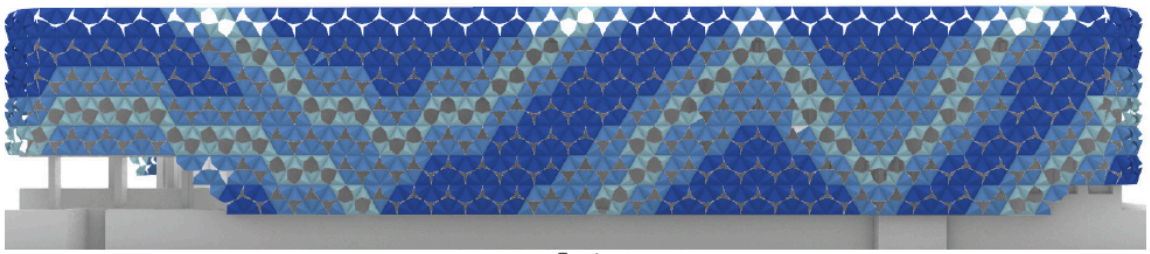
Geometric Investigations

Geometric investigations are central to the design process. Students are expected to use geometry to translate key parameters and design intentions into clear rules that can generate and test multiple design options. The aim is not to define a single form, but to develop **a geometric system** that adapts to different conditions, such as sun exposure, programme, structure, and night-time lighting.

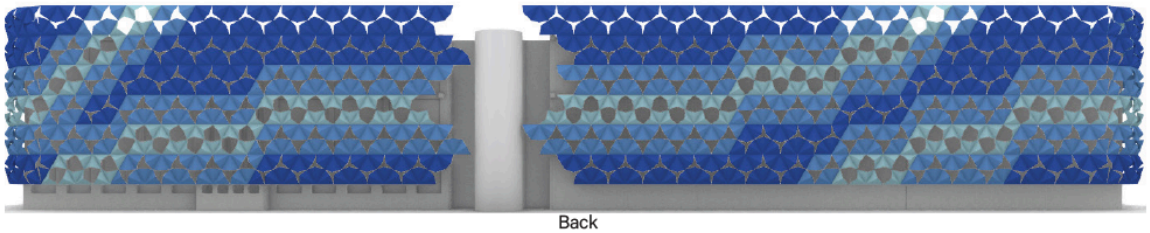
The design process is based on testing, comparison, and gradual refinement of ideas. These investigations should follow a sequence:

- Identify **key parameters** from the site analysis.
- Define simple **geometric rules** that respond to these parameters.
- Develop a **geometric method statement** illustrated with diagrams.
- Generate a **catalogue of variations** by changing parameter values.
- Select and apply variations to the library façade to test architectural performance.

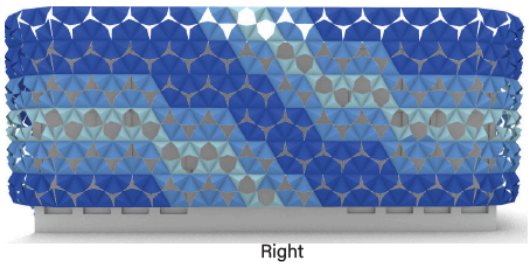




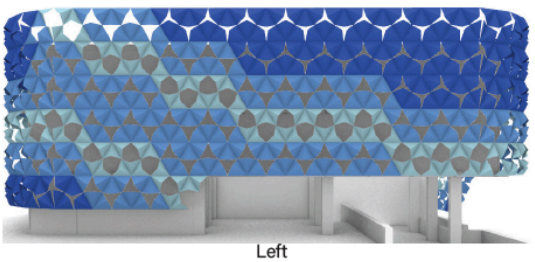
Front



Back



Right



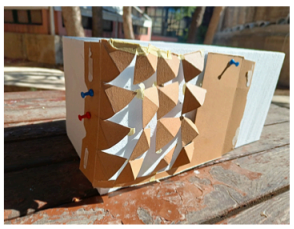
Left

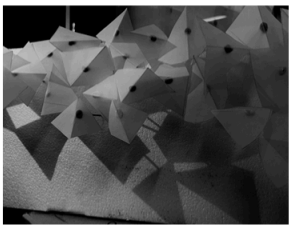
Investigation Tools

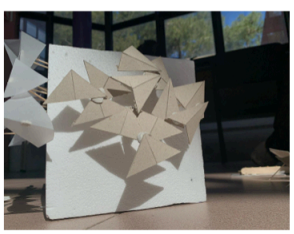
The main investigation tools throughout the design process are:

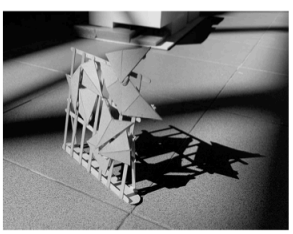
- **Physical working models,** to explore geometry, depth, continuity, shadow behaviour, and night appearance directly and intuitively.
- **3D digital models,** to define geometric rules, control parameters, and organise design information.
- **AI tools** to support exploration, comparison, and visual testing of variations. AI should not be used as an automatic form generator, but as a working partner that supports the student-defined design logic. Students are encouraged to use multiple AI tools to avoid bias and support critical evaluation. (e.g., ChatGPT and Gemini).

Digital and AI tools are used for **thinking and testing**, not only for final representation.









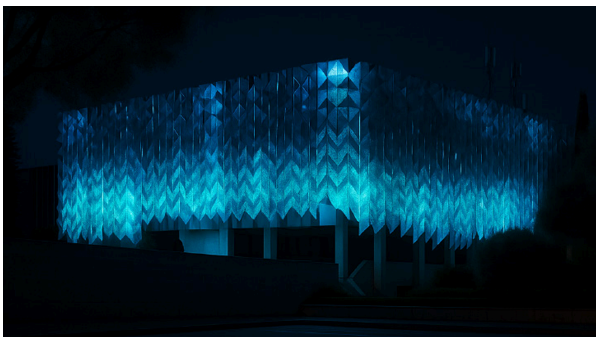
Deliverables

The deliverables are structured to demonstrate the design process, not only the final outcome. Students are assessed on how clearly they translate key parameters into geometric rules, generate and test variations, and apply these to an architectural proposal.

Weekly Deliverables: Throughout the 7-week workshop, students are expected to complete and present weekly tasks during workshop sessions. The tasks build progressively toward the final submission. Weekly pin-ups and tutorials are considered part of the learning process.

Final Submission and Reviews: The final submission consists of **a report** uploaded to the VLE, followed by design reviews held on **Friday, 27th March 2026.** Each group must submit the following:

1. **Site Analysis** as explained above.
2. **Geometric Method Statement,** presented diagrammatically, as a step-by-step explanation of the rule-based system.
3. **Catalogue of Variations,** showing how the façade adapts to different conditions of key parameters.
4. **Architectural Design Application** of the selected variations to the University of Malta Library.
5. **Structure, Materials, and Assembly Diagrams and Drawings** that explain load paths, material choice, fabrication logic, and attachment to the building at an architectural level.
6. **Models,** including working models that showcase the development of the design process, final models, and representative fragments showing geometry, depth, and light behaviour.



Learning Outcomes

By the end of this Design Workshop, students will be able to:

- Communicate the analysis of key parameters through clear diagrams.
- Apply computational thinking by translating key parameters into simple geometric rules.
- Develop a rule-based geometric system capable of generating multiple design variations.
- Produce a geometric method statement explaining how the system is generated and varies.
- Generate and evaluate a catalogue of variations to inform design decisions.
- Demonstrate a basic understanding of the relationship between geometry, structure, materials, fabrication, and assembly.
- Use physical, digital, and AI-supported tools for design investigation.
- Communicate design ideas and processes through diagrams, models, and drawings.

Assessment Criteria

The assessment focuses on the design process, clarity of geometric logic, and the connection between analysis, geometry, performance, and construction.

The project is developed in pairs. Both students will receive the same grade, unless the Board of Examiners decides otherwise.

- **Site Analysis and Parameter Definition (25%):** Clear identification and diagrammatic representation of key parameters informing the design process.
- **Geometric Logic and Design Process (30%):** Innovation and creativity in the geometric approach, clarity of rules and method statement, and evidence of testing and refinement.
- **Architectural Application and Design Performance (20%):** Effective response to day-time and night-time conditions and integration of structure, materials, fabrication, and assembly logic.
- **Investigation Tools and Methods (15%):** Effective use of physical, digital, and AI-supported tools for investigation and exploration.
- **Presentation and Communication (10%):** Clarity and organisation of diagrams, drawings, and models explaining the design process and decisions.

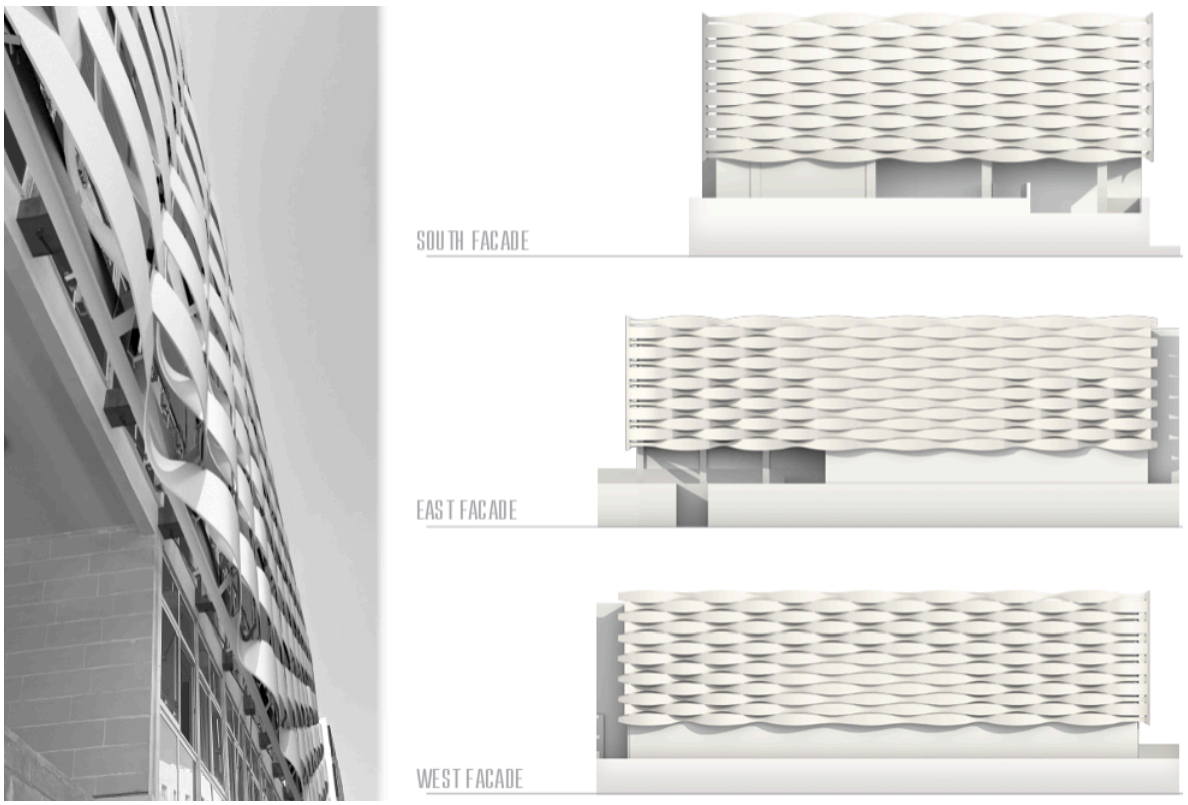
Design Studio & Design Workshop Ethics

The brief serves solely as the basis for the Design Workshop and is developed through the tutorial sessions. The tutorials systematically introduce the full scope of the brief and guide students toward learning outcomes through weekly milestones. They also present the theory and software knowledge required for the Design Workshop task, which is not covered in the study units.

The tutorials combine lectures, class discussions, student presentations (pinups), and feedback sessions. Students' participation in all components is essential to the design development process. Students must follow peer feedback throughout the session, recognising and taking on board aspects that apply to their design process.

Students must complete weekly tasks. Weekly tutorial reviews are as valuable as the final one, as they offer an opportunity to present work and receive timely feedback.

For this reason, attendance is mandatory throughout the tutorial. Poor attendance will affect students' progress, results, and their ability to deliver expected deliverables at the required level.



Tentative Timeline

Session 1 - Friday, 13th February: Introductory Workshop

Aim: The whole design process is run in one day as a first iteration. The focus is on intuitive investigation, rule formulation, and high-frequency iteration, with AI supporting the generation, comparison, and evaluation of variations, rather than on producing a resolved design outcome.

Task: The session focuses on key parameters A, C, and D, namely **sun exposure and shading behaviour, geometry and shadow patterns, and day–night appearance.** Programme, structure, materials, and assembly (B, E, F) are intentionally set aside at this stage. The task is to isolate and understand how geometric rules generate shading effects and nighttime appearance.

Students investigate parameters, identify their interdependencies, and translate them into simple geometric rules. The rules are expressed as a geometric method statement, executed to generate variations and a first catalogue.

Resources: Students must bring modelling tools and materials, and laptops with access to AI tools (recommended: ChatGPT and Gemini)

Programme:

- 10 am Introduction and brief launch
- 11 am Task 1, independent work
- 1 pm Task 1 pin-up and Task 2 introduction
- 2 pm Task 2, independent work
- 4 pm Task 2 pin-up and Task 3 introduction

Task 3 is presented the following week.

Task 1: Rule-Based Shading Investigations

Based on case studies, students develop three shading screen proposals. Each proposal must investigate one simple geometric rule that generates changing shadow patterns. Each option must wrap around at least one corner of the EPS block.

Task 1 Deliverables: A 9-slide digital presentation, structured as follows:

- Slides 1, 4, 7: Case study and physical working model
- Slides 2, 5, 8: Shadow patterns, variations, and night-time view
- Slides 3, 6, 9: Evaluation, strengths, limitations, when it works and when it does not

One option is selected during the pin-up.

Task 2: Versatility and Variations

The selected option is developed further to test its versatility and limits. Students define the geometric logic of the rule and explore parametric variations.

Using physical models and AI-supported images, students produce a catalogue of variations that document shadow behaviour and night-time appearance.

Task 2 Deliverables: A 3-slide digital presentation:

- Slide 1: Diagram sketch of the geometric rule and parameters
- Slide 2: Catalogue of five variations with shadow patterns and night views
- Slide 3: Initial contextual application

Task 3: Materiality and Architectural Application

Students investigate how the option can be applied at the architectural scale in context. Material choices are explored based on geometry and visual intent, using AI and or 3D tools.

Task 3 Deliverables: 3 visual sketches showing architectural applications in context

Session 2 – Friday, 20th February

Finalise and present:

- Task 3 outputs
- Site Analysis, focusing particularly on:
    - (A) Sun Exposure and Building Programme Analysis diagrams
    - (B) View Analysis Photos

Session 3 – Friday, 27th February

Tasks to be completed:

- Conceptual development based on parametric and geometric studies
- Initial material feasibility studies
- Early integration of site analysis with geometric logic

Session 4 – Friday, 6th March: Pin-up

- Design refinement
- Review of geometric method statements, variations, and early architectural applications

Session 5 – Friday, 13th March: Individual Feedback Session

- Focused feedback on presentation structure and deliverables
- Identification of gaps before final development

Session 6 – Friday, 20th March: Pin-up

- Presentation mock-up
- Review of clarity, structure, and narrative of the design process

Session 7 – Friday, 27th March: Final Reviews

- Final submission via VLE
- Design reviews