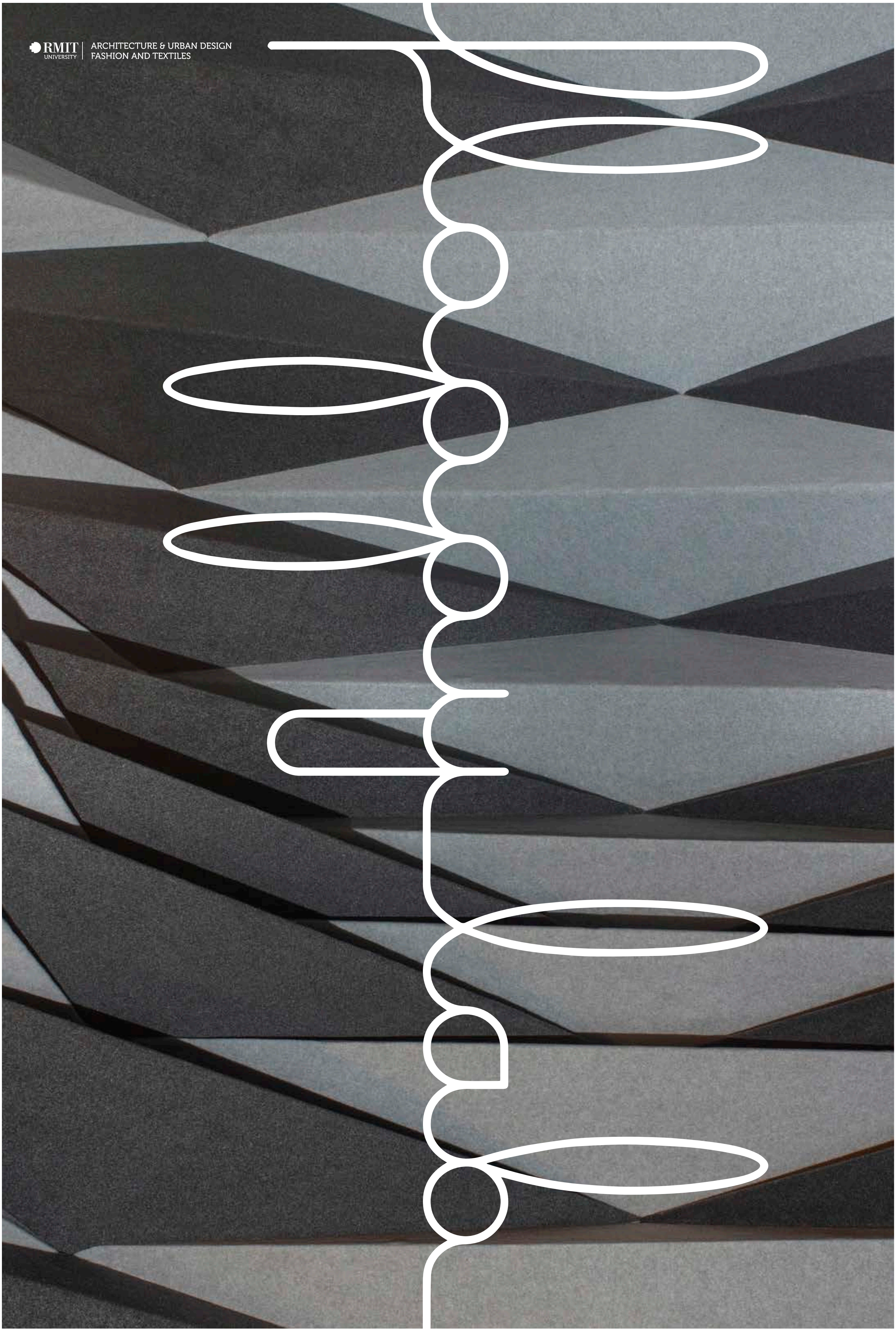
RMIT UNIVERSITY | ARCHITECTURE & URBAN DESIGN
FASHION AND TEXTILES



Floppy Lab is focused on the architectural design implications of fashion and textile based approaches. The research bridges knowledge between the academy and practice to offer design solutions to problems facing our cities and spaces.

In particular, the lab develops and leverages techniques and technologies embedded in the disciplines of fashion and textile design that can make architecture lighter, more responsive, and efficient in its use of materials. It is also interested in exploring the aesthetic opportunities that emerge when engaging in the cross disciplinarity of the research.

Some of the projects in the lab currently include urban shade solutions, facade retrofit, resolving complex fabric based fabrication solutions, applying zero-waste textile technologies and applying novel textile fibres to architectural problems. These projects are practice based and the lab has expertise in navigating the complex compliance issues faced by looking at novel solutions to buildings and cities.

The Lab which is embedded within RMIT Architecture, Fashion and Textile Design is led by Dr Leanne Zilka and Dr Jenny Underwood. Both Leanne and Jenny are leaders in this multidisciplinary approach and through this collaboration speculations on the future of architectural fabrication together with ready to deploy and commissioned research have resulted in a rich research ecosystem within RMIT Universities school of Architecture and Urban Design.

↑
2022 MPavilion now relocated to RMIT Brunswick Campus. Photo credit John Gollings

RMIT UNIVERSITY | ARCHITECTURE & URBAN DESIGN
FASHION AND TEXTILES

floppy lab

Knitting Architecture
National Gallery of Victoria
2021

This commissioned work was part of the Sampling the Future Exhibition at the National Gallery of Victoria. The installation included 11 'columns' at 4.5m high and 1.2m wide with varying complex curves. The structure, form and skin of each column was simultaneously developed in architectural and textile design software to explore fabrication efficiencies.

The exhibition 'featured newly-commissioned works to reveal how and why design experimentation can help us imagine the future and question today. It examined how, in our digital age, small-scale, distributed and high-tech manufacturing within a circular economy may replace the large-scale factory production that defined the last century. These new systems for high-strength, lightweight construction promise a more ecologically balanced future. This future will be defined by material efficiency, minimal waste and the capacity to manufacture and build considering the common needs of people, ecosystems and other species.'

↑

top image:
NGV Installed knitted 'columns

bottom left image:
fabrication of columns showing the structural ribs and tensioned knitted skiin

bottom right image:
Whole garment knitting machine producing the knitted membranes

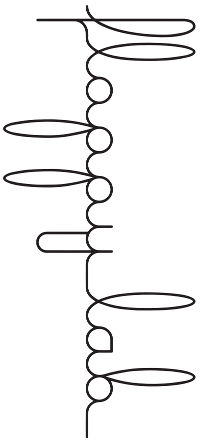
PleatPod
RMIT Design Hub
2017

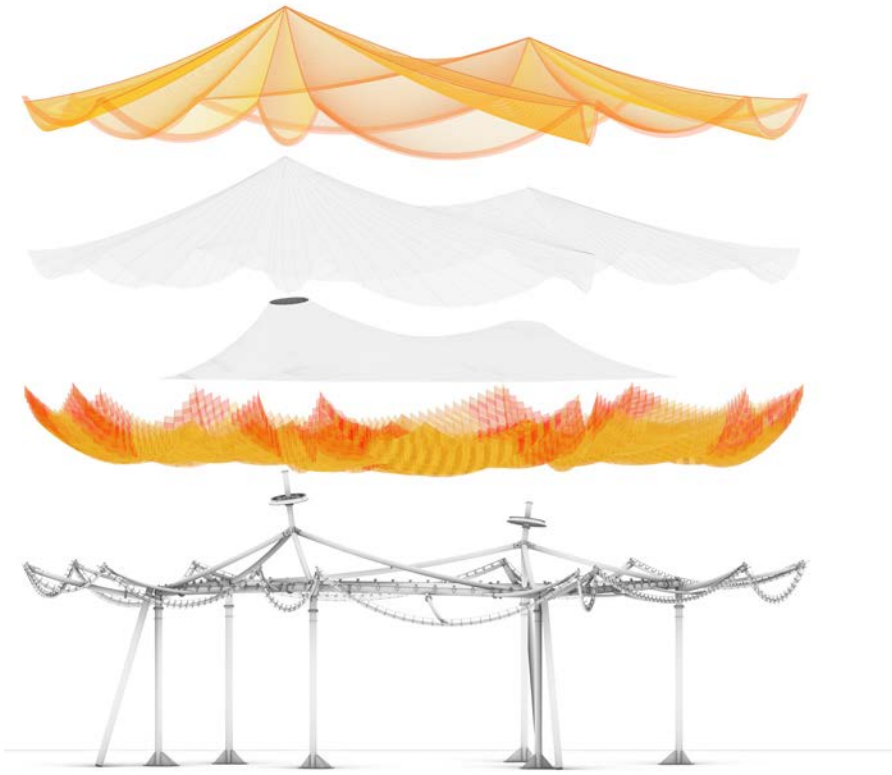
The PleatPod was a winning competition entry selected by RMIT University for a meeting space that could be installed in generic open plan spaces where there is little privacy. The PleatPod explored the technique of a pleat, commonly used in fashion and textile design to fold a straight piece of cloth around a curve. The architectural equivalent is the fold, which does not relate to form making. By exploring the pleat, structure form and skin are simultaenously considered, not common in architecture.

The result is a pleated enclosure that compresses for vertical stability and expands to define space. The form of the pleatpod is essentially a cantilevered structure that is fixed at the base. The PleatPod was constructed from acoustic panels, MDF and acoustic fabric that together provided sound attenuation for meeting as well as sound aborption around the exterior of the pod. Fabricated using CNC milling machines and upholstery techniques as well as conducting a structural analysis to understand how the structrual forces can be distributed through the pleats gave a seamless enclosure.

↑ both images

PleatPod installed on level 9 of the Design Hub- RMIT University





MPavilion
Queen Victoria Gardens
2022

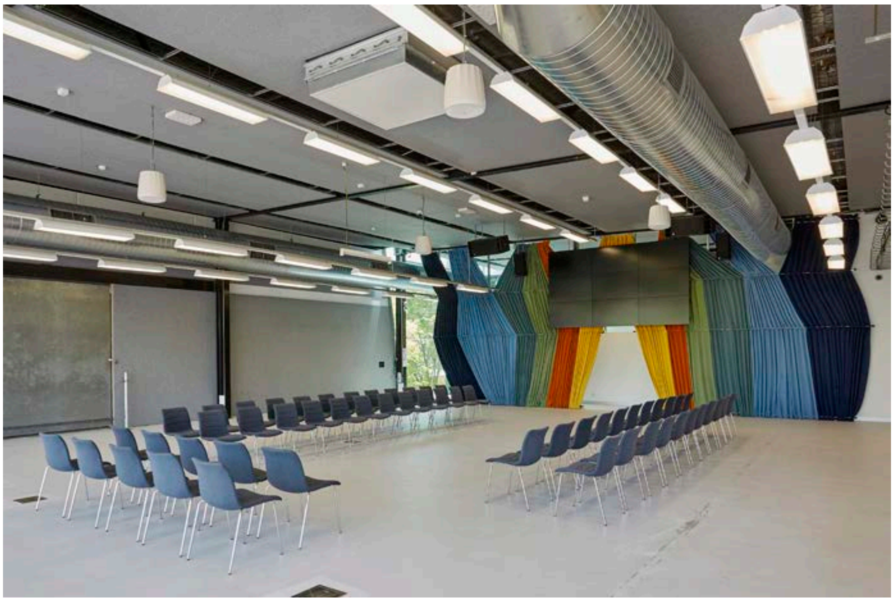
The Allzone MPavilion was a collaborative design effort to resolve a fabric structure that is required to be rain proof and comply with Australian building codes. The Floppy Lab worked with a team to realise the pavilion in the Queen Victoria Gardens.

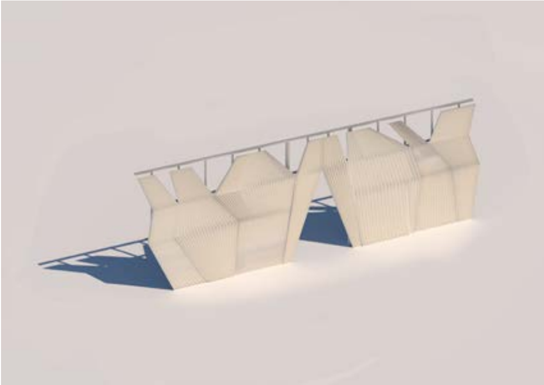
The pavilion is constructured from 3 layers of roofing supported by a steel structure. The first layer is the upper roof, made from custom orange/red thread woven fishing net. This semi-transparent layer obscures the second layer - the STFE tensile structure which was selected for its transparency, allowing dappled light to penetrate into the space. STFE has never been used before and this was the first structure to deploy it to provide weather protection. The roof falls to a peripheral gutter that is connected to angled downpipes and is setback from the edge of the pavilion to disguise this. The third layer, the ceiling, is constructed from Serge Ferrari shade materials tailored into cloud like forms that hang and move with the breeze.

The project team included Allzone, ZILKA Studio(local architects), Tensys (tensile engineers), Aecom(engineers), Bluebottle (lighting), Gardner Group (certification)Schiavello (builder), City of Melbourne, Creative Victoria, MPavilion and Naomi Milgrom Foundation.

↑
3d knitted elements as acoustic ceiling membrane

floppy lab





↑
pleated acoustic fabric fixed to a lightweight frame.

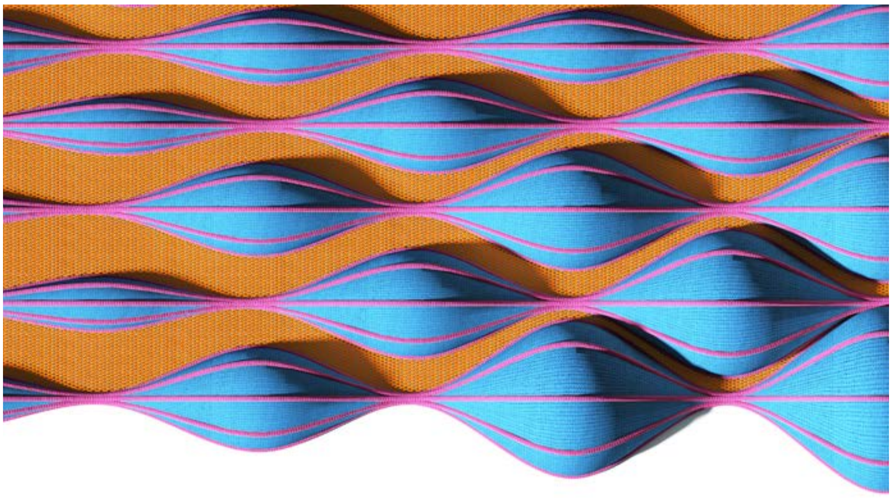
Frozen Curtain

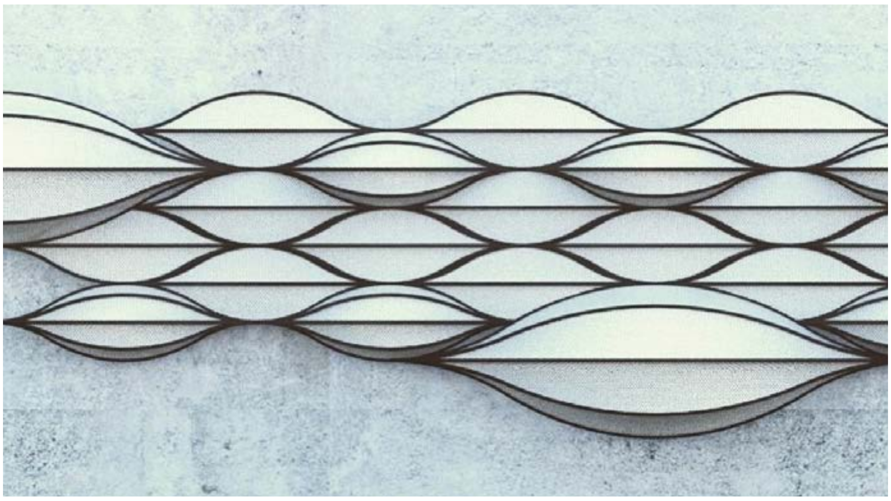
RMIT Brunswick Campus
B516
2018

Working with Paul Morgan Architects, the brief was to develop a screen that could avoid services while providing privacy to green-room activities. The new multipurpose space was designed for the school of fashion and textile design and their wide variety of activities includion fashion shows, lectures, workshops, tutorials and presentations.

The design was an exploration of the pleat hand its ability to create texture, movement and be flexible enough to provide openings where required. Utilising minmal structure to support the acoustic fabric, a pleated pattern was developed that compressed and opened to allow for services in the space. Using 'soft' detailing, the felt was folded to give space between the pleated elements allowing for a variety of denisities.

Project team: Paul Morgan Architects, ZILKA Studio, Floppy Lab





Knitted Ceiling

RMIT Brunswick Campus
2020

The school of fashion and textile design refurbishment of building 515 included fabrication workshops with informal teaching spaces where classes could be held in conjunction with workshop activities. These informal teaching spaced needed some acoustic attenuation to protect from the noisy workshop equipment.

A ceiling pattern that could incorporate sound absorbtive wadding was designed in a pattern that could be knitted using the whole garment machines based in Brunswick. The cross disciplinarity of a ceiling structure together with the translation of architectural model into knitting language demonstrated the capacity of textile technologies to address complex architectural fabrication opportunities.

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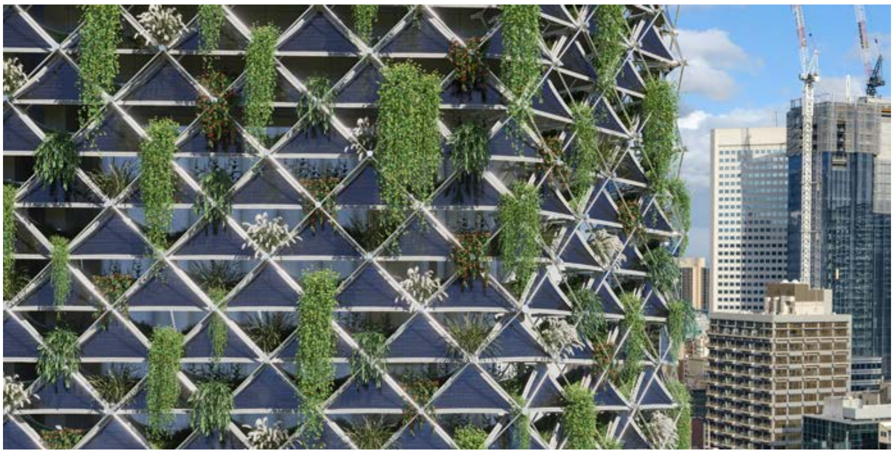
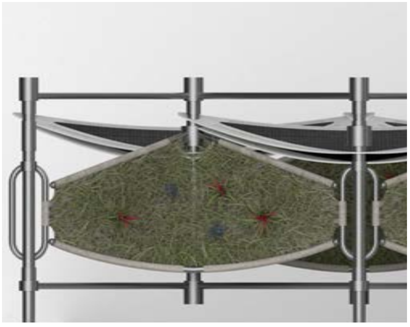
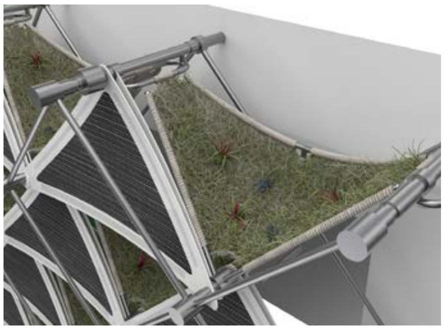
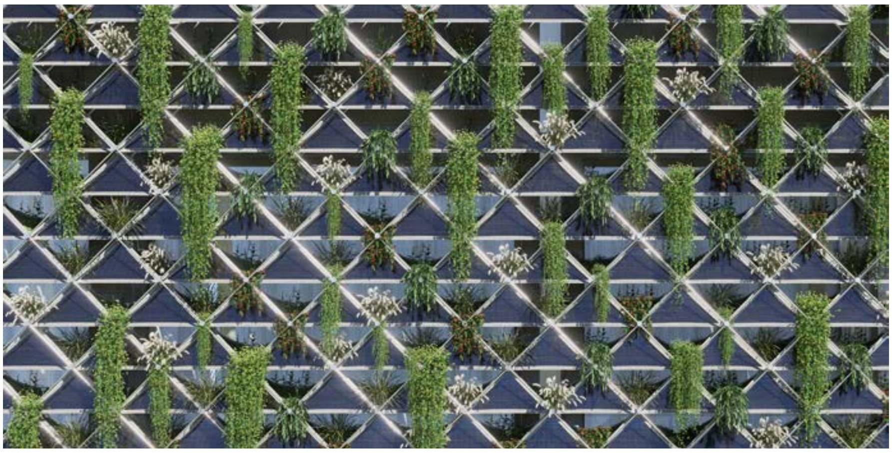
3d knitted surface with acoustic qualities for open plan teaching zones within a workshop









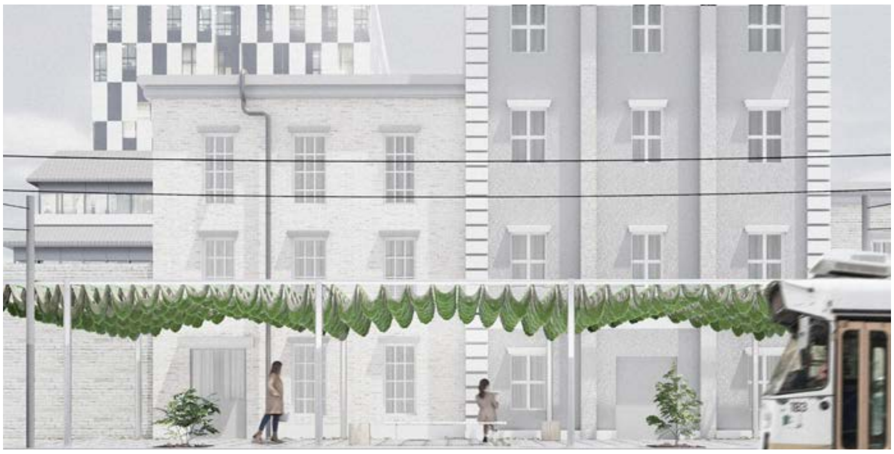
Retrofit Facade

601 Bourke Street,
Melbourne
2024

Existing building stock lacks the resilience needed to withstand climate change and contribute actively to a zero-carbon future. This research explores a textile-based retrofitting solution that integrates emerging flexible solar technologies for energy harvesting, incorporates plant-based strategies to support biodiversity, provides sun shading for heavily glazed façades, and remains lightweight and adaptable for application across a variety of façade types.

Textile technologies have evolved significantly. Advances in fabrication techniques and the interface between architectural models and digital knitting machines now enable the mass production of highly customizable textile membranes. These new materials include advanced fibers capable of energy harvesting and root-reinforced textiles that reimagine the role of façades. Moreover, the industrial-scale capabilities of 3D whole-garment knitting technologies offer a key advantage: unlike woven textiles, knitted membranes can be produced with zero material waste.

↑
tensile structure shown on facade with flexible solar cells integrated with planted fabric.



Urban Shade

MDW 2025

RMIT City Campus Our

As urban temperatures rise and existing street tree canopies struggle to survive, additional shade will become increasingly essential to protect city populations from intensifying heat.

This research explores the use of lightweight, plant-integrated textiles designed to cool the space beneath them while creating habitats for insects and birds. Utilizing the shape-forming capabilities of whole-garment knitting machines, canopy structures can be engineered to support plants, root systems, and various soil types.

These customized knitted membranes can also incorporate above-ground irrigation systems, enhancing cooling effects below. Textiles naturally allow air to circulate, while integrated plant systems offer benefits such as air filtration. This research merges the advantages of lightweight knitted textiles with innovative methods of plant propagation.

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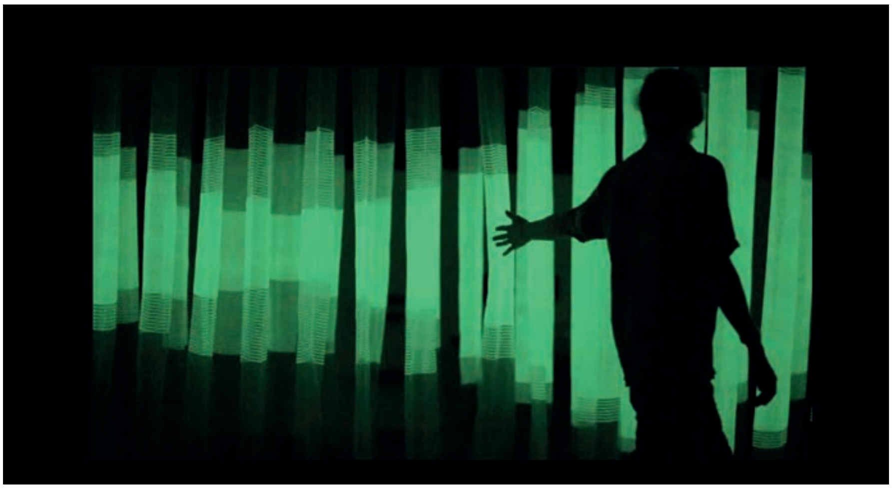
Urban shade concept above with prototype testing to be installed in the RMIT City campus



Glow Installation

RMIT Design Hub,
Canberra Design Festival
2015

Research into architectural application of new photoluminescent materials developed by Prof. David Mainwaring, materials engineer at RMIT University, and industry partner - GlowBright. The new nano-particle developed meant that the photoluminescent material was able to glow for upto 7 hours after a short exposure to light and was small enough to be embedded in fibres.

The Glow project explored passive lighting surfaces constructed from fibres knitted using the whole garment knitting machines. A series of exhibitions explored the spatial impact of this material technology demonstrating the different spatial qualities of a passively lit space vs traditional lighting. Typical LED or traditional lighting projects light and illuminates whole spaces. Photoluminescent lighting is limited to glowing of surfaces or elements which requires a different way of navigating such spaces. Instead of reading whole space, navigation is via the surfaces of the glow materials.

The Floppy Lab looks to new material technologies to envisage the spatial potential of such technologies to explore opportunities for materials not typically applied to architectural space.

↑
3d knitted tubes with glow fibre embedded in knit pattern then installed in a space.

RMIT
School of Architecture
and Urban Design

RMIT
School of Fashion
and Textiles

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Architect, Academic
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Roy Meuleman
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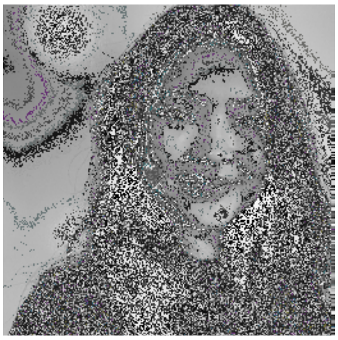
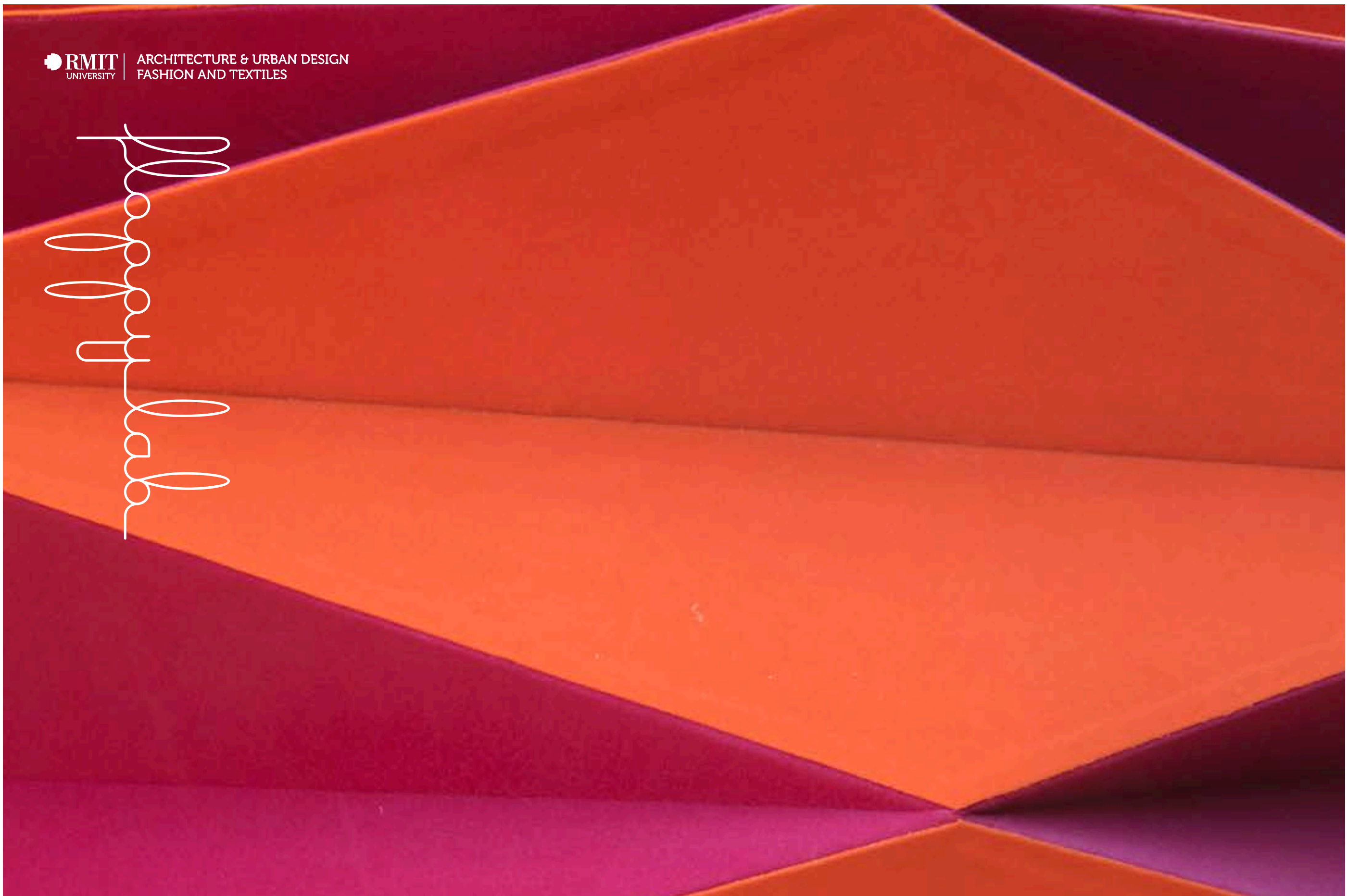


Elisa Lai Sang
Research Assistant

Marissa Samrai
Research Assistant

Team
Floppy Lab consists of researchers with a diverse set of expertise across disciplines. Working across architecture, fashion and textile design that often involves specialist engineers, textile technicians and specialists, local government, industry, and institutions allows for an integrated approach to problems tackled in the lab. The vertical integration that includes PhD researchers, architecture, fashion and textile design students all work together to develop innovative solutions and ideas, learning from each other in a rich ecosystem.



RMIT University | Architecture & Urban Design, Fashion and Textiles

floppylab

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TENSYS Engineering • Analysis | Smarterlite Renewable Light for Safety | NGV

RMIT University | Monash University | PMA

Estudio Carme Pinós | Laminex | Autex Acoustics

Naomi Milgrom Foundation | NGV | MPavilion | all(zone)