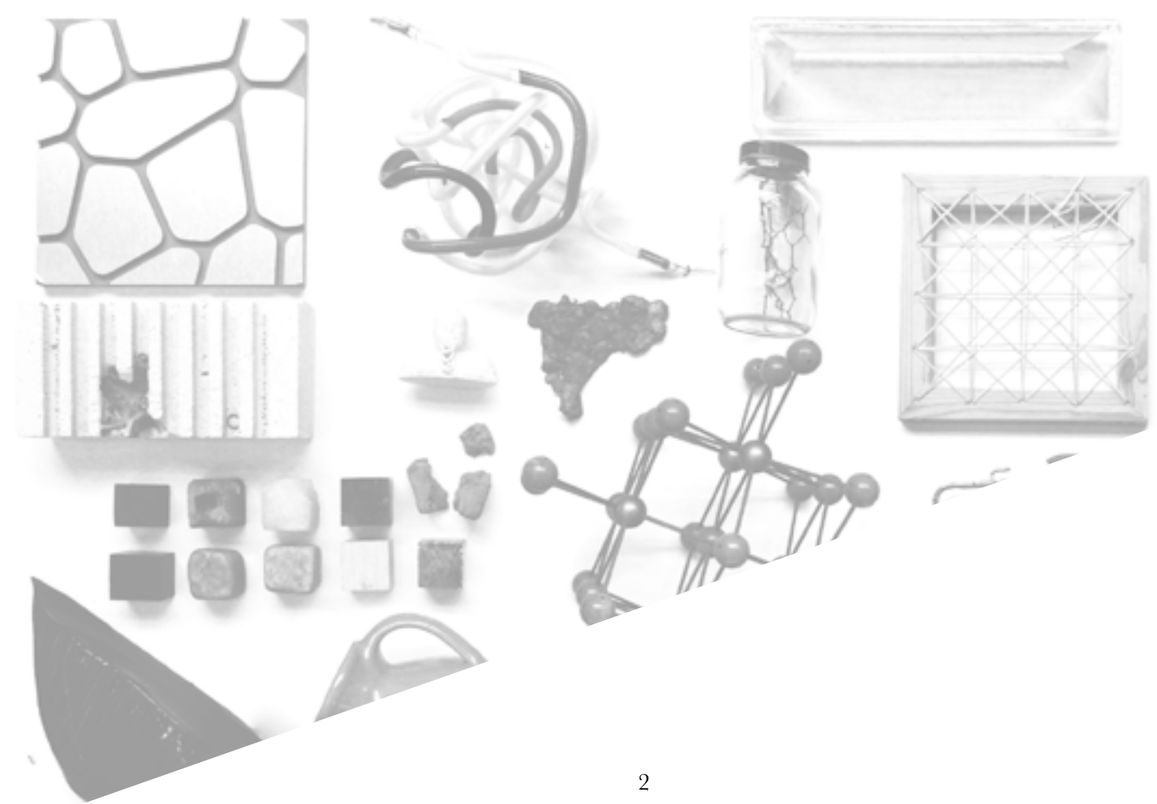
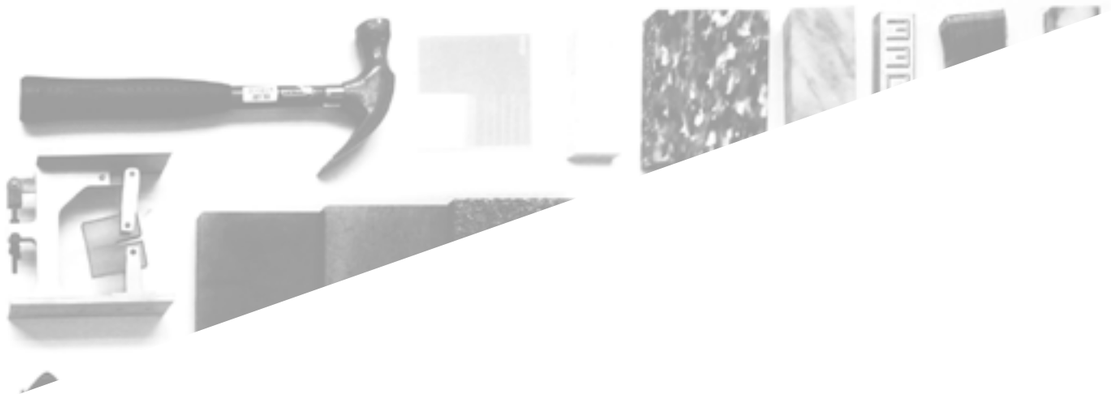
Institute of Making

Fourth Year Report

Institute of Making, UCL 2016-17





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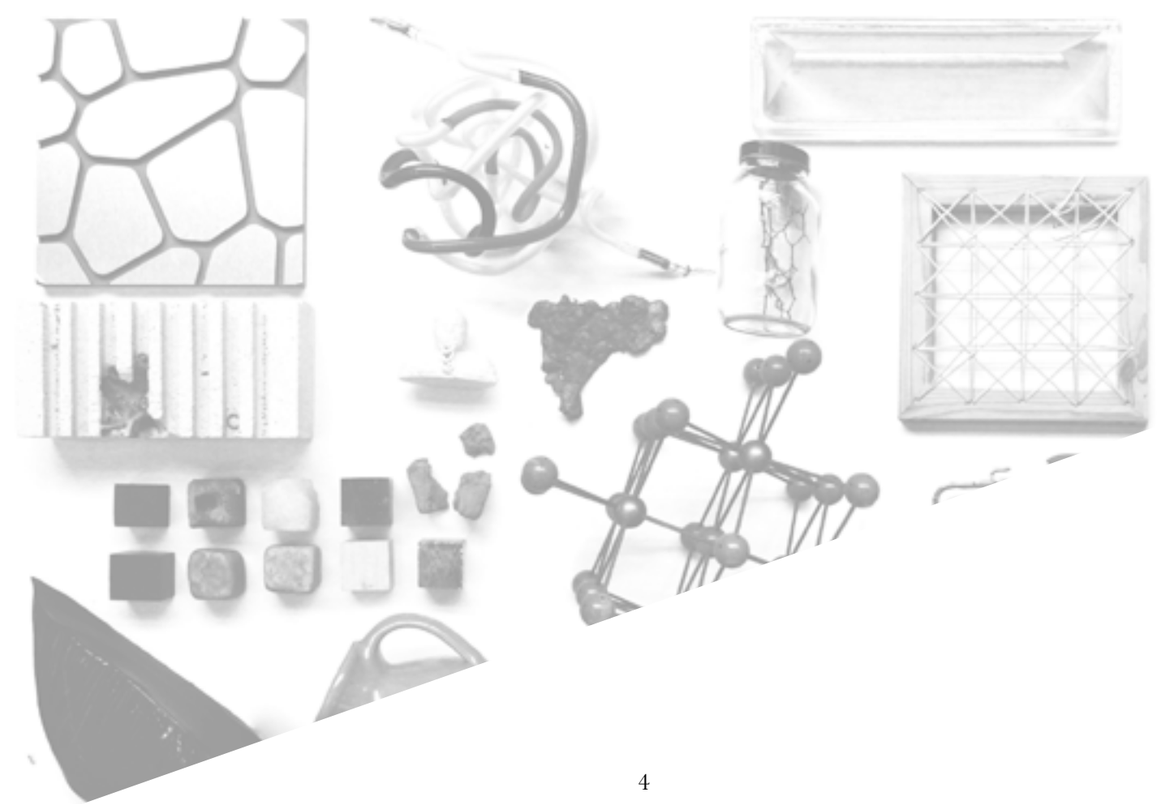
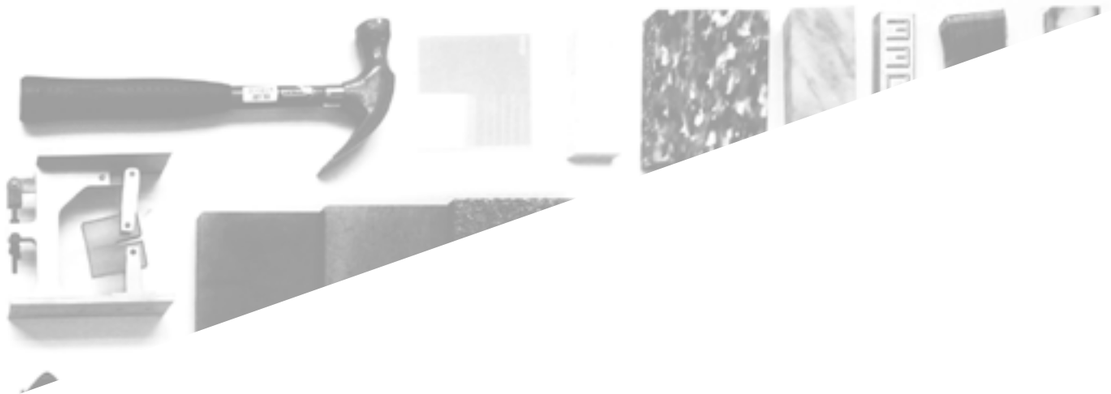




The Overview

Why we do what we do...

"I wanted to thank you for all the help you have given me and my group in designing and manufacturing our ALS Neck Collar, as well as for the help you offered my flatmate with her 3D printing project. Without your assistance and patience we would be nowhere near as close to being where we are now; our collar will be undergoing testing on healthy volunteers at Stanmore Hospital next week."
Nicolas Wood, Medical Physics undergraduate.

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...

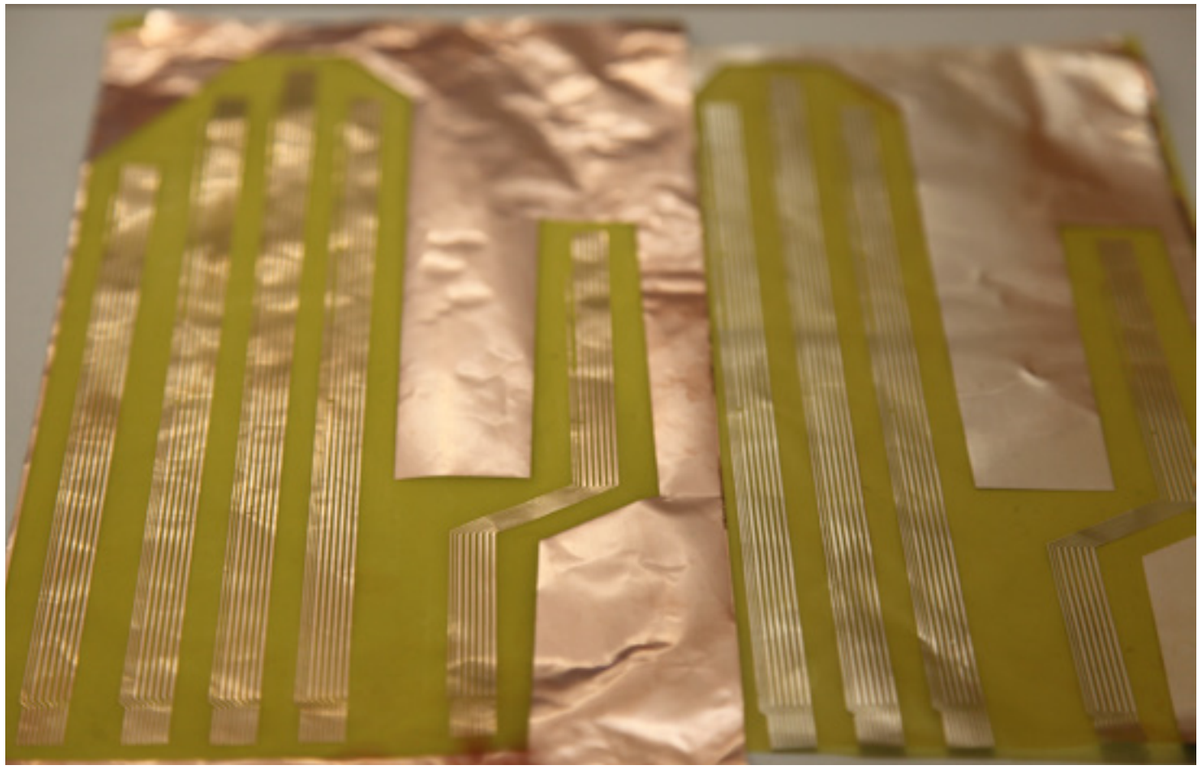
We currently have 3212 active members, of whom 16% are staff and 84% are students. A further breakdown of the member demographic is as follows: female (41%), male (44%), no gender declaration (15%); undergraduates (47%), postgraduates (34%), academic staff (12%), and professional services staff (7%). The membership encompasses a wide range of specialisms and interests, from Architecture to Medicine, Art History to Engineering, and Archaeology to Biology.

Doing is a different way of thinking...

A typical snapshot of activity at the Institute is as follows: a group of MSc students from Mechanical Engineering fabricates a prototype robotic cleaning device with help from our technicians; a Professor of Anthropology uses the Materials Library to develop a new grant proposal; one of our 3D printers is used to print out a replica of a Neolithic tool while another is used to print a model of Andrew Marr's brain; a research workshop on our EPSRC funded Hands of X project gathers together designers, prosthetics wearers, engineers and materials experts from all over the UK; a masterclass on glass making is attended by ten students and staff from UCL, each one from a different department; we hold an Open Day on the theme of 'rocks' and more than 600 members of the public take part in hands-on making activities.

We specialise in multidisciplinary materials research...

The Institute of Making acts as a research hub, bringing together and supporting interdisciplinary teams of researchers both at UCL and beyond.
This year we were successful in establishing a research partnership with the Making Lab at the new Francis Crick Institute and were awarded an associated EPSRC collaborative grant (EPSRC NS/A000047/1). This award adds 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); Scrambled Messages with The Courtauld Institute of Art (AHRC EP/K038656); Centre for Nature Inspired Engineering with UCL Chemical Engineering (EPSRC EP/K038656/1); Hands of X with Dundee University (EPSRC EP/N01006X/1); Material Anxieties (Wellcome Trust 200354/Z/15/Z) led by our former Research Manager Dr Sarah Wilkes; and PhysFeel with UCL Psychology and the Institute of Education.
The Institute of Making is also a research partner in Liz Corbin's PhD on The Open Workshop Network, her foundation and development of the Maker Assembly and Hello Shenzhen, and Ellie Doney's PhD research on Food and Transformation.



Our events often get fully booked in seconds...

Our events programme aims to inspire the public with regard to all things materials and to place us at the heart of the international making community. The programme also exists to introduce our members to new areas of interest and 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 52 events, 32 of which were member events and 29 of which were public (see pp. 144-146 for the full list of events). These included 31 masterclasses (including concrete explorations and chair caning), 6 research events (including Hands of X and Object-based & Creative Methods for Communicating Emotions), 4 research hub events (including Scrambled Messages and Co-Lab), 2 Materials Library evenings, 1 corporate event, 2 outreach events, 3 large-scale public open days, 3 week-long events (including Beer Brewing and Jeremy Atkinson, clog maker in residence). Over the past year our events have attracted an audience of more than 6000 people with a high representation of families and young people.

We have one of the most wondrous collections of stuff...

The Materials Library is a collection of some of the most wondrous materials 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 saw the expansion of 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...

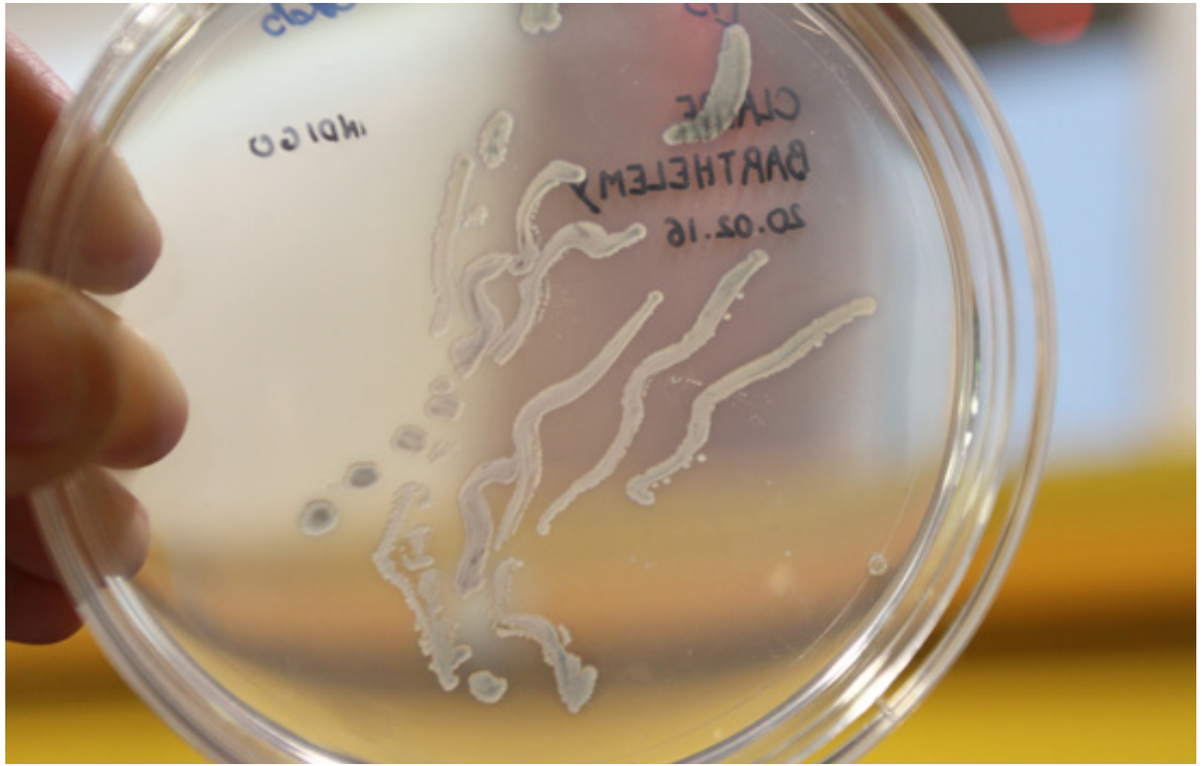
The Institute of Making and its team have gained a public profile as champions of making and materials, promoting them through television and radio programmes. This year a new television series called The Big Life Fix was launched on BBC2 which embodies much of the spirit of the Institute of Making and featured Director Zoe Laughlin. We are active on social media (Twitter, Facebook, Instagram, Tumblr) and online in the form of podcasts (The Things That Make Us), radio programmes (BBC Radio 4, The Science of Dr Seuss) and films (BBC iWonder, A Perfect Cup of Tea).

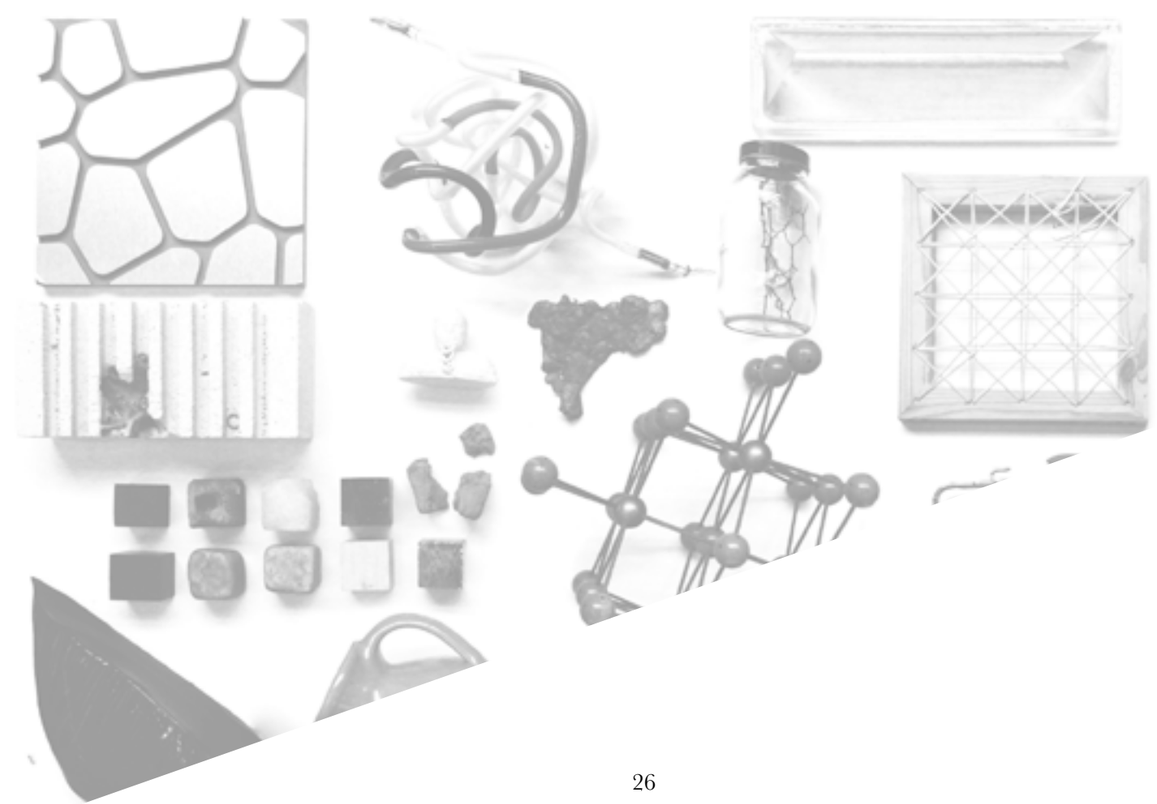
We are international...

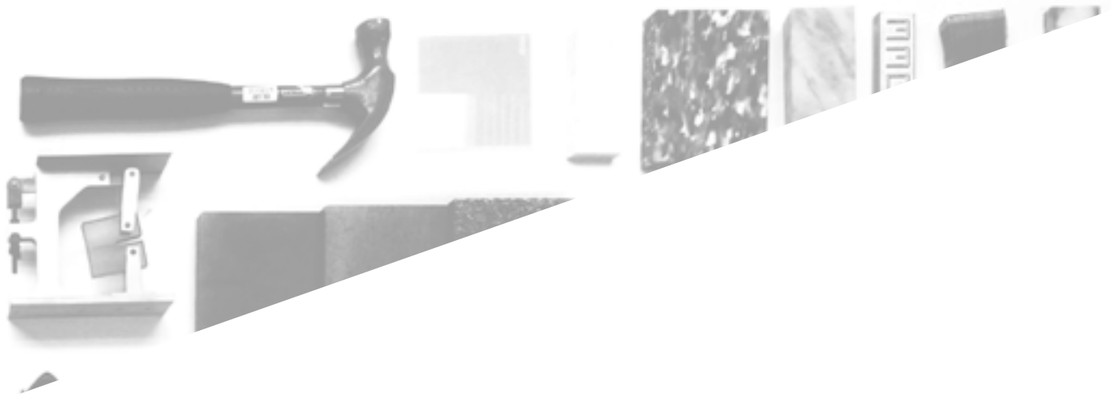
The Institute of Making has an international reputation; we have given invited talks all around the world from Seattle to San Sebastian on our interdisciplinary materials research and our other activities. This year we also produced a Massive Open Online Course (MOOC) called Design-Led Materials on the Institute of Making website which is aimed at materials researchers and design practitioners embarking together on design-led materials research projects.

We do commercial & policy stuff...

Our profile has allowed us to influence policy makers and the national academies, attract industrial collaborators, and inspire both current and future students and staff. We frequently attract visitors from other institutions who wish to collaborate with us, and many of these relationships are being actively developed.



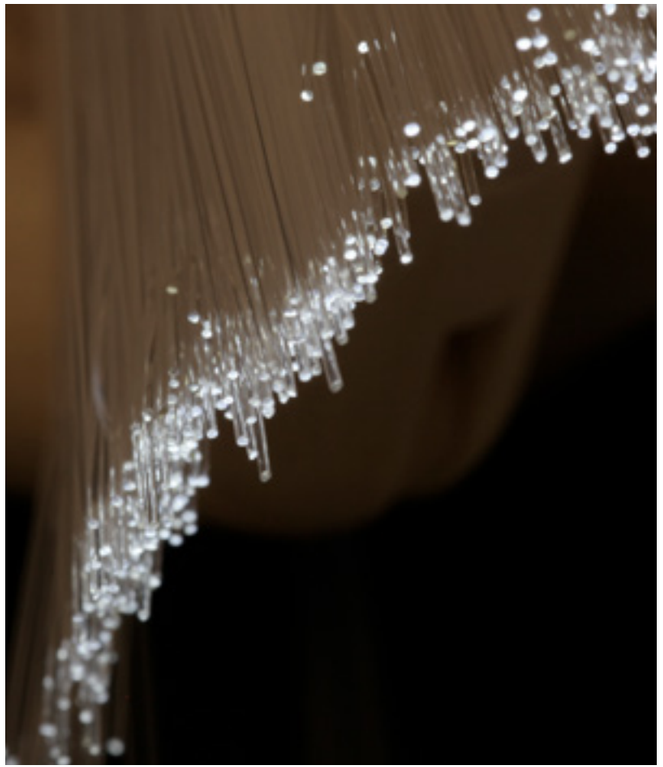




Member Profiles

Our membership is growing faster than ever, with new faces joining our Makespace community of students, staff and researchers each month, as keen as ever to learn new skills and take their research projects into their own hands. At the end of Spring 2016 we were at capacity every day and had to operate a one-in-one-out policy to keep the workshop running safely. The team is always ready to respond to the challenges and excitement of final year projects, conference deadlines, degree shows, research workshops, fashion shows and end of term deadlines happening all at once, as part of the rhythm of the year.

In this section we profile some of our members and their diverse projects, which include personal research and making projects alongside their academic research activities. Members are often experts in their own areas of materials and making, and this year we opened up our events programme, inviting members to pitch a masterclass that we supported them to run. This resulted in the excellent week-long Brewery Masterclass in collaboration with UCL Biochemical Engineering staff and Howling Hops Brewery which revealed the materials, processes, tools, science and craft of beer making.



Feedback from members often reveals partnership and collaboration across disciplines that would never have happened if it were not for our unique community. This year we can also claim the first Institute of Making marriage, between Yva Jung and Daniel Ashworth!

"We met in the Makespace as students – a Mechanical Engineer working alongside a Fine Art PhD student. We were making things alongside each other for a long while before we finally started dating. It is a place we look back on fondly and miss very much!"

Yva continues to develop her art practice with new experiments and projects, and Dan is working as a professional building services engineer.

Kati Carter
Department Manager, Security and Crime Science

Kati joined the Institute of Making when her sewing machine broke whilst making her wedding dress – it's still broken so she often takes a half-day holiday to come and make something here. At the moment she's sewing a woollen dress, broadly based on a 1940s pattern that she's altered. She can never find fabric or shapes that she likes on the high street so makes her own, inspired by vintage design. She also refurbished a Bakelite telephone, changing the electronics so it rings on pulse dialling, and upholstered a 1950s club chair with instruction from books, stripping it down, replacing the webbing and stuffing it with horsehair. She'll give anything a bash if it needs fixing and would like to have a go at soldering next – she has an old music box that she wants to convert to digital. Kati is also interested in 3D printing, and wants to make a model of the house she is building to cast in gold for her charm bracelet!

"It's unusual to be able to explore hands-on craft in a research institute. It has made me aware of how closely allied sewing is to engineering – material construction and drape, structural properties, stretch, problem solving, pattern interpretation and re-engineering when using different fabrics. I've been sewing for 35 years and only just realised this!"

The Institute of Making has delivered a relaxing atmosphere for Kati that she finds good for the soul and provides the opportunity to concentrate on just one thing. She has been fascinated by seeing other members' projects. Our community illustrates a real cross-section of people able to exhibit and develop their skills in a warm and collaborative environment. She would like to be able to contribute more to the community here, perhaps by offering a practical clothes fixing workshop.

Javier Ormeño
MA Human Rights

"The Institute of Making is a space where you can be yourself."

Javier was attracted to the Institute of Making after seeing all the materials in the window. With a background in philosophy, he's interested in the feelings that objects produce, and believes that making is important for mental health. He was excited about the offer to train in pottery, which he had postponed for a long time. Now when he is turning and throwing with clay he feels he is evoking and exploring memories. Javier says that physical aesthetics offer an understanding like no other, informing thoughts with embodied feeling; he has made this the subject of his MA dissertation. He can combine ideas about Human Rights and embodiment in memory and affect, and it all comes out on the pottery wheel.

Javier also used our space to work with Urushi, a Japanese lacquer used in the Kintsugi method of visible repair which highlights a crack or repair line in gold. Kintsugi evokes the memory of an object, telling its history. On Javier's suggestion, we ran an extremely popular Kintsugui workshop with his teacher Iku Kishigawa. The first object Javier repaired was a doll belonging to his grandmother that he had broken. For him, the act of visible repair allows one to become at peace with memories and acknowledges origin. Javier would now like to learn other methods of visible repair like sewing and 3D printing.

"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."

Kara Chin
BA Fine Art

"So many more things in life are available to you when you know how to make and do things yourself."

Kara first came to the Makespace to do ceramics – she made a fish which is part of a bigger installation involving an aquarium and an animation on a welded frame. The blue and white patterned glazed surface on the fish was carefully painted on, inspired by funereal ceramics and blue and white ware like the willow pattern.
The fish 'screams' at intervals based on the psychology of the variable-ratio schedule of behaviour reinforcement which can be addictive – fruit machines and casino algorithms are often based on this interval.

Being in the Makespace also inspired Kara to learn other skills, like Arduino and basic programming, in part due to the help and support of our technicians. She then learned how to 3D scan objects and, while she did not use her scans in her work, it got her thinking in 3D. Kara recently changed her degree subject from painting to sculpture and thinks that the Makespace may have contributed to this change – the business and work of other members is infectious and she has been able to learn new skills and techniques.

Kara thinks that the best thing about the Institute is the open access out of term time, and being free to learn new making skills. She's making the most of the tools and technicians as she thinks she'll never have access to this many resources again, and says "you can teach yourself the skills but it's not the same as being shown by someone".

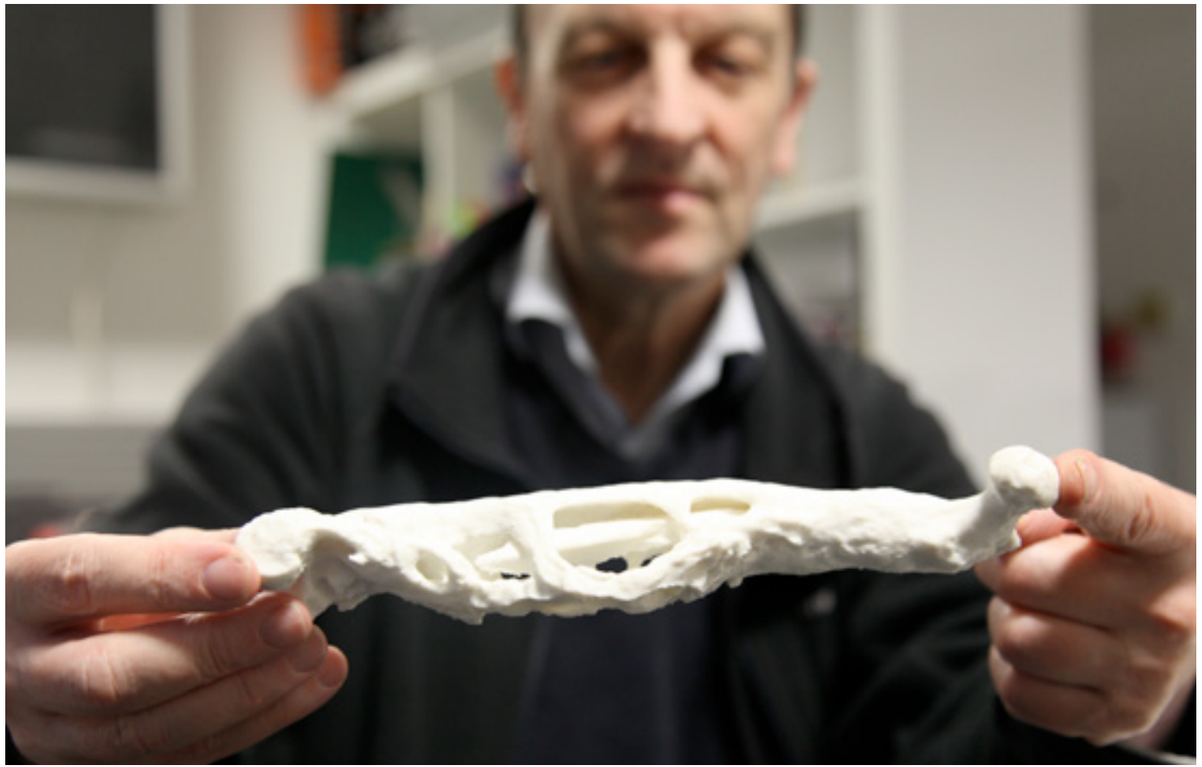
Garrard Cole
Honorary Research Associate, Archaeology

"This facility is unique because you meet people who are doing something different – you can't predict the outcome of your own project because of the new connections you make with people and new techniques, it's exciting. You need to be open-minded to get the best out of it."

Garrard is a retired archaeologist who now spends his time researching human remains. By 3D laser scanning and printing objects from historical collections he is able to build up clearer stories of the past. For instance, Garrard recently investigated pyogenic osteomyelitis - a bone infection - in a femur excavated from an ancient cemetery in Chichester. Nowadays we rarely see this infection affecting a whole bone because it is treated early after diagnosis. In the Makespace, he wanted to make a physical model of this bone, so he printed it using our Ultimaker 3D printers. It was important to enable others to handle it, he says:

"When you hold replica human remains you can relate them to your own body, feel the weight and physicality which helps you imagine what it might have been like for the person. You can also glean insights; in this case, you can tell that the person must have been cared for during the disease as they survived quite a while during the abnormal bone development."

Garrard is also a software engineer and picked up 3D printing quickly, learning how the materials work with the software, geometry and supports. By chance, while at work in the Makespace, he met a surgeon, who he introduced to new software to convert his medical scans. He's also grateful for some valuable advice from Elliott Magee, one of our expert member supervisors.



George Bolwell
MArch Architecture

"Due to my experiences here I now make stuff a lot more during a project, and find it a big part of my thinking process – working to think rather than conceiving of a project and making a model – less a demo, more a material manifestation of an idea."

George enjoys the workshop atmosphere in the Makespace and finds people friendly and approachable. He's been making models of wire and cast glass, networked nodes of different densities as found in the natural environment. These explore thickness of space, imagining the mass of a building as inhabitable, rather than as empty space. As a result, he can better understand how a building might be inhabited. George feels that glasswork lends itself to visualisations of space, its inherent translucency and mystery relates to environments. For him the material articulates levels of obscuration, opacity, and translucency. He finds glass fascinating and challenging to work with: it is mysterious and precious, hard and stable, fragile and jewel-like.

Thus far, George has done one successful kiln cast. He has received a lot of help in mould making from our technicians and has been using the microwave kilns, pushing the capabilities of the tool. He tried a lost-wax technique unsuccessfully and then tried 3D printing in ABS plastic and melting it out with a heat gun which worked very well. He would like to try enamelling for faster and more playful results in glass.

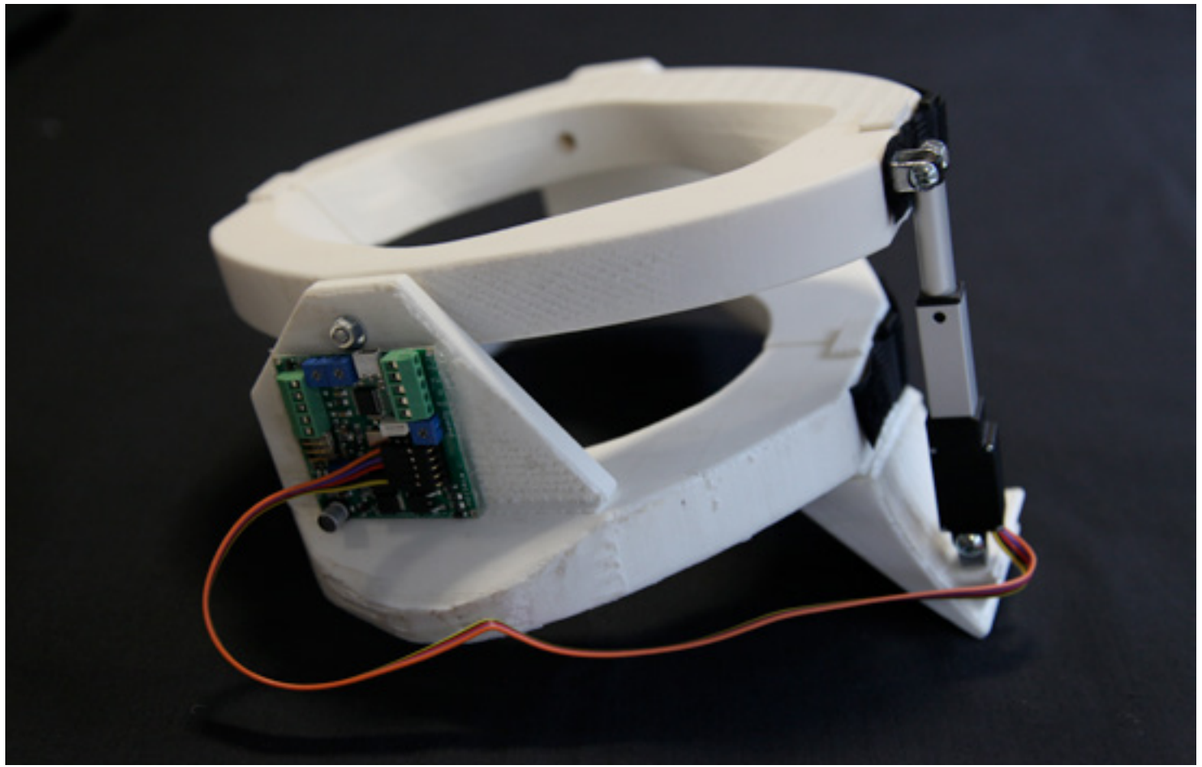
"One of the things I like best about working here is that you can just drop in - once you've done your induction there is minimum bureaucracy. Everyone always really wants to help and manages to maintain levels of friendly patience."

Nicholas Wood
Teammates: Edward James, Nishat Ahmed and Bindia Venagopal
3rd Year, MEng Biomedical Engineering

"The best thing about the Institute is the fact that you have the opportunity to use all this previously inaccessible equipment, with technicians there to help; not stopping you, but trying to problem-solve with you.

Nicholas is part of a student team who are designing and prototyping a neck collar for people with motor neurone disease (MND) or amyotrophic lateral sclerosis (ALS). This was a project devised four years ago by Dr. Pilar Garcia Souto, Senior Teaching Fellow in Medical Physics and Biomedical Engineering, who came across a patient with MND and thought that there must be something that she could do to help. People with MND/ALS can lose muscle strength, and with that lose the ability to do many things that we take for granted in our normal life. One of the more common symptoms of both these conditions is loss of neck muscle control causing the head to drop and require support. At the moment, the only provision for people with these conditions are neck braces for those with spinal injuries which allow no movement. Pilar decided to pose this project as a challenge to her students.

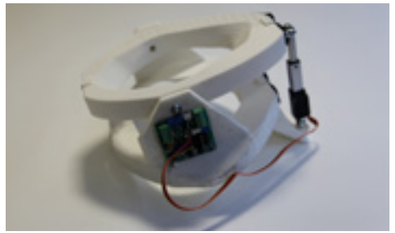
Nicholas' team have gone through a number of design iterations aimed at reducing the likelihood of pressure sores on the neck when a brace is worn. For example, they tried making a brace with inflatable sides and another with cotton lining. But, in the end, they used the 3D scanner to make a bespoke brace. This has been the most effective method for reducing the problem of abrasion, and Nicholas' first prototypes



using a twisted cylinder provided good forward and back movement. Nicholas also just wanted a chance to play with scanning and 3D printing! For the design process, he started with 3D software like AutoCAD and Catia but found them too complex to design fluidly, so he moved on to free programmes like Netfabb and 123D Catch, which worked best for the team's process.

Each member of the team brought different strengths: making, electronics, medical and physiological research, and business planning. Nicholas feels more comfortable with the mechanical side - he likes hitting things! The team found the Makespace technicians really helpful, they offered to lend Arduino microprocessors and servomotors to try out before committing to a design. The technicians also provided excellent instruction and guidance in scanning, meshes, printing and modifying the brace.

At the start of the project, the team also attended a Materials Library consultation with our researcher Liz Corbin. They tested material samples and used the app to look up the materials with the properties that they required. Liz also suggested talking to students in UCL's COMPLEX research group about bespoke materials that they have made for their own projects.



"The Materials Library consultation really helped with our design iterations. It's really interesting to discover things you've not thought of before, new materials and new ways to consider familiar materials."

Nicholas says that previously he was very focused on the one tool that he knew, but now his attitude is much more about finding the best tool for the job. He would really like to learn the lathe and he's getting more interested in electronics. He also wants to make customised insulation for his student flat.

"This way of working has changed how I make things, I now might try to fix something instead of buying a new one, and next time I have an idea I will feel much more equipped and inclined to have a go at attempting to make it myself."

Piotr Wasylczyk
Visiting Lecturer, Department of Physics

Piotr joined the Institute of Making shortly after starting at UCL. He arrived when Jeremy Atkinson was our clogmaker-in-residence, (see pg 82) and they bonded over the properties of different woods. He knows about wood from his childhood – his physics adventure started at the age of ten with model aircraft kits and the realisation that he loved building things.

Piotr is an expert in experimental laser physics, working with a research group on optical tweezers – where a focused beam of laser light is used to trap very small objects like blood cells. The trap can hold a cell and stretch it. He says:

"If you are trying to synthesise life, the mechanical properties of cells are as important as other factors. When people try to grow cells on scaffolding it has to be the right stiffness; materials matter on a cellular level."

Currently in the Makespace he is working on a project that he saw advertised on the Institute of Making noticeboard. The conductor of a major orchestra in the UK was looking for someone who had the skills to make bespoke wooden conducting batons. The conductor had originally bought 20 batons from a specialist maker who sadly now has died, and since then he has not been able to buy batons or find a replacement maker that he could work with commercially. The conductor's batons are made of birch - the lightest hardwood in the UK - but commercially they tend to be made of glass reinforced plastic or carbon fibre. The conductor is extremely sensitive to the subtleties of the baton. He can sense if the paint is even a millimetre

too thick, or the weight minutely unbalanced, as the tolerances are extremely important in the hand. Each baton is a bit different and the composer picks the one that feels best before each concert according to the music and his mood. But he is down to his last 2 or 3 batons and needed to find a new maker.

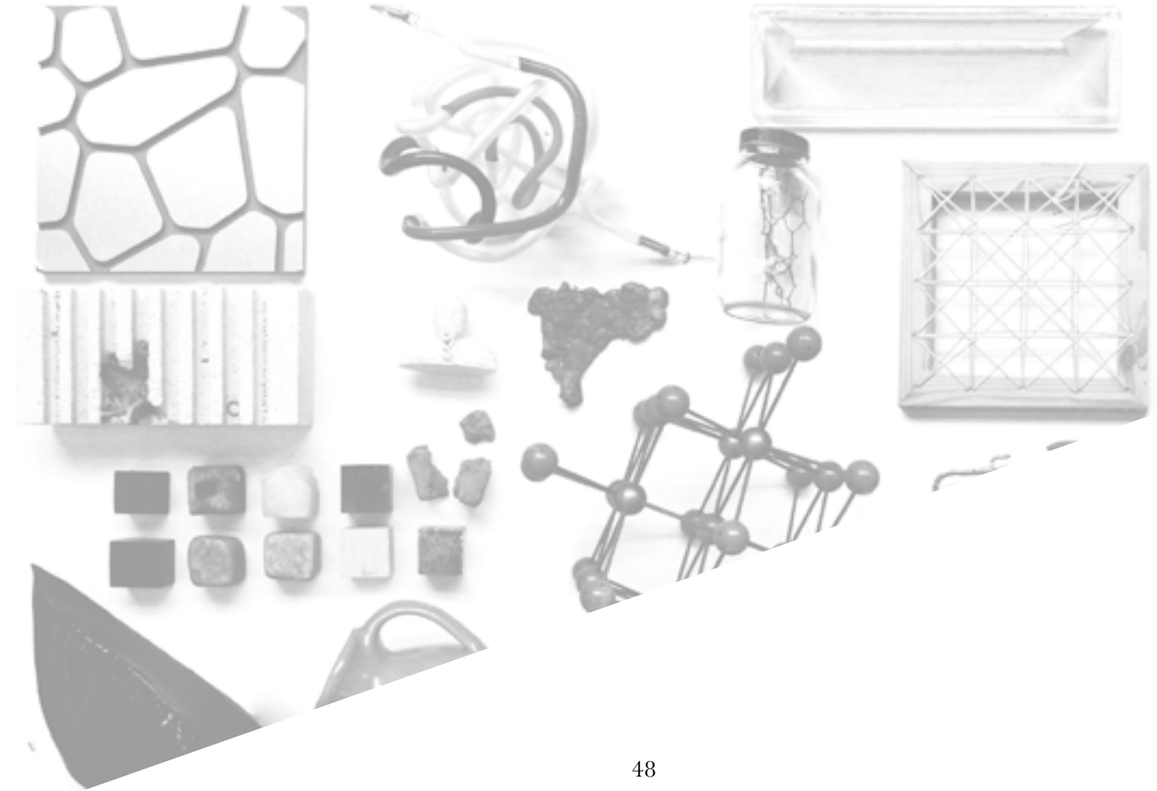
Piotr's innovation was to create a baton with a locking screw at the tail so that the batons have an interchangeable bulb that acts as a counterbalance to the wooden baton stick. The main difficulty in making these was getting the wooden baton straight enough, with the perfect taper. As a solution, Piotr measured the curvature using a grid and a photo for his first prototype, and then turned the batons on the lathe.

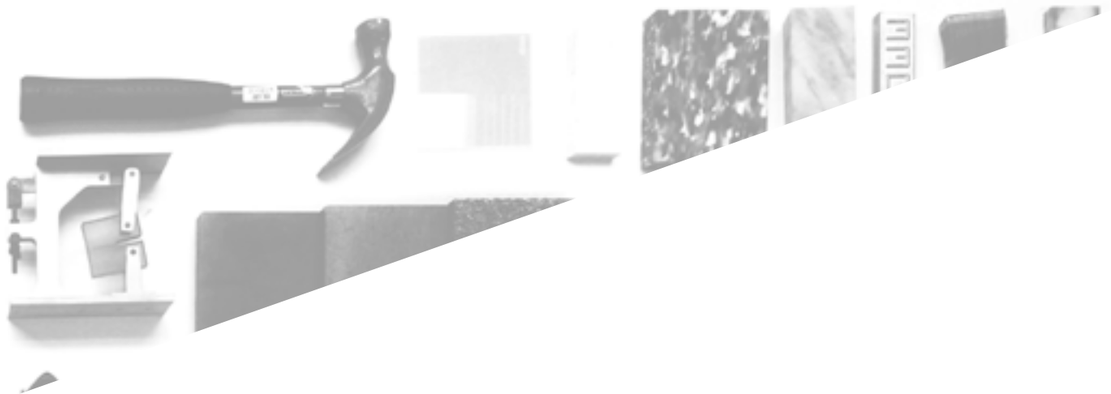
He's found people in the Makespace friendly and willing to talk freely about their ideas, which makes for a collaborative atmosphere. The assistance of the technicians is vital because the first steps when you learn a new skill are critical to a successful outcome.

"It's the best thing you can do for learners and researchers, but being so encouraging is the unusual thing – it empowers even those people who never imagined they would be doing something like this when they came to UCL."

Piotr believes you are sure to be proud of something that you have made with your hands and he's not sure that this happens as often with computers; he finds great satisfaction in making things. His two dreams from childhood - using the potter's wheel and making a bowl on the lathe - have been realised within his first six months in the Makespace. Piotr thinks it's so important for physicists and physics students to understand making - he now wants to go back to Poland and ask his team to create a makespace.

"We are in danger of living in a time of theory without valuing physical knowledge. My experiences with the Materials Library have revealed just how much I already know about materials just by touch - with touch you can imagine what you can do, start rehearsing it, in a way you just can't do in theory alone. It is crucial to understand how materials and things are made when you design them or design for them - it should be obligatory."





Research Programme

We are a research hub for multidisciplinary materials research, bringing together and supporting teams of materials researchers and makers from different disciplines, around UCL and beyond. This year we established a research partnership with the Making Lab at the new Francis Crick Institute, a partnership between the Medical Research Council (MRC), Cancer Research UK, Wellcome Trust, UCL, Imperial College London, and King's College London. Through this new partnership we have recently been awarded an EPSRC collaborative grant; *The quantitative analysis of signalling dynamics in breast cancer* (EPSRC NS/A000047/1, £163,944).

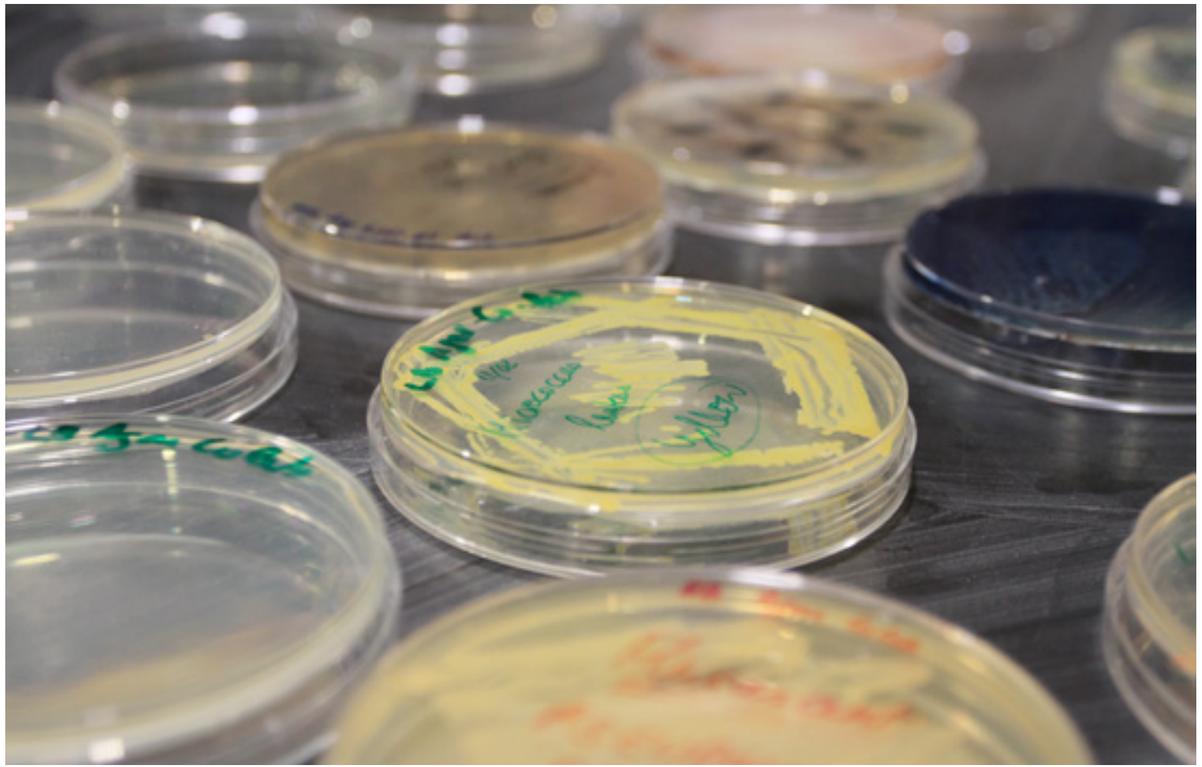
This award adds to our ongoing funded research projects: Self-Healing Cities with the University of Leeds, University of Birmingham and University of Southampton (EPSRC EP/N010523/1; £5,247,017); Centre for Nature Inspired Engineering led by Professor Marc-Olivier Coppens (EPSRC EP/K038656/1, £4,980,773); Hands of X led by Dr Graham Pullin at DJCAD (EPSRC EP/N01006X/1; £287,813); Material Anxieties (Wellcome Trust 200354/Z/15/Z, £200,556) led by our former Research Manager Dr Sarah Wilkes; and PhysFeel, led by Dr Andy Fugard in UCL Psychology and in collaboration with Dr Praveetha Patalay from the Institute of Education. The Institute of Making is also a partner in Liz Corbin's UCL PhD research on The Open Workshop Network, and Scrambled Messages, a project led by Professor Caroline Arscott at The Courtauld Institute of Art (AHRC EP/K038656/1, £731,190), which culminated in the exhibition *Victorians Decoded: Art and Telegraphy* held at the Guildhall Art Gallery in London.

Making Lab at the Crick

"The Institute of Making team were instrumental in getting the Making Lab going, and indeed we do look up to the Institute of Making as a very successful model"
(Ravi Desai, The Francis Crick Institute)

The Making Lab is a Science and Technology Platform intended to be a hub that will integrate people, ideas, biological projects, equipment and expertise to advance and accelerate scientific discovery at The Francis Crick Institute. It is being set-up and run by Dr Ravi Desai and once fully operational it will provide researchers with the tools, training and expertise needed to make devices and equipment for their experiments. The Making Lab will specialize in microfabrication (photo- and soft-lithography, and specifically microfluidics and micropatterning), macrofabrication (3D printing, CNC milling) and electronic fabrication (sensors, actuators, and control systems). It is inspired by, and will use the membership model of the Institute of Making, providing a mechanism to facilitate productive interactions between the biological community of researcher-makers and technical experts.

Together with our partners at the Making Lab we have been awarded a collaborative EPSRC /CRUK grant (NS/A000047/1 (£163,944)) to investigate *The quantitative analysis of signalling dynamics in breast cancer.* The project is led by Prof Buzz Baum (UCL MRC Laboratory for Molecular Cell Biology) in collaboration with Dr Helen Matthews (UCL MRC Laboratory for Molecular Cell Biology), Dr Alan Lowe (Biosciences), Dr Ravi Desai (The Crick) and Prof Mark Miodownik (UCL Institute of Making).
www.crick.ac.uk/research/science-technology-platforms/making-lab/



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's inspiration from 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 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 is hosting a two-day robotics challenge event to bring academics, industry, policy makers and stakeholders together to explore a future use of robots in the creation, inspection, repair and maintenance of critical infrastructure. Application areas are across broad domains including civil infrastructure, transport (rail, road, sea), offshore energy, space, and nuclear.
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 third 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 synthesising artificial systems that borrow the traits of the natural model. These systems, which include desalination membranes, fuel cells, catalysts, adaptive materials and built environments, thus become endowed with the same desirable characteristics 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. A new 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 is the Robust Self-healing Fabrics for Soft Robotic Applications, funded through an Inspiration Grant carried out by Mark Ransley.
www.natureinspiredengineering.org.uk

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

This project is an 18-month collaboration between the Duncan of Jordanstone College of Art and Design, the Scottish charity and public access makespace MAKLab, and the Institute of Making. It aims to expand the palette of materials available to wearers of prosthetic hands. 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 explores 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 a series of participatory workshops, amputees, prosthetists, engineers, material scientists, designers and other makers explored materials that can be combined in simplified, representative hands. The most striking result from the workshops has been the meaningfulness of materials selection, with the most popular types of materials being leather, textiles and woods. This confirms the hypothesis that the current standard silicone prosthetic hands are not what many wearers would specify if given other options. The team are currently fabricating simple hands based on individual wearers' material choices, designing the infrastructure needed for this kind of affordable and bespoke prosthetics service, and prototyping the user's experience of it. This final year will also see the research expanded and presented at a number of events and exhibitions in Glasgow and London in June and July 2017.

This project is 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
Wellcome Trust 200354/Z/15/Z (£200,556)

With this three-year project, Research Fellow Dr Sarah Wilkes is following both new and familiar materials being developed for healthcare applications: from their inception in laboratories and manufacturing facilities to their selection in design studios and finally to their everyday use in formal and informal healthcare environments. Using a mixed method that combines ethnography, design research and psychophysics, this project aims to better understand how materials like stainless steel, silicone rubber and polyurethane mediate people's experiences of health and wellbeing in positive and negative ways. 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.

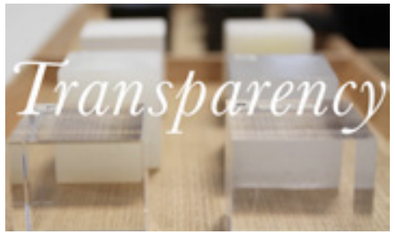
The project is now in its first year and Sarah is conducting research with materials manufacturers, healthcare architects and clinicians to identify applications where materials have the potential to enrich patient experiences, or conversely cause illness or exclude people. Sarah has been collaborating with healthcare workers at UCLH and RNOH Stanmore, as well as a variety of materials and healthcare product manufacturers, to examine the material properties and characteristics that are the focus of anxiety or debate in hospital bedside furniture and upper limb prosthetics.
www.instituteofmaking.org.uk/research/material-anxieties

PhysFeel
UCL Grand Challenge for Human Wellbeing (£2318)

The first stage of this UCL Grand Challenge of Human Wellbeing project culminated in July 2016 with a final event that brought together researchers and practitioners from around UCL as well as from the RCA, Goldsmiths and London School of Hygiene and Tropical Medicine. This event presented the PhysFeel method and findings, and explored the role of physical objects, cultural encounters and creative practice in communicating emotions and improving patient experiences.

Led by Dr Andy Fugard (UCL Psychology) in collaboration with Dr Sarah Wilkes (UCL Institute of Making), Dr Praveetha Patalay (University of Liverpool) and Prof Mark Miodownik (UCL Institute of Making) this exploratory study examined whether people can represent and communicate the experience and intensity of emotion non-verbally, via the look and feel of specially made physical objects that vary along one material dimension (e.g. softness, roughness, density). This project was motivated by reports from clinical practice that filling in questionnaires can be frustrating and repetitive for some mental health service users, leading to participant disengagement, and explored whether the use of multisensory objects could make the measurement of affect more engaging for participants.

Initial findings suggest that there was agreement between participants in assigning emotion terms to some of the object sets; in particular those embodying softness, elasticity, roughness and density. The team presented these findings as a poster at the European Conference of Positive Psychology, and are in the process of preparing a paper for publication. *www.instituteofmaking.org.uk/research/physfeel*



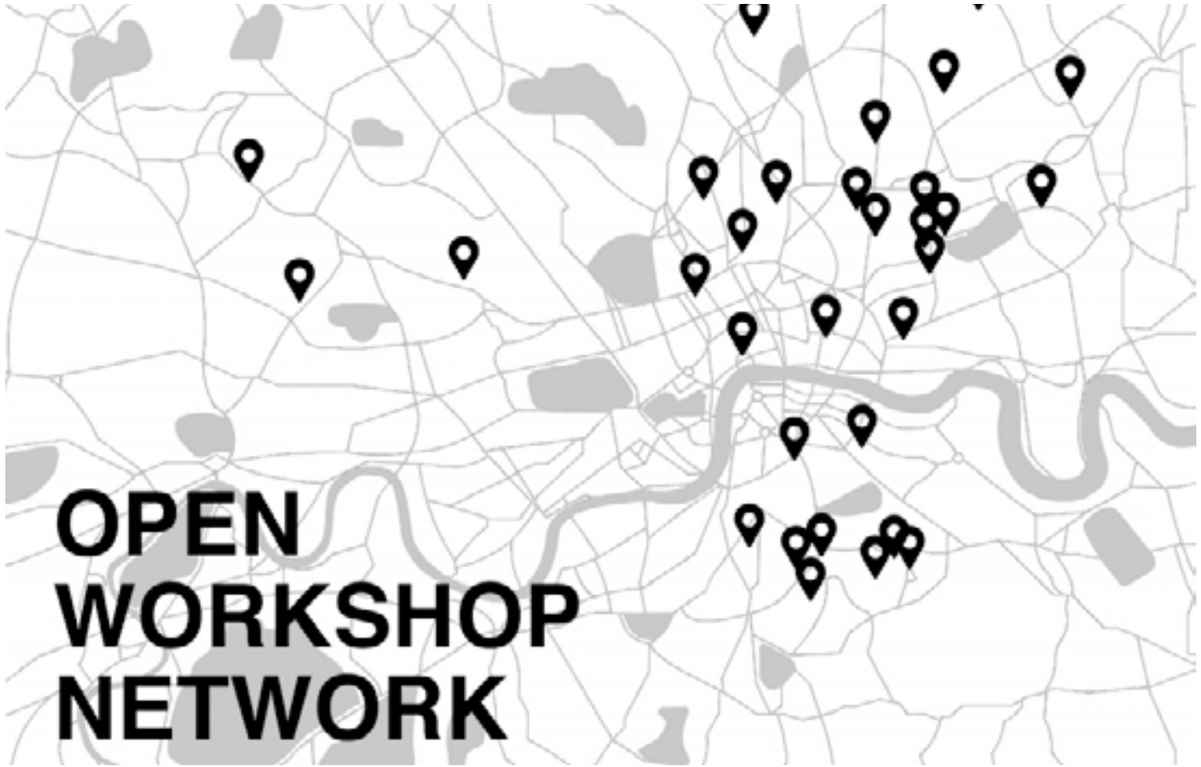
Open Workshop Network

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

This project is operating in a time where increased interest and speculation into the broader "Maker Movement" is taking place. The goal of this project 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 currently 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 thus far 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



Maker Assembly
Comino Foundation (£20,000)

Institute of Making PhD student Liz Corbin co-produces Maker Assembly which is a platform for those interested in making. By combining the use of digital networks with a national event series, Maker Assembly brings people together to have critical conversations about cultures of making: their meaning, politics, history and future. Events have taken place in cities throughout the UK including London, Belfast, Manchester, Sheffield and Edinburgh. Through its online digital network and offline event series, Maker Assembly has engaged with an audience of over two thousand participants.

Diversity and inclusivity are the two definitive pillars to the platform's understanding of 'making'. Makers come in all shapes and sizes; people craft, design, manufacture, tinker, engineer, fabricate, and repair - young and old - as a hobby and as a profession - with digital tools and by hand - sharing unique historical perspectives and visions for how things might change in the future. The ambition is to make this dialogue open and accessible to as diverse a group as possible. The platform is carefully curated in a way that encourages participants to hear new ideas and gain new influences; share their passions and insights with others; connect with fellow practitioners that are like-minded and not-so-like-minded; question their worldview by listening to others' that may be lesser known; test assumptions and hypothesis; and think through acts of making with others.

Maker Assembly is co-produced by Liz Corbin (Institute of Making, UCL), Irini Papadimitriou (Victoria & Albert Museum), Andrew Sleigh (Lighthouse), Marc Barto and Tom Lynch (London College of Communication), with support from the Comino Foundation.
www.makerassembly.org

Hello Shenzhen
British Council Project (£300,000 - £500,000)

Maker culture is dynamic and growing both in the UK and abroad. Maker communities are transforming the creative process - developing innovative products and forming new models of social, civic and educational practices. This new and emerging sector is internationally focused and digitally connected but to date there have been few formal opportunities for cross-cultural exchange.

Hello Shenzhen is a 3-5 year bilateral exchange programme that seeks to build stronger links between UK and Chinese making practices, to support meaningful collaboration and to deepen learning between the two countries. Forming a greater connection between UK and Chinese making cultures will inform and develop making practices in both countries, inspiring makers to find new ways of working.

Through in-depth residencies, makers in the UK and China participate within collaborative inquiry and practice in relation to a number of themes including sustainability, education, community development and enterprise. Significantly, residencies will be developed in partnership with local communities and those organisations that support them. In the pilot year of the programme (2016/2017) the residencies took place in Shenzhen and the UK in March 2017.

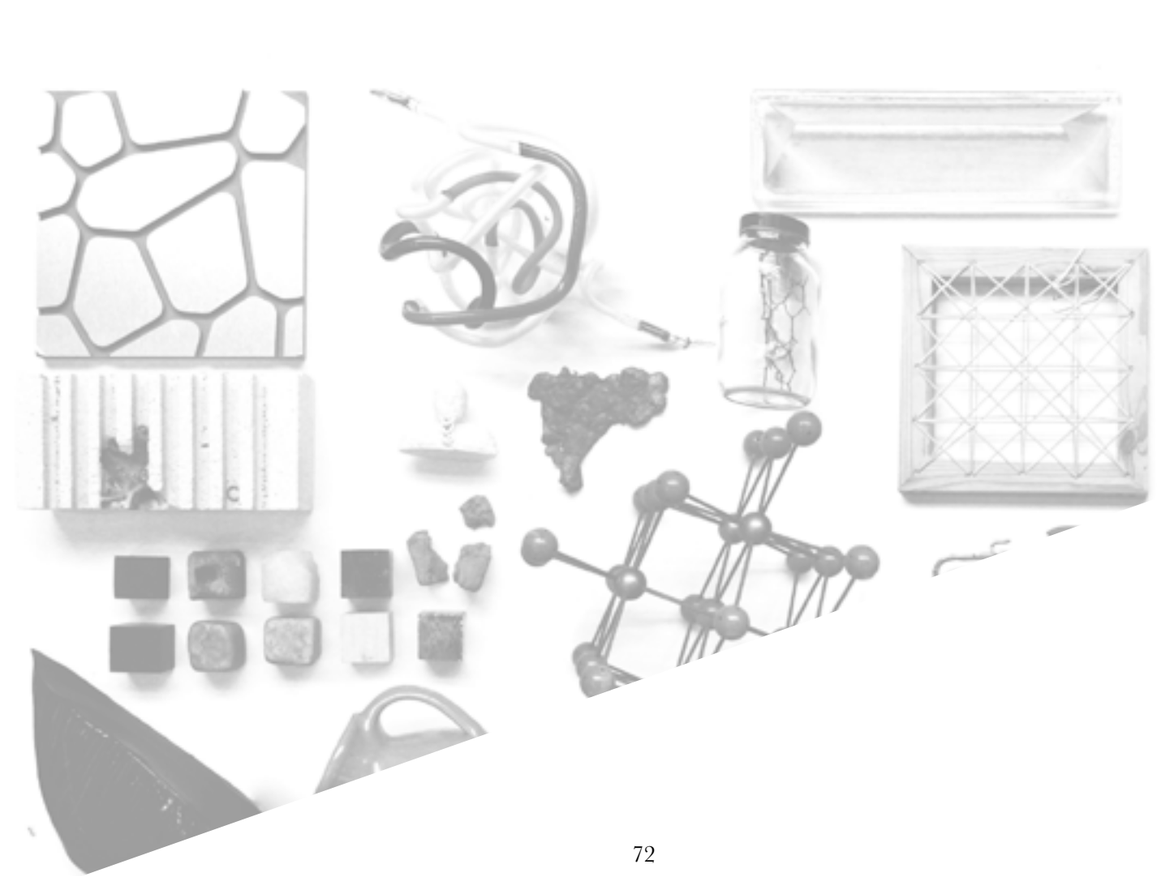
Hello Shenzhen partners are the British Council, The Shenzhen Foundation for International Exchange and Cooperation and Shenzhen Open Innovation Lab, supported by the AHRC. The strategic development of Hello Shenzhen has been led by Liz Corbin, Institute of Making, UCL. *www.creativeconomy.britishcouncil.org/projects/hello-shenzhen/*

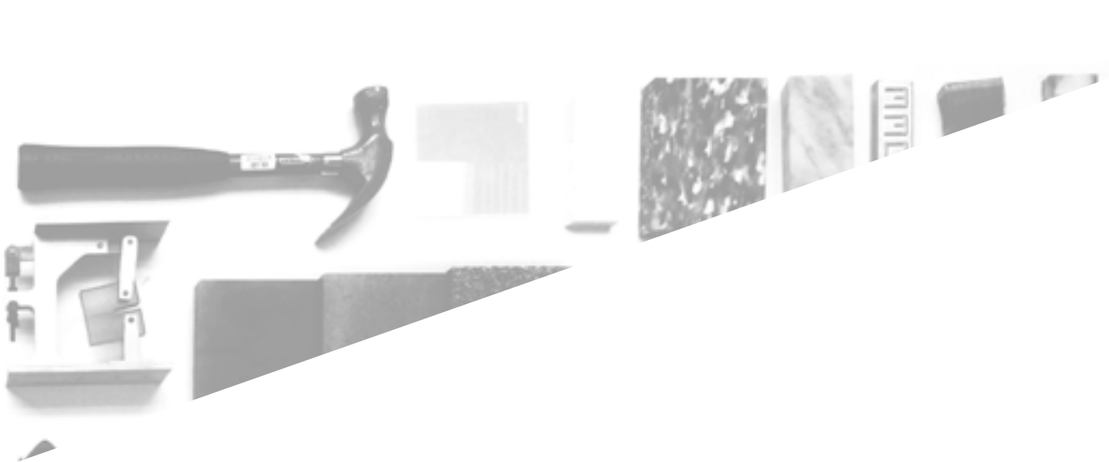
Scrambled Messages
AHRC EP/K038656/1 (£731,190)

It is often said that the trans-Atlantic telegraph changed the world in the nineteenth century. The Scrambled Messages project looks beyond the obvious reasons why this technology had such a profound impact to examine how it entered the public imagination. The project brings together researchers from fields as diverse as Engineering, Art History, English and Archaeology. Through a combination of primary research, dialogue, research events and exhibitions, the team look at the way in which popular understandings of the trans-Atlantic submarine telegraph fed the Victorian imagination and made certain themes, metaphors and paradigms urgent and relevant for artists, writers, scientists and other cultural producers. The Institute of Making contributes to materially-grounding the understanding of the impacts of the technology on the Victorian cultural imagination.

The Scrambled Messages project culminated with *Victorians Decoded: Art and Telegraphy*, an exhibition at the Guildhall Art Gallery, which ran from 20 September 2016 - 22 January 2017. The exhibition celebrated the 150th anniversary of the first communications cable laid across the Atlantic Ocean, connecting Europe with America. One of our members, Alexandra Bridarolli, won a competition to design and make an interactive message-scrambling machine which interprets 'telegraphy' freely. The machine allowed the public to produce and print a message that could be taken home. The Great Grammatizor took pieces of literary text and scrambled them, echoing the difficulties of early telegraphy in which complete messages might be sent from one end and be indecipherable upon reception.

The project is led by Prof Caroline Arscott, The Courtauld Institute of Art and Prof Clare Pettitt, King's College London. The exhibition catalogue can be downloaded here: *www.scrambledmessages.ac.uk*





Events & Public Engagement

Our events and public engagement programme is designed 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. We organise events from specialist making masterclasses for small groups of members to public festivals for thousands of people, as well as talks, seminars and research workshops. Every event we run enables its audience to gain an insight into the art and science of expert makers and a chance to discuss broader issues around materials and making. Our research workshops focus on specific research themes and gather together experts and enthusiasts working in related areas to share their ideas and discuss the issues surrounding their topic. These events have the explicit aim of creating new interdisciplinary research collaborations.

From March 2016 to March 2017 we held 52 events, 32 of which were member events and 29 of which were public (see pp. 144-146 for the full list of events). These included 31 masterclasses (including concrete explorations and chair caning), 6 research events (including Hands of X and Object-based & Creative Methods for Communicating Emotions), 4 research hub events (including Scrambled Messages and Co-Lab), 2 Materials Library evenings, 1 corporate event, 2 outreach events, 3 large-scale public open days, 3 week-long events (including Beer Brewing and Jeremy Atkinson, clog maker in residence). All our events are extremely popular: many are booked up within minutes of release and form extensive waiting lists.

The events programme was developed and expertly managed by our Events Coordinator Olivia, with help from her trusty team of volunteers. Over the past year our events have attracted a total audience of more than 6000 people. The demand for our events far outstrips supply, and to cope with the large volume of people

who attend we regularly recruit both staff and students as volunteers to help. For the Saturday Open Day during the Festival of Stuff we worked with 40 volunteers. Through these events our wonderful and knowledgeable community of staff and members get experience and training in interacting with and talking to the public.

Only with Olivia's energy, enthusiasm and determination were we able to offer such a jam-packed, exciting and inclusive array of events that cater to people from all disciplines, age groups and from all over the world. The jewel in her crown is undoubtedly the five-day Festival of Stuff, which is dedicated to our public audience. Unfortunately, in January 2017, Olivia moved to Cardiff to be closer to her family. The events programme has been her passion for the last three and half years and now its time for Sara Brouwer else to make it her own.

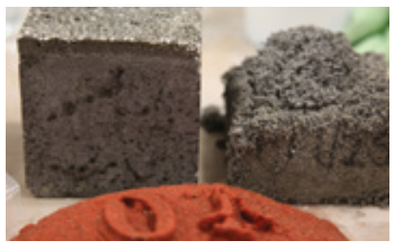
Here are a few twitter mentions from the Festival of Stuff:

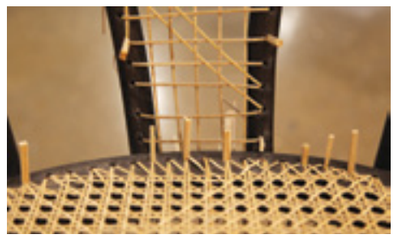
'Great day volunteering at the Inst. @of_making festival, making music w/coathangers & playing with @hackoustic toys'
(James Lawrence, volunteer)

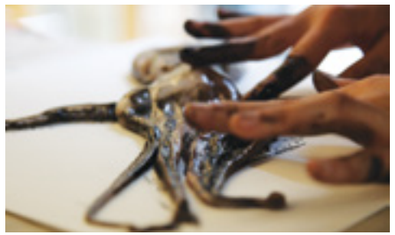
'Great work brought home from #festivalofstuff @of_making Beautiful pewter cast and a very happy child. Thank you!'
(Carole Pearson)

Festival of Stuff
(Masterclasses)

A five-day festival of materials and making, aimed at a public audience of adults and children, brought back the most popular masterclasses from the past year. Each day we held masterclasses along different themes including experimental pewter casting, fabric colouring and sensor making. All 19 masterclasses organised for the festival sold out within minutes. The first day's events involved morning and afternoon felt balls with 3D hand embroidery, chair caning, wooden whistle crafting, and dustpan and brush making. The second day entailed morning and afternoon experimental fabric colouring and laminate wood forming. In the evening Director Zoe Laughlin raised the roof her talk 'Performing Matter'. On the third day we had morning and afternoon experimental pewter casting, plant moisture sensor constructing and fish printing. The fourth and final day of masterclasses we held morning and afternoon concrete experimentation and wearable sensor making.







Festival of Stuff
(Open Day)

An overwhelming 2000 people came to the Saturday finale of the Festival of Stuff. The Open Day extravaganza brought back old favourites such as pewter casting, meanwhile chemist Andres Tretiakov discovered nano-metals, Dat Brass brought the street to life with their music and Fraise Sauvage kept everyone cool with free ice lollies. We heard the sound of materials in library when Vulpestrument displayed their adapted sound machines, Hackoustic made sound with coat hangers, showcased curio no.1, allowed visitors try the big blade and taught them to make whistles from carrots. In a pigment-themed area, experts Ruth Siddal and Jo Volley explained the subject with gusto, artist Rachael Colley made paint brushes and UCL Museums opened their pigment-inspired cabinet of curiosities inspired. Master maker Rachael South was chair caning, Jeremy Atkinson was clog making and Faye McNulty was textile dying. Other stations included kinetic sand, artificial snow, earthquake proofing, self-healing cities research project, Silo Studio brought their latest projects, Jochen Holz was glass-blowing and UCL Robotics set up a Prof Tickle Machine.

Sand Casting with Silver (Members Masterclass)

"Working with metal is a deeply rewarding experience. There is something elemental and magical about the process of heating metal until it turns to liquid; the silvery pool of molten metal spinning in the bright orange crucible." (Grant McCaig)

Sand casting metal is one of the earliest and simplest ways to work metal. This masterclass was led by silversmith and educator Grant McCaig. His work is exhibited internationally and forms part of several national silver collections. In 2011 Grant travelled to Bogota, Colombia to teach and share his metal working skills. During this period he was introduced to sand casting, a process that he continues to work with today, driving of much of his current practice. This accessible technique offers a unique insight into the fundamentals of fine silversmithing. During this masterclass members learnt how to pack casting sand into frames, how to take moulds using the sand and how to heat silver to a liquid state before being poured.

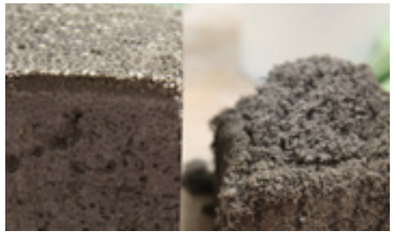
Jeremy Atkinson - Clog Maker (Maker in Residence)

In October we welcomed our second Maker in Residence, traditional clog maker Jeremy Atkinson. Jeremy comes from a long line of clog makers and is one of the few remaining traditional hand carvers making bespoke clogs in England. The clog is thought to have developed from a Patten shoe - a protective work overshoe worn in Europe throughout the Middle Ages. A Patten shoe has wooden block or sole with a leather strap to attach it. These were designed to be worn outdoors over a normal shoe to raise the wearers feet above the mud. Those who could not afford shoes wore these directly against their skin, leading to the development of the clog.

English clogs are traditionally made from a combination of wood and leather. The English clog makers tended to carve Welsh and West Country alder, Scottish birch and Lincolnshire willow. The Welsh clog makers also used sycamore, which was a more expensive wood, however, Jeremy has found it to last much longer in muddy conditions. During his week-long stay at the Institute of Making, Jeremy made a pair of clogs for Makespace manager Ellie. He began by measuring her feet, then carved the base, often referring back to her feet as a template. Jeremy stained the leather strap to the desired colour and attached this with brass nails to the sycamore sole. Throughout the week, members had the opportunity to come and see his progress.

Concrete with Leigh Cameron (Public Masterclass)

In May 2016 we teamed up with London Craft Week, which showcases exceptional craftsmanship from around the world through a journey-of-discovery programme of over 130 events across the city, featuring hidden workshops and unknown makers alongside celebrated masters, famous studios, galleries, shops and luxury brands. Participants explored the materiality of concrete with master maker Leigh Cameron who has dedicated his life's work to this material. Leigh works with concrete using new techniques to develop and explore its 2,000 year history. He aims to develop a new context and aesthetic dialogue through considering concrete's materiality; investigating its diversity, structural properties, weight, adaptability and material content, exploring its texture, colour, form and relationship to other materials. The masterclass included casting concrete, playing with concrete and looking at different processes and formulations.

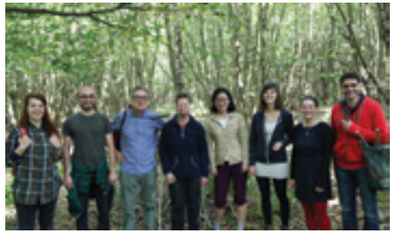


Geology (Open Day)

Towards the end of 2016, in partnership with the Geologists' Association we celebrated everything geological with the Festival of Geology. We showcased some of rare rocks, minerals and fossils from the UCL Geology Collection and the Materials Library. Visitors viewed a meteorite composed of a rare type of iron not otherwise found on earth and watched master flintknapper Karl Lee make delicate tools, weapons and decorative items. We also explored the world of geological fakery with fool's gold, synthetic rubies and Brighton rock. Visitors had a go at making and naming their very own fake rock with prop maker Richard Graham. Participants could also try their hand at carving soft materials, like chalk, chocolate, cheese and soap with architectural stonemason Paul Jakeman, who was on hand to give carving tips.

Day in the woods with Geoffrey Fisher (Members Masterclass)

During the summer we took a group of members out of the Makespace for an action-packed day out with green woodworker Geoffrey Fisher in his studio in High Wycombe. Geoff is a green woodworker, which means the wood he uses is fresh and full of sap, unlike most other timber which has been dried over a long period of time to make it stable. He uses a range of traditional cabinet making techniques to transform twigs and branches into characterful, handcrafted objects for the home. His collection ranges from hooks, table top dustpan and brushes, to skipping ropes, whistles and slingshots. We visited Geoff's studio and then headed to Mop End Woods to coppice some wood. After a lunch break in the local pup, we drove back to Geoff's studio where we transformed the wood into whistles, slingshots and coat hooks.



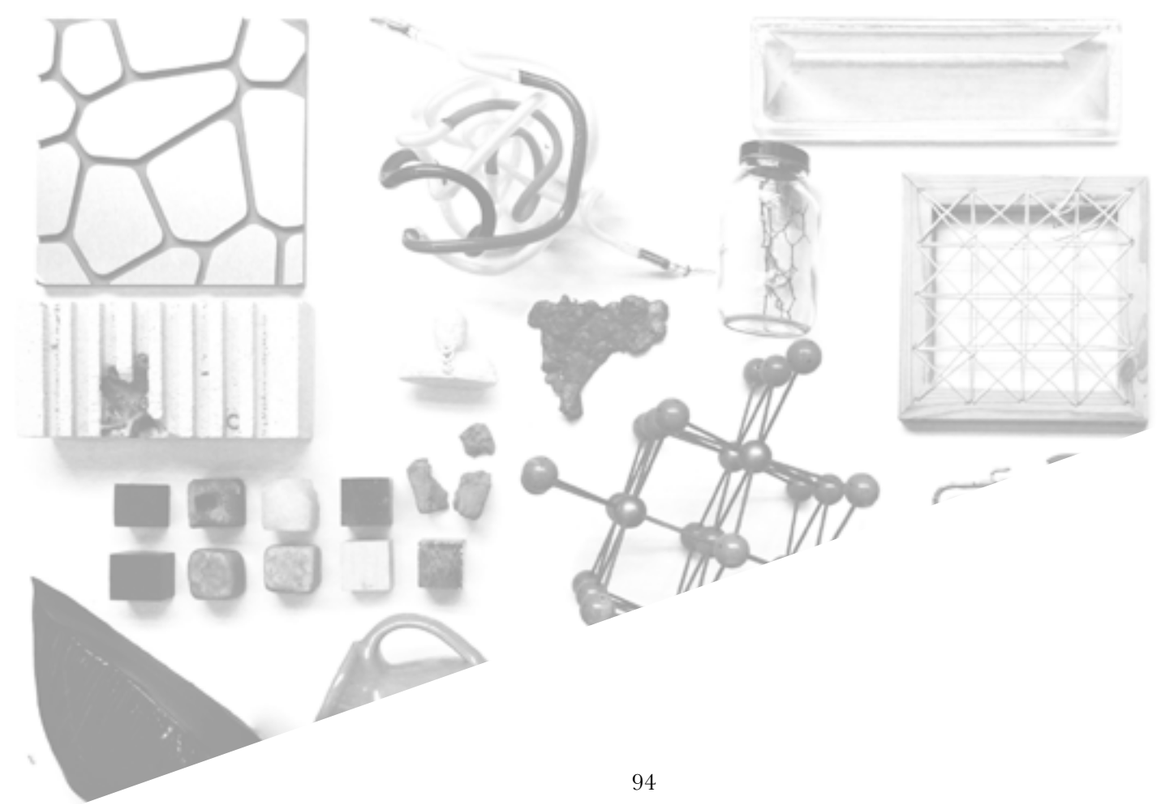
Materials Library Evening - Pigments, Paints and Prints (Public Event)

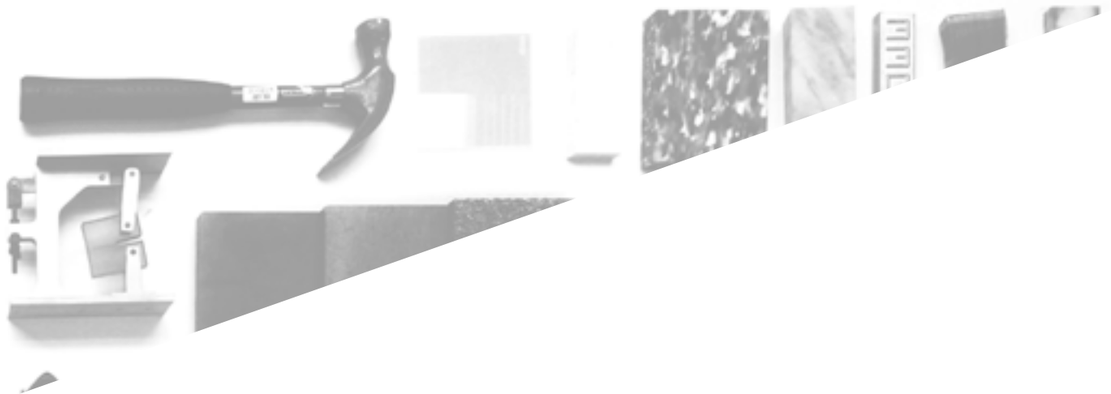
A few days each year, we open up the Materials Library to the public for an evening of exploration, experimentation and play. In April 2016 we focused on all things pigments, paint and prints. Expert Ruth Siddall was on hand to answer questions about pigments, whilst visitors made paint from powdered pigments and then applied it in various forms of printmaking.

"I am writing to say how much I enjoyed last night's Pigments evening. Ruth Siddall's pigments talk and display of samples was both delightful and highly illuminating, underpinned by absolute mastery of the subject. The explainers running the printing area were welcoming, encouraging and full of infectious enthusiasm. Altogether a wonderful introduction to the Institute of Making, huge thanks to all involved.
(Charles Ormrod who attended the Materials Library Evening on 28th April 2016)

Hands of X, London (Research Event)

This research workshop brought together participants with an interest in prosthetics – including wearers, designers, makers, prosthetists, material scientists and engineers – to discuss and design prototype prosthetic hands made out of materials chosen by potential wearers. We created twelve specifications for hands in different combinations of two materials. The most striking result was how meaningful the selection of materials was for our participants. Two of our prosthetics wearers, with whom we have since co-designed prototypes, attest to the feelings of the ownership they have towards hands that have not yet been made, let alone worn. And yet the longevity of this relationship, deepening with use and wear, has been part of their rationale for taking part. This has profound clinical implications but also commercial – and sustainable.





Materials Library

"Having the opportunity to meet and converse with a materials expert about the particularities and demands of my project was truly invaluable."
(Demitris Ktorides, Postgraduate student, MArch Architecture, Bartlett Faculty of the Built Environment)

The Materials Library is at the heart of the Institute of Making. It is a fluid and ever-evolving collection of some of the most wondrous materials on earth. The collection exists as a resource, laboratory, studio and playground for both the Institute of Making members and it's public following to seek inspiration, conduct hands-on research, and get involved in interdisciplinary inquiry and innovation. This multi-faceted and highly diverse collection cuts across all research borders and cultures of practice; fusing together disparate academic disciplines and fields of industry, and standing as a catalyst and common language for cross-disciplinary work. The collection has now grown to over 2,100 material samples.

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 monthly open days and quarterly Materials Library evenings. All of this would not be possible without Liz Corbin, who curates the Materials Library collection, leads the Materials Library Consultancy programme, and manages our amazing volunteers alongside her full time PhD.

This year saw the expansion of 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 material consultation, advice and guidance in regards to a particular area of research or project from the Institute of Making team. The consultancy programme has remained in high-demand throughout the year, with each weekly series being oversubscribed. The consultancy programme serves as a successful example of teaching-research interaction and hands-on, object-based learning.

Materials Library Consultancy Programme

"The consultation I had with Liz was quite early on in my research as I was getting to grips with an elusive new material for me - Zambian copper. I am fascinated by both its social and physical dimensions and was able to discuss with Liz - who fortuitously has background of research metalwork in Southern Africa! - cultural and poetic attachments to the material, as well as the difficulties of determining its origin once it has been let loose in the global market. It was a brilliant opportunity to gain a fresh perspective outside of my immediate field and Liz was a fountain of knowledge with historical and contemporary references."
(Thandi Loewenson, PhD Architectural Design, Bartlett Faculty of the Built Environment)

Through the Materials Library Consultancy Programme the Institute of Making has been able to offer regular one-on-one sessions to our members on a bookable basis. The consultations are an opportunity for members to explore the collection in greater detail and to seek material consultation, advice and guidance in regards to a particular area of research or project from the Institute of Making team.

Through the Programme the Institute has successfully provided support to both students and staff from a wide range of departments, including the Bartlett School of Architecture, the Slade School of Fine Art, UCL Engineering, UCL Medical Sciences, the Institute of Education, UCL Museums and Public Engagement, and UCL Arts and Humanities. From the production of solar panels and the designing of living walls, to the materiality of digital media and the material culture of Zambian copper - the consultancy programme serves as a successful example of teaching-research interaction and hands-on, object-based learning.

A small selection of examples has been included below to illustrate the diversity of projects and fields of research the Materials Library Consultancy programme has supported.

Ava from the Bartlett Faculty of the Built Environment booked a session after embarking upon a new area of research - the materiality of digital media. We curated a small collection of materials that enabled her to translate particular material phenomenon and concepts to her students, from bioluminescence and thermochromictic properties, to the optical properties of refraction and reflection. This curated collection – which we were able to provide in both physical and digital form – has proved an invaluable communication tool for her teaching and research. (Reader in Media Architecture and Urban Digital Interaction, Bartlett Faculty of the Built Environment)

George, a postgraduate student in UCL Engineering, booked a session to help him develop a novel knee brace for applications in water sports. Using the Materials Library Collection, we were able to introduce George to a selection of materials including kevlar (in the form of thread, yarn and textile), carbon fibre (in the form of thread, yarn and textile) and neoprene of varying elasticity. This small collection enabled George to practically think through the required structural, aesthetic and physical properties of his prototype, expediting its development. (Postgraduate student, MSc Engineering with Innovation and Entrepreneurship, UCL Engineering)

Chong, an MArch Architectural Design student in the Barlett Faculty of the Built Environment, booked a session to help him develop a built environment horticultural system. His ambition was to create a more efficient integrated system rather than the living wall layered-based systems currently available. Using a small collection

of materials from the Library including terracotta, concrete, perlite, soil and honeycomb paneling we were able to develop a concept for a homogenous material that would be both structurally sound and suitable to support the growth of plants. Whilst far from a finished product, the material collection gave Chong the ability to work through the project's design conception and initial material selection in an explorative and novel way. (Postgraduate student, MArch Architectural Design, Bartlett Faculty of the Built Environment)

Karolina, an MFA Media student in the Slade School of Fine Art, booked a session to move forward her research on hearing aids. Karolina wanted to create an interactive installation that, in part, exhibited glass-like replicas of a collection of hearing aids. The Materials Library's extensive collection of silicone rubber introduced Karolina to the possibilities and potentials of mouldmaking and casting. With this collection, Karolina was able to work through an initial material selection process for both the mould and the cast object, taking into consideration necessary requirements of shore hardness, tear resistance and optical properties. Although the consideration of such requirements and properties came as new territory to Karolina, the materials library as guide enabled an intuitive approach. (Postgraduate student, MFA Media, Slade School of Fine Art)

Demitris, an MArch Architecture student within the Bartlett Faculty of the Built Environment, booked a session relating to his project exploring the occupation of space between walls, allowing architectural design to move more fluidly between structural layers and densities. The project's development demanded a transition to materials that are unconventional to Architecture practice. Through the Materials Library's collection of latex, silicon and fabrics, Demitris was able to explore novel

techniques for achieving inflation, contraction, flexibility and structure within his project. (Postgraduate student, MArch Architecture, Bartlett Faculty of the Built Environment)

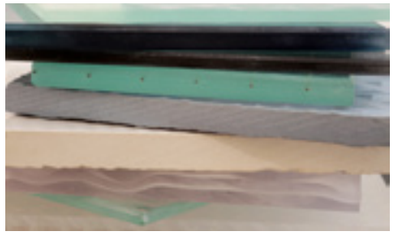
"Meeting with Liz was fantastic. I am in the process of refining a large sculpture that will mark the centenary of the first women in the UK to get the right to vote, and I was keen to explore this in the context of the Materials Library. I felt Liz really appreciated both my practical requirements and the political significance of how I am approaching the use of materials in this work. As a result of our meeting I will be exploring the use of a material I did not previously know of - thank you!"
(Kristina Clackson-Bonnington. Artist in residence, Medical Sciences)

Materials Library Volunteer
Valerie Yingli Ngow

"The Materials Library is home to some very wonderful and curious materials. A highlight of my time with the Library is when I get to share these curiosities with members of the public during open days. I've got to teach kids about how exciting a material is as well as speak to people who are more familiar with the materials. It's been a good outlet for me to be more connected with the Institute of Making community."

Valerie is a third year Mechanical Engineering and Business Finance student. She has been an integral part of the Institute of Making team since 2015. Previously, she had coordinated the development of the Materials Library Health and Safety Plan. She is currently working on the Library's cataloguing and material profiling efforts and hopes to make significant progress by the end of the year.

"It's been very exiting watching the changes that take place in the Library and the Makespace. I am very proud to have helped the Materials Library reach its goal of making materials discovery more accessible to anyone in any field."



Optical fibres

With the number of wireless devices in use at the moment it is tempting to think that Internet cables are a thing of the past, but more cables are being laid than ever before and at their heart lies super fast optical fibres. Optical fibres are made from a mixture of silicon and germanium oxides, and formed through a modified chemical vapour deposition (MCVD) procedure. A glass blank is made and the glass fibres are pulled and then wound onto a spool like thread. The process modifies the refractive index on the outside of the glass fibres which is the key to their ability to efficiently transmit light.

Optical fibres carry telecommunication signals in the form of pulses of laser light. Millions of miles of fibres have been laid across the seabed, enabling fast global telephone and Internet access. The fibres trap and reflects due to modification of their refractive index so that the light follows the curve of the optical fibre wherever it leads. Another application is in key-hole surgery, which sees the use of optical fibres being inserted into the body to allow surgeons to clearly see what's going on inside. Optical fibre-based IT networks support a move toward sustainable networks as they reduce energy consumption and lower the total cost of ownership for a network through longer product lifecycles. Optical fibres consume less energy than copper-based IT systems, not just initially, but also across the lifespan of a network. The inherently high bandwidth in optical fibre means that once the cable is installed, it has a potential working life of 25-plus years, thereby providing network managers a strategy that minimizes materials consumption and maximizes support for emerging technologies.

Particularities: State: solid Category: glass
Relationships: light, bundling, transmission, seabed, telecommunications

Zebra Fish

Zebrafish have many remarkable properties which makes them an ideal organism for health research. One of the most interesting properties is the ability of the zebrafish to regenerate various tissues and cells in their body, including their fins, scales and heart tissue after damage. Although this is not unique in the animal kingdom, the advantage of the zebrafish is that the embryos grow very quickly, they have a fully-sequenced genome, and they are easily observable under a microscope. Understanding their regeneration abilities could give scientists clues into how to regenerate damaged human heart tissue, a process that does not occur naturally and leads to many premature deaths. In 2011, the British Heart Foundation signalled their intention to invest £50 million into this kind of research.

This particular zebrafish has been used for a different type of research. It has been genetically engineered to express a special protein during its growth. Green fluorescent protein (GFP) is a naturally occurring protein in the bioluminescent jellyfish Aequorea Victoria, and it has attracted much scientific attention in recent years. This is because the protein can be engineered into other biological organisms, such that they become fluorescent. This zebrafish does not fluoresce strongly green all over, instead the fluorescence acts as a subtle marker under a microscope to track the growth and development of a zebrafish embryo, a process which has shed light upon how cells change and arrange themselves during the growth stages of all living organisms.

Particularities: State: solid Category: animal
Relationships: fish, animal, genetics, fluorescent, fluoresce, tissue-regeneration

Flint

Flint is a glassy, waxy-looking sedimentary rock that can be knapped into faceted shapes with very hard and sharp edges. It is one of the hardest naturally occurring materials and has an amorphous atomic structure similar to that of glass. Shaping flints by striking them with other rocks or tools - flint knapping - is a difficult skill as there is no grain to the material and flakes of flint fracture off as a result of the shock waves that are caused by a strike. Some of the ripples of these waves are visible on the surface of flakes that fall away. These flint shards have been flaked from a much larger piece; you can see the rind-like surface of the naturally occurring nodule from which they came. Flint nodules are found in between ancient layers of soft sedimentary rock like limestone or chalk. They are likely to have developed from the decomposed skeletons of billions of silica-based sea-creatures.

Knapped flints were among the first reliable tools made by humans for hunting, butchering and scraping animal hide. As flint also creates sparks when struck with an equivalent or harder material, the material is also a useful fire-making tool. Flint is still used as a tool to this day in eye-surgery as an ultra-thin and sharp knife, for it can be made more sterile than metal and incisions heal better due to the fine nature of the blade it makes.

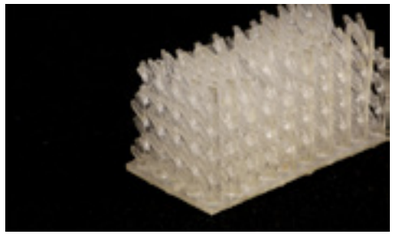
Particularities: State: solid Category: mineral
Relationships: silica, glassy, sharp, sedimentary, knife, flake

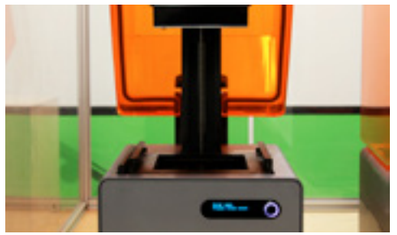
Stereo lithography resin

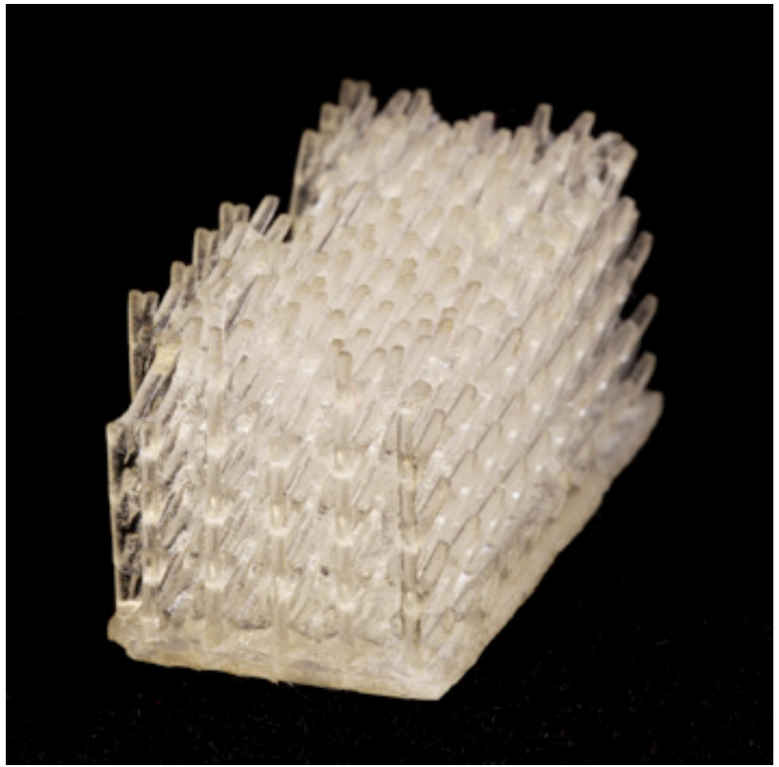
The geometry and fine tolerances of this intricately shaped polymer part are beyond those obtainable by the use of traditional polymer manufacturing techniques like ejection moulding. Instead, a novel stereo lithographic technique was used, and constitutes a type of 3D printing. The process involves a Computer Aided Design (CAD) drawing of the desired part being produced in a virtual environment, then electronically sectioned into thin layers (typically less than a quarter of a millimetre) and then sent to the printing device that additively constructs the object layer by layer.

In the case of this object, a small diameter ultraviolet (UV) laser scans across a bed of liquid resin, curing and thus turning hard the area where the light touches, creating a single layer of the final part. A new layer of resin is then swept across the first and the UV laser applied, forming the next layer and binding it to the previous one. This continues until the full 3D form has been rendered physical. A major advantage of this technique, of which similar varieties exist for powders of metals and ceramics, is that bespoke one-off parts can be generated relatively quickly and cost effectively.

Particularities: State: solid Category: polymer
Relationships: yellow, resin, manufacturing, UV-cured, 3D printed, stereo lithography







Piezoelectric Materials

Piezoelectric materials generate electricity as the result of an externally applied mechanical force, converting kinetic energy into electrical energy. The piezo effect occurs in a number of naturally occurring and synthetic materials including crystals, sucrose, bone, ceramics and polymers. With novel applications of piezoelectric materials, the architects, designers, scientists and engineers of today's advanced industries are exploring viable alternatives for energy generation and capture.

Pavegen is a flooring system that captures kinetic energy from pedestrian footfall and converts it into electrical energy. Pavegen slabs can be incorporated within urban pavement where large numbers of people can generate the electrical energy for pedestrian lighting, wayfinding solutions and traffic lights, for example. Trials to date have shown the electricity generated from the surrounding foot traffic provided all the electricity needed to run a train station's ticket gates and display systems.

The Institute of Making has been involved in an EU-funded project that brought together product designers and material researchers to develop a new generation of affordable, flexible piezoelectric materials for novel care and well-being applications. Unlike the rigid, brittle nature of ceramic piezoelectric materials, this new polymeric piezoelectric will be both flexible and formable. They can therefore be seamlessly integrated into products, resulting in entire objects that respond to their user.

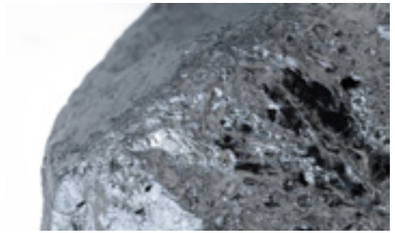
Particularities: State: solid Category: composite
Relationships: kinetic, smart, electricity, light, touch

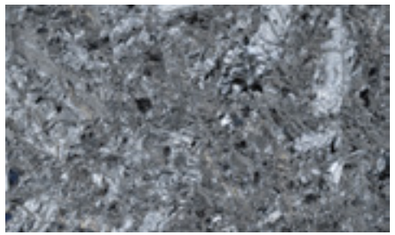
Silicon

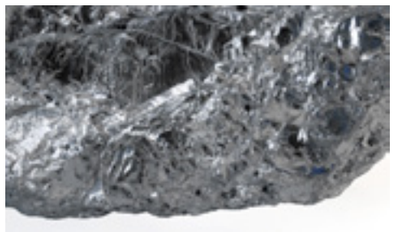
Silicon chips are the electronic brains that run the world. They fly our planes, drive our trains, take care of the washing while we are out, keep us alive in hospital and handle our most intimate conversations. We get all this from a thin sliver of material the size of a postage stamp that was invented in the 20th century when the popularity of the telephone and the radio led to a general enthusiasm for all things electronic.

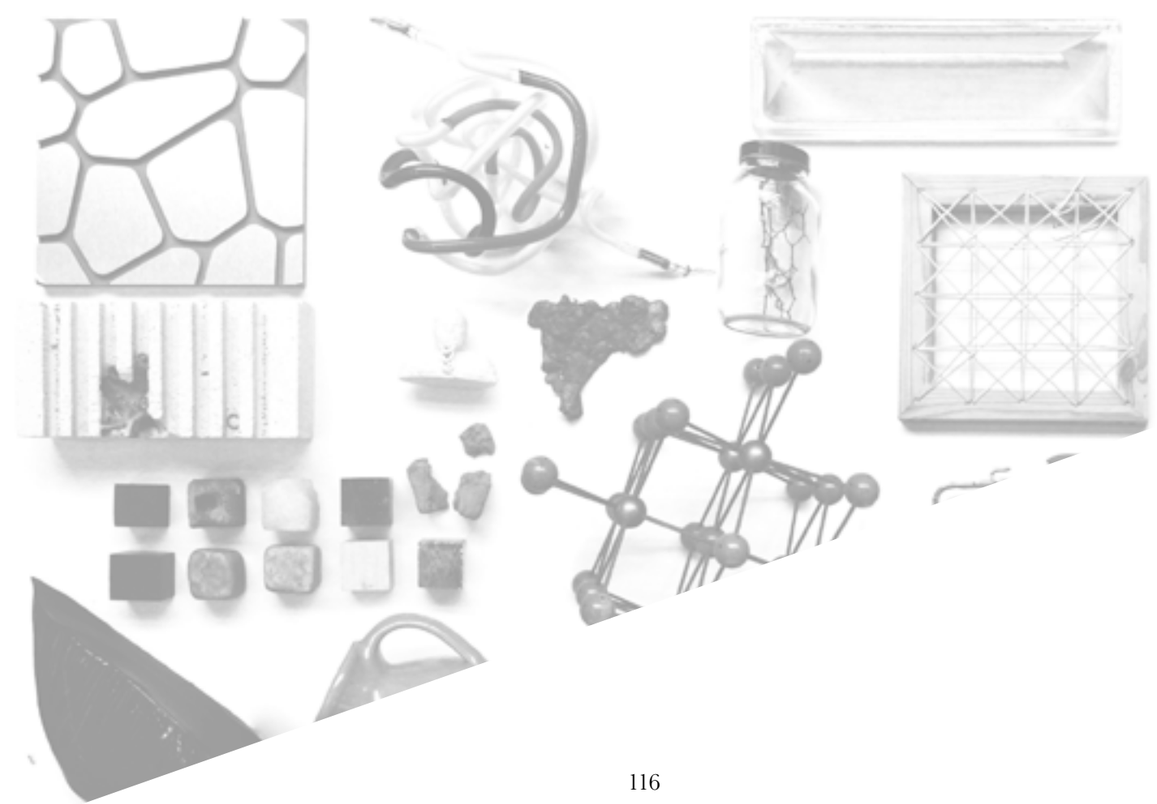
Silicon is a semiconductor, which means that it conducts electricity, but not very well. This sounds like a problem, but is exactly what you want if you are trying to create a computer out of a single material because you need some parts to conduct electricity and others not to conduct at all. Engineering the material to do this involves introducing tiny amounts of defects into the silicon, such as phosphorus or boron atoms. By layering these impurities in particular configurations it is possible to create resistors, diodes and transistors. Being able to make such electronic components out of a single piece of silicon and connecting them all yielded the archetype of the integrated silicon chip that we have today. Silicon chips perform digital computation and are the technology that underpin the whole IT revolution.

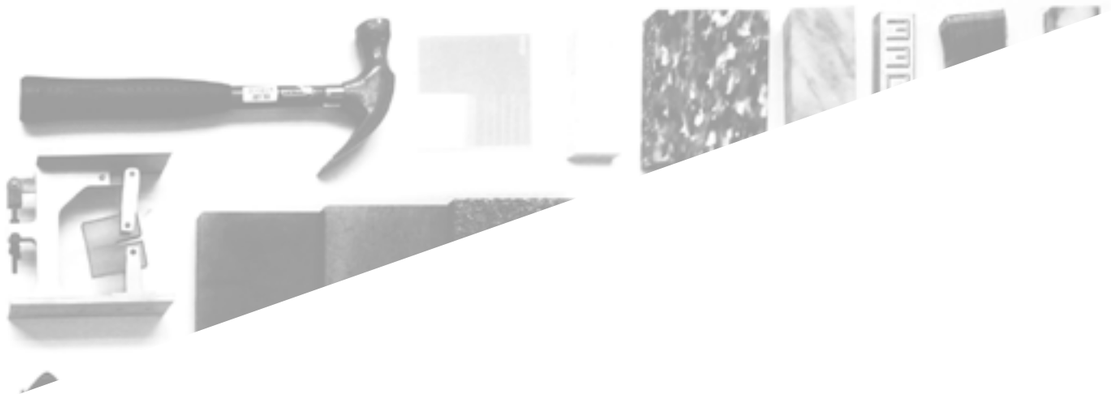
Particularities: State: solid Category: mineral
Relationships: element, silver, shiny, metallic, rock, revolutionary, ubiquitous











The Makespace

Under the practiced eye of our Makespace team, the workshop has continued to thrive after 4 years of constant operation. New tools, replacement machines, modifications to space and exciting extensions to existing facilities have all been added this year, broadening the opportunities for members to learn new things and combine techniques.

We have streamlined member admin systems and are launching an improved members section on the website, making it easier for members and staff to manage bookings and tool training record-keeping online.

A measure of our success is the feedback from out members that they appreciate the atmosphere of trust, friendliness and open mindedness. This is largely due to the nature and attitude of our technical staff who are the first point of contact in the Makespace, and can advise and teach members a broad range of material and making approaches with skill, imagination and a sense of humour, combined with a commitment to teaching people to work safely.

This year we said goodbye to our brilliant technician Zachary Eastwood Bloom who has moved to Scotland to work full-time as an artist and sculptor.

Darren Ellis is a highly skilled and creative potter who enjoys learning and sharing his knowledge, from kiln building and layout, to the molecular structure of clay and glazes. With a background working in his family textile mill, he's a strong all-round problem-solver, fabricator and engineer. Darren takes the time to ensure that all members feel listened to and safely advised.

Romain Meunier is a versatile maker and a creative technologist who likes mixing a variety of digital and analogue tools to reconcile the virtual and the physical world, bringing together data flows and human senses. Growing up with a dressmaker mother and a mechanic/carpenter father, Romain has always been surrounded by craft, and he considers himself an artisan of new technologies. He is particularly skilled in CNC tools.

George Walker is our newest team member, joining us as assistant technician. He has a background in music programming, and works at Edtech startup Ohbot: a robot head designed to help teach kids to code. His experience with CAD, 3D print technologies, Arduino, and internet of things networks has made him a vital presence for our members. He is also assisting with systems and digital solutions to the smooth running of our member operations.

Ellie Doney is our workshop manager, she has an all-round knowledge of materials and making processes with a specialisation in ceramics. She is able to advise on creative approaches to problem-solving, using the right material for the job, and makes sure the technical team and member supervisors are able to feel relaxed and supported while advising members.

"My experience at the Institute of Making has changed how I view the world around me. Seeing the importance of a high attention to detail in many of the members and my colleagues, accompanied by the sense that anything is possible has profoundly changed my approach to my own making and experimentation. I now realise the surrounding world is something I can change and adapt, and I can increasingly see objects as the individual parts, materials and processes that went into making them."
(George Walker, Makespace assistant technician)

NextEngine Scanning Multidrive robot

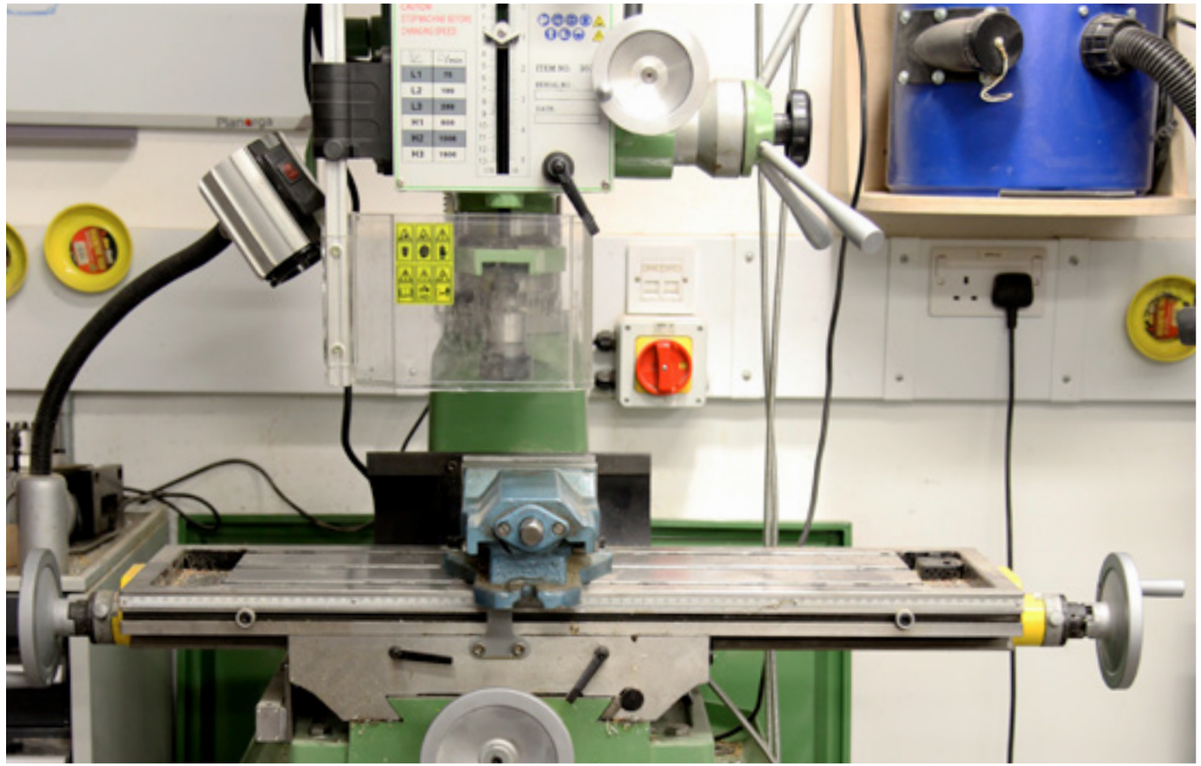
For a number of years we have used a NextEngine 3D scanner in the Makespace that is great for scanning smaller objects at a high resolution. This year we have upgraded the scanner by adding the MultiArm. The arm allows the scanner to not only rotate the object in the y axis but also rock it forward and backwards. This ensures the scanner can pick up the full 360° image of the object being scanned. Our members, as always, have found interesting ways of making use of these new possibilities. They have scanned among many things, pork scratchings, rubber toys and robot parts.

Timber Thicknesser

Another new tool this year is the planer thicknesser. This tool had been on our wish list for a while but we had not able to get one as they take up so much space. We then found a tabletop thicknesser that is small enough for us to fit into the workshop but can plane large enough planks to be useful. The tool is often used to repurpose timber from pallets and scrap wood, encouraging reuse of materials. Members have been busy using reclaimed wood in a host of different projects, from furniture to sculptures to scientific machines.

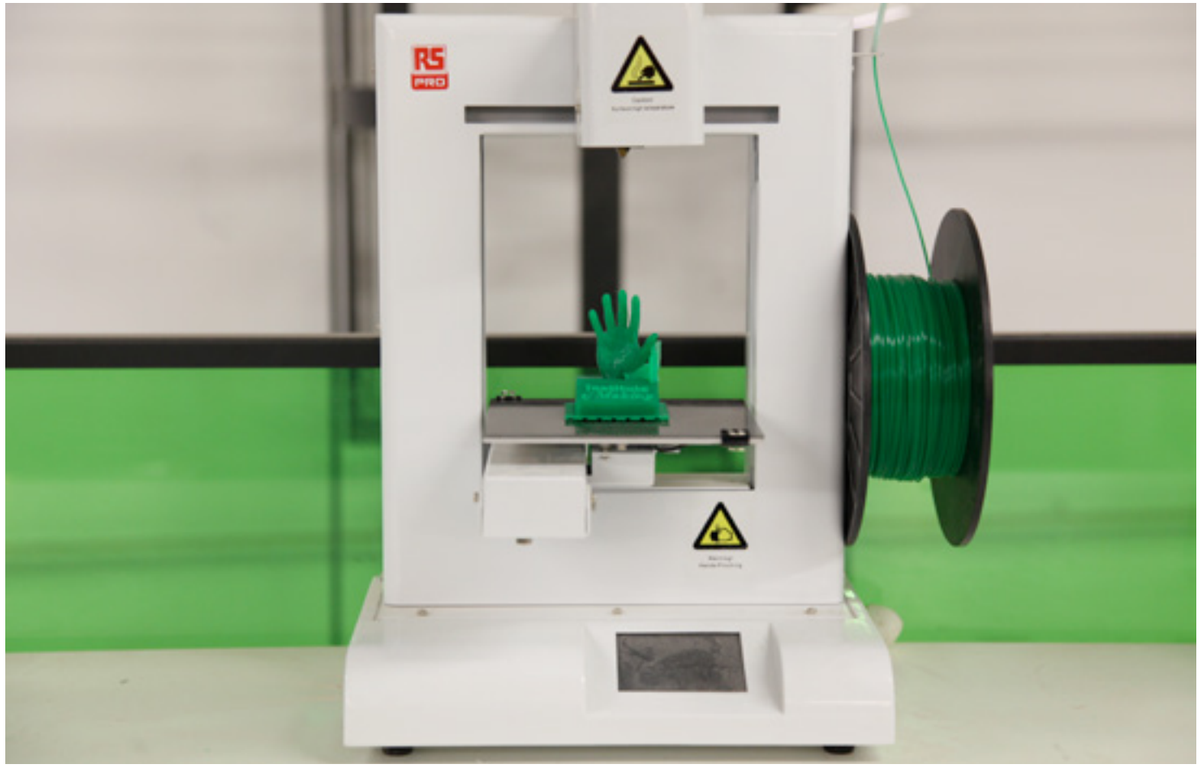
Milling Machine

This term we have installed a new milling machine which is more accurate than our previous one, and has a digital readout to help users achieve a high level of precision. We had a lot of fun installing the new machine as we were forced to attach it to our crane to manoeuvre it into position in the workshop.



RS IdeaWerk Pro

We have recently acquired a new low cost 3D printer, the RS Ideawerk Pro, to allow members to explore and experiment with materials other than the white PLA we use with our Ultimakers. We are now able to print in a wide range of colours, using other plastics such as nylon and polycarbonate, and with materials with interesting properties such as flexible and conductive filaments. This has greatly increased the range of applications of 3D printing for our members. An example of this is a member who printed buttons using the conductive filament which he connected to capacitive sensors to enable him to create an interactive notice board for the Olympic park. Flexible filament has also been used by a number of members to create parts for machines and other projects.



Jeremy Atkinson – Clog maker in Residence

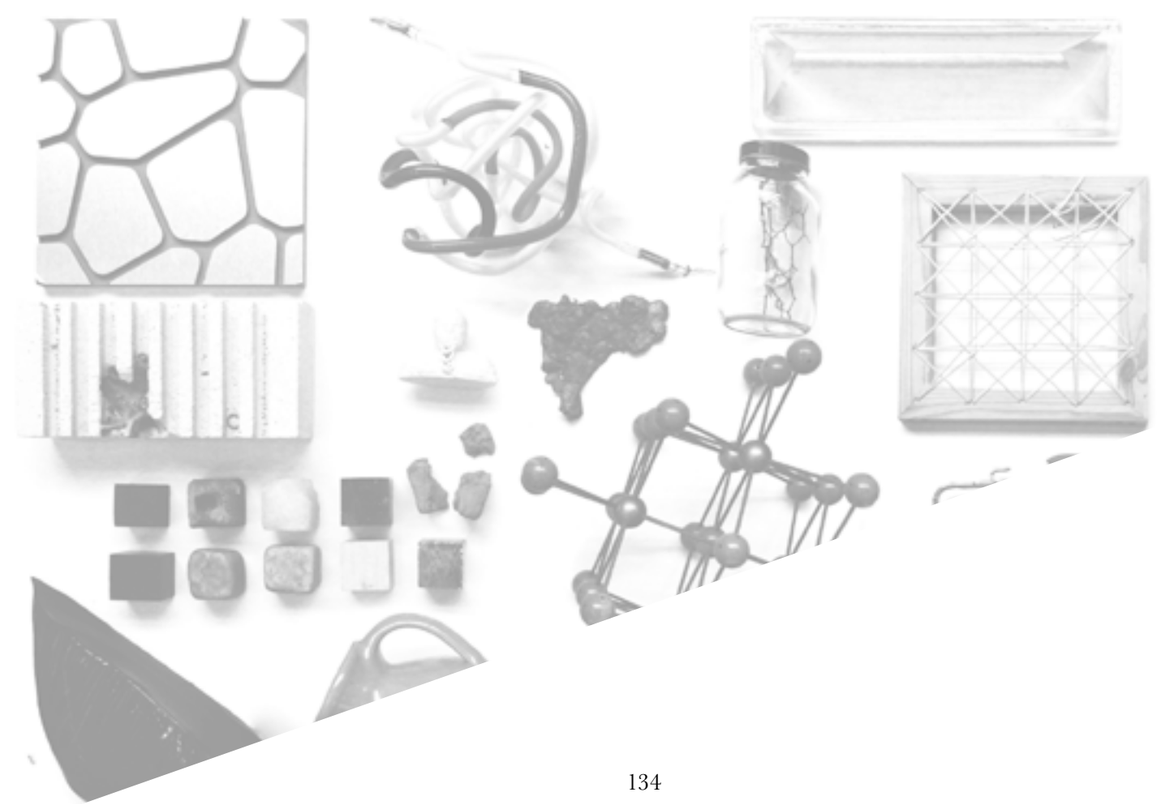
During our ‘lunchtime looks’ at the beginning of October, we opened our doors to all newcomers to pop in and take a nose around the space, to ask questions, find out how to join, and satisfy their curiosity. This year our maker in residence in was Jeremy Atkinson, England’s sole remaining traditional hand carver who makes bespoke clogs. He demonstrated traditional 19th century clog making techniques, and shared his deep knowledge of materials and making with members. Jeremy knows the whole process from felled tree to footwear, including preparing and shaping the wood, sizing, cutting and hand dyeing the leather to measure, and fixing them together with copper and brass tacks, glue and stitches. We collected a selection of animal and non-animal leathers for members to draw inspiration from, including mushroom leather.

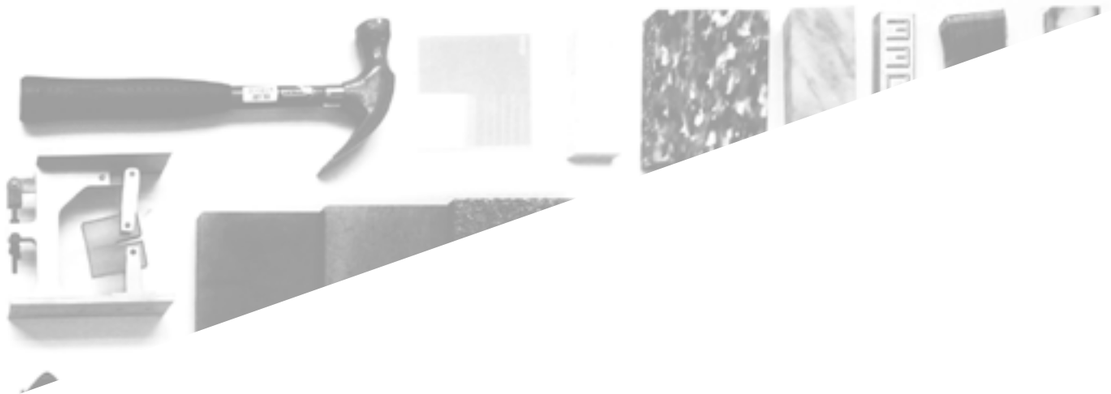
Visiting Artist Shelley James

Glass artist Shelley James and assistant Adam Leedham spent time in the Makespace working on geometries and materials for casting glass. Shelley found a type of PLA plastic that burns out very cleanly in the kiln, allowing her to cast glass with a surface that can be made relatively optically clear. They road-tested our new experimental 3D printer and gave a lecture on digital to traditional mouldmaking techniques, and mathematically inspired geometries for conducting and modifying light though glass.

Raft Race

This year we took part in the Inaugural Community Raft Race, supported by the Open Workshop Network (see p.64). Our entry “Rafty McRaftrace” had a timber frame strapped to recycled office water cooler bottles, and recycled woven seats. We took advantage of some of the expertise within the Makespace and were able to have the craft modelled and tested digitally by one our members Nick Bradbeer who is a lecturer in naval architecture. Once we were confident the raft would float we switched our attention to how we would propel it through the water. After much discussion, we settled on a pedal powered design that incorporated two sets of pedals connected to a central drive shaft which turned a propeller. We cut and shaped the propeller from sheet aluminium fastened it together using jubilee clips. We used bike chains and sprockets to connect the pedals to the drive shaft. To ensure our pilots were comfortable we created seats from recycled plastic drinking bottles, cut into strips and woven together with help from one of our masterclass experts, weaver Rachael South and Sustainability & Resource Efficiency programme director at Innovate UK, Nick Cliffe.





Concluding Remarks

"What I cannot create, I do not understand" (Richard Feynman, 1988)

This was a year of significant transition. Four years ago we opened our doors with the aim of creating a vibrant research club for everyone at UCL with an interest in materials and making. The team was small and comprised of Zoe, Mark and Martin as Directors, Sarah Wilkes as Research Manager, Ellie Doney as Makespace Manager and Richard Gamester as our Makespace Technician.
Sarah masterminded the research programme, getting to know pretty much everyone at UCL involved in materials research from art history to nanotechnology. Mark and Sarah put together a programme of research workshops and from that built multidisciplinary teams, applied successfully for funding, and created an impressive research portfolio. Ellie, Zoe, Martin and Richard got the MakeSpace going, developed the workshop, brought in expert practitioners to teach a programme of masterclasses and most importantly the developed the MakeSpace ethos. Zoe masterminded the public engagement and curated the Materials Library, with us all helping to collect materials and deliver events.

Such was the appetite for our approach and facilities that our membership grew to more than 5000 in the space of two years, and to keep pace we recruited more staff in the form of Olivia Clemence as Events Coordiantor, Zachary Eastwood-Bloom as another Makespace Technician and Liz Corbin as Materials Library Curator and PhD student. Olivia took our events to new heights of ambition, both technically, such as masterclasses in luted crucible bronze casting, and in terms of size and engagement, building up the five-day Festival of Stuff to the point where it took over the whole of Malet Place. Our public audience as measured through the mailing list grew to more than 20,000 and our global reach through media work grew to millions; we spun out two companies, and our research programme delivered both high profile interdisciplinary journal papers and

industrial impact. Most importantly we built a community of students and staff at UCL who through making and materials understand the world better, and have the learnt the skills to change it. This was achieved not just by the core team but also through the effort and goodwill of our members and through the enlightened financial and organisational support of UCL Engineering.

Now at the end of four years Zach and Richard have gone on to build their solo practices: Zach is a ceramic artist based in Edinburgh, Richard is a contemporary jeweller based in Kent. They have been replaced by expert makers Romain Meunier and Darren Ellis who have made the MakeSpace a welcoming and dynamic workshop. Sarah Wilkes has won a Wellcome Trust fellowship to become an Institute of Making research fellow researching the perceived healthiness of materials. Ellie has been accepted as a PhD student jointly between the Slade and the Institute of Making on the topic of food and transformation. Olivia Clemence has gone into business for herself running events on making and materials. Liz Corbin is coming to the end of her PhD on the topic of makespaces and innovation and is writing grants to continue the work with us. All this feels like end of something - the end of building the research platform that is the Institute of Making.

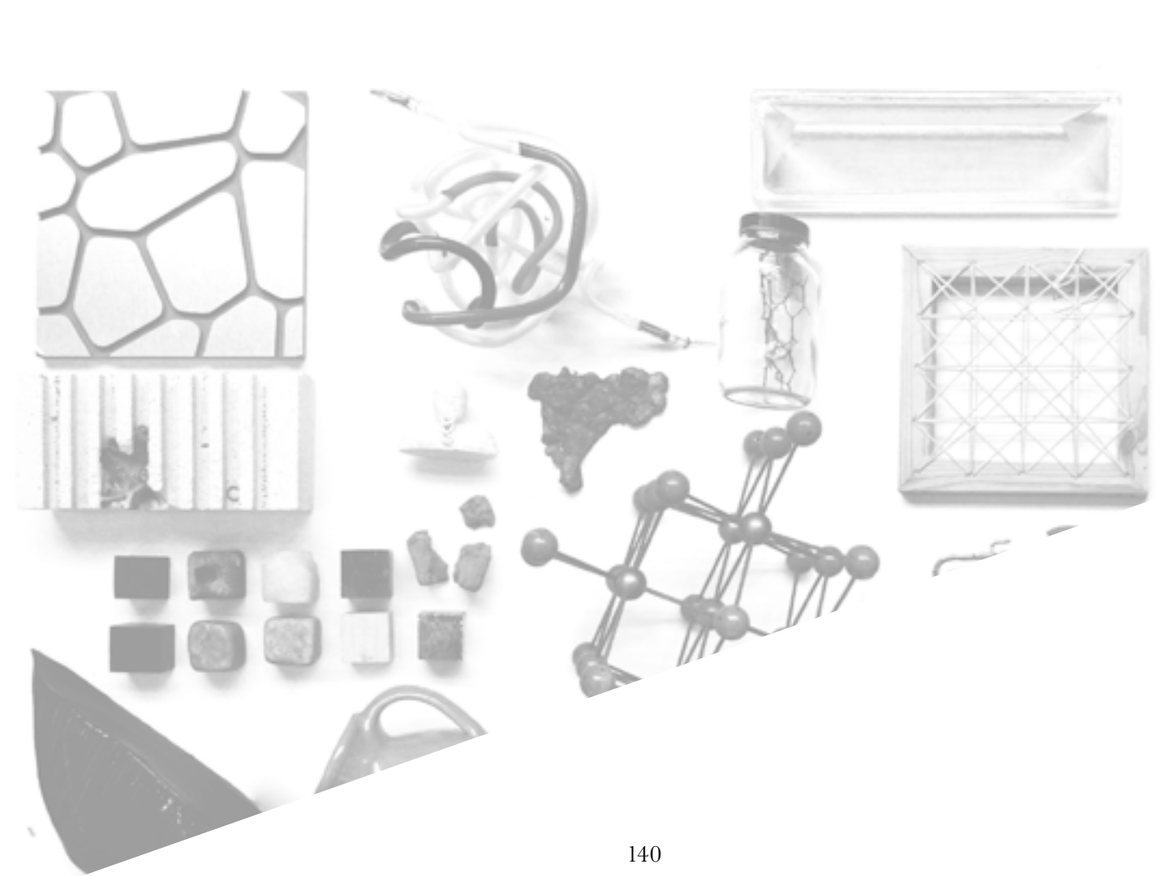
Now it feels like we are embarking on a new phase where we can explore how far we can go, and how innovative the Institute of Making approach can really be. To do this we have expanded the team by bringing in new people: we have recruited a new Research Manager, Beth Munro, who is an archaeologist with a doctorate in Roman recycling of materials; we have recruited a new Assistant Makespace Technician, George Walker, who is expert in building electronics, robots, and music technology; and we have recruited Sara Brouwer, formerly at the Crafts Council, to take on the Events Coordinator role.

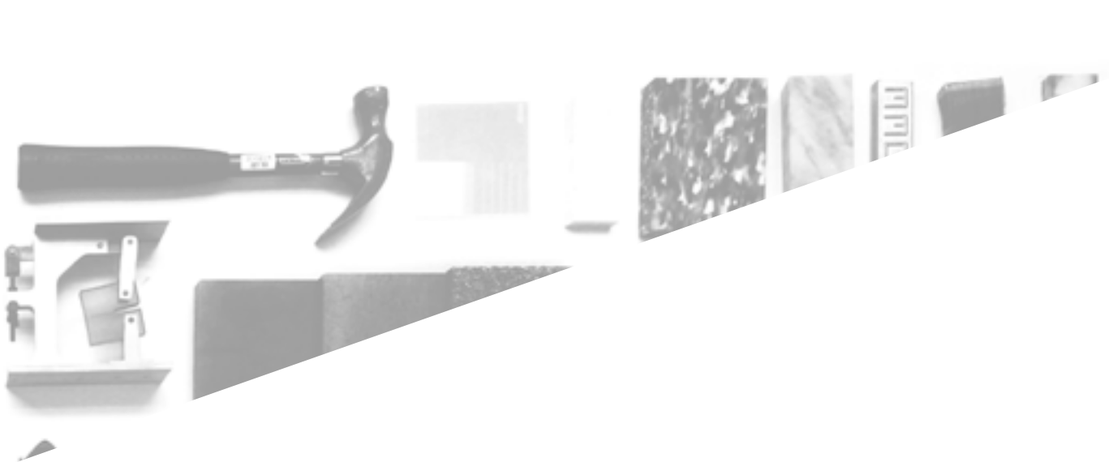
These are exciting times with many challenges ahead; from the uncertainty of Brexit and it's imperative to build a less divided and more equal world, to the opportunity of UCL's new campus in East London which is an empty canvas for a new type of open inclusive university. We are very much looking forward to it!

"Our biggest challenge is yet to come: we need to help the UK build a society that moves away from consumerism and towards a more environmentally sustainable and socially equitable approach to manufacturing the stuff on which we all rely."
Mark Miodownik
Director, Institute of Making 2017

"It is vital that we continuity to support and celebrate the broadest possible perspective on materials and making, to as wide an audience as possible. Innovation, creativity and ingenuity is not the preserve of any one field or set of disciplines, but rather an expression of the complexity and interconnectedness of the human cultural ecosystem."
Zoe Laughlin
Director, Institute of Making 2017

"The Institute of making is more than just a place to engage with tools and materials, it is a place where people can ask questions that are still as important today as they were when people first made their own tools, clothes and shelters. What is this made from? Can it be made of something else? Is there a new way of making it, to benefit society? While we endeavour to preserve and share the past's knowledge and techniques of materials and making we also want to spark a curiosity that enables communities to engage in new research for the future."
Martin Conreen
Director, Institute of Making 2017





Appendix

Full Statistics of Membership

Total number of registered members: 7,402
Active inducted members: 3,212

Gender
Female 41%
Male 44%
No gender declaration 15%

Member type
Staff 19%
- Academic staff 12%
- Professional services staff 7%

Students 81%
- Undergraduates 47%
- Postgraduates 34%

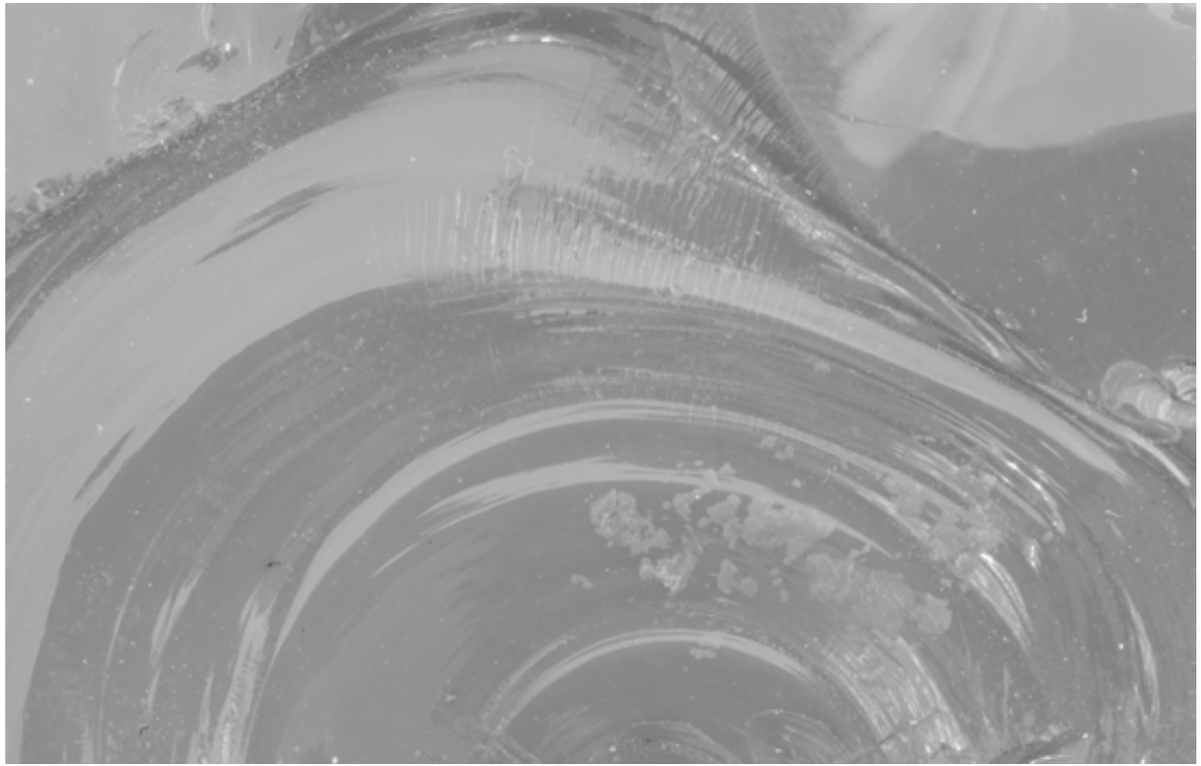
Full List of Events

Total number of events: 52 (32 member events and 29 public events)
Breakdown: 31 masterclasses, 6 research events, 4 research hub events, 2 Material Library Evenings, 1 corporate day, 2 outreach events, 1 workshop, 3 week long events and 3 large public open days.

18th April, 2016. *Akins Away Day.* (Corporate).
28th April, 2016. *Materials Library Evening.* (Library) Public event.
4th May, 2016. *Concrete with Leigh Cameron.* (Masterclass) Public event.
9th May, 2016. *Copper Spoon Making.* (Masterclass) Public event.
24th May, 2016. *Hands of X, Dundee.* (Research event)
6th June, 2016. *Hands of X, London.* (Research event)
15th June, 2016. *Hands of X, Glasgow.* (Research event)
21st June, 2016. *Wooden Whistle Masterclass.* (Festival of Stuff)
21st June, 2016. *Morning – Felt Ball and 3D Hand Embroidery Masterclass.* (Festival of Stuff)
21st June, 2016. *Morning – Chair Caning Masterclass.* (Festival of Stuff)
21st June, 2016. *Dustpan and Brush Masterclass.* (Festival of Stuff)
21st June, 2016. *Afternoon – Felt Ball and 3D Hand Embroidery Masterclass.* (Festival of Stuff)
21st June, 2016. *Afternoon – Chair Caning Masterclass.* (Festival of Stuff)
22nd June, 2016. *Laminate Wood Forming Masterclass.* (Festival of Stuff)
22nd June, 2016. *Morning – Experimental Fabric Colouring Masterclass.* (Festival of Stuff)
22nd June, 2016. *Afternoon – Experimental Fabric Colouring Masterclass* (Festival of Stuff)
22nd June, 2016. *Performing Matter – Greatest Hit and New Findings.* (Festival of Stuff)

23rd June, 2016. *Morning – Experimental Pewter Casting Masterclass.* (Festival of Stuff)
23rd June, 2016. *Morning – Fish Printing Masterclass.* (Festival of Stuff)
23rd June, 2016. *Morning – Plant Moisture Sensor Masterclass.* (Festival of Stuff)
23rd June, 2016. *Afternoon – Experimental Pewter Casting Masterclass.* (Festival of Stuff)
23rd June, 2016. *Afternoon – Fish Printing Masterclass.* (Festival of Stuff)
23rd June, 2016. *Afternoon – Plant Moisture Sensor Masterclass.* (Festival of Stuff)
24th June, 2016. *Morning – Concrete Masterclass.* (Festival of Stuff)
24th June, 2016. *Sensors Masterclass.* (Festival of Stuff)
24th June, 2016. *Afternoon – Concrete Masterclass.* (Festival of Stuff)
25th June, 2016. *Festival of Stuff.* (Open day)
13th July, 2016. *Failure Non-Event.* (Research Hub event)
26th July, 2016. *Object-based and Creative Methods for Communicating Emotions.* (Research event).
18th July – 18th August, 2016. *Beer Brewing.* (Masterclass) Member event.
26th July, 2016. *Touching Emotions: Object-based and Creative Methods for Communicating Emotions.* (Research event) Public event.
16th August, 2016. *Day in the woods with Geoffrey Fisher.* (Masterclass) Member event.
17th September, 2016. *Cutlery Design Challenge.* (Exhibition) Public and members challenge.
20th September – 22nd January, 2017. *Victorians Decoded: Art and Telegraphy.* (Research Hub event)
4th – 7th October, 2016. *UCL Lunchtime Looks.* (Open to all UCL).
4th – 7th October, 2016. *Jeremy Atkinson – Clog Maker.* (Maker in Residence).
28th October, 2016. *Sand Casting with Silver.* (Masterclass) Member event.
28th October, 2016. *Sand Casting with Silver.* (Masterclass) Public event.
5th November, 2016. *Geology.* (Open day) Public event.
23rd November, 2016. *Museums on Prescription.* (Outreach).

28th November, 2016. *Co-Lab.* (Research hub event).
5th December, 2016. *Introduction to pattern cutting with Juliana Sissons.* (Masterclass) Member event.
5th December, 2016. *Interpreting of a shop-bought pattern with Juliana Sissons.* (Masterclass) Member event.
19th December, 2016. *Make Merry.* (Workshop) Member event.
20th - 21st January, 2017. *Coding & Representation Conference.* (Research Hub event)
13th February, 2017. *Stool in a day.* (Masterclass) Member event.
20th February, 2017. *Introduction to the art of Kintsugi.* (Masterclass) Member event.
24th February, 2017. *Materials Library talk with Mark Miodownik.* (Library) Public event.
25th February, 2017. *Design inclusive workshop.* (Outreach)
27th February, 2017. *Morning – Glass working.* (Masterclass) Member event.
27th February, 2017. *Afternoon – Glass working.* (Masterclass) Member event.
11th March, 2017. *4th Birthday.* (Open day) Public event.



Media Coverage

Today Programme, BBC Radio 4, March 2016.

Everyday Miracles: The Genius Of Sofas, Stockings And Scanners, TV series (repeat), BBC4, April 2016.

The Kitchen Cabinet, BBC Radio 4, May, June, Sept 2016, Jan, Feb March 2017.

Science in Action, BBC World Service, Jul 2016.

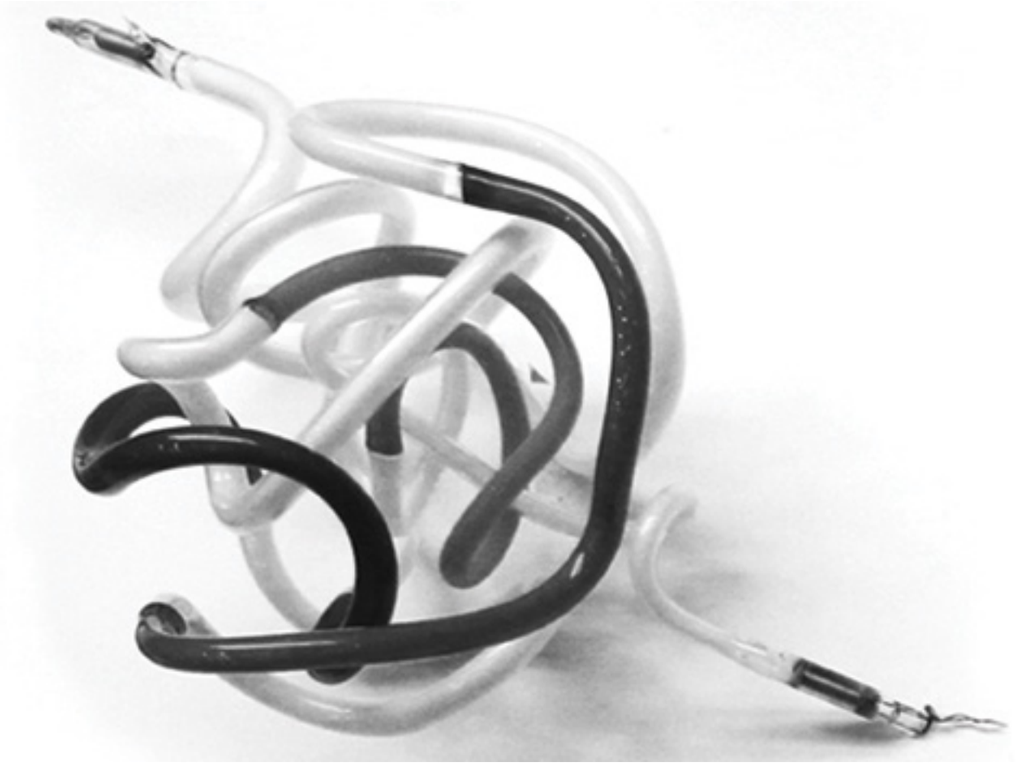
The Big Life Fix, BBC2, December 2016.

The 12 Key Science Moments of 2016, The Observer, December 2016.

How It Works TV series (repeat), BBC4, January 2017.

The Science of Dr Seuss, BBC Radio 4, January 2017.

Good Evening Wales, BBC Radio Wales, April 2017.



Social Media Feeds

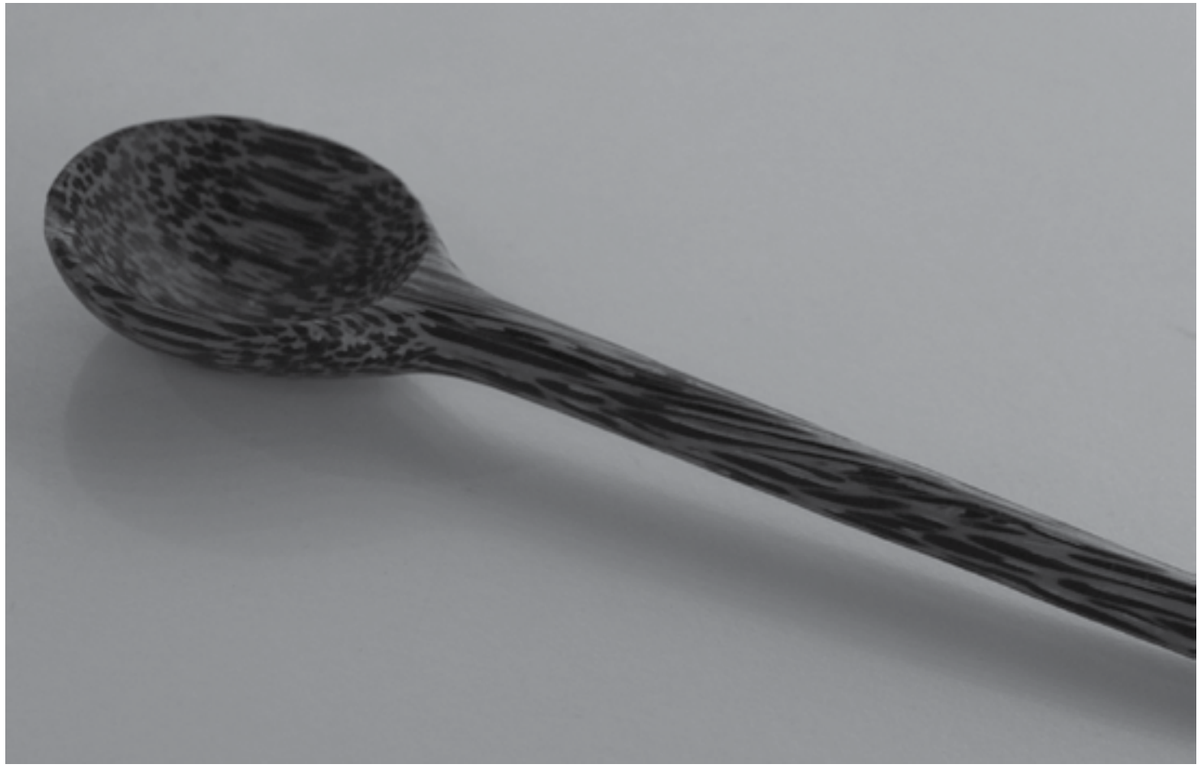
www.facebook.com/Institute-of-Making-173558692663820

www.facebook.com/groups/197250337040270/

www.instagram.com/of_making/

www.twitter.com/of_making

www.instituteofmaking.tumblr.com/



Institute of Making Member Supervisors

Anne Zakrzewski

Becky Lee

Elliott Magee

Emilia McLaughlin

Jack Heintz

Jack Reynolds

James Lawrence

Laura Dempsey

Laure Durand

Prashanthan Ganeswaran

Rhys Williams

Thore Bucking

Birthday Award Winners

Outstanding Contribution: Lee Wilkinson

Most Helpful Staff Member: Nick Bradbeer

Research Through Making: Karen Ko

Attention To Detail Award: Piotr Wasylczyk

Persistence Award: George Bolwell

Materials Library Award: Valerie Ngow

Spirit of the Makespace: Yan-Kay Ho

Politeness Award: Ruchir Shah

Community Award: Evangelos Himonides

The Institute of Making Current Team

Beth Munro – Research Manager

Darren Ellis – Makespace Technician

Elizabeth Corbin – Materials Library Assistant and PhD Student

Ellie Doney – Makespace Manager

George Walker – Makespace Assistant Technician

Mark Miodownik – Director

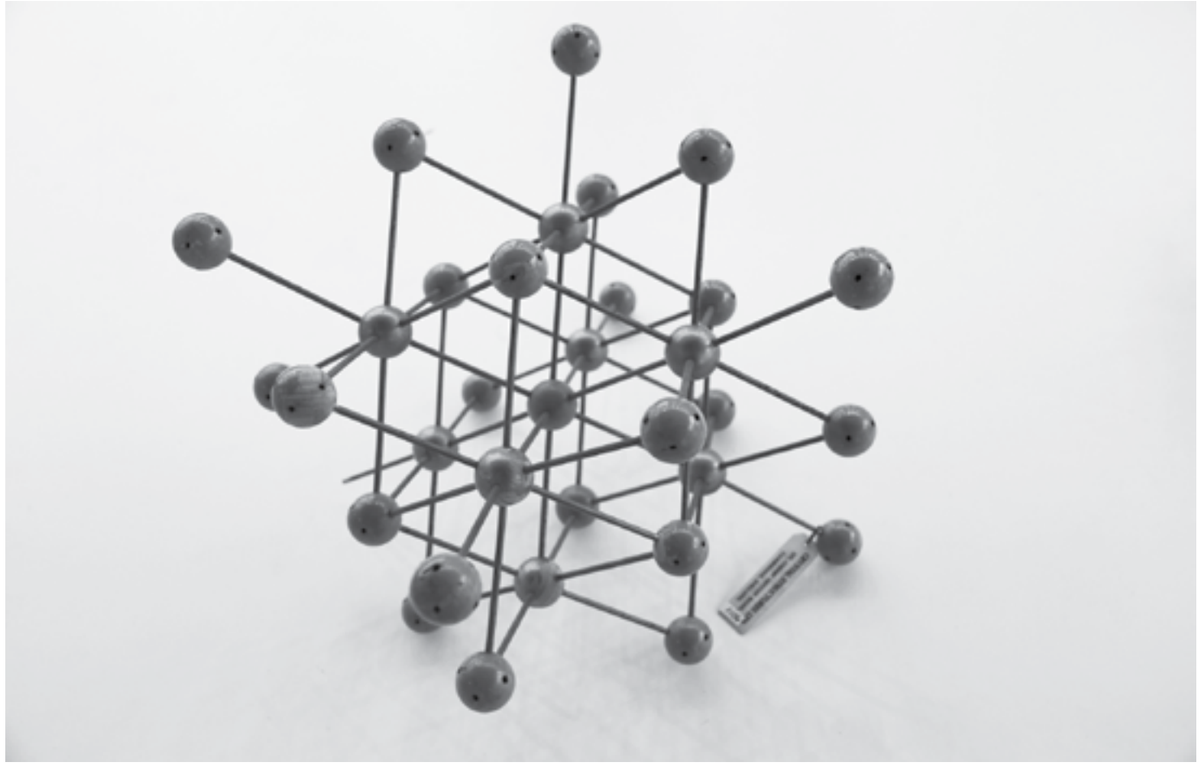
Martin Conreen – Director

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

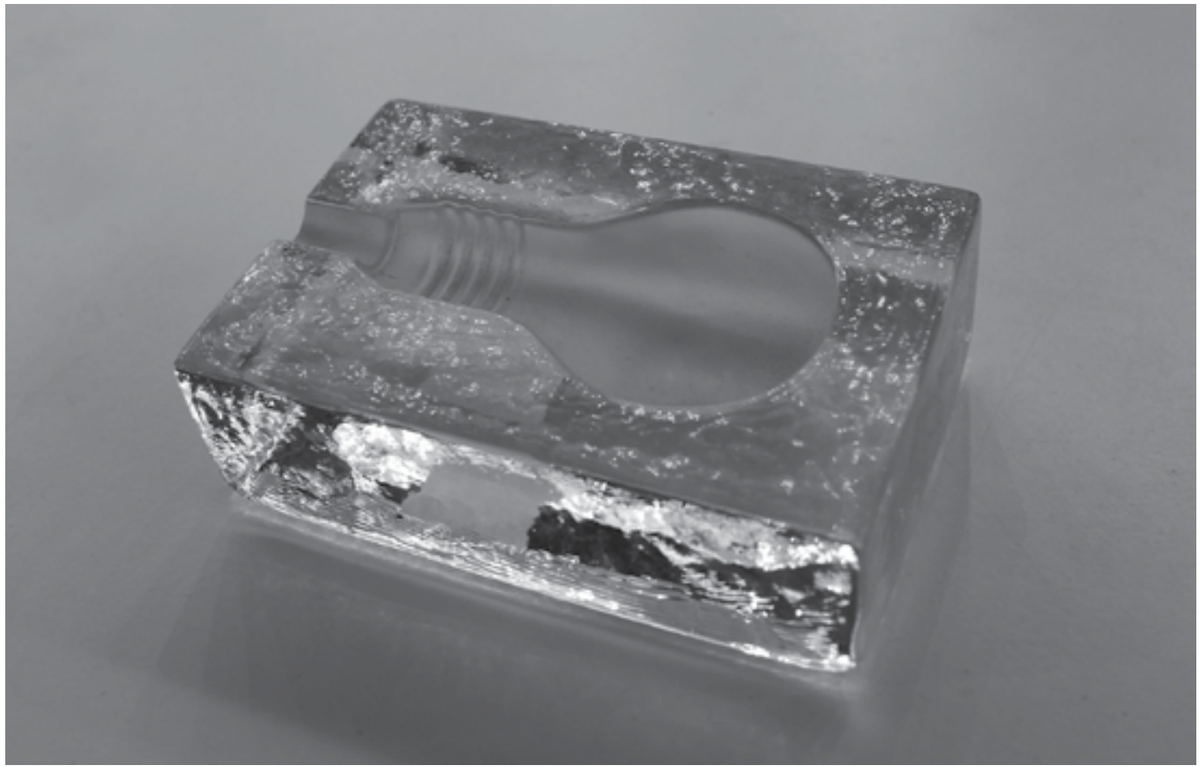
Chris Wise – Expedition Engineering

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

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UCL PACE
Wellcome Trust

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Praveetha Patalay
Puja Bharadia
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