Institute of Making

Fifth Year Report

Institute of Making, UCL 2017-18

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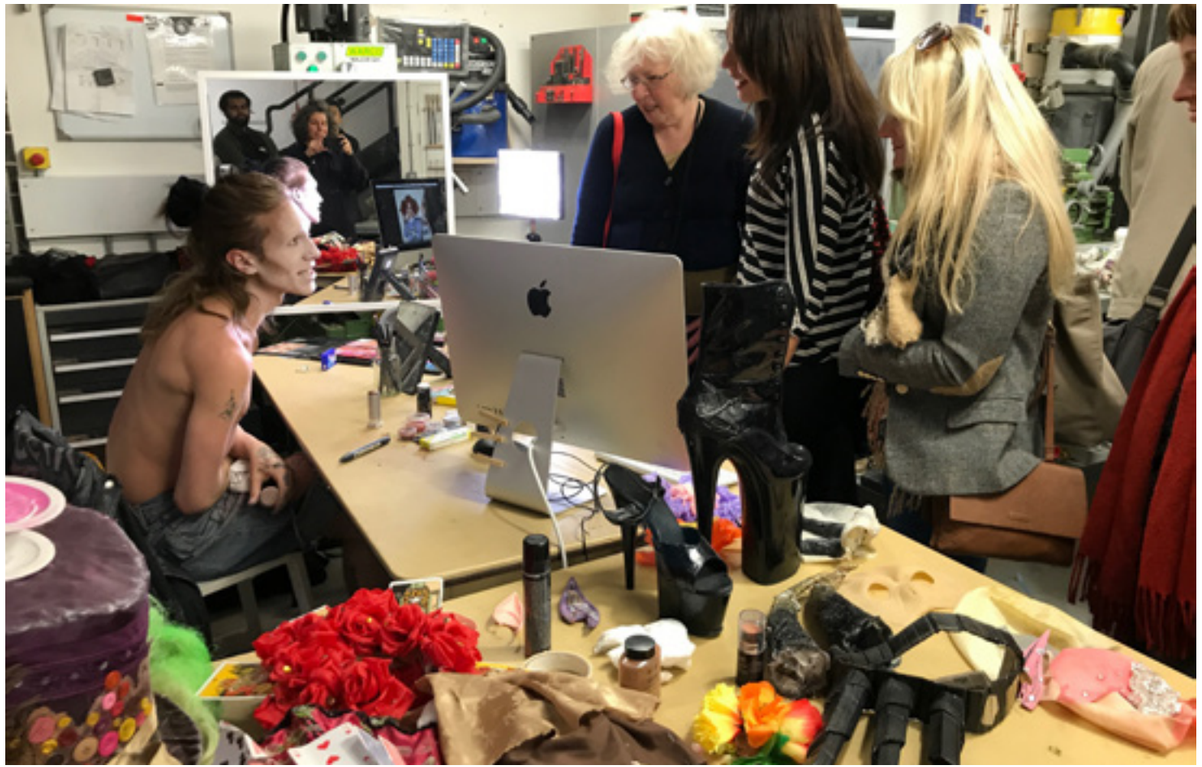
The Overview

Why we do what we do...

"…such a brilliant atmosphere, so many fascinating people to talk to and memorable things to do - the friends I brought with me are now wondering about enrolling at UCL just so they can join the Institute!"

Shelley James



We are a very unusual research club...

The Institute of Making is a place that encourages play, research and development of materials and processes. We believe that until you make something you don't really understand it. We are a diverse multidisciplinary community whose activities support teaching and research through making. We provide a fully equipped workshop, technical training, a library of materials and most importantly, inspiration and support.

Membership is open to anyone at UCL...

We currently have 3094 active members, of whom 26% are staff and 74% are students. A further breakdown of the member demographic is as follows: female (41%), male (52%), no gender declaration (7%); undergraduates (41%), postgraduates (34%), academic staff (16%), and professional services staff (9%). The membership encompasses a wide range of specialisms and interests, from Architecture to Chemistry, Anthropology to Education, and Materials Science to Medicine.

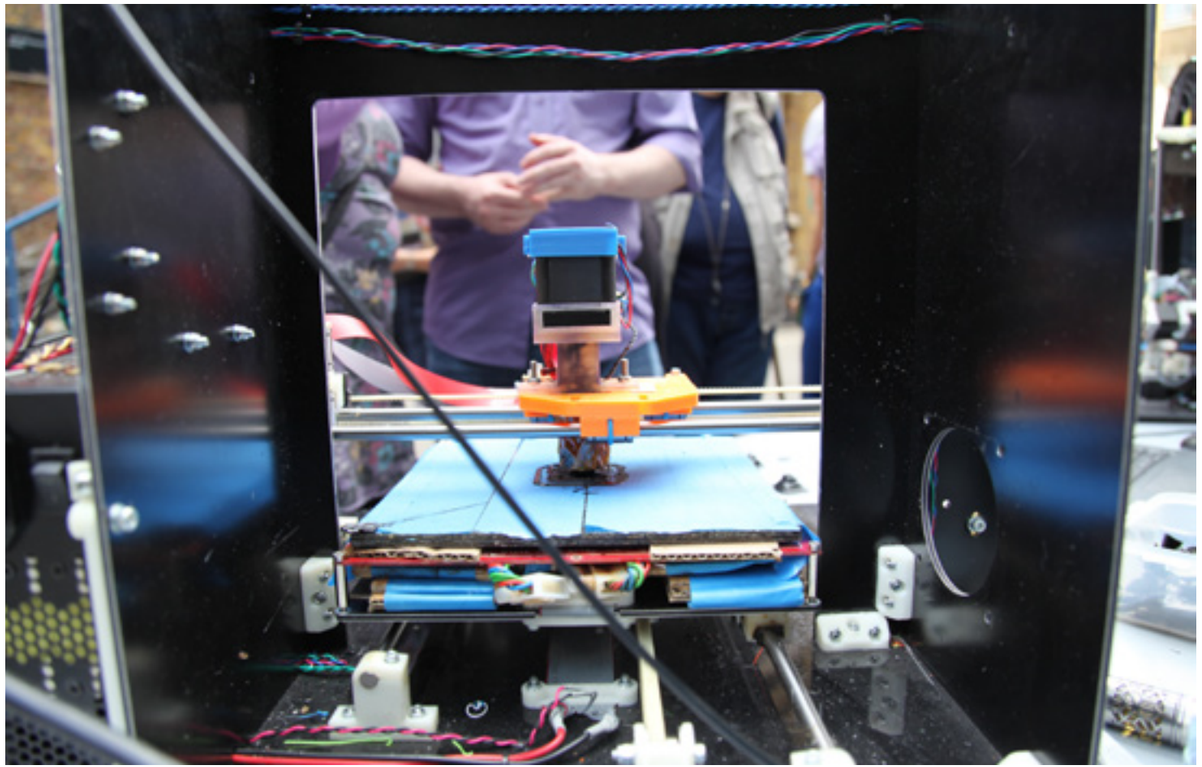
Doing is a different way of thinking...

A typical snapshot of activity at the Institute is as follows: a group of physics students are using the Materials Library to gain a deeper understanding of how nanotechnology affects materials design; a Biochemical Engineering PhD student uses the laser cutter to create some micro-fluidic devices for their experiments; a History student is responding to an essay assignment by making a series of ceramic pots; a research workshop on 3D printing of flexible sensors gathers together electrical engineers, computer scientists, designers and medics; a master class on millinery is attended by students and staff from all over UCL; we hold an Open Day on the theme of 'faking it' and more than 1200 members of the public take part in hands-on making and faking activities.

We specialise in multidisciplinary materials research...

The Institute of Making acts as a research hub, bringing together and supporting multidisciplinary teams of researchers both at UCL and beyond. This year we secured funding for three new partnership projects: Fit-for-purpose, affordable body-powered prostheses (EP/R013985/1); Developing bespoke flexible sensors for prosthetic and orthotic liners (EPSRC EP/N02723X/1); and Nature Inspired 4D printing for biomedical applications (CNIE “Inspiration” Grant).

These awards add to our ongoing funded research projects: Self-Healing Cities (EPSRC EP/N010523/1); Centre for Nature Inspired Engineering (EPSRC EP/K038656/1); Material Anxieties (Wellcome Trust 200354/Z/15/Z); The Open Workshop Network (PhD Studentship); Food and Transformation (PhD funded by BEKO).



Our events get fully booked in seconds...

Our events aim to inspire the public with all things materials and place us at the heart of the international making community. The programme also exists to introduce our members to new areas of interest, to help them acquire new skills, encourage them to engage with experts in various fields of materials and making research and allow them gather together research collaborators. Last year we held 54 events: 29 member events and 24 public events (see p.138-140 for the full list). These included 27 masterclasses (including the Art of Kintsugi, Arduino electronics and Linoleum printing), 10 research events (including Material (Im)Mobility in Past Societies), 3 Materials Library evenings, 3 large-scale public open days, 4 week-long events (including Lorna Hamilton-Brown, Maker in Residence). Over the past year our events have attracted a total audience of more than 5000 including a high representation from families and young people.

We have a wondrous collection of stuff...

The Materials Library is a collection of some of the most wondrous material on earth, gathered from sheds, labs, grottoes and repositories around the world. It is a resource, laboratory, studio, and playground for the curious and material-minded to conduct hands-on research through interdisciplinary inquiry and innovation. What makes us unique is the relationship between the library and the making activities. This year we continued our Materials Library Consultancy Programme. These one-on-one sessions are open to Institute of Making members on a bookable basis. Consultations give members the opportunity to explore the collection in greater detail and to seek advice and guidance from the Institute of Making team in relation to a particular area of research or project.

We have a public profile...

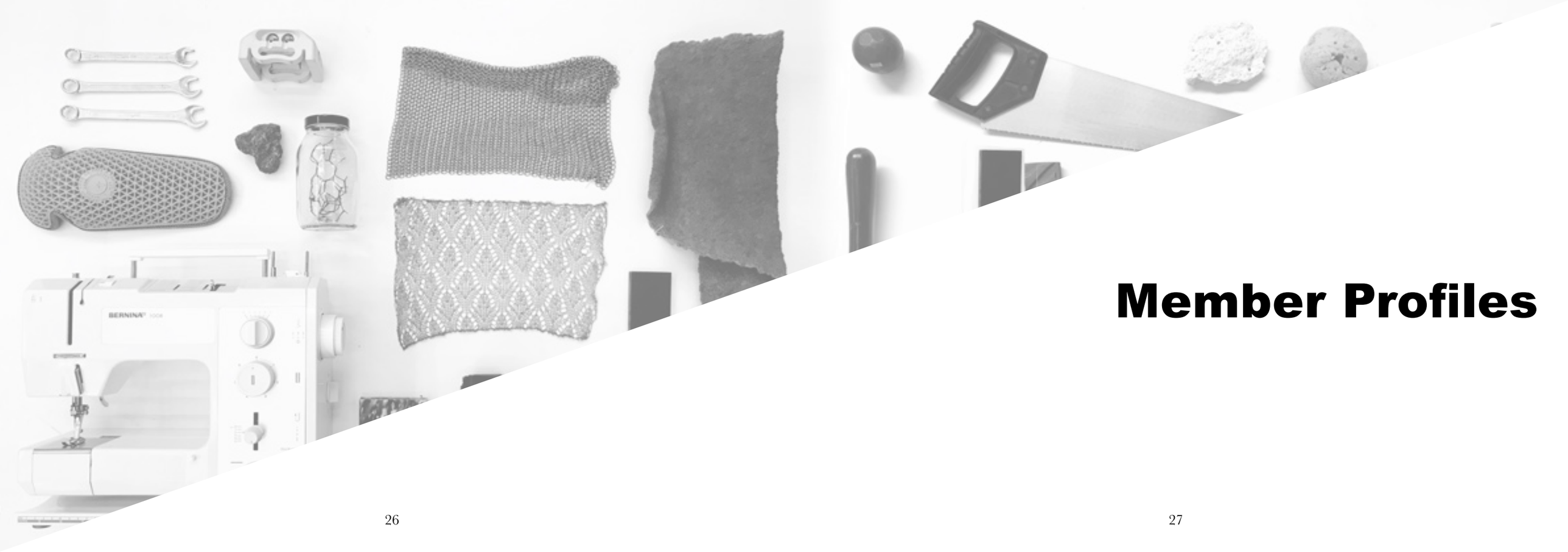
The Institute of Making and its team have gained a public profile as champions of making and materials, promoting them through numerous TV and radio programmes (BBC2 TV Big Life Fix, BBC4 TV Secrets of the Super Elements, BBC Radio 4 Today Programme, BBC Radio 4 Kitchen Cabinet , BBC Radio 4 PM Programme). We are active on social media (Twitter, Facebook, Instagram, Tumblr), and online in the form of podcasts (The Things That Make Us).

We are international...

The Institute of Making has an international reputation; we have given invited talks all around the world from Boston to Beijing on our interdisciplinary materials research and our other activities. We have active research links with the Global Disabilty Innovation Hub, the British Council, and Ellen MacArthur Foundation.

We interact with policy makers and industry...

Our profile has enabled us to influence funders (EPSRC), policy makers (Government Departments, Mayor of London) and national academies (Royal Academy of Engineering, Royal Society), attract industrial collaborators, and inspire both current and future students and staff.



Member Profiles

Our membership continued to grow in 2017, with new and returning UCL students and staff joining the Institute of Making throughout the year. The ever-popular 3D printer and laser cutter inductions, alongside our fully booked ceramics and sewing inductions, give a flavour of the diversity of interests of our members, and their desire to combine technology and traditional tools in their innovative projects.

Feedback from our recent member's survey, indicated that 41% of member respondants used the space for personal projects, 13% for research projects, and 43% for both personal and research. One member wrote that the Institute of Making had "wonderful staff and a great space that is fundamental to the student experience." The Makespace and Materials Library team is always ready to respond to unique challenges and excitement of final year projects, conference deadlines, degree shows, research workshops, fashion shows and end of term deadlines, as well as creative and distinct personal projects.

This year we challenged members to make use of the teak that was salvaged from the Bloomsbury Theatre renovation. Members came up with some great ideas to make furniture, kitchen boards and bowls, games and toys. Our joint staff and member team participated again this year in the Raft Race challenge between makespaces in London, building a raft out of palets, plastic, and pedal power. It is always fun for our members to join in representing the Institute in a London-wide event, and exhilarating to have a swim in the canal!

In this section we profile some of our members and their projects, which include personal research and making projects alongside their academic research activities. Feedback from members often reveals partnership and collaboration across disciplines that would never have happened if it were not for our unique community.

Gabriella Hirst
Slade MA Fine Art

Gabriella discovered the Makespace after Slade students recommended it to her for the excellent technicians and ease of making. After doing a new members induction and meeting with Liz Corbin to talk about a project using the Materials Library for inspiration, she 'wanted to do everything'.

In April, she approached our technician Darren with the idea of making a Korean moon jar based on one found in the British Museum. One of her motivations for choosing this object was that it would be an 'incredibly difficult task' and the hours of effort may not result in any tangible object. As a ceramics novice, Darren encouraged her to take a step by step approach, beginning with a pottery induction. After that Gabriella was on the pottery wheel as often as possible, building her skill in throwing and picking Darren's brain about clay and its properties. She also began to learn about glazing and mixed her own glazes.

As the hours of practice piled up, her project began to take on a new line of investigation. She began to explore the idea of pushing herself to her physical limits to question the blurry line between reality and art, muscle memory and practice. She started considering other elements as part of her practice. She feels that the Institute really made it possible to work on this project both through the materials and facilities provided, but moreover because of the generosity and patience of the technicians.

"The technicians' enthusiasm and positivity made me feel more independent and empowered in learning creative processes and becoming self-sufficient…and the materials available such as clay made it financially possible to complete the project".

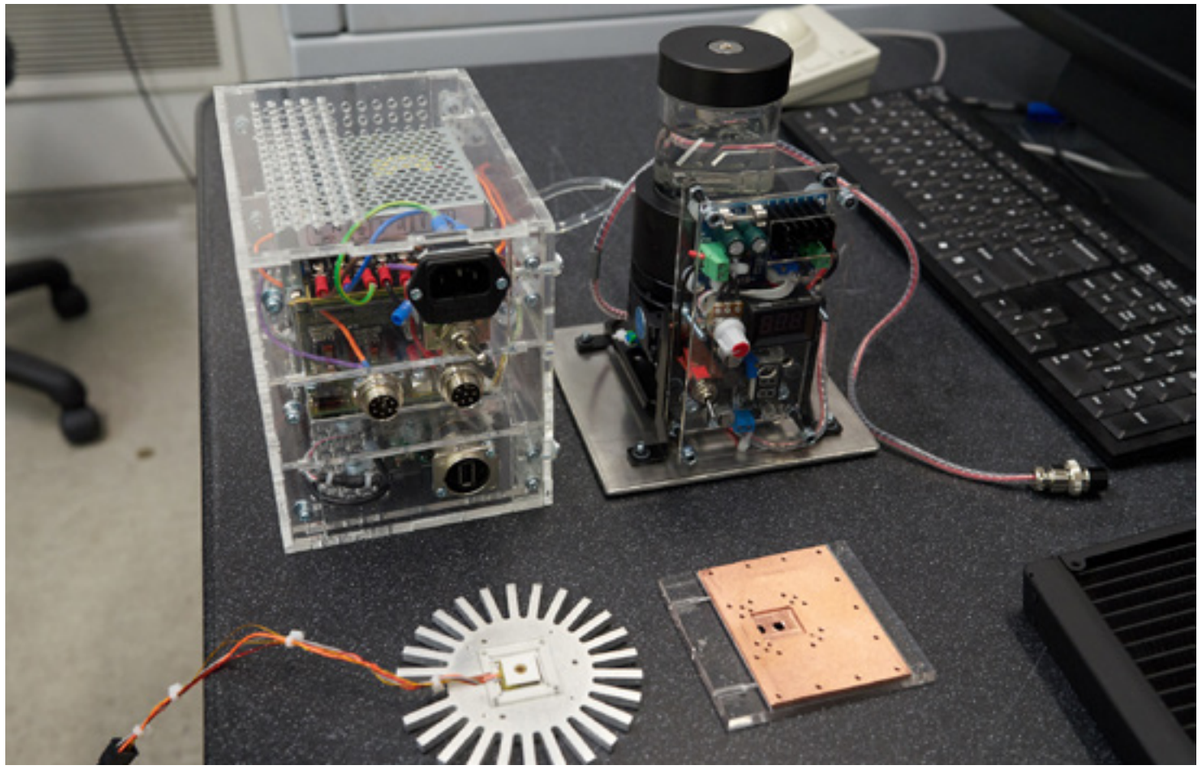
She feels what makes the Institute really stand out is the positive environment and encouragement from the staff, as well as the wide variety of people and creative practices in the workshop. 'There is often such a mystique around making, but the Makespace allowed me to try things without the macho attitudes or mystery that can surround making. There is a playfulness here because everyone is trying stuff out.'

Alex Yon and Adrian Hodel
PhD students in London Centre for Nanotechnology

Alex and Adrian came to the Institute of Making with ‘a problem in the lab; they needed a cooling system for their microscopes. They were frustrated by the expensive, impenetrable boxes that are commercially available, and wanted to design a product that would be accessible and ideally could be made open source after completion. The Makespace was a perfect place to design and make the cooling system. Alex and Adrian liked the idea of ‘doing it ourselves and cheaply’, and also received a grant to complete the system. Far from the closed off boxes of the commercial versions, their design uses a clear acrylic casing to showcase its inner workings.

They were attracted to the Institute of Making as they were able to ‘come in more less when we needed to’. They worked with our technician Romain, who was a great resource in using the CNC and milling machines. This gave them a freedom to try things that they otherwise wouldn’t have tried. Like other members they felt the Makespace was an hub of diverse research and practice. ‘It can be very busy, but even when you have to wait it’s a good place to wait. You meet interesting people doing different research.’

“It’s been so refreshing comparted to what we do 9-5. It is encouraging people to get hands on and make things. The best things about being here are having the opportunity and tools for making, and learning and sharing. The interaction with others builds new skills, points of view, and new applications.”



Janneke Van Leeuwen
PhD researcher Brain Sciences

'The Institute of Making was on my radar from the beginning' - Janneke was drawn to UCL in part because of the Makespace. Her PhD, which focuses on the way dementia affects ones' experience of colour, is the first in the Neurology department to have an arts component.

Part scientific research and part artistic reflection, Janneke explores the subjective experience of people with dementia. The way dementia affects ones' experience of colour is not well understood. Janneke used scale models of rooms along with colour fields to help quantify how colour was experienced both as a plain colour field and also how participants might imagine themselves within a particular space using eye tracking devices.

This research was presented to the public at Creative Reactions, part of Pint of Science, an initiative to communicate science research using art. Janneke decided to built an interactive art installation using the images of the colour rooms, a set of doors and virtual reality headsets. For the event, members of the public could open a door in real life and then virtually step into the colour field rooms. It was 'way more complicated than I anticipated, but the technicians took my sketchy drawing and helped me develop it into a project that could be made'.

Janneke felt that the Makespace provides an optimal atmosphere to do work and feel inspired. 'Everyone is so generous sharing their knowledge. There is a super friendly atmosphere here and collegial but also super focused. People come here to get things done!' The fact that the Institute of Making is completely free for members allows experimentation and flexibility in their approach. This freedom to do things over and over until it is right is really valued as part of the making process.

"When you walk into the Institute of Making with an idea the attitude is 'Cool, let's see how we can make it happen'."

Karen Ko
MArch Bartlett Faculty of the Built Environment

Karen embarked on a project to better understand the nature of erosion in eco-friendly building materials such as rammed earth and cob. She felt that if the material was better understood it might be more widely used and better looked after throughout the life of the building. Karen began her research by testing the material to its limits by heating, freezing then thawing it, and finally eroding it with water.

'Staff at the IOM are absolutely brilliant and very open to trying things. Darren really helped me. He is very generous with his time. I would come in with lists of questions and he would sit down, sometimes for hours at a time, going through them. He was willing to try things out whether it was process or experimental firings in the kiln.'

Karen used regular geometries like circles and triangles to explore whether clay erosion could be altered or tracked. She wanted to ascertain how the pattern of brickwork or shape of a façade could affect the way a building changed over time, and as a result affected the interior environment of the structure.

She found the Makespace a place of endless curiosity with an open-minded attitude toward making and process. The Institute of Making was, 'a place to meet people from different disciplines and departments, from humanities to science, and a space to chat about different things and learn what other people are working on.'

"Darren literally taught me everything about clay…he is like a dictionary of information."

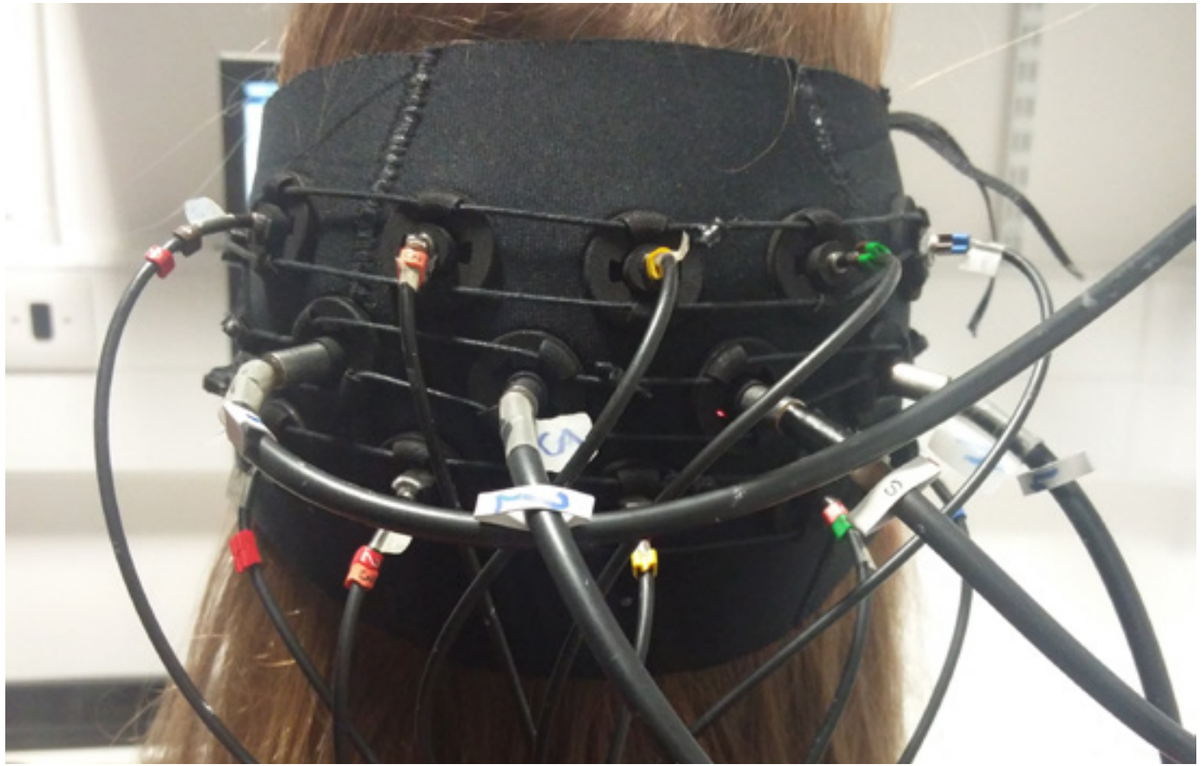
Maheen Faisal
PhD in UCL Medical Physics and Birkbeck Centre for Brain and Cognitive Development

Maheen first came to the Makespace to use the sewing machines to make a device to safely and comfortably hold scanning sensors over certain areas of the brain. In her research, Maheen uses a neuroimaging technique called near-infrared spectroscopy to shine light on brain tissue and obtain information about blood oxygen levels as well as energy metabolism in the brain. This information is useful in investigating conditions such as migraines, traumatic brain injury and autism spectrum disorders.

After initially sewing the sensor headgear in neoprene, she moved on to using the 3D printers to quickly turn around new iterations of the sensor holders. A high level of precision was needed in the placement of the sensors, as well as a great deal of flexibility, because the device would be used on many participants.

Previously, Maheen had used other workshops and 3D printing services, but she needed a faster turnaround so that versions of the headgear could be trialled and new iterations made quickly. She was making novel equipment that had to be very accurate, so there was a lot of trial and error in designing the headgear. She felt the Institue of Making provided the freedom to explore different materials and processes, including use of her own printing materials.

"The technicians were really helpful and so many random things and tools were available to use- it was a one stop place to try a lot of different things. When we needed something even if it was obscure it was usually available in the Makespace. The technicians were really great, I don't think I could have succeeded without them."



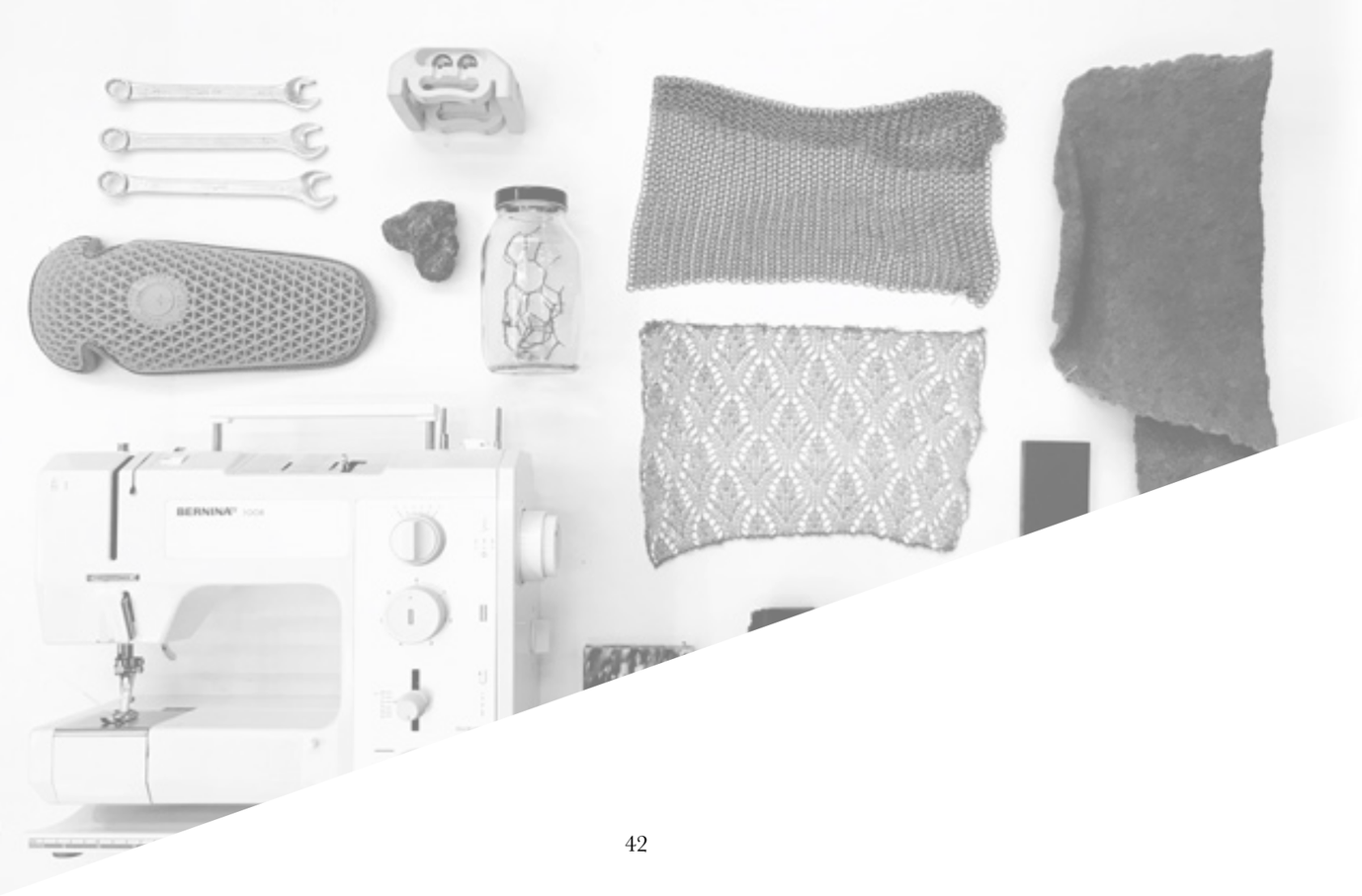
Kevin Green
Teaching Fellow in Architectural Design

Kevin is a Teaching Fellow in Architectural Design at the Bartlett, and a practicing artist. He first came to the Institute of Making when a colleague from Engineering told him about the Makespace. Because he is working in higher education, Kevin was very aware of different educational models, but he felt there was something really exciting about bringing together different types of people with different approaches to making. He found it refreshing to be around making not just for an academic exercise, but also for members' personal projects.

He feels that the uniqueness of the Makespace starts with the new member inductions. Most inductions are passive learning, but the staff in the Makespace promote an active learning environment where members and staff are 'figuring it out together'. This means members and technical staff are actively participating in problem solving and learning technical processes. He feels this creates a more independent and responsible membership who are very switched on about safety.

Kevin teaches the tool trainings for 3D printing most weeks to members who are keen to learn a new skill. He doesn't actually use 3D printing much in his practice but finds it interesting to teach. He feels that everyone is learning from each other because they actively share their expertise.

Kevin enjoys the exploratory nature of the Makespace environment. He says it is;
"strangely homely here, feels like you can make mistakes and it can be as hands on or off as you need, which is really unusual."



Research Programme

We are a hub for multidisciplinary materials research. We bring together and support teams of materials researchers and makers from different disciplines around UCL and beyond. This year we have continued our research award success, securing funding for three new projects: Fit-for-purpose, affordable body-powered prostheses, led by Professor Laurence Kenney, University of Salford (EP/R013985/1; £1,390,144); Developing bespoke flexible sensors for prosthetic and orthotic liners, funded through the Medical Devices and Vulnerable Skin Network – Research Stimulus Fund (EPSRC EP/N02723X/1; £18,996); and Nature Inspired 4D printing for biomedical applications (CNIE "Inspiration" Grant; EPSRC EP/K038656/1 £29,769).

These awards add to our ongoing funded research projects: Self-Healing Cities with the University of Leeds, University of Birmingham and University of Southampton (EPSRC EP/N010523/1; £5,247,017); Centre for Nature Inspired Engineering led by Professor Marc-Olivier Coppens (EPSRC EP/K038656/1, £4,980,773); Material Anxieties (Wellcome Trust 200354/Z/15/Z, £200,556) led by Dr Sarah Wilkes. The Institute of Making is also a partner in Elizabeth Corbin's UCL PhD research on The Open Workshop Network. This year, we are also thrilled to welcome Ellie Doney, our former Makespace manager, as a PhD student; her project Food and Transformation is funded by BEKO and is being undertaken in conjunction with the Slade at UCL.

This year also marked the successful completion of Hands of X (EPSRC EP/N01006X/1 (£287,813)), which culminated with a service prototype and exhibitions in June/July 2017. We have also recently established collaborations with the UCL MRC National Survey of Health and Development, around taste of materials and

ageing, and with Birkbeck and the University of Nanterre, continuing the PhysFeel project, which explores whether material properties can be used to communicate emotions in psychological therapies.

The Institute of Making launched a new seminar series in 2017 – My Research Makespace – aimed at showcasing how members use the Makespace to advance their research. This multidisciplinary, monthly meeting has featured the ingenuity of our members and highlights the how fundamental the Makespace is for research activities across disciplines. We also hosted two research workshops in July and September 2017, respectively: Making Spaces, co-led by the Institute of Education, and Material (Im)Mobility in Past Societies.

Our research program is overseen by our Research Manager, Beth Munro, who is also an archaeologist and expert in ancient materials recycling. As research is at the core of what we do at the Institute, we rely on members and academics throughout UCL and beyond to expand our project portfolio and push boundaries of multidisciplinary materials and making research. We are delighted to see our research projects and interests expand every year.

Fit-for-purpose, affordable body-powered prostheses
EPSRC EP/R013985/1 (£1,390,144)

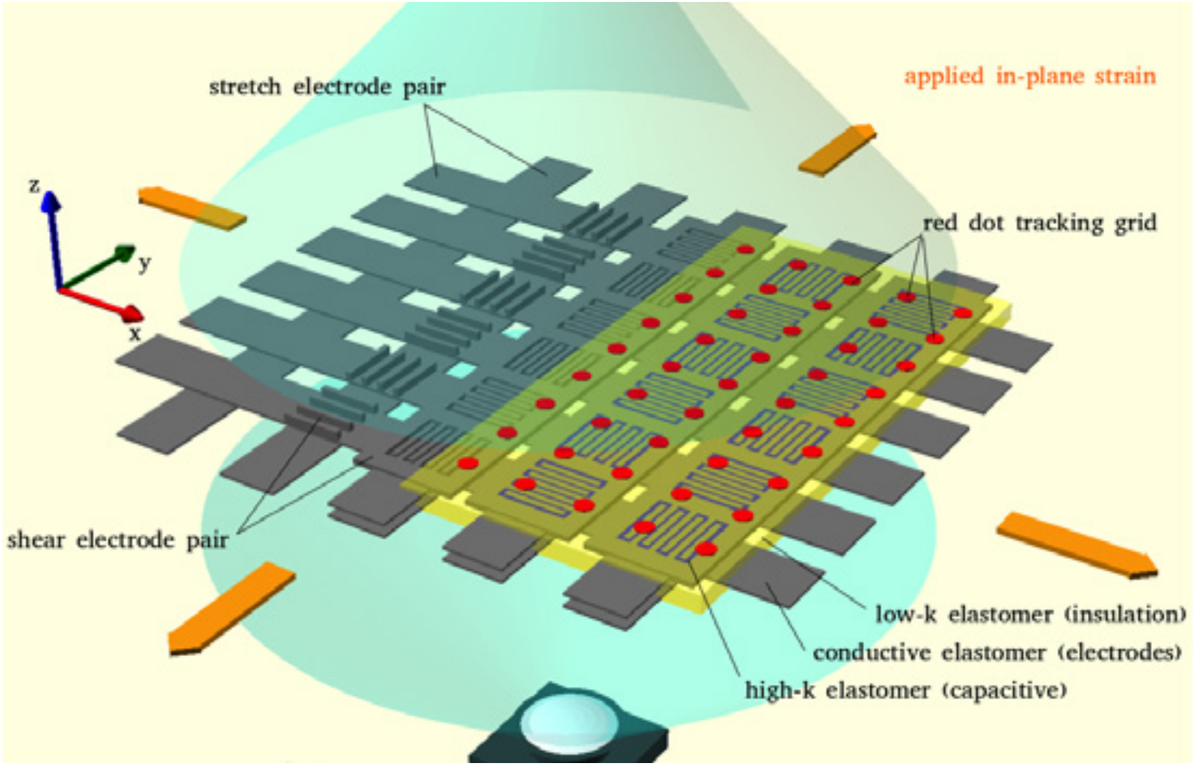
Upper limb loss can have devastating results for the individual, particularly when people are already surviving at a subsistence level. Demand for upper limb prostheses due to conflict and road traffic accidents is high in lower and middle income countries (LMICs), but provision is very poor, depending on costly imported components and scarce, poorly trained prosthetic services; maintenance is a major challenge. Body-powered (BP) prostheses have seen little development since the early 20th century, despite high self-reported rates of rejection. Nevertheless, BP prostheses are well suited for use in LMICs, being potentially simple to manufacture and maintain. If the reasons for rejection (e.g. limited functionality, cost and heat-related discomfort) can be addressed, BP prostheses offer a potentially viable solution.
This three-year project brings together an experienced team from across the UK, Uganda and Jordan to create a new BP prosthesis that is optimised for adoption by LMIC prosthetic services and acceptable to LMIC users. This will include establishing methods of fabrication, fitting and evaluation of the prosthesis which are appropriate to LMICs. An important element of the work will be to identify LMIC appropriate materials and fabrication methods. The aims will be to utilise local materials, simplify manufacture, minimise cost, and enable local repair and maintenance.

This project is led by Professor Laurence Kenney, (University of Salford), with Dr Cathy Holloway (Global Disability Innovation Hub) and Prof Mark Miodownik (Institute of Making) as research investigators from UCL.

Developing bespoke flexible sensors for prosthetic and orthotic liners EPSRC EP/N02723X/1 (£18,996)

It is considerable engineering challenge to make prosthetic and orthotic liner materials that ensure mechanical transmission of forces while ensuring comfort and prevent skin damage on a user. With funding from the Medical Devices and Vulnerable Skin Network – Research Stimulus Fund, this project aims to create a liner material that can sense pressure and sheer forces within a prosthetic or orthotic device, providing data as real-time feedback to the user allowing them to prevent their skin becoming damaged. Led by PhD student Ben Oldfrey (UCL COMPLEX), the project also works collaboration with Prof Mark Miodownik (Institute of Making), Dr Cathy Holloway (UCLIC) and the Global Disability Hub.

The technology combines existing stretchable sensors with computation to create an intelligent system that adapts to the user allowing them to monitor the vulnerability of their skin to damage. This project will produce a prototype of the technology and make available online a full open source toolkit to allow others in the EPSRC Vulnerable Skin Network to build upon and apply this system to other applications.
www.instituteofmaking.org.uk/research/developing-bespoke-flexible-sensors-for-prosthetic-and-orthotic-liners

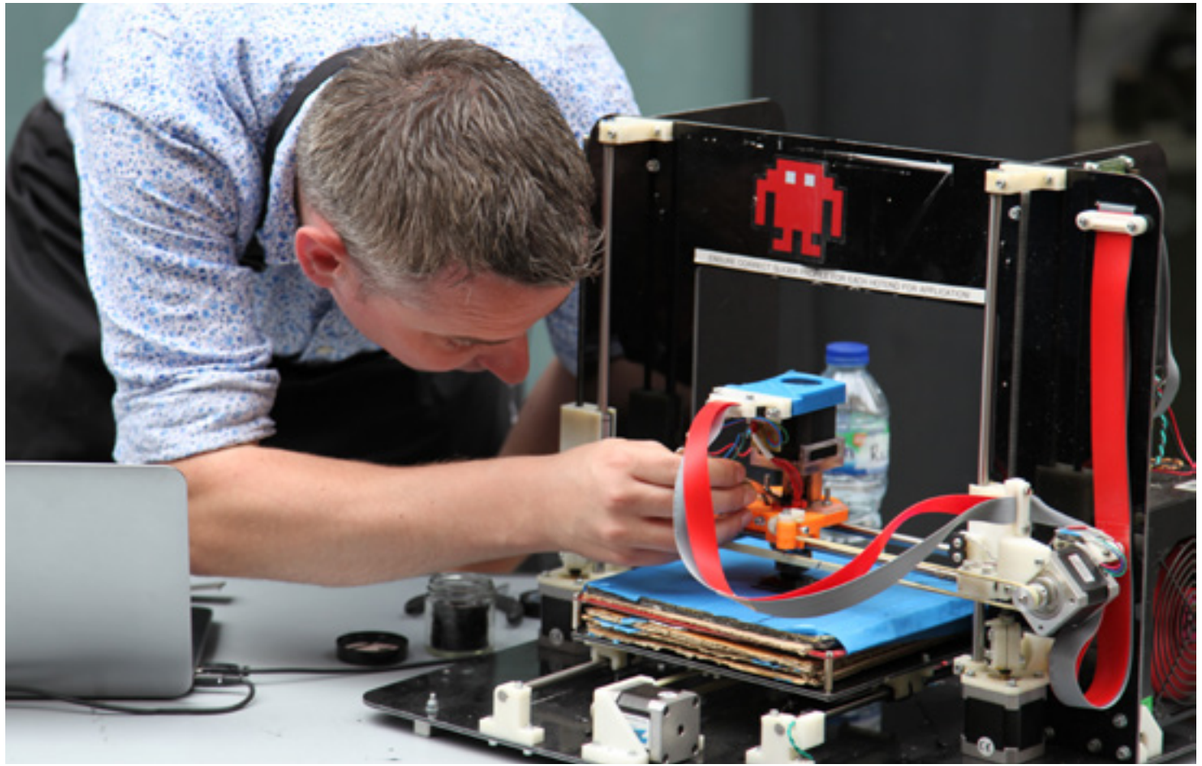


Self-Healing Cities
EPSRC EP/N010523/1 (£5,247,017)

This EPSRC Grand Challenge project is led by the University of Leeds and involves academics at the University of Birmingham and University of Southampton, as well as local councils and industrial partners. The project takes it inspiration with a vision of a city where the infrastructure is autonomously and dynamically diagnosed, maintained and repaired by robotic systems.

Institute of Making Director Mark Miodownik and post-doctoral fellow Dr Richard Jackson are leading on the materials aspects of this project. They are developing technologies for robotic repair and maintenance of city infrastructure. This includes assessing non-conventional materials for suitability in repair of infrastructure, and designing new 3D printing techniques designed for mobile robots. The ultimate aim of this project is to improve the resilience of the UK city infrastructure through materials research and engineering.

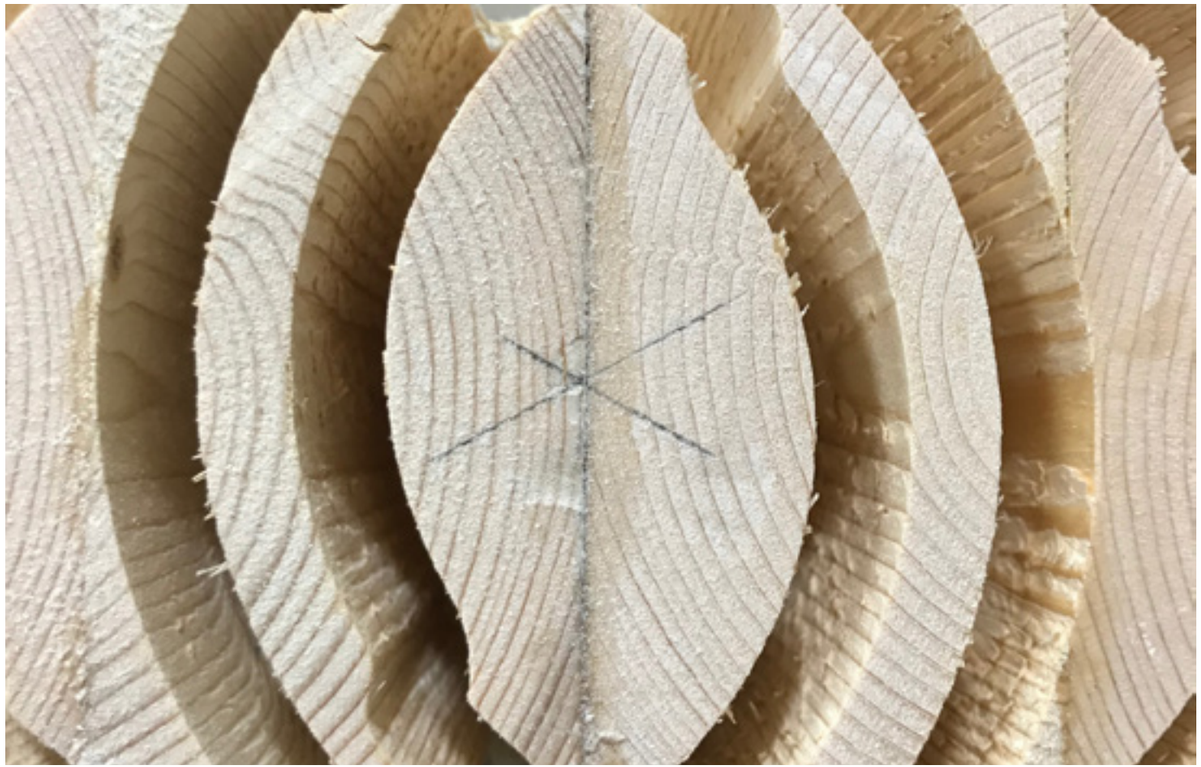
This year the project team hosted a two-day robotics challenge event bringing academics, industry, policy makers and stakeholders together to explore a future use of robots in the creation, inspection, repair and maintenance of critical infrastructure. The UCL team contributed to the 3D-printing drone demonstrator for road repair.
www.selfrepairingcities.com



Centre for Nature Inspired Engineering
EPSRC EP/K038656/1 (£4,980,773)

The Centre for Nature Inspired Engineering at UCL is now in its fourth year, and the number of researchers at the centre is growing. Rather than imitating nature out of context or succumbing to superficial analogies, research at CNIE takes a scientific approach to uncovering fundamental mechanisms underlying desirable traits, applying these mechanisms to design and synthesise artificial systems that borrow the traits of the natural model. These systems, which include desalination membranes, fuel cells, catalysts, adaptive materials, or built environments, thus become endowed with the same desirable characteristic as their models in nature – cell membranes, lungs, trees and bacterial communities – with associated extraordinary performance, such as scalability, robustness, material and energy efficiency.

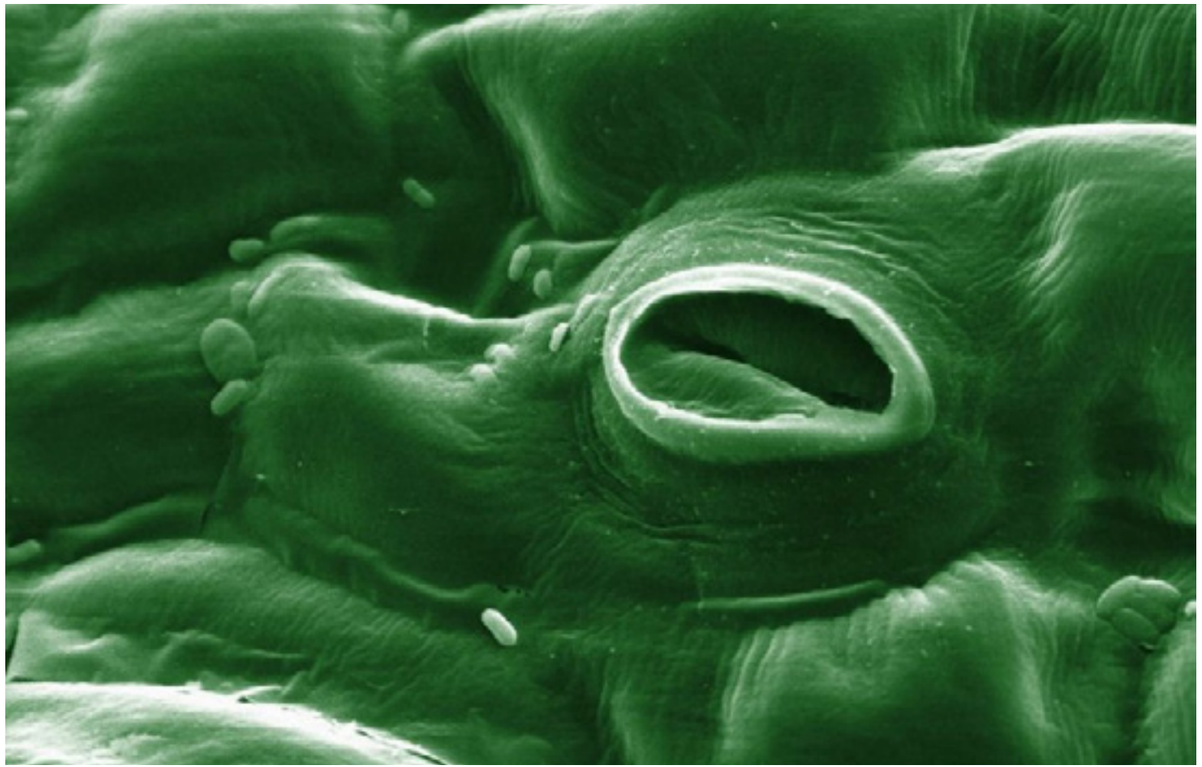
Institute of Making Director Prof Mark Miodownik leads one of the areas of research pioneered by CNIE: the theme of Dynamic Self-Organisation, studying self-organising, adaptive and self-healing materials that are able to adapt their structure and associated properties in response to a changing environment. An on-going collaborative PhD project on this theme is with Richard Beckett of the Bartlett School of Architecture entitled Designing Bioreceptivity – Architectural Biofilms. Another project on this theme, Robust Self-healing Fabrics for Soft Robotic Applications, was completed by PhD student Mark Ransley, and the resulting paper has had 2000 downloads.
www.natureinspiredengineering.org.uk



Nature Inspired 4D printing for biomedical applications
CNIE “Inspiration” Grant
EPSRC EP/K038656/1 (£29,769)

Many disabled people who wear prosthetics and orthotics on a daily basis face problems with temperature and moisture regulation where their stump interfaces with the prosthesis liner. This affects not just the person’s comfort but also their skin health. In nature, plants use millions of actuating micro-respirational pores to perform important physiological functions, such as regulating temperature and moisture level. Inspired by these functions, this project will investigate whether problems with temperature and moisture regulation in prosthetics can be solved by emulating plants’ micro-respirational pores.

Led by Dr Anna Polszajski (UCL Institute of Making) and in collaboration with Dr Cathy Holloway (Director, Global Disability Innovation Hub), and Dr Patrick Cullen (UCL Chemical Engineering), this pilot project will lay the groundwork for the long-term aim of creating a 4D printing platform to manufacture bespoke liners with actuating pores for prosthetics and orthotics wearers to regulate their skin temperature and moisture levels. 4D printing is the process of using additive manufacturing techniques (3D printing) to produce materials with programmable functionality. This first phase of the project will create new composite smart materials which actuate in response to various stimuli and are suitable for processing into pore structures by 4D printing.
www.instituteofmaking.org.uk/research/nature-inspired-4d-printing-for-biomedical-applications



Hands of X
EPSRC EP/N01006X/1 (£287,813)

Nowhere is the selection of materials more profound than for a prosthetic hand, which becomes part of its wearer's identity. Currently amputees can choose between hands in skin-coloured silicone gloves or cyborg-like carbon-fibre. Hands of X has explored a more nuanced choice of materials, chosen by the wearer, exploiting the possibilities of digital fabrication techniques whilst also drawing on a deeper cultural history of familiar materials; worn and handled.

In final six months of the Hands of X project, the team completed fabrication of simple hands based on individual wearers' material choices, designed the infrastructure for an affordable and bespoke prosthetics service, and prototyped the user's experience of it. The service prototype was held at Cubitts, London in June 2017, and capped off with exhibitions of the project at Cubitts and the Institute of Making's Festival of Stuff in July. The project has been documented in a book, produced at the Duncan and Jordanstone College of Art and Design (DJCAD), and a commissioned film.

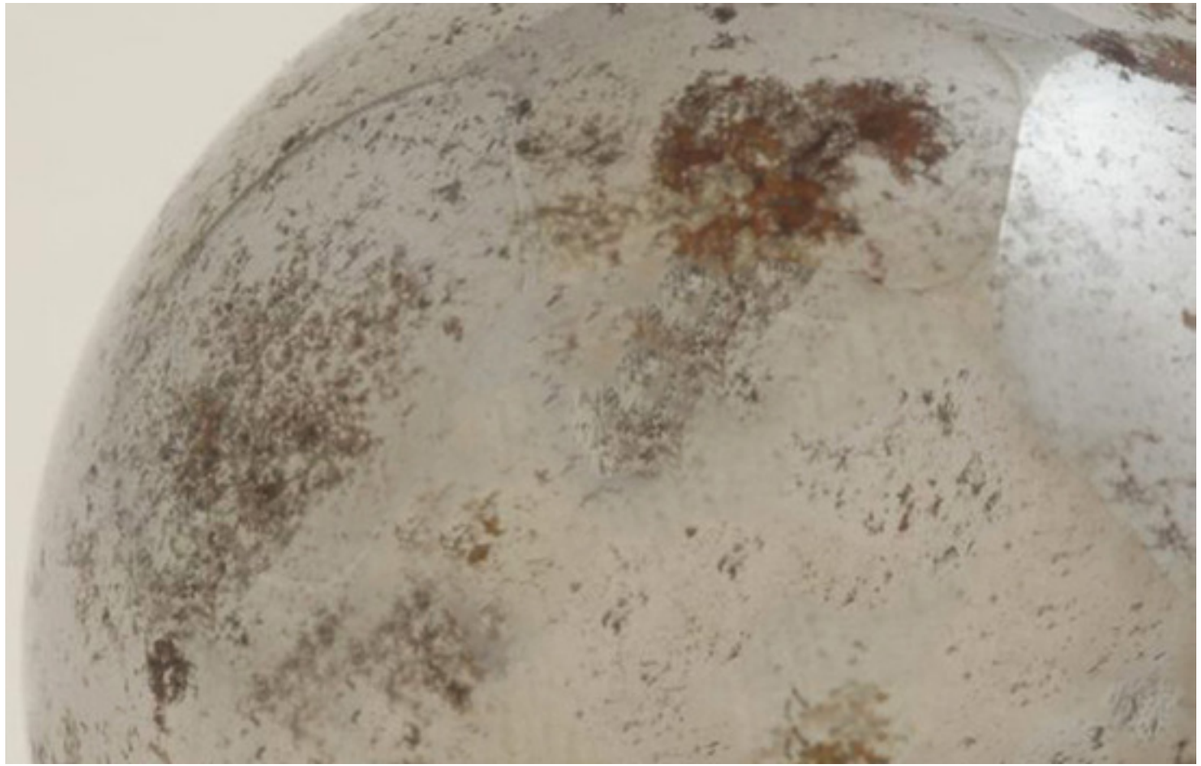
Hands of X was an 18-month collaboration between DJCAD at the University of Dundee, the Scottish charity and public access makespace MAKLab (which sadly has now closed), and the Institute of Making. The project was supported by the EPSRC; Finding Your Feet, a charity founded by amputees for amputees; the Royal National Orthopaedic Hospital, Stanmore and Steeper, makers of mechanical, electric and bionic hands.
www.handsofx.co.uk

Material Anxieties: The Perceived Health of Materials in Medical Products Wellcome Trust Medical Humanities Fellowship 200354/Z/15/Z (£200,556)

In this three-year project Research Fellow Dr Sarah Wilkes brings together a novel multidisciplinary combination of methods to better understand how materials developed and selected for healthcare applications impact on patient experiences in positive and negative ways.

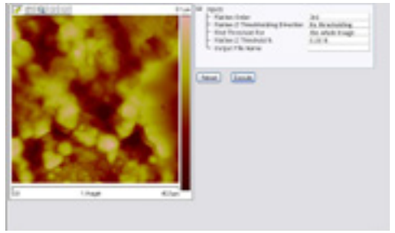
The project is now in its second year, and Sarah has spent 16 months doing ethnographic research and object-centred interviews with medical materials manufacturers, healthcare architects and designers, clinicians and patients to determine where materials have the most potential to influence patient health and wellbeing. This has enabled Sarah to funnel the focus of the project to a series of case studies that span formal and informal healthcare settings, different relationships with the body, and functional, sensory and aesthetic affordances of materials, including a study of materials selection for hospital furniture and for prosthetic limbs.

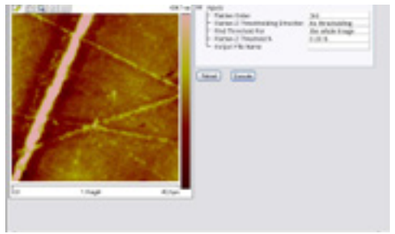
This period of qualitative research has also allowed Sarah to map out where concerns about materials intersect from a materials research, design and clinical perspective, to highlight gaps in existing materials research for healthcare and to identify communication problems between clinicians and designers. For example, it showed that the relationship between material choice and infection control is poorly understood in the design industry, and there is no clear and well-defined guidance to inform materials selection. Sarah has therefore developed a piece of service

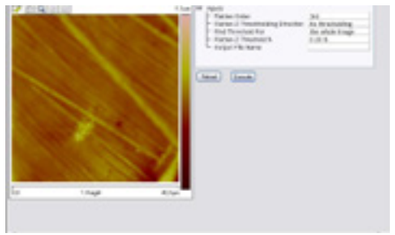


evaluation in partnership with the UCLH Clinical Microbiology team to address this problem, and is conducting quantitative materials analysis (Raman, XRF, AFM) in hospitals to create a database of material properties in high-touch hospital products e.g. bed rails, computer keyboards, patient call buttons. The resulting database will be used by materials researchers to inform the development of healthcare materials and by clinicians to inform their procurement practices. This work will also inform the development of a design tool to guide materials selection for hospital furniture.

The next stage of the project uses design research and psychophysical experiments to explore how the measurable physical properties of materials (e.g. surface roughness and topography) relate to psychosocial factors (e.g. perceived hygiene, body image, comfort and aesthetic preferences). This understanding will be used to influence healthcare design practice, inform research directions in materials science and identify and develop materials that better suit the needs of clinicians and patients.
www.instituteofmaking.org.uk/research/material-anxieties







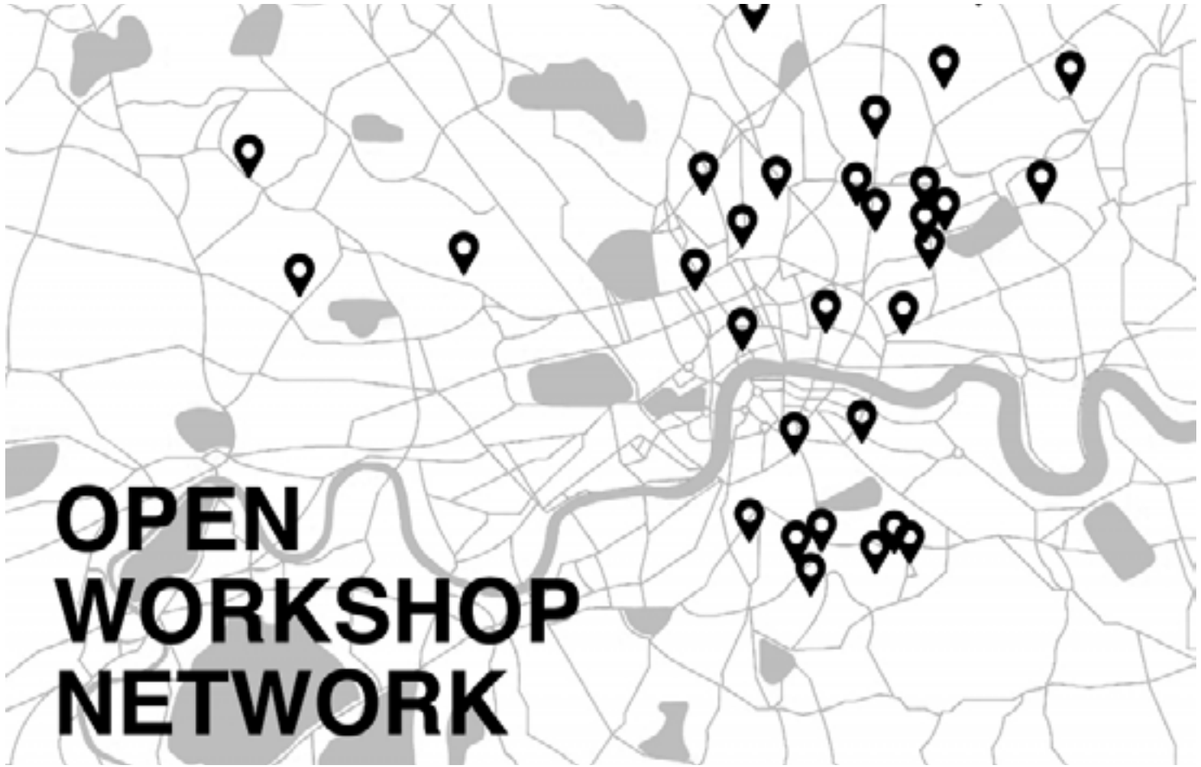
Open Workshop Network

The Open Workshop Network (OWN) is the doctoral research project of Liz Corbin. The research looks into the making community of London. Research is being done in collaboration with over 40 makerspaces, Hackspaces, Fab Labs and open workshops that comprise the network.

The project operates in a time where increased interest and speculation into the broader "Maker Movement" is taking place. The goal is to extend beyond anecdotal enquiry, developing a rich dataset that encapsulates the material, technical, social and cultural nature of this nascent and ever fluid culture. In-depth research is being conducted to identify the realities, triumphs and challenges that individuals and workshop collectives face in the day-to-day running of open-access, community-centred spaces for making.

A key aim of the project is to develop a method of research whereby respondents and participants play a more active role in plotting the course of inquiry. The workshops and individuals participating within the network collectively steer the direction of the project and hold co- ownership over the data that is produced. By adhering to this adaptable and responsive methodological approach, the project hopes to bridge the gap between academic research and the communities and individuals that are the focus of study.

One outcome of the project that is currently accessible is a digital platform that maps the open workshops in London. From printmaking to welding, 3D scanning to plaster casting, the OWN digital platform provides a place for people to learn about and connect with the many London-based organisations that are dedicating themselves to providing publicly accessible means for making.
www.openworkshopnetwork.com



Food and Transformation
BEKO (£287,813)

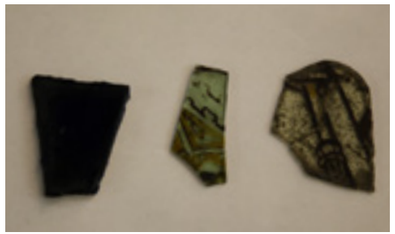
Food and Transformation is the PhD project of our former Makespace manager, Ellie Doney. The practice-led project examines how embodied research, via the sensory practices of cooking and eating together, can advance knowledge between disciplines about the nature of matter exchange between human and non-human bodies, asking how we become like the materials we spend time with. The method of research attempts to think through edible materials and their related transformative technologies/tools.

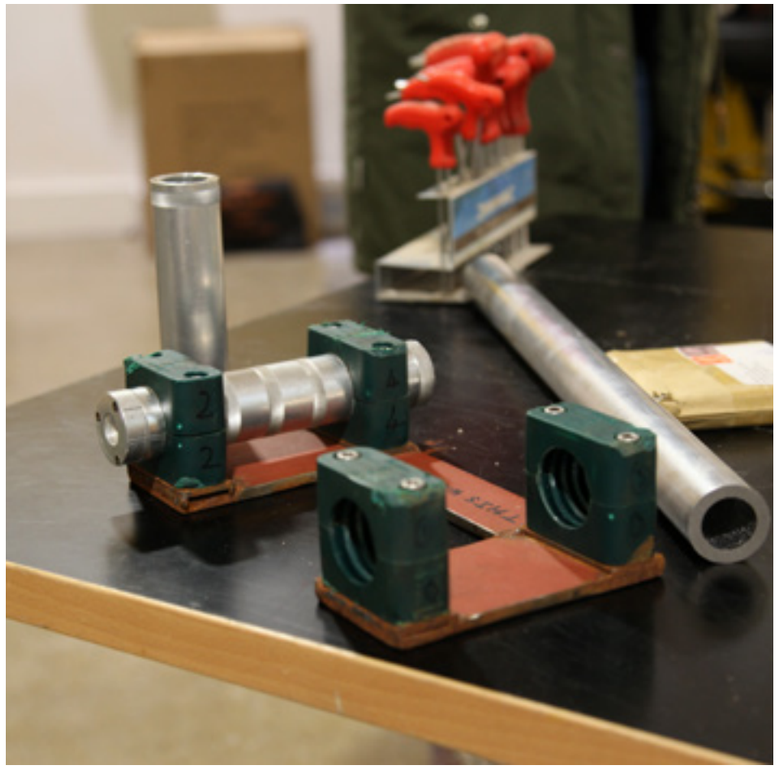
The PhD is joint-supervised by Gary Woodley at the Slade School of Fine Art, and by Mark Miodownik at the Institute of Making. It is funded by a studentship with the UK R&D arm of BEKO, a company that makes domestic appliances. Together Ellie and BEKO are investigating how the technology we use every day mediates our connection with edible materials. They are developing technologies that address food waste and childhood obesity, alongside future health concerns, such as understanding what is in our food, and the materials that it comes into contact with.
www.instituteofmaking.org.uk/research/food-transformation-how-are-materials-like-us

My Research Makespace
Research Seminar Series

In 2017, the Institute of Making hosted the first three talks in a new seminar series – My Research Makespace. This series, open to all members, highlights the making in our research and the research in our making, and how the Makespace fundamentally transforms projects and solves tricky research problems.

In October, Ben Oldfrey, a PhD student in UCL's COMPLEX, discussed the challenges of 3D printing flexible sensor skin, and demonstrated how sensors in different synthetic skins can work to give us 1D, 2D and 3D force readings. In November, we welcomed Laura Adlington, a PhD student in Archaeology, who produced a bespoke "spacer" using the 3D printers in the Makespace to analyse medieval window glass using a portable XRF. Her uniquely designed spacer allows Laura to control the accuracy of her results and means that she does not have to remove or destroy any of the medieval glass to conduct analyses. Finally in December, Stephen Long, a PhD student in Zoology, demonstrated how he made custom casings to hold lasers for scanning and measuring the deep-sea bed in the arctic waters of Greenland. Stephen's research focuses on the impact of deep-sea trawling on arctic marine ecosystems. We are looking forward to hearing about more multidisciplinary research in 2018.





Research Workshop: Making Spaces Institute of Education Seed Funding

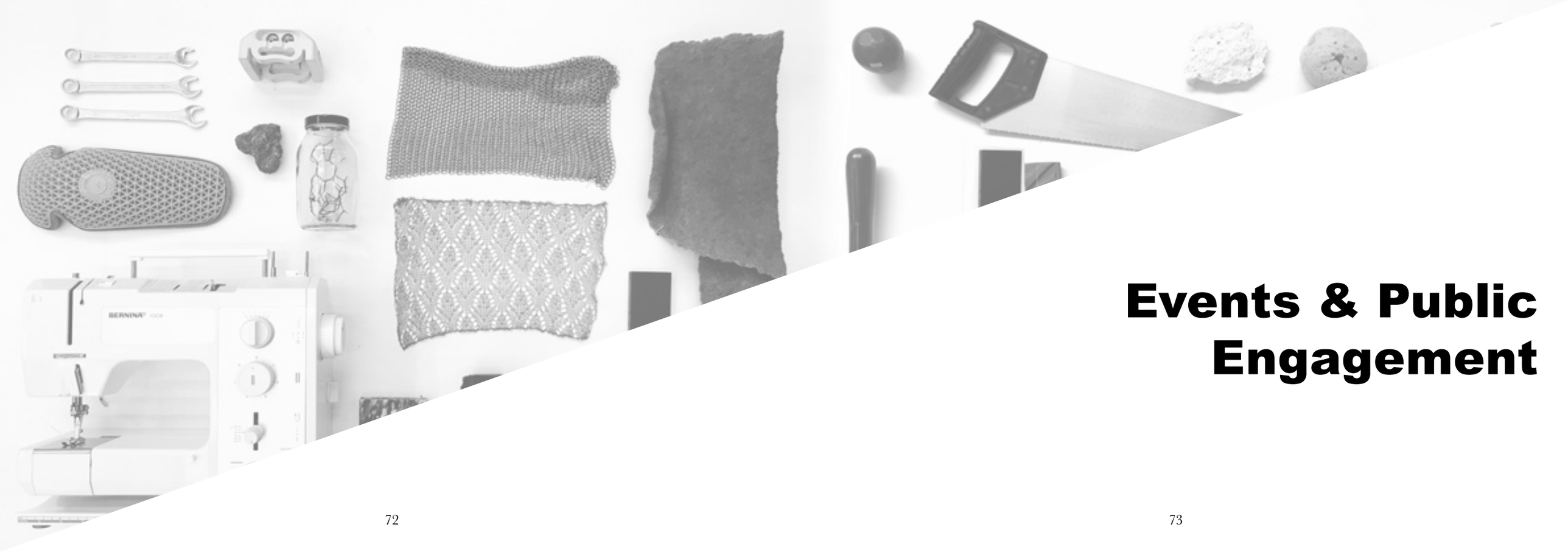
On 24 July 2017, colleagues from the education, museums, charitable, private, and HE sectors gathered at the Institute of Making for a one-day research workshop to explore how children and young people experience makespaces and how we, as various stakeholders, might enhance equitable practices in makespaces.

Led by Professor Louise Archer from UCL's Institute of Education, and made possible by the IOE Seed Funding Scheme 2016/17, four international panellists discussed best practices, challenges, and future development for makerspaces that engage with our youth. Participants also shared from their own experiences across different sectors in two breakout sessions, and Dr Edna Tan, from the University of North Carolina Greensboro, led an LED light greeting card making activity that exemplified equity making principles. The Institute of Making research team also facilitated wax finger candle and polymorph making at the start of the day.

Research Workshop: Material (Im)Mobility in Past Societies

Humans have profitably, meaningfully, pragmatically and ideologically transformed materials throughout history. In a one-day workshop held at the Institute of Making in September 2017, we brought together experts from a range of historical periods and disciplines to highlight and explore material flow in past societies. Talks focused on the social and cultural motivations for material reuse and recycling. Some of the objects we explored were the bi-products of 20th century manufacturing found on the shores of the Thames, recycled Roman glass found in an early medieval monastery, continuously reworked prehistoric iron axes detectable through chemical analyses, and the ideologically motivated melting of early modern religious relics into coinage. Throughout European history, our motivations for shifting, mutating, and altering materials have been many and varied.

One notable thread was the contrast between our wasteful modern societies and the lack of waste in historical societies. This was highlighted in our keynote talk, delivered by Dr Lucy Norris, on contemporary textile recycling in India. It seems as important as ever to be knowledgeable about those materials and objects we interact with in our everyday lives and the potential of these materials to be granted new lives by us, as human actors. There is great potential to learn lessons from historical material reuse and recycling to move towards a more sustainable material future.



Events & Public Engagement

"Hello to all of the lovely people at the Institute of Making. A massive thank you for such a wonderful Festival of Stuff. I was fortunate enough to attend the 'stool in a day' masterclass which was fantastic. Emma was a wonder at both her craft and at teaching. A special thank you also to technician Darren who was amazingly helpful and informative. My whole family delighted in the extravaganza on Saturday and we stayed from start to finish, sucking up all of the wealth of information and inspiration on offer. It all makes a huge difference to our lives and we really look forward to being able to benefit so highly from the public events. Many thanks!"
(Scarlet Burgess Turner)

Our firth year of events marks a period of heightened cross-pollination between the diverse people, pockets of knowledge, processes and projects that inform the Institute's activities. New events such as My Research Makespace and technician-led masterclasses put the expertise that plays a daily part in Makespace life into an event spotlight, allowing us to highlight the extraordinary knowledge and technical capabilities of our team and affiliates to members.

Our large-scale open days create new horizons for the public through collaboration with innovative external makers as well as UCL experts and labs. Most recently, our open day Faking It allowed visitors the rare opportunity to walk into the incredibly sophisticated technology of the VR CAVE, as part of seeing the state-of-the-art laboratories of our neighbours, the IVEL (Immersive Virtual Environments Laboratory).

The diverse range of people who have shaped our activity this year - including skilled deliverers, Makespace members, public audiences and a new Events Coordinator - brings freshness to the programme and creates a loop from which to draw inspiration. In this sense, the Institute's events do not solely inform our visitors'

professional practices and personal interests, but event participants inform programming; interaction with the Makespace environment inspires makers-in-residence; labs become playgrounds and students become teachers.

The events at the Institute of Making welcome anyone and everyone into our unique and personal world of making and materials, which our activities aspire to share in a surprising, joyful and hands-on spirit. We hope to inspire our members and the public to explore new areas of interest, acquire new skills and engage with experts in diverse fields of materials research and making processes.

From small specialist making masterclasses to public festivals for thousands of people, as well as talks, research seminars and outreach workshops, every event we run enables participants to gain an insight into the art and science of expert makers and discuss broader issues around materials and making. Our research workshops focus on specific themes and gather together experts and enthusiasts working in related fields to share their ideas. These events aim to create new interdisciplinary research collaborations.

From March 2017 to March 2018 we held 54 events, 29 of which were member events and 25 of which were public (see p. 138-140 for the full list of events). These included 27 masterclasses (including glass making and kintsugi), 10 research events (including My Research Makespace evenings and Material (Im)Mobility in Past Societies seminar), 3 Materials Library events, 3 outreach events, 3 large-scale public open days, 4 week-long events (including the Raft Race and Lorna Hamilton-Brown, maker in residence). All our events are extremely popular: many are booked up within minutes of release and form long waiting lists.

The events programme is developed and expertly managed by our Events Coordinator Sara Brouwer, with help from her brilliant team of volunteers.

The demand for our events far outstrips supply, and over the past year our events have attracted a total audience of more than 5000 people. To cope with this volume of people we recruit both UCL staff and students as volunteers, and work with groups of up to fifty volunteers for our large-scale open days. Therefore our events also serve to offer our wonderful and knowledgeable community of members experience of and training in interacting with and talking to the public.

"It was a great pleasure to visit the Institute of Making again. The Faking It extravaganza was wonderful! There are so many visitors. I didn't manage to take all the pictures I want, but I still enjoyed it very much."
(Fan Mo, open day visitor)

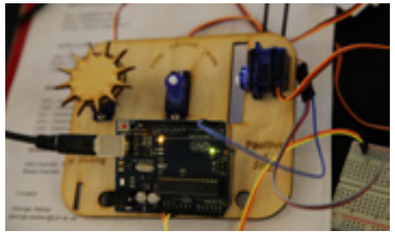
"This place is amazing. My kids have really enjoyed and engaged in the activities. We will come again."
(Mr Tooting, Festival of Stuff visitor)

"Many thanks @of_Making for having me at the #festivalofstuff My absolute favourite event! & so much pHun"
(Andres Tretiakov, contributor)

"Had so much fun volunteering with the @of_Making and so did they. Fake snow was mesmerizing kids and grown ups all the same."
(Anne Zakrzewski, volunteer)

Festival of Stuff
(Masterclasses)

Our five-day festival of making and materials once again brought back the most popular masterclasses of the year. The festival continued its unique tradition of giving the public free access to specialist tuition by master makers. The undeniable need and desire for such opportunities is clear; all 16 masterclasses sold out within 30 minutes of going live. Each day of the festival celebrated not just the skill of accomplished makers but, as events were carefully chosen to run alongside each other, also fostered exciting dialogues between specialist practices. The festival's first day explored mould-making, by setting NSEPS (Not So Expanded Polystyrene) in textile moulds and by mixing and casting concrete in silicone forms. Day two explored weather forecasting with Arduino code while, in the evening, participants sipped potato vodka and snacked on crisps, learning about the remarkable materiality of the potato with director Martin Conreen. The third day laid links between paper, print and paint, with Japanese papermaking, linoleum printing and paintbrush making. Joinery characterised day four, where traditional stool making ran side-by-side with a new heat shrink method called Bottle Joinery.



Festival of Stuff
(Open Day)

The terrific finale to the Festival of Stuff brought over 1200 people to the Institute of Making for an extravaganza of making and materials. The day took in tar 3D printing, plank guitars, a paddling pool filled with swelling dough. Director Mark Miodownik illuminated the life cycle of coffee from bean to bio-fuel, then helped visitors to roast and brew their own beverage which baristas Coffee Geek and Friends embellished with dollops of micro-foam. Patisserie legend Happy Endings Kitchen free stroopwafel ice cream sandwiches. Meanwhile, in a 'M.I.Y.' spirit, BentoBio exposed strands of people's DNA and turned these into jewellery pendants, another station created etchings with humble kitchen foil. Designers and makers Silo Studio led another improbable polystyrene moulding activity evocatively named 'alphabet soup'. An extremely popular making station led by artist Richard McVetis taught textural embroidery and stitching, inspired by Materials Library cubes. Inside the Makespace, Research Fellow Sarah Wilkes showed Marvellous Medical Materials and explained the multi-faceted ways in which materials impact on health and wellbeing, while on the mezzanine Hands of X exhibited their materials-led prosthetics.

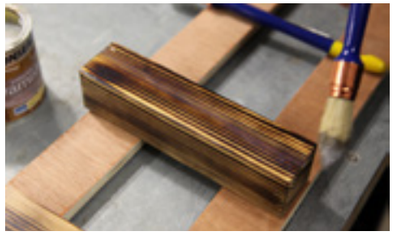
"Great to see so many interesting things at the #festivalofstuff. Not least the number of people absorbed in stitching with @richardmcvetis Great to see! #embroidery" (Kim Morris)

"Who knew you could make litmus paper with red cabbage? Thanks @of_Making" (Kate Poland)

"Shout-out also to Rick Powell demo-ing lathe carving at #festivalofstuff. Beautiful craftmanship. Passionate designer." (Yan Kay)

Bottle Joinery with Micaella Pedros (Public Masterclass)

In July, we welcomed back Micaella Pedros, social entrepreneur and product designer, to teach members of the public aspects of furniture-making processes using her unique plastic bottle joinery process which she developed while at the Royal College of Art. The masterclass began with a demonstration by Micaella, after which participants chose their own stone and wood components. They then learned how to burn, carve and varnish wooden parts as Micaella does for the aesthetic look and feel of her designs. Finally, brandishing heat guns, participants tried out the magical and highly satisfying technique of bottle joinery, which embraces the thermoplastic nature of polyethylene terephthalate and other plastics that are commonly used in the production of water bottles, to shrink plastics into a durable and highly secure joinery material.
Micaella says about her bottle joinery technique: “Millions of plastic bottles are used and thrown away each day, which makes it such an available material. Everyone comes across plastic bottles. It means that the ‘Joining Bottles’ technique can be applied everywhere in the world by anyone.”



Glazing Ceramics with Darren Ellis (Technician Masterclass)

Glazes provide a myriad of textural properties for ceramics, and the results vary depending on application, firing, combination and more. It's a tricky craft to master for even experienced potters; therefore who better to lead this workshop than our resident ceramics expert and technician Darren.

Our new technician-led masterclasses aim to provide members who have already been using particular Makespace facilities with more advanced skill training, whereas most of our other masterclasses are aimed at complete beginners. This simultaneously gives our technicians an opportunity to extend their teaching knowledge and celebrate the specialist skills that they build in their own practices. The Glazing Ceramics Masterclass was aimed at members who had already been making ceramics in our space, and who were looking to learn more about finishing their pieces through glazing. Darren led a fantastic session; he introduced members to common glaze ingredients, glaze recipes and mixing, different application techniques and tidying a piece once glazed, and finally ended the day with an exercise for participants to glaze their very own Darren Ellis ceramic mug.

Faking It (Open Day)

"Some of the crazy amazing things I saw today at the Institute of Making: VR Lab, Fake Snow & the Craft of Drag!" (Natalie Bayfield).

Our autumn open day brought together a blistering extravaganza of materials and making around the theme of deception and fabrication, bringing our most misleading and mysterious materials out of the shadows and into the public sphere.

The day was an enormous success with more than 1250 visitors joining in to experience everything from 'masquerading materials' to painting in Virtual Reality with the experts from UCL's Immersive Virtual Environments Laboratory. The Materials Library rose to the challenge with a gamified display of 'real or fake' material samples which illuminated understandings of authenticity in the made world. Meanwhile, in the Fake Over section, participants employed our tools, tricks and tips to make wigs and watched a spectacular demo of the craft of drag by the

talented Charity Kase. Other areas of the event explored hidden worlds of illusion, imitation culture and secretive objects, including fool-worthy Shabtis generously loaned by the Petrie Museum of Egyptian Archaeology and Mark Miodownik's personal collection of currency and counterfeits. In the energetic maelstrom of the event, visitors enjoyed a moment of calming reflection at the Quorn party sausage barbecue station or took a minute to play with the paddling pool of artificial snow.

"The Institute of Making Open Days are a great way to spend an afternoon learning about everything that makes the environment that we live in. You can explore old and emerging materials that will form the future and learn about new technologies too. Students and staff are on hand to showcase projects and guide you through practical activities which can be fun and educational too. My only criticism is that it can get busy and crowded which shows how popular these events can be." (Chetan Joshi)

Materials Library Evening - Potato Mish Mash and Chip Chat (Public Event)

A few days each year, we open up the Materials Library to the public for an evening of exploration, experimentation and play. In July 2017 we explored the materiality of the potato with our director Martin Conreen in a roof-raising lecture.

Martin was on hand to answer questions about the humble potato and illustrated that, while it has been an important part of our diet for over 7000 years, this marvellous tuber also has many other remarkable properties and uses. Demos and tastings took in potato products including vodka, glue, foam packaging, poison, microwave oven chips, medicines, ceramic potato peelers, a myriad of vitamins and minerals and rare species, leaving audiences generally amazed by tater-tales.

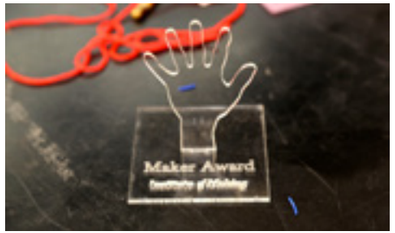
"Thank you, Martin and everyone involved in tonight's fascinating talk on and tasting of the potato."
(Jo Crighton)

Exercise Motivation Trainers Workshop (Outreach Event)

"Totally cool!!!" (participant)

In November, the Institute of Making collaborated with a group of intrepid young people to build smart footwear as part of an outreach workshop for Make:Shift:Do, a festival that gives young people the chance to get hands-on with digital making. Our workshop set a brief to design and build a system to motivate people to keep moving and assess levels of exercise, by hacking low-cost running shoes with electronics and code. Students were introduced to the Materials Library, and encouraged to carefully consider materials as part of their creative design process. Components included wearable Arduino, pressure sensors and programmable LEDs which allowed for a running shoe with pressure-sensitive pads to measure gait continuously during a running cycle. Skills explored during the workshop included sewing, product design, soldering, circuitry, and coding. Materials used included Materials Library staples such as reflective wool and polymorph, which participants were shown how to manipulate by the Institute's technicians.

"Really fun, an opportunity I wouldn't have otherwise had that let me experience a career I would never otherwise consider" (participant)



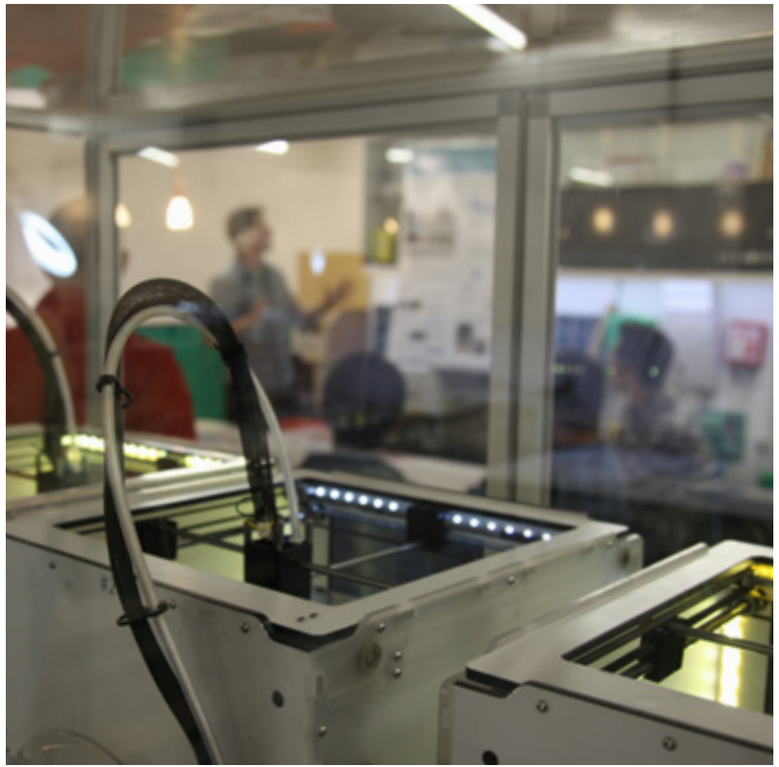
My Research Makespace (Research Event)

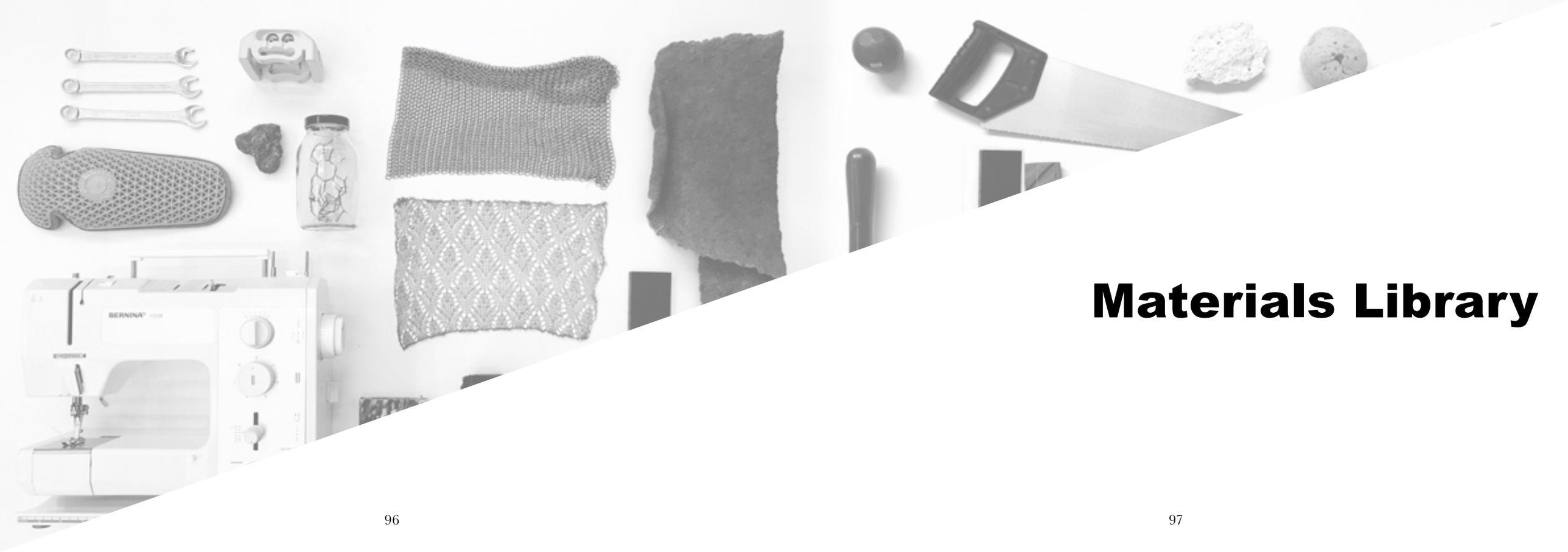
One of our final events of 2017 was also it's most epic, taking the Institute into the realm of deep-sea trawling, Arctic Greenland and underwater lasers. Stephen Long, PhD Student at the London NERC Doctoral Training Partnership, led our third My Research Makespace evening.

This new informal research event series sits along our more formal programme of research seminars and workshops. Each evening investigates how a UCL Researcher navigates the Makespace and uses hands-on making to develop their academic work. Stephen talked about producing low-cost video rigs in the Makespace to help his study of sustainable fishing in Greenland, and the impact of deep-sea trawling on benthic ecosystems.

Stephen's talk formed the last of a brilliant trio of events, which had already featured Ben Oldfrey, Centre for Mathematics and Physics in the Life Sciences and Experimental Biology (CoMPLEX) PhD, who creates and researches Flexible Sensor Skin Systems, and Laura Adlington, Archaeology PhD, who used 3D printing to further her study of medieval stained glass.

"Thank you again for the invitation to participate in the research workshop last month, I found it extremely enjoyable and useful. The existence of the Institute of Making has given me great hope that there are still spaces for real innovation within the constraints of current University life."
(Peter Bray)





Materials Library

The Materials Library is at the heart of the Institute of Making. It's home to some of the most wondrous materials on earth and acts as an ever-evolving source of inspiration for the Institute of Making membership and the UCL community more broadly. From materials engineered in labs, such as cylinders made of carbon aerogel, to materials engineered by nature, such as wasps nests, the Materials Library collection contains over 2,000 material samples and provides the material-minded and curious with a snapshot of the marvellous world that surrounds us.

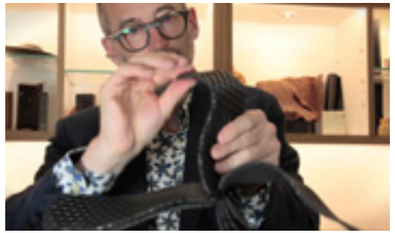
The Materials Library is open to all Institute of Making members on a daily basis. We run events, workshops and consultancy sessions to provide members with a variety of ways to engage with, learn from, and contribute to the collection. The Library is also open to the public on open days and public events such as the Materials Library Evening series. All of this would not be possible without our fantastic team of Materials Library volunteers who help to manage the collection, curate the Library, and bring to life the many stories behind the materials within the collection.

This year saw the development and launch of the Mobiles Materials Library Collection, done in collaboration with UCL Culture. This curated collection of materials alongside a wide range of lesson plans and mixed-media content will tour East London secondary schools to inspire the next generation of materials scientists, engineers, designers and artists.

The Mobile Materials Library Collection

This collection has been specially curated to represent emerging fields across materials science, engineering and design. It also provokes student-lead inquiry into the big questions facing the materials community today, such as how to design cradle-to-cradle products and how to tackle packaging waste through circular economy principles. Through a mixed-media approach, the Materials Library team, in collaboration with UCL Culture, have designed and developed creative learning plans that encourage students to explore materials through hands-on experimentation and self-initiated curiosity. Students are supported through in-school demonstrations, on-line interactive films and how-to activities that can be done in class alongside the mobile collection.

Through exploring the mobile collection and connecting to its bespoke creative learning content students are able to explore not only the physical properties of materials, but the wider environmental, technological, and social contexts that materials influence through novel application. Importantly, through exploring the collection and its many activities, students are encouraged to create and test wholly new materials and applications –empowering them to become the next generation of material inventors.



Materials Library Volunteers

Valerie Ngow Yingli, 4th Year, Mechanical Engineering with Business Finance.
"Being a Volunteer here has given me the opportunity to meet with students from other courses. Within the Materials Library there is a different dialogue and engagement with materials than within my own course, which I find enriching."

Valerie has been an integral part of the Institute of Making since 2015, during which she coordinated the development of the Materials Library Health and Safety Plan. She has since been the driving force behind streamlining the Library's digital cataloguing and database management efforts. Valerie particularly loves the Wasp Nest within the Materials Library collection because she feels it represents the ingenuity of nature's engineered systems.

Anja Petersen, 1st Year, Masters in Fine Arts (Sculpture)
"Being part of the Institute makes me investigate materials that I wouldn't normally pay attention to. It is exciting to discover materials that I can connect to sculpture and possibly use in the future."

Anja has been involved with the Library's cataloguing and material profiling efforts. She has also been a key part in the reorganization of the Material Library stores – helping us to uncover and display some of the hidden jems within the collection. The most exciting material Anja has come across in the Library is the fibrous stainless steel. She is intrigued by its contrasting soft, fragile look and its mechanical strength. The Materials Library has allowed her to explore more materials and she hopes to find ways of integrating them into her sculpture practice.

Kiar Cher Shen, 2nd Year, Biochemistry
"On my first day, I discovered a packet of face cream containing gold particles as an active ingredient. It inspired me to think about what other type of nutrient-rich materials I could study and develop within my own research."

Cher Shen has been involved in the Library's efforts to digitise the materials collection. Cher Shen enjoys the friendly, multidisciplinary and innovative environment of the Institute of Making. Whilst he does not deal with materials in his course, he hopes to find creative inspiration from the materials collection for his course work and future research projects.

Xiong Yuelin, Masters in Biomaterials and Tissue Engineering
"Being able to explore and research the Materials Library collection in a hands-on way has taught me how the physical appearance of materials can help me to distinguish and understand other materials with similar properties and functions."

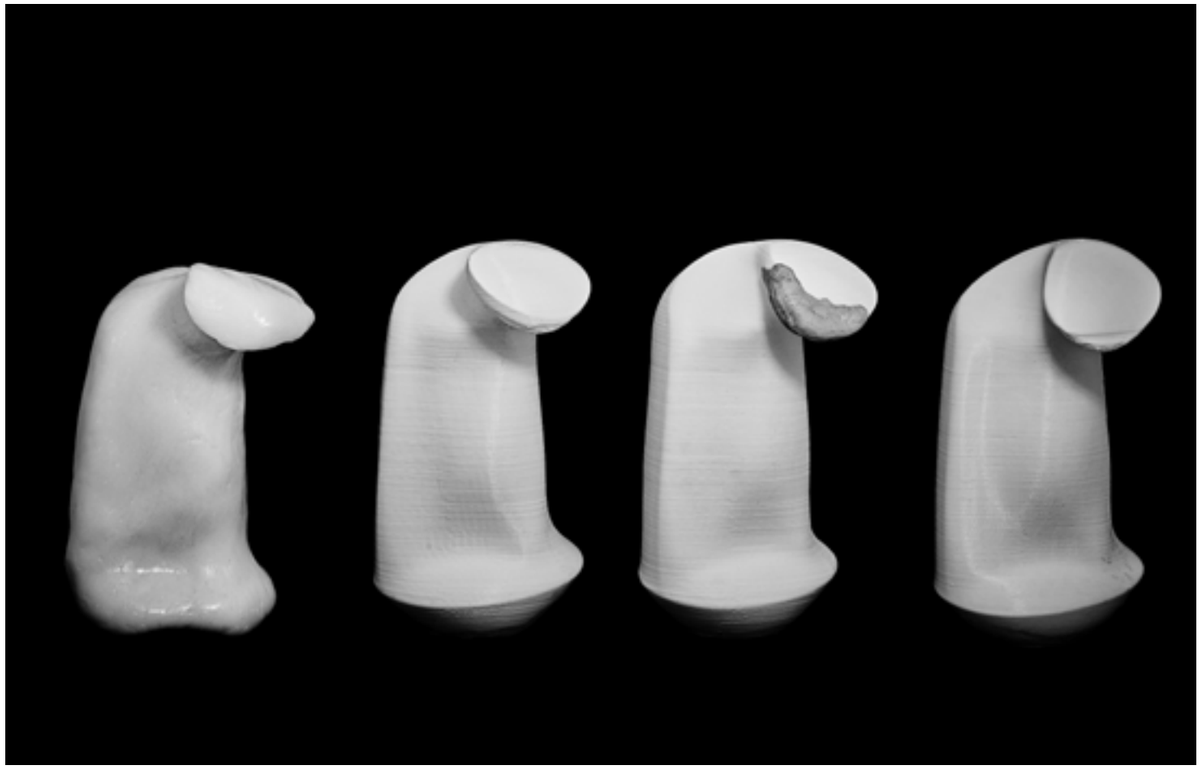
Yuelin has been involved in researching and writing about the materials in the collection. Working with the materials has made her more aware of the materials around her, from her clothes to the food she eats. A memorable Materials Library moment was when she found some artificial skin which felt soft and sticky to the touch. It was an exciting process for her trying to figure out what it was and what it was used for.

Thermo-soft plastics for rapid prototyping

These are handle prototypes made by Director Zoe Laughlin as part of the BBC series The Big Life Fix for a man who has lost mobility in his hands. The handles are designed to attach to basic cooking equipment like whisks, spatulas and mixing spoons. Customising the handles of such cooking instruments has now enabled the man to cook with his young daughter; an activity they previously enjoyed together prior to his loss of full function in his hands.

Rapid prototyping, as illustrated in these handle iterations, is a key component of the engineering and design process. Highly flexible and mouldable materials enable the forming, breaking, and reshaping of prototypes rapidly and in response to user feedback. These prototypes are made of two thermo-soft plastics: polycaprolactone (PCL) and polylactic acid (PLA), both of which have relatively low melting points of 60°C and 200°C respectively. The first prototype is made of PCL pellets, often commercially referred to as polymorph. The PCL pellets were softened in hot water to form a molten mass that was hand moulded into the negative space of the man's hands. PCL is an ideal choice here as it can be softened repeatedly without loss of material integrity. Using a 3D scanner, these prototypes were digitised into an initial Computer Aided Design model. The second prototype was then made of PLA, extruded and cooled in layers by a 3D printing method called fused deposition modelling. PLA is well suited to 3D printing given its melting point and quick cooling time. This second stage prototyping method, which combines 3D modelling and printing, is more accurate than hand shaping with PCL.

Particularities: State: solid Category: polymer
Relationships: polymer, thermo-soft, 3D printed, design process, prototyping

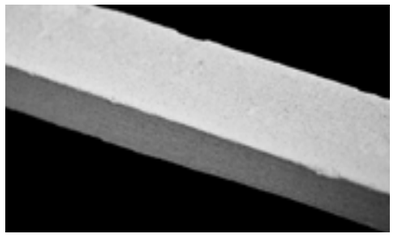


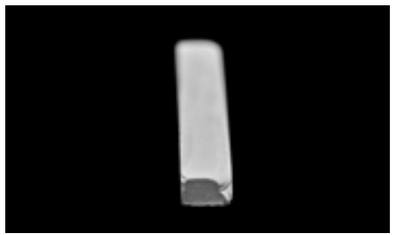
Chitosan

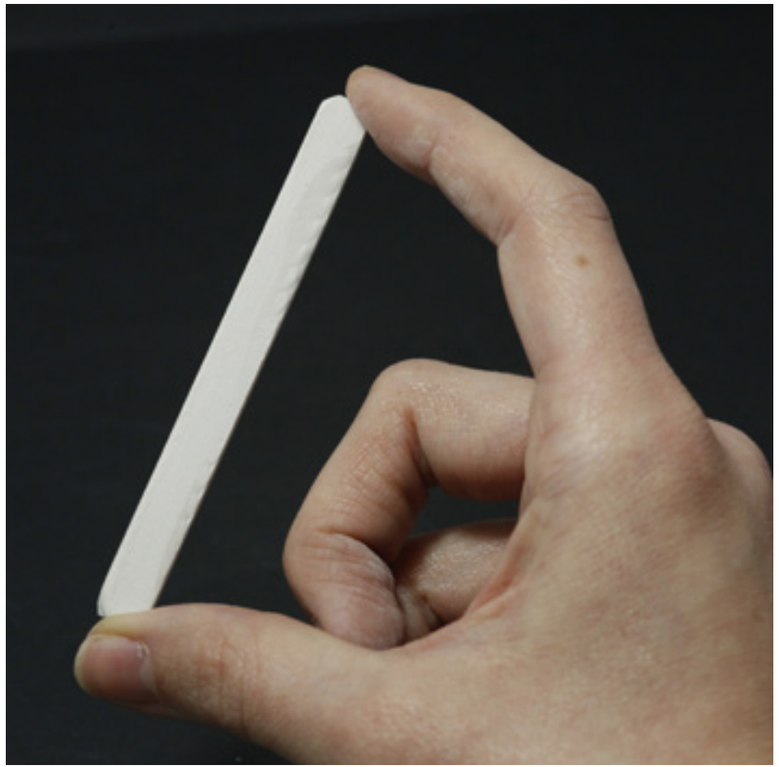
Chitosan, pronounced kaɪtəsæn (kai-the-zen), is derived from chitin -the naturally occurring polymer that makes up the bulk of fungi cell walls and the hard-outer shells of crustaceans. Chitosan was first identified in mushrooms in 1811 and has since found potential in many industries. It is used in bio-pesticides and fertilizers for agriculture, as a bulking and strengthening additive in paper, within bandages because of its antibacterial properties, and most controversially sold as pills to aid in weight loss.

This sample of chitosan is made from mussel shells collected from local restaurants and supermarkets. The mussel shells were ground up to form a fine powder and combined with a mixture of alginate and water in order to form a paste that can be extruded using a ceramic 3D printer. This material and its printing process are the result of academic research into circular product design and development. The research aims to develop new materials made from locally abundant nutrients as well as new additive manufacturing technology that when paired with these new materials reduces the amount of material waste produced within the manufacturing process. Chitosan is particularly ideal in this study as it is fully recyclable, biodegradable and non-toxic to the environment. Nor does it require intensive energy or other resources to produce, in fact, it makes use of waste materials produced from shellfish consumption.

Particularities: State: solid Category: animal
Relationships: additive manufacturing, mussel shells, crustaceans, biodegradable, environmentally friendly





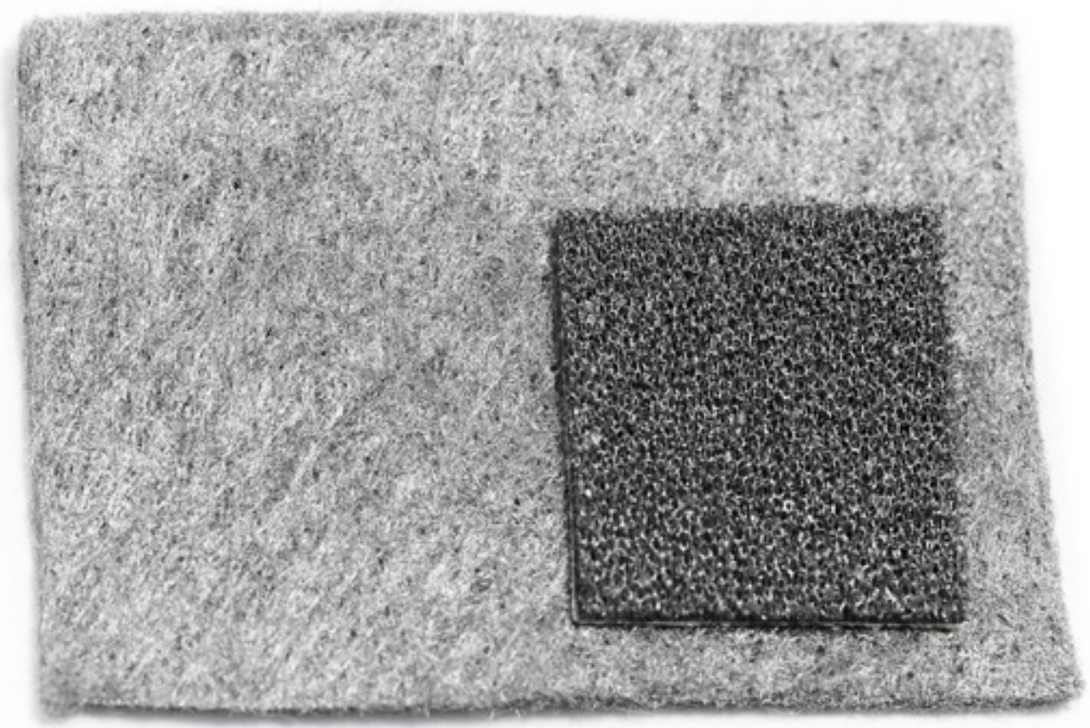


Conductive foam and felt

Conductive foam and felt are materials that can conduct electricity. The foam is made from polyurethane (PU) with a copper and nickel coating. The felt is made from a non-woven polyester coated in nickel. Interest in conductive foam and fabric are due to their weight and flexibility compared to current electrical components and wiring.

Apart from conducting electricity, these materials are commonly used in dissipating static electricity, lending them to the nickname Flexible Faraday Cages. Conductive foams and felts are also being explored as a replacement for pressure sensors with novel applications including “stun-gun proof” clothing and lightweight shielding for aircrafts.

Particularities: State: solid Category: polymer
Relationships: shielding, conductive, fabric, foam, flexible



Carbon Aerogel

Carbon aerogel is an organic aerogel that has undergone pyrolysis. Pyrolysis is an irreversible process of dehydration or thermal decomposition in an inert atmosphere. The process involves high temperatures of 400°C to 1100°C and one to twelve hours during which non-carbon matter is expelled. Carbon aerogel is commonly derived from the organic resorcinol – formaldehyde (RF) aerogel. The result is a black carbon aerogel that has a consistency similar to that of activated charcoal. Additionally, it is highly porosity with a high surface area and electrical conductivity.

Common uses of carbon aerogel focus around energy storage. It is currently used as an electrode within super-capacitors because it can store a large amount of charge and rapidly release the stored energy. In the future, carbon aerogel could improve current lithium ion batteries as it can charge and discharge more quickly.

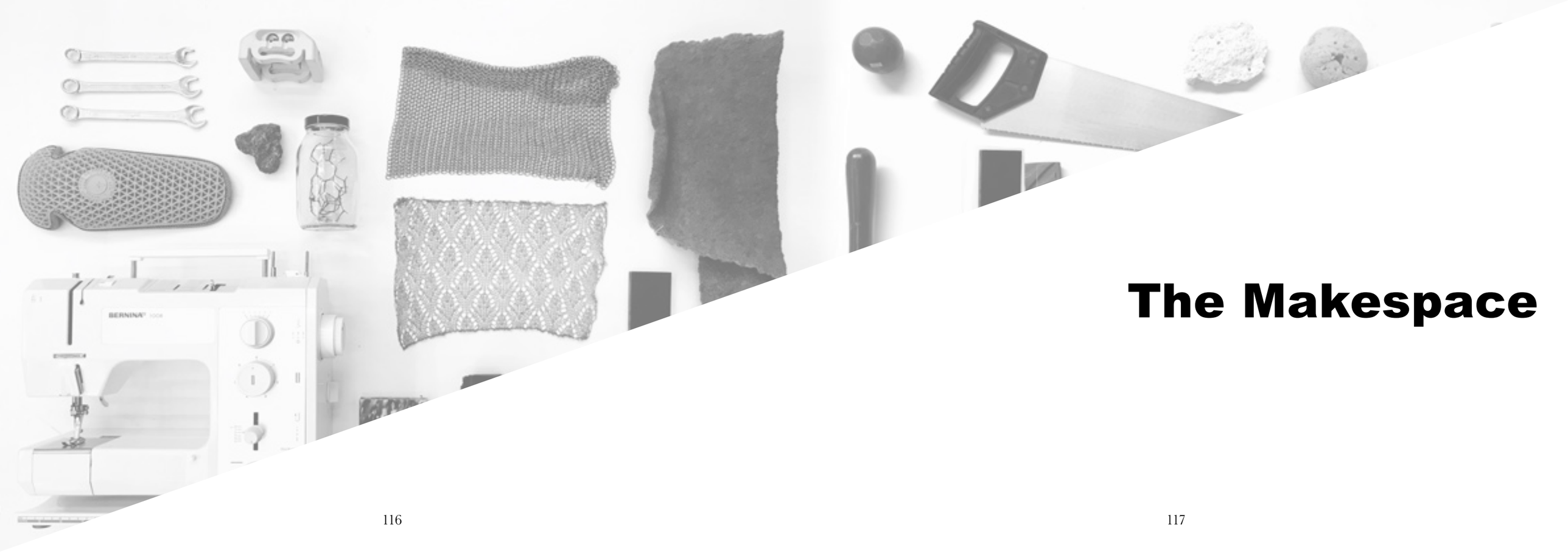
Particularities: State: solid Category: polymer
Relationships: carbon, lightweight, foam, energy storage

Gallistan

This silver, reflective liquid is an alloy of gallium and indium. It is known as a eutectic alloy, meaning that the proportion of gallium and indium within the mixture creates the lowest melting point that is possible to obtain. In this case, the eutectic is composed of 75.5% gallium and 24.5% indium and boosts a melting point of 15.7 °C. Alloys of very low melting points such as this are often referred to as liquid metals. More commonly, we know of mercury, but gallium-based alloys are lower in vapour pressure, highly conductive, and non-toxic. Therefore gallistan is becoming a common replacement of mercury in numerous applications.

Because liquid metals have a thermal conductivity far superior to that of non-metallic liquids and can efficiently transfer energy from heat-source to liquids, they are typically used within thermostats, switches, barometers, heat transfer systems and thermal cooling and heating designs. Uniquely, they can be used to conduct heat and/or electricity between non-metallic and metallic surfaces.

Particularities: State: liquid Category: metal
Relationships: gallium, indium, eutectic alloy, conductivity, liquid metal



The Makespace

The Institute of Making is a whirlwind of activity with the Makespace and Materials Library at the centre of the excitement. The Makespace is filled with members spilling into the Library to work on projects amidst its inspiring array of materials and objects. It is a place where members come to learn new skills and share old ones. It is a place for events and masterclasses. It is a unique place where all of UCL can mix with the expert guidance and support of our knowledgeable and welcoming staff.

The motivations of members who use the space are as diverse as the members themselves. Some come to the Makespace to support academic research projects while others are pursuing personal creative explorations. One member may be sewing a modified strap to their cycling bag, another milling a component for a machine, and another quickly making a crate to move an important bit of lab equipment. All of these making practices are embraced in the Makespace.

Through all of the prototypes, experiments, problem solving and craftsmanship, our strength, especially, is in our members. We are continually amazed by their curiosity for materials and love of making. Their projects delight and surprise us in their breadth and creativity and sometimes sheer wackiness. In this section, we highlight the making journeys of a few of our members. We hope this will give a feeling of the diversity, curiosity and imagination of our member community.

The workshop and library that is the Makespace is more than a collection of useful tools and interesting objects, it is a place for our members to meet, collaborate and gather. Impromptu creative teams form, friendships materialise and work colleagues meet in person eschewing the virtual in favour of the face to face.

"If I didn't know how to do something I could ask for help and get it. It was a friendly vibe between members who were really interested in what we were doing and really collaborative. If I had a problem with something I probably could find the answers."
(Maheen Faisal, member)

Ellie, our former Makespace Manager, has transitioned to her new role as a researcher as she pursuits a PhD at the Slade. Her practice-based research explores food and transformation by experiments in cooking and eating with people across disciplines, to travel the borders between human and non-human matter. Her research activity is driven by her enthusiasm for unwrapping the many layers of properties within (other) matter, and finding out how we interrelate.

We have welcomed a new member of the team, Necole Schmitz, as Makespace Manager. She brings a love of materials and making process that permeates all her work professionally and personally. She is an artist who has a technical background teaching the processes used in traditional lost wax foundry work and metal fabrication. After working in art and design focused environments for most of her career, she was drawn to the Institute of Making because of its diversity of members and projects.

"As my making interests and projects have widened, I felt the Institute was a great place to explore making and develop professionally. Whether it is streamlining some of our workshop practices or sewing tipi's in my spare time, I find the Makespace an exciting and stimulating environment to learn."
(Necole, Makespace manager)

Necole Schmitz
Makespace Manager

Necole is an artist who is interested in materiality and the tactile experience of objects. She has a diverse making background and uses a variety of materials from thatching wheat to dancing to steel to textiles in her work. She studied painting and history of art at Boston University before moving to London and completing an MA in fine art at Chelsea College of art, where she became interested in foundry work and the excitement of molten metal.

Her training is in mould making, lost wax metal casting and other foundry work as well as metalwork and fabrication. She has a studio in London as well as an ongoing collaboration with an artist run foundry in Dorset. Currently, when not at the Makespace, Necole is fabricating a cupola furnace for smelting iron.

Darren Ellis
Technician

After Graduating in Ceramics, Darren apprenticed with internationally renowned potter Lisa Hammond as a small batch production thrower in South East London before becoming self-employed to exhibit his own domestic ware for the use of cooking, serving and presenting food. Prior to his formal education, Darren's background was from the family business, a small textile mill, in the north of England. Here he worked with Victorian machinery to process textiles or repair and refabricate them. From this he learned to work with clay and the equipment needed to produce ceramics, such as learning to build and operate kilns; this acquired knowledge of traditional methods has fed Darren's problem-solving skills, which he enjoys passing on to those around him at the Institute of Making.

Romain Meunier
Technician

Romain is an artist, designer and creative technologist. His work takes the form of interactive installations, product design or window display developments. He draws inspiration from people's relationship with technology and its rapid evolvement. Romain likes mixing a variety of digital and analogue technologies; his work tries to reconcile the virtual and the physical world, bringing together data flows and human senses.

Growing up with a dressmaker mother and a mechanic dad working in carpentry, Romain has always been surrounded by craft and he considers himself an artisan of new technologies.

George Walker
Assistant Technician

George is a creative technologist, sound engineer and graduate of the Music Informatics BSc course at The University of Sussex. He has worked on a broad range of digital projects from physical music controller hardware to generative software art. He is also part of the teams behind the Eyeduino workshops, the robot Ohbot and the band Fatlion Hi-Fi. He is interested in music, programming, crowdfunding and of course making, and joins the team as an Assistant Technician with particular responsibility for the digital tools in the mezzanine.

Member supervisors

Member supervisors are a crucial part of the success of the Institute. Alex Kanellopoulos, Anne Zakrzewski, Becky Lee, Ben Oldfrey, Eamon Hassan, Evangelos Himonides, India Davies, Kevin Green, Laura Dempsey, Prashanthan Ganeswaran, Thore Bucking and Valerie Ngow go beyond their normal remit to formally use their skills to help other members. They teach pottery, laser cutting, 3D printing and other skills to fellow members as part of the weekly tool trainings. They guide new members through the unfolding resource that is the Materials Library and help to digitise its catalogue so that it can be viewed around the world through the Institute of Making website and the Materials Library app. They help events and open days run smoothly, becoming a vital part of our public facing programmes.

In regard to using the Makespace as a base for his work, member supervisor Kevin Green says, 'I believe in it, so coming here is a way of supporting it', and that the Institute of Making is 'really materials based and open to many different things for thinking through making.'

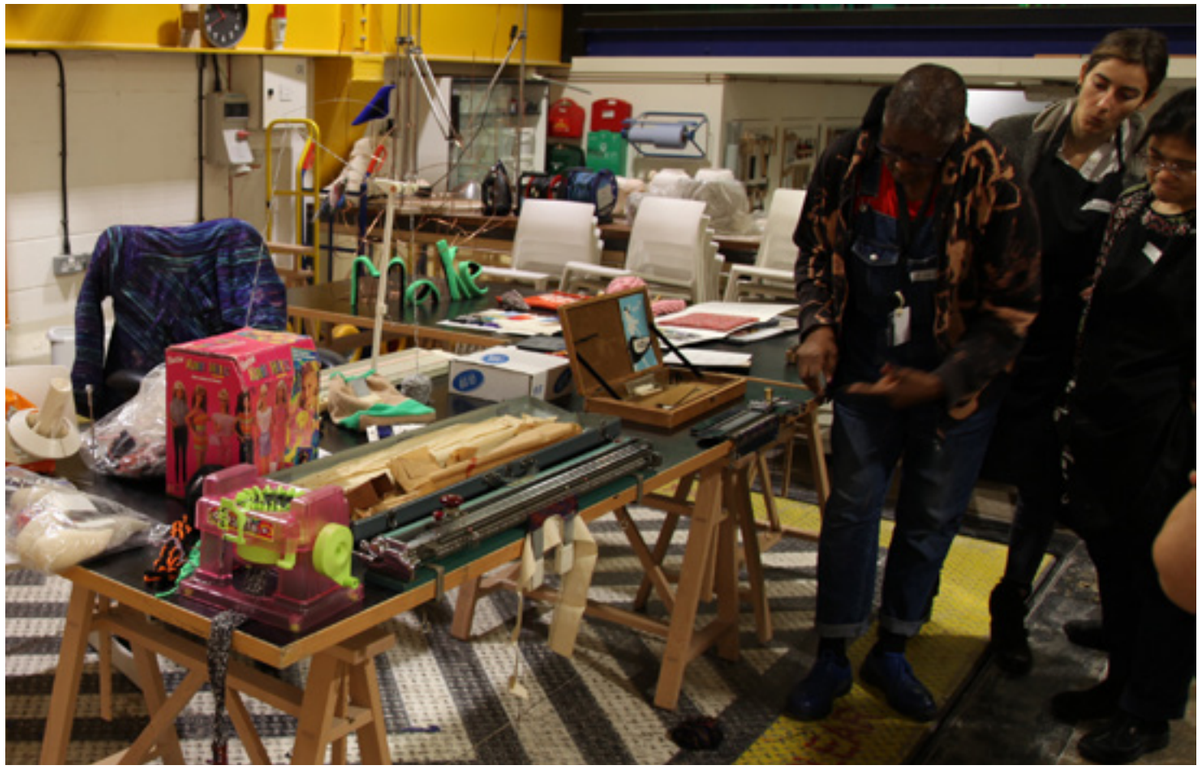
Member supervisors are a huge inspiration not just for the place they hold in our community, but also the roles they play in the wider UCL community. Member supervisors are students, and academic and professional staff. They bring a valuable diversity of skills and experiences to the Makespace.

Pictured are Member Supervisors (l-r): Eamon Hassan, Laura Dempsey, Thore Bucking.

Lorna Hamilton-Brown
Maker in Residence

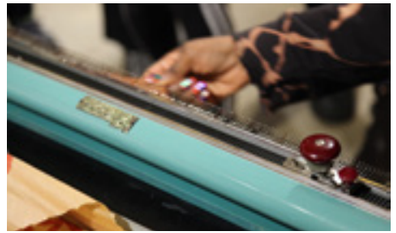
In October we were thrilled to host our third maker residency in the Makespace. Lorna is a skilled artist whose extensive expertise of and contemporary approach to knitting has earned her a reputation as the 'Banksy of Knitting'. She has used her narrative textiles within both her community work and her social activism. Lorna is keen to get more people knitting and to bust the myths and stereotypes associated with who can knit. In the guise of Lorna H-B the Knitting MC, she created a music video entitled 'Knitting aint Wack' and raps to teach people how to knit. She is currently in the final year of an MA in Knitted Textiles at the Royal College of Art.

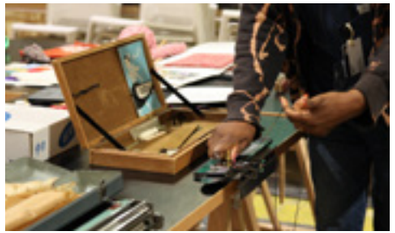
The craft of knitting on domestic machines is Lorna's passion. Instead of being limited to two needles, on a knitting machine you can work with hundreds of needles. Patterning can be done manually, or by using special punch cards. You can even link a laptop to certain electronic machines to create custom design. For her residency, Lorna recycled wool from hundreds of 'shade cards', used by the textile industry to advertise new wool ranges to suppliers and commonly discarded in bulk. Alongside the shard cards, Lorna brought four vintage knitting machines from her personal collection, demonstrating their mechanics to Makespace members by teaching them



to knit a simple square. She transformed these squares into a piece of textile art, Birds of a Feather Flock Together, which will remain in the Makespace as a tribute to the collaborative and interdisciplinary nature of the Institute that inspired Lorna. She also introduced members to the properties and uses of reflective wool during a finger knitting workshop, shining a spotlight on and adding a practical dimension to the reflective lace material sample that features in the Materials Library.

"I loved doing the residency at the Institute making. It's one of the best things I've done for long time. It was so nice to be working as an artist with other makers of different disciplines."
(Lorna Hamilton-Brown)





Raft Race

This year we once again took part in the Community Raft Race, now in its second year, organised by the Open Workshop Network (see p.62). In true Institute of Making style, a cross-disciplinary team designed the raft and had a lot of fun combining everyone's wacky ideas into a final design. We tried to apply lessons from our successes (and failures) at last year's competition, settling finally on a slimmer and more streamlined craft, named 'Canal Cosmonauts'. We aimed to again use recycled material where ever possible in the raft. An old wooden pallet was used as the basis for the chassis and plastic drums were strapped to the underside for buoyancy. We revived the pedal-powered concept of our first vessel but this time opted to drive paddles directly with pedals made of wood. The paddles themselves were made by stretching plasitc over old bicycle wheels. A prescient impulse caused us to additionally design a pair of wooden oars as a backup in case our primary form of propulsion failed us.
We had a fantastic day competing against teams from other makespaces but unfortunately what we gained in speed we lost in stability, resulting in a very wet crew by the end of the day.

Concluding Remarks

"What you think is the point is not the point at all but only the beginning of the sharpness."
Flann O'Brien, The Third Policeman

This report marks the end of our 5th year of full operation as the Institute of Making at UCL. We have achieved a lot in that time, and as this report makes clear, we are now a very successful multidisciplinary hub for materials and making. It is traditional at times like this to think of the future and to map out plans for expansion. But to look ahead without looking back is often a mistake. Instead, in these final remarks we would like to reflect on our trajectory, and how we got to this point.

We started off as a team of three people who created a materials library together. This was funded through a grant from the National Endowment for Science, Technology and the Arts (NESTA) in 2003. This was not a grant you could apply for; in the early days of NESTA they were on the look-out for interesting individuals, and spotted MM working in the interface between materials science and the arts. The fellowship they offered him had no strings attached, and so allowed him to collaborate freely. This is how MM started working with the artist ZL, and the designer MC. Together they used the NESTA funding to build a materials library as a translation tool for materials research between the arts and science communities. It also became a test bed for such research: ZL carried out her PhD on this topic, also funded by the NESTA grant. At the end of this first phase we knew that we needed more than a materials library do this type of research, we need a multidisciplinary workshop too.

The second phase of development was funded by the EPSRC and the Leverhulme Trust and our team grew. We had now got to the point where the research was much less speculative. We had a track record, and our research questions were well honed. For instance, in 2005, EPSRC funded work expanding the scope of our work with

the materials science community. Then in 2006, the Leverhulme Trust funded our research project quantifying the taste of materials. Several more EPSRC grants followed. At the time we were located in the lower basement of King's College London on the Strand Campus and we had no public venue. So we worked with the Tate Modern, The Wellcome Collection and the Victoria and Albert Museum (as well as many other public-facing organisations) to put on events for the public. This was not just outreach; we realised quite quickly that the public had a lot to offer us in terms of influencing and structuring our research questions – especially the human aspects of the materials interaction. The public also included people who owned companies in design, engineering, cooking and other materials focused activities. Thus, the events, and the extra publicity we generated through the media, turned out to be a very good way of attracting research partners.

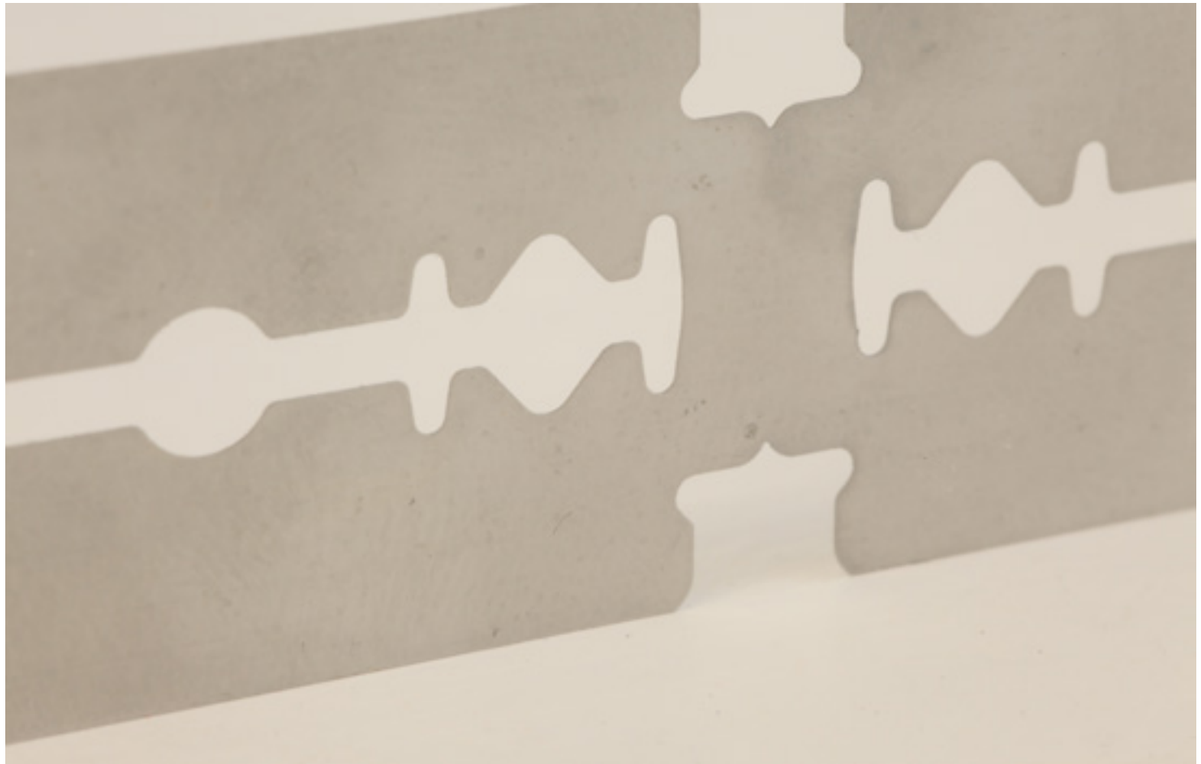
The third phase of development was to transform from a research group to a university-wide research hub. We accomplished this by winning an EPSRC Bridging The Gaps grant that allowed us locally fund research projects between academics of different disciplines. Through curation of this multidisciplinary research portfolio we interacted with departments throughout the whole of the university from Classics to Medical Physics. By curating events both with these researchers and the public we built up an ethos of open enquiry, mutual respect between disciplines, rigor, and playfulness. Working out how to do this was crucial because what we wanted to avoid the retreat into traditional academic silos by those doing multidisciplinary work for the first time. Publishing the research was a significant challenge though, because we found that referees of academic journals were far more conservative we had expected. We also realised that impact of involving the public would never be fully realised until we had our own venue where we could allow them to take part in making and accessing the materials library.

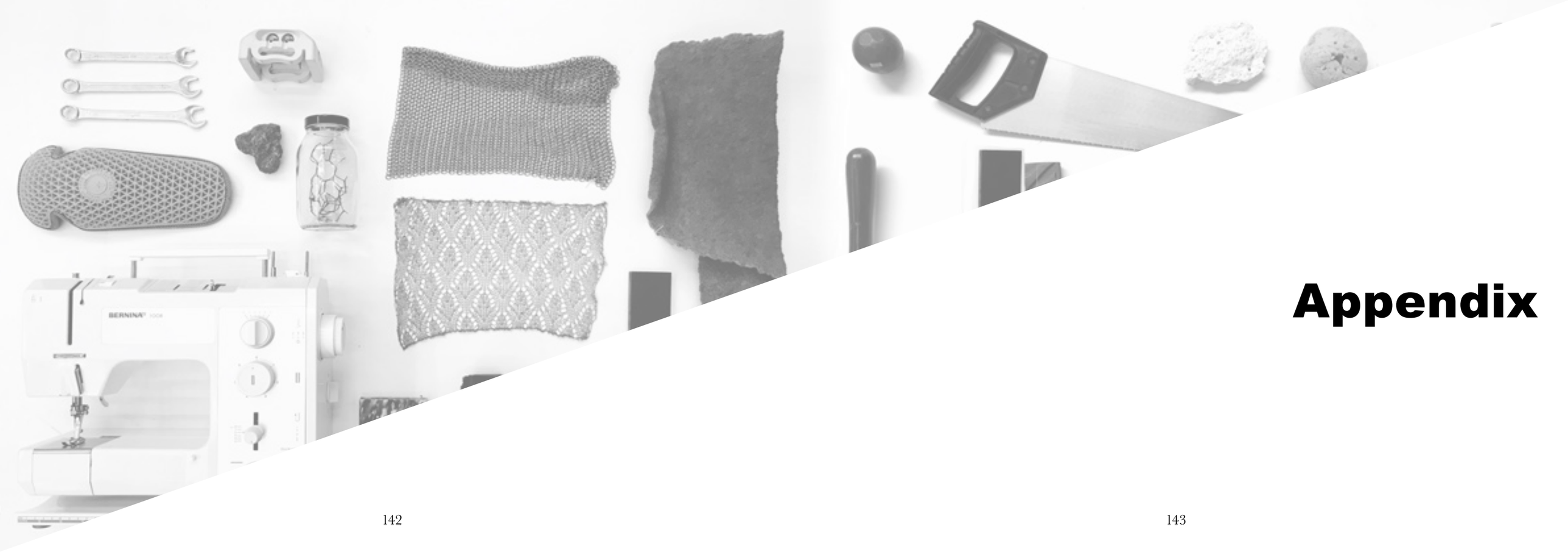
The fourth phase of the development came when UCL offered us the perfect space to build the workshop with an integrated materials library. They also offered support to grow a great team to run the research hub for the benefit of everyone in the university and the public. That was in 2012. It took a little more than a year to open, and we have been going strong ever since- for five years in fact.

What have we learnt? We have learnt that the study of materials and making come together as a pair: you cannot fruitfully study one, without knowledge and understanding of the other. We have learnt that this topic is not owned by any one discipline. This is because materials are not just a collection of atoms, they are part of our history and they part of our future; they are part of high-tech industry and they are part of mundane life; they are sometimes art and they are sometimes functional; they are sometimes valuable and they are sometimes waste. We have learnt that by creating a place where people from all kinds of disciplines can come together we gain more than we would if we ignored each other. We have learnt that the Institute of Making as you see it today, took more than ten years to establish, and that without enlightened funders and universities, it would not happen at all. We have learnt that the best way to involve the public in our research is to let them get stuck-in. We have learnt that when you offer this, thousands of people come. We have learnt that research is a team game, and it is wonderful to have such a great team.

This is only the beginning of our sharpness.

Mark Miodownik (MM), Zoe Laughlin (ZL) and Martin Conreen (MC)
Directors, Institute of Making 2018





Appendix

Full Statistics of Membership

Total number of registered members: 10,636
Active inducted members: 3,094

Gender
Female 41%
Male 52%
No gender declaration 7%

Member type
Staff 26%
- Academic staff 16%
- Professional services staff 9%

Students 74%
- Undergraduates 41%
- Postgraduates 34%

Full List of Events

Total number of events: 54 (29 member events and 25 public events)
Breakdown: 27 masterclasses, 10 research events, 3 Material Library Evenings, 3 outreach events, 4 workshop, 4 week long events and 3 large public open days.

11th March, 2017. *4th Birthday.* (Open day) Public event.
3rd May 2017. *Papermaking with Mandy Brannan.* (Masterclass) Public event.
8th May 2017. *Stone Lamp with Micaella Pedros.* (Masterclass) Member event.
15th May 2017. *Linoleum Printing with Ruby Wright.* (Masterclass) Member event.
20th May 2017. *Materials Library Presents... Sensoaesthetics.* (Library) Public event.
22nd May 2017. *5x5 Research Workshop.* (Research event)
25th May 2017. *Currency with David Blackmore and UCL Art Museum.* (Public event)
10th June 2017. *Pewter Casting workshop.* (Library) Alumni event.
22nd June 2017. *Hands of X at Cubbitts.* (Workshop) Reseach event.
23rd June 2017. *Hands of X at Cubbitts.* (Exhibition) Public event.
30th June 2017. *UCL Lunchtime Looks.* (Open to all UCL).
3rd July 2017. *Morning – Polystyrene Textile Moulding Masterclass.* (Festival of Stuff)
3rd July 2017. *Morning – Concrete Masterclass.* (Festival of Stuff)
3rd July 2017. *Midday – Polystyrene Textile Moulding Masterclass.* (Festival of Stuff)
3rd July 2017. *Afternoon – Concrete Masterclass.* (Festival of Stuff)
3rd July 2017. *Afternoon – Polystyrene Textile Moulding Masterclass.* (Festival of Stuff)
4th July 2017. *Morning – Arduino Weather Station Masterclass.* (Festival of Stuff)
4th July 2017. *Afternoon – Arduino Weather Station Masterclass.* (Festival of Stuff)
4th July 2017. *A Potato Mash-up and Chip Chat.* (Festival of Stuff)
5th July 2017. *Morning – Papermaking Masterclass.* (Festival of Stuff)

5th July 2017. *Morning – Paint Brushmaking Masterclass.* (Festival of Stuff)
5th July 2017. *Linoleum Printing Masterclass.* (Festival of Stuff)
5th July 2017. *Afternoon – Papermaking Masterclass.* (Festival of Stuff)
5th July 2017. *Afternoon – Paint Brushmaking Masterclass.* (Festival of Stuff)
6th July 2017. *Morning – Bottle Joinery Masterclass.* (Festival of Stuff)
6th July 2017. *Stool in a Day Masterclass.* (Festival of Stuff)
6th July 2017. *Afternoon – Bottle Joinery Masterclass.* (Festival of Stuff)
7th July 2017. *Festival of Stuff Saturday Extravaganza.* (Open Day)
19th July 2017. *Glazing Ceramics with Darren Ellis.* (Masterclass) Member event.
24th July 2017. *Making Spaces.* (Research event)
5th August 2017. *Raft Race.* (Makespace Challenge) Member event.
18th September 2017. *Material (Im?)Mobility in Past Societies.* (Research event)
10th October 2017. *My Research Makespace: Flexible Sensor Skin Systems.* (Research event)
17th–20th October 2017. *UCL Lunchtime Looks.* (Open to all UCL).
17th–20th October 2017. *Lorna Hamilton-Brown - Knitting Artist.* (Maker in Residence)
18th October 2017. *Reflective Yarn with Lorna Hamilton-Brown.* (Masterclass) Member event.
21st October 2017. *Faking It.* (Open Day)
31st October 2017. *Repair Cafe.* (Outreach) Public event.
14th November 2017. *My Research Makespace: 3D Printing for the Study of Medieval Stained Glass.* (Research event)
16th November 2017. *Listening to Incense Workshop.* (Research event)
17th November 2017. *Make:Shift:Do workshop: Exercise Motivating Trainers.* (Outreach)
20th November 2017. *Currency with David Blackmore.* (Masterclass) Member event.
27th November 2017. *The Art of Kintsugi with Iku Nishikawa.* (Masterclass) Member event.
2nd December 2017. *Maker Assembly Workshop.* (Research event)

12th December 2017. *My Research Makespace: Using Underwater Lasers to Study the Impact of Deep-Sea Trawling in Greenland.* (Research event)
18th December 2017. *Sausage Making Workshop.* (Research event)
19th December 2017. *Make Merry - Session 1.* (Workshop) Member event.
19th December 2017. *Make Merry - Session 2.* (Workshop) Member event.
5th February 2017. *Morning – Glass working.* (Masterclass) Member event.
5th February 2017. *Midday – Glass working.* (Masterclass) Member event.
5th February 2017. *Early afternoon – Glass working.* (Masterclass) Member event.
5th February 2017. *Late afternoon – Glass working.* (Masterclass) Member event.
28th February 2017. *Materials Embroidery with Richard McVetis.* (Masterclass) Member event.
28th February 2017. *Big Make: Embroidery with Richard McVetis.* (Workshop) Member event.

Publications

Ransley, M., Smitham, P., & Miodownik, M. (2017). Active chainmail fabrics for soft robotic applications. Smart Materials and Structures, 26 (8), ARTN 08LT02. doi:10.1088/1361-665X/aa7221

Ramirez, D. Z. M., Souto, M. D. P. G., Oldfrey, B. M., Smitham, P., Miodownik, M., & Holloway, C. (2017). Characterization of Bespoke Force Sensors for Tailored Applications. IEEE Sensors Journal, 17 (6), 1727-1734. doi:10.1109/JSEN.2016.2644378

Wilkes, S.E. and Miodownik, M.A. (2018). Materials Library Collections as Tools for Interdisciplinary Research. Interdisciplinary Science Reviews 43(1), pp.3-23.

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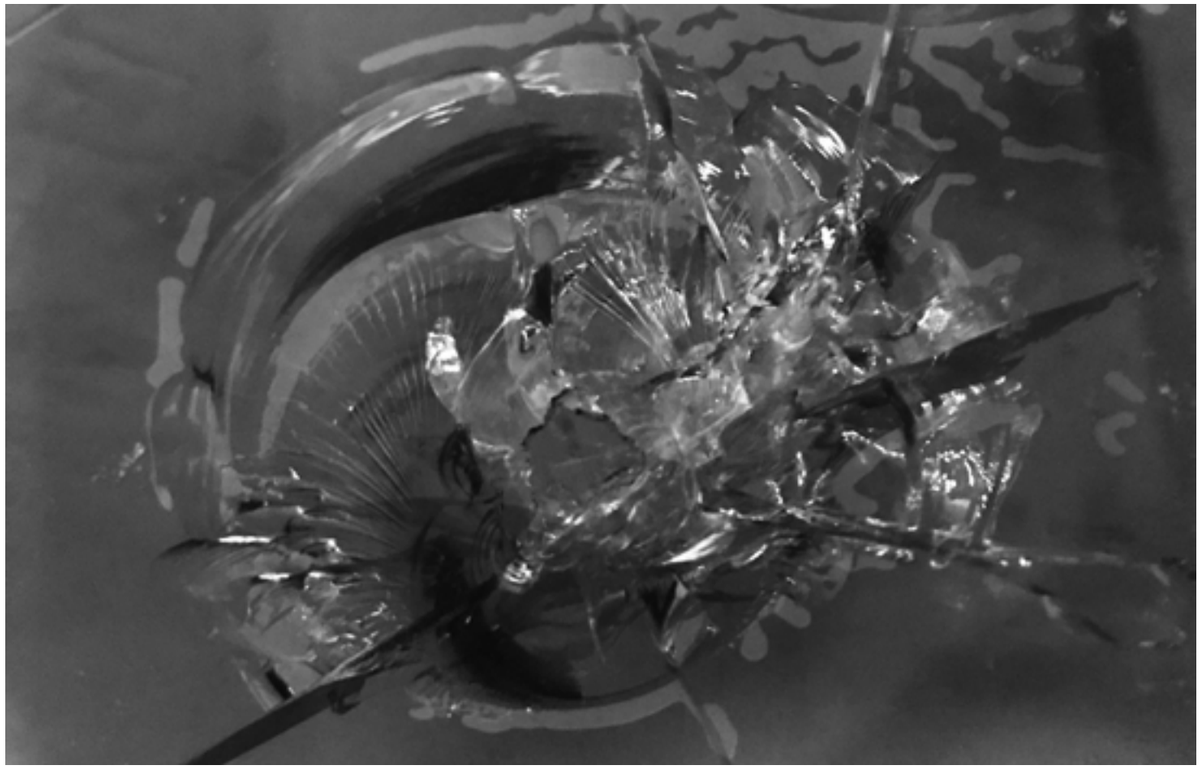
Williams, S. -. J., Miodownik, M., Jamieson, V., Winkless, L., & Sheldrick, C. (2017). Journey to the city of tomorrow. New Scientist, 236 (3149), 20-21.



Media Coverage

Secrets of the Super Elements, BBC4, April 2017
The Kitchen Cabinet Chelmsford, BBC Radio 4, April 2017
The Kitchen Cabinet Coventry, BBC Radio 4, April 2017 Graphene, Guardian Science Weekly Podcast, May 2017
Print Me A New Body, BBC Radio 4, June 2017
The Kitchen Cabinet Shoreditch, BBC Radio 4, July 2017
The Kitchen Cabinet Yeovil, BBC Radio 4, July 2017
The Science of Cake, BBC Radio 4, September 2017
The Kitchen Cabinet Bletchley Park, BBC Radio 4, September 2017
Kaputt: The Academy of Destruction, Tate Modern, October 2017 The Kitchen Cabinet Ipswich, BBC Radio 4, October 2017
Contain Yourself, The Food Chain, BBC World Service, November 2017
Big Life Fix Children in Need Special, BBC2, November 2017
How Does It Feel? Material witness, Nature Materials, December 2017.
The Science of Crisp Packets, Today Programme, BBC Radio 4, December 2017
Laughing parrots, backflipping robots and saviour viruses: science stories of 2017, The Guardian, December 2017
The Problem with Plastics, BBC Radio 4, January 2018
The Problem with Plastics, BBC World Service Newshour, January 2018
The Problem with Plastics, BBC World, January 2018
The Kitchen Cabinet Worcester, BBC Radio 4, January 2018
A Good Read, BBC Radio 4, February 2018
Fireworks for a Tudor Queen, BBC 4 TV, March 2018
Today Programme, BBC Radio 4, March 2018

Social Media Feeds

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www.facebook.com/groups/197250337040270/

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Institute of Making Member Supervisors

Alex Kanellopoulos

Anne Zakrzewski

Becky Lee

Ben Oldfrey

Eamon Hassan

Evangelos Himonides

India Davies

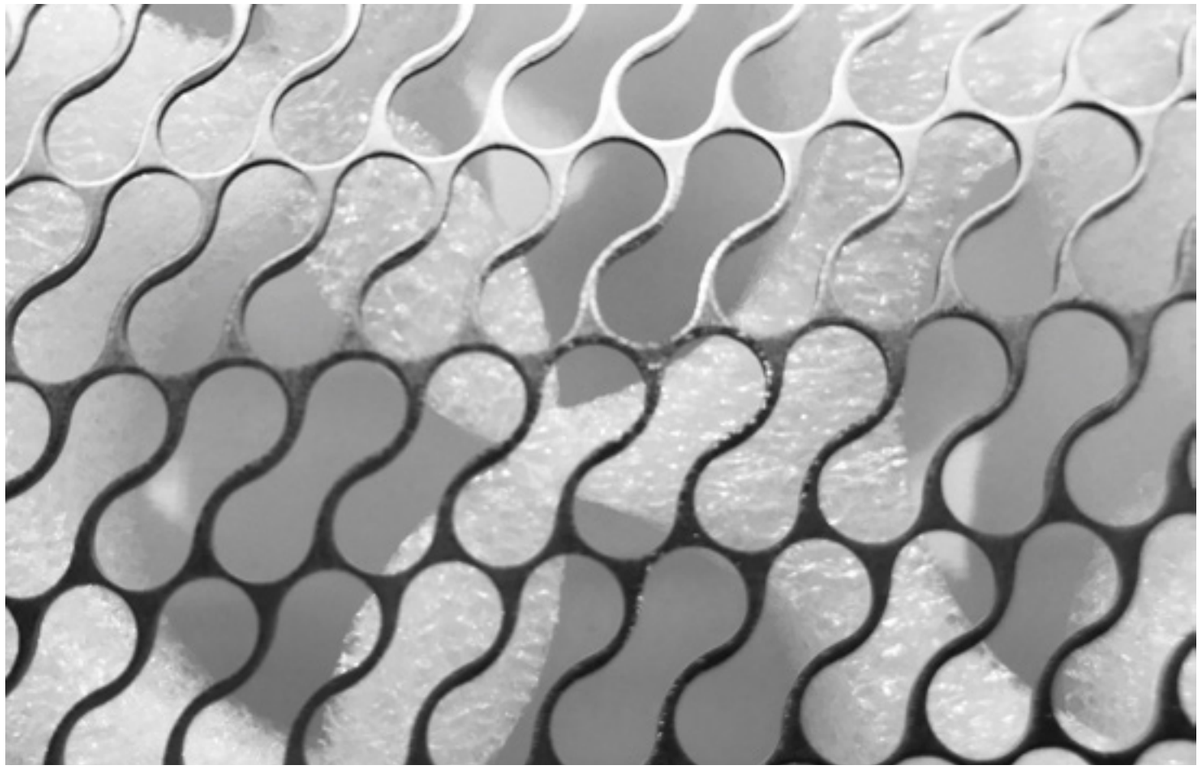
Kevin Green

Laura Dempsey

Prashanthan Ganeswaran

Thore Bucking

Valerie Ngow



Birthday Award Winners

Outstanding Contribution: Valerie Ngow

Community Award: Anne Zakrzewski

Development Award: Gabriella Hirst

Diligence Award: Alex Pakpour-Tabrizi

Ethos Award: Kevin Green

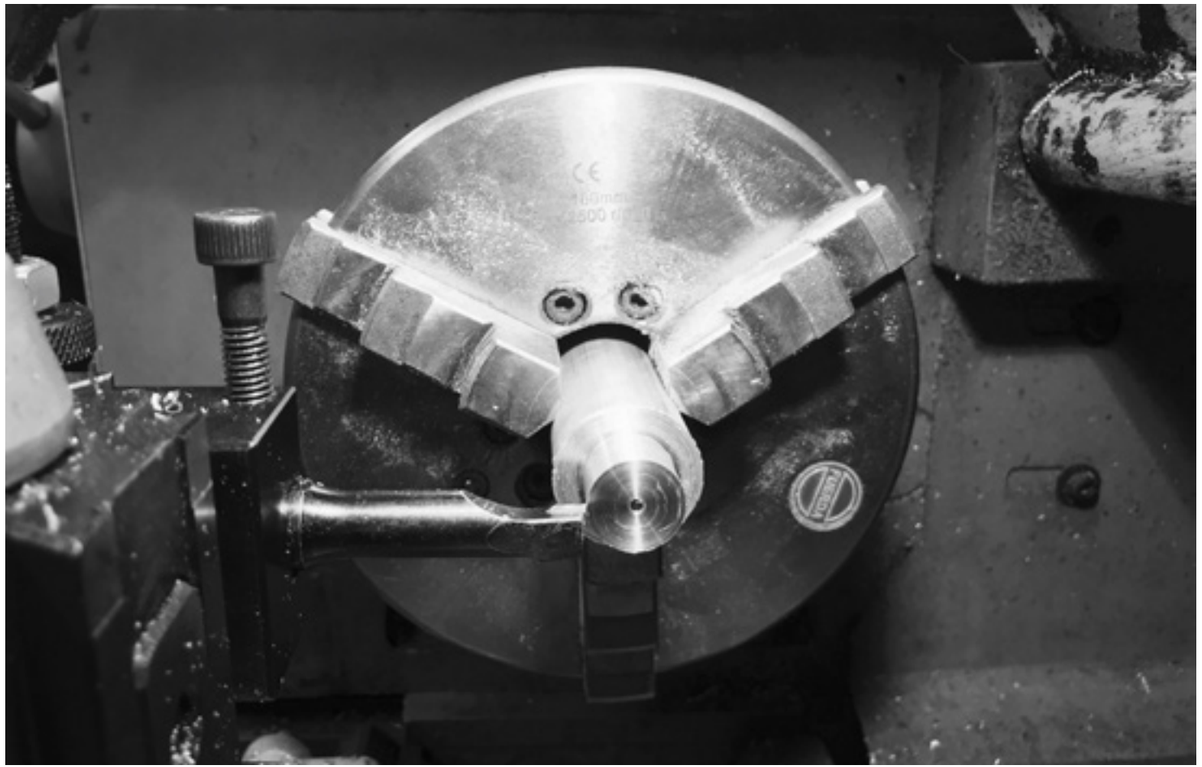
Extra Mile Award: Becky Lee

Leadership Award: Aqil bin Muhammad Ali

Most Helpful Staff Member: Hayley Midwinter

Research Through Making: Janneke van Leeuwen

Spirit of the Makespace: Eamon Hassan



The Institute of Making Current Team

Beth Munro – Research Manager

Darren Ellis – Makespace Technician

Elizabeth Corbin – Materials Library Assistant and PhD Student

Ellie Doney – PhD Student

George Walker – Makespace Assistant Technician

Mark Miodownik – Director

Martin Conreen – Director

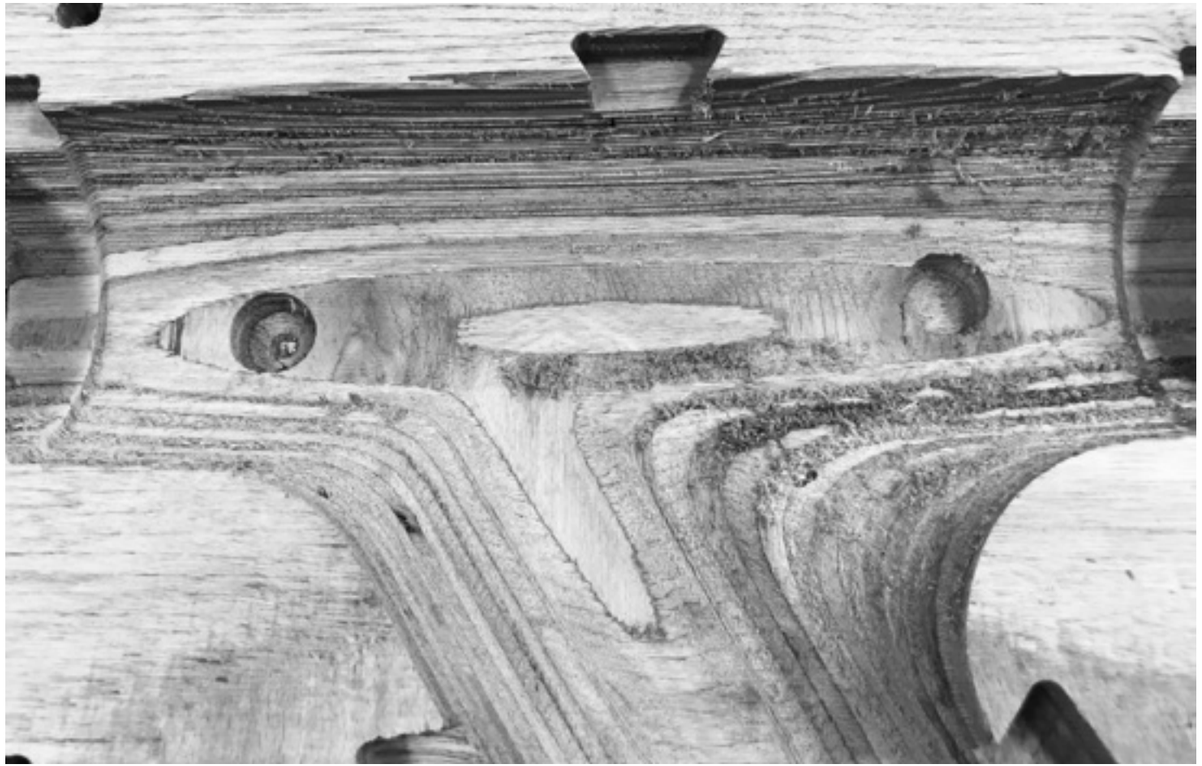
Necole Schmitz – Makespace Manager

Romain Meunier – Makespace Technician

Sara Brouwer – Events Coordinator

Sarah Wilkes – Research Fellow

Zoe Laughlin – Director



Steering Committee

Andrea Sella – Professor of Inorganic Chemistry, UCL

Bob Sheil – Professor of Architecture and Design through Production, and Head of the Bartlett School of Architecture, UCL

Chris Wise – Expedition Engineering

Mark Handley – Professor of Networked Systems, Computer Science, UCL

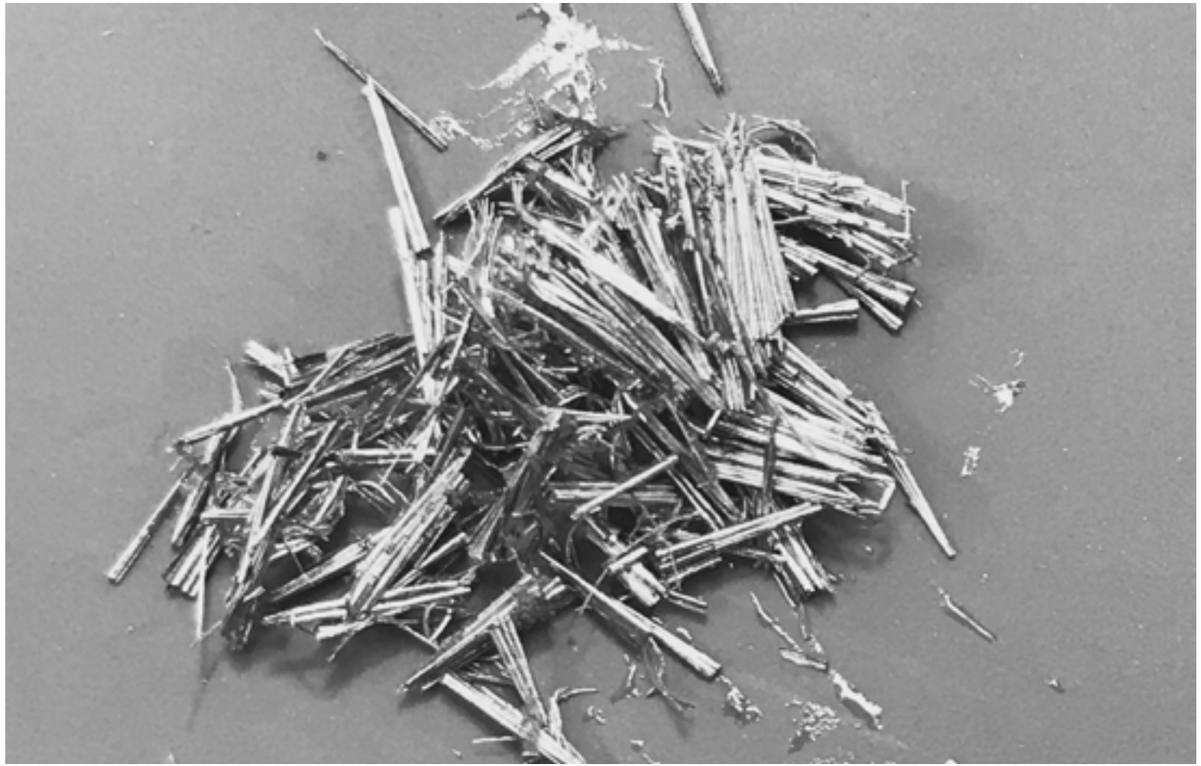
Nigel Titchener-Hooker – Dean of Faculty of Engineering Sciences, UCL (Chair)

Susan Collins – Director, Slade School of Fine Art, UCL

Susanne Kuechler – Head of Anthropology, Professor of Material Culture, UCL

Funding, Donations & Commercial Support

Alan Brener
AHRC
Atkins
BBSRC
Cancer Research UK
Chris Nolan
Emma Thomas
EPSRC
European Union
Jeremy Anderson
Leverhulme Trust
Robert Nichols
UCL Engineering
UCL Grand Challenges
UCL PACE
Wellcome Trust



Thanks

Alan Brener
Alan Philcox
Andrea Sella
Andres Tretiakov
Andy Fugard
Andy Minnis
Angela Clemo
Angharad Milenkovic
Anna Clark
Anthony Finkelstein
Bob Sheil
Brenda Parker
Brendan Bryne
Caitlin O'Grady
Chris Wise
Christine Simms
Christopher Nolan
Diane Davis
Elaine Briggs
Eleanor Morgan
Elpida Makrygianni
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Gwen Mott
Hassan Osman
Hayley Midwinter
Hilary Powell
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Michael Arthur
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Miranda Laughlin
Neil Moscrop
Nick Booth
Nigel Titchener-Hooker
Peter Kelly and team
Phil Howes
Prashanthan Ganeswaran
Praveetha Patalay
Puja Bharadia
Rob Nichols
Rosie Meredith
Ruth Siddall
Saffron Hutt
Sam Green
Sara Collins
Sarah Mackay
Sarah Richey
Sarah Wishart
Simon Werrett
Subhadra Das
Susan Collins
Susanne Kuechler
Thea Sherer
Tom Hamer
Tom Kile Hartshorn
Tony Lawler


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