

NTRO DOCUMENTATION

Final Prototype Photographer: Nick Burrows

IMAGE

Original Creative Work Architectural Project

TYPE

PROJECT DATA

RESEARCH STATEMENT

Researchers:	Dave Pigram [University of Technology Sydney] Shirley Tam [University of Technology Sydney] Iain Maxwell [University of Canberra] Tran Dang [University of Technology Sydney] Sam Tomkins [University of Canberra]
Title of Work:	KnitWing 1.0
Commissioned By:	Alistair Swayn Foundation
Peer-Review:	KnitWing was exhibited as part of the Design and Craft Canberra Festival in the Second Skin Exhibition at the University of Canberra.
Venue:	Second Skin: Exploring Bioclimatic Wrapping For Climate- Resilient Housing In Australia University of Canberra Lodge Gallery Space 8th November 2024 — 13th November 2024
Publication Date:	8th November 2024

Research Background

KnitWing 1.0 is a 3d-knitted prototype of an external sunshade for building façades. It contributes to the fields of material and fabrication innovation; and design for decarbonisation.

Retrofitting existing buildings to increase their performance and prevent demolition is vital for meeting Paris Agreement climate goals. This research asks: can 3d-knitted shading elements enable more buildings to be retained?

Research Contribution

KnitWing 1.0 demonstrates the potential of 3d-knitting to produce functionally graded textiles within bio-composite sunshading elements. These elements are particularly suitable for re-skinning existing buildings, as many older structures rely on air-conditioning to manage excessive heat gain and cannot support the weight of conventional shading systems. Bio-composite textiles offer lightweight solutions that also enable actuation, allowing sunshades to open and close. This dynamic capability helps to balance heat gain, daylighting, and views according to seasonal and diurnal changes, improving building performance.

3D knitting allows for precise customization of shading elements' density, translucency, and structural integrity, tailoring them to specific locations. This method is material-efficient, scalable and facilitates localized production. The research contributes to decarbonising construction through a novel approach to facade design that combines aesthetic value with environmental benefits, reducing the need for demolition.

Significance

The research contributes to decarbonizing construction through a novel approach to facade design that combines aesthetic value with environmental benefits, reducing the need for demolition.

Supported by the UTS Research Office and the Alistair Swayn Foundation, KnitWing 1.0 was exhibited in 'Second Skin' at the Art and Design Canberra Festival 2024.

Dave Pigram ERA

CRAFT AND DESIGN CANBERRA FESTIVAL

ALISTAIR SWAYNE FOUNDATION AND THE UNIVERSITY OF CANBERRA



Dave Pigram, University of Technology Sydney Shirley Tam, University of Technology Sydney Tran Dang, University of Technology Sydney

NTRO DOCUMENTATION

SECOND SKIN EXHIBTION

ALISTAIR SWAYNE FOUNDATION AND THE UNIVERSITY OF CANBERRA



VENUE MAP

 interactive facade model
 facade visualisation
 1:1 flaxwing prototype
 mock ups & material samples [5] looping production footage & visualisations
[6] interactive interior visualisation
[7] 1:1 flaxwing moulds [8] 1:1 knitted flax matrix

[2]

[7]

Dave Pigram ERA

NTRO DOCUMENTATION

Second Skin Exhibition Posters and Venue Map

PEER REVIEW

Original Creative Work Architectural Project

TYPE

Dave Pigram, University of Technology Sydney Shirley Tam, University of Technology Sydney Tran Dang, University of Technology Sydney

Iain Maxwell, University of Canberra Sam Tomkins, University of Canberra

KnitWing 1.0 3D-Knitted External Sunshade Prototype

SECOND SKIN EXHIBTION

ALISTAIR SWAYNE FOUNDATION AND THE UNIVERSITY OF CANBERRA

Dave Pigram ERA

NTRO DOCUMENTATION

Peer Review Australian Furniture Design Award 2024

SELECTION PROCESS AND EVIDENCE OF ESTEEM

Original Creative Work Architectural Project

TYPE

SECOND SKIN EXHIBITION

ALISTAIR SWAYNE FOUNDATION AND THE UNIVERSITY OF CANBERRA

Dave Pigram ERA

NTRO DOCUMENTATION

Peer Review Australian Furniture Design Award 2024

SELECTION PROCESS AND EVIDENCE OF ESTEEM

Original Creative Work Architectural Project

TYPE

Iain Maxwell, University of Canberra Sam Tomkins, University of Canberra

DESIGN ARTEFACTS TOPOLOGICAL OPTIMISATION RESULTS

Dave Pigram ERA

Topological Optimisation Results University of Canberra

IMAGE

Original Creative Work Architectural Project

TYPE

NTRO DOCUMENTATION

Dave Pigram, University of Technology Sydney Shirley Tam, University of Technology Sydney Tran Dang, University of Technology Sydney

Dave Pigram ERA

NTRO DOCUMENTATION

Open CV Image Processing of Topological Optimisation Results Tran Dang

Original Creative Work Architectural Project

TYPE

lain Maxwell, University of Canberra Sam Tomkins, University of Canberra

DESIGN ARTEFACTS SHIMA-SEIKI APEX 3D-KNITTING SOFTWARE — 3D-KNIT PATTERNS

Dave Pigram ERA Screengrabs APEX 1 Knitting Software Shirley Tam

IMAGE

Original Creative Work Architectural Project

TYPE

Dave Pigram, University of Technology Sydney Shirley Tam, University of Technology Sydney Tran Dang, University of Technology Sydney

NTRO DOCUMENTATION

DESIGN ARTEFACTS SHIMA-SEIKI APEX 3D-KNITTING SOFTWARE — 3D-KNIT PATTERNS

NTRO DOCUMENTATION

IMAGE

Original Creative Work Architectural Project

TYPE

Dave Pigram ERA

NTRO DOCUMENTATION

3D-Knitting Process and Outcome Shirley Tam

IMAGE

Original Creative Work Architectural Project

TYPE

Dave Pigram ERA

NTRO DOCUMENTATION

Retrofit Scenario Renders Images: Iain Maxwell

IMAGE

Original Creative Work Architectural Project

TYPE

DESIGN ARTEFACTS FACADE ELEVATION

Dave Pigram ERA

NTRO DOCUMENTATION

Facade Elevation - Variable Opening Image: Iain Maxwell

IMAGE

Original Creative Work Architectural Project

TYPE