



digital and material morphology

# vol 1

Di ar Ma Me

---

# 2

# Digital and Material Morphology

Introduction

## Content

### RESEARCH PROJECTS

Abstract Machine and Procedural Methodologies

Keith Andrews, staff research profile

Mycelium Curiosities

Ian Fletcher, staff PhD project

Connective Design, Fabrication & Deployment

Nick Tyson, staff research profile

Eco-Habitat, Analogue Bank, Rough Sleeping Rehab

Poppy Palmer (MArch), William Gains (third year undergraduate) and Louis Smith (third year undergraduate)

### DESIGN STUDIOS

Contested Ecologies, second and third year undergraduate studio

Leader: Ian Fletcher

Abstract Machine, MArch studio

Leader: Keith Andrews

### SYMPOSIUM

Technical Future

Keynote: Tim Burton

Speakers: Anne Schiffer, Tess Widdowson, Nic Wright, Andrew Jenkins

### OUTREACH

Construction and Environmental Technology

Site Visits

## Polemics

Procedural Methodologies

Relational Parametrics

Self-assemblies

Open-ended Life-cycles

Transformative Deployment

Social Justice and Sustainability

Building as Food System

Nature-Culture Integrations

Recycle, Reuse, Reappropriate

Modular Fabrication

This research cluster traverses frontiers of digital processes and material experimentations to demonstrate new possibilities of translations from digital processes to actual building assemblies, as well as inventions of new constructional/structural materials and physical components as part of new bio-synthesis processes in architecture. Procedural methodologies that involve a range of digital software and analog testing are explored in both studio design projects and live projects in context. The design, constructional and experiential implications of working with a relational and parametric matrix, i.e. immediately three-dimensional, performative and interactive, are extrapolated from simulations, prototyping to actualisations. In parallel, new sustainable and biodegradable materials for construction are synthesised by utilising biopolymers obtained from agricultural waste. This specific development of material morphology, producing and testing the performance of mycelium-based materials that involves biological engineering, will have significant implications when applied to the engineering of the built environment, from constructional assembly and dis-assembly, criteria of sustainability, life-cycles of buildings and energy use, as well as socio-political implications linking to industry and labour, supply-chain, bottom up economics models and educational possibilities.

**Abstract Machine and  
Procedural Methodologies**

Keith Andrews, staff research profile

In September 2017, BMMJV, working on behalf of the Environment Agency, RSPB and Teesside Environmental Trust, approached a number of universities for expressions of interest in the design and erecting of a seal and bird hide. The hides were to be located on Greatham Creek between Middlesbrough and Hartlepool. The budget of the project was a lump sum of £100k, with a completion date of November 2018. The client group elected to run with Abstract Machine MArch Design Studio led by Keith Andrews, which is part of the Leeds School of Architecture. The Abstract Machine Studio focuses on digital design and fabrication methodologies in architecture, with a track record in the design and production of built works.

Students of the Abstract Machine studio met with the consortia of interested parties in February 2018 presenting a range of initial designs. The designs were well received, leading to a final design of both the bird and seal hide being developed by both students and alumni of the studio. The designs were presented to the client in April 2018 and signed off for production.

The seal and bird hides are both Cor-Ten steel fabrications, over-looking the estuary and newly created salt marsh. They were officially opened on Thursday 8 November 2018 by Sir James Bevan the chief executive of the Environment Agency, the event featuring on the BBC Look North Tyneside news program. The projects have been shortlisted for the RIBA North East regional award and national Structural Steel awards.



Keith Andrews and the Abstract Machine Studio,  
Greatham Creek Seal and Bird Hides



### Mycelium Curiosities

Ian Fletcher, staff PhD project

The PhD research project investigates the feasibility of fungal mycelium synthesised materials and the utilisation of nature's biopolymers obtained from agricultural waste to biologically engineer a sustainable and biodegradable material for use in construction. The aims of the research project are to provide an overview into the production, properties and performance of mycelium-based materials, extract natural cellulose fibres from wheat straw and to determine whether the material can be implemented for structural and/or non-structural applications. Mycelium is the vegetative part of a fungus consisting of a mass of branching thread-like hyphae, which act as a natural binder (matrix) in the mycelium-based composite system. Mycelium is mainly composed of natural polymers, such as chitin, cellulose and proteins and is a natural polymeric composite fibrous material. Mycelium digests nutrients from agricultural waste and in the process bonds to the surface without use of any additional energy input. It also depolymerises and colonises natural cellulose fibres acting as a natural self-assembling glue.

### Connective Possibilities

Nick Tyson, staff research profile

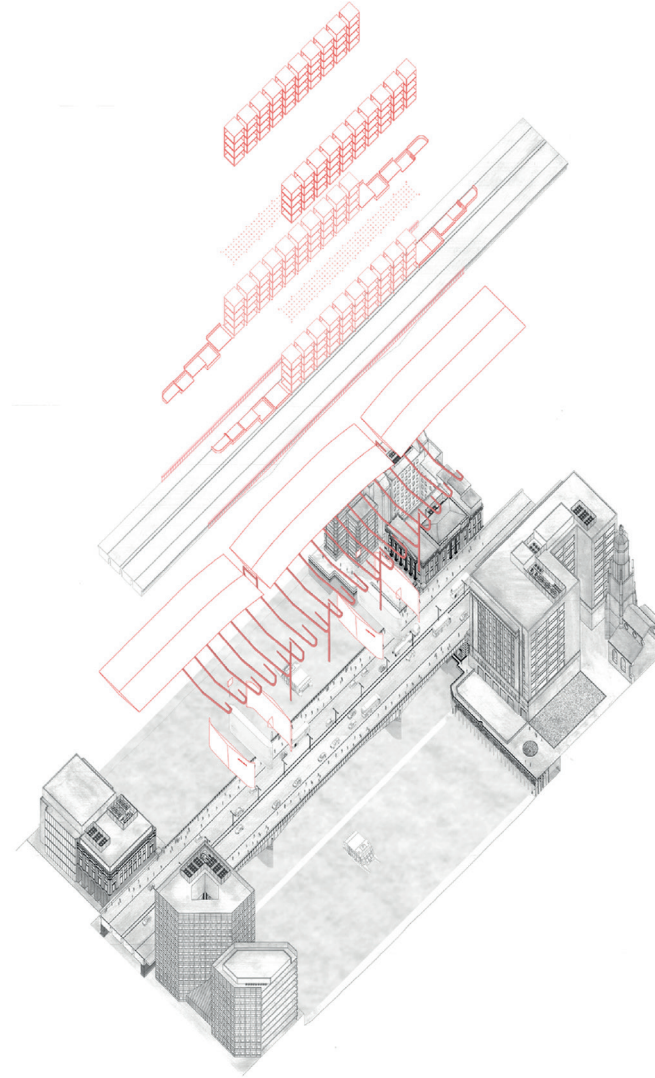
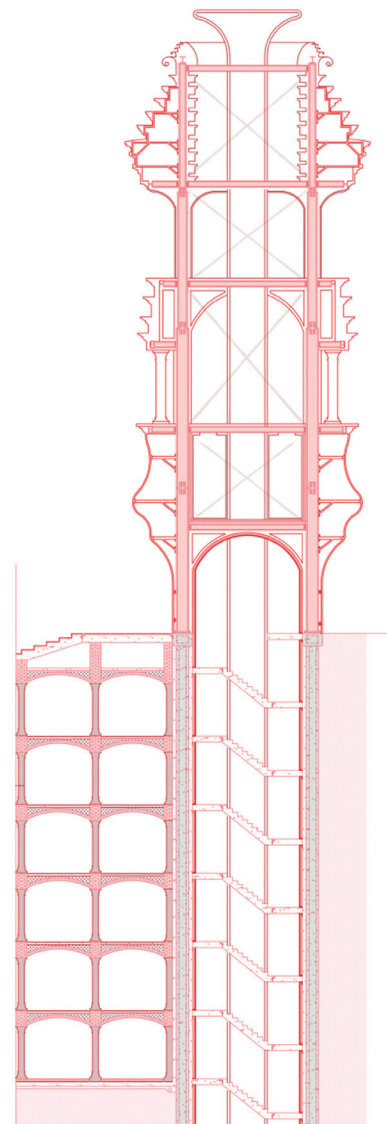
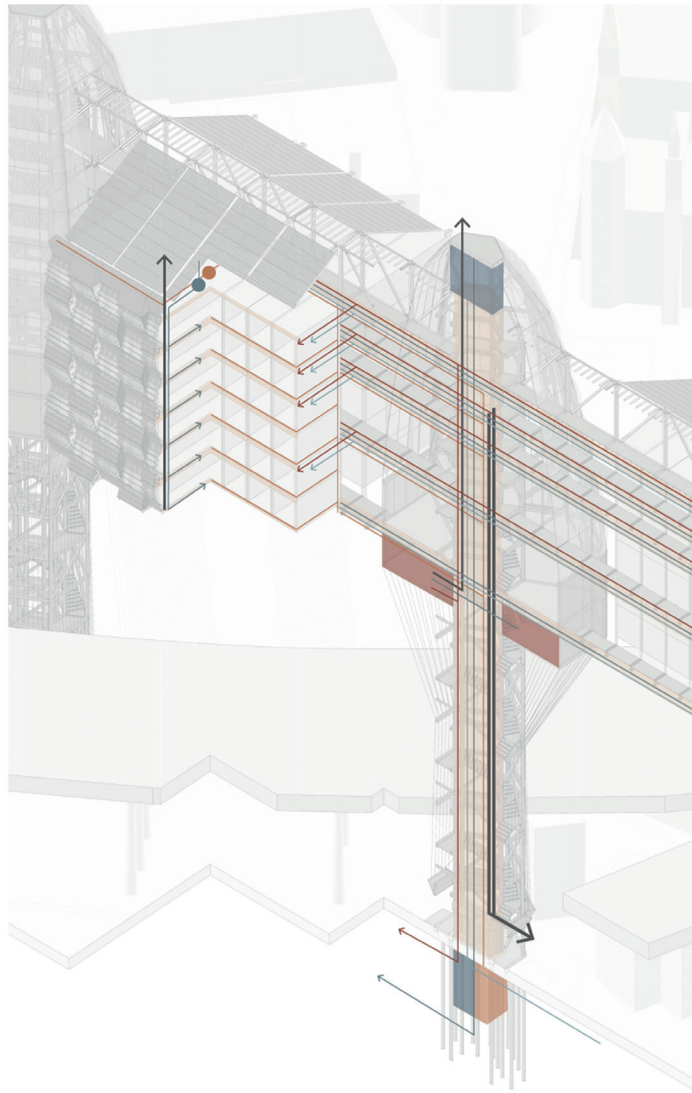
Nick's work is focused around three fields of activity: architectural practice, academic teaching and research. These are autonomous but complementary areas of work that allow connective possibilities in the areas of design, fabrication and deployment. In architectural practice we take a hands-on approach to projects that range from furniture, interiors and small buildings to sets for television production. The workshop provides a venue for open-ended experimentation and making prototypes as well as the pre-fabrication of architectural and design commissions. The building is in itself an ongoing project taking on gradual transformation from abandoned coach garage to workshop house, through a series of built elements and installations - a testing ground for material detail and construction.

Teaching and research explore design through making, aiming to close the gap between speculation, the representation of architecture and realisation - the building of things. Both analogue and digital tools are employed to create alternative possibilities for design and fabrication. Machines and materials are investigated within the contemporary contexts of sustainability, economics and lifecycle, driving the potential for new modes of architectural production. Chung Tyson Architects are based in Manchester and regularly collaborate with architect makers, specialist tradespeople and design engineers.



Nick Tyson,  
the experimental studio of Chung Tyson Architects

Will Gains, The Analogue Bank  
 Poppy Palmer, Borough Market Eco-Habitat  
 Louis Smith, The London Bridge Community



**Poppy Palmer, MArch technical research**  
 Borough Market Eco-Habitat

The proposal scheme is for a series of towers connected by structural truss bridges. The towers are used as points for access and vertical circulation. The top of the towers house vertical gardens within ETFE clad greenhouses. The bridges accommodate modular residential housing that is suspended above Borough market (Southwark, London) using tension rods.

The system aims to provide self-sufficient housing that produces its own food and energy using minimal ground area. The proposal utilises the area above the elevated railway in Southwark that is otherwise unused air-space. The proposal also allows the general public to access the towers and walk on an elevated garden path above central London. The scheme acts as a district heating plant, providing renewable energy and hot water to the surrounding buildings.

**Will Gains, third year undergraduate technical research**  
 The Analogue Bank

The proposed development for this site is to create an alternative banking system in the heart of the financial district of London. The proposed scheme intends to hold analogue technology at the core of its design ethos as a direct reaction to the increasingly unsafe digital world of banking. Christ Church Greyfriars has been chosen as site because it links multiple layers of existing analogue data transfer. King Edward street was the site of the former general post office for London housing all the Pneumatic pipe exchange system for the City of London. It also lies upon the former underground Mail Rail Lines that will be harnessed within the design as a means for data exchange.

**Louis Smith, third year undergraduate technical research**  
 The London Bridge Community

The proposal ideology of this project is to expose the issue of rough sleeping to a high volume of people who would/ could ordinarily turn a blind eye. This would be done through choosing a prominent location and showcasing the skills of the rough sleepers by utilising them as a workforce for construction whilst they gain vital skills and a living space to be rehabilitated from - something which is not currently prioritised in the UK. The starting point of this proposal would firstly be to construct a recycling centre. The project would then evolve out from this point and include, living accommodation, charities, washing facilities counselling offices etc. to become a centre for rough sleeping rehabilitation. The intention of the buildings would be for them to be in a constant state of evolution, improving as the skills of the workforce improve.

**Contested Ecologies, second and third year undergraduate design studio**

Leader: Ian Fletcher

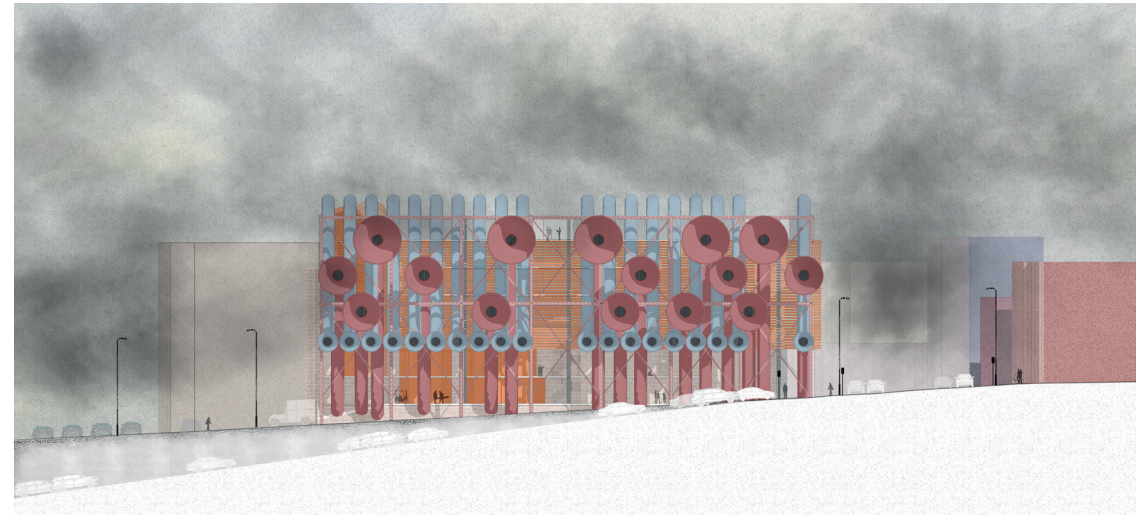
Contested Ecologies is a project based in València, Spain. The design studio explores the relationship between living and non-living organisms and their communities in a changing environment. Students are asked to consider nature as a contested territory of shared communal activity between living and non-living organisms and how a changing natural environment affects this relationship. Contested Ecologies requires the reimagining of the nature-culture divide to provide new ways in which modern thinking, with its bifurcation of nature and culture, constitutes 'ecology' within a very particular politics of urban development. The studio aims to contest this framework of knowledge that has deadlocked nature and culture, tradition and modernity, scientific and indigenous to make a case for rethinking architecture beyond the nature-culture divide. Students are asked to reconsider and reimagine new relationships between living organisms in a changing environment and in doing so present a new dialogue for the value of rethinking architecture beyond this division. Students were encouraged to intervene in the dialogue on ecology, culture, human habitation and climate change. Based on research, field studies, and environmental analysis, student projects evolved through the production of models, narratives and prototypes.

**Abstract Machine, MArch design studio**

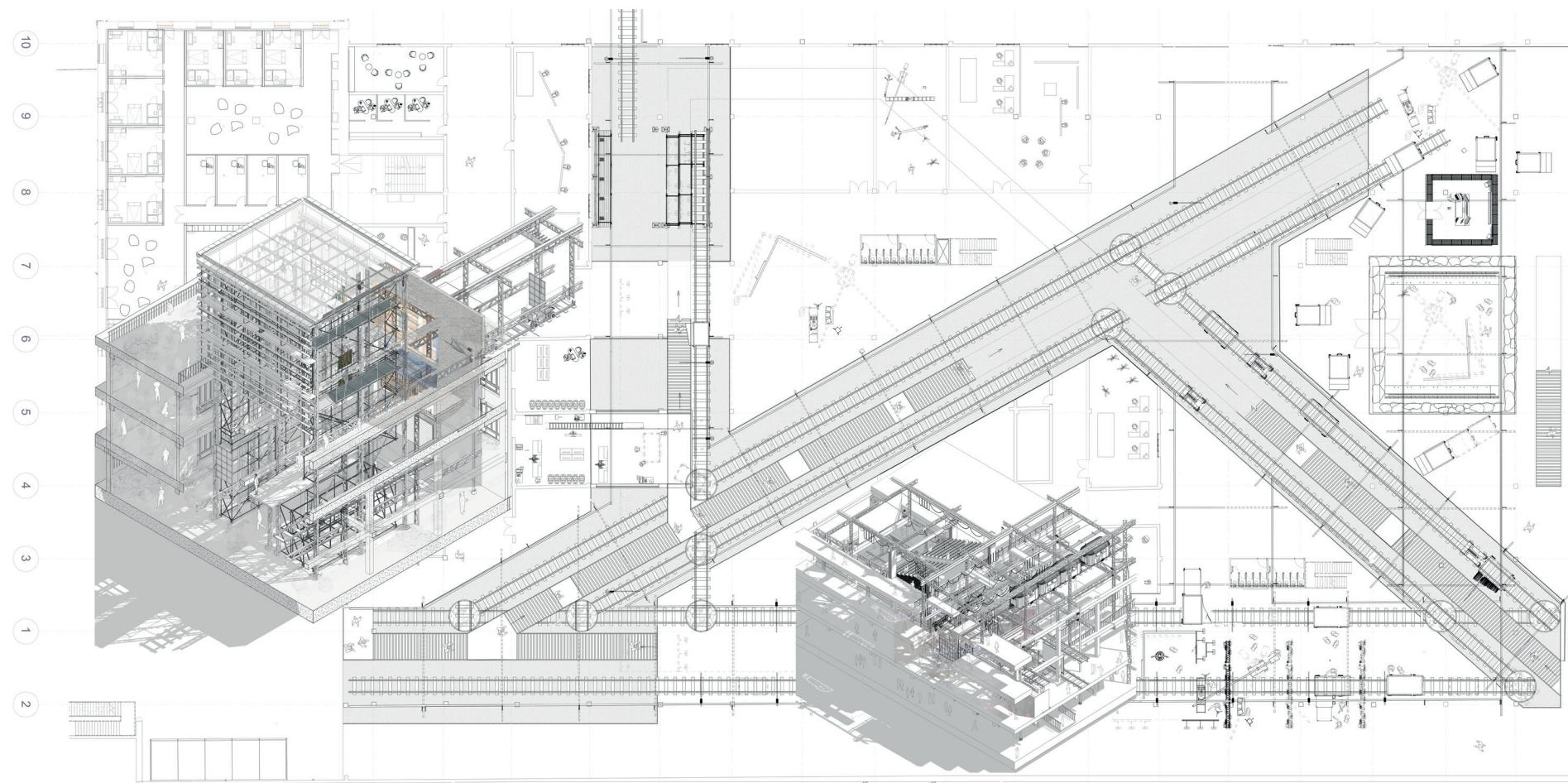
Leader: Keith Andrews

The primary focus of the Abstract Machine studio is on computation, parametric design and how applying these evolving technologies can shape construction. Abstract Machines aims to give students the skills to design then build. The unit is led by Keith Andrews, and supported by studio alumni Nick Tyrer, Jack Drinan and Richard Laycock. Now architects, these individuals have an involvement and specialism in digital design and fabrication across scales. The studio has consistently built works and installations, the latest being the double commission for a seal and bird hide at Greatham Creek at the behest of the RSPB and Environment Agency. The projects have been shortlisted for the RIBA North East regional award and national Structural Steel awards.

Architectural systems are developed through a thorough regime of process driven design, simulation and physical prototyping. Allowing the creation of space that can contain greater complexity and personality. Students develop their own innovative digital fabrication workflows, to visualise and build novel forms of architecture. Utilising advanced fabrication tools such as laser-cutting, CNC milling and 3D printing, alongside more traditional methods.



Poppy Palmer, Borough Market Eco-Habitat  
Nur Isa, Mining Urban Pollutants



### Symposium: Technology Futures

The whole school event ‘Technology Futures’ Symposium was held on Wednesday 7 November 2018 involved students from all levels engaging in talks and discussions with five invited speakers, including three school alumni. Their talks generated in-depth debates between the audience and panel on the role of technical expertise and the future of design. Dr. Anne Schiffer of LBU gave a talk titled ‘Social Justice as Integral to Sustainable Energy Futures’, Tess Widdowson of Citu presented ‘Challenging Convention Through Modular Fabrication’, Nick Wright from Hodder + Partners took us on the journey ‘From Hodder’s to Uganda through Building Techniques and Material Systems’, Dr. Andrew Jenkins from Queen’s University Belfast explored ‘Building Integrated Technical Food Systems’, and finally the keynote speaker Tim Burton from SHStructures presented ‘The Art of Engineering and Design’.

### Construction and Environmental Technology Site Visits

Leeds Beckett University Architecture students across undergraduate and postgraduate levels were presented with the opportunity to tour around some of Leeds’ most interesting construction sites in the week commencing 15 October 2018. Tutors teaching technology modules organised seven construction sites of differing scales, technical approaches and level of completion to open their doors to provide a fantastic hands on learning experience. Students enjoyed guided tours of The Majestic, Leeds Arts University, Leeds University’s Newlyn Building, 33 Wellington St, Spenfield Court, Symonds House Student Accommodation and the West Yorkshire Playhouse renovation. Special thanks are extended to all collaborators including Sir Robert McAlpine Construction, DLA Design, DLG Architects, Evora Construction, RG Group, BAM Construction and Actavo Construction.

In particular, a special site visit to Veolia’s Leeds Recycling and Energy Recovery Facility on 5 March 2019 was arranged with the aim to help students to understand the energy and material flow through the city. The scheme by internationally renowned architect Jean-Robert Mazaud of S’pace Architects, boasts a spectacular 42m high glulam frame and Europe’s largest green ‘living’ wall to the southern façade, enhancing visual impact and providing biodiversity. Designed to remove recyclable waste from black bins and recover energy from anything remaining, the facility produces energy for 22,000 homes and will soon heat Leeds City Council’s new district heating system for civic buildings and social housing, all whilst ensuring no Leeds city region waste goes to landfill.





LEEDS BECKETT UNIVERSITY  
LEEDS SCHOOL OF ARTS

# Digital and Material Morphology

D  
a  
M  
M

For more information visit  
[leedsbeckett.ac.uk/lsa](https://leedsbeckett.ac.uk/lsa)