
Institute
of Making
GOLDEN
OPEN

Eighth Year Report

Institute of Making, UCL 2020-21

Contents

Introductory Remarks

During the first few weeks of the pandemic in the UK, it was clear that engineers, craftspeople, scientists, designers and makers could provide skills and knowledge to the unprecedented challenges of COVID-19. In addition to participating in the UCL-wide effort to tackle the respiratory needs of hospitalised COVID-19 patients in early March, we recognised that our specific expertise in materials and making would be helpful on the issue of Personal Protective Equipment (PPE). Severe global shortages of key items meant that health care professionals all over the world were improvising protection with whatever they could find and those in less frontline medical settings, like care homes, were unable to source even the most basic of protective items.

Our first PPE-related intervention began with a survey of the available DIY PPE options, looking at what solutions were being used in other parts of the world, for example, in places that were further ahead in their experience of the disease. We facilitated and coordinated contact between material suppliers, NHS purchasing teams and distributors who already supplied hospitals. We used our UCL network to contact medical practitioners and sterilisation experts who tested prototypes and provided feedback on what was, and was not, acceptable. This culminated in the secondment of two of our technicians to the Batch.works project in East London, where they helped to establish a small but extremely agile micro-factory producing the Batch Shield to supply the NHS.

Our second PPE-related intervention looked at what might be helpful to those outside of the NHS, with no traditional access to PPE, but who none the less were in need of protection – the home carer, the supermarket worker or delivery driver. Ordinary people needed simple, accessible and well-considered options. Our first intervention is this area was an improvised visor design for a face shield that one of our directors, Zoe Laughlin, put together one evening using the limited resources that she found at home.

The resultant shield (made from paperclips, a document wallet and a headband) proved surprisingly practical, comfortable and easy to clean. After running it past researchers, clinicians, engineers and sterilisation experts at UCL, who all agreed it was a good option for those in immediate need with no official PPE at their disposable, we put the design into the public domain. To date, the freely downloadable how-to-make guide and the how to-make video tutorial have collectively been viewed over 200,000 times.

Our third PPE-related intervention came in the form of an informative guide for anyone wishing to make or wear a face covering. By April, it was clear that face coverings were going to become more commonplace for the general public and there was a need for clear advice on materials selection and design options. Our team set about surveying different designs, making our own versions at home, assessing what skill levels were needed to make different types, and providing feedback on what each option was like to actually use on a daily basis. We then collated our research into a frequently asked questions guide to face coverings and put this in the public domain in early May. It proved extremely useful for the general public, who welcomed our clear, straightforward approach and the wide range of areas covered – from how to stop glasses from steaming up whilst wearing a mask to which materials provide the optimum filtration and why.

Our fourth PPE-related intervention came through our research programme on designing out plastic waste. By May 2010 the whole world was gearing up to require the use of masks of the public as one of primary methods to halt the spread of COVID-19. Clearly, the mass use of billons masks has a detrimental environmental impact. The question for global governments was whether re-usable masks would be as effective as single-use masks in preventing infection, and what were the environmental risks both options. We performed a multidisciplinary analysis and showed that if single-use masks

were adopted for public use in the UK that would create 128,000 tonnes of plastic waste and create ten times more climate change impact than using reusable masks. We published the analysis in the journal UCL Open Environment which had over 6800 views, was widely reported in the media (ITV, Mail Online, Radio 4, Radio Five Live, Channel 5 News, and fed into the formulation of UK government policy to mandate reusable face coverings for the public. We are now working with the NHS and several other universities to create reusable facemask for clinical use in hospitals.

Our fifth PPE-related intervention came as we responded to the need of other countries to develop their own PPE manufacturing capabilities as global supply chains broke down due to surges in demand. This resulted a project called Innovation Action, a collaboration led by the Global Disability Innovation Hub funded by UK Aid. We help local companies pivot their production to PPE and also provide advice and consultancy to make this change long term sustainable and resilient. (www.innovationaction.org)

This is a small part of the work we accomplished through this most unusual year. We continued to produce extraordinary (online) Events; our work developing the digital access to our Materials Library continued apace and was accessed by researchers, students and the public from all over the world; our Workshops were closed but we still served our UCL community through online consultations and operating a bureau service; our Research programmes continued operating from home with significant new projects such as Innovation Action, Compostable Plastics, and Ever After. There is lots to look forward to, but above all, we are looking forward to getting back into the workshop!

Mark Miodownik, Zoe Laughlin, Martin Conreen
& the Institute of Making team

The Overview

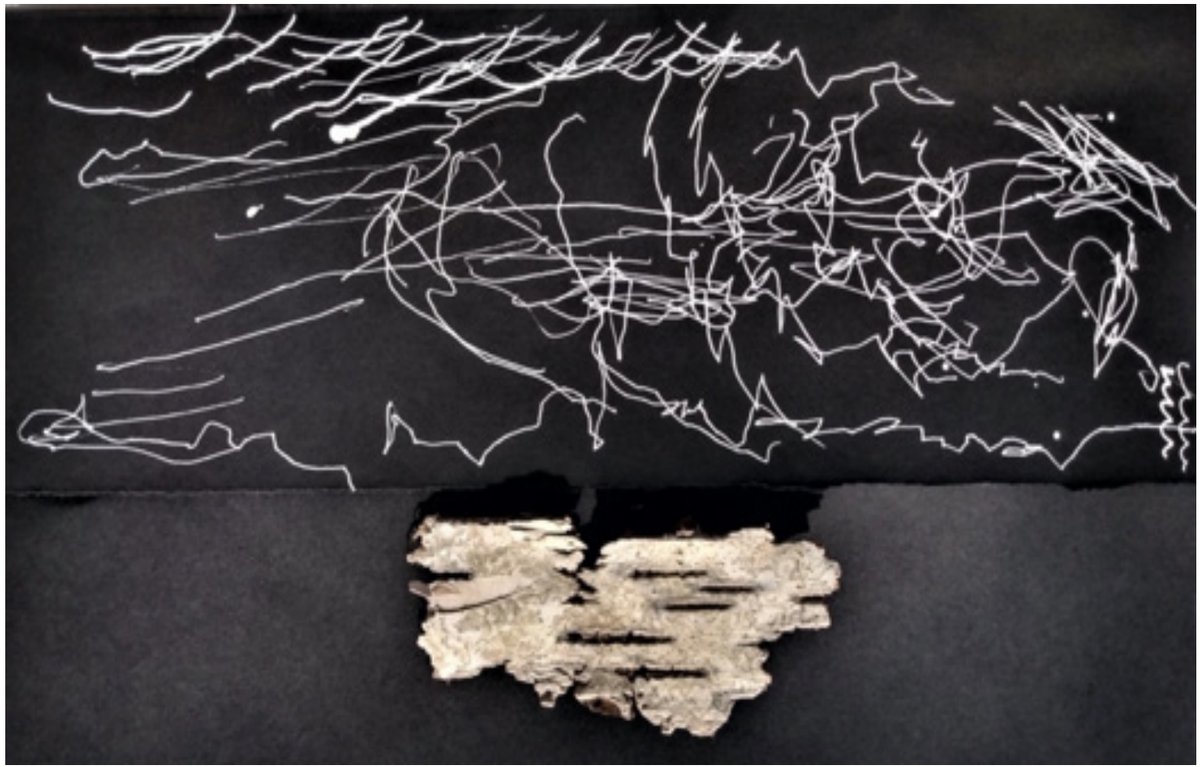
Why we do what we do...

"I just wanted to say a huge thank you for this afternoons' session, it was such a lovely way to end carers week. You pulled together an incredible panel of guests, I know that is not easy to do, they were all so engaging and inspiring and the students were very engaged."

Layla Conway, Senior Communities and Business Manager, Queen Elizabeth Olympic Park

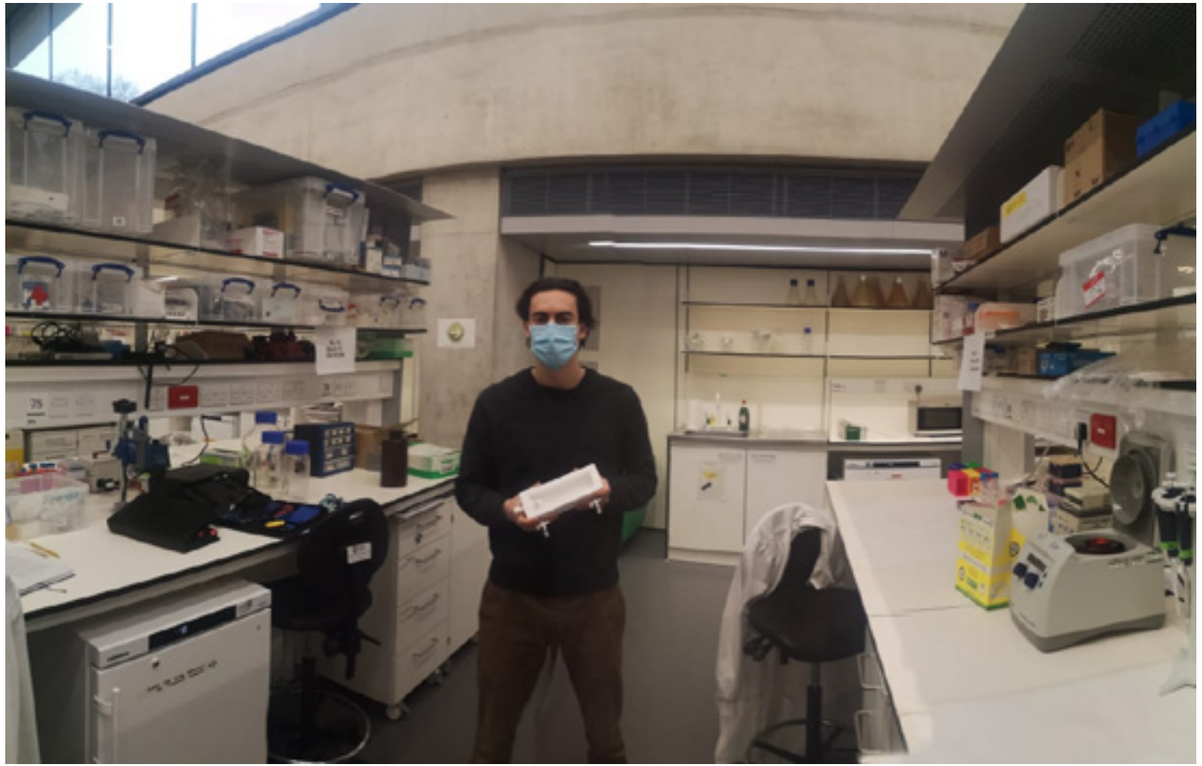
We are a very unusual research club...

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 14,007 registered members of whom 2787 are inducted and 299 joined and were able to access out online programmes during lockdown. Amongst them 31% are staff, 66% are students, and 3 % not specified. A further breakdown of the member demographic is as follows: female (46%), male (50%), genderqueer/ non-binary/prefer not to disclose (4%); 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...

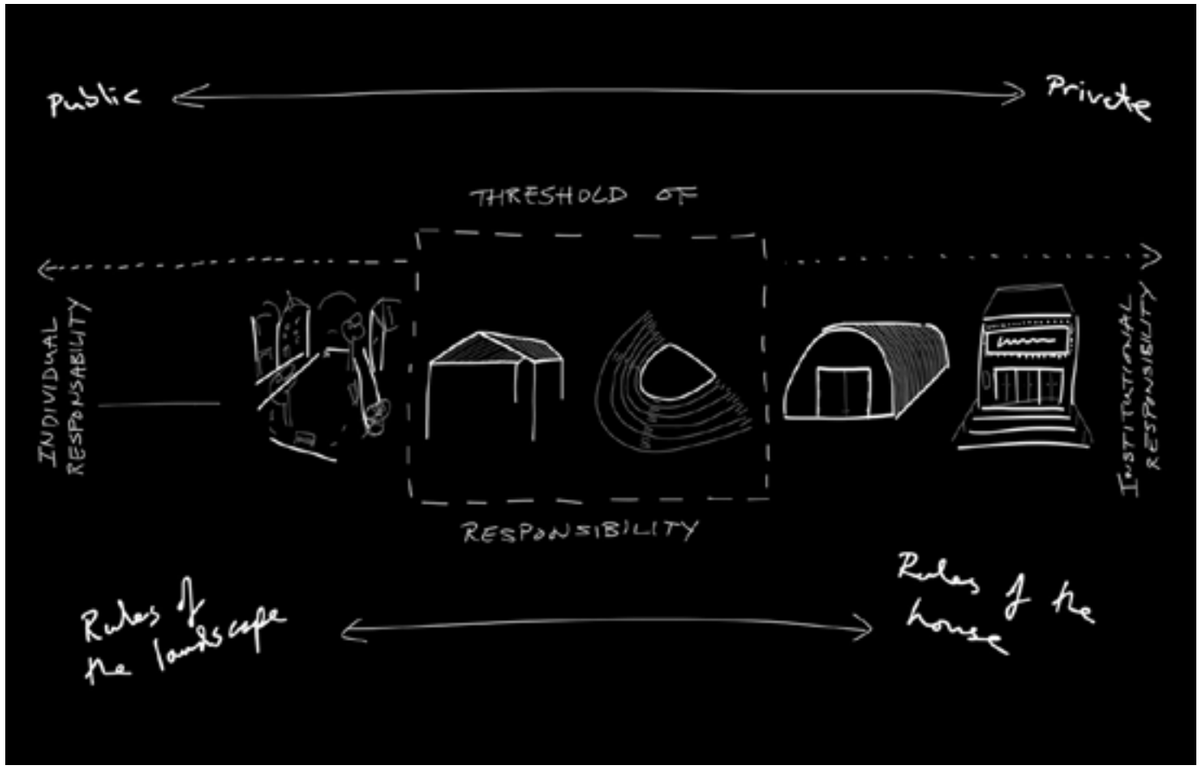
A typical snapshot of activity at the Institute (due to the impact of the COVID pandemic) is as follows: a Cell Biology student walks past our closed MakeSpace and wonders what we do, checks us out on the website and becomes a member; a Computer Scientist prototypes a new digital device from home with online help from our technicians; an online drawing event is attended by students and staff from all over UCL; we live-cast a masterclass from the Materials Library; a research workshop held on the topic of Compostable Plastics is attended by 300 participants; we develop a research project to help the NHS test new re-usable PPE; a Geography PhD student uses our bureau service to get a prototype laser cut; we hold an online workshop on The Art and Science of Face Filters for underrepresented young people.

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 were also successful in securing external funding for four new projects.

To continue our work on plastic waste, we were awarded funding for Compostable Plastics: Unlocking Existing Barriers to Systems Change (NERC, NE/V010735/1, £1,167,770), and to continue work on healthcare manufacturing, we were awarded funding for the 'Materials and manufacturing in healthcare' Innovation Network (UCL's UKRI IAA Knowledge Exchange and Innovation Fund, EP/R511638/1, £29,975).

We have also been awarded new funding as partners in the UKRI Circular Economy Centre – Circular Metals, led by Professor Fan Zhongyun, Brunel University London (EPSRC EP/V011804/1, £1,049,960), and as partners in Ever After (National Theatre of Wales).



Our events get fully booked in seconds...

Our events programme pivoted during the pandemic to be online-only. Our aim was still to inspire the public with regard to all things materials but also to connect and support our making communities while they were isolated. These new online sessions included regular weekly community making groups, large- scale public making masterclasses, specialist technician consultations and popular skill- training workshops.
From March 2020 to March 2021, the team have run 208 online events, worked with 1727 event participants. In a highlight of the year, the team put on a two-day online festival revisiting some of our favourite masterclasses and workshops of the lockdown period and provided large-scale public access for events that were usually restricted to our members.

We have a wondrous collection of stuff...

The Materials Library is a collection of some of the most wondrous materials on earth, gathered from sheds, labs, grottoes and repositories around the world. During the pandemic we used this opportunity to broaden the geographical reach and accessibility of the collection by expanding our digital catalogue, online events and social media outputs. This included a new interactive blog series, developed during the first lockdown, that used stories of the expansive inner lives of humble everyday materials as a way to free us from the confines of our homes. This popular series was read by over 10,000 people from all over the world, with over 17,000 social media interactions with the series as a whole. It also inspired some wonderful responses from our community in the form of their own photos and stories of much-loved domestic material companions.

We have a public profile...

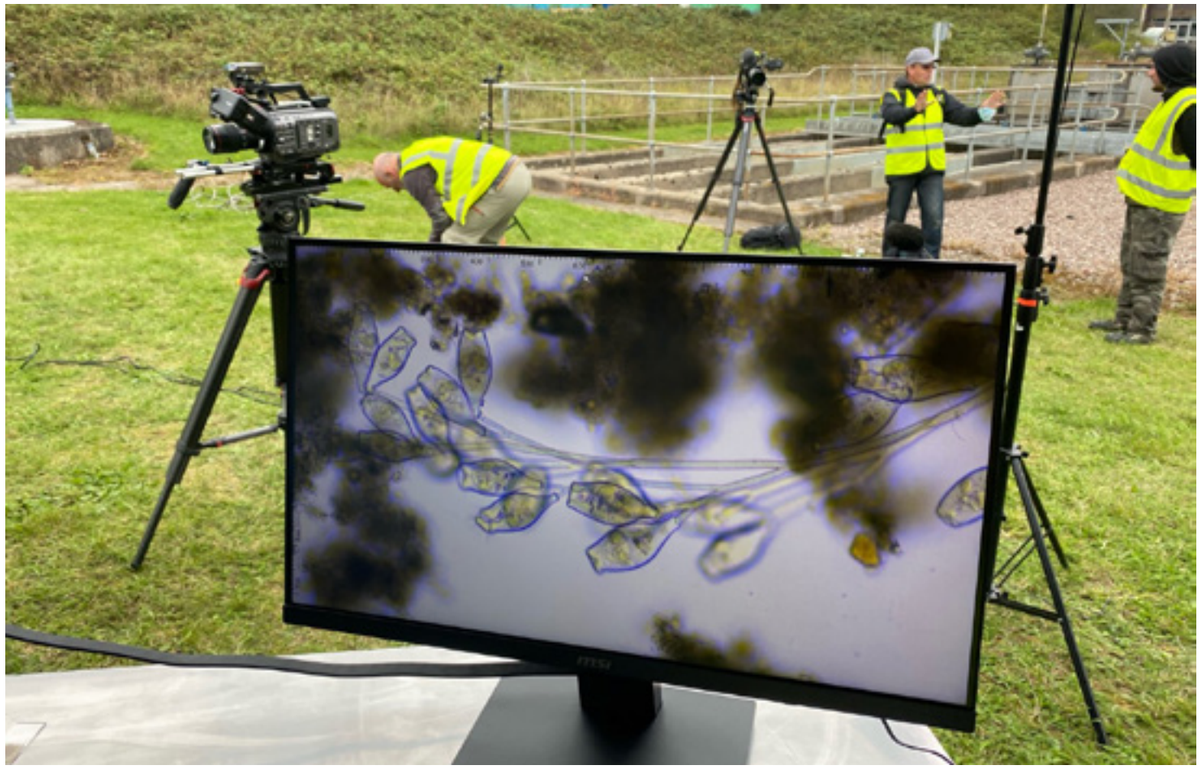
The Institute of Making and its team have gained a public profile as champions of making and materials, promoting them through TV, radio programmes, newspapers, and online festivals (eg. BBC Four, BBC Radio 4, ITV, The Times, The Guardian, Cheltenham Science Festival, Sligo Science Festival, ect..). We are active on social media (Twitter, Facebook, Instagram).

We are international...

The Institute of Making has an international reputation; during the pandemic we have given invited zoom talks all around the world from Nigeria to Switzerland on our interdisciplinary materials research and our other activities. We have active research links with the Global Disability Hub, Government of Kenya, UK Aid, University of Jordan, Makerere University, Ellen MacArthur Foundation.

We interact with policy makers and industry...

Our profile has enabled us to influence funders (eg. EPSRC, UKRI), policy makers (eg. DFID, DERA, BEIS) and national academies (Royal Academy of Engineering and the Royal Society), attract industrial collaborators (eg. Vegware, VEOLIA, Mace, P&G, and others), and work with charities and third sector organisations (eg. LLDC, WRAP) to increase our impact.



Member Stories

In a year that was full of challenges for students, staff and faculty at UCL, our members found innovative ways of working on their making projects during the pandemic. Back gardens, garages, bedrooms and kitchen tables became workshops, enabling many members to continue with their making journeys throughout the year. To help with their projects, members emailed us for advice on home-based techniques and materials. Because in-person contact was very limited, and our usual hands-on approach to teaching and technical help wasn't possible due to social distancing, we found new ways of connecting with our members and saw a different version of our Makespace community form across the geographical divide.

Technicians brainstormed how activities could continue using minimal tools and they shifted to focus on using materials that were to hand. We highlighted safety concerns and best practices for members having a go themselves from their lockdown spaces.

In this section we tell the stories of some of our members and their projects, both personal and academic research activities. Despite the difficulties, our members continued to use their ingenuity and creativity to collaborate across disciplines, forging the types of partnerships that are unique to the Institute of Making community. Frederik fashioned a high-tech table from a neighbours' felled tree, Zoe screen printed her infamous squirrels, Roberto learned new skills in CNC to prototype a bioreactor and Wen worked on her interactive notebook. We are so proud of our members for their perseverance and delighted we have been able to continue to work with members remotely.

Frederik Sarathchandra
Cell & Development Biology PhD student, LIDo Program

Frederik discovered the Institute of Making when walking past during one of our open days. The Materials Library and workshop caught his eye, and with his background in mechanical engineering, he was keen to sign up. He knew this was the place for him after completing the New Members' Induction. Before the pandemic, Frederick used the Makespace for building 'stuff', such as experimental devices and equipment for his project work in Cell Biology. During the pandemic closure, Frederik used the online Technician consultations to support and further his making from home. He has also taken advantage of our making service.

Frederik has designed a rig to measure the sounds of mosquitos. The rig can differentiate between species to potentially identify those that could be carrying diseases such as Malaria. After a technical consultation, he sent in detailed CAD drawings to be cut out using the laser cutter. Romain, one of our Technicians, completed the cutting for Frederik's project while working in a COVID-safe manner in the Makespace.

In addition to working on his academic research, because of the pandemic, Frederik found more time at home for personal making projects. This kept him active and creative despite lockdown limitations. Frederik once again called on the Makespace Technicians for advice about his projects. He was inspired to make a small side table for his mother from a section of tree trunk that was felled in a neighbour's garden. Frederik spoke with the Technicians about the best way to recut the rough, jagged edges made by the tree surgeon's chainsaw without the use of workshop machinery. Our Technicians also advised him on sanding and finishing techniques that would highlight the grain and seal the wood with layers of wax to create a durable, smooth

surface. He then integrated a lamp and wireless phone charger into the table and added a control panel to adjust the brightness and warmth of the light. These components were contained in a box that he made from bending and shaping aluminium to conceal the wiring.

Eager to document his projects, Frederik attended the Institute of Making's photography workshop hosted online. Through this masterclass, Frederik learned how to better work with his SLR camera. He used natural light at different times of the day and experimented with the aperture and shutter speed to focus on particular areas of the table in each image that he captured.

Frederik found that despite the challenges presented by COVID-19, being able to speak with a number of technicians with different skill sets provided him with very helpful hints, tips and advice on making. This allowed him to continue working from home in the garage that's now been repurposed as a workshop.

"If it wasn't for that open door, I would have never found out about the Institute of Making and it's been so helpful"

Nyima Murry
BA Architecture & Interdisciplinary Studies

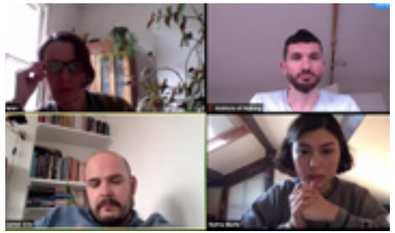
During her first year Nyima began using the Makespace after hearing about our equipment and friendly atmosphere through friends at UCL. During her third year Nyima's project work focused on ceramics and she began to spend more time in the Makespace. At this time she also attended her first Masterclass, taking part in a session about natural dyes and fermentation. This aligned with her explorations of sustainable making as part of her architectural practice.

With her academic work proving to be very conceptual, she found working with ceramics grounding. Nyima developed the long-term goal idea of bringing the two areas – conceptual and practical – together to create fermentation ceramics. At the Institute of Making, she learned the basics of working with clay, throwing on the wheel and glazing with advice from our technicians.

As the country entered its first lockdown, Nyima headed out of London to her family home. Despite the postponement of her final show, she realised that she still needed to continue with her work even without access to a workshop. Nyima looked for a way to fire her ceramic work without a kiln. She identified pit-firing as the only accessible way to fire the clay pieces. After struggling with the loss rates during her pit firings, Nyima became our first online consultation.

The technicians helped Nyima understand the firing process, the materials that needed to be used, as well as safety precautions. Nyima found that the new circumstances and restrictions really pushed the project to become much better than she first imagined. Having to see her ceramics go through the entire process from making to firing gave her new knowledge of materials and their uses.

"There were quite a lot of pointers – quite small but really crucial tips – that I got from that consultation that helped me have some successful pit firings. [To actually have] successful firings was really nice."



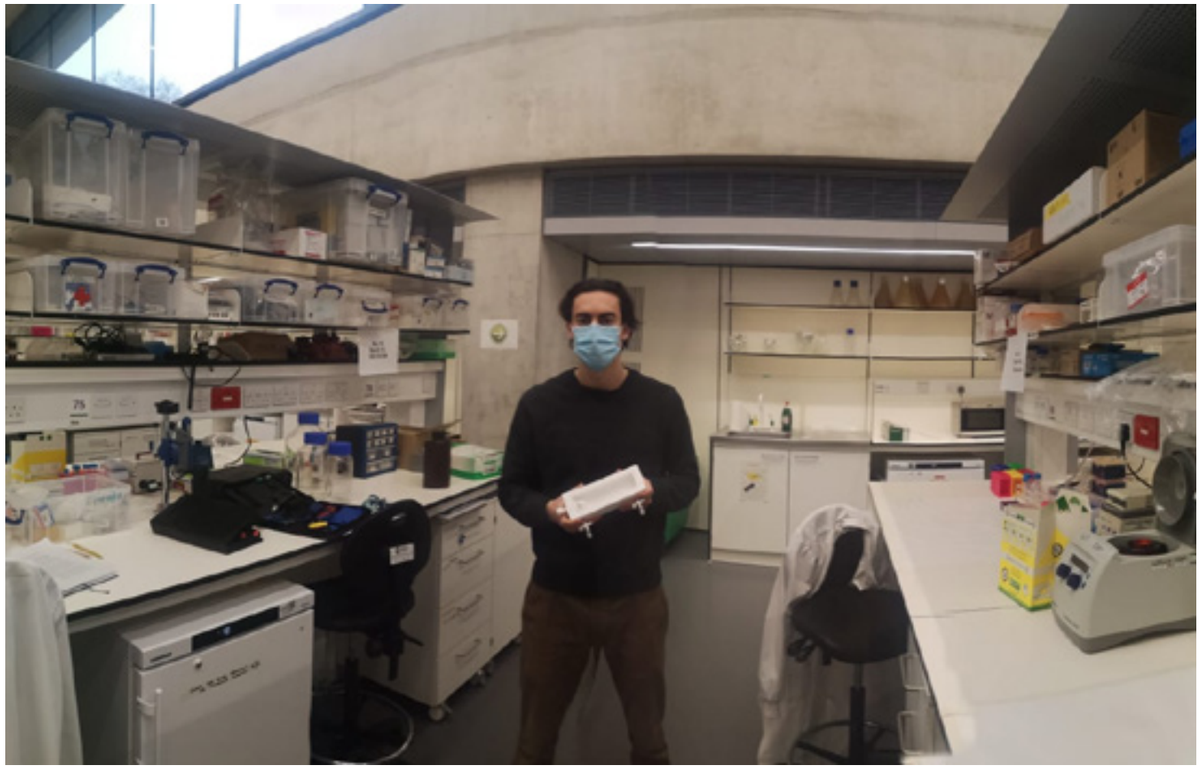
Roberto Lutman
Biomedical Engineering Master's student at the Polytechnic University of Milan

Roberto came to UCL last year as a visiting student to work on a project at the Zayed Centre for Research into Rare Disease in Children (ZCR) and write up his Master's thesis. He heard about the Institute of Making through his colleague, Giulia, who also used the Makespace for her research. Because working with different materials and equipment in his departmental lab was not possible, Giulia recommended he try the Institute of Making to develop his prototype.

Roberto is working with a group that is trying to grow an oesophagus, or part of it, using a pig's oesophagus and patients' cells. Their project is part of the Developmental Biology of Birth Defects section who employ genetic techniques together with cellular, molecular and developmental biology to elucidate mechanisms of morphogenesis and how these are disrupted in human birth defects, including childhood tumours. Their technique consists of decellularising a pig oesophagus to take away all the biological material (cells, DNA, etc.) to create a biologically inert scaffold. It is then repopulated with a patient's cells. During these processes, the oesophagus is held in a bioreactor with two connectors. Its chamber is filled with a solution including nutrients to help the cells grow. Roberto's work has been focused on creating this bioreactor.

Due to the pandemic, Roberto has never been able to come into the Makespace in-person but he has been able to access help through the online Technician consultations and making service, which was in operation between the COVID-19 lockdowns.

Through discussions with our Technicians, Roberto realised that different processes would be needed to machine the different components of his prototype. The Teflon chamber and



polypropylene lid would have to be milled with a CNC milling machine while other intricate parts would have to be 3D printed. Roberto had previous experience with 3D printers and he further developed his skill with our Technician George. George was able to give him feedback and advise him on best practices for using supports. Roberto didn't know anything about CNC, but with the guidance of our Technician Romain, he has begun to learn how a CNC works, what materials he can machine and how to create toolpaths. One of the most difficult aspects of using a CNC is creating toolpaths. Roberto was able to develop this skill in a few weeks on his own with the Makespace Technicians online tutoring. Once the toolpaths and 3D print files were ready, the Technicians machined and printed all the components and Roberto was able to quickly test his prototype.

For Roberto, having access to the online Makespace consultations and the making service was fundamental to his project. Thanks to the consultations, Roberto was able to continue to work efficiently during the pandemic. Roberto wants to improve his project and his next step is to learn about laser cutting.

"Without the Institute of Making I would still be at the beginning of my project. (…) If I had to use external providers to create my model, I would not have been able to experiment as I did with the Institute of Making because of the time, cost and lack of advice. Even though I would have preferred to spend my time in the Makespace, I really appreciate our friendly conversations and the fact that I could quickly contact you via MS Teams anytime I had a doubt".

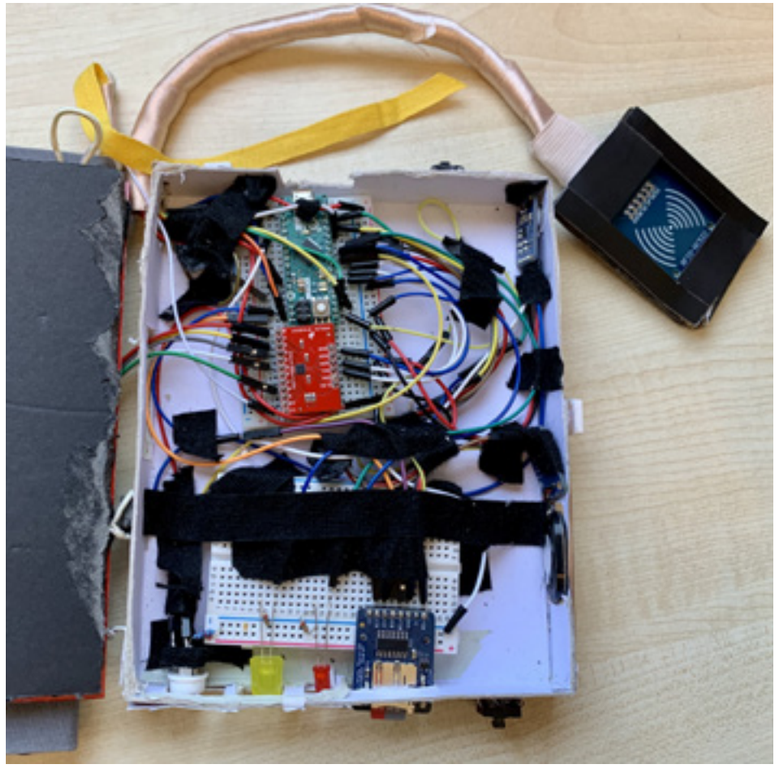
Wen Ho
Human-Computer Interaction MSc Student

Wen first heard about the Institute of Making from her course tutors who recommended that she register and complete a New Member Induction.

This year, Wen needed some help with one of her MSc projects: an interactive notebook. After she read about the online consultations through the Institute of Making newsletter, she decided to contact the Makespace Technician team for advice. She booked a consultation with George and Romain to discuss how to create a sketchbook that could record lectures corresponding to her sketches. Wen had a lot of ideas and her project was a bit complicated. Being able to speak with our Technicians helped her not only develop her technical skills but also develop and simplify her concept. She realised she just needed a proof-of-concept and that her basic knowledge of Arduino with some advice would be enough.

After her first consultation, Wen continued to chat with George and Romain on a regular basis for more than a month. She learned how to identify the different electronic parts needed for her project: the right Arduino board, capacitive sensors, an MP3 shield, speaker and memory card. She also learned how to manipulate Arduino by working on a separate simple circuit before merging multiple together.

"Researching solutions online can be very overwhelming sometimes because of the amount of information but knowing that I would be able to discuss my doubts and problems with George and Romain calmed me down when I was stressed. It inspired me, helped me to keep a cool head in front of a problem and taught me how to work better on my own. I can't imagine finishing my project without the consultations!".



Zoe Andrews
BASc Arts and Sciences student

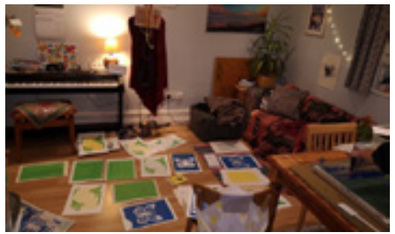
Zoe first got involved at the Institute of Making as a volunteer on our Gases Open Day in 2019. Since being inducted, she has experimented with the sewing machine and attempted to repair some of her clothes, and after the 2-hour induction run by our member supervisor, Ella, Zoe was hooked on screen printing. *"I wouldn't have thought of using paper-cut stencils; however, they are brilliant for experimentation and detailed pieces alike."*

Zoe's printing work features squirrels. Her affection for the critters started when they repeatedly broke into her house, smashing a wine glass, ripping open a bag of pasta, and attempting to steal an apple! What began as a joking response has now developed into a series: *"the printed squirrels squeak the things I cannot say!"*

During the pandemic, Zoe contacted us to borrow our screen-printing kit. How could we refuse?! She was not only able to create her squirrel-esque Christmas card, but also made a poster for an upcoming radio drama and some visuals for a volunteering scheme.

For Zoe, the best thing about the Institute of Making is the people. One of the most special moments at the Makespace was a chance encounter, with a frazzled member at the end of the day. He pulled out a sewing machine, some fluffy brown fabric and a cycling helmet, muttering: "I'm never gonna get it done in time". Zoe ended up helping him create a giant mammoth headdress for his stag-do.

"I've made so many friends there and I love the enthusiasm of the team. We are all missing it because at the Makespace, you feel that you are really a part of something. All you need is an apron!"



Research Programme

Multidisciplinary research defines our approach at the Institute of Making. In 2020-21, our researchers successfully responded to new ways of working and continued to make exciting progress on our on-going projects. Our research community also contributed their expertise to the design, manufacture and knowledge dissemination of protective gear during the COVID-19 pandemic.

In April 2020, we co-launched Innovation Action, together with the Global Disability Innovation (GDI) Hub and UCL Engineering. The Innovation Action web-platform brings people together to tackle global challenges, initially building a technology and innovation pipeline to support COVIDaction led by the Frontier Technologies Hub.

This year we were also successful in securing external funding for four new projects. To continue our work on plastic waste, we were awarded funding for Compostable Plastics: Unlocking Existing Barriers to Systems Change (NERC, NE/V010735/1, £1,167,770), and to continue work on healthcare manufacturing, we were awarded funding for the 'Materials and manufacturing in healthcare' Innovation Network (UCL's UKRI IAA Knowledge Exchange and Innovation Fund, EP/R511638/1, £29,975).

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These awards add to our on-going funded research projects: Making Spaces (Lloyds Register Foundation, £688,467.51); AT2030 – Spark: Innovation (DfID AT2030, £10,000,000), in collaboration with the GDI Hub, co-led by Dr Catherine Holloway; Fit-for-purpose, affordable body-powered prostheses, led by Professor Laurence Kenney, University of Salford (EP/R013985/1, £1,390,144); Self-Healing Cities with the University of Leeds, University of Birmingham and University of Southampton (EPSRC EP/N010523/1, £5,247,017); Centre for Nature Inspired Engineering (EPSRC EP/K038656/1, £4,980,773) led by Professor Marc-Olivier Coppens; The Institute of Making is also a partner in Ellie Doney's UCL 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 Designing-out Plastic Waste (EPSRC EP/S024883/1, £1,248,910) and the development of a 4D-printing manufacturing platform (EPSRC EP/N509577/1, £114,318.64).

Our Research Manager, Dr Beth Munro, oversees our research programme. As 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. Beth is also contributing her research expertise to our CircularMetals project.

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.

COVIDaction - Local Production and Local Solutions (LPLS) UK Foreign, Commonwealth and Development Office

COVIDaction LPLS is crowdsourcing and mapping innovative responses to the demand for personal protective equipment (PPE) and other unavailable goods. Since April 2020, the initiative has launched a series of open calls to discover how organisations and grassroots innovators across Africa and South Asia have pivoted in local production and novel approaches to meet community needs. The programme provides identified social entrepreneurs financial and technical assistance to scale their impact.

The LPLS theme addresses supply-chain issues that have arisen during COVID-19. LPLS, while currently focused on COVID-19-related products, prioritises making local production systems more resilient. Global logistics have been compromised by lockdowns and border controls across Africa and other low to middle-income countries (LMICs), leaving many businesses and citizens without key parts of their supply chain. This condition has exposed the rigid state of production in many settings, and the need for locally resilient, flexible production ecosystems. Lead by Dr Ben Oldfrey, LPLS is works to develop broader, restorative, and agile supply systems, while providing people with the life-saving health and community resources they need to face current restrictions.

Since establishing our call, we have received 500+ submissions, across 40+ countries. LPLS has awarded grant funding and is providing business development support to 10 organisations. One of these includes to Global Auto Systems in Uganda, who are using 3D printing technology and other manufacturing processes to produce reusable vacuum moulded face masks and building platforms to enhance local education on PPE creation and health awareness.

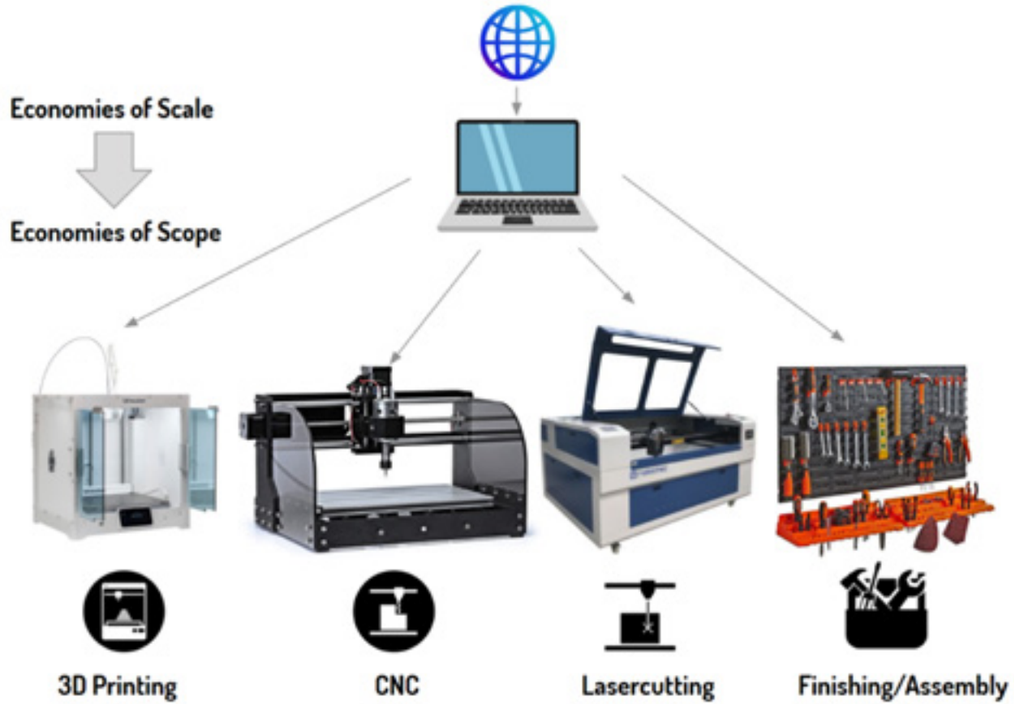
COVIDaction is funded by the UK Foreign, Commonwealth, and Development Office (FCDO) and is a partnership between the UK Foreign, Commonwealth, and Development Office's Frontier Technology Hub, Global Disability Innovation Hub (GDI Hub), UCL Institute of Healthcare Engineering, and UCL Institute of Making along with other collaborators.
www.innovationaction.org/lpls/

Innovation Action
UK Aid

Innovation Action helps to bring people together to innovate on global challenges.
We provide a space for open-source designs to be shared and collaborated on by people all over the world.
This platform was launched by a consortium of partners brought together by innovation catalyst Global Disability Innovation (GDI) Hub and led by UCL Engineering. After the COVID-19 pandemic, the website will be an innovation exchange addressing global challenges such as Assistive Technology – using the principles of open-source innovation to positively impact the lives of millions of people around the world who are living with disabilities.

Building on its research-led expertise and the Frontier Technologies Hub #COVIDaction response, GDI Hub has joined forces with the UCL Institute of Making, UCL Institute of Healthcare Engineering and UK Aid's Frontier Technologies Hub to establish a dynamic, multidisciplinary team – bringing together unique skills across design, engineering, healthcare, product development, innovation and technology.

The website was launched in April 2020 with design specifications for several UCL-approved innovations, chosen with the support of multidisciplinary expertise across the university. They included a Continuous Positive Airway Pressure (CPAP) that supports patients who have breathing difficulties, and a DIY face shield that can be made using resources that might be found in a home or office, for use by those in immediate need who have no other alternative i.e. no approved PPE at their disposal.
www.innovationaction.org



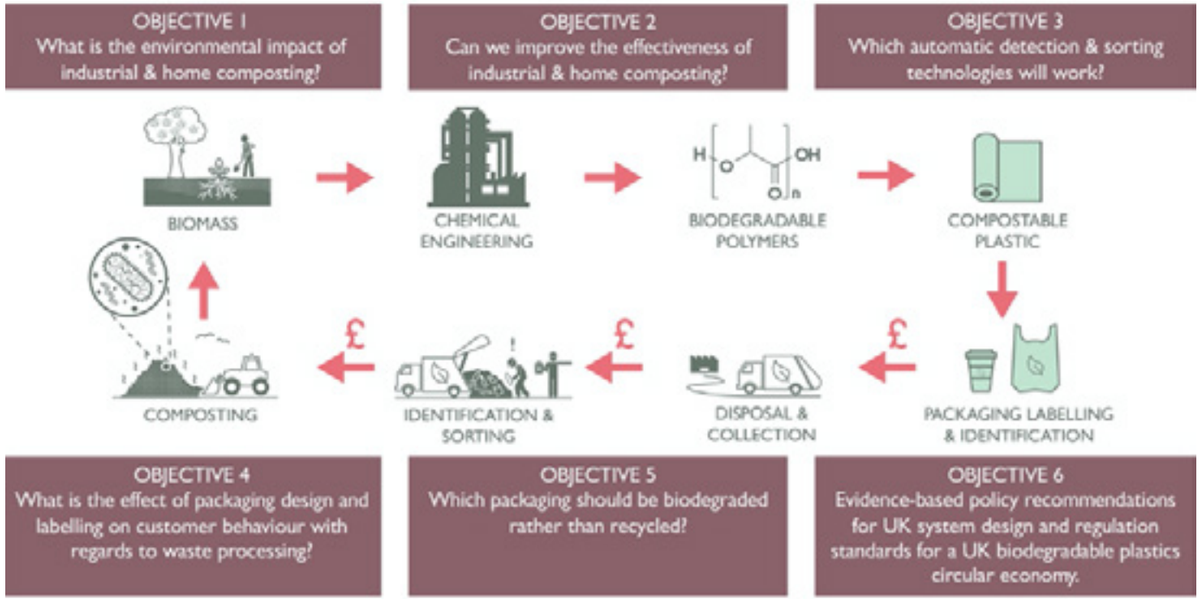
Digital fabrication facilitates the sharing of designs and expertise from anywhere in the world, to be made locally using computer controlled machinery

Compostable Plastics: Unlocking Existing Barriers to Systems Change. NERC NE/V010735/1 (£1,167,770)

In 2018, the UK Plastics Pact set a target to make all plastic packaging 100% recyclable, reusable, or compostable, and to eliminate all unnecessary single-use packaging by 2025.

This declaration has resulted in a significant growth of the compostable plastics packaging sector. New companies are offering a vast range of products that are intended to replace single-use plastic packaging in products that are not suited to recycling due to contamination such as nappies, wipes, and take-away food packaging and ready-meal trays. Our own citizen science research showed a strong consumer demand too: 84% of UK households taking part reported that they are more likely to choose products that are marked as "biodegradable" or "compostable". Plastics Europe estimate the global market for biodegradable plastics, which was 1.2 million tonnes in 2018, is set to grow by 60% by 2023. However, compostable plastics need to be disposed of properly if they are to deliver on their environmental promise and in the UK there is currently no system for collection, sorting or processing of compostable plastics. Through a series of industry meetings and site visits with our industrial partners we undertook a preliminary systems analysis of compostable packaging.

Led by Professor Mark Miodownik, with Professor Helen Hailes (UCL Chemistry), Professor John Ward (UCL Biochemical Engineering) and Jenny Bird (Public Policy Manager for UCL STEaPP), and funded by UK Research and Innovation (UKRI) and the Natural Environment Research Council (NERC), this 3-year project follows on from Designing-Out Plastic Waste and continues the work of the Plastic Waste Innovation Hub that we founded in 2019. *www.instituteofmaking.org.uk/research/compostable-plastics*



‘Materials and manufacturing in healthcare’ Innovation Network EPSRC EP/R511638/1 (£29,975)

The ‘Materials & Manufacturing in Healthcare’ Innovation Network is a multidisciplinary network to foster new collaborations and tackle patient needs. A safe space for co-creation between scientists, engineers, clinicians, industry and policy makers is vital but absent from most hospitals across London and the UK. This network aims to deliver on society’s challenges by creating the opportunity to work around unmet clinical needs and create pathways to fast-track innovation. The goal is to achieve greater impact for the research in the sector and therefore better health outcomes in the UK by bringing together academics, industry and clinicians.

UCL is one of the world-leaders in fundamental medical research. Engineers, clinicians, scientists and policy makers are all trained in different ways. Despite that, all have a crucial role to play when it comes to solving medical challenges. By not coordinating at an early stage, crucial opportunities are sometimes lost and there are too often delays in the translation of therapies and devices from the bench to the bedside. This project aims to change that in the sector of materials & healthcare.
Led by our former interim Research Manager, Dr Ana Rita Pinho, this project results from a joint effort of the UCL Institute of Making and the Institute of Healthcare Engineering.

UKRI Circular Economy Centre – Circular Metals EPSRC EP/V011804/1 (£1,049,960)

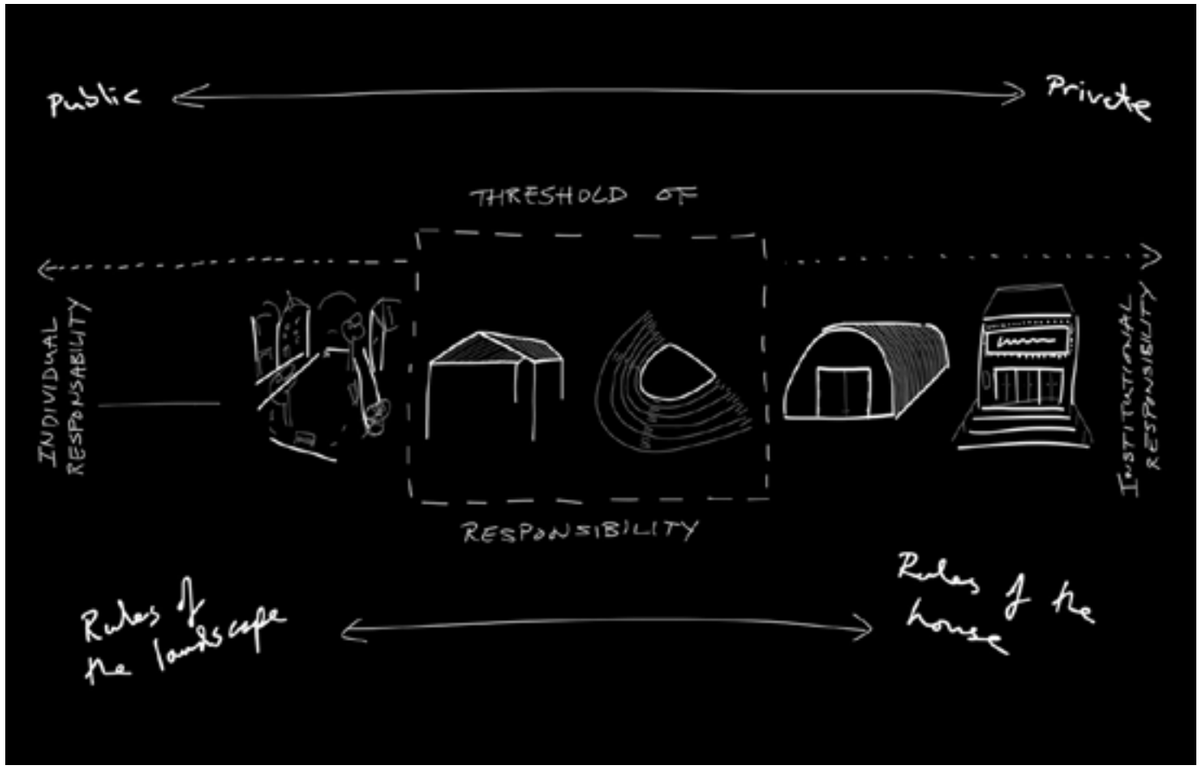
Metallic materials are the backbone of manufacturing and the fuel for economic growth. The UK metals industry comprises 11,100 companies, employs 230,000 people, directly contributes £10.7bn to the UK GDP, and indirectly supports a further 750,000 employees and underpins some £200bn of UK GDP. As a foundation industry, it underpins the competitive position of every industrial sector, including aerospace, automotive, construction, electronics, defence and general engineering.

Transformation of the metals industry from the current largely linear economy to a circular economy plays a critical role in delivering the government's industrial strategy for clean growth, doubling of resource productivity and reaching net zero carbon emissions in 2050. This UKRI Circular Economy Centre (CE) brings together a truly interdisciplinary academic team with a wide range of expertise and a strong industrial consortium involving the full metals supply chain. As an integral part of the national CE community, our ambition is to make the UK the first country in the world to realise full metal circulation by 2050.

Led by Professor Fan Zhongyun at Brunel University London, the Centre includes participation from academics at UCL and the University of Warwick. The Institute of Making is leading research on the interaction between society and metals. Contemporary UK society struggles to use materials efficiently and sustainably, and in particular, since the mid-20th century we have seen a dramatic decline in the repair and recycling of household objects. Our Research Manager, Dr Beth Munro, has been conducting initial research for this project, focusing on consumers and issues of social equity in practices of repair in the circular economy. In the next phase of research, we will collect and analyse public behaviours to repair of household goods containing stocks of steel and aluminium using a citizen science approach, and work closely with manufacturers to explore modularity in appliance design for ease of repair.

Ever After
National Theatre of Wales

Conceived at the dawn of lockdown, the project is directly situated in the changing landscape of social distancing, spatial reconfigurations and new modes of communication. Bringing together academics and practitioners from the National Theatre Wales, Aberystwyth University and UCL's Institute of Making, Ever After envisions futures for live performance: for theatre-making and theatregoing. This is a conceptual and design-led project, with real-world implications, and it seeks to imagine, develop and propose initiatives in architecture, scenic composition, dramaturgical structures, and performative modes and styles. Ever After has developed and produced transferable principles, proposals, prototypes, models and recommendations for new approaches to theatre and performance within the following six thematic blocks: Assembly, Relationships, Materiality & Design, Space & Architecture, Techniques & Expression, and Production Processes.



Events & Public Engagement

The past year has challenged the Institute of Making team to think about its events more creatively than ever before. Both our large-scale open day events (which usually attract thousands of people) and our intimate masterclasses became unthinkable in early 2020. Our Events Manager Sara Brouwer was left with a dilemma: how to continue the spirit of Institute of Making events, when these hands-on events have always revolved around the direct, sensory and in-person interaction with 'stuff'?

The answer lay in the principles that guide our Institute of Making events, irrespective of physical proximity: 1) there will always be a fundamental bond that people feel to the materials surrounding them; 2) there is a thrill in learning to manipulate those materials through making processes; 3) there is joy and fulfilment in such discovery amid like-minded people. At a time when people were afraid, bewildered, and isolated, our events programme shifted to reach out to the public virtually, providing solace through online making communities.

These new online sessions included regular weekly community making groups, large-scale public making masterclasses, specialist technician consultations and popular skill-training workshops. From March 2020 to March 2021, the team have run 208 online events, worked with 1727 event participants, engaged 10,000+ Materials Library blog series readers. These numbers present a huge increase in events activity, as our equivalent event output pre-lockdown would have been around 30 events, albeit more logistically complex. Our online events have been more frequent and catered for groups of 10-150.

In order to deliver such a rapidly created and ambitious new programme to the UCL community and the public, our team of Technicians, the Events Manager, Makespace Manager and Materials Librarian all adapted their working patterns and scope to provide new online events.

In a highlight of the year, the team put on a two-day online festival revisiting some of our favourite masterclasses and workshops of the lockdown period and provided large-scale public access for events that were usually restricted to our members. The festival was a huge success where all events quickly became fully booked, with the virtual nature of the programme allowing a diverse range of participants from different countries and cultures to interact.

It is heartening to report that not all changes to our events in the past year have been due to the pandemic. In 2020, the team enjoyed delivering a new programme for young people who don't traditionally go to university to study art, design, science and engineering subjects with an exciting array of expert makers. This formed a series of summer and autumn school events organised by Research Fellow and Materials Librarian Sarah Wilkes in collaboration with the London Legacy Development Corporation, as part of our work on the Making Spaces research project. In a year filled with involuntary change, it was extremely satisfying to be able to intentionally expand and diversify our practice with a planned programme.

"Briliant masterclass, lots of inspiration. I don't have anything to show, rather a piece of practice that I will continue to study and build on. it was great to be aware of the feel of different sized needles, different threads and materials. thank you." (embroidery participant)

"Thanks for the session today! So much fun and kept my attention. I'd definitely want to do this again, and was so glad it was on zoom, even though things are opening again. It's so much more accessible for me." (Materials Library drawing participant)

Best of Lockdown Festival
(Masterclasses)

Our two-day online festival in July 2020 revisited some of our favourite masterclasses and workshops of the lockdown period. The virtual nature of the festival allowed a diverse range of participants from different countries and cultures to interact.
Among the sessions that drew hundreds of participants, were specialist workshops by the Institute of Making team. Director Zoe Laughlin and Materials Librarian Sarah Wilkes delivered a Materials Library Drawing session which challenged attendees to use their senses to sketch materials. Technician and ceramicist Darren Ellis taught participants how to photograph ceramics, focusing on natural light, reflections and styling. Technician and technologist George Walker explained the first principles of CAD (computer aided design) and how to make 3D self-portraits. Technician and designer Josie King explored plastics by transforming LDPE shopping bags into durable tote bags.
A highlight of the festival was the large-scale Embroidery Masterclass, taught by artist Richard McVetis with guest and fellow textile maker Celia Pym. Drawing on his love of traditional hand embroidery, Richard illuminated three different embroidery techniques. In spite of an audience of a hundred people, the masterclass proved surprisingly intimate. Richard and Celia discussed the versatility and strengths of stitching as a form of drawing and mark-making, the vulnerability and emotion that can come with repair, and the pleasure in having time to make.

"Thank you for two more interesting events. Yesterday morning I was lucky enough to join both of them. It was well organised and enjoyable, I will continue to work on the stitching – thank you to all involved. I really enjoyed the Embroidery Masterclass not only for the stitching but felt the discussion between the two artists was valuable with regards to materials, making and processes. More workshops with makers together please!" (Connie Flynn)

"Thank you so much for creating the excellent workshops which I greatly enjoyed joining last week. I can't over emphasise what a beacon these workshops were in these strange times when physical workshops still feel a little uncertain." (Karen Morton)

Facial Recognition Camouflage by Yoke Collective
(Online Masterclass)

Participants joined the artists from Yoke Collective for an online masterclass on facial recognition technologies. The group discussed the implications of and ethics behind camouflaging techniques used by anti-surveillance activists, while getting hands-on with face paint, stickers, hair extensions and other materials.

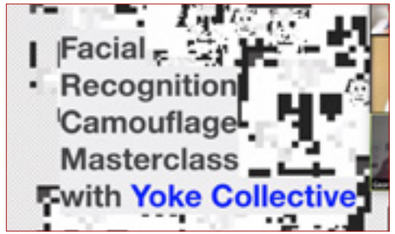
While the group applied colour and accessories to their faces for graphic and striking looks, Emily Roderick and Georgina Rowlands led a discussion about surveillance in public and private spaces. The conversation drew on their curatorial research of cyber-politics, powerful surveillance systems, and the positioning of the female body within the algorithms of facial and full body-recognition. The session also explored possible future fashion and design trends within societies of heightened security.

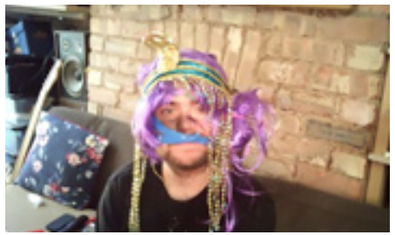
The progressively unrecognisable faces on-screen were a direct result of the online format of the masterclass. Our small-scale online masterclasses have been a great tool for in-depth learning of practical skills. The screenshare and spotlight functions of video calls enable clear and close-range visual examples of a making process, while allowing for verbal instructions at the same time.

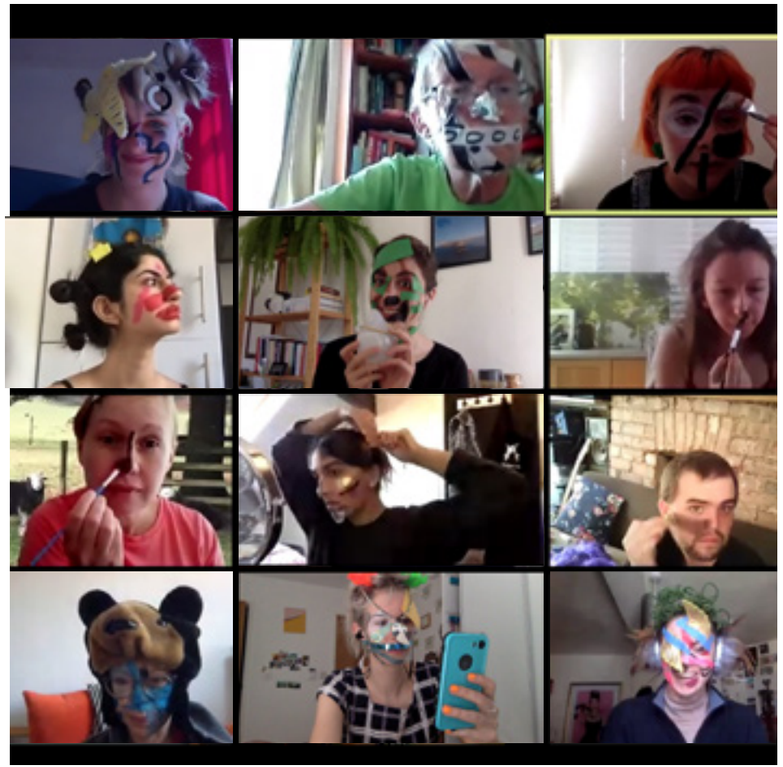
As the session drew to a close, the now strange and anonymous portraits of participants contrasted sharply with the ever more human understanding that the group formed of facial recognition programmes. The group brought up the unequal treatment of gender, ability and race by the algorithms that create the beloved selfie camera effects of Instagram and snapchat, rounding off a rich discussion about identity, privacy, and the social impact of technology at a time of increased monitoring of the public.

"I also think it's such an interesting time to talk about this now with the pandemic and mask-wearing" (Susan)

"[...] thank you, that was really cool and insightful!" (Isha)







Bags4Life by Josie King
(Specialist Technician Workshop)

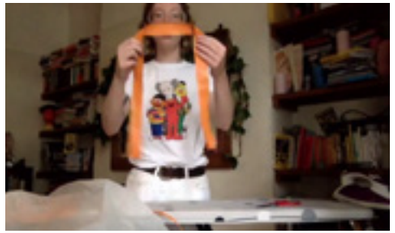
As Institute of Making activities moved online, our Technician team rose to the challenge and sought to pass on their making skills through online workshops. All in all, the Technicians triumphed, delivering 23 workshops to over 200 people, despite having never taught activities online before. Workshops were delivered to small groups of UCL students and staff and included topics such as 'Photographing Ceramics' and 'CAD for Beginners'.

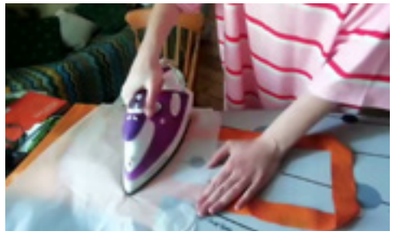
Another such workshop was the 'Bags 4 Life: Plastic Upcycling' workshop, delivered by designer and Technician Josie King. Josie taught members how to create fabric from old plastic shopping bags using only baking paper and an iron or hair straighteners. Through the processes like collage and pattern cutting, Josie and her workshop participants produced remarkable designs, and each left the workshop with a fresh, reusable messenger bags that should last a lifetime.

"Plastic Upcycling workshop by of_making was superb! I learned from Josie […] that LDPE plastic bags can be merged into a sturdy plastic textile, which we put together into a tote bag." (Yunmyeah on Instagram)

"This bag 4 life, made this afternoon on the @of_making zoom workshop, is perfect for carrying my shoes so I can walk through the waves. Institute of Making, thank you." (Kathleen on Instagram)

"Brilliant workshop. Thank you so much. Such fun with lots of ideas for more creativity. I loved it!!!" (Liz over email)





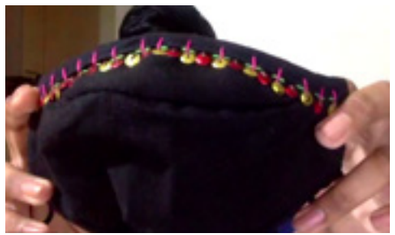
Customise Your Own Face Masks by Rebeckah Kemi Apara
(Young People workshop for Making Spaces project)

This year we produced a new programme of events for young people, supported by the Making Spaces research project, funded by Lloyds Register. One of the creative and hands-on online workshops for 15 – 18-year-olds from East London was run by Tottenham-based textiles designer Rebeckah Kemi Apara. As part of the online making session, Rebeckah showed us how to customise our own three-layer cotton face masks using embroidery and embellishment techniques for decorating fabrics, and all without compromising their function. Whilst we embroidered and embellished, Rebeckah talked to us about her career journey, her blog 'Embellished Talk', and how she taught herself to embroider. We were also joined by materials scientist Mark Miodownik who led a discussion about the health and environmental benefits of reusable versus disposable face masks with the group, whilst also embroidering his own mask. This is what some of the young participants thought of the session:

"I really enjoyed today's workshop. It revived my love for embroidery again and now I am addicted to sewing! I want to customise more face masks for my family and friends, and the face masks you sent to me were perfect." (workshop participant)

"This was so therapeutic! I can't wait to experiment with this with the other mask. Bye everyone - have a great evening." (workshop participant)

This workshop was part of a larger series called East Autumn School that we developed and ran in partnership with the London Legacy Development Corporation's (LLDC). These workshops were open to all 15–18-year-olds from Hackney, Newham, Tower Hamlets and Waltham Forest and were designed with a steering group of young people who fed into their content and delivery. They were particularly interested in facemask customisation, for example, because they'd just started wearing masks at school and were generally keen to engage more with environmental issues.



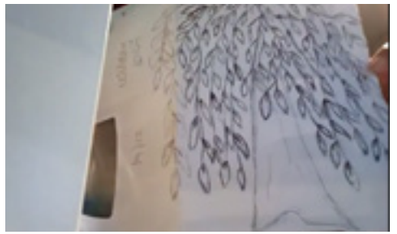
Knitting Circles
(online community workshops)

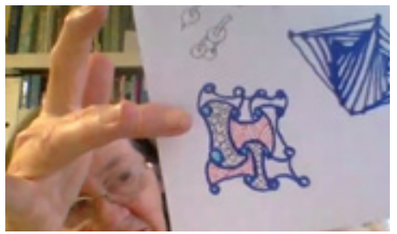
The Institute of Making knitting circle, originally intended to take place in the Makespace and for members only, moved online with the onset of the first UK lockdown. Another two online knitting circles were then set up, for the public and for the wider UCL community. The members circle and the public circle have taken place almost every week over the course of the past twelve months.

Two loyal participants of the public knitting circle, Tessa and Joan, meet up weekly on Zoom. Joan says she 'likes to be in a creative bubble' – she is an arts lover and a passionate, life-long learner, although her main love is for fabrics. She was born in Guyana into a family of seamstresses. Her aunt made all her clothes until Joan made her first piece at 11 years old – a Twiggy dress with a dropped waistline. Tessa says that her experience was the direct opposite, her mother did not sew, but she taught herself, so she did not have to wear clothes that she didn't like!

Unlike Joan, who took her sewing skills to fashion college, Tessa studied science and qualified as a teacher. In a strange twist of fate, Tessa used to work on research in the building that has now become the Institute of Making workshop. But she never stopped pursuing her passion for textiles and painting and was so often asked to tutor people in painting that it ended up as her career for the past 30 years.

Joan and Tessa joined the online knitting circle because lockdown quietened their usually busy lives, and they had time to give to a new pursuit. Joan says "It came at a good time – things were so uncertain, so odd, you couldn't go anywhere. I just thought I'd try it. I joined to learn and to have conversations. I wanted to speak to different people, but I was surprised that it was so





international." Since March 2020, 600+ participants have joined the online knitting circle from as far afield as Germany, Sweden, Alabama, Canada, and Argentina.

During the meetings Joan has worked on making projects like hexagonal patchwork, quilting, jewellery-making, drawings of willow trees, and more. Tessa meanwhile has made cards with home-made batik textile, created botanical dyes and fashioned beaded necklaces with hand-painted silk. Tessa also practiced making 'zentangles', a mindful drawing technique of linework and shapes that she went on to teach in a workshop for Royal Brompton Hospital. She found the zentangles a 'calming, mindful activity while having a natter'. "They're so nice!," Joan chips in, who had a go at the zentangles too - she didn't consider them very successful but, as Tessa says, "it's about the process. It keeps you focussed." Joan, from her side, taught Tessa to make beautiful ornamental fabric hearts, a skill which Tessa then passed onto her granddaughter, continuing the inspiration and creative transference that has sprung from their meet-ups.

"The people-side is very important – the exchange of ideas" says Tessa about the knitting circle. Joan agrees; "it's more about the conversations, with people from around the world, seeing what they are doing." In the get-togethers, they have discussed making topics from Harry Styles' viral knitted jumper pattern, to making washable sanitary pads for charity, and their sewing of scrubs for the NHS. When asked if they know each other well, the answer is an emphatic 'yes!'.
"We are planning to meet up for an exhibition after lockdown!"

Materials Library

As a collection that exists to offer face-to-face, sensory and hands-on experiences of materials to members and the public as a way to deepen our understanding of them, this year has been both challenging and extremely creative for the Materials Library.

As a result of COVID-19, our work and social lives have been constrained by lockdowns, social distancing measures and the need to limit what we touch to control the transmission of infection. Faced with these new challenges, we've had to rethink what hands-on learning and public engagement with a materials collection looks and feels like in the current climate. These new restrictions have also taught us the immense importance of both social touch (with families, friends, local communities) and of rich tactile experiences with materials and objects outside the confines of our own homes.

This year we've therefore been busy working on new ways to carry on providing our community with the joys of shared, sensory but safe materials experiences, whilst also using this opportunity to broaden the geographical reach and accessibility of the collection by expanding our digital catalogue, online events and social media outputs. This included a new interactive blog series, developed during the first lockdown, that used stories of the expansive inner lives of humble everyday materials as a way to free us from the confines of our homes. This popular series was read by

over 5000 people from all over the world, with over 17,000 social media interactions with the series as a whole. It also inspired some wonderful responses from our community in the form of their own photos and stories of much-loved domestic material companions.

This year we also drew together a new and geographically-dispersed community of 146 material aficionados for semi-regular, live zoom drawing sessions that used the techniques of sketching and sensory deprivation as ways of learning more about the materials we share our homes with. Wherever possible, we've also continued to support staff and students at UCL and other universities, members of the public and those in the architecture, design and manufacturing industries with their materials queries, explorations and experiments at a distance, through emails and video calls. Finally, our ever-expanding digital catalogue of materials profiles has really come into its own this year and has proved to be an extremely valuable resources for students and members of the public far beyond UCL.

Up Close & Personal Blog Series

During the first lockdown in March, we developed a new, interactive series of blog and social media posts called Up Close & Personal. At a time when staying at home had made many of our worlds suddenly and significantly smaller, Materials Librarian Sarah Wilkes set about exploring the expansive inner lives and backstories of tarmac, blu-tack, cardboard, cork, salt, wax and more (see p.94 for our July blog on salt). The aim of this regular post was to provide some distraction and relief from lockdown by encouraging our online community to focus on the details and joys of mundane, everyday materials. Every week or so, we shared a homage to a humble substance with our community through the blog and social media channels. These long-form blog posts have been read by 5171 people from all over the world, with 17070 social media interactions with the series in total, and readers spending an average of 3.5 minutes on each post. These are just a few of the comments from people who engaged with the series:

"Wonder-ful. Literally. Evoking wonder in the stuff of life" (Gabriela Szalay)

"Thanks for the IoM updates – it's definitely helping to keep sane!" (Ella West)

"Just wanted to thank you for publishing the work on waxes! Was fascinated reading the blog" (Rosie Khandwala)

We alo invited fellow materials enthusiasts to join us in exploring materials from home by sending us photos and thoughts about their favourite household substances, as a way of creating an online community. In return, we were treated to conversations about colour-changing glass paperweights found on travels, ceramic baking beads that look like tiny, very hot planets, the joys of a reliable towel that provides reassurance at a trying time and the cultural and personal significance of African batik fabrics, as well as meditations on slug slime, skin, soap and salty grit. A collection of these little gems were published on our blog as part of the series

Materials Library Drawing
(online workshops)

"Thanks @of_Making for such an inspiring, creative morning! Here are my attempts at sensory drawing. The online format was great too, I hope you'll keep that!" (Alice Harvey)

Over the last year, we've brought together a community of 146 materials aficionados on zoom for semi-regular Materials Library Drawing sessions. These live events, run by Director Zoe and Materials Librarian Sarah, and involving between 15 and 75 participants at a time, used the techniques of sketching and sensory deprivation as a way of learning more about the materials we share our homes with.

These sessions were free, open to all, and required no experience, skill or specialist equipment to take part (we suggested whatever drawing materials you had to hand plus a pad of paper, back of an envelope, or inside a cereal packet). Exercises included quick-fire drawing exercises to try and capture the spirit of objects from the Materials Library and Zoe's personal materials collection, all whilst they were slowly spinning on a rotating banding wheel. Participants were also asked to bring three materials or objects from around their home, and we experimented together with drawing by feel, sight, taste or sound only, to explore how shutting down one of your senses affects your perceptions and draughtsmanship. Not only were these sessions creative, joyful and intense, but the online format meant that people who had previously been unable to travel to central London to visit the Materials Library were able to join us in exploring our collection, as well as the fabric of their own homes.

"Thanks for the session today! So much fun and kept my attention. I'd definitely want to do this again, and was so glad it was on zoom, even though things are opening again. It's so much more accessible for me." (participant)

Materials Advice at Distance

This year the Materials Library has continued to support UCL staff and students in their materials explorations and experiments at home, with lectures and library tours for 69 UCL students pre-lockdown, and 27 post-COVID lockdown emails and video support for UCL members and our external community. Sarah has been joining the Makespace team whenever needed to provide materials advice as part of the Technician Consultations (p.108). These sessions have covered topics as varied as testing the inflatability, elasticity, decay and biodegradability of natural rubber; ephemeral and organic materials for a one-off sculpture involving body casting; and finding materials with the right melting point and thermal expansion coefficients to create multi-material models with meltable inclusions in order to mimic plate tectonics.

Whenever possible, we've also been responding to the queries we get from other universities, the public and from industry. For example, we recently helped the Dartington Morris Men group in Gloucestershire to find mouldable materials to make a Hart (stag's head) for their latest Morris performance, gave advice to an external student wanting to make structural, architectural materials from seaweed, and discussed transparent materials for lipreading facemasks for a local school in Worcestershire, as well as sound damping materials for COVID-19 air disinfection systems on isolation wards in Gaza.

"The heat mouldable polyesters are new to me and Wonderflex looks as though it may be the material to fit the bill for our Hart! I shall, armed with this information, purchase a sample and do some research tests".
(Colin Lodge, Dartington Morris Men)

"The consultation from the Institute of Making provided me with an opportunity to enquire about specific questions as to the behaviour and properties of materials (in my case natural rubber) in a digestible and informative manner".
(Harry Hinton-Hard, Bartlett School of Architecture)

Image credit: Harry Hinton-Hard

New Online Materials Profiles

"Thank you for alerting me to the Online Catalogue; so much good stuff here! The world of Materials is just so endless - I'm happy to say!" (Karen Morton)

Our digital catalogue of materials has really come into its own this year, proving to be a very valuable resources for students and members of the public far beyond UCL. On top of the work we do with the UCL community, we regularly receive requests from other universities to support their students in their materials learning, as shown by this quote from a member of staff at another HE institution:

"We are a reference library of Materials and Products, supporting the School of Art, Architecture and Design. As a consequence of Covid-19, students and staff have no physical access to the collection…The content of your database and its construction would make a valuable resource and we would be delighted if you would agree to us providing a link on our website for all our students and staff?"

This year we've therefore been focussing our efforts on getting as much of our collection online as possible. We've written and added a further 157 profiles to our digital catalogue this year, with a rich mix of content exploring the properties, histories and delights of materials such as slippery teflon, glossy shellac, silky alpaca wool, supremely hard silicon nitride, explosive and revolutionary celluloid and euphoric and environmentally damaging nitrous oxide. This trove of digital materials treasures only represents 28% of our amazing collection, so we still have so many more wonders to be released into the wild! However, we are on our way to making this one-of-a-kind collection accessible to as many people as possible, and we are exploring new ways to make materials learning as digestible and welcoming to people of all ages, nationalities, cultural backgrounds and disciplines.

Materials Up Close & Personal: SALT
(long read)

This is a reprint of our Materials Library blog from June, which scrapes the surface of SALT, examining our physiological need for simple sodium chloride, its hidden colonial history, and its cultural importance in food preservation, road safety, textile dyeing and soap manufacture.

This week we look in fine-grained detail at common SALT. Simple sodium chloride, the inorganic mineral that hails from the sea and the rocks that erode into it, is not only a favourite flavouring for our food. It also plays a crucial role in food preservation, textile dyeing, ceramic glazing and soap manufacture. Salt is present in our blood, sweat and tears, and is at once essential for human life, and a danger to it.

Hundreds of millions of tons of salt are produced every year, all across the world, but with China and the US as the biggest, saltiest players. Approximately 293 million tons of the white stuff were made in 2019 by one of three processes. The first and by far the oldest method is solar evaporation from sea water in open-air salt pans, which dates back to at least the Bronze Age in the UK. The second process involves mining from underground seams of rock salt (halite) that were left behind by the evaporation of prehistoric oceans. The third method involves pumping water into those deposits to dissolve out salt and then evaporate the brine.

Only 6% of that enormous global glut of salt is used in our food, and more than half of the salt produced is used by cold countries to prevent roads from icing over in winter. The mixture of rock salt and grit used on our roads combines with water on the surface of the tarmac to produce a salty solution that has a lower melting point than pure water, meaning that it no longer freezes at zero degrees. This salty sprinkling keeps traffic moving in a blizzard, and is thought to reduce ice-induced accidents by nearly 90%, but comes with

its own hazards. Road salt run-off has known environmental impacts: accumulating in waterways and killing off rainbow trout, roadside and aquatic plants, and salamanders and frogs. It is also thought to attract birds, deer, elk and moose to roads to satisfy their salt cravings, ironically increasing the risk of car vs. animal collisions.

Aside from its use in cooking, salt is central to innumerable making processes. It is an essential ingredient in the production of glossy, salt-glazed ceramics, like these distinctive, orange-peel-surfaced Bernard Leach pieces. Salt also plays a crucial role as a catalyst in textile dyeing, whereby salt's easily dissolvable, positively-charged sodium ions (Na+) attach to the fabric, and attract the negatively-charged ions of the dye, helping to absorb and fix colour to cloth. Salt's offspring, chlorine and caustic soda – produced by the electrolysis of brine – are essential ingredients in the manufacture of numerous other materials. Caustic soda (a.k.a. sodium hydroxide or lye) is a core ingredient in soap-making, paper-making and in the extraction of aluminium from its ore bauxite, whereas chlorine is used to treat drinking water, to make titanium dioxide pigment for white paint, and as a feedstock for PVC plastics that are prevalent in our raincoats and drainpipes.

We can also thank salt for the sausages, spams and salamis of this world. Both dry salt cures and saturated aqueous solutions of salt (brine) are used to preserve food, and are responsible for the joys of saltfish, smoked salmon, beef jerky and pickles. Salt sucks moisture out of both the food and the bacteria that live on it by the process of osmosis. The salt around the outside of the food draws water molecules out and replaces them with salt (sodium and chloride) ions until the amount of salt is equal inside and out. The same thing happens to bacteria, which become dehydrated. Because most micro-organisms cannot survive and replicate in this kind of salty environment, this slows down decomposition. Salting is one of the oldest food preservation techniques and was heavily used by the Egyptians, Romans and Gauls, continuing right up until the middle of the 20th Century, but becoming less widespread with

the advent of the fridge. The Egyptians also famously used similar techniques to mummify the bodies of their pharaohs using natron, a naturally-occurring combination of sodium chloride (table salt), sodium bicarbonate (baking soda) and sodium carbonate (washing soda).

Salt is a favourite flavouring for our food, and we are not the only animals who feel that way: horses, elephants and porcupines are all partial to salt licks, and Japanese macaques have been known to dip potatoes in salt water before eating them. Some of this hankering for salt may be down to a physiological need for sodium, as it is crucial for many bodily processes, but the fact that we are not the only mammals to eat far more salt than we need suggests that this selection of salty foods also comes down to taste preference. Chemists think salt is so significant for our taste experience because it selectively filters flavour; supressing unpalatable tastes, like bitterness, and enhancing more pleasant tastes, like sweetness. Our sensitivity to, and preference for salt can vary a lot from person to person (and probably from macaque to macaque), and is affected by inherited differences and the number and effectiveness of taste receptors on our tongues, as well as by general health, age and experience.

Salt has varying levels of saltiness: the amount of sodium chloride in it can range from 98% to 99.7%. The rest is made up of other minerals and sediments that add to the salt's flavour and appearance, like the potassium, magnesium and calcium that make Himalayan salt pink, or the ground lava, clay or coral in red and black Hawaiian salts, as well as anti-caking additives like magnesium carbonate that prevent crystals from getting damp and clumping together. Fleur de sel (literally translated as 'flowers of salt') is one of the saltiest salts, and is thought by chefs and chocolatiers to have one of the most complex flavours, thanks to its variety of trace minerals. This patissier's favourite is most commonly associated with the North Atlantic coast of France, where its crystals are grown in enormous open air salt flats.

The way that salt crystals form determines their shape: whether they become solid, crunchy cuboids, or fragile, crumbly flakes. When salt is formed by the slow evaporation of seawater in an open salt pan, salt crystals form at the surface of the brine and solidify into fragile, hollow pyramids that need to be gently raked off the surface of the pool to prevent them sinking and solidifying. When salt is produced by quick evaporation in a closed tank, often under a vacuum, evaporation occurs simultaneously throughout the brine, resulting in the small regular cube-shaped crystals that become the grains of salt in a shaker.

There's been a lot of attention paid in recent years to the perils of too much salt in our diets, with excessive consumption linked to hypertension and heart disease. However, salt is used elsewhere in the body to positive effect in cleaning wounds, irrigating snotty nostrils, removing contact lenses, and replacing lost bodily fluids when given intravenously. We need a certain amount of salt in our diets, as its component sodium and chloride ions keep our body chemistry in working balance, affecting our nervous system, muscles and blood flow. Most of the body's sodium ions are located in plasma: the fluid portion of our blood and the liquid around our cells. If we consistently consume too much salt we produce excessive amounts of plasma, which

puts too much pressure on our blood vessels, increasing our risk of heart disease and stroke. On the other hand, too little salt can also result in cardiac and other health problems.

As an essential nutrient that allows for the preservation and long-distance transportation of food, salt was massively important to ancient economies, as it is today. Despite the difficulties of tracing salt in the archaeological record (because of its solubility in water), there has been an explosion of interest in its history and prehistory since the 1970s. Even though salt itself almost never survives the ravages of time, production sites and clay vessels used for evaporation provide evidence of its manufacture and exchange between communities with and without local availability of salt. Salt's bacteriocidal properties also help to preserve organic remains like leather and textiles, leaving us with a record of equipment used. With this evidence, researchers have shown that access to salt has played an important role in bringing communities together through trade, building the wealth and power of cities, kingdoms and empires, but also in dividing people through numerous 'salt wars'.

The stories of many of the materials we now take for granted, like salt (and sugar, coffee, gold, diamonds…), are often inextricably linked with difficult and painful colonial legacies, where the production, exchange and consumption of everyday substances were used as instruments for establishing and maintaining power. We talk a lot about the overconsumption of salt in societies where we now consume too much processed food, but in 19th and 20th Century British India, where this essential mineral was heavily controlled and highly taxed by colonial powers, salt starvation was much more of a problem. Mahatma Gandhi's Salt March was a pivotal moment in the campaign for Indian independence, where he walked 240 miles to the Arabian sea to disobey the British Raj's law that Indian citizens could not collect their own salt. In picking up a pinch of natural salt from the flats, he symbolically defied British rule.

The Makespace

Like much of the world, the Makespace operated in a very different way this year. With busy spaces and close contact with other people off limits due to the COVID-19 pandemic, we had to find new ways to continue our creative journeys, support our members and carry on making remotely. We looked for ways to do what we do best in the Makespace, brainstorming with members, problem solving and continuing to be curious about the world around us, even if that was limited because of the public health lockdown.

With Necole Schmitz away on parental leave, Romain Meunier took up the role of Makespace Manager. The team welcomed two brilliant new Technicians Helen Carnac and Josie King to fill the gap left when Romain changed roles. Led by Romain, this new formation of the team worked together to adapt to the challenges posed by the pandemic.

As people across the world were locked down to stop the spread of the novel corona virus, members were connecting across the geographical divide to carry on making. Technicians engaged with members in a variety of online classes and making events from knitting circles to photography classes to introductions to CAD.

The technical staff began to offer consultations to members looking to continue their making projects remotely, giving advice and support through video calls. These online consultations reflected the diverse interests of our members' academic and personal projects and drew on our Technicians broad making experience. They helped members find safe alternatives to making in the workshop, often using minimal tools or equipment.

After the end of the first lockdown when it was safe for some Technicians to return to the Makespace, we began to offer a making service. This allowed members to have their 3D printing, laser cutting or CNC projects realised for them by Technicians who were able to use the space in a socially distanced, COVID-safe manner.

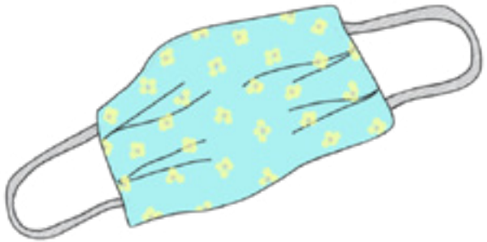
As we look forward to hopefully having our members return to the Makespace when it is safe to do so, some methods of working and innovations will be carried forward hopefully adding to the creative and comprehensive way that we look at making, inside and out of the Makespace.

Response to COVID-19

During the first few weeks of the pandemic in the UK, it was clear that engineers, craftspeople, designers and makers could provide skills and knowledge to the unprecedented challenges of COVID-19. In addition to participating in the UCL-wide effort to tackle the ventilation needs of hospitalised COVID-19 patients in early March, we recognised that our specific expertise in materials and making would be helpful on the issue of Personal Protective Equipment (PPE). Severe global shortages of key items meant that health care professionals all over the world were improvising protection with whatever they could find and those in less frontline medical settings, like care homes, were unable to source even the most basic of protective items.

Our first PPE-related intervention began with a survey of the available DIY PPE options, looking at what solutions were being used in other parts of the world, for example, in places that were further ahead in their experience of the disease. We searched for open-source designs for things like face shields that utilised 3D printing or laser cutting technologies. And we examined the types and availability of materials that were required to make masks.

At this point we split our work into two streams. The first stream supported the collaborative effort to make open-source face shields for NHS workers. We facilitated and coordinated contact between material suppliers, NHS purchasing teams and distributors who already supplied hospitals. Using our links established through the UCL ventilator design sprint, we were also able to contact medical practitioners and sterilisation experts who tested prototypes and provided feedback on what was, and was not, acceptable. This culminated in the secondment of two of our technicians to the Batch.works project in East London, where they helped to establish a small but extremely agile micro-factory producing the Batch Shield to supply the NHS.



Our second stream of work looked at what might be helpful to those outside of the NHS, with no traditional access to PPE, but who none the less were in need of protection – the home carer, the supermarket worker or delivery driver. Ordinary people needed simple, accessible and well-considered options. Our first intervention is this area was an improvised visor design for a face shield that our director, Zoe Laughlin, put together one evening using the limited resources that she found at home. The resultant shield (made from paperclips, a document wallet and a headband) proved surprisingly practical, comfortable and easy to clean. After running it past researchers, clinicians, engineers and sterilisation experts at UCL, who all agreed it was a good option for those in immediate need with no official PPE at their disposable, we put the design into the public domain. To date, the freely downloadable how-to-make guide and the how to-make video tutorial have collectively been viewed over 200,000 times.

Our second PPE-related intervention came in the form of an informative guide for anyone wishing to make or wear a face covering. By April, it was clear that face coverings were going to become more commonplace for the general public and there was a need for clear advice on materials selection and design options. Our team set about surveying different designs, making our own versions at home, assessing what skill levels were needed to make different types, and providing feedback on what each option was like to actually use on a daily basis. We then collated our research into a frequently asked questions guide to face coverings and put this in the public domain in early May. It proved extremely useful for the general public, who welcomed our clear, straightforward approach and the wide range of areas covered – from how to stop your glasses from steaming up whilst wearing a mask to which materials provide the optimum filtration and why.

www.instituteofmaking.org.uk/blog/2020/04/diy-face-shield

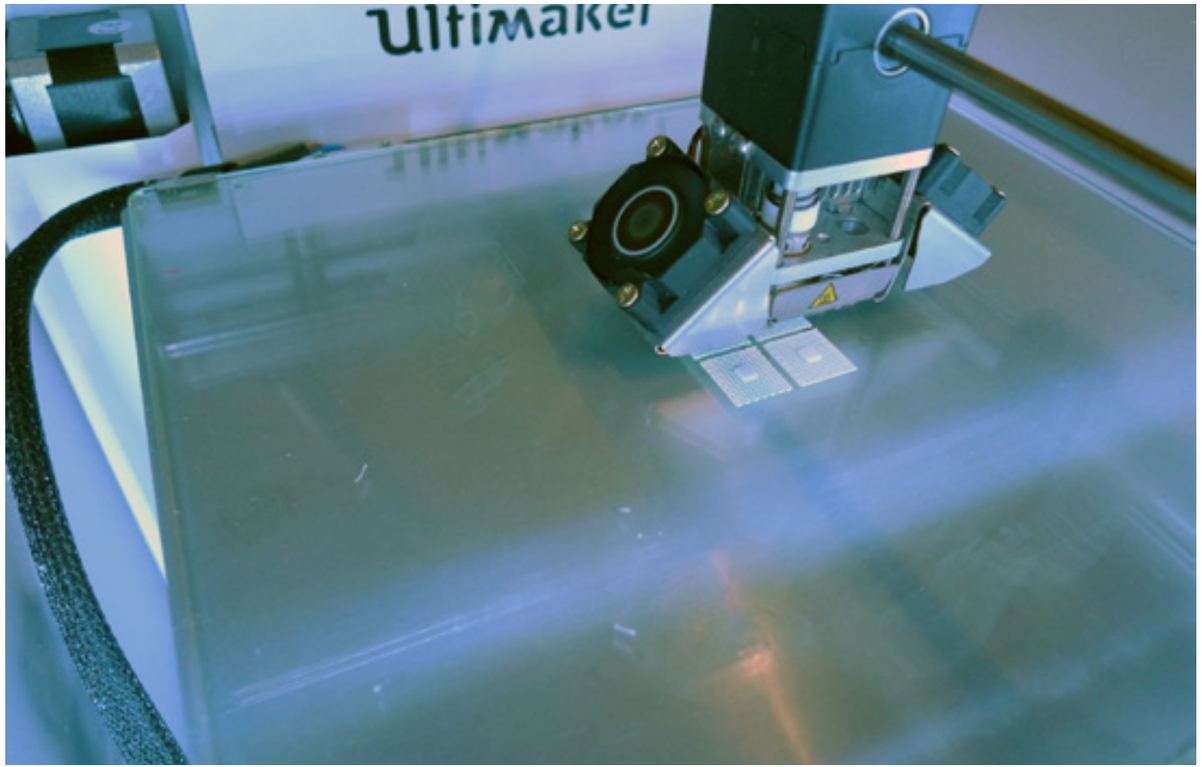
www.instituteofmaking.org.uk/blog/2020/05/face-coverings-faqs

Making Service – A new service

The Makespace has always been a place where magic happens. That's down to our amazing members who come through the space with a vast array of ideas. These ideas become a reality through so many different making processes and materials.

Unfortunately, when the UK entered its first lockdown in March, and to ensure everybody's safety, we closed the Makespace to our members and staff. With no making happening on UCL campus, but with some of our members still keen to proceed with their projects, we initiated online consultations, which provided advice and guidance on making from the safety of home. As soon as we were given the go ahead for limited staff to re-enter the building, the Technicians then expanded the consultations to into a new service - a making service.

In addition to the online consultations, Technicians were now able to process members' ideas and plans into objects using the tools in the Makespace. CAD drawings soon became physical pieces on the CNC, laser cutter and 3D printers. We were also able to offer hands-on completion of members' projects using routers, drills, and saws, and the kiln was firing once again! While this was different to how we normally operate, the making service enabled members to access tools that they did not have at home and the potential to make real progress on their projects. Even in these most extraordinary circumstances, the making service allowed a taste of the Makespace and all that it has to offer to its members.



New skills in the Technician Team

In 2020, our team was enriched by expertise of two talented makers; Helen Carnac and Josie King, who joined in maternity cover posts.

Helen Carnac
Helen is an acclaimed artist and enameller who trained as a silversmith and works with vitreous enamel on steel. Her collections of vessels crafted from vitreous enamel have built her reputation as a respected maker. Helen's expertise and experience as a teacher was very appreciated not only by our members but also by the other Technicians. Always calm and confident, she was an invaluable authority in the workshop. Her knowledge of metalworking, particularly enamelling, was a great asset to the team. During her time as technician, Helen was also a UCL Artist-in-Residence and helped many of our members to get started with enamelling.

Josie King
Josie is a designer and maker who joined the Institute of Making team after work at Machines Room and Green Labs. Her personal making practice is rooted in play; less of an artisan more of a 'master of none', Josie is interested in awkward materials and processes. For example, her 'slime on legs' furniture series was made in collaboration with traditional craftspeople and induced improvisation and play back into the making process. Josie's broad making practice meant that she a natural at helping with diverse members' projects, including 3D printing, set design, installation and furniture making. While working with us, Josie also volunteered at the Batch.Works makespace, to manufacture PPE. In her role as technician, Josie helped to create, coordinate and present a diversity training program for the Institute of Making team in her own brilliant and unique way.

Image credit: Josie King

Appendix

Full Statistics of Membership

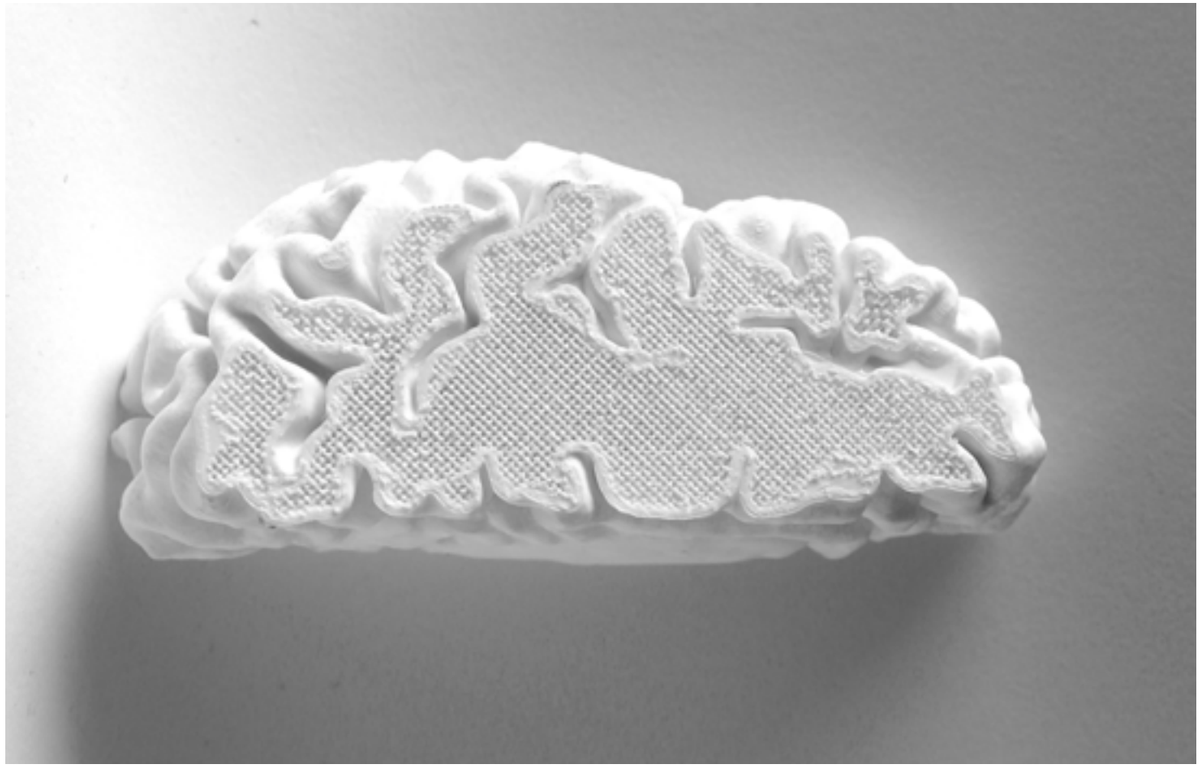
Total number of registered members: 14,007
Active inducted members: 2,787 (+ 299 members who joined during lockdown)

Gender
Female 46%
Male 50%
Genderqueer/non-binary/prefer not to disclose 4%

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: 208
(122 member events and 99 public events) Breakdown: 14 Masterclasses, 44 Makespace events, 11 Materials Library events, 12 outreach events, 140 workshops

6th March 2020. Plastic Waste Innovation Hub - Community-building Workshop (research workshop)
24th March 2020. Members Knitting Circle. (workshop)
31st March 2020. Members Knitting Circle. (workshop)
2nd April 2020. Technician Consultations. (Makespace activity)
7th April 2020. Members Knitting Circle. (workshop)
8th April 2020. Technician Consultations. (Makespace activity)
16th April 2020. Members Knitting Circle. (workshop)
16th April 2020. Public Knitting Circle. (workshop)
21st April 2020. UCL Knitting Circle. (workshop)
21st April 2020. Members Knitting Circle. (workshop)
21st April 2020. Public Knitting Circle. (workshop)
23th April 2020. Technician Consultations. (Makespace activity)
28th April 2020. UCL Knitting Circle. (workshop)
28th April 2020. Members Knitting Circle. (workshop)
28th April 2020. Public Knitting Circle. (workshop)
29th April 2020. Technician Consultations. (Makespace activity)
30th April 2020. Technician Consultations. (Makespace activity)
5th May 2020. UCL Knitting Circle. (workshop)
5th May 2020. Members Knitting Circle. (workshop)

5th May 2020. Public Knitting Circle. (workshop)
5th May 2020. Public Knitting Circle. (workshop)
6th May 2020. Technician Consultations. (Makespace activity)
7th May 2020. Technician Consultations. (Makespace activity)
12th May 2020. UCL Knitting Circle. (workshop)
12th May 2020. Members Knitting Circle. (workshop)
12th May 2020. Public Knitting Circle. (workshop)
12th May 2020. Public Knitting Circle. (workshop)
18th May 2020. Member Embroidery Masterclass (masterclass)
18th May 2020. Public Embroidery Masterclass (masterclass)
19th May 2020. UCL Knitting Circle. (workshop)
19th May 2020. Members Knitting Circle. (workshop)
19th May 2020. Public Knitting Circle. (workshop)
19th May 2020. Public Knitting Circle. (workshop)
20th May 2020. Technician Consultations. (Makespace activity)
21st May 2020. Introduction to CAD for absolute beginners. (workshop)
26th May 2020. UCL Knitting Circle. (workshop)
26th May 2020. Members Knitting Circle. (workshop)
26th May 2020. Public Knitting Circle. (workshop)
26th May 2020. Public Knitting Circle. (workshop)
27th May 2020. Technician Consultations. (Makespace activity)
28th May 2020. Introduction to CAD for absolute beginners. (workshop)
28th May 2020. Member Supervisor meet up (Makespace activity)
29th May 2020. Member Facial Recognition Camouflage Masterclass (masterclass)
29th May 2020. Public Facial Recognition Camouflage Masterclass (masterclass)
1st June 2020. Material Library Drawing (Materials Library activity)
2nd June 2020. UCL Knitting Circle. (workshop)

2nd June 2020. Members Knitting Circle. (workshop)
2nd June 2020. Public Knitting Circle. (workshop)
2nd June 2020. Public Knitting Circle. (workshop)
3rd June 2020. Technician Consultations. (Makespace activity)
4th June 2020. Photographing Ceramics. (workshop)
4th June 2020. Introduction to CAD for absolute beginners. (workshop)
6th June 2020. 1pm Public Embroidery Masterclass (masterclass)
6th June 2020. 3pm Public Embroidery Masterclass (masterclass)
9th June 2020. UCL Knitting Circle. (workshop)
9th June 2020. Members Knitting Circle. (workshop)
9th June 2020. Public Knitting Circle. (workshop)
9th June 2020. Public Knitting Circle. (workshop)
10th June 2020. Technician Consultations. (Makespace activity)
11th June 2020. Photographing Ceramics. (workshop)
11th June 2020. Introduction to CAD for absolute beginners. (workshop)
15th June 2020. Material Library Drawing (Materials Library activity)
16th June 2020. UCL Knitting Circle. (workshop)
16th June 2020. Members Knitting Circle. (workshop)
16th June 2020. Public Knitting Circle. (workshop)
16th June 2020. Public Knitting Circle. (workshop)
17th June 2020. Technician Consultations. (Makespace activity)
18th June 2020. Photographing Ceramics. (workshop)
18th June 2020. Introduction to CAD for absolute beginners. (workshop)
23rd June 2020. UCL Knitting Circle. (workshop)
23rd June 2020. Members Knitting Circle. (workshop)
23rd June 2020. Public Knitting Circle. (workshop)
23rd June 2020. Public Knitting Circle. (workshop)

24th June 2020. Technician Consultations. (Makespace activity)
25th June 2020. Photographing Ceramics. (workshop)
25th June 2020. Introduction to CAD for absolute beginners. (workshop)
29th June 2020. Material Library Drawing (Materials Library activity)
30th June 2020. UCL Knitting Circle. (workshop)
30th June 2020. Members Knitting Circle. (workshop)
30th June 2020. Public Knitting Circle. (workshop)
30th June 2020. Public Knitting Circle. (workshop)
1st July 2020. Technician Consultations. (Makespace activity)
2nd July 2020. Photographing Ceramics. (workshop)
2nd July 2020. Introduction to CAD for absolute beginners. (workshop)
7th July 2020. Members Knitting Circle. (workshop)
7th July 2020. Public Knitting Circle. (workshop)
7th July 2020. Public Knitting Circle. (workshop)
8th July 2020. Technician Consultations. (Makespace activity)
9th July 2020. Upcycling Plastics (Bags 4 Life). (workshop)
9th July 2020. Introduction to CAD for absolute beginners. (workshop)
14th July 2020. Members Knitting Circle. (workshop)
14th July 2020. Public Knitting Circle. (workshop)
15th July 2020. Technician Consultations. (Makespace activity)
16th July 2020. Photographing Ceramics. (workshop)
16th July 2020. Introduction to CAD for absolute beginners. (workshop)
21st July 2020. Members Knitting Circle. (workshop)
21st July 2020. Public Knitting Circle. (workshop)
22nd July 2020. Technician Consultations. (Makespace activity)
23rd July 2020. Photographing Ceramics. (workshop)
23rd July 2020. Upcycling Plastics (Bags 4 Life). (workshop)

28th July 2020. Public Knitting Circle. (workshop)
30th July 2020. Public Embroidery Masterclass (masterclass)
30th July 2020. Material Library Drawing (Materials Library activity)
30th July 2020. Material Library Yoga. (workshop)
31st July 2020. Photographing Ceramics. (workshop)
31st July 2020. Upcycling Plastics (Bags 4 Life). (workshop)
31st July 2020. Introduction to CAD for absolute beginners. (workshop)
4th August 2020. Members Knitting Circle. (workshop)
4th August 2020. Public Knitting Circle. (workshop)
7th August 2020. East Summer School: Art & Science of Face Filters. (outreach)
11th August 2020. Members Knitting Circle. (workshop)
11th August 2020. Public Knitting Circle. (workshop)
18th August 2020. Members Knitting Circle. (workshop)
18th August 2020. Public Knitting Circle. (workshop)
25th August 2020. Members Knitting Circle. (workshop)
25th August 2020. Public Knitting Circle. (workshop)
1st September 2020. Public Knitting Circle. (workshop)
15th September 2020. Members Knitting Circle. (workshop)
14-18 September 2020. Technician Consultations. (Makespace activity)
29th September 2020. Members Knitting Circle. (workshop)
29th September 2020. Public Knitting Circle. (workshop)
29th September 2020. Technician Consultations. (Makespace activity)
6th October 2020. Members Knitting Circle. (workshop)
6th October 2020. Public Knitting Circle. (workshop)
6th October 2020. Technician Consultations. (Makespace activity)
13th October 2020. Members Knitting Circle. (workshop)
13th October 2020. Public Knitting Circle. (workshop)

13th October 2020. Technician Consultations. (Makespace activity)
20th October 2020. Members Knitting Circle. (workshop)
20th October 2020. Public Knitting Circle. (workshop)
20th October 2020. Technician Consultations. (Makespace activity)
22nd October 2020. Autumn Schools Steering Group. (outreach activity)
27th October 2020. Members Knitting Circle. (workshop)
27th October 2020. Public Knitting Circle. (workshop)
27th October 2020. Technician Consultations. (Makespace activity)
3rd November 2020. Members Knitting Circle. (workshop)
5th November 2020. New Members Knitting Circle. (workshop)
3rd November 2020. Technician Consultations. (Makespace activity)
6th November 2020. Materials Library Drawing. (Materials Library activity)
10th November 2020. Members Knitting Circle. (workshop)
11th November 2020. Technician Consultations. (Makespace activity)
17th November 2020. Members Knitting Circle. (workshop)
17th November 2020. Public Knitting Circle. (workshop)
17th November 2020. Technician Consultations. (Makespace activity)
18th November 2020. Autumn School: 3D Design for animation & 3D printing (outreach)
23rd November 2020. Members Online Masterclass - Fermentation pt 1. (masterclass)
24th November 2020. Members Knitting Circle. (workshop)
24th November 2020. Technician Consultations. (Makespace activity)
24th November 2020. UCL Plastic Waste Innovation Hub: Compostable Plastics Research Launch (research event)
30th November 2020. Members Online Masterclass - Fermentation pt 2. (masterclass)
30th November 2020. Autumn School: Design from Waste - Plastic Fantastic (outreach)
1st December 2020. Members Knitting Circle. (workshop)
1st December 2020. Public Knitting Circle. (workshop)

1st December 2020. Technician Consultations. (Makespace activity)
8th December 2020. Members Knitting Circle. (workshop)
8th December 2020. Public Knitting Circle. (workshop)
8th December 2020. Autumn School: Customise Your Own Facemask (outreach)
8th December 2020. Technician Consultations. (Makespace activity)
15th December 2020. Make Merry (workshop)
15th December 2020. Members Knitting Circle. (workshop)
15th December 2020. Public Knitting Circle. (workshop)
15th December 2020. Technician Consultations. (Makespace activity)
16th December 2020. Autumn School: Household Material Sneaker Design (outreach)
22nd December 2020. Public Knitting Circle. (workshop)
29th December 2020. Public Knitting Circle. (workshop)
5th January 2021. Members Knitting Circle. (workshop)
5th January 2021. Public Knitting Circle. (workshop)
5th January 2021. Technician Consultations. (Makespace activity)
12th January 2021. Members Knitting Circle. (workshop)
12th January 2021. Public Knitting Circle. (workshop)
12th January 2021. Technician Consultations. (Makespace activity)
19th January 2021. Members Knitting Circle. (workshop)
19th January 2021. Public Knitting Circle. (workshop)
19th January 2021. Technician Consultations. (Makespace activity)
26th January 2021. Members Knitting Circle. (workshop)
26th January 2021. Public Knitting Circle. (workshop)
26th January 2021. Technician Consultations. (Makespace activity)
2nd February 2021. Members Knitting Circle. (workshop)
2nd February 2021. Public Knitting Circle. (workshop)
2nd February 2021. Technician Consultations. (Makespace activity)

9th February 2021. Members Knitting Circle. (workshop)
9th February 2021. Public Knitting Circle. (workshop)
9th February 2021. Technician Consultations. (Makespace activity)
11th February 2021. Materials Love Letters blog. (Materials Library activity)
16th February 2021. Members Knitting Circle. (workshop)
16th February 2021. Public Knitting Circle. (workshop)
16th February 2021. Technician Consultations. (Makespace activity)
17th February 2021. Members Online Workshop: Introduction to Darning. (workshop)
19th February 2021. Public Online Workshop: Introduction to Darning. (workshop)
23rd February 2021. Members Knitting Circle. (workshop)
23rd February 2021. Public Knitting Circle. (workshop)
23rd February 2021. Technician Consultations. (Makespace activity)
2nd March 2021. Members Knitting Circle. (workshop)
2nd March 2021. Public Knitting Circle. (workshop)
2nd March 2021. Technician Consultations. (Makespace activity)
2nd March 2021. Members Online Masterclass Series: Creating Colour with Lauren MacDonald. (masterclass)
9th March 2021. Members Knitting Circle. (workshop)
9th March 2021. Public Knitting Circle. (workshop)
9th March 2021. Technician Consultations. (Makespace activity)
9th March 2021. Members Online Masterclass Series: Creating Colour with Lauren MacDonald. (masterclass)
16th March 2021. Members Knitting Circle. (workshop)
16th March 2021. Public Knitting Circle. (workshop)
16th March 2021. Technician Consultations. (Makespace activity)
16th March 2021. Members Online Masterclass Series: Creating Colour with Lauren

MacDonald. (masterclass)
17th March 2021. Materials Love Letters From You blog. (Materials Library activity)
23rd March 2021. Members Knitting Circle. (workshop)
23rd March 2021. Public Knitting Circle. (workshop)
23rd March 2021. Technician Consultations. (Makespace activity)
23rd March 2021. Members Online Masterclass Series: Creating Colour with Lauren MacDonald. (masterclass)
26th March 2021. Public Online Workshop for Instagram Followers: Introduction to Darning. (workshop)
30th March 2021. Members Knitting Circle. (workshop)
30th March 2021. Technician Consultations. (Makespace activity)

Research Publications

Allison, A.L., Ambrose-Dempster, E., Domenech Aparsi, T., Bawn, M., Casas Arredondo, M., Chau, C., Chandler, K., Dobrijevic, D., Hailes, H., Lettieri, P., Liu, C., Medda, F., Michie, S., Miodownik, M., Munro, B., Purkiss, D. & Ward, J. (2020). The environmental dangers of employing single-use face masks as part of a COVID-19 exit strategy. UCL *Open:Environment*. doi:10.14324/111.444/000031.v2

Allison, A.L., Lorencatto, F., Michie, S., & Miodownik, M. (2021). Barriers and enablers to buying biodegradable and compostable plastic packaging. *Sustainability* 2021, 13(3), 1463. doi:10.3390/su13031463

Filmer, A., Brookes, M., Laughlin, Z. & Pearson, M. (2020) Report from…Wales *The Ever After Project*: considering theatre and performance in the era of Covid-19. *Theatre and Performance Design 6*, 2020. (RDES), 383-393. doi:10.1080/23322551.2020.1856304

Jackson, R., Patrick, P.S., & Miodownik, M. (2020). Functionally Graded 3D Printed Asphalt Composites. *Materials Letters: X* (7), 100047. doi:10.1016/j.mlblux.2020.100047

Liu, C., Medda, F. & Miodownik, M. (2021) Plastic Credit: A Consortium Blockchain based Plastic Recyclability System. *Journal of Waste Management* 121, 42-51. doi:10.1016/j.wasman.2020.11.045

Miodownik, M., Morris, R. & Pilkington, J. (2021) *Animate Materials - Perspective*. Royal society. royalsociety.org/-/media/policy/projects/animate-materials/animate-materials-report.pdf

Oldfrey, B., Tchorzewska, A., Jackson, R., Croysdale, M., Loureiro, R., Holloway, C., & Miodownik, M. (2021). Additive manufacturing techniques for smart prosthetic liners. Medical Engineering & Physics, 87, 45-55. doi:10.1016/j.medengphy.2020.11.006

Media Coverage

Newspapers and magazines

Aid budget to tackle NHS ventilators shortage in coronavirus crisis. *The Times*, March 2020.
Engineering giants in race to design new medical ventilator as NHS warns it needs an extra 20,000. *This is Money*, March 2020.
Fact check: is PPE causing an environmental pandemic? *The Week*, June 2020.
Join the Plastics Summer Challenge. *Waitrose Weekend*, July 2020.
Are face masks the new plastic pollution? Concerns grow over spikes in litter as people improperly dispose of used PPE. *MailOnline*, July 2020.
The new plastic bottle? How to dispose of face masks in an environmentally-safe way. *The Independent*, July 2020.
What kind of face mask best protects against coronavirus? *Guardian*, July 2020.
Ditch the gloves, buy a litter-picker, but don't carshare! How to be eco-friendly in a pandemic. *Guardian online*, July 2020.
Compostable Plastics Research Launch. *Gardeners World Magazine*, January 2021.
Progress on plastic choked by 100m discarded masks a week. Sunday Times, February 2021.
Big Compost Experiment. N*ew Scientist*, February 2021.

Performance
Ever After performance (online performance), 11 December 2020.

Television and Radio
UCL leads efforts to design and produce low-cost ventilator. *BBC World Service* (Science in Action), 19 March 2020.
Innovation Action initiative. *BBC World Service* (Science in Action), 1 May 2020.
How to Make - The Trainer. *BBC Four*, 2 April 2020.
The Kitchen Cabinet. *BBC Radio 4*, 4 April 2020.
How to Make - The Toothbrush. *BBC Four*, 9 April 2020.
How to Make – Headphones. *BBC Four*, 16 April 2020.
The Kitchen Cabinet. *BBC Radio 4*, 2 May 2020.
This Morning. *ITV*, 6 May 2020.
Cheltenham Science Festival. *BBC Points West,* 3 June 2020.
Face masks and plastic waste. *BBC Radio 4* (You and Yours), 13 July 2020.
Plastic waste and face masks. *ITV* (News), 14 July 2020.
Plastic waste and face masks. *Channel 5* (News), 15 July 2020.
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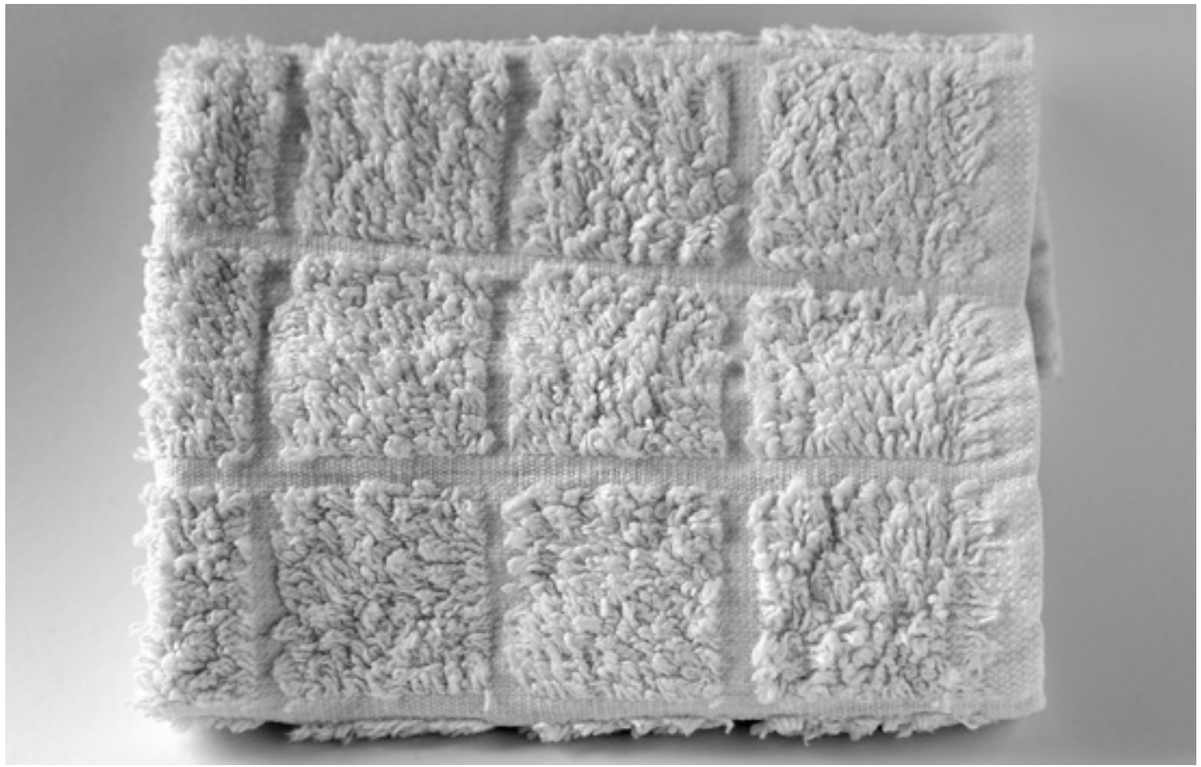
Big Compost Experiment/Webinar publicity, *BBC Radio 4* (*Inside Science), 19 November 2020.*
Pollution and coronavirus pandemic. Deutsche Welle (DW), 5 January 2021.
The Kitchen Cabinet. *BBC Radio 4*, 9 Jan 2021.
Facemask waste interview, *BBC Radio 4* , 16 February 2021.

Social Media Feeds

www.facebook.com/InstituteOfMaking

www.instagram.com/of_making

www.twitter.com/of_making



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Ellie Doney – PhD Student

George Walker – Makespace Assistant Technician

Helen Carnac – Makespace Technician (maternity cover)

Josie King – Makespace Technician (maternity cover)

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

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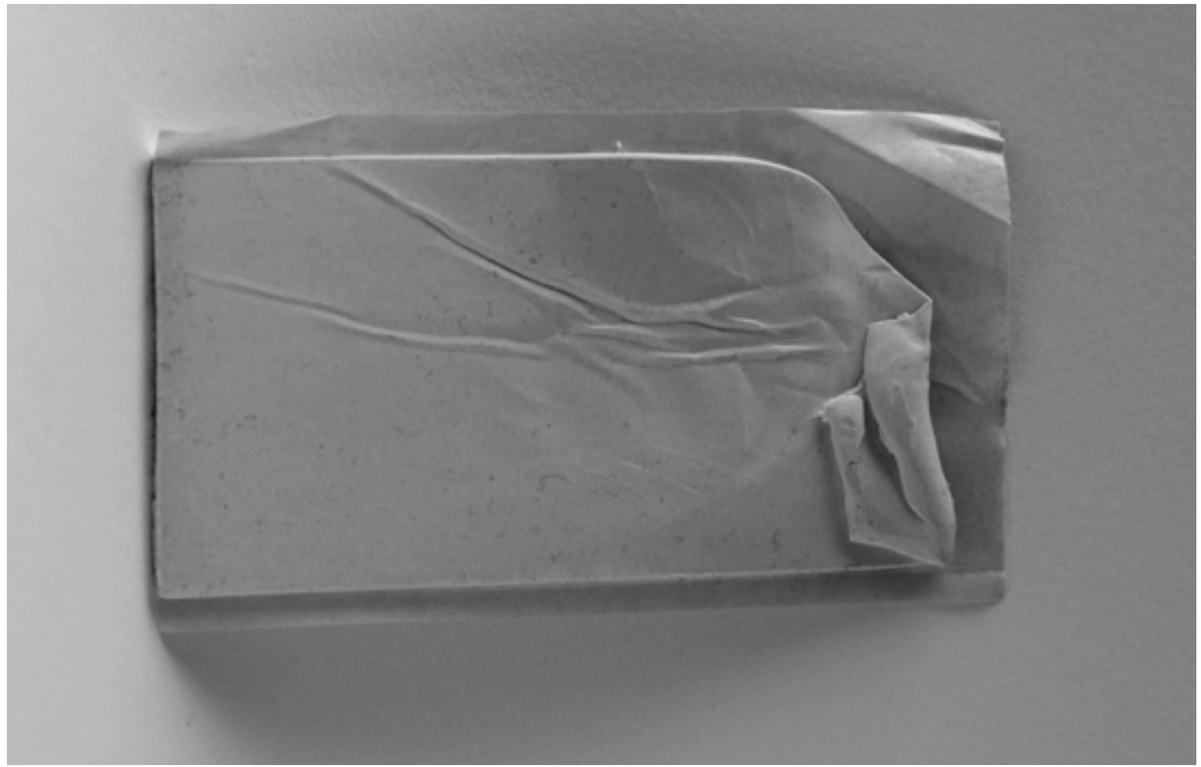

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