

Seventh Year Report

Institute of Making, UCL 2019-20



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The Overview

Why we do what we do...

“...I just want to reiterate how important the Institute of Making was in getting me from a lost undergrad, to a ‘real’ researcher! For all the work you and the amazing team put in, thank you from the bottom of my heart.”

Rhys Williams, Centre of Excellence in Human-Computer Interaction



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 through making comes a deep understanding of materiality and possibility. 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.



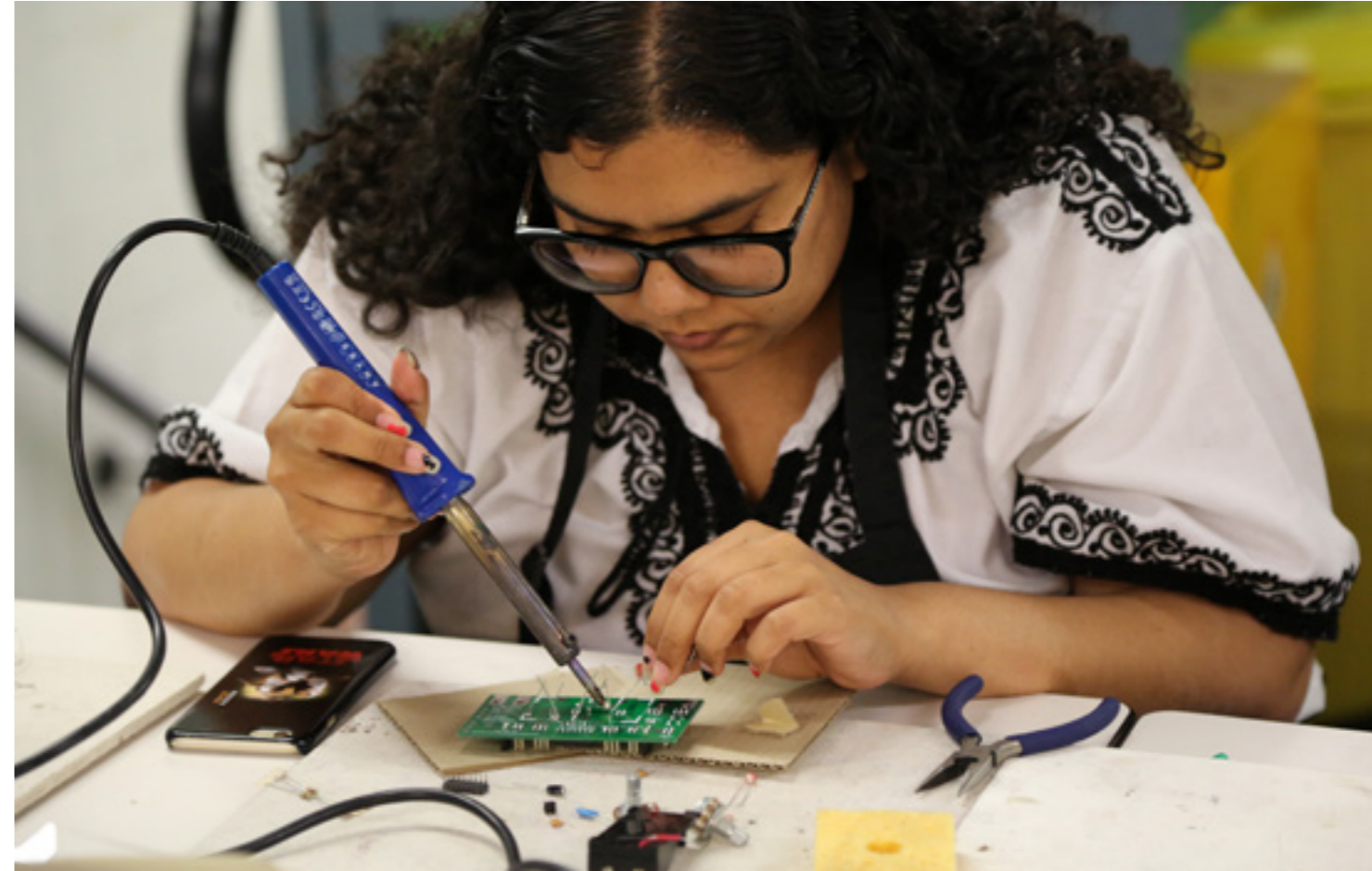
Membership is open to anyone at UCL...

We currently have 13762 registered members of whom 2769 are inducted. Amongst them 31% are staff, 66% are students, and 3 % not specified. A further breakdown of the member demographic is as follows: female (44%), male (51%), genderqueer/non-binary/prefer not to disclose (5%); undergraduates (33%), postgraduates (33%), academic staff (20%), professional services staff (11%), and 3% not specified. The membership encompasses a wide range of specialisms and interests, from food to art, Materials Science to Architecture, and Chemistry to Anthropology.



Doing is a different way of thinking...

A typical snapshot of activity at the Institute is as follows: an Architecture student uses our 3D scanning equipment to map materiality of places; a PhD student from the Medical School prototypes a new surgical device; a masterclass on jewellery making is attended by students and staff from all over UCL; the BBC arrives to record a podcast about gold with some of our members; a research workshop is held on the topic of Materials and Manufacturing in Healthcare; an engineer teams up with an artist and geographer to create a robotic suitcase; a masters student from History of Art explores our Materials Library to understand contemporary plastic better; we hold an open day on the theme of Gases and more than a thousand members of the public take part.



We specialise in multidisciplinary materials research...

The Institute of Making acts as a research hub, bringing together and supporting multidisciplinary teams of researchers both at UCL and beyond. This year we secured funding for a new collaborative project, Making Spaces (Lloyd's Register Foundation) led by the Institute of Education (Professor Louise Archer).

This award adds to our ongoing funded research projects: Innovation hubs for assistive technology in developing countries (part of Global Disability Innovation Hub AT2030); Designing-out Plastic Waste (EPSRC EP/S024883); The Development of a 4D printing manufacturing platform (Dr Anna Ploszajski's EPSRC Doctoral Prize Fellowship); Self-Healing Cities (EPSRC EP/N010523/1); Centre for Nature Inspired Engineering (EPSRC EP/K038656/1); Fit-for-purpose, affordable body-powered prostheses (EPSRC EP/R013985/1); Food and Transformation (Ellie Doney's PhD funded by BEKO).

We completed the projects Developing bespoke breathable prosthetic liners with growth tracking & active cooling (NIHR STWK-016); and Material Anxieties (Dr Sarah Wilkes' Wellcome Trust Fellowship 200354/Z/15/Z).



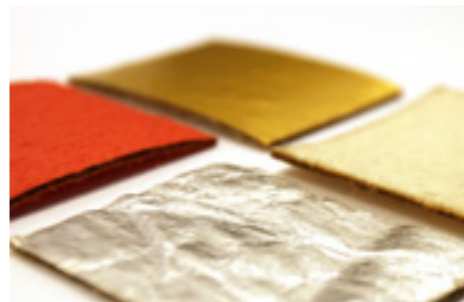
Our events get fully booked in seconds...

Our events programme aims to inspire the public about 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, to help them acquire new skills, to encourage them to engage with experts in various fields of materials and making and to allow them to gather together research collaborators. Last year we held 60 events, 18 of which were member events and 42 of which were public. These included 30 masterclasses (including the Tin Can Furnace Building Masterclass), 13 research events (including My Research Makespace: Pancake Making for Glaucoma Surgery), 3 big public open days and 3 week-long events (including Sensory Prosthetics at the Makershack, Cheltenham Science Festival). Over the past year, our events have attracted a total audience of more than 5500 including a high representation from families and young people.



We have a wondrous collection of stuff...

Our Materials Library is a handling collection of over 1300 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 get inspiration, conduct hands-on research, and get involved in interdisciplinary enquiry and innovation. What makes us unique is the relationship between the library and the workshop, and we use these facilities to fire the imagination, stimulate new research and enable deeper learning experiences for people of all ages and backgrounds. We are also constantly collecting objects that reveal the simultaneously marvellous and mundane world of materials. This year, new materials have included the tiniest ball bearings in the world, glittering bulbs of narcotic nitrous oxide and remarkable natural materials like sugar cane, muscovite mica and mulberry bark.



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 TV, radio programmes, newspapers, and festivals (e.g. BBC Four, BBC Radio 4, The Times, The Guardian, Cheltenham Science Festival, New Scientist Live, Dartington Literary Festival). We are active on social media (Twitter, Facebook, Instagram), and online in the form of podcasts (The Things That Make Us and 'Rial Talk).



We are international...

The Institute of Making has an international reputation. We have given invited talks all around the world from Belfast to Berlin on our interdisciplinary materials research and our other activities. We have active research links with the Global Disability Hub and Ellen MacArthur Foundation.



We interact with policy makers and industry...

Our profile has enabled us to influence funders (e.g. EPSRC, UKRI), policymakers (e.g. DFID, DERA, BEIS) and national academies (Royal Academy of Engineering, Royal Society), attract industrial collaborators (e.g. Recycling Technologies, VEOLIA, Mace, VOID, FLO and others), and work with charities and third sector organisations (e.g. LLDC, WRAP) to increase our impact.





Member Profiles

The Makerspace is a unique place at UCL. It is open to everyone who is part of the university. Our members are students, staff, researchers and even technicians from other UCL workshops. They are very different from each other: they come from all over the world, are all ages, and have a diverse set of skills and interests. What they all have in common is a real curiosity, a desire to learn, and their knowledge. Members need no previous making experience when they join and there are endless possibilities for what to make. Some of our members use the workshop for their personal projects, and others work on their professional research; often they do both.

The Makerspace is also a social and creative place where our members are inspired by talking to each other, observing what others are making and how they are doing it. Many of our members become friends who regularly meet in the workshop. They collaborate across disciplines and share expertise, which results in truly unique outcomes.

In that spirit, this year we created a new event series called Making Circles. Every other Tuesday lunchtime we invite members with different interests to come together to make and help each other. This term's Making Circles are 'Arduino' and 'Knitting,' and it is a pleasure to hear all the conversations about stitching and coding patterns. It's an easy example of the new friendships and collaborations that are continuously born in the Makerspace.

In this section, we celebrate our members: their creativity, diversity and motivation. This year we showcase examples of experimenting with biomaterials, pushing boundaries with our 3D clay printer, learning new skills and building things for our loved ones, working in a team, and overcoming challenges of prototyping the machines of tomorrow. Our members are at the heart of what we do, and this is our way to say thank you for creating an exciting, playful, sociable and special Makerspace.

Miranda Nixon PhD Student in Medical Imaging

Miranda came to the Makerspace to complete a project in the first year of her PhD studies in Medical Imaging. She used the laser cutter to make light diffusers that fit over the flash of a camera, as part of a monitoring system designed to detect jaundice by imaging the white of the eye.

Throughout her second year, Miranda continued to use the Makerspace for her own personal projects. Miranda structured her days to get the most out of both her PhD research and her making activities. She took longer lunch breaks to work on projects at the Institute of Making and worked late to make up research time. Overall, she became more productive and created the right balance between the physical processes of making and her less tangible research.

Miranda has always been a fan of woodworking, but missed practicing the skills she had learned in school. She started with smaller woodworking projects such as making coasters, chopping boards, a holding cross, and a rosary counter to familiarise herself with the tools. The motivation for Miranda's big project came when her sister moved to a new home. She decided to make a housewarming gift of a hybrid mantelpiece and mirror. This gave her the opportunity to learn to use new tools and to work precisely. She chose hand tools, such as the mitre saw and chisels, when particular accuracy was needed. She also worked with the chop saw, table router, Domino joiner, and orbital sander to construct her design from planned drawings.

Over her two years at the Institute of Making, Miranda's confidence has grown. She is grateful for having designated technicians to help her use the tools and to inspire her to try more.

“The longer I've been using the Makerspace, the more I think it's the best thing about UCL”



Aman Atak

MEng in Mechanical Engineering

Aman has always been interested in innovation and technology. As part of her Mechanical Engineering degree, she wanted to work on more interdisciplinary projects. For her final year group project, she helped develop a mobility capsule - the ModPod - a modular robot unit, which allowed autonomous navigation.

Initially, the group worked from the engineering workshop, getting a lot of support on how to manufacture. But they quickly realised that their project required electrical and information engineering, software and hardware, and one of her group members recommended the Institute of Making. With the help of the Makespace technicians, she quickly found solutions to her project challenges. She ended up learning a lot about electronics, soldering, wiring, coding, machining, drilling, taping and more, and as a result her group produced a high-quality robot.

For Aman, UCL provides great infrastructure and supportive staff, but at the Institute of Making she found all the technical support and facilities she needed in the same place. She could be working on materials, joining parts, mechanics, electronics, or design, and in the Makespace there was always someone who could help. This gave her confidence to build her own project.

At the Institute of Making Aman was surrounded by passionate people. Members are very motivated and captivated by their making and the technicians love to transmit their passion for making to others. It feels really good to be in such a place; it is very inspiring and motivating. Aman said she really hopes that there will be more Makespaces around in the future.

“I wish there was such a Makespace nearby when I grew up, it is exactly the kind of place I was dreaming about.”



Kamran Hussain **BA Geography**

In 2019 Kam graduated from UCL with a BA Geography, and currently works in the start-up scene, but in his spare time he focuses on his luxury leather goods brand – HOLSTRAP.

Kam made the initial prototype for his HOLSTRAP bag at the Institute of Making. He can't recall the exact moment that he discovered the Makespace but it was pivotal for his entrepreneurial journey. Kam wanted to develop a prototype of a bag to showcase at the Hatchery at UCL Innovation and Enterprise. Originally feeling insecure about designing a product himself, he tried to find a student fashion design student but the collaborations didn't work. He was now a few days away from his demo with no prototype and he had to make it himself. So Kam ran to Brick Lane, he sourced some leather, used his braces for the straps and a handkerchief as the bag's inner lining. He signed up to the Institute of Making, attended a sewing machine induction class, and managed to stitch his prototype in a couple of days!

Kam believes students should explore their creative side by venturing into the Makespace. For him, there are many obvious benefits to meeting like-minded people and being exposed to new ways of making. He sees the Makespace as a truly complete design space, fit for naturally artistic people but also students who would like to prototype an idea. For him the Makespace was the place that he used as a launchpad for his own business.

“If you have an idea (business or otherwise), and have no idea on how to build it, visit the Makespace. Even if you don't end up making the final product yourself, there are enough resources and helpful technicians there for you to understand and appreciate the making process a little better, so eventually, you can realise your own vision.”



Timothy Ryan MArch in Bio-Integrated Design

Timothy studies biology and architecture through a program called Bio-Integrated Design at Here East, which is part of the Bartlett School of Architecture. The program combines the study of design with the sciences to create sustainable architecture. Timothy's personal objective is to tackle the issue of climate change. He is trying to make carbon-negative architectural components out of ceramics, reinforced with other natural materials (such as wood fibres). Timothy wants to create living, breathing architectural elements. He dreams of cities that can neutralise pollution, fertilise soils, and feed populations, as well as tackle the lack of biodiversity in urban spaces by boosting pollinators, plant species, and insects.

Timothy mainly works with clay and soil as architectural substrates and has a particular interest in biochar. Biochar is a charcoal-like substance made by pyrolysis, an anaerobic burning of organic matter that stores carbon in a natural way. Timothy was inspired by indigenous people of the Amazon, who created and used biochar in an agricultural context. When used in architecture, biochar can counter atmospheric pollution by trapping carbon and turning it into a useful structural material.

Timothy has access to other workshops at UCL. However it was at the Institute of Making that he was able to try different ways of working with clay, either on the wheel, through handbuilding or through experimental processes. Discovering, understanding, and mastering the clay 3D printer in the Makespace became a pivotal moment in his project. While testing, refining, and scaling up his process, Timothy was surprised and delighted by the support that he received from the Institute of Making staff and members. He was inspired by the technicians, in particular ceramicist Darren and all the weird and wonderful things that Darren could tell

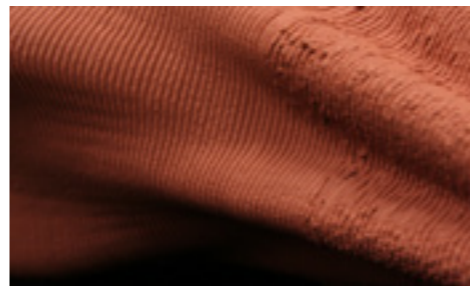
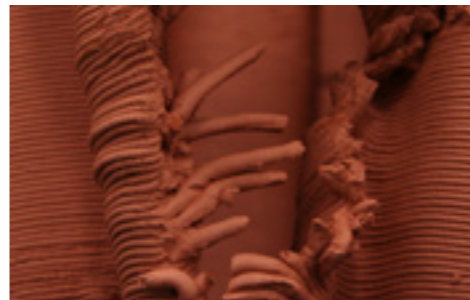


him about clay, but was also grateful for advice from George and Romain about machining and printing. He felt that the team really took the time to answer his questions and that the collaborative and interdisciplinary spirit in the Makerspace was precisely what he needed for his research.

“The willingness of staff to support, at a detailed level, the machining processes is unprecedented. You guys are unbelievably generous and kind. [...] There is a culture of care and cooperation that allows you to delve into the nuts and bolts [of your project].”

For manual and experimental work, Timothy feels that the Institute of Making is the dream place. He was very inspired by the different kinds of making happening in a single space. He really likes the friendly environment and loves spending time here. Being surrounded by people who are knitting, enamelling, or screen-printing has also had an impact on his work. For example, Timothy found a better wood supplier by talking to a member who was making his own pool cue. Timothy was also very keen to share his knowledge with other members and gave tutorials and advice on how to use the 3D clay printer, which reinvigorated our community’s relationship with the equipment and process.

“It is productive without being stressful, which is a really hard balance to find. [...] People get work done, but they’re still smiling all the time. That’s quite amazing!”



Rebecca Outterside MArch Bartlett Faculty of the Built Environment

“For me the Institute of Making is a place to come and test your ideas, and create things with other people who share a curious mindset. I don’t know anywhere like it!”

Rebecca’s academic work focuses on the construction industry. She is interested in renewable/ biodegradable building materials, carbon-offsetting, and how to achieve a carbon-neutral building. She has been researching the use of waste materials and ways of creating a circular economy.

Rebecca started to use the Makespace while working on an architecture project for her Design module. She was assigned the redesign of a site in Seoul, South Korea, located next to a food market. This inspired her to consider the potential of using food waste to create a biomaterial for the construction of local buildings. The Institute of Making seemed like the perfect place to experiment!

Rebecca selected sweet potato as a material because it is widely used in South Korean cooking, and because the statistics show that this produces a vast amount of waste. The biomaterial that she created could be formed into sheets to be used as tiles and veneer in construction, but also had the potential for object making. Working with such a unique material was challenging, but Rebecca found that the Makespace gave her real freedom to experiment. She tested the 3D abilities of her biomaterial with a variety of tools, including the laser cutter, bandsaw, heat press, and hot wire strip heater. The Materials Library also provided a source of inspiration for Rebecca.

Rebecca feels that the Institute of Making is a very welcoming place, with helpful staff, and she really enjoys working with the other members.

“All members seem so curious, and it was fun to see everyone doing such different things in the same space!”



Ignacio Echeverria Faccin ('Nacho') **Curatorial & Collections Assistant at UCL Culture**

Nacho works at UCL as a Curatorial and Collections Assistant. He has been an active member of the Institute of Making for three years and the Makespace is a place where he can work and relax. His projects in our workshop are both personal and professional.

As part of his job at the UCL Pathology Museum, he is responsible for building watertight boxes for the museum's many fluid-preserved specimens. Originally made of glass, nowadays the boxes are made of acrylic. But building acrylic boxes is challenging and time-consuming! The sanding and polishing process means that constructing a single box can take a day or even longer. Nacho wanted to explore ways of shortening this process. He came across an exciting process developed by a German maker to fold acrylic using a table saw. However, after chatting with one of our technicians, Nacho realised that using a table saw in this way was not possible in the Makespace. Instead, with further advice from our team of technicians, he developed a new method for making boxes using the CNC or the milling machine. He can now make fluid-preserved specimen boxes using an innovative process that saves him valuable time and effort.

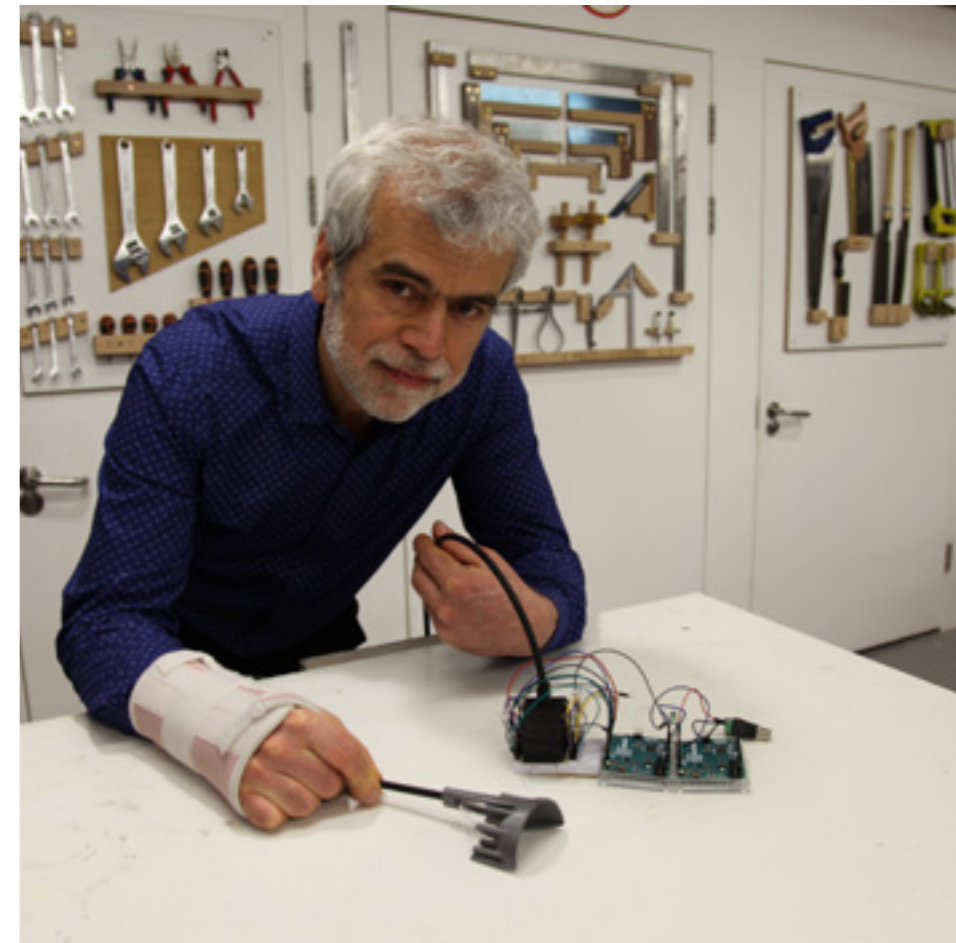
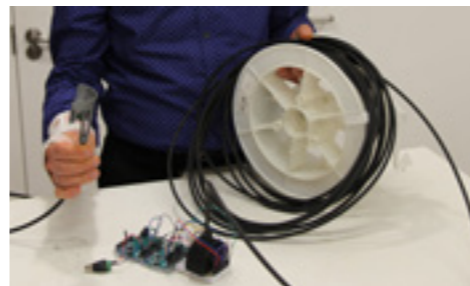
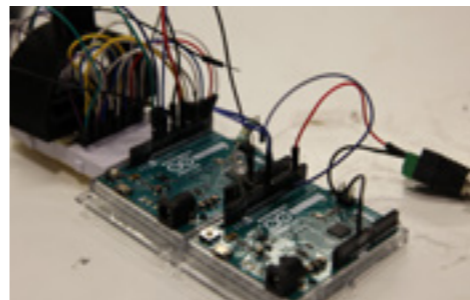
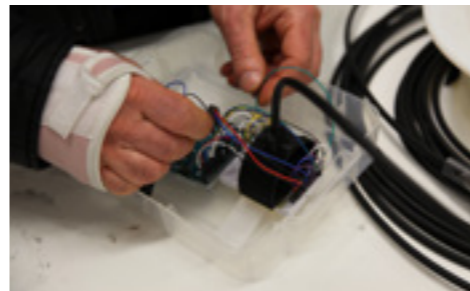


Abbas Heydari Technical Staff at the UCL Centre for Medical Imaging

Abbas is a long-standing member of the Institute of Making. He has made many devices in the Makespace, including those currently used in MRI scanners at the UCL Centre for Medical Imaging. For example, the device pictured on the opposite page is designed to help researchers map the visual cortex under an MRI scanner. It is a semi-spherical helmet with lots of built-in illuminating points which can be turned on or off with a remote control device that is connected via fibre-optics some twenty metres away. Abbas 3D printed this device using the Ultimaker-3 Extended. Because of the delicate nature of its structure, Abbas struggled to use other 3D printers which produced considerably more light leakage between channels, resulting in more cross-talk. Using the Ultimaker-3 Extended with its dissolvable support material proved to be the solution.

Abbas believes that most of his projects could not have been made or would have produced very different results if the Institute of Making did not exist.

“What makes the Institute of Making unique is the combination of tools and the expertise of the staff who are happy to help at any time. What I admire even more is the people who thought of making such a centre. In my view, founding the Institute of Making should be considered one of the greatest steps in education in recent years since it allows students to take their theoretical learning to another level. I hope they can be credited for their thought and effort in creating this facility.”





Research Programme

Multidisciplinary materials research is at the heart of the Institute of Making. We create new research collaborations and welcome teams of materials researchers and makers from different disciplines around UCL and beyond. This year we were successful in securing external funding for a new collaborative project, Making Spaces (Lloyd's Register Foundation), led by Professor Louise Archer at the Institute of Education.

This award adds to our ongoing funded research projects: Designing-out Plastic Waste (EP/S024883/1, £1,248,910); AT2030 – Spark: Innovation (DFID AT2030, £10,000,000), in collaboration with the Global Disability Innovation Hub, co-led by Dr Catherine Holloway; The Development of a 4D-Printing Manufacturing Platform (EP/N509577/1, £114,318.64), led by Dr Anna Ploszajski; Self-Healing Cities with the University of Leeds, University of Birmingham and University of Southampton (EP/N010523/1, £5,247,017); Centre for Nature Inspired Engineering (EP/K038656/1, £4,980,773) led by Professor Marc-Olivier Coppens; Fit-for-Purpose, Affordable Body-Powered Prostheses, led by Professor Laurence Kenney, University of Salford (EP/R013985/1, £1,390,144). The Institute of Making is also a partner in Ellie Doney's PhD research on Food and Transformation, funded by BEKO and undertaken in conjunction with the Slade School of Fine Art.

This year also marked the successful completion of Dr Sarah Wilkes' fellowship, Material Anxieties (Wellcome Trust 200354/Z/15/Z, £200,5560).

This year we also hosted a research workshop on Materials and Manufacturing in Healthcare that brought 20 academics and 20 industry partners together to foster

collaborations (p.68 & p.69). As part of Dr Ben Oldfrey's current research, we also hosted an innovation evening with partners and other guests from the AT2030 project.

The research program is overseen by our Research Manager, Dr Beth Munro, who is also an archaeologist and expert in ancient materials recycling. She has helped the Institute of Making to diversify its work by shining a light on making linked to the humanities. While Beth was on leave for part of this year, our programme was managed by Rita Pinho. Rita usually defines herself as an engineer by training and a biologist by heart. She is passionate about policy, innovation and public engagement. Her biomedical background was key in the development of the 'Materials and Manufacturing in Healthcare Network.'

As research is at the core of what we do at the Institute, we rely on members and academics at UCL and beyond to expand our project portfolio and push the boundaries of multidisciplinary materials and making research. We are delighted to see our research projects and interests expand every year.

Making Spaces

Lloyds Register Foundation (£688,467.51)

In engineering, computing and the physical sciences, women, people from low income and some minority ethnic backgrounds remain starkly under-represented, despite decades of initiatives aimed at widening participation. While there are over 600 organisations recorded as running initiatives to engage school age young people with STEM, there has been little change in the STEM participation profile. Improving STEM participation remains an urgent challenge for both national economic growth and sustainability.

Led by Professor Louise Archer (UCL Institute of Education), with Professor Mark Miodownik and Dr Sarah Wilkes at the Institute of Making, this project aims to provide a distinct, new contribution to the ongoing STEM participation ‘problem’ by working with young people from under-served communities, makerspace professionals and researchers. Using mixed methods and design-based research, the team is identifying factors which support or constrain young people’s participation in makerspaces and STEM, by compiling key principles and developing components of equitable practices within makerspaces. The project works with young people and practitioners, and includes survey work, interviews, discussion groups, observations and visual research methods.

This is an interdisciplinary partnership between educational sociologists, science educators, engineering academics and three makerspaces, including the Institute of Making (UCL), Knowle West Media Centre (Bristol) and MadLab (Manchester).



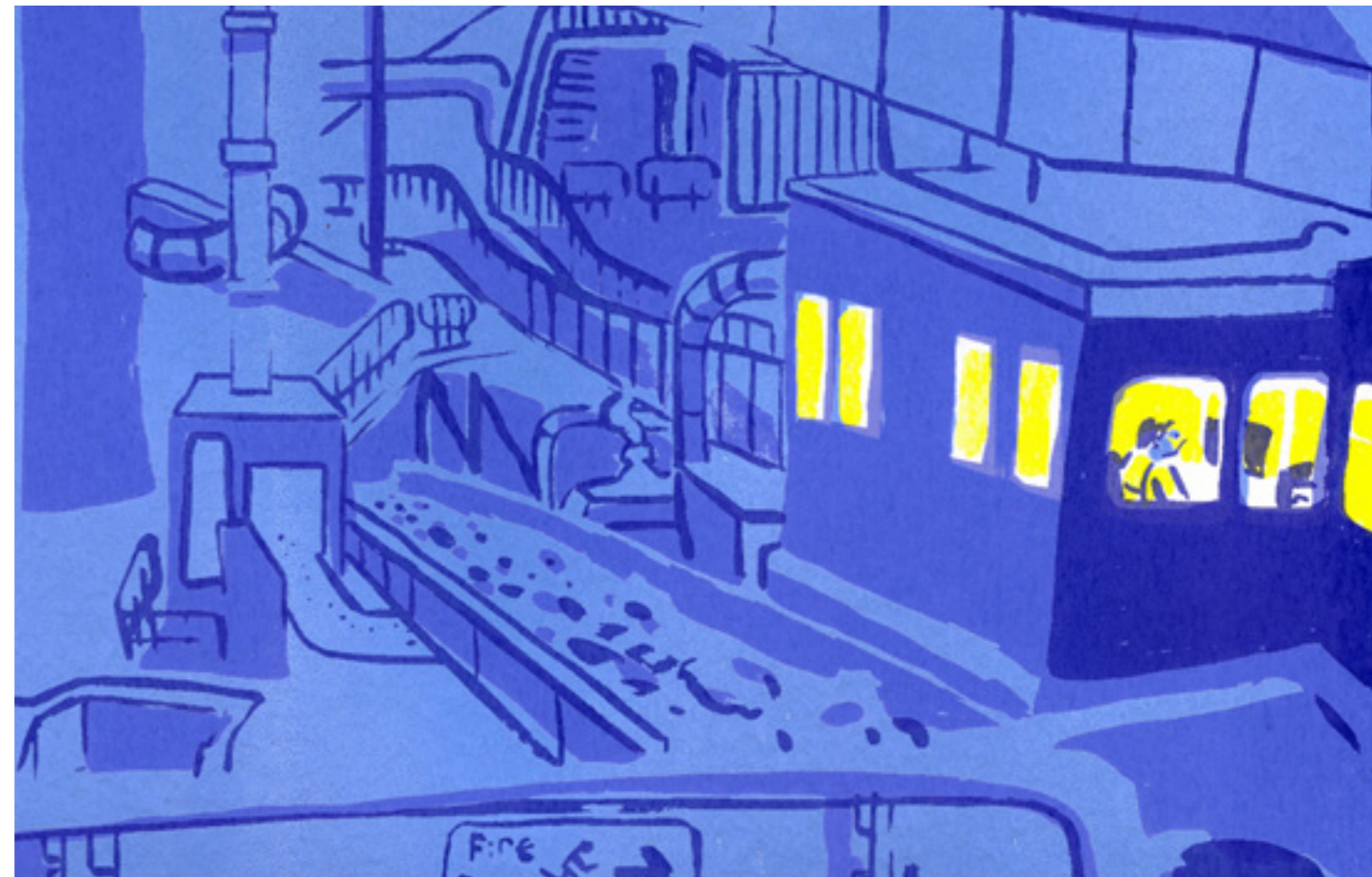
Designing-Out Plastic Waste **EPSRC EP/S024883/1 (£1,248,910)**

This 18-month project, funded by UKRI and EPSRC, brings together a diverse team of UCL researchers, led by Professor Mark Miodownik, to help solve the UK's plastic waste problem. Our aim is to develop novel ways to design out waste from plastic packaging and create new business opportunities. We believe that waste is a failure of design. Each design failure affects and compromises the whole system, leading to the leakage of plastic into the environment, and creating an economic burden on the UK.

Our projects include: developing novel approaches to molecular recycling and the synthesis of bio-derived plastics using enzymes; and using life cycle analysis, material flow analysis, and financial analysis to conduct circular economy analyses of the existing UK biodegradable plastics sector. Our full report was submitted to the UK Government's consultation in October 2019. We have also been instrumental in getting UCL to commit to going plastic-free by 2024. In partnership with UCL Sustainability, we are exploring implementing a system of reusable coffee cups across UCL's Bloomsbury campus.

This autumn we launched the Big Compost Experiment, a nationwide citizen science research experiment designed to collect data on current public opinion on biodegradable plastics, their use, and their disposability and degradation through home composting in the UK. Its main objectives are to gather and analyse data on public opinion and behaviour in relation to biodegradable plastics and home composting.

www.plasticwastehub.org.uk; www.bigcompostexperiment.org.uk



AT2030 – Spark: Innovation

DfID AT2030 (£10,000,000)

The Institute of Making are partners on AT2030 Programme 3 - Spark: Innovation. Based at the GDI Hub, Spark: Innovation is led by Dr Catherine Holloway (Computer Science UCL) with Professor Mark Miodownik (Institute of Making) and Dr Ben Oldfrey (GDI Hub). The programme seeks to improve the use of emerging technology for accessibility, spark innovation, and scale up proven assistive technology (AT) and associated service delivery models. The team are working to establish an Innovation Ecosystem in Kenya, create a Challenge Fund for AT innovation acceleration, and support start-ups.

This year, Spark Innovation has developed five sub-projects focused on and based in East Africa. The first of these puts disabled people at the forefront of AT design which is fit for purpose and affordable. A second strand of research will demonstrate the ability to scale up a revolution in wheelchair provision. The project will use novel manufacturing methods, specifically 3D printing, to provide bespoke seating and modular wheelchair construction. The GDI Hub has also partnered with Amparo to support a clinical trial to evaluate how the Amparo Confidence Socket could help the provision of lower limb prosthetics in Kenya. AT Innovation for Humanitarian Response also combines telemedicine and 3D printing, in order to provide bespoke orthotic devices and splints for use in emergencies and remote settings. Finally, a project entitled, “Horizon scanning to harness the power of mobile and ICT”, uncovers opportunities to work with mobile operators and disabled people to close this gap.

<https://at2030.org/>



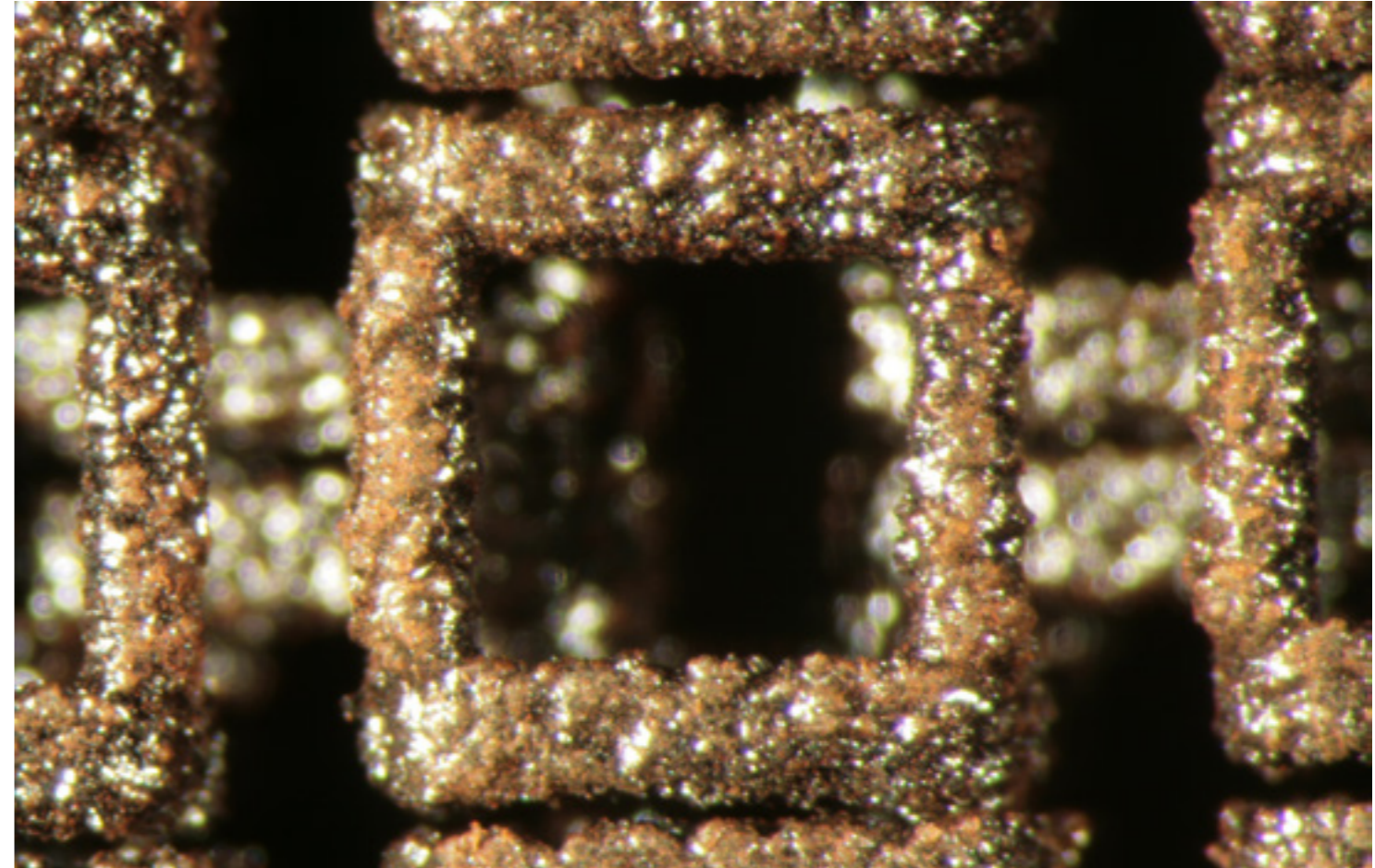
The Development of a 4D-Printing Manufacturing Platform EPSRC EP/N509577/1 (£114,318.64)

4D printing uses 3D printing to produce materials and structures which move. The ability to print actuating devices has great potential in soft robotics, wearable technology and biomedical devices. For example, adaptable fabrics with programmable stiffness could be used to make exoskeletons with advanced therapeutic functionality. However, this new field is in its infancy. Researchers are struggling to create more complex designs because techniques for modelling and designing actuators lack the multiscale sophistication required.

The aim of this project is to produce a 4D printing manufacturing platform which includes new active materials, bespoke hardware, and new modelling software.

This project is led by Dr Anna Ploszajski, who is based at the Institute of Making. Anna completed her PhD at UCL in 2017, and she is also currently writing a book about materials, entitled *Handmade* (Bloomsbury Publishing).

www.instituteofmaking.org.uk/research/the-development-of-a-4d-printing-manufacturing-platform



Fit-for-Purpose, Affordable Body-Powered Prostheses **EPSRC EP/R013985/1 (£1,390,144)**

This three-year project brings together an experienced team from across the UK, Uganda and Jordan to create a new body-powered (BP) prosthesis that is optimised for adoption by Lower and Middle Income Countries (LMIC) prosthetic services and acceptable to LMIC users. This will include establishing methods of fabrication, fitting and evaluation of the prosthesis. The aims will be to utilise local materials, simplify manufacture, minimise cost, and enable local repair and maintenance.

This year we conducted scoping interviews in Uganda and Jordan, and we have identified two common problems: (1) lack of data regarding the real-life use of upper limb prosthetics and (2) lack of community or networks for people with upper limb absence. Thus, over the past year we have performed two pilot studies that: (1) use activity tracking and human-computer interaction methods to obtain evidence of how prosthetics are used outside clinics (in the wild) and (2) explore the impact of removing barriers to communication technology. We are set to start data analysis in February 2020. This project is led by Professor Laurence Kenney, (University of Salford), with Dr Cathy Holloway (Global Disability Innovation Hub) and Professor Mark Miodownik (Institute of Making) as research investigators from UCL.

www.fit4purposeprosthetics.org/



Self-Healing Cities

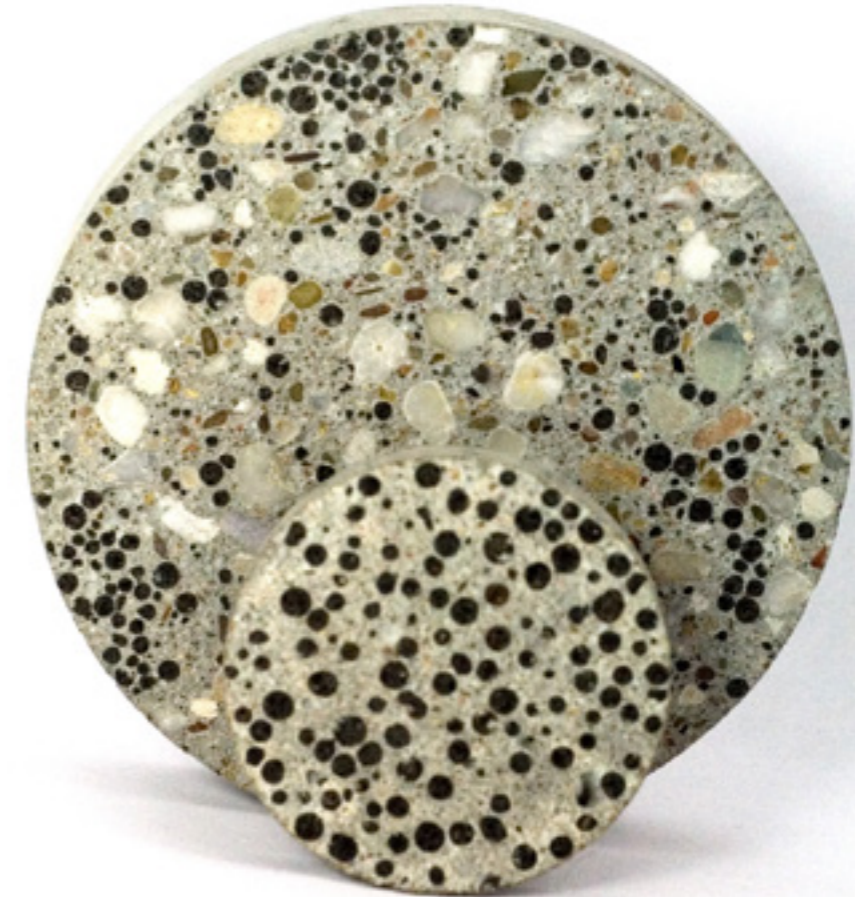
EPSRC EP/N010523/1 (£5,247,017)

The Self-Healing Cities project takes inspiration from a vision of a city where the infrastructure is autonomously and dynamically diagnosed, and maintained and repaired by robotic systems. 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.

Institute of Making Director Mark Miodownik leads research into materials for this project, including 3D printing technologies for minimally-invasive sensing, maintenance and repair of city infrastructure. This includes the assessment and mechanical testing of non-conventional additive manufacturing and 3D printing materials, to ascertain their suitability and reliability in the 3D repair of infrastructure. The ultimate aim of this project is to improve the health, wellbeing, happiness and economic prosperity of those living in future cities through materials research and engineering.

This year research focused on optimising crack repair durability through the 3D printing of functionally-graded asphalt. We also developed novel visual crack detection approaches. These include: a noise-tolerant and accurate crack tracking system; new noise-tolerant edge detection from camera oscillations; and a hyper-spectral crack detection system.

www.selfrepairingcities.com



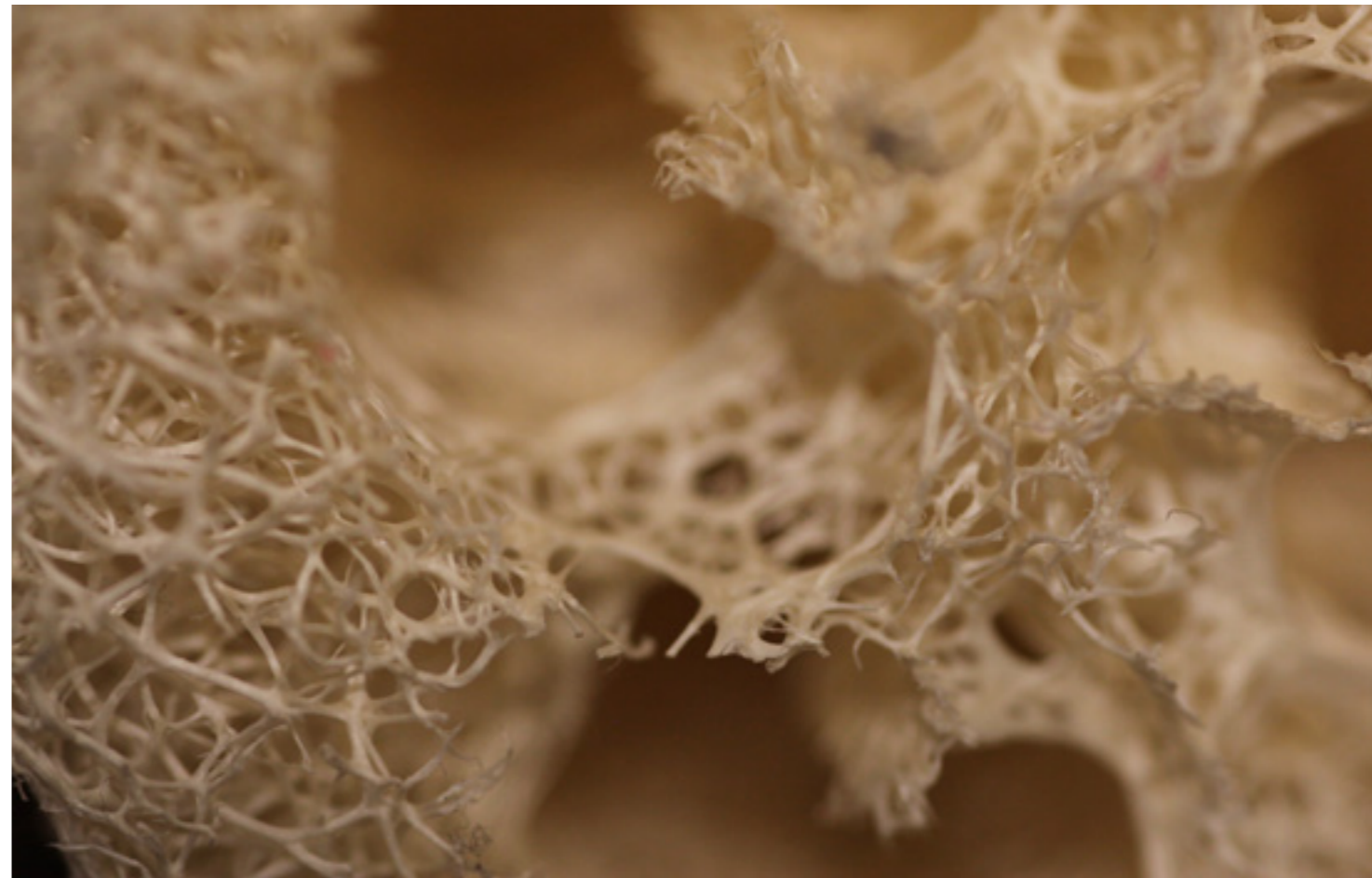
Centre for Nature Inspired Engineering EPSRC EP/K038656/1 (£4,980,773)

The Centre for Nature Inspired Engineering (CNIE) at UCL, led by Professor Marc-Olivier Coppens (Chemical Engineering), takes a scientific approach to uncovering fundamental mechanisms that underlie desirable traits found in nature, applies these mechanisms to design, and synthesises artificial systems that borrow the traits of the natural model. These systems, which include desalination membranes, fuel cells, catalysts, adaptive materials or built environments, thus become endowed with the same desirable 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.

This year, the CNIE was awarded a Progression Grant from the EPSRC (EP/S03305X/1 £758,983), which will extend the underpinning investment in the Centre for a further two years. This grant enables the exploration and validation of the nature inspired engineering approach within a new theme of Ecosystems, Control & Modularity. It will also allow for further expansion of the CNIE's approach to new application areas in built environment and design, and biomedical and healthcare engineering. Finally, the new funding enables the development of the existing theme of process intensification and energy.

Institute of Making Director Professor 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.

www.natureinspiredengineering.org.uk



Material Anxieties

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

This year saw the successful completion of Dr Sarah Wilkes's fellowship project. In the final year of the project Sarah focused fully on the Sensory Prosthetics study, a collaboration with designer, independent researcher and below-knee amputee Caitlin McMullan. This study took a participatory approach, working with amputees with the aim of improving the health services that affect them. The project used a combination of object-handling tasks, questionnaires and semi-structured interviews to explore what materials amputees would like to see in their prosthetic limbs, and why. Sarah and Caitlin also worked with documentary maker Dorothy Allen-Pickard to produce two short films documenting the experiences and materials preferences of amputees, and in particular, female and LGBTQ+ amputees who are often under-represented in the male-dominated world of rehabilitative engineering. The films are being disseminated to prosthetics manufacturers, clinicians and the design community with the aim of encouraging them to offer more materials for prosthetics that fit with the needs, identities and body images of all their wearers.

Public engagement activities have been central to this project from the start as opportunities to engage patients and the public in directing this research. Sarah has discussed the project with diverse public audiences at Cheltenham Science Festival's Makershack, the International Agatha Christie Festival and three Institute of Making open days. The culmination of this public engagement activity was the March Delight & Disgust open day; an extravaganza of revolting and sublime sensory experiences that attracted 1660 visitors.

The Materials Library has played a pivotal role in this project as a research tool enabling discussion about materials for future healthcare products in a creative and non-verbal way. Sarah will be adding to the library with specially made objects sets used in her research and a collection of 'medicinal and healthy materials' gathered in the course of her project.

www.instituteofmaking.org.uk/research/material-anxieties



Food and Transformation

BEKO PLC EP/N509577/1 (£287,813)

Ellie Doney's PhD project focuses on how food serves as a method and a metaphor to gain knowledge about human-material ecology. Through an art research practice of making, cooking and eating with people, she is creating aggregates of thought: methods and objects that are active, transformative tools. She uses these tools to investigate how materials become embodied, and how organisms and environments interconnect to create each other, through food and its active qualities.

The emblem of this project is the Ouroboros Sausage, which stands for the liquidity of subject and object in our relationship with materials, and is a medium for thinking and doing research about boundary slippages between human and non-human matter. The work asks how materials become embodied in not only our physical but also in our cognitive being, through ingestion, metaphor, and consubstantiation. It also asks how two or more substances can co-exist. If these tools can enable an understanding of ourselves as mixed materials connected to our environment, would they change our behaviour and treatment of other matter and ecosystems?

This year Ellie's research collective, the Roving Microscope, has been collaborating with the Big Compost Experiment to help people discover what is happening at the micro-scale in their compost. She has been teaching undergraduates at UCL's Medical School an elective course titled The Material Body: exploring anatomy through materials and making, art and food. Ellie has also launched an online artwork ofstandfound.org, and was guest editor of art and food journal FEAST for the Sugar Issue.

This PhD is supervised between the Slade School of Fine Art and the Institute of Making, and is funded by the UK R&D arm of BEKO Plc.

www.instituteofmaking.org.uk/research/food-transformation-how-are-materials-like-us



Research Workshop: Materials & Manufacturing in Healthcare

The ‘Materials & Manufacturing in Healthcare’ Workshop was held at UCL in July 2019 and was organised by our interim Research Manager, Rita Pinho with assistance from the UCL Institute for Healthcare. The goal of the day was to bring together academics and industry representatives working in healthcare manufacturing. This included engineers, scientists and industry partners who are aiming to deliver significant impact by building a connected research community to exchange information and understand industry needs; co-designing a focused strategy to increase future collaborations; promoting collaborative research funding applications; influencing government policy to increase funding streams and healthcare impact; and promoting technology transfer, including the translation of research.

The day started with a speed networking session where each academic had the chance to meet at least four industry representatives. This was followed by roundtables on ‘hot topics’ within the field. The top three ‘hot topics’ were defined as: Personalised Therapies, Manufacturing, and Innovation Hubs. Finally, the participants had the opportunity to discuss next steps and maintaining momentum. Following this successful event, we have now been awarded funding to work with UCL Innovation and Enterprise to further develop this network and bring clinicians onboard.

“A big thank you from all of us in the department. I thought the event went incredibly well, still not sure how you managed to get so many people to turn out from industry, and everyone engaged well. I’ve already had several follow-up emails and proposed projects.” (UCL Professor of Materials Science)

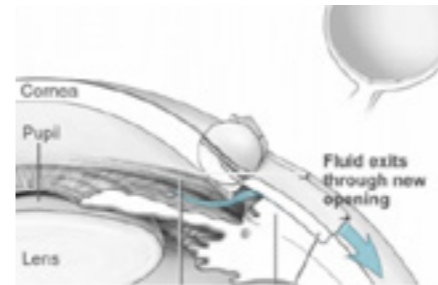
“Thank you for the opportunity to attend the workshop yesterday. I found it very informative and enjoyable and think that there was good energy in the room that was very productive.” (Industry Executive)



My Research Makespace: Pancake Making for Glaucoma Surgery

In February 2020, Dr Yann Bourmel showcased the relationship between glaucoma surgery and cooking pancakes in honour of Pancake Day. The event included a ‘scientific’ workshop animated by Dr Christin Henein, Dr Sahar Awwad and Peggy Khaw, who helped participants to cook pancakes to unravel how the different patterns relate to glaucoma surgery.

Glaucoma is the most frequent cause of irreversible blindness worldwide. It is characterised by raised pressure when the fluid in the eye does not flow as it should, and exerts stress on the optic nerve at the back of the eye. One of the ways to treat the excess pressure is to create an escape route for the fluid by carefully cutting the flexible layer covering the eyeball called the sclera. Similar phenomena happen when cooking pancakes. Water trapped under the batter of the pancake finds escape routes, and this produces the different appearances of the pancake. Understanding how to make the perfect smooth and unmottled pancake could help improve surgical methods for treating glaucoma. Yann used the extensive Materials Library available at the Institute of Making to learn more about material properties for his research and is now a regular user of its facilities.



My Research Makespace: Material (Im)Mobility in Laser-Scanning for PHX [X is for Xylonite]

Frances Scott is an artist working with moving image, presented through screenings, installations, events and publications. As part of a collaboration with UCL, Frances worked at the Institute of Making over a number of weeks to produce 3D laser scans.

In November 2019, Frances screened her new film PHX [X is for Xylonite] at a My Research Makespace, showing these 3D scans becoming animated forms. Following the screening, Frances was in conversation with Natasha Vicars, Project Manager for the Bow Arts 'Raw Materials: Plastics', and Romain, our Makespace Manager, to discuss how she made use of the Makespace to further her research through making.

Frances' film, PHX [X is for Xylonite], explores the first semi-synthetic plastic - cellulose nitrate - and its use in photography and film. Until the mid-20th century cellulose nitrate was used as the base for film stock, and elsewhere in props production. Collaging digital animation with hand-processed 16mm film, Frances explores plastics as strata. This process makes evident the layers that make up film - its emulsion and substrate - like the material seams that will, in future sedimentary rock layers, signal our Anthropocene era and its flawed capitalist productions.

PHX [X is for Xylonite] was commissioned as part of Bow Arts heritage project 'Raw Materials: Plastics', with generous support from the National Lottery Heritage Fund and University College London.





Events & Public Engagement

Eighteen golf holes. Twenty thousand invisible balls. Forty-eight embroidered nipples. One tonne of recycled HDPE plastic pellets. Ninety contributing makers, engineers, scientists and artists. Two hundred volunteers and event delivery staff. One Victorian steam engine called Dorothy.

A numerical snapshot of our seventh year of events is as colourful, diverse and surprising as ever. We continued our mission to provide inventive, joyful programmes for our members and the general public.

From March 2019 to March 2020 we held 60 events, 18 of which were member events and 42 of which were public (see pp.130-134 for the full list of events). These included 30 masterclasses (including a Tin Can Furnace Building Masterclass), 13 research events (including My Research Makespace: Pancake Making for Glaucoma Surgery), 3 large-scale public open days and 3 week-long events (including Helen Carnac, Enamel Maker in Residence, and Sensory Prosthetics at the Cheltenham Science Festival Makershack).

This year a highlight of working on the Institute of Making programmes has been the joy of thoughtfully matching up makers, skills and materials. The resulting dialogues between people, processes and products, was all that we intended and everything that we could never have imagined. The beauty of events is two-fold: on the one hand they are the coming together of a detailed plan, and on the other hand, they bring unpredictable connections between different areas of knowledge, experience and imagination.

A special pleasure this year came from watching different making practices run side by side during the Festival of Stuff week of masterclasses. At one point during the festival, the Makespace resonated with the sound of making through the ages. Taking processes from Prehistory to Classical Japan to the Information Age, participants knapped flint, pounded kozo paper fibre and wired digital synthesisers. Experiencing making from different times in close proximity to each other hammered home that although there have been considerable changes in techniques and materials through time, there was

already great sophistication and complexity in hand-making many millennia ago. On another day of the festival, participants reworked the concept of beauty with a featherlight touch in both kintsugi and body embroidery, where blemishes in both objects and bodies were sought out, embellished and celebrated. Being able to witness these craft practices in tandem emphasised the diligence and care in each and impressed on viewers and makers alike the sensitivity and tenderness ingrained in the processes.

A new informal lunchtime programme during Makespace opening hours carries on provision of this type of happy coupling of making practices on the most casual basis. Our new Making Circles run in three-month cycles as drop-in events, and always pair two making processes side by side. The sessions usually feature one digital and one non-digital technique, so that different groups of makers have the chance to interact and learn from the similarities and the differences in their methods. From January to March the Making Circle themes have been knitting and Arduino, where two groups that both use pattern and code have sat alongside and learned from each other.

“This is a bowl repaired with kintsugi a few weeks ago at the brilliant Institute of Making. [...] We only had a few hours but it still was a great start for understanding the method and exploring further in the future. I was always keen on repairing [...] and in the world we live in today these seems to be the skills we need a lot more of...” (Haein Song, masterclass visitor)

“A brilliant time playing with gases at @of_making today. ‘They are all so good at explaining’ said 7-year-old nephew, on his way home with a puffy, expanding ‘stress ball’ made by filling a balloon with bread dough...” (Eleanor Margolies, Gases open day visitor)

“What a great day volunteering at UCL Institute of Making festival around the science of gases! Everything from fermentation to levitation; with foams, farts and steam engines. Many children engaged with STEAM. Even some DIY as we built a sculpture from steam-bent wood.” (Ryan Clifford, volunteer)

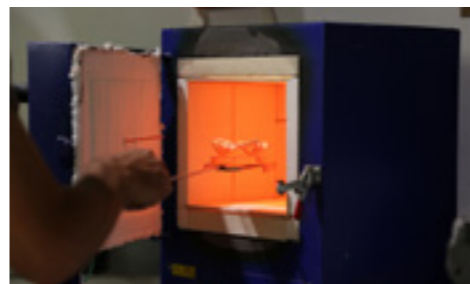
Festival of Stuff (Masterclasses)

Our five-day festival of making and materials revisited some of our favourite masterclasses and topics of the year. In its seventh year, the festival continues its unique tradition of giving the public free access to specialist tuition by master makers. These 18 covetable workshops once again sold out entirely, most within minutes.

We carefully curated the events so that each day we celebrated not only the skill of accomplished makers, but also fostered exciting dialogues between specialist practices. The festival's first day explored steam-bending wood and extruding HDPE plastic, creating pliable materials from what we would often consider the rigid and unbending. Day two explored the sound of materials through different ages of making. We heard the sharp 'chink' of knapping flint (Stone Age), the dull thud of wooden hammers separating kozo fibres for papermaking (Classical Japan) and the high nasal whine of the oscillator synth as part of circuit building (present day).

The third day explored the act of melting, through the processes of soldering electronics and enamelling copper. In the evening, Institute of Making Director Mark Miodownik spoke about the possibilities and pitfalls of our use of plastics to a packed room. He challenged us to see this material for the true polymer powerhouse that it is, and reinvigorate our relationship with it. The love of imperfection took centre stage on day four, when the separate crafts of kintsugi and body-embroidery showed how intricate and care-infused making can raise perceived 'brokenness' and blemishes into a new and richer beauty.

"A really happy couple of days spent at @of_making ...exploring enamelling with @helencarnac and the potential of recycled plastics with @jamesshaw - I learnt so much in such a short time, and will definitely continue experimenting!" (Rosina Godwin)



Crazy Materials Golf (Open Day)

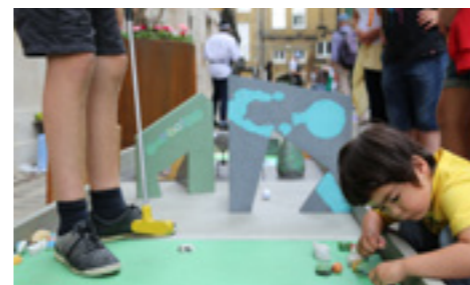
Our Saturday Extravaganza is always the seminal event of the Festival of Stuff. It is an enormous, free, drop-in occasion that allows thousands to celebrate a cornucopia of processes and materials. This time we set ourselves the most joyful of challenges: to build an 18-hole mini-golf course for the public to play, which would sit alongside in-depth exploration of the nature of kinetic sand, artificial grass, optics, angles and more.

In true Institute of Making style, our home-built golf course was imaginative and surprising. Teams of visitors played holes that showcased the wondrous properties of lasers, wood, velcro, mirrors, liquids, invisible balls, pipes, synthetic fur, books, bathtubs, microscopes and more. Concrete maker Leigh Cameron, woodworker Stefano Santilli, glassworker Shelley James and metalsmith Stephen Coles were commissioned to use their materials expertise to produce unique golf holes about timber, glass and airflow, and were at the event to explain their designs and making processes.

The day included hands-on activities like spherification led by unbeatable science duo Andres Tretiakov and Jess Wade, pencil modification led by designers Silo Studio, futuristic golf gear design with technologist Jude Pullen and sphere making with polymorph. Pandan Bakery served surprising ball-themed refreshments at a terrific 19th hole, and visitors who completed the course were awarded a marimo moss ball in a jar.

“Back at the #instituteofmaking for their Crazy Golf Extravaganza - completed all 18 holes so won a rare form of algae called a marimo!” (Aiden Tsen)

“The Festival of Stuff at the Institute of Making was a blast! Deconstructing the stuff of golf to interrogate the material world! Fabulous!” (Phoenix Lindsey Hall)



Delight & Disgust (Open Day)

“Delight and Disgust event at the Institute of Making at UCL - ya know, casual Saturday of turd polishing, the usual!” (Miho, visitor).

We asked the public to put their senses to the test at our Delight & Disgust event; a free festival around materials, sensory preference and emotion. The day was based on the work of our research fellow Dr Sarah Wilkes (see ‘Material Anxieties’ p.64). Besides co-programming the day, Sarah created an experiential ‘Land of Sensory Delights’ at the event, allowing visitors to understand and explore the many mind-boggling factors of materials selection for hospital environments.

The day itself was a hive of activity, and included areas that focussed on the revolting and the sublime in relation to food and hygiene, including crossmodal research on taste, smell and flavour. Professor Barry Smith from the Centre for the Study of the Senses explained what ‘mouth feel’ means and challenged the multi-sensory nature of people’s taste experience with large quantities of chocolate.

The event showcased highly-skilled makers, such as concrete-maker Leigh Cameron who provided beautiful cement formulations for people to mix with their own bodily aggregate (visitors rose to our challenge to bag up and bring along their hair, nails or any other inert, dry product from home). Artist Sally Hewett exhibited her exquisitely corporeal textile pieces and taught on-the-spot nipple embroidery. The day also featured activities based on the delightful and disgusting worlds of dental hygiene, moving geometries, deodorant making, mozzarella stretching, professional hugs and coprolite turd polishing.



Body Embroidery with Sally Hewett (Public Masterclass)

Sally Hewett is an artist and embroiderer who loves bodies. But it is not conventionally beautiful bodies that catch her eye. Instead, she is interested in bodies which show their history and have been altered by experience: decorated with bruises, scars, spots, stretch marks, freckles, pigmentation, veins - bodies that show the marks of life. Her use of fabrics, stitching and embroidery interrogates how we represent our physical forms, ideas of beauty and ugliness, as well as investigating the divide between craft and art.

Using two or three simple embroidery stitches, Sally showed our masterclass participants how to make their own unique nipple or pair of lips. Participants worked with thread, embroidery hoops, felt padding and other materials to create their sculptural body-embroidery pieces. Sally provided an array of colours and sizes to choose from as well as detailed stitching diagrams and on-hand tuition.



Food Waste Textile Dyeing with Lauren MacDonald (Member Masterclass)

In this masterclass, artist and designer Lauren MacDonald taught the fundamentals of botanical textile dyeing with dyestuffs sourced from household food waste. She covered the basics of dyeing materials, process and best practice, and taught our members three separate recipes for botanical food waste dyes.

As part of the masterclass, Lauren led the group in a discussion of responsible material use and the surprising beauty that can be found in objects which would otherwise be thrown away. At the end of the session, participants bagged up their newly-transformed socks, t-shirts, tote bags, shawls and shorts, infused with delicate new hues of avocado-pip pink, onion-skin gold and pomegranate umber.

“Learned another way to utilise food waste today from lovely @working_cloth at the Institute @of_making! And crazy thing is avocado is a fascinating pink dye!” (Aleksandar Taralezhkov)



Plastic Fantastic with Mark Miodownik (Public Evening Talk)

“Went to Mark Miodownik’s talk on plastic waste at the #instituteofmaking - it was really cool, I highly recommend their yearly Festival of Stuff!” (Aiden Tsen)

For our Festival of Stuff talk, Director Mark Miodownik challenged his audience to reinvigorate their relationship with a much-reviled materials group: plastics.

Mark started with a whirlwind tour through the history of plastics, explaining how at the beginning of the twentieth century, plastic brought us modernity, making the telephone, the radio, and the television widely available to all. More plastics followed, changing the way we lived in almost every way, from footwear to furniture, from stockings to tennis racquets. In a poll in the 1940’s, ‘cellophane’ was rated the third most beautiful word in the English language, ushering in an age of single-use objects and throw-away culture, and a growing environmental catastrophe.

Mark looked at different causes of plastics pollution, and how plastics may or may not be recycled, reused, replaced or broken down. He emphasized in his talk that; *“the answer isn’t to ban plastics. They are hugely useful, not least in our homes, hospitals and transport systems. The way forward is for us to engage more with plastics, to build trust in and a love of plastics again. It is only by understanding that they are indispensable, and re-learning how to value them, that we will summon the political will to end the era of disposability.”*





Materials Library

The Materials Library has had over 170 visitors this year. We were involved in Architecture Beyond Sight, a summer school for blind and partially sighted students, which explores materials selection for the built environment in a way that challenges fixations with the visual (p.94). We've delivered object-centred sessions for the Bartlett's BSc Architecture and Interdisciplinary Studies course, exploring the social, environmental and geopolitical histories of materials. We've used the Materials Library to explore materials and the body with first-year medical students. We've also worked with UCL's Pre-University Engineering Education Outreach team to encourage young people from traditionally underrepresented backgrounds to progress into STEM degrees through a session exploring the pros and cons of plastics.

We have continued to widen our impact and engage with the public. The Materials Library was featured as part of a series of BBC Radio 4 programmes with Claudia Hammond to initiate and celebrate the Touch Test, a large-scale national online survey exploring the impact that touch has on our daily lives (p.96). We've also been making links with other materials collections around the country, including new libraries that are being developed in the School of Art, Design and Architecture at Huddersfield University and at Arts University Bournemouth.

Despite not having had a caretaker for the collection for most of this year, these activities have been overseen by Dr Sarah Wilkes, our former research fellow and materials researcher, who is now taking on the role of Materials Librarian. We also have an amazing new library assistant, Imogen Cowley, who is studying for an MSc in Advanced Materials Science. We are busy making plans for the collection going forwards, including working on engaging our members with the library through regular themed displays of materials and a new 'process library'. We will be focusing on making the collection more digitally accessible to the public by ensuring that all our materials are featured on the website. We are also aiming to be more proactive in supporting teaching and research on materials and making around UCL. We will establish group and one-to-one learning sessions, teaching object loans and researcher-led displays that celebrate and highlight materials-oriented projects.

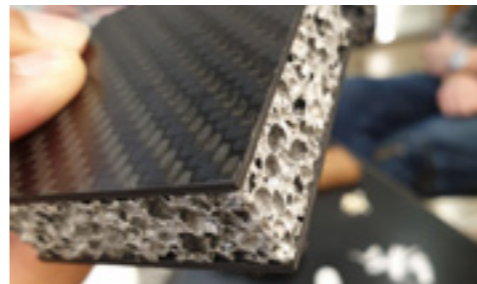


Architecture Beyond Sight

Architecture Beyond Sight was a project commissioned by Professor Alan Penn, Dean of the Bartlett, and involving internationally renowned blind designers Chris Downey and Duncan Meerding, blind writer and theatre director Mandy Redvers-Rowe and Jos Boys, Zoe Partington and Rachel Tyler of DisOrdinary Architecture. The aim of this project was to offer a radical alternative to architecture's visual bias by working with blind and partially sighted people to rethink design and representational methods, and create built spaces that respond to all the senses.

Last summer we were part of their flagship short course for blind and partially sighted students. We worked with 16 students in the Materials Library to introduce them to the amazing array of materials and surfaces that exist in the world. We explored the smell, sound, taste, touch and stories behind materials such as smoked natural rubber, fake fur, Teflon, stainless steel fibres and foamed aluminium so that students could get a feel for their own sensory preferences and develop a language with which to talk about materials. We also explored the research sets of cubes, spoons and tuning forks as a way of stimulating discussion about how students could use materials to influence sensory experiences and the cultural and emotional associations of a building or object. The session ended with a creative writing task aimed at developing the students' descriptive and interpretative writing skills using materials library objects. The group then went on to spend the rest of the week in the Bartlett workshops, producing some amazing designs in response to their visits to the Materials Library and British Library.

This pilot short course aimed to develop and test a foundation course for blind and visually impaired people who want to study architecture and related creative subjects. The summer school has secured funding for another year, and we're looking forward to being part of the next iteration.



Touchy Subject

On Tuesday 21st January, the Materials Library appeared on a special BBC Radio 4 programme to launch The Touch Test, in which *All in the Mind* presenter Claudia Hammond explored the many aspects of touch and the impact that it has on our daily lives. The Touch Test is a large-scale online survey, commissioned by the Wellcome Collection and designed by Goldsmiths' Professor Michael Banissy, that explores the similarities and differences in our experiences of touch, with the aim of increasing understanding of its role in health and wellbeing.

For the first programme to initiate The Touch Test we pulled out some delightful and disgusting materials for Claudia to handle and respond to, as provocations to encourage listeners to think about the materials and textures that they like and dislike touching. We discussed materials like chocolate, aerogel and bubblewrap that can bring joy, alongside materials like polystyrene, foam and human hair that can elicit phobias, strong physiological responses and moral disgust. We explored materials in and on the body through the badger hair toothbrush, implantable bioglass scaffold and the collection of spoons, and materials that respond to our touch like kinetic sand and thermochromic silly putty. We also talked about how we use the library and its specially made sets of objects in our research, exploring the materials and sensory preferences of amputees to improve materials for prosthetic limbs for example, which will feature in later programmes in the series.

www.touchtest.org
www.bbc.co.uk/programmes/m000dfp3



FLOP: 13 Stories Of Failure

Three of our materials are currently part of the latest Octagon Gallery exhibition 'FLOP: 13 Stories of Failure' by Dr Thomas Kador. The Materials Library's Silly Putty, super black and 'failed' 3D prints are part of this display and the accompanying podcasts that explore the joy and pain of mistakes. Our materials have joined other 'failed' objects from the UCL Collections including a macerated plum that was misidentified as a testicle and added to the Grant Museum collection, and a human oesophagus that was fatally pierced by a sword-swallower's blade.

Our Silly Putty was chosen as a material that started its life in the 1940's as a failed rubber replacement, only later achieving success as a children's toy. When Japan invaded Southeast Asia in 1942 and supplies of natural rubber were cut off, chemists at Dow Corning and General Electric independently created this material using a combination of borax and silicone oil. They found that in some ways this material does mimic rubber: if you roll it into a ball and throw it against the floor it will bounce. However this material has a strange mix of elastic and liquid behaviour that is described as non-Newtonian, where it flows as a liquid when left alone but hardens to solid if you apply a lot of force over a short period of time.

Because it flows like a liquid, Silly Putty was not a useful replacement for natural rubber. James Wright, the scientist who was awarded the patent for this material in 1943, sent samples to scientists all over the world, but no-one was able to find a practical application. Although Silly Putty began its life as a failure, it finally achieved success in the 1950's as a hugely popular toy. Since then, there have been a host of other apocryphal uses including: to secure tools and relieve stress at zero gravity on the Apollo 8 mission; for the rehabilitation of hand injuries by physical therapists; and to mimic the plasticity of plate tectonics in geological models of the earth's crust.



Tiniest Ball Bearings

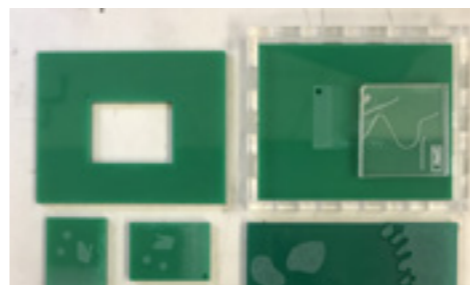
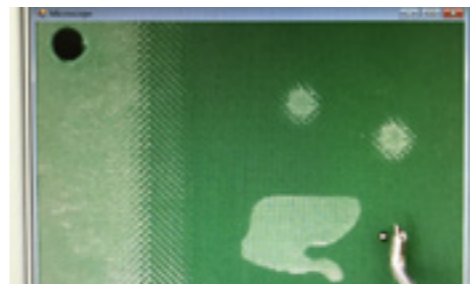
These diminutive orbs were collected as part of our Materials Crazy Golf open day, where they featured in the dramatically scaled-down and genuinely ‘mini’ microscopic golf hole. These steel balls measure 0.25mm in diameter and are used in the smallest commercially-available ball bearings. For as long as we have needed to move things around, we have used round objects as rollers to make the job easier. The Egyptians used logs as a way of moving large slabs of stone for the pyramids, and every kind of machine that deals with motion will make use of bearings to smooth its path and reduce friction.

There are thousands of sizes and designs of ball bearings, but modern steel ball bearings are all manufactured in the roughly the same way: the process starts with a metal wire, usually carbon or stainless steel, which is cut into sections and cold formed into a spherical shape by smashing it between two hemispherical dies. The ‘flash’ or ridge that is left by the forming dies is then removed by rolling the balls between heavy cast iron plates. The balls are then ground with a grinding stone, heat treated for hardness and descaled to remove any residues from the heat treatment process. Finally, the balls are ground, lapped and polished slowly and meticulously to tolerances of within 0.0025 millimetres.

Balls produced in this way are responsible for the smooth spinning of bike wheels and the functioning of hard drives and photocopiers, amongst many other things. Plastic, ceramic (e.g. silicone nitride) and jewel (e.g. sapphire) ball bearings are used where low density, chemical resistance or non-magnetism are required, and are responsible for the functioning of roll-on deodorants, watches and wind turbines.

Particularities: State: solid; Category: metal

Relationships: balls, smooth, polished, small, friction, movement



Nitrous Oxide

Commonly known as laughing gas, nitrous oxide has been consumed by humans since the 1700s, when it was first isolated by Joseph Priestley. It was initially used for public entertainment. Inhaling the gas can give feelings of euphoria or relaxation, fits of giggles, sound distortions and hallucinations and, as first noticed by dental surgeon Horace Wells in the 1840s, relief from pain. This was the beginning of its use as an anaesthetic in dentistry, surgery and childbirth. It is also used to whip cream because it is bacteriostatic, dissolves in the cream easily and does not cause the cream to oxidize. It can also be injected into a car's engine during motor racing to give it more power.

But is this substance all laughs? Aside from being an asphyxiation hazard, nitrous oxide also contributes to global warming. We tend to focus on carbon dioxide when we talk about greenhouse gases, but nitrous oxide, along with methane and fluorinated gases like sulphur hexafluoride (SF_6), have a much greater impact on global warming. All of these gases enhance the greenhouse effect in that same way as CO_2 , by capturing reradiated infrared radiation from the earth's atmosphere and warming up the lower atmosphere. However although nitrous and SF_6 are present in smaller concentrations, they trap heat very effectively, making them high global warming potential (GWP) gases. Nitrous oxide is 300 times more warming than CO_2 , it lasts a very long time in the atmosphere, and the process to remove it from the atmosphere also depletes ozone. Globally, about 40% of N_2O emissions come from human activities including agriculture, fuel consumption, wastewater management and as a by-product of industrial processes like the production of nitric acid, which is used to make synthetic fertilizers.

Particularities: State: gas; Category: gas

Relationships: medical materials, anaesthetic, greenhouse gases, sustainability



Activated Charcoal Filter

This innocuous looking substance that we now put in our trendy water bottles has been used for decades as protection against unseen dangers like chlorine, sarin nerve agents and paint fumes. Activated charcoal is the substance contained inside many gas masks, which rely on two different technologies to function. Firstly, very fine particulate filters act as physical barriers to prevent particles of a toxin reaching the face and lungs. Secondly, materials like activated charcoal neutralize toxic chemicals in a process called adsorption. Through adsorption, a solid or a liquid can trap toxic particles on its surface, stopping them from being inhaled. It also has the same effect when ingested as an antidote for poisons, when used to remove bacteria from drinking water, or when used in underpants to counteract malodourous gases.

Activated or oxidized charcoal is carbon that has been treated with either a combination of heat and pressure (steam activation), or with a strong acid or base followed by carbonization (chemical activation). These processes erode the extensive pores on the surface of charcoal particles making it highly porous, giving it a very large functional surface area and enhancing its capacity to adsorb impurities. This means its molecular structure ends up looking a bit like chicken wire; filled with loads of 'sticky' holes that catch any toxins that pass through. This material was collected as part of our Gases open day where it formed part of a display exploring effervescent materials in their many forms.

Particularities: State: solid Category: vegetable, mineral
Relationships: Filtration, harmful gases, poison, adsorption





The Makespace

The Makerspace is where the magic of making happens. Rather than a specialised space, the Makerspace offers an incredibly broad spectrum of tools. From wood bending to enamelling, mould making, 3D scanning or pewter casting, it is a place where ideas become physical. It is not only the tools that energise our members, but also our expert and friendly team of technicians who are always there to provide support and advice.

The Makerspace opened six years ago, and it keeps on growing and evolving to enable our members to experiment, play and learn with more materials, skills and processes. After setting up a new layout on the ground floor last year, this year we reorganised the mezzanine. This new layout not only created a safer environment for our members but also allowed us to continue to expand our diverse set of tools. This year the Makerspace was able to acquire, among other things, a brand-new bench saw, a jewellery-making kit and add an extraction system to our 3D printing cabinet.

Necole, our amazing Makerspace Manager, worked particularly hard to ensure that all our equipment was in line with the latest health and safety regulations. By updating our risk assessments, inductions and adding necessary fittings, our workshop is safer and more welcoming. Our team of technicians are now able to focus even more on helping, teaching and advising our growing numbers of members.

From December, Necole is on parental leave, and our former Technician, Romain, has stepped into the role of Makerspace Manager. Technicians Fran and Helen have joined our team, bringing unique expertise in woodwork and enamelling. They are both friendly and knowledgeable, and it has been a joy to see our members welcoming them and learning new skills.

This year, as ever, the Makerspace was the birthplace of so many projects. We have seen a growth of interest in biomaterials, materials made for instance from sweet potatoes, leaves, bark, wood dust, orange peel, and more. Innovating with materials is where we particularly excel. We allow our members the freedom to experiment while at the same time making sure that they understand potential dangers and when to ask for advice. Our philosophy has always been to say “yes” as often as possible, by finding safe ways of working with dangerous processes and materials.

Our mezzanine has also been bustling with the activity of members building robots, smart objects and interactive installations, as well as scanning, building, modifying and printing 3D models. Our super Technician George has been particularly helpful in this area, using his extensive experience in robotics, programming and 3D modelling.

Our ever-popular ceramics facilities have continued to grow with Technician and ceramics expert Darren actively responding to questions and challenges from our members. New member supervisors, as well as our Events Manager Sara, are now also part of the potters team. They induct members on the potter’s wheel and again bring different skills and experience to the workshop. It is incredible to see the volume and variety of work that is coming out such a small part of the workshop. Members are experimenting with glazes, creating glass casting and continuously pushing boundaries. It is always so satisfying to see members helping and advising each other.

The Mezzanine

After successfully reformatting the Makerspace ground floor last year, this time we decided to focus our attention on the mezzanine level. We faced a number of challenges: finding a solution to filter the fumes from the 3D printers; creating more open space; and finding a way to cancel the vibrations from the laser cutter extraction that were causing extrusion problems for the 3D printers.

After considering various scenarios, we built a new 3D printer cabinet, which hangs from the wall so that the printers are not affected by vibrations. We researched and purchased a specially adapted extraction system. Our Technician George designed and built a system allowing our members to open the cabinet only once the air inside was filtered. With the cabinet snug against the wall, the space is now more open, and members can circulate around the mezzanine and communicate more easily. We also redesigned our soldering area; selecting and assembling comprehensive sets of tools and making sure it is simple to find and tidy the tools. All in all, the revamped mezzanine feels better organised, bigger, friendlier and safer.



New Skills in the Makespace

New year, new skills! This year our team of technicians received more skills training and had the chance to pass on their knowledge to each other. Helen, one of our new technicians, was also Maker in Residence at the Institute for a week. Our members learned about enamelling with her while other technicians consolidated their knowledge and learned valuable ways of teaching enamelling.

We collaborated with The Bartlett, and Donat, a Senior Technician at BMade, came for a session with our team about Fusion 360 - a CAD, CAM and CAE software. Donat kindly showed us how to use Fusion for creating CNC toolpaths, making sure knowledge and standards are also shared between workshops. We were also joined by Adam, workshop manager at Makerversity, to build and strengthen our collaborations with London makerspaces.

Thanks to the masterclass programme, organised by our Events Manager Sara, our technicians had the opportunity to learn new skills. They can now pass these on to each other and ensure that this unique expertise stays in the workshop after the masterclass.



New Specialist Tools

This year we have continued to expand our list of tools. Two of the most popular new additions to our facilities were the bench saw and jewellery kit.

Bench saw

We procured a new bench saw last year, but it has become operational, and truly came into use in the course of 2019. The bench saw has allowed our members to work on larger-scale projects, such as furniture, installations and large-scale prototyping. It also has enabled more precise hardwood cutting. The bench saw is typically used when one of our members wants to cut parts out of a full sheet of plywood. Using the bench saw is safer, quicker and more accurate than using a track saw, and is also very good at cutting thicker hardwood which was rarely possible in our workshop before.

Jewellery kit

After running a Silver Ring Making Masterclass for the second time, we decided to purchase a jewellery kit which included all the tools for cutting, pickling, soldering and finishing silver. The masterclasses were inspiring and educational for our members and technician team. Jewellery making is now a popular activity among our members.



Member Supervisors

Member Supervisors are essential to the smooth running of the Makerspace. They are truly an inspiration, not just for the positive and effective role they serve in our member community, but also for the diverse skills they demonstrate to their peers. Member supervisors are students and researchers as well as professional and academic staff. Our current Member Supervisors Arkadiy Serezhkin, Ben Oldfrey, Ella West, Evangelos Himonides, India Davies, Kevin Green, Louise Oates and Tom Crossland go beyond their official remit to formally use their skills to help other members. They teach pottery, laser cutting, 3D printing, screen printing, sewing and other skills to fellow members through our weekly tool training. They help with events, inductions and organising the workshop. They are an essential part of the public programme and members' experience.

This year, we have sadly had to say goodbye to some of our amazing Member Supervisors, as they graduated or otherwise moved on to greener pastures. They were essential in establishing the Member Supervisor programme and training new members over the years. Leaving us are Anne Zakrzewski, Elliot Magee, Kareem Khazem, Naomi De Barr, Noor Khazem and Piotr Wasylczyk. We will miss you!



Helen Carnac Maker in Residence

As an enamelling expert, Helen Carnac has provided exceptional masterclasses for our programmes for years. However, being able to install Helen in the Makespace for an entire week allowed members to unlock a treasure trove of materials as well as bring our enamel kiln back to life in a glorious burst of activity.

Helen set up the Makespace as her temporary studio with an array of small bowls of twinkly metal powders, luminous retroreflective beads and earthy oxides, as well as displays of numerous enamelled squares in various states of disintegration. Her extensive knowledge of metal and enamels, matched with her experimental approach to making, gave members the freedom to test and trial material behaviours with great creativity.

By the end of Helen's residency, her temporary studio was filled with layered, crumbling, oxidised and shin-engraved copper squares. Our members and staff alike were left not only with knowledge of how to enamel in the Makespace, but also with a great appreciation for Helen's work, which will be displayed around UCL campus.





Concluding Remarks

When plastics were first invented and developed in the nineteenth century, they were an answer to a looming environmental crisis. Now, a hundred and fifty years later, they are the cause of one. So what shall we do? There are many calls to replace them with more sustainable materials. Still, history will repeat itself if we do, and we will stagger from one environmental crisis to another. This is because there is a widespread misconception that sustainable materials exist. They don't. They are a mirage. Only sustainable systems exist, and we have very few of those.

The first commercial plastic celluloid was invented in response to a shortage of ivory, and the recognition that the market for it was driving animals like elephants to extinction. Celluloid became synthetic ivory first before finding an even bigger market, replacing glass as the flexible substrate for photography. Because of this flexibility, rolls of film became possible and using them to take a sequence of pictures created a new visual culture, the movies. More plastics followed, changing the way we lived in almost every way, from footwear to furniture, from telephones to packaging. But despite all the excitement, and birth of modernity through these plastics, a system was never put in place to collect them after use. Nor was there a plan or the economic model to fund recycling and re-manufacture. Without such a system, plastic pollution grew to become the disaster it is today.

There are no simple solutions to tackle the plastic waste crisis. Take food packaging as an example. The analysis shows that banning plastic will be counter-productive because it will increase food waste and so increase carbon dioxide emissions and global warming. Moving to biodegradable plastics just replaces one problem with another - they also require energy to manufacture and need a separate collection so they can be industrially processed. These collection and processing systems largely don't exist thus biodegradable plastics mostly end up in landfill, where the conditions

mean that they are likely to create methane, which is twenty-eight times more potent as a greenhouse gas than carbon dioxide. If they end up in the sea, the evidence indicates that they will be there for years because the temperature is too low. Paper and glass are frequently mentioned as less environmentally damaging alternatives to plastic packaging, but although there are effective recycling systems for both, their impact in terms of energy and water usage is high.

Packaging is a reasonably simple example, now think of your trainers, or your bicycle tires, or your clothes, all of which end up in a landfill. These examples illustrate a truth which is that all materials have an environmental impact and unless you design a sustainable circular economy for manufacture, use, collection and re-manufacture, this impact will be high and will scale with consumption. In other words, we need to be clear that there is no such thing as a sustainable material, there are only sustainable systems.

So how do we build help build these sustainable systems? The first thing to do is to help companies restrain the urge to swap one material for another in the hope that it makes a product superficially more sustainable. As the biodegradable plastics example shows, this tends just to shift the problem onto someone else. What most products need is a complete redesign so that the production, use, and end of life are all assessed in terms of environmental and carbon climate change impact. The tools and methodologies for doing this are in their infancy. One established tool is life cycle analysis (LCA) which is a quantitative methodology to assess the environmental impact of a product or process. However, it is rarely used by product designers because it requires specific training, the software is expensive, and developed for use by scientists and engineers.

This is where the Institute of Making and its members can make a valuable contribution. With our multidisciplinary approach to materials and making, we are well placed to help the design community use a more informed systems approach. We can also help LCA experts to make the tools easier to use, widely available, and crucially, make them relevant to the iterative and playful approach of designers. We also need to link up product designers and manufacturers with the waste processing industry so they can certify whether their products are recyclable or not, and if not, engage in further design iterations.

The effectiveness of medicines has to be certified before they can be sold. We agree to this as a society even though it increases drug development costs because the benefits to public health outweigh the risks of unregulated medicines. To create a more sustainable world, we are going to need to do the same for products, but now it is the health of the environment that we will be seeking to protect. This is likely to require a completely different economic system, a so-called circular economy where waste materials are valued and recycled rather than dumped. This is why we have been working closely with policymakers to create regulation that creates this framework and tax incentives to aid the transition to circular product design.

The future is uncertain, and the stakes are high, but at least we know what we need to do, now it's a question of how fast we can make it happen. The Institute of Making is up for the challenge!

Mark Miodownik
Zoe Laughlin
Martin Conreen



Full Statistics of Membership

Total number of registered members: 13,449

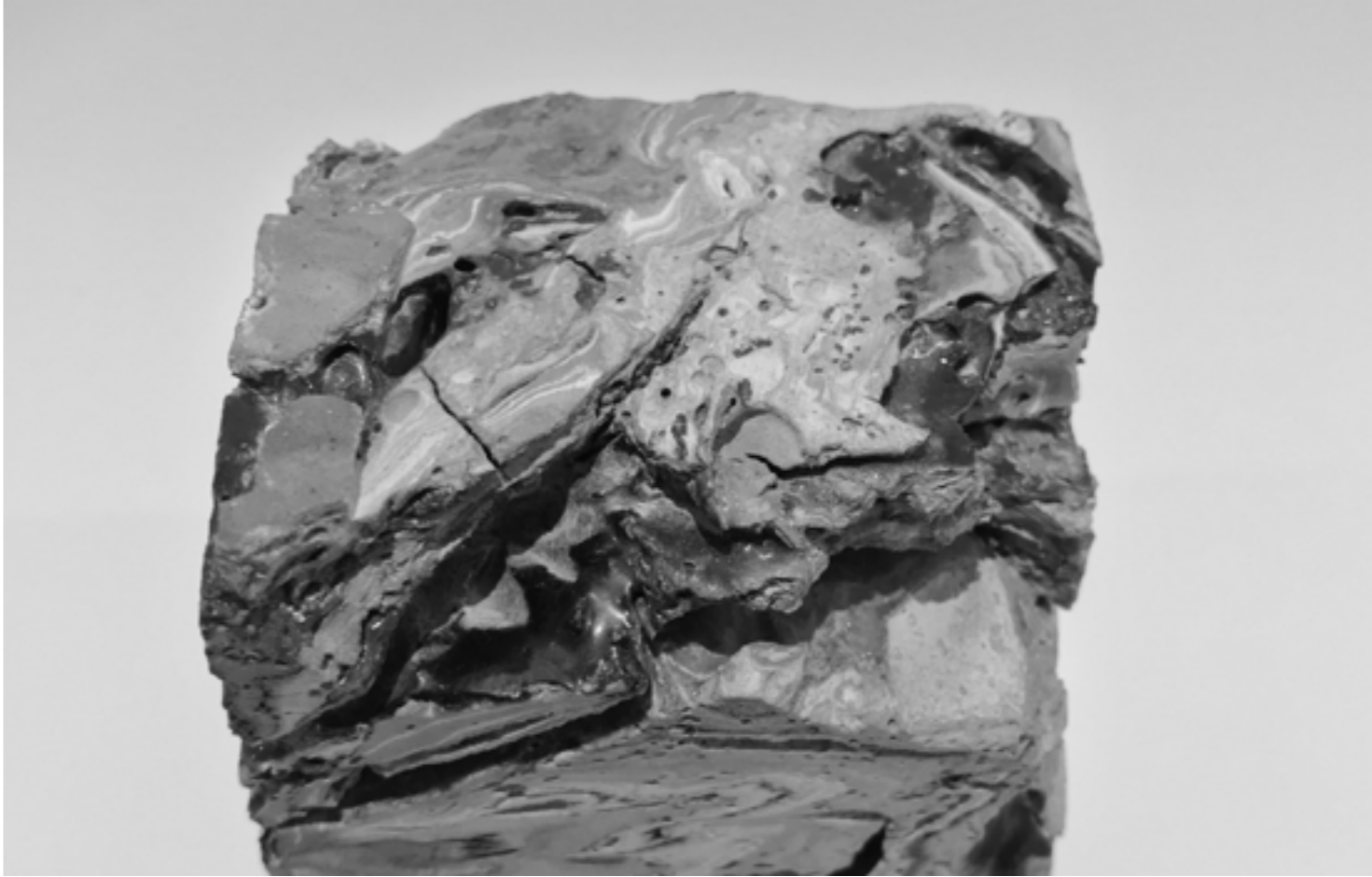
Active inducted members: 2,769

Gender
Female 44%
Male 51%
Genderqueer/non-binary/prefer not to disclose 5%

Member type
Staff 31%
 Academic staff 20%
 Professional services staff 11%

Students 66%
 Undergraduates 33%
 Postgraduates 33%

Not Specified 3%



Full List of Events

Total number of events: 60 (18 member events and 42 public events)

Breakdown: 30 masterclasses, 13 research events, 3 outreach events, 6 workshops, 3 week-long events and 3 large public open days.

23rd March 2019. Delight & Disgust (Open Day).

1st April 2019. Morning - Flint-Knapping with Karl Lee (Masterclass) Member event.

1st April 2019. Afternoon - Flint-Knapping with Karl Lee (Masterclass) Member event.

2nd April 2019. Royal Institution Lecture: Gold as a Human Barometer (Public Event).

4th April 2019. Sprouts in Small Spaces I: Home Hydroponics Workshop (Research Event).

5th April 2019. Roving Microscope: Microscopic Lunch (Research Event).

24th April 2019. Feast: Caribbean Sugar Tea Party (Research Event).

29th April 2019. Tin Can Furnace with Coles Castings (Masterclass) Member event.

4th May 2019. Material Exploration with James Shaw (Masterclass) Public event.

4th May 2019. Material Exploration with James Shaw (Masterclass) Member event.

7th May 2019. Sprouts in Small Spaces II: Harvest Workshop (Research Event).

11th May 2019. Roving Microscope: Microscopic Lunch (Research Event).

1st & 2nd June 2019. Sensory Preference in Prosthetics (Research Event).

5th June 2019. Enamelling with Helen Carnac (Masterclass) Member event.

5th June 2019. Big Make: Enamelling with Helen Carnac (Workshop) Member event.

6th-9th June 2019. Sensory Prosthetics at the Makershack, Cheltenham Science Festival (Outreach).

1st July 2019. Morning - Microwave Steam-Bending Masterclass (Festival of Stuff).

1st July 2019. Afternoon - Microwave Steam-Bending Masterclass (Festival of Stuff).

1st July 2019. Morning - HDPE Extruding Masterclass (Festival of Stuff).

1st July 2019. Afternoon - HDPE Extruding Masterclass (Festival of Stuff).

2nd July 2019. Morning – Flint-Knapping Masterclass (Festival of Stuff).

2nd July 2019. Afternoon - Flint-Knapping Masterclass (Festival of Stuff).

2nd July 2019. Morning - Papermaking Masterclass (Festival of Stuff).

2nd July 2019. Afternoon - Papermaking Masterclass (Festival of Stuff).

2nd July 2019. Morning - Circuitry & Synth Building Masterclass (Festival of Stuff).

2nd July 2019. Afternoon - Circuitry & Synth Building Masterclass (Festival of Stuff).

3rd July 2019. Morning – Enamelling Masterclass (Festival of Stuff).

3rd July 2019. Afternoon - Enamelling Masterclass (Festival of Stuff).

3rd July 2019. Morning - Circuitry & Headlight Building Masterclass (Festival of Stuff).

3rd July 2019. Midday - Circuitry & Headlight Building Masterclass (Festival of Stuff).

3rd July 2019. Afternoon - Circuitry & Headlight Building Masterclass (Festival of Stuff).

3rd July 2019. Evening Talk - Plastic Fantastic with Mark Miodownik (Festival of Stuff).

4th July 2019. Kintsugi Masterclass (Festival of Stuff).

4th July 2019. Morning - Body Embroidery Masterclass (Festival of Stuff).

4th July 2019. Afternoon - Body Embroidery Masterclass (Festival of Stuff).

5th July 2019. Crazy Materials Golf (Open Day).

7th July 2019. Roving Microscope: Microscopic Lunch (Research Event).

20th July 2019. Roving Microscope: Remaking the Soil Food Web (Research Event).

22nd July 2019. Architecture Beyond Sight (Outreach).

1st September 2019. Roving Microscope: Close Encounters with Materials & Microbes (Research Event).

18th September 2019. Papermaking with Mandy Brannan. (Masterclass) Member event.

18th September 2019. Big Make: Papermaking with Mandy Brannan (Workshop) Member event.

26th-27th September 2019. UCL Lunchtime Looks (Open to all UCL).
28th September 2019. Roving Microscope: Anaerobia - Under the Microscope (Research Event).
6th October 2019. FungiFest: Medicinal Mushroom Broth Workshop (Public Event).
26th October 2019. Gases (Open Day).
27th October 2019. Roving Microscope: Seed Stories and Symbionts (Research Event).
18th November 2019. Morning - Silver Ring with Rahel Pfrommer (Masterclass) Member event.
18th November 2019. Afternoon - Silver Ring with Rahel Pfrommer (Masterclass) Member event.
19th November 2019. My Research Makespace: Laser Scanning for PHX [X is for Xylonite]. (Research event).
26th-29th November 2019. Helen Carnac – Enamelling Artist. (Maker in Residence).
27th November 2019. Enamelling with Helen Carnac. (Masterclass) Member event.
5th December 2019. UCL Medical School Undergraduate Teaching Session: Human Materials (Outreach)
17th December 2019. Big Make Merry: Pewter Decorations. (Workshop) Member event.
10th January 2020. DIY Cultures: Home Fermenter Workshop (Research Event).
16th January 2020. Sensory Prosthetics Film Screening (Research Event).
21st January 2020. Making Circle: Arduino & Knitting (Workshop) Member event.
3rd February 2020. Morning - Textile Dyeing with Food Waste with Lauren MacDonald. (Masterclass) Member event.
3rd February 2020. Afternoon - Textile Dyeing with Food Waste with Lauren MacDonald. (Masterclass) Member event.
4th February 2020. Making Circle: Arduino & Knitting (Workshop) Member event.
18th February 2020. Making Circle: Arduino & Knitting (Workshop) Member event.



Research Publications

Yolland, L., Burki, M., Marcotti, S., Luchici, A., Kenny, F. N., Davis, J. R., Serna-Morales, E., Müller, J., Sixt, M., Davidson, A., Wood, W., Schumacher, L. J., Endres, R. G., Miodownik M., & Stramer, B. M. (2019). Persistent and polarized global actin flow is essential for directionality during cell migration. *Nature Cell Biology* 21,1370–1381. DOI: 10.1038/s41556-019-0411-5

Khalilgharibi, N., Fouchard, J., Asadipour, N., Barrientos, R., Duda, M., Bonfanti, A., Yonis, A., Harris, A., Mosaffa, P., Fujita, Y., Kabla, A., Mao, Y., Baum, B., Muñoz, J. J., Miodownik, M. & Charras, G. (2019). Stress relaxation in epithelial monolayers is controlled by the actomyosin cortex. *Nature Physics* 15, 839–847. DOI: 10.1038/s41567-019-0516-6

Wang, K., Kenanidis, E., Miodownik, M., Tsiridis, E., & Moazen, M. (2019). Periprosthetic fracture fixation of the femur following total hip arthroplasty: a review of biomechanical testing – part II. *Clinical Biomechanics*. DOI:10.1016/j.clinbiomech.2018.12.001

Domenech Aparsi, T., Chau, C., Chandler, K., Dobrijevic, D., Hailes, H., Hall, L., Leipold, L., Lettieri, P., Lu, N., Medda, F., Michie, S., Miodownik, M., Partridge, C., Purkiss, D., Ward, J., & Wright, R. (2019). Biodegradable plastics: An assessment of their role in the plastic waste crisis. Report submitted to the UK Government’s Consultation on Standards for biodegradable, compostable and bio-based plastics, on the 14th Oct 2019.

Partridge, C. & Medda, F. (2019). Opportunities for chemical recycling to benefit from waste policy changes in the United Kingdom. *Resources, Conservation & Recycling*, Vol. 3, 3 October 2019. DOI: 10.1016/j.rcrx.2019.100011

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feastjournal.co.uk/issue/sugar/
ISSN: 2397-785X

Morgado Ramirez D. Z., Chadwell A., Sobuh M., Ssekitoleko R., Donovan-Hall M., Holloway C. & Kenney, L. (2019), Digital Tools for A Connected Community of Upper Limb Prosthesis Users in Lower- and Middle-Income Countries. ISPO 17th World Congress: Basics to Bionics, Kobe, Japan 5-8 October 2019.

Morgado Ramirez, D. Z., Chadwell, A., Sobuh, M., Ssekitoleko, R., Donovan-Hall, M., Holloway, C. & Kenney, L. (2019). Real life Use of Upper Limb Prosthetics in Lower- and Middle-Income Countries. ISPO 17th World Congress: Basics to Bionics, Kobe, Japan 5-8 October 2019.

Kenney, L. P. J., Ssekitoleko, R., Chadwell, A. E. A., DonovanHall, M., Morgado Ramirez, D. Z., et. al (2019). Prosthetics services in Uganda – A series of studies to inform the design of a low cost, but fit-for-purpose, body-powered prosthesis. World Health Organization, Global Report on Assistive Technology (GRaAT) Consultation, Geneva, 22-23 August.

Media Coverage

The Kitchen Cabinet, Leeds. (2019). BBC Radio 4, 13th April.

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Social Media Feeds

www.facebook.com/InstituteOfMaking

www.instagram.com/of_making

www.twitter.com/of_making

www.instituteofmaking.tumblr.com



Institute of Making Member Supervisors

Arkadiy Serezhkin

Ben Oldfrey

Ella West

Evangelos Himonides

India Davies

Kevin Green

Louise Oates

Thomas Crossland



Birthday Award Winners

Comunity Award: Isabelle Gin

Creative Contibution Award: Jakub Zalesak

Experimentation Award: Louise Oates

Makespace Ethos Award: Ella West

Most Helpful Staff Member Award: Caralyn Banham

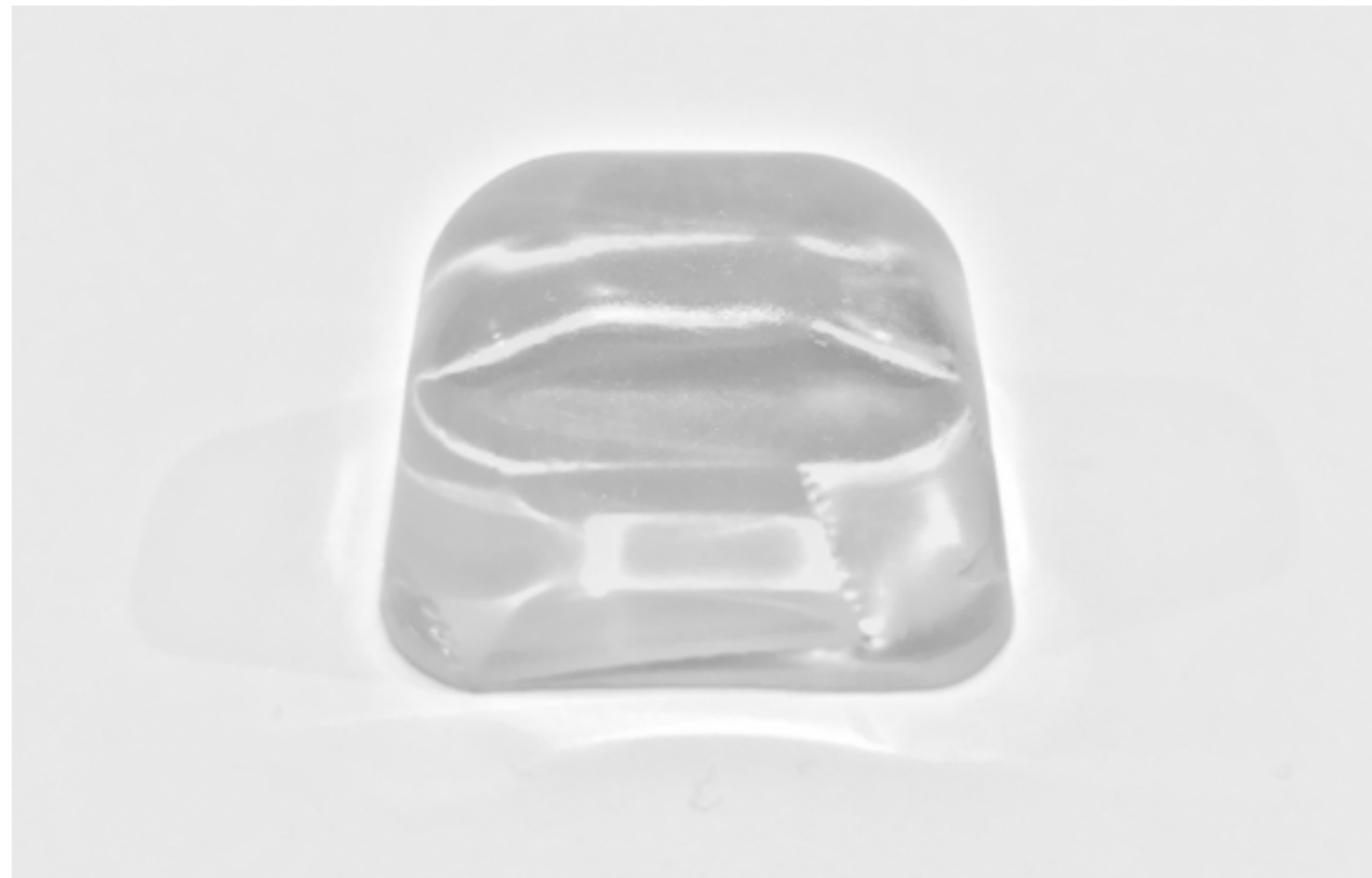
Outstanding Contribution Award: Nick Bradbeer

Perseverance Award: Timothy Ryan

Public Engagement Award: India Davies

Research Through Making Award: Ana Rita Pinho

Spirit of the Makespace Award: Miranda Nixon



The Institute of Making Current Team

Ana Rita Pinho: Research Manager (maternity cover)

Anna Ploszajski – Research Fellow

Beth Munro – Research Manager

Darren Ellis – Makespace Technician

Ellie Doney – PhD Student

George Walker – Makespace Assistant Technician

Mark Miodownik – Director

Martin Conreen – Director

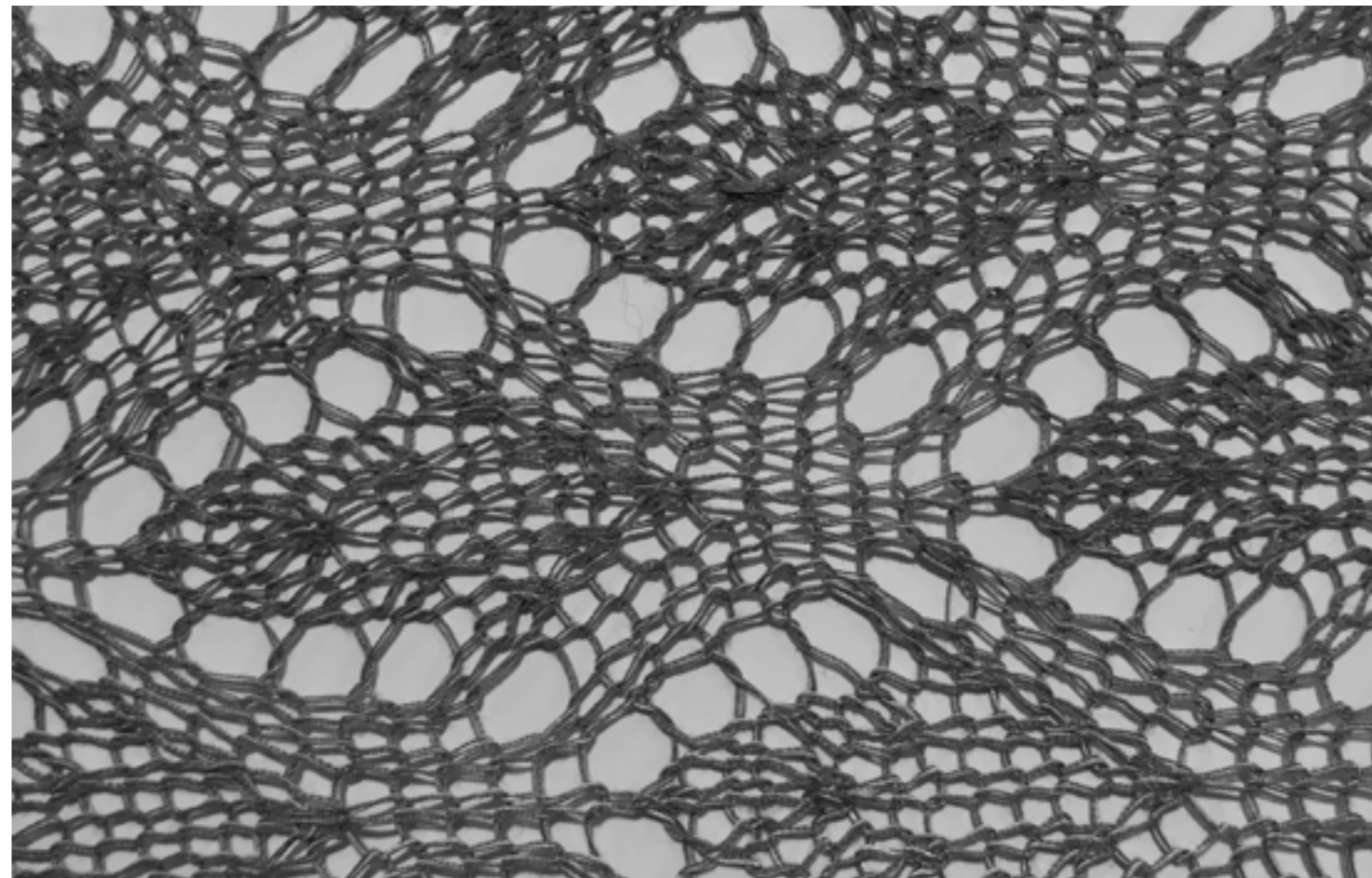
Necole Schmitz – Makespace Manager

Romain Meunier – Makespace Technician & Acting Makespace Manager (maternity cover)

Sara Brouwer – Events Manager

Sarah Wilkes – Materials Librarian & 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

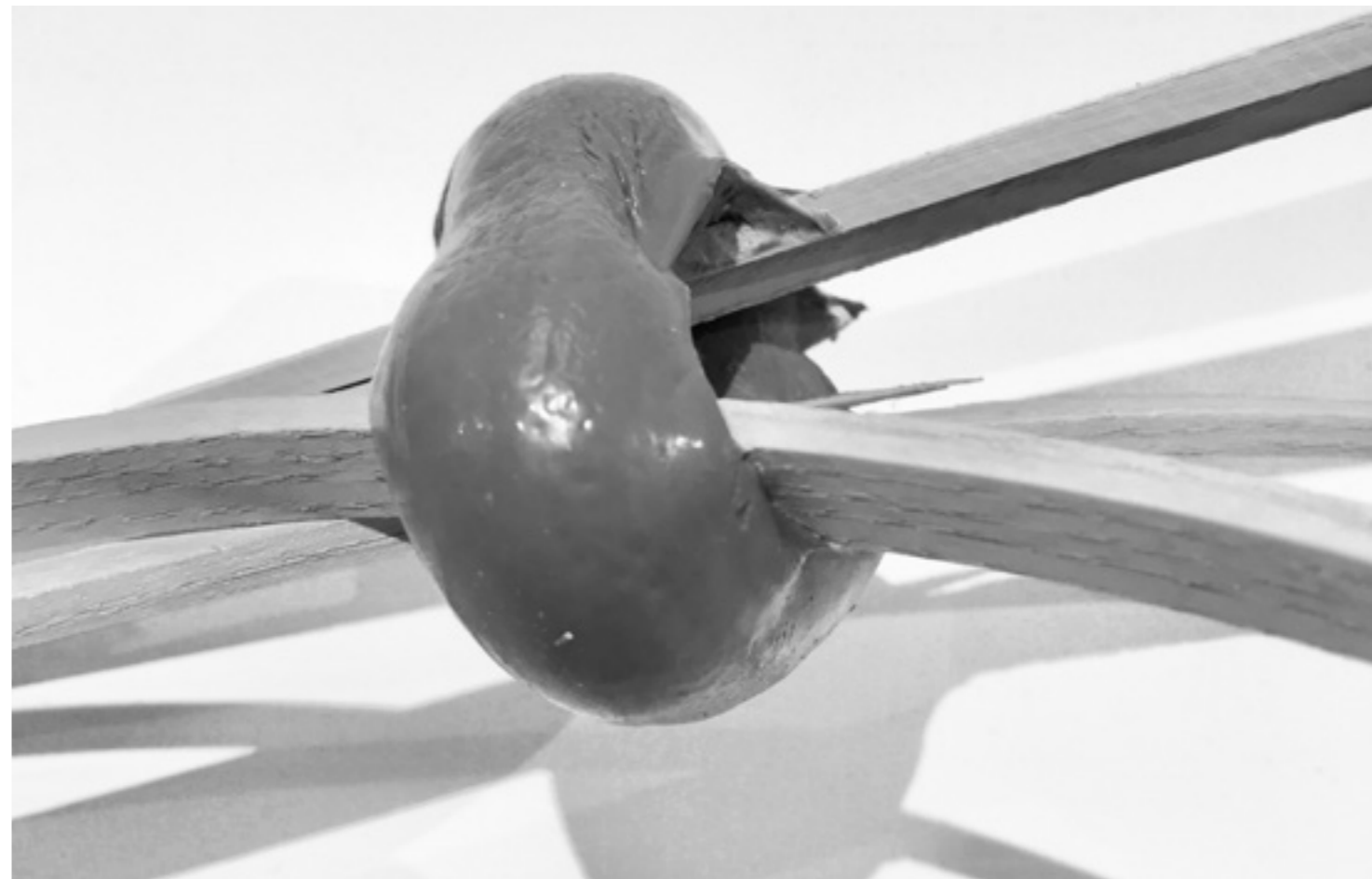
Chris Wise – Expedition Engineering

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

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

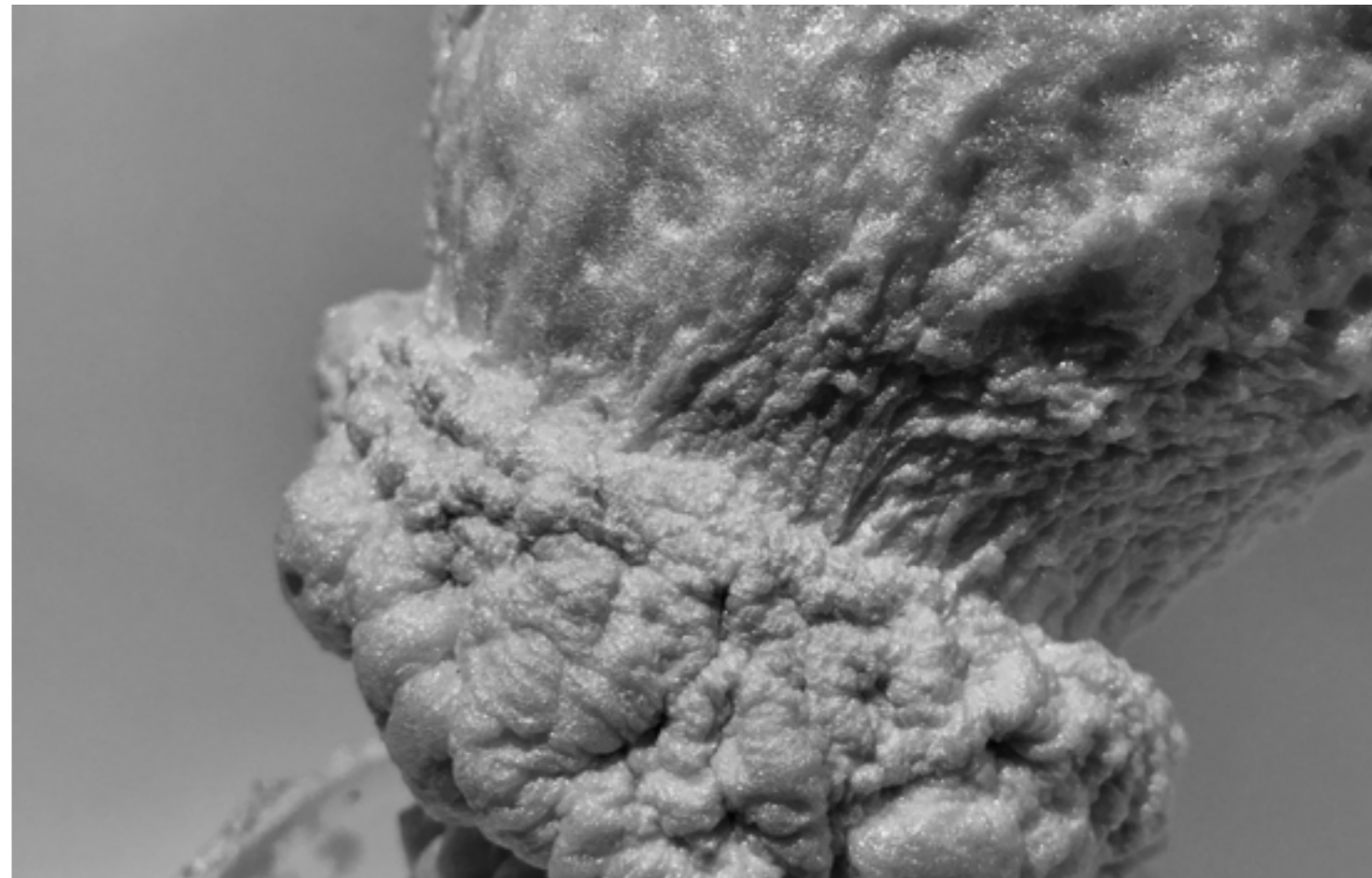
Susan Collins – Director, Slade School of Fine Art, UCL

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



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UCL Innovation & Enterprise
UCL PACE
UKRI
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Puja Bharadia
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Sam Green
Sara Collins
Sarah Mackay
Sarah Richey
Simon Cooke
Simon Werrett
Subhadra Das
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Susanne Kuechler
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Tom Hamer
Tom Kile Hartshorn
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