



# **First Year Report**

**Institute of Making, UCL, 2013-14**





## Why we do what we do...

*“In my experience, the Institute of Making checks all the boxes that a University Education can help to provide. It promotes interdisciplinary and intercultural understanding, imbues willing participants with a passion for learning and a sense of wonder at the world, and instills a sense of ‘can-do’ spirit at tackling challenges ahead.”*

(Heng Liang Lim, graduated Library & Information studies, 2013)





## **We are a very unusual research club...**

The Institute of Making opened within UCL Engineering on the 14<sup>th</sup> March 2013. Our aim is to champion making and materials, both as a multidisciplinary activity supporting teaching and research communities within UCL, but also as a place that encourages play and personal research and development 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 2616 members, of which 572 are staff and 2044 are students. A further breakdown of the member demographic is as follows: female (910), male (1164), no gender declaration (542), undergraduates (802), postgraduates (1165), academic staff (390), professional services staff (178). The membership encompasses a wide range of specialisms and interests from Art to Anthropology, Chemistry to Architecture, and Engineering to English Literature. Of those who declared an affiliation, 1466 members are from physical sciences, 550 are from arts and humanities, and 205 are from the social sciences.



## Doing is a different way of thinking...

A typical snapshot of activity at the Institute is as follows: a Computer Science Professor uses the laser cutter to repair a robot he uses for teaching; an English undergraduate uses the Materials Library for a coursework project on 'stickiness'; an Architecture undergraduate spends all week building a wind turbine, learning the electronics she needs from a fellow student who is making a watch; a Slade student learns how to 3D scan objects; a Physics PhD student uses one of the 3D printers to make a piece of equipment for his research; a one day research workshop on 'Repair' gathers together researchers from across UCL.





## **We specialise in multidisciplinary materials research...**

We have several grants underpinning our research programme, including one for a Materials Innovation Hub (EPSRC) and another for the EU Light.Touch.Matters project (EU FP7). Our in-house prototyping knowledge and facilities have made us ideal collaborators for a number of successful multidisciplinary research projects, and as a result we are co-investigators for the Wearable Assistive Materials project led by Professor Nick Tyler (EPSRC) and partners in the new Centre for Nature Inspired Engineering led by Professor Marc-Olivier Coppens (EPSRC).



## **Our events often get fully booked in seconds...**

Our events programme aims to do several things: to inspire our members and the public with regard to all things materials and making, to place us at the heart of the international making community, to introduce our members to new areas of interest, to help them acquire new skills, engage with experts in various fields of materials research and making, and gather together research collaborators. In 2013 we held 33 events: 14 masterclasses (Blacksmithing, Animatronics and Flintknapping, for example), 4 talks (Tim Hunkin and Tom Pellereau, for example), 6 research workshops (3D Manufacturing and Making Repairs, for example), 2 week-long events (Wood Week and Mould-Making Week), 7 public open days with a total attendance of approximately 3000, including a high representation from families and children, and 6 public talks and workshops similar to the members' masterclasses.



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

The Materials Library is a collection of some of the most wondrous materials on earth, gathered from sheds, labs, grottoes and repositories around the world. It is a resource, laboratory, studio, and playground for the curious and material-minded to get inspiration, conduct hands-on research, and get involved in interdisciplinary inquiry and innovation.





# We have a public profile...

The Institute of Making and its team have gained a public profile as a champion of making and materials, promoting it through social media (eg. Web, Twitter, Facebook) many newspaper articles (eg. Guardian, The Times, Wired Magazine) and TV and radio programmes (eg. ITV's This Morning, BBC2's Dara O'Briain's Science Club, BBC Radio 4's Any Questions).



## We are international...

The Institute of Making has an international reputation; we have given invited talks all around the world from Berlin to Beijing on interdisciplinary materials research and our other activities building a multidisciplinary research environment centered on making. We have hosted visits from international research organisations, universities and companies such as the Japanese manufacturing giant IHI.





## **We do commercial & policy stuff...**

Our profile has allowed us to influence policy makers, the national academies, and attract industrial collaborators (eg. ARUP, AIRBUS, ATKINS, Royal Academy of Engineering, Crafts Council), and inspire both current and future students and staff. We have had many visits from other institutions that wish to collaborate and many of these relationships are being actively developed.





The relationship between culture and materials is most obviously demonstrated in the naming of ages of civilisations after materials, such as the Stone Age, Bronze Age and Iron Age. The twentieth century is often referred to as the Silicon Age in reference to the materials breakthrough that gave rise to the computer, mobile phone and the internet. In the twentieth century, architects took new mass-produced sheet glass and combined it with structural steel to produce skyscrapers, inventing a new type of city life. Product and fashion designers learned to work with new plastics and transformed the home and fashion. Polymers were used to produce celluloid, ushering in the biggest change in visual culture for a thousand of years; cinema. The development of aluminium alloys and nickel superalloys by materials scientists allowed us to fly cheaply and changed the rate at which cultures collided. The biomechanics community developed medical and dental ceramics, which allowed us to rebuild ourselves and change the social context of disability and age. As the term plastic surgery itself implies, materials are often the key to new treatments used to repair a patient's faculties (hip replacements) or to enhance their features (silicone implants for breast modification). Thus materials, and the skilled community that make them into objects, products and technologies, are a defining part of society, with far-reaching historical, cultural and economic effects (Miodownik 2013).

Despite their co-dependence, the materials research and making communities are rarely brought together in universities. The scientists involved in designing new materials (physicists, chemists, materials scientists) are separated from those who study the cultural and environmental significance and impact of materials (humanities scholars and social scientists), and are often further distanced from those who do the making (medics, engineers,



architects, designers, artists) who are themselves separated from each other by disciplinary boundaries. This has a detrimental effect on the research and teaching being carried out in universities and its relevance to the wider world, since many of the important issues of contemporary society, such as global health, wellbeing, security and sustainability, require a multidisciplinary approach in order to arrive at solutions that benefit society as a whole, and not just limited sectors of the economy or community. In creating the Institute of Making we have sought to address this issue by creating a place that does not belong solely to one academic discipline but is open to them all, and encourages conversations between them. Moreover the Institute focuses on the making of physical objects through the transformation of materials, and champions this as a complementary alternative to traditional methods of scholarship.

We opened our doors in a converted loading bay of UCL Engineering on the 14<sup>th</sup> March 2013, offering an open workshop called the Makespace complete with tools and equipment, and located alongside one of the best Materials Library in the world. Anyone at UCL can join, whether staff or student, and our member demographic reflects this openness. There was clearly a huge unmet need for this type of facility because after only one year in operation we have 2616 members, of which 572 are staff and 2044 are students. A further breakdown of the member demographic is as follows: female (910), male (1164), no gender declaration (542), undergraduates (802), postgraduates (1165), academic staff (390), professional services staff (178). The membership encompasses a wide range of specialisms and interests from Art to Anthropology, Chemistry to Architecture, and Engineering to English Literature. Of those who declared, 1466 members are from physical sciences,

550 are from arts and humanities, and 205 are from the social sciences. For a full breakdown of the statistics of membership, see pages 218-221 in the Appendix.

We are open Tuesday-Friday for members, with Monday reserved for Institute of Making research workshops and for maintenance. With well over two thousand members, the Institute is full to capacity most days. Once the members have had a safety induction then they can come and use the Makespace workshop and the Materials Library for their own projects or to collaborate with other members. We are keen to ensure that there is no hierarchy of activities in the Institute: our role is as much to support someone learning the fundamentals as it is to support those interested in the more contemporary manufacturing techniques like 3D printing or laser cutting. Similarly the Materials Library does not focus solely on new materials, but contains a broad selection of the range of substances in existence. Mundane, everyday materials are put on an equal footing with their more unusual counterparts, allowing users to build an appreciation of the complexity and interconnectedness of the made world. Each user brings their own disciplinary lens to the collection, allowing for the same material to be seen from multiple perspectives. For instance, our enormous chunk of bark from the cork tree might inspire a biologist to consider the structure of natural foams, a chemist may be interested in the process of gas exchange through the material, a material scientist may want to explore the production of natural and synthetic corks, whereas for an anthropologist, economist or historian it might prompt a discussion about the democratisation of wine consumption in the seventeenth century, or a discussion of the sustainability of the cork industry. Crucially, and this is what makes the Institute of Making unique in



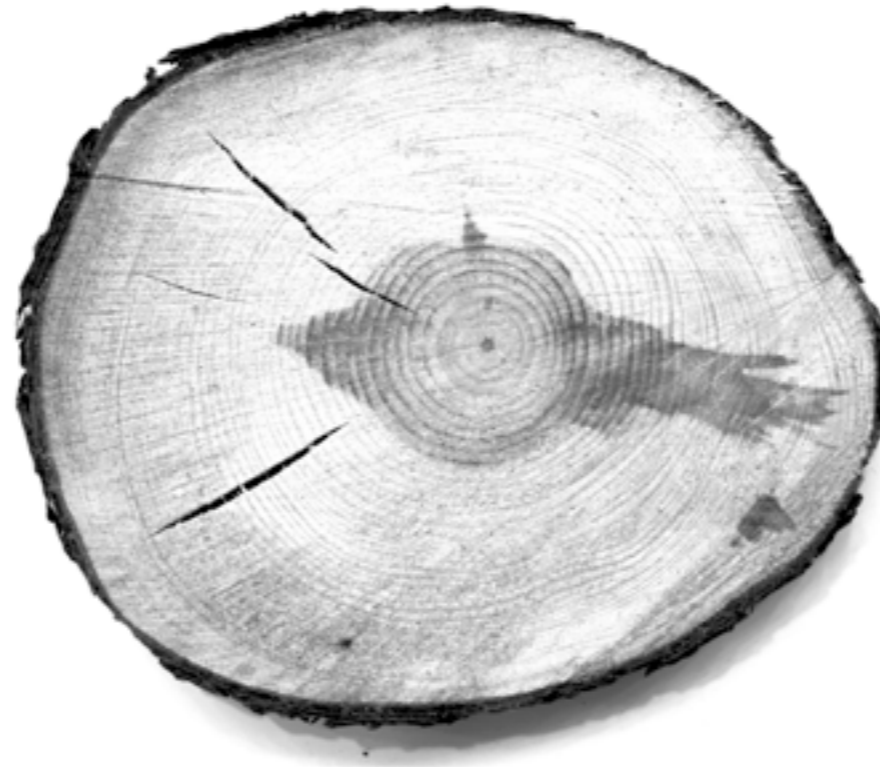
the world, we encourage users to make the transition from contemplating a material sample in the Materials Library to understanding it in a different way by making something with it in the Makespace. In this crucial moment, a practical hands-on appreciation of different material processes is gained, and new modes of enquiry open up.

We encourage play with materials as a way of engaging with and learning about their affordances. As anthropologist Tim Ingold (2007, 2012) has argued, this sort of sensory, phenomenological and processual engagement allows for a different sort of understanding of the material world. Ingold prescribes actual, physical engagement with materials in practice; “sawing logs, building a wall, knapping a stone or rowing a boat” (2007 p.3) as a way of enquiring into the properties, “transformations and affordances” of materials (2007 p.3). A hands-on engagement with materials and processes can lend a different kind of understanding of their behavioural qualities than desk-based rumination. At the Institute of Making, we do not consider these physical attributes “in the abstract” or trace them back to “some natural state of inherently bundled attributes” (Miller 2007 p.24), but instead promote hands-on engagement as a way of drawing our attention to those materials that, often silently, surround us, to learn about their performative properties.

For this reason, the Materials Library is designed to be aesthetically appealing and to be as irresistible as a sweet shop, encouraging sensory engagement. However, many of our users’ needs are more functional. They might want to mend something and simply require access to the right tools and equipment. We support this, because our philosophy is that even the most trivial act of making is something of value, both in its own right but also

because it provides the impetus to get more deeply involved in understanding materials. Some users may need to make something as part of an academic programme, be it a solar cell, a wind turbine, a teapot, or a pair of trousers. Other users may want to recreate an object from one of the UCL museums to use as a teaching tool, and so need help to learn how to 3D scan objects and print them out again on the 3D printer. A PhD student may need to create a piece of equipment for their research lab to enable them to count cells in their cancer research experiments. Someone else may just be interested in understanding the affordances of objects, and so wants to spend a week playing with making techniques. A Computer Science Professor may need to use the laser cutter to repair a robot he uses for teaching. All these activities happen in the Institute, and many more besides. What links them together is the need or desire to manipulate materials and transform them into objects. Our members need tools and equipment, but they also need a supportive environment to learn practical skills, and we provide that.

Hands-on learning differs from, and is complementary to, academic scholarship for a number of reasons. Firstly, in the making process you get immediate feedback from the materials you are using, and it quickly becomes apparent whether you understand a process or not, because lack of understanding stops you from progressing. Success requires patience, perseverance and discipline. If you want to push the boundaries of what is currently possible you need to be both creative and have a very good grasp of theory, because without that you will have to proceed by trial and error alone. This is true whether you are trying to develop a new glaze for a ceramic, or a new electrically-conductive ink for a piece of electronics. This is, of course, why the theory of materials developed in the first place. However what has



been lost due to specialisation is the two-way link between material skills and theoretical knowledge, and this is why having the Institute positioned at the heart of the UCL academic community is so important. The production of sophisticated prototypes of new technology is ultimately a demonstration of a deep understanding of both the theory and practice of material culture: practical skills push theoretical understanding, and vice versa. This is one of the reasons why the Institute has become so popular: it is a research tool every bit as important as a library or a super-computer.

A by-product of creating a physical space that is shared by people with different disciplinary backgrounds is that a multidisciplinary community has formed. What our members share is not just the space but the materials and the tools, and this leads to both tensions and benefits. The benefits are that members sharing a common passion are teaching each other; not just techniques, but disciplinary approaches to making and materials. The membership itself is highly expert and so there is a great deal of skill and knowledge sharing, which builds trust and enables multidisciplinary groups to form. A good example of this is the LEGO2NANO project that came about from members of the London Centre for Nanotechnology getting together with members of the Institute of Making to form a team that went to Beijing to build an atomic force microscope from LEGO. Other impressive multidisciplinary groups have emerged around the UCLoo project and the Darwin (or) Bust competition. But we should not give the impression that all these activities emerge autonomously by the fact of the Institute being a physical space open to members. There are limited resources and space, and so to ensure fair use, all the activities of the Institute need to be curated and managed. This is done by the Institute of Making team, who, first and



foremost, make sure the facility and activities are safe and well-maintained. They mentor and train users in different materials processes and techniques. They themselves are a finite resource and they are definitely stretched with more than 2000 members requiring support. For examples of the kind of objects that have emerged from the Institute in the last twelve months, see the Members section, pages 43-61.

The Institute of Making team undertakes its own research programme. We specialise in developing innovative multidisciplinary research methods for exploring the many different facets of materials, drawing together approaches from design research and materials research with anthropological techniques and manufacturing expertise. For instance we undertook a systematic investigation of the taste of materials, exploring both the chemistry and psychophysics of the phenomenon, expressing knowledge gained both through the traditional method of academic publications, but also by creating a physical set of different-tasting spoons, and in one case a restaurant menu utilising the spoons research to create a new dining experience (Laughlin 2010; Laughlin et al. 2011). This research is ongoing, and has expanded into investigations of the feel of materials, the perceived healthiness of materials, and the antimicrobial potential of surfaces in care environments. We have a Bridging The Gaps grant to bring together other teams of researchers at UCL (EPSRC EP/I00159X/2) to use similar methodologies, while our involvement in the EU Light.Touch.Matters project (FP7-NMP-2012-SME-6) extends our capabilities. Our in-house prototyping knowledge and facilities have made us ideal collaborators for a number of successful multidisciplinary research projects: as a result we are co-investigators for the Wearable Assistive Materials project led by Professor Nick Tyler (EPSRC EP/K020323/1) and



partners in the new Centre for Nature Inspired Engineering led by Professor Marc-Olivier Coppens (EPSRC EP/K038656/1). For more information about how we operate as an innovative materials node in the UCL research landscape see pages 63-77 of this report.

Our Events and Research Workshops perhaps do more than anything to open up research opportunities to our members. Their role is to inspire our members to explore new areas of interest, acquire new skills, engage with experts in various fields of materials research and making practice, and to gather together research collaborators. Without these, there is an understandable tendency for users to stick with what they know and work in teams with familiar faces. In the first year of operation we held 33 events: 14 masterclasses (Blacksmithing, Animatronics and Flintknapping, for example), 4 talks (Tim Hunkin and Tom Pellereau, for example), 6 research workshops (3D Manufacturing and Making Repairs, for example), 2 week-long events (Wood Week and Mould-Making Week), 7 public open days and 6 public masterclasses. Our programme is extremely popular, with some events selling out in less than five minutes of being released and with extensive waiting lists forming. For example, 1156 people requested to attend *Roja Dove: An Olfactory Experience*, with 40 spaces available. For more information on these see the Events section, pages 105-161.

Because the Institute gives equal status and access to students and staff alike, we have been remarkably successful in embedding undergraduates into the ethos and practice of research. We organise research workshops and seminars for staff and students on topics like ‘3D Manufacturing’. We have a Small Research Grant award scheme, which recently funded a

mix of staff- and student-led interdisciplinary projects exploring topics like boron-doped diamond antimicrobial materials (Chemistry and Surgery), consumer perceptions and environmental effects of recycled polyester fleeces (Anthropology and Chemical Engineering), the relationship between sensory engagement with food and language used to describe it (Slade and SELCS) and an ‘e-noses’ air quality citizen science project (Chemistry and Civil Engineering). This scheme also supports interdisciplinary research and teaching workshops run by other materials and making groups at UCL, including the UCLoo Makeathon (Bartlett and Civil Engineering) and the forthcoming Material Histories seminar series (Museums and Public Engagement, History and STS). We also have a Summer Studentship scheme, which allows undergraduate students to get involved in interdisciplinary materials and making research projects over the summer. Recent examples include the development and testing of vapour-deposited nanomaterials for microreactors (Chemistry and Chemical Engineering), the development of a spectral library of emissivity for building materials (Geography and Mechanical Engineering), and a comparative ethnographic study of materials used in religious and atheist spaces (Bartlett and Anthropology). For students who want to develop their own research but lack the money to buy particular materials we offer a Materials Bursary scheme to support them. These research activities attract undergraduates, postgraduates and members of staff to the Makespace that are not the obvious ‘hackspace’ users, and have underpinned a new and growing Materials & Society research theme at UCL. For more information about these activities see pages 63-103.

At the heart of the Institute is our Material Library, which contains more than a thousand material samples. Some are exotic, such as aerogel, uranium



glass or self-healing concrete, but the vast majority are the materials used in everyday practice and in manufacturing around the world. Our Institute also contains a fully kitted-out workshop containing a laser cutter, milling machine, kiln, kitchen, 3D printer, sewing machines etc. We do not have every tool, but we aim to provide a representative sample of different making techniques. Our aim is to create a workshop where you use the materials discovered in the library to prototype ideas or explore how they behave when processed in different ways to better understand their affordances. Together, we hope these two resources and the connection between them create the right environment where complex problems that sit outside the traditional boundaries of any one discipline can be addressed. The hands-on testing of existing material objects and processes, an exploration of the Materials Library, and the construction of prototypes all become part of the thinking process. This is problem-solving by doing: not because theory is irrelevant to tackling complex problems, but because making stuff stimulates a different set of ideas and a creative approach. For more information about our Materials Library and the tools in our Makespace see pages 163-175.

Materials have an immense social significance that goes far beyond their functional or economic value. The cultural and historical associations of materials are embedded in the fabric of our world and cannot be extracted from their technical properties. Metals tend to be very tough and strong, so it makes sense to build machines with them, but the reliability and resilience we associate with these materials is at least partly the result of their social history. Metals are often described in both technical and popular literature using terms like homogenous, heavy, hard, cold, powerful, indomitable and dominant. They are often associated with solidity, stability, masculinity,

strength, power and industry in the popular imagination; they have a reputation for being “denser, stronger and more malleable than non-metallic elements” (Street and Alexander 1994 p.6).

However, this conception of metals is in no small part due to the ways in which we have historically put them to use (Wilkes 2014). Many of the pure metals are too soft, brittle or reactive to be put to any practical use. Prior to the accidental discovery of bronze, copper was the most widespread metal, but it was still too soft to hold up to aggressive use as weaponry or tools, and quickly lost its shape, colour and sheen. For example, copper chisels were used to build the pyramids of Egypt, but although they were an advance on existing technologies, they would not have been the ideal cutting material since the chisels would have needed to be sharpened every few hammer blows to be useful (Miodownik 2013 pp.19-20). The hardening effects of naturally-occurring impurities in copper ores were first taken advantage of as far back as the 4<sup>th</sup> millennium BC in a number of ancient civilisations, and the resulting metal, bronze, is considered to have been so significant in the development of more complex societies that a whole period of human history is named after it.

Much of mankind’s lengthy relationship with metals, from the Copper Age, Bronze Age and Iron Age to the present day, has therefore been directed at making metals stronger and stronger by alloying (Miodownik 2013 p.21), and this shaping and modifying of materials is part of who we are. The search for strength in metals is part of the reason why we see them as durable and inert, but it also has to do with our reliance on the ferrous metals. Almost all of the modern metals that we come into immediate contact with on a daily basis are



relatively resistant to impact, hard and inert. Steel and iron, those stalwarts of the Industrial Revolution, which made possible flight and railway travel, are still the most widely used materials on the planet and are familiar for their use in applications that require inertness and structural strength, like bridges, railway tracks and cutlery (Wilkes 2014).

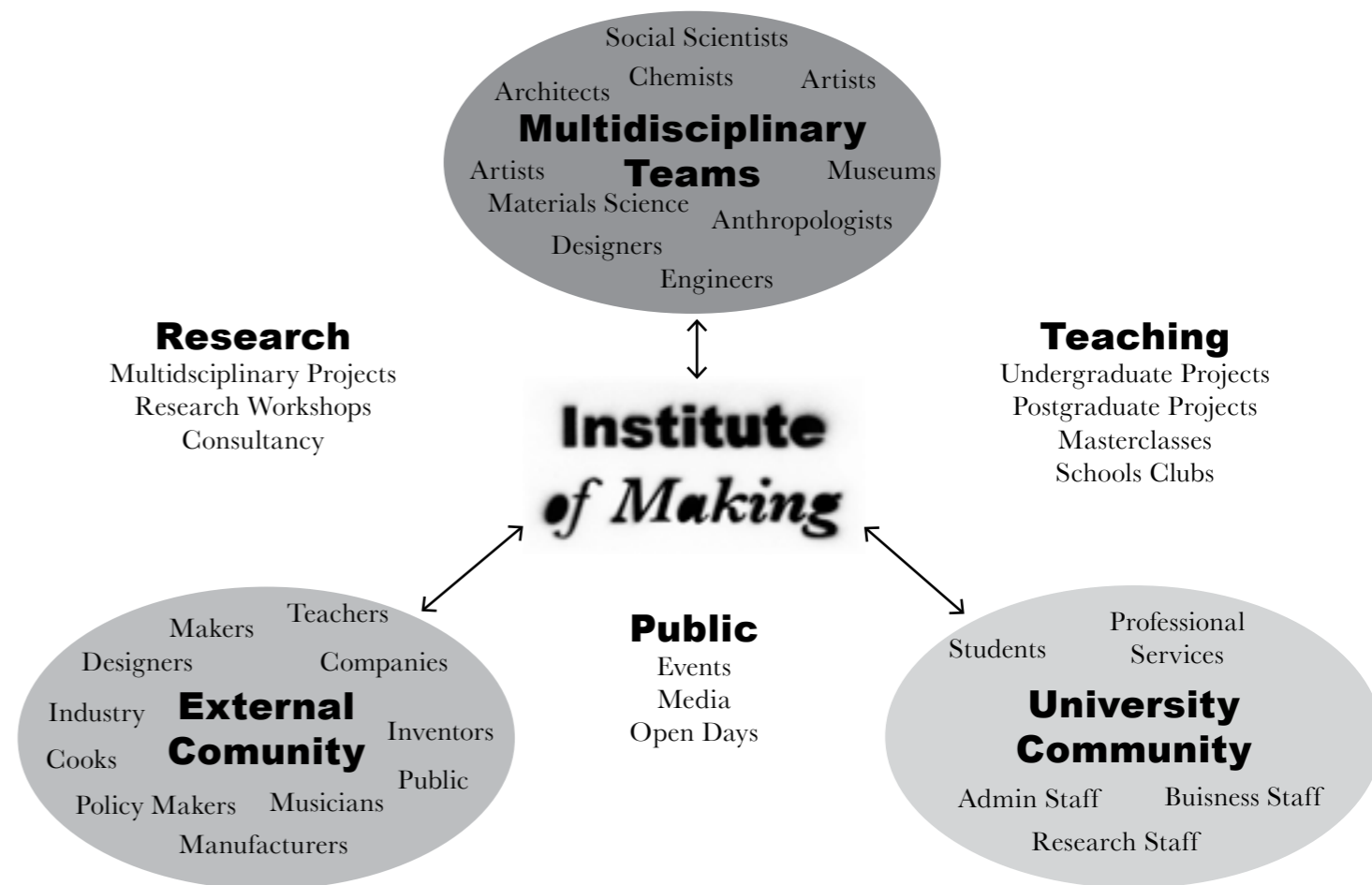
As a result of these historical associations and characteristics, metals are consciously used by designers to lend certain qualities to their products. The metallic look is part of the language of industrial design: it speaks of the industrial revolution that first gave us mass transport and the machine age. Of course designers and architects consciously use these associations to create clothes, products and buildings that we like, that we identify with, that we want to surround ourselves with, and in turn we choose objects, and materials, that reflect the type of person we want to be, aspire to be, or are forced to be. However, materials are much more than a ‘language’ that designers and consumers use to speak about themselves. They make up everything around us and their power lies precisely in this ubiquity and their capacity to perform and inform our behavior in a way that “always exceeds language” (Lloyd Thomas 2007 p. 8). Geographer Gay Hawkins, for example, demonstrates that the “material affordances” of PET bottles, like their “lightness, strength and physical lustre... translucency and clarity” play an important role in their uses and identities (2011 p.545). Our work explores this relationship between the historical and cultural associations of materials, the ways in which they are used, and their performativity (Laughlin 2010).

In recent years we have seen increasing consumer demand for ethically produced and environmentally sound products to reflect their principles.

The material components of every product can have an enormous effect on the environmental, social and economic impacts of a product, so understanding the biographies of materials becomes increasingly important.

This social, environmental and economic importance of materials is why we take public engagement so seriously. We champion the importance of materials and making and we constantly seek to engage with policy makers and industry to further understand how what we learn as we evolve can have maximum external relevance. The Institute of Making and its team have gained an international profile as a champion of making and materials, promoting it through social media (eg. Web, Twitter, Facebook) many newspaper articles (eg. Guardian, The Times, Wired Magazine) and TV and radio programmes (eg. ITV's This Morning, BBC2's Dara O'Briain's Science Club, BBC Radio 4's Question Time). For more information about our Public Engagement see pages 105-161.

Our mission is to provide UCL staff and students with a creative home in which to innovate, contemplate and understand all aspects of materials and making. Although we do write academic publications (see Appendix, pages 202-204), we consider our main outputs to be the materials, objects and prototypes that emerge from the Institute. This report introduces a few of these (see pages 43-61) but cannot be comprehensive because of the huge number and variety of things that get made by our members. Our intention in this report is to give a representative snapshot of activities at the Institute of Making in its first year of operation.







*“I am now working as an intern in Bayer, learning how to do government permitting certificate and process control technology. I came to realise that the most wonderful time I had at UCL was learning from you in the Institute of Making; thinking and making all day. This is the Engineering spirit that you taught me.”*

(Jia Li, MSc Mechanical Engineering, 2013)

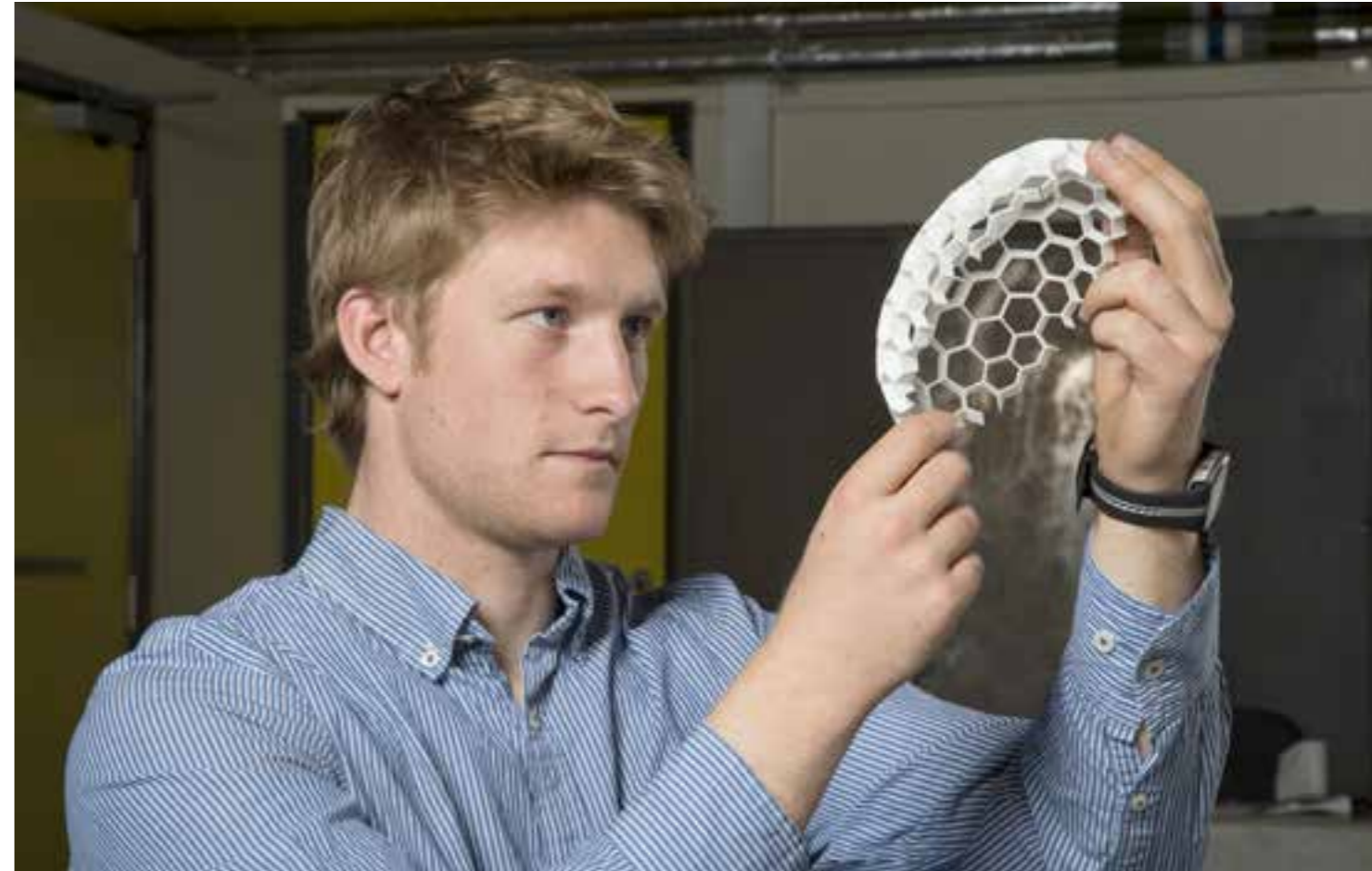
We currently have 2616 members, of which 572 are staff and 2044 are students. A further breakdown of the member demographic is as follows: female (910), male (1164), no gender declaration (542), undergraduates (802), postgraduates (1165), academic staff (390), professional services staff (178). The membership encompasses a wide range of specialisms and interests from Art to Anthropology, Chemistry to Architecture, and Engineering to English Literature. Of those who declared an affiliation, 1466 members are from physical sciences, 550 are from arts and humanities, and 205 are from the social sciences.

Our aim is to create a workshop in which members have full use of the tools and equipment to do their projects, but at the same time create an atmosphere of collaboration, courtesy and enquiry. We offer materials bursaries for the student members (through the support of alumni donors) precisely because we want to encourage experimentation and practical learning unfettered by the limitations of materials costs. Access to the equipment is free for all (although we do charge basic material costs for repeated use of the most expensive processes). At its best the Institute is a place where people help each other, teach each other and inspire each other.



## **James Cook (Mechanical Engineering Undergraduate)**

As part of his third year project James is developing a technology for 3D printing bespoke bicycle helmets. The idea is that helmets of the future will be made-to-measure using 3D scans of the customer's head, and then printed to order. The technology James is developing is based on lightweight honeycomb structures developed for the aerospace industry. These are strong, stiff, and light but can easily crumple to absorb impact forces. By 3D printing these structures, not only does the helmet become tailored to the user, but it can be customised for them too, allowing them to optimise comfort, weight, breathability, and most crucially the protection against different impact modes. Cycle head injuries typically involve not just direct forces to the skull but also rotational forces too. These rotational forces can cause severe brain bruising and permanent damage, but are not mitigated against in current EPS bicycle helmets. James' design allows for rotational elements within the helmet honeycomb mechanism to be incorporated to absorb these rotational forces. Such mechanisms are expensive to incorporate in normal bicycle helmets (eg. MIPS), but with 3D printing this complexity comes for free. It became clear during this project that there is a commercial case for these helmets. James' prototypes are already attracting attention from the venture capital world; he has found a business partner, and with help from UCL Advances he has started a company called Bentham 3D and has won a UCL Bright Ideas Award of £15,000 to develop the business.



## **Bernadette Devilat (Architecture PhD Student)**

*“At the Institute of Making you can really explore materials and making, not just finished objects. It allows real research and enquiry into process, allowing you to discover unexpected outcomes and have a much more whole knowledge. The space to play around has been the nicest part of my PhD. The bursary money was great but it was just an excuse to get going. The staff at the Institute’s willingness to help is the best thing.”*

(Bernadette Devilat, Architecture PhD Student, 2014)

Bernadette’s project involved making twelve 3D printed models based on the 3D laser scans she made in a Chilean village as part of her PhD fieldwork. The village, San Lorenzo de Tarapacá, was affected by the 2005 earthquake. Despite being officially reconstructed by the Government, most of it is still in ruins, making this detailed record very important. Bernadette proved that it is possible to obtain accurate representations using 3D laser scanning to create material models, bringing to reality complex shapes; something that is very important for the design of reconstruction and repair projects. This relatively easy process could open a completely new understanding of design and reconstruction in earthquake-affected areas.

Bernadette learnt the basics of scanning at the Institute on our NextEngine, and then went on to work with ScanLab at the Bartlett before making the final scans in Chile. Having never done any Computer-Aided Design before, she put the scans through four different pieces of software, before



learning how to print them with our Makerbot printers. Learning how the machines worked made it possible to get the best out of them, and having the time and money to experiment equipped her with the skills to fix the geometry on-screen and print the scans far more accurately. She also learnt how to experiment here, rather than handing over her data to a technician and receiving a finished project. As a result, her project was looser than a technician-controlled one, with no guarantees the data would even print. Bernadette now feels like she could take these skills anywhere. She is also a recipient of our Materials Bursary, which coincided with an invitation to present her work in an exhibition.

Attending our 3D Manufacturing research workshop was pivotal for Bernadette as she was able to solve scan-to-print problems in discussions with researchers from other fields. Our member supervisor Tom also advised her on geometry, and mended the open source Ultimaker 3D printer, which printed one of her best models.

Bernadette’s supervisor was so pleased with the models that he could not believe she had printed them all herself. At the end of the year she will go back to Chile and take the models with her. When she has written up the PhD she would like to explore laser cut and 3D printed jewellery.



## Samir (Sam) Aoudjane (Engineering PhD Student)

*“[The Institute of Making is] a space to think. Learning to be self-sufficient is cool, and learning by doing gives you the confidence to build on your knowledge quickly. The idea of sharing skills is fundamental - someone showed me, and I want to pay it forward. I helped the technicians out with making machine parts, and really feel a part of something.”*

(Samir Aoudjane, Engineering PhD Student, 2014)

Sam's first projects in the Makerspace were work-related. He made microscope mounts by learning to mill aluminium plates and mount glass capillary tubes on them for analysis. This equipment is normally very expensive to buy and you cannot specify size. He then went on to create his own optical bench in a box at the London Centre for Nanotechnology. The lasers need to be contained, so he made a bespoke 1.5m<sup>3</sup> steel box lined with blackout fabric. The box is magnetic to allow for cable management. He also soldered up a magnetic safety relay switch for the door. He then bolted it to his bench and installed £30,000 worth of optics inside it. This bespoke bench is much cheaper and more flexible than anything he could buy. As part of making the optical bench, Sam learned entirely new skills, including tapping threads, angle grinding, priming and painting non-reflective paint, tailoring, eyeleting and gluing textiles. He has since learnt to use the sewing machines so will be upgrading the blackout fabric soon.



After spotting other members on the potters' wheel, Sam also decided to make an ashtray for his flat. He made a second, better ashtray after a stressful day, which he found very calming. Sam has attended masterclasses on neon tube making, flintknapping and the introduction to Arduino. Despite knowing basic programming, this new knowledge was of great advantage out in China as part of the LEGO2NANO project where he was on the winning team.

Sam has either helped or been helped by other members every time he has visited the workshop. He joined a focus group for a member citizen science project that he saw advertised on our noticeboard, and really feels like he can be useful there. He said he feels that this is what university should be like. He has also been showing people how to use a multimeter; with just that knowledge they can find where faults occur in a circuit and fix their problem.

In the future, Sam would really like to learn how to weld, more advanced sewing and ceramics techniques, and to use the lathe.

## Tom Catling (Astrophysics PhD Student)

*“[The best thing about the Makespace is] meeting people and discovering what they are up to. I think making stuff is fun but a bit pointless if you can’t share it. My own lab is a bit empty; here people are always working on stuff – it is interesting, inspiring and sociable. I can learn to use the mill and lathe here; equipment that is usually out of bounds to students. I have spoken to people at the open days who have been swayed to come to UCL because of the Institute of Making.”*

(Tom Catling, Astrophysics PhD Student, 2014)

Tom has been involved in a number of projects. He made his own 3D printer, and although he is studying instrumentation, he had never built a machine before. He is now on his fourth generation of the printer, having made three iterations of it before he perfected the final machine. Tom has also made a brass pen on the lathe for his Dad, who is a retired engineer. He recently made a metre-long tin whistle with a 3D printed mouthpiece, and has started a band at UCL. He bought an old lathe, and is using a bit of money from our Materials Bursaries scheme to refurbish it and machine new parts. Right now he is cutting up a meteorite and etching it to reveal the crystalline structure inside as a wedding present.

Tom has spent a great deal of time here learning and refining skills; he has done masterclasses in knife making, spoon making and animatronics. Tom is always passing on what he has learnt; he is one of our member



supervisors, and regularly runs tool inductions and assists our technicians. Everybody talks to Tom if they spend time here; he is so friendly, helpful and knowledgeable. He is a great example of the spirit we have helped to create. People recognise him from inductions and feel comfortable asking his advice as a peer. From his work in the space he has noticed that more people are trying electronics recently and is helping us set up more inductions for this side of our activity.

Tom is also involved in the Darwin’s Toolbox project – an open source biotechnology lab-in-a-box collaboration that has become very successful. He got involved by answering a post on our Makespace Facebook group. The Darwin’s Toolbox team have won several prizes and are applying for a loan to take the project further, travelling to Ghana this year to test its effectiveness in different environments.



## Will Usher (Energy Institute PhD Student)

*“Being in the space and working with your hands helps with not going crazy as a PhD student. People need an outlet for making in their lives, now that the culture of renting has meant fewer DIY projects, and no garden sheds to tinker in.”*

(Will Usher, Energy Institute PhD Student, 2014)

Will is into wood. He had never worked with it before but came along during our wood week and was very inspired by green woodworker Jim Steele. His first project was making a very precisely measured plywood box. He learned more by comparing his controlled method to Jim’s practice where everything is measured by experience, by eye and by thumb. It has now become a minor obsession and he started with a series of stackable boxes from plywood, each one better than the next, moving onto a set of “wonky man shelves”, and an oak bedside table.

Will is enthusiastic about sustainability and natural resources, and his research made him think about working with wood. It chimes with his environmental beliefs. He wants products and objects to last and sees disposability as false economy.

Before the Institute of Making opened Will followed MIT’s Fab Lab movement and always wondered why there was not one in London. He thought about starting one but we came along at the right time. His Dad had



a shed where he messed around when he was a kid, but here he had to learn woodworking from the beginning. Our technician Rich taught him about hand tools, and how to use power tools like the router and circular saw. He then took to YouTube and the advice of online woodworking legends for specific tips, and came in regularly to practice and learn from his mistakes. He uses Google sketch-up to model his ideas in 3D, and finds that going through a virtual making process and solving problems is useful.

Will’s experience at the Institute inspired him to found PL(A)YWOOD, an open woodworking group based at the London Hackspace. It has blossomed into an evening group of fifty people including retirees, day workers and people with specific projects, with an even split between women and men. They have new members every week to learn the tooling and safety, then people can make whenever they want. They purchased tools through a member’s fund, and also received donations, including from charity Tools for Self Reliance and are slowly building experience and the capacity to take on more adventurous and skilled projects. Will also has plans to help us devise and lead further woodworking inductions here.

Will has just bought a narrowboat, so in the future he will be working his way through a full refurbishment. He also has some funds from our Materials Bursary to explore a variety of different wood finishes, which will be made up into a board and used as a reference tool for our members. After that, he would like to explore laser cut marquetry and start using Formica.

## Yva Jung (Slade PhD Student)

*“Understanding feeds imagination. When I learn how to do something, that in itself is a tool – now I can imagine more. It’s like with cooking; tasting a new ingredient, you can imagine new things to cook, new flavours that go together.”*

(Yva Jung, Slade PhD Student, 2013)

Yva first came into the Makespace to make a large-scale canvas screen on a frame for a projected photographic installation at the Slade. After working with our technician Rich, and learning the basics of wood construction, she went on to create a much bigger three-part projector screen out of plywood to present her PhD upgrade. Before she came here, Yva found making difficult; she had a fear of workshops, of not knowing how to make stuff and of feeling stupid.

Rich made it sound easy. He was patient with her ideas even though she felt her language skills were not perfect. She found the Makespace to be a safe environment to experiment, and learnt that is is ok, even useful, to make mistakes. Yva and Rich worked together to design solid and safe constructions, and making now does not seem so intimidating.

Yva’s work was selected for the CAFAM Beijing Biennale and she made a number of wooden “suitcases for suitcases” to show there. She went on to work with an architect to design a vast tower and walkway for the Biennale,



which she had built by a construction company in China. She feels she never would have had the confidence to design something like this if she had not got to know the material by making her own work. Right from the induction to the Institute of Making it is clear that you can come to get advice on materials and making, and feel much more involved in the whole process. When you are making an artwork, it is emotional and personal, and it is so important to feel like you are realising what is in your head.

Working with wood and joinery techniques has given Yva an understanding of how materials really work and how to use their strength to construct. Having got to know hard materials, Yva now wants to explore soft materials like ceramics; using clay to fluidly sketch, improvise and do 3D ‘drawing’. She is already concerned about leaving, and what she will do without the Institute of Making: *“like jumping out of a plane without a parachute...”*

## **Mark Handley (Computer Science Professor)**

Mark made colourful new cases for the robots he uses regularly for teaching. They each house a raspberry Pi and a computer display. The original cases were getting battered and broken and these new ones are far more robust. He laser cut the box sides and glued it all together with acrylic weld and bolted them on. Indestructible! Plus they are all so colourful it helps people to distinguish them in a race.

As a personal project, Mark has designed and made an Internet radio, with a laser cut and stained ply panel and a smoked acrylic display. It has an Arduino controller that connects the knobs and dials to internet radio. Mark has also started making a large robot. It is a work in progress, but he has made the torso, legs and sensor mounts from cut acrylic and slotted wheel covers to detect how fast the robot moves. Mark has also been on a flintknapping masterclass and the 3D print induction.

Mark has also run Arduino and robotics sessions with our members which were a great success and we will be doing them again next year. These sessions were attended by a really surprising range of people from every faculty. These workshops teach the skills in a very hands-on way by starting with a ready-made example of something that works, then learning from that rather than starting from the basic principles. Mark believes that if you start with a project rather than a set of principles, people can build on



that in a more creative way. It is an effective approach, as by the end of the session, members from a real variety of disciplines seemed to get the essence of programming. Mark has also run outreach sessions for teenagers, covering skills as diverse as electronics, software programming, basic construction with glues and rubber bands, engineering design and using the laser cutter.

Mark is often in the space, talking to lots of our members, and is really looking forward to getting people working together to contribute their different skills on 'robot week'. For him, these projects are all about inspiring ideas in people and opening people's eyes to new ways of working, and the possibilities for collaboration. Sometimes even seeing other people's projects can be inspirational and it is often how people self-teach now, from videos on the Internet, learning from others' mistakes.



## James Moreland (Marine Engineering MSc Student)

James saw a poster in one of the lifts advertising the very first Makespace meeting held in Engineering Cafe, before the space was properly open.

*“We did pewter casting and I was amazed that you could make something so delicate by casting metal in a fish bone. It gave me an idea... I decided to make an engagement ring from 18 carat gold, diamonds and an emerald, and propose to my girlfriend. She said yes!”*

(James Moreland, Marine Engineering MSc Student, 2014)

Rich talked him through the process, and rather than casting the ring James decided to solder and construct it. James was shown all the equipment and the techniques, and was left to put the knowledge into practice. He learnt to shape the gold, solder it, make the setting for the jewels and polish it all up. Emeralds are so fragile that jewel traders will not insure them, so the setting had to be very accurate. He ended up getting a professional to set the jewel so he did not damage it and it would last. He really did not think he would actually be good enough to finish the ring but Rich made it seem easy to achieve; not out of the reach of the average person.

James is now making both the wedding rings; he has bought all the tools and can do goldsmithing on the kitchen table. It has started a proper hobby for him now.



James commented that he likes that it is not just engineers and not only students that use the space, but a really interesting mix of people. Everyone is so enthusiastic about what they are doing and that they have found somewhere to do it. Even if members are busy, they can pop in and do a bit of tinkering on a lunch break. Doing stuff for yourself is sometimes what you need to de-stress and build your confidence.





*“I joined UCL in 2012 and was extremely excited to discover the Institute of Making. The Institute is an invaluable resource not only because it provides unique facilities for creative practices and working with materials in UCL, but also because in doing so, it encourages innovative conversations and entirely novel directions for academic research. The Institute of Making has quickly proven itself to be an extremely energetic and dynamic hub for community-building, where scholars, artists, and practitioners of the most diverse kinds have opportunities to come together, learn, and interact in new and surprising ways.*

*I have been fortunate to be the beneficiary of a small grant which will allow myself and colleagues Leonie Hannan and Anna Maerker to run practice-based workshops which we hope will really push the boundaries of historical scholarship by putting making practices and materials at the centre of research.”*

(Dr Simon Werrett, Science and Technology Studies, 2014)

*“Both schools have been involved in robotics research for a number of years with little interaction and exchange. This project provides ... a platform for an exciting and fruitful collaboration bringing together our individual expertise....that will lead to a longer term and more ambitious relationship between the faculties.”*

(Ruairi Glyn, Bartlett School of Architecture, 2014)

The Institute acts as a conduit for multidisciplinary research at UCL, promoting innovative work on themes of materials, material culture, and materiality. Our research projects span the arts and humanities as well as engineering and the sciences.



## Materials Innovation Hub EPSRC EP/I00159X/2

The Institute of Making runs an EPSRC-funded initiative aimed at bridging the gaps between the internal communities of UCL, through the topic of materials and making. We run research workshops designed to bring researchers around UCL from multiple disciplines together for the day to explore common materials and making-related research interests. These workshops typically gather together a range of speakers on a theme that spans disciplines, giving an idea of the breadth and wealth of materials and making research going on at UCL. Participants come from all levels of the university (with undergraduate students and professors in attendance), and all are encouraged to contribute through discussions, object-centred roundtables and team making sessions. The purpose of these days is explicitly to encourage new interdisciplinary research projects that draw on the expertise we have at UCL, as well as in the Institute's wider community of researchers, makers and manufacturers. More informally, we also act as a conduit for researchers from different parts of the university. Because we span different parts of UCL, we are in a position to 'match make' groups with common research interests. Although many of these incipient collaborations are still in the early stages, we hope to see some new grants and exciting interdisciplinary research coming out of these engineered meetings in the next year.

We also have funding to support these incipient collaborations. For instance, our Summer Studentship and Small Research Grant schemes



have encouraged and supported 34 interdisciplinary pilot projects between researchers at UCL in the last year and a half. For a full list of interdisciplinary research and teaching projects funded by the Institute see the Appendix (pages 186-195), and for a description of a representative sample of them, see pages 79-103.

This EPSRC research project is also about exploring the most effective way to encourage interdisciplinary interactions and conversations. Starting from the observation that discussions stimulated by objects, materials and the making process have the ability to encourage conversations across disciplinary boundaries in a way that a purely verbal conversation cannot, we are exploring how different combinations of presentations, demonstrations, material explorations, discussions and making tasks contribute to a successful workshop.

Research workshops, discussions and forums designed to bridge the gaps between different UCL communities have included the Materials at the Centre workshop, an Art History forum, a Material and Visual Culture Library discussion, a 3D Manufacturing workshop, the UCLoo Makeathon, Ad Hoc's 'Waxiness' forum, the Making Repairs workshop and a Digital Humanities forum.

For more information: <http://www.instituteofmaking.org.uk/research/bridging-the-gaps>

## **Light Touch Matters**

### **EU FP7-NMP-2012-SME-6**

The Institute of Making are involved in an EU-funded project that brings together product designers and material researchers from nine countries and seventeen different organisations to develop a new generation of affordable materials and products that respond to touch with light.

The team of designers and materials researchers will be working together to combine flexible piezoelectric polymers and organic light-emitting diodes (OLEDs) in a variety of ways. Piezo materials respond to pressure to produce electricity and OLEDs emit light in response to electric currents, so the end products will combine touch sensitivity with luminosity. Existing ceramic piezo materials are limited by their rigidity and brittle nature but the new polymeric piezo and OLED stacks being developed will be both flexible and formable. They can therefore be seamlessly integrated into products, resulting in entire objects that respond to their user. The consortium will be applying these novel 'light touch' materials in care and well-being applications.

As well as developing new materials and novel uses for them, this project is also about developing new methodologies to help designers and materials scientists work together successfully. The Institute of Making are working with technology and innovation researchers and design researchers to enhance the dialogue between designers and materials scientists. For more information: <http://www.instituteofmaking.org.uk/research/light.touch.matters>



## **Sensoaesthetic Materials Leverhulme Trust**

At the Institute of Making, we are actively conducting research into developing a sensoaesthetic theory of materials. Materials science concerns itself with the physical characterisation of materials, while artists and designers are generally much more interested in the aesthetic side of materials. Applying scientific methodology to the study of the aesthetic, sensory and emotional side of materials (their sensoaesthetic properties) may improve our understanding of how people interact with materials, and may lead to more innovative and multisensory design. In developing a sensoaesthetic theory of materials we aim to forge links between these two material domains.

There has been very little work that has looked at how the physical properties of materials relate to their sensorial and aesthetic properties. The overall aim of our research is to attempt to fill in this gap by using scientific methods to study those properties of materials which are largely ignored by materials scientists, yet are vitally important to the materials-arts community.

For more information: <http://www.instituteofmaking.org.uk/research/sensoaesthetic-materials>





## **Wearable Assistive Materials**

### **EPSRC EP/K020323/1**

The Institute of Making is involved in an EPSRC-funded project, led by Professor Nick Tyler in Civil Engineering, which aims to develop the materials for a wearable exoskeleton that can act as a walking support system.

The Wearable Assistive Materials (WAM) project is part of a programme of research designed, in the long term, to make wheelchairs redundant for as many people as possible. In 2004 the Department of Health estimated that there are some 1.2 million wheelchair users in the UK, with about 850,000 of these being regular users of NHS services. Although the use of a wheelchair can enable a person to move around, this comes with a cost. There is a real problem with rotator cuff tears and other shoulder problems resulting from the continued work of self-propulsion, and these injuries themselves require costly treatment.

The long-term aims of the project are to make a wearable assistive material that can support walking without the need for motors, visible splints or other perceivable supports, so that people can enjoy life without having to think about accessibility for their wheelchair. This project is also based on Prof Tyler's previous research with clinicians and users of walking support systems, and responds to what they want out of these technologies. Taking into account user requirements, this project aims to develop a system that can be worn underneath clothing, providing invisible and inaudible support.



In order to achieve this, the team need to develop a material that can extend and contract repeatedly and quickly, rather like a muscle, stiffen to perform like a bone, relax to behave like a soft material, be controllable so that the transition between stiff and relaxed is smooth, breathe like natural skin and be light enough to be worn easily. The research team has identified three likely technologies to enable them to develop this exoskeleton, including a chemical actuator, a magnetic gel and interlocking ceramic tiles, which they are testing separately and in combination for functionality.

For more information: <http://www.instituteofmaking.org.uk/research/wearable-assistive-materials>



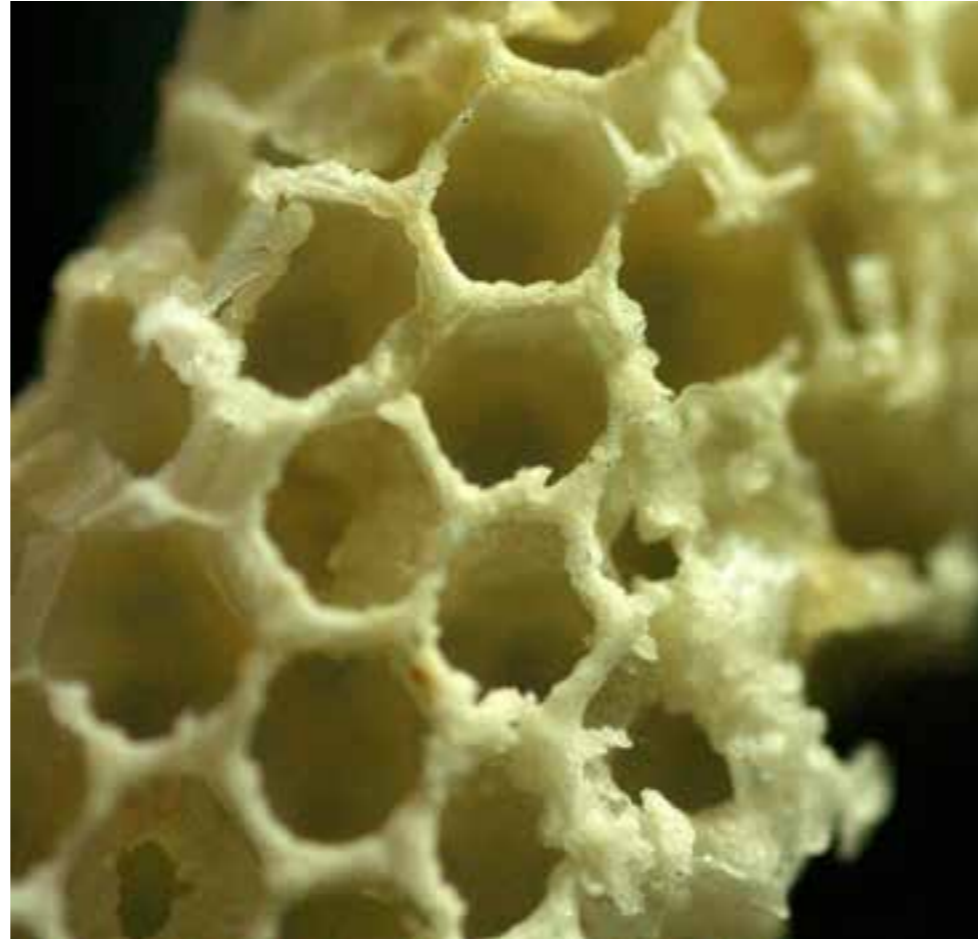
## Nature Inspired Materials

### EPSRC EP/K038656/1

The Institute of Making is involved in an EPSRC-funded project, led by Professor Marc-Olivier Coppens in Chemical Engineering. The Centre for Nature Inspired Engineering draws lessons from nature to engineer innovative solutions to our grand challenges in energy, water, materials, health, and living space. Going beyond using nature as an analogy or the simple imitation of natural processes out of context, researchers at the Centre aim to uncover the fundamental mechanisms underlying desirable natural systems traits and apply these mechanisms to the design and synthesis of man-made systems.

To begin with, researchers have focussed on three nature-inspired core themes:

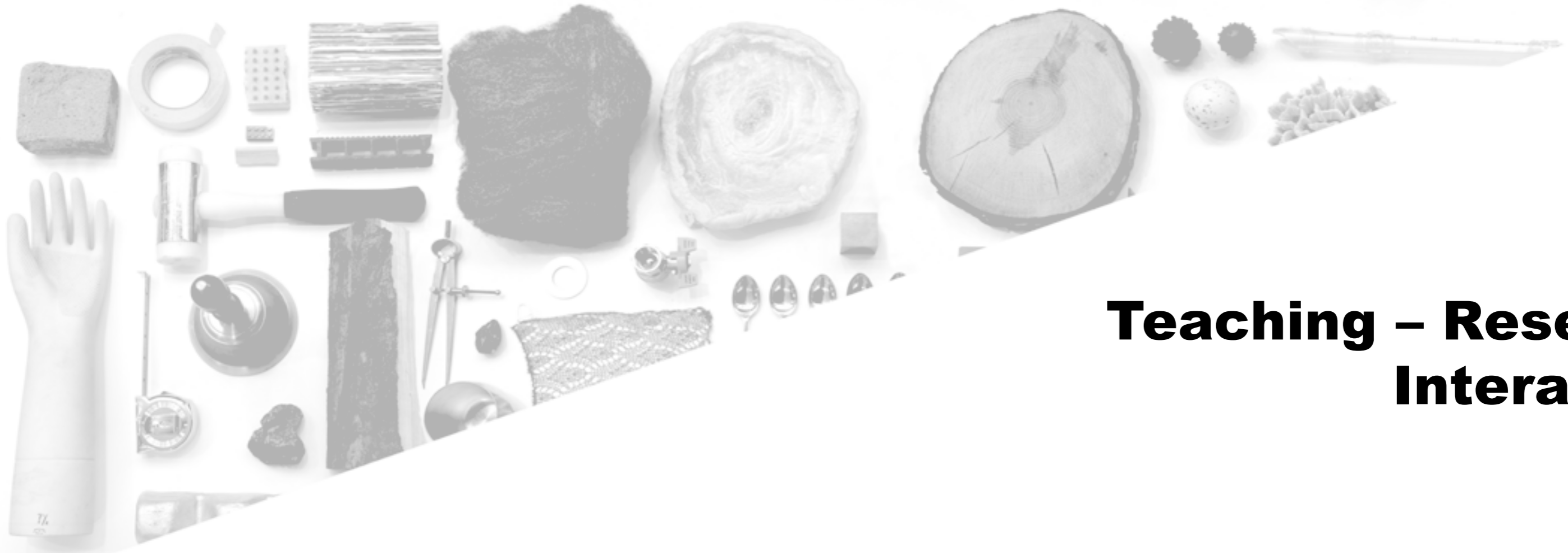
- Hierarchical Transport Networks: this strand of research explores the way natural systems move seamlessly between microscopic and macroscopic scales, for example in trees, lungs and the circulatory system.
- Force Balancing: this strand examines the balanced use of fundamental forces by natural entities like protein channels.
- Dynamic Self-Organisation: this strand explores the creation of robust, adaptive and self-healing materials thanks to collective cooperation and the emergence of complex structures out of much simpler individual components, for example in bacterial communities.



The Institute of Making is a key research partner in this project, providing materials research and prototype construction. An interdisciplinary team of experts from around UCL are involved, with researchers from the Bartlett, Biochemical Engineering, Chemical Engineering, Chemistry, Computer Science, Genetics, Evolution and the Environment and Mechanical Engineering. The Centre for Nature-Inspired Engineering also acts as a hub for involving industrial partners and other researchers beyond UCL.

For more information: <http://www.instituteofmaking.org.uk/research/nature-inspired-materials>





# Teaching – Research Interaction

*“Approaching problems from different perspectives improved the learning process substantially. It cannot be emphasised enough how important it is, in a multidisciplinary project such as this one, to have the opportunity to talk to supervisors with expertise in more than one field of study.”*

(Tudor Besleaga, 4th year Mechanical Engineering, 2013)

*“I have a fervent belief in the study of the philosophy and history of science as benefiting the imaginative and creative features of the scientific mind, helping to release a ‘discovery mentality’ ...[this project] broadens the scope of Chemistry, expanding the intellectual base for undergraduate students by encouraging their participation in arts activities that are closely related to Chemistry, prompting a more integrated approach to Art and Science and wider intellectual and creative debate and production. I see this unique collaboration with an artist as key to extending the interdisciplinary nature of our work in the Chemistry Department helping to develop our outreach activities exploring the depth and breath of how chemistry influences the world we live in.”*

(Prof Julian Evans, Chemistry, 2013)



The Makespace and Materials Library are not bookable spaces, and because we are not aligned with any one course no formal teaching goes on in the space; nevertheless a great deal of informal learning and teaching happens here. We have gone to great lengths to curate the space in a way that encourages our members to interact with each other whilst using the equipment and library. By having members from diverse backgrounds and disciplines sharing the same space, they can, and do, learn from each other.

This happens organically when undergraduates learn about the practice of research by working in the same space and using the same equipment as PhD students, postdocs and staff. Equally, researchers sometimes learn about making techniques from their students.

We deliberately curate themed research workshops and events that allow people with similar passions to meet and work together from very different parts of the university. Summer studentships have also played a crucial role in developing teaching-research interaction, because they pay for an undergraduate to do interdisciplinary research over the summer through a collaboration between two different departments. Research teams are also sometimes formed at the Institute through opportunities offered by other departments, such as the LEGO2NANO and Darwin (or) Bust projects. This section describes some of these interactions.



## Summer Studentships

*“[The summer studentship] gave me a ‘taste’ of research work and enabled me to further my skills in experimental science... I enjoyed this experience as it gave me a chance to come to know how research is carried out. I intend to continue this onto my MSc research project.”*

(Manpreet Padwal, graduated Medical Physics, 2013)



We have run the Institute of Making Summer Studentship scheme for the last two years, with another round to come later this year. This scheme pays for undergraduate students to get involved in materials- and making-related research for up to 10 weeks over the summer, and to gain some experience of projects that sit between two departments, disciplines and areas of expertise. We have supported 16 studentships so far, and of the 7 students who have since graduated from their courses, 4 have carried on into postgraduate research.

The nature of these projects is many and varied. One studentship involved helping to develop a new methodology to pave the way for fabrics that are kinder to the skin, for use in incontinence pads. Another student designed and made a series of models of the various bodies of our solar system that are predominantly composed of ice, in order to communicate the latest discoveries of astronomy and planetary science to the public through an exhibition at the Royal Society. A third project focused on understanding the relationship between oxygen gradients and cell death in 3D engineered tissue cultures. This section will not describe all of the projects in detail, but will attempt to give a flavor of a few of the projects undertaken. A full list of titles and people involved in projects can be found in the Appendix, pages 196-199.

## Architecture and Atheism: Making Spaces of Godlessness (Bartlett and Anthropology)

*“This research project has given me the opportunity to be pro-active in participating in the research object, something which anthropological analysis alone ... does not allow. I have been able to think beyond anthropological writing ... [and] this summer I began to see how anthropology might pro-actively make, as well as study, culture. Besides the more tangible outcomes of this project, I feel this is an invaluable lesson in itself that would not have been possible without the architectural and anthropological expertise of [my supervisors].”*

(Gareth Breen, graduated Anthropology, 2013)



Gareth Breen initiated a project that drew on the expertise of supervisors Dr Ben Campkin from the Bartlett School of Architecture and Prof Charles Stewart in Anthropology to accomplish an ethnographic study of materials used in religious and atheist spaces. This collaborative investigation explored the materials involved in making the Sunday Assembly, a “godless congregation” in Islington that “meets...to hear great talks, sing songs and generally celebrate the wonder of life”.

Gareth was able to explore anthropological ideas in a hands-on manner, something that is surprisingly rare in anthropology, and found that making played a pivotal role in his research process. In taking photographs of pre-existing buildings that might approximate an atheist building, and drawing and painting his own designs, he was able to think through the project in a pragmatic way. He found that these designs and photographs were often pivotal in the discussions he had and the interviews he conducted with his research participants.

Gareth’s BSc dissertation work was chosen to be the subject of one of the Anthropology department’s Working Papers series, which is available at <http://www.ucl.ac.uk/anthropology/research/working-papers/152014.pdf>.

He has also since presented his findings at the biggest annual event in the discipline of anthropology (the American Anthropological Association (AAA) conference) alongside PhD students from the Material Culture group at UCL, and he has gone on to enroll as a PhD student himself at LSE.



## **Vapour Deposited Nanomaterials for Microreactors (Chemistry and Chemical Engineering)**

Chemistry students Leila Hedayat and Ian Godfrey were both involved in two consecutive years of a studentship aimed at the development and testing of vapour-deposited nanomaterials for microreactors. They were supervised by Dr Chris Blackman in Chemistry and Prof Asterios Gavriilidis in Chemical Engineering. The project aimed to explore how the vapour-deposition of catalysts might be able to improve the efficiency and reduce the negative environmental impacts of this process. Using a novel technique, the team deposited gold nanoparticles in a tungsten oxide medium onto a range of different materials like glass, alumina and silicon.

Ian and Leila were both able to draw on Chris Blackman's expertise in chemical vapour deposition (CVD), a novel yet simple processing technique for producing functional nanomaterials, and Asterios Gavriilidis' expertise in catalytic microreactors. They set out to investigate how they could reduce the amount of metals used in catalysis, employing a combination of nano-scale materials and microfluidics. Ian used CVD to deposit gold nanoparticles onto a range of different materials like glass, alumina and silicon. In exploring the structure of the resulting material, they got some interesting and unpredicted results, especially with the glass, as the material's structure was not as expected. As a direct result of the first studentship the team produced a range of samples with catalytic films that could now be tested for potential industrial application. Leila took on the next stage of the project, which involved



developing these materials and testing their ability to catalyse a carbon monoxide oxidation reaction.

This project stimulated a new collaboration between Dr Blackman and Prof Gavriilidis, and gave Leila and Ian the opportunity to gain hands-on experience in an academic research lab and experience with a variety of experimental techniques that they would otherwise not have encountered. In Ian's own words, this experience has "fostered a greater appreciation for the links between a material's underlying chemistry and its final properties and applications" and has encouraged him to "consider the different roles played by the diverse range of people in the materials development process e.g. engineers in reactor design, chemists in film development and optimisation, chemical engineers in application and scale up".

## **Weaving the Window: Exploring Materials and Processes that Transmit Light (Slade and Anthropology)**

First year undergraduate sculpture student Jana Bercelova used her summer studentship to conduct an investigation into the materiality of weaving, and to explore the ways in which different materials can be ‘thoughtful’ and confer meaning through a woven sculpture in different ways.

Working with Melanie Jackson from the Slade and Prof Susanne Kuechler in the Anthropology department, Jana initially experimented with weaving transparent, light-transmitting and screen-like materials like cellophane and screen foils. She explored their physical properties and found that whilst screen foils allow you to layer images in a way that other materials do not, they cannot be used for weaving. She also considered the anthropological and philosophical connotations of these materials; their relationship to the urban environment and modern technologies like computers and televisions.

In a radical contrast to these experiments with screens, Jana also spent time in a rural Slovakian village observing the Perseids meteor shower and experimenting with using more traditional methods of basket-weaving to make a ‘basket telescope’ that shows glimmers of light whenever you look through it. In her final piece she drew on this contrast between the materiality of screens and the cityscape of London and her experiences of quiet contemplation and traditional weaving in a rural environment.



For Jana, this studentship provided an opportunity to explore the relationship between philosophy and science from an academic point of view, but it also gave her the time to engage with this a new set of materials and concepts in an experiential way.



## Small Research Grants

*“Thank you for supporting the project – it’s fantastic to be able to get all this usually behind the scenes process more visible and open for debate and exchange of ideas.”*

(Dr Hilary Powell, Bartlett School of Architecture, 2013)

We primarily devised the Small Research Grants scheme as a way of encouraging new interdisciplinary projects between members of staff at UCL, but it also attracted a lot of interest from postgraduate and postdoctoral researchers, enabling us to support a number of students and early career researchers, as well as some more established academics.

So far we have funded 16 projects, which are all in the early stages, but the researchers involved in them are already enlivening the Institute of Making community in a number of ways. Some of them are using the Makespace to make objects or equipment for their research and rubbing shoulders with regular users, and others are putting on research conferences, film screenings and workshops at the Institute or around UCL that members can be part of. This section details a couple of these projects to give an idea of the sort of research that we have been supporting.



## Boron-doped Diamond Antimicrobial Materials (Chemistry and Surgery)

This project between postdoc Dr Tom Varley in Chemistry and Prof Sandy MacRobert in Surgery & Interventional Science proposes a novel application for the material boron-doped diamond (BDD), to kill bacteria at clinically important surfaces. Current research into sterilisation focuses on using reactive oxygen species that kill bacteria when subjected to light, but the major drawback with these materials is that they will not function in low light conditions. BDD is thought to generate reactive oxygen species on demand, at their surface in aqueous solutions. This project is carrying out a set of proof-of-concept experiments with BDD electrodes to confirm the presence and type of reactive oxygen species.

This project bridges a gap between researchers working on the same materials in very different areas of electrochemical material science and medical device design by using an electrochemical material for the creation of sterile surfaces, potentially leading to the design and manufacture of real-life clinical devices. The preliminary findings from this project will also enable the construction of a full research proposal to develop the work further.



## **Emotions, Transformations & Restorations: Material Histories Seminar Series (MPE, History and STS)**

This seminar series explores how people respond to materials emotionally, and how this has changed over time. Dr Simon Werrett (STS), Dr Leonie Hannan (History and MPE) and Dr Anna Maerker (History of Medicine, King's College London) are using this series as an opportunity to experiment with new interdisciplinary methods for using materials in the practice of history.

For each workshop, a presenter, a respondent, and participants drawn from a range of academic disciplines are brought together around practical demonstrations with materials to encourage reflection on our emotional responses to materials and their properties, and how these responses might signal new historical questions. Participants include a surgeon, a pyrotechnician, a preservation librarian and several artists. This seminar series is the first part of a larger research project, currently in the planning stages, which will develop innovative approaches to making materials and making practices more central to historical inquiry.

The workshop themes (Emotions, Transformations, and Restorations) have been chosen as a means to transcend the disciplines and point to new ways of engaging with materials and history. 'Emotions' explores the history of people's emotional responses to materials. For example, how do



rubber, leather, plastics, or metals shape medical or other experiences? 'Transformations' explores how people have historically experienced and made sense of changes in the state of materials in the past. How did they react to changes between liquids, solids, and gases; sudden colour or texture changes; or transformations like explosions? 'Restorations' examines how people have sought to restore properties of materials they perceive to have been lost in the past. What is the history of repairing, cleaning, reinvigorating and restoring material objects?

After each of these workshops, the research participants share their experiences of the workshops with the rest of the Institute and UCL materials research community through the following dedicated blog. <http://emotionstransformationsrestorations.wordpress.com/category/transformations/>

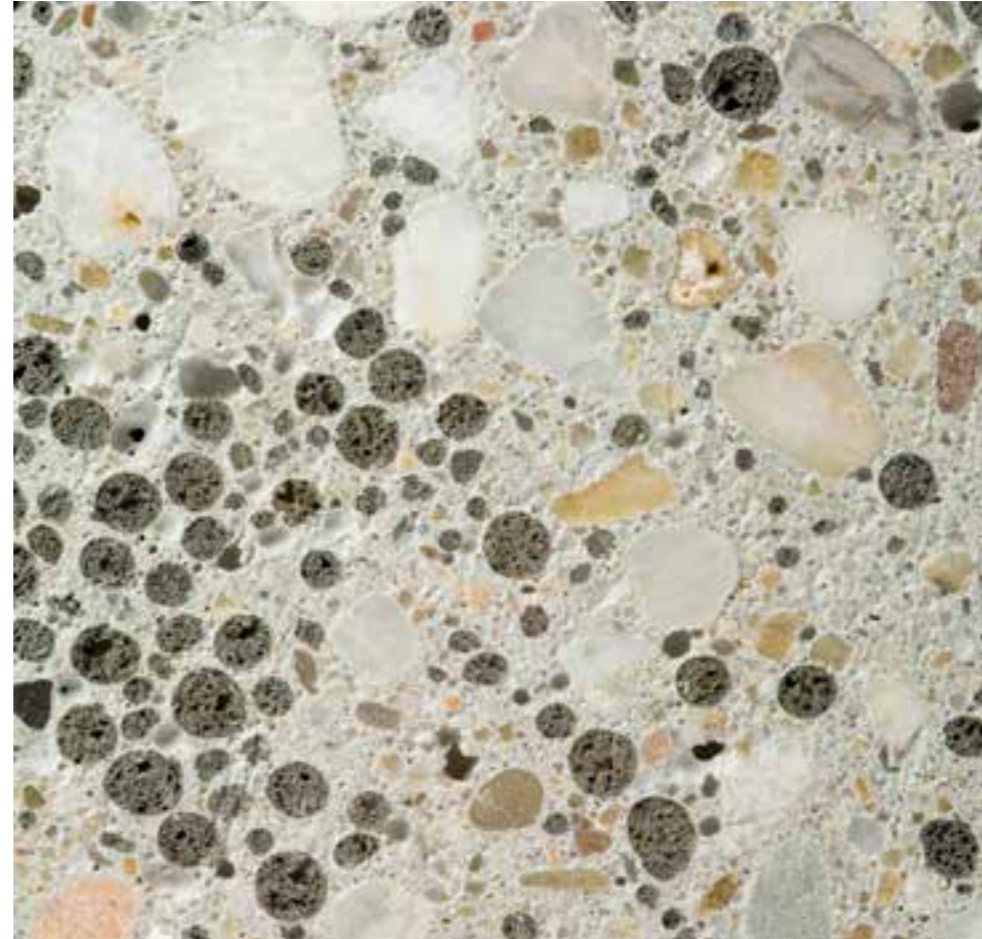


## **Nanomaterial-Based Sensors for Urban Environmental Monitoring (Chemistry, Civil Engineering and the London Centre for Nanotechnology)**

This collaborative citizen science project between three departments aims to provide mapped data on air pollution throughout central London, in order to benefit and involve local communities, as well as develop new research. The lead researchers on this project are an MRes student, Gwyn Evans, and Louise Francis, research assistant in Civil Engineering and CEO and co-founder of social enterprise ‘Mapping for Change’. They are being supported in this project by researchers like Prof. Ivan Parkin and Prof Muki Haklay.

The UCL Gas Sensor Laboratory (Chemistry) focuses on the fabrication of sensing materials and devices that are capable of monitoring commonly found air pollutants. These devices can be used in sensor arrays, known as “e-noses”, to discriminate between and identify different gases that are present in the atmosphere. Highly portable, low-cost devices are highly suited to environmental monitoring applications on a large scale, and thus are an ideal technology for use in projects such as the “Smart Cities” initiative recently supported by the UK government.

However, in order to deploy sensors capable of monitoring the gases present in an urban environment on a large scale, low-cost sensing technologies with



suitable levels of performance, complex network communications and data interpretation must be developed. In this project, the Gas Sensor group, which has previously focused on laboratory-based research to improve the sensing characteristics of metal oxide materials, shifts its focus towards “in field” testing, and tailoring devices and materials to applications such as environmental monitoring.



## **Metal Skies and Shades of Brick: Urban Print and Palette (Bartlett and Chemistry)**

This project is a collaboration between Dr Hilary Powell (AHRC Fellow in the Creative and Performing Arts, Bartlett School of Architecture) and Prof Julian Evans (Chemistry), along with external partners in demolition firms and development sites in East London.

Putting the physical remnants of industrial decline to creative use, Hilary is salvaging an array of materials from the demolition site and using these to create images of processes and sites of urban change. Reclaimed roofing zinc and copper are used as etching plates and heavy demolition machinery becomes alternative printing presses. Using specialist machinery (like vibro-energy mills) and expertise within the Chemistry department, the team are developing a palette of intaglio ink pigments and washes made from ubiquitous urban materials ground to micron-size powders. London stock brick ink becomes the urban alternative to burnt sienna/ochre, lime mortar is used for off-white, chimney soot becomes the original lamp black and manganese-rich brick stock is used for red and purple tones.

Their progress is being documented and, as it stands, the film can be seen on the dedicated project website that details processes and experiments ([www.demolitionsite.net](http://www.demolitionsite.net)). This film was premiered as part of a series of events on the theme of demolition Hilary curated with UCL Urban Lab. The team will be presenting their research to the Institute community later in the



year, and they are currently awaiting the outcome of a Leverhulme Artist in Residence grant application to further develop the collaboration in the coming year, with larger scale print production, ongoing filming and a book.

## **LEGO2NANO Project (UCL, LCN, Tsinghua & Peking University)**

The Institute of Making and the London Centre for Nanotechnology have teamed up with Tsinghua University and Peking University to take part in LEGO2NANO, part of an ongoing series of China-UK Summer Schools. Last autumn they took the challenge of developing a new type of low-cost scanning probe microscope with the power to capture images of the nano world, and to make the device available to school kids.

In September 2013, thirty-two young scientists, researchers and designers from China and the UK came together in Beijing to form four interdisciplinary teams, and faced their first challenge. They competed to build and present a working Atomic Force Microscope (AFM) capable of seeing objects only a millionth of a millimeter in size, in just one week, using LEGO and hacked components.

After the exciting experimental week and a nail-biting race to the finish at Tsinghua University, Institute of Making members and their new colleagues in China are taking the project forward in the Makespace.

Their aim is now to refine the winning design to develop an open source AFM that can be built by school students around the world, making use of LEGO, Arduino, cheap 3D printable parts and local components. Research-grade AFMs typically cost over £60,000, but by using less specific, low cost AFMs, experiments can be carried out across the world, with a far



larger amount of collected data shared and compared. The project has attracted interest from makers and research facilities from all over the world, and the participants are presenting the project at both the third Citizen Cyberscience Summit in London, and the Interaction Design for Children conference in Aarhus, Denmark.

The Summer School collaboration continues in Beijing in September 2014. Read much more about the summer school on the project wiki: <http://lego2nano.openwisdomlab.net>

## **Darwin (or) Bust (UCL SMB, GEE, Grant Museum & the Institute of Making)**

This project is an imaginative members' making challenge, devised and organised in collaboration with the faculty of Life Sciences, Museums and Public Engagement, and the Bartlett School of the Built Environment. The exhibition that resulted from it was on show from the 12th February - 2nd April in the Grant Museum of Zoology at UCL.

A bust of the legendary biologist Charles Darwin was relocated from the window space of UCL's Darwin Building when the Grant Museum of Zoology moved to a new home across the street. One of our members, Suzanne Ruddy, a lecturer in Structural and Molecular Biology, came in to ask our advice on 3D printing a replacement bust for the window. We got excited about getting more members involved in the making, and the idea blossomed. This kicked off a truly cross-faculty interdisciplinary making project, which involved cutting-edge technologies as well as hand making, and brought together academic and faculty staff, researchers and students, as well as the public.

We found that the original bust had already been 3D laser scanned by another of our members, researcher Mona Hess. We hatched a plan with Life Sciences and the Grant Museum: a member competition to create a new Darwin for the Darwin Building.



We challenged our members to recreate the Darwin bust in any way they liked. Proposals flooded in, and crazy ideas inspired by the challenge included casting him in concrete, seeding him with barnacles and submerging him in the sea. Other entries involved chocolate casts, Darwins made of light, a live ant farm, and a crocheted floating head. It captured people's imaginations and gave them a reason to come in and try something. Entries came from faculty and teaching staff, students and researchers from all over the university.

To aid the re-creation process, we asked the team at the Bartlett's CAD CAM Workshops to help us machine him from resin tooling board, using LaToyah, their huge 8 axis robotic system. Our members could then cast this replica to make their own Darwins, or start directly from the data from the original laser scan. The Bartlett also used it to test and publicise their new robots, and have kept the mini test-Darwins they made to help with teaching the principles of robotic fabrication.

UCL biologist Steve Jones announced the winners on the night of the exhibition opening, with prize money donated by the Faculty of Life Sciences, and gold, silver and white 3D printed Darwin replicas to be won.

The re-imagined Darwins were displayed in a dual-location exhibition, which opened on Darwin's birthday, scattered among the skeletons, skulls and jars in the Grant Museum, as well as in the Darwin Building and Institute of Making's windows.





We organise several different types of event, ranging from masterclasses run by expert makers for small groups of members, to large scale public extravaganzas, talks, seminars and workshops. Our events and public engagement programme perhaps does more than anything to inspire people to explore new areas of interest, acquire new skills, and engage with experts in diverse fields of materials research and making.

Each type of event enables those attending to gain an insight into the practice and philosophy of expert makers and a chance to discuss broader issues around materials and making. The research workshops are focused on specific research themes, and gather together experts and enthusiasts working in related areas to share their ideas and discuss the issues surrounding their topic, with an explicit aim of creating new interdisciplinary research collaborations.

In 2013 we held 33 events: 14 masterclasses, 4 talks, 6 research workshops, 7 public open days and 2 week-long events. Our programme is extremely popular, with many events being booked up in less than five minutes of being released and with extensive waiting lists forming. For example, 1156 people applied to attend *Roja Dove: An Olfactory Experience*, for which there were only 40 spaces available.

During our open days we throw wide the doors of the Makespace and the Materials Library to the public. We organise various making activities designed to appeal to seasoned makers, first-time tinkerers and families alike, and curate a themed selection of materials for visitors to explore in the Materials Library. In our first year of opening we hosted seven public



open days with a total attendance of approximately 3000 including a high representation from families and children. The demand for these events far outstrips supply, and to cope with the large volume of people who attend, we regularly recruit both staff and students as volunteers to help on these occasions. Through these events the public get both a taste of the Makespace and Materials Library, and a chance to meet and interact with our wonderful and knowledgeable community of members.

*“Thank you so much for a fantastic day last Saturday. We waited nearly an hour but it was totally worth it - eating ‘homemade’ ice cream, flying paper aeroplanes and once inside we had an amazing time. My first time, my children’s (7.5 years and 5 years) 3<sup>rd</sup> time. They absolutely love your open days - thank you so much to everyone who is involved in the set up (massive organisational feat) and running of the afternoon, which is done with such joy and patience. Thank you! We can’t wait ‘til your June day.”*

(Romola, Amalia and Christoph, 2014)

## Blacksmithing (Masterclass)

In April last year, Ian Lowe and Richard Pace, blacksmiths from Stepney City Farm, set up their mobile forge on our doorstep for our very first members' masterclass.

With fewer than 1000 registered blacksmiths in the UK, this was a very rare opportunity for our members to heat, hammer, quench and fettle some metal, especially as we cannot offer hot metal working in the space due to the constraints of the building.

Ian and Richard ran three hot iron working sessions with groups of ten people, and members got to get to grips with smithing by making some fantastic iron leaves and s-hooks.



## Folding Knife (Masterclass)

Contemporary knifemaker and researcher Grace Horne led a masterclass in making a folding knife in a day. Grace has a workshop in Sheffield, home of cutlery and stainless steel, and has studied with traditional blade-grinders and cutlers through her work. She is an expert in blade forging, shaping and tempering, as well as lock and spring mechanisms and handle design and construction.

Grace spoke about her own practice, and then showed members how to construct and finish a knife. In most cases, participants left the workshop with a fully constructed folding knife. Those that did not finish during the day learnt the skills to come back and finish their knives in the Makespace at a later date.





## Neon Tube Making (Masterclass)

Artists and neon light specialists Julia Bickerstaff and Richard Wheeler ran two days of activities exploring what neon is, how it can be harvested to produce light, and how to make neon tubes.

Glowing examples of neon art were made *in situ* for a public audience, with mesmerising demonstrations of cutting, blowing, stretching, bending and fusing glass with flame, filling with gas and illuminating with electricity.

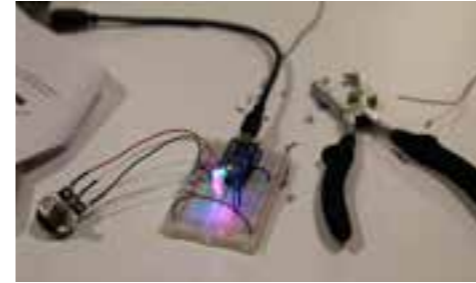
Members of the Institute got a chance to delve deeper into the world of neon, with taster sessions that explained the art of making cold cathode ray tubes in depth, and allowed the groups to have a go at making these tubes themselves.





## Animatronics (Masterclass)

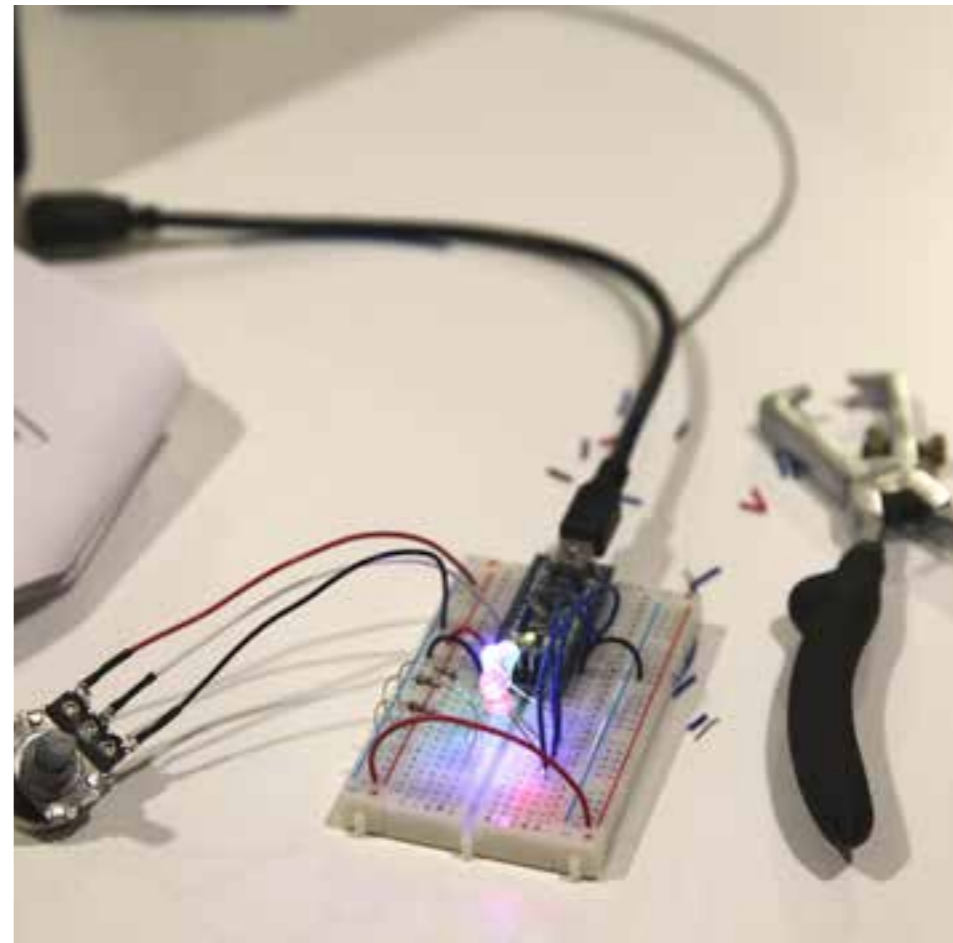
Independent animatronics consultant Matthew Walker and inventor of Inkha, the robotic receptionist at Kings' College London, led an afternoon masterclass for our members. Participants built the beginnings of an animatronic simulacrum of their own eye. Starting from the (messy) basics of mould-making and casting in latex, they achieved a latex copy of the eyelids, and then constructed mechanisms to mount glass eyeball so that it could swivel from side to side behind skin-like rubber eyelids. Matthew explained how this mechanism could be attached to servo motors and an Arduino board at a later date to automate the movement of the eye. A later masterclass taught the basics of Arduino to achieve this (see pages 116-117).



## Arduino – Interactive Objects (Masterclass)

This introductory workshop was specifically aimed at makers with little or no electronic or programming experience. In this hands-on afternoon session, Mark Handley (Professor of Networked Systems at UCL, robotics programming teacher and all-round inventor of egg cannons and electric snowmobiles) covered the basics of software programming, and taught members how to connect switches and other inputs to an Arduino to get it to control LEDs and servo motors.

After this introductory session, members were encouraged to carry on getting to grips with these open-source, flexible and easy to use microcontrollers in their own time, and to encourage and teach each other.



## Science of Cooking (Masterclass)

Food and flavour scientist Dr Rachel Edwards-Stuart ran a session exploring food as a material, and illuminating the science of creating different textures in the kitchen. Rachel is a biochemist by training, but has worked with a number of experts in the culinary field over the last few years including event food curators Bompas and Parr, French chemist Dr Herve This and well known chef Heston Blumenthal.

She began with an overview of the science of flavour perception, describing the importance of the relationships between the senses in the way we experience food, and demonstrating the science of flavor matching by giving members a taste of some bizarre but enjoyable food pairings (white chocolate and caviar, for instance).

The practical aspect of Rachel's session really brought to light the wonder and versatility of the simple egg. She demonstrated how processing it in a variety of different ways can produce structures as diverse as foams, mousses and emulsions. Using a *sous vide* machine made by one of our members, she demonstrated that by changing the temperature by a few degrees you can produce stiffnesses and textures that range from a rubber ball to a soft gel.





## Jim Steele: Part of Wood Week (Masterclass)

Professional chair-maker Jim Steele was in residence with us for a week, turning rough components into a traditional double bow back Windsor chair. Over the course of the week he gave advice to members on their woodworking skills, and consulted on chair designs. On the last day of the week, UCL staff and students joined us for the grand reveal of Jim's finished double bow back Windsor chair, which is now a permanent item in the Materials Library collection.





## Barn the Spoon: Part of Wood Week (Masterclass)

Barn Carder, who whittles green wood to create the perfect wooden spoon, spent two days with us at the Institute of Making. On day one he led three workshops, teaching groups of keen members the traditional skills of spoon carving. On day two he entertained the public with demonstrations and tales of woodland life and competitive spoon making. Members and public alike were inspired by his skills and commitment and have been whittling sets of their own spoons and spatulas ever since.



## Flintknapping (Masterclass)

Due to the popularity of this masterclass, master technologist and archaeologist Karl Lee came to the Institute twice this year to demonstrate how to make arrowheads, spearheads, hand axes and scrapers from brittle flint.

The art of flintknapping is a skill that has largely been forgotten since the end of the Bronze Age. In this workshop, members got to have a go at reviving that skill by making their own Paleolithic scrapers for stripping hides, learning how early humans made the stone tools needed for survival.





## sKINship (Masterclass)

This masterclass explored points of commonality and contrast between plastic surgery and pattern cutting for fashion, and drew on those practices to design and create new garments. The masterclass was led by specialist pattern cutter and knitwear designer Juliana Sissons and sKINship director Rhian Solomon.

Both members and the general public got to try their hand at pattern cutting inspired by reconstructive plastic surgery techniques.



## Bodging and Repairing with Jasleen Kaur (Masterclass)

Artist, designer and Royal College of Art graduate Jasleen Kaur explored the joys of ‘bodging’ and repurposing. Jasleen makes objects from found materials that reference everyday habits rather than formal etiquette, “built for how we do things, not for how we should be doing them”. In this masterclass, members got a chance to create a series of ‘bodged’ inventions through intuitive hands-on making using everyday materials and low-tech processes.

Participants were faced with the challenge of coming up with an impromptu set of tools from the assortment of materials provided. Imagining how they might make ‘chip-oil drainers’ and ‘jam-spreaders’, both members and the public got a chance to create a series of ‘bodged’ inventions through intuitive, hands-on making using everyday objects and low-tech processes.





## Smell and the City (Masterclass)

Dr Victoria Henshaw from the University of Sheffield led a 'smell walk' with two groups of members and the general public, exploring fumigated, pollution filled streets with whiffs of fast food, smelly bus stop ad campaigns and floral community gardens.

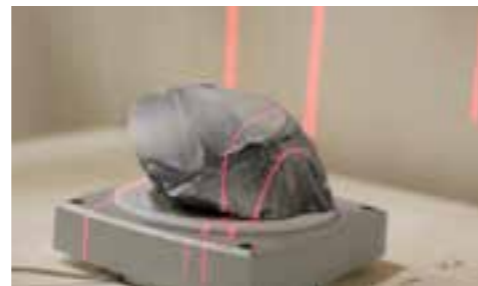
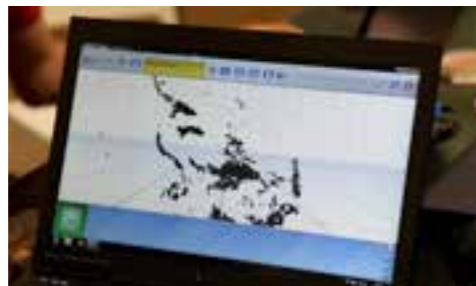
Following this, she gave a short talk about the science behind how we smell, covering topics as disparate as scented car parks, perfumed fountains, drainage systems, eye-watering food odours and phantom city stinks. This walk and talk session really got our noses twitching, tickled our trigeminal nerves, and stimulated our sensory imaginations.



## Low-Cost Laser Scanning (Masterclass)

This session was led by Mona Hess and Jan Boehm of UCL's Photogrammetry, 3D Imaging and Metrology Research Centre.

They designed and ran a hands-on scanning practical, using a kinect-style sensor and the in-house NextEngine laser scanner. Members used open source and free software to scan objects and prepare them for 3D printing or other computer-controlled making techniques. Members also scanned themselves using the hand-held sensor.





## Wood Week (Open to all UCL)

For one week of term we opened the Makespace and Materials Library every lunchtime, throwing open our doors for all UCL students and staff to take a look around.

Hoads of passers-by on their way to lectures popped in to have a look at our materials, the workshop and the various woodworking activities that were taking place. Master chair maker, Jim Steele, was in residence for the week demonstrating his craft, alongside stick makers and spoon carvers.

The centrepiece of the Wood Week was a 15 metre Scots Pine tree that was erected in the space and then used by members as a material for making.



## Roja Dove: An Olfactory Experience (Evening Talk)

In a once-in-a-lifetime evening of sensory delight, a mixed group of members and the public were invited to smell the rarest and most prestigious perfumery materials in the world.

They were guided through the olfactory process by one of the world's most respected perfumers and master storyteller, Roja Dove. Roja led participants on a romantic and evocative journey through the world of perfumes, exploring their historical and social context, as well as the art and science of making them.

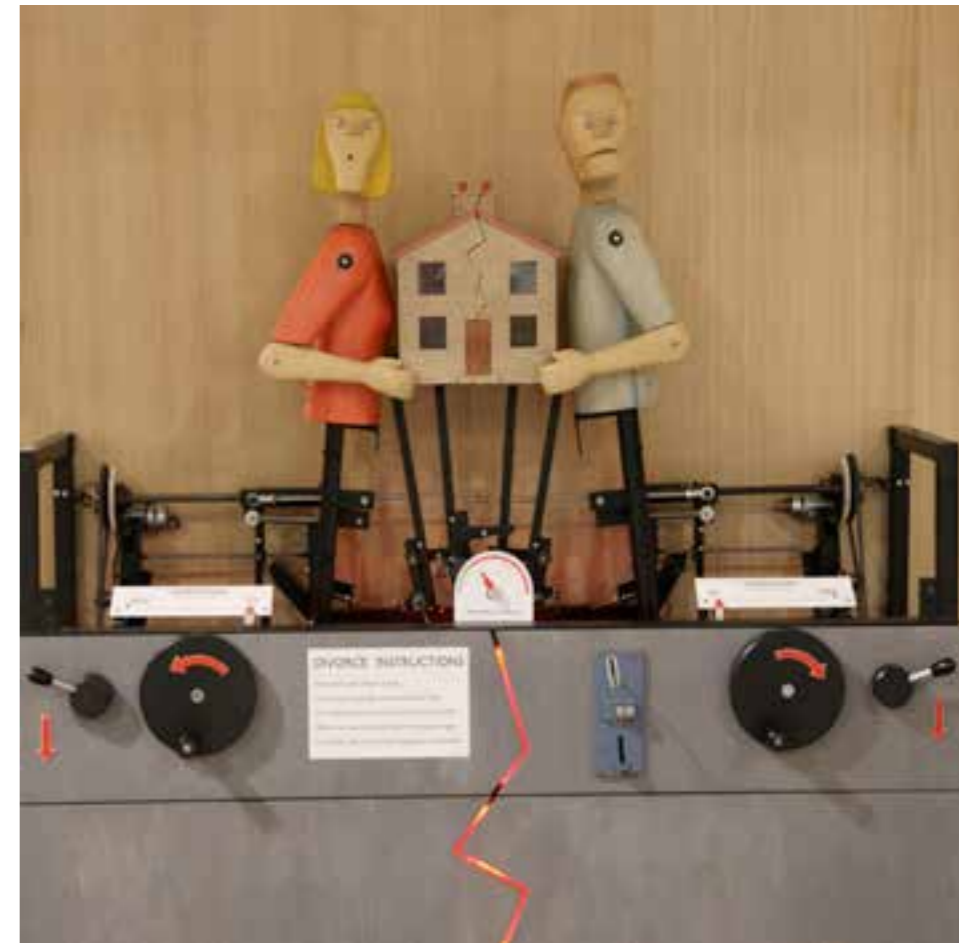




## Tim Hunkin (Evening Talk)

Maker, engineer and cartoonist Tim Hunkin uprooted his studio and came to the Institute of Making to discuss his latest edition to 'The Under the Pier Show' arcade in Southwold.

During the day, Tim was in the Makerspace tinkering with his newest prototype machine, 'The Divorce' and letting members test it out. In a lively evening discussion, Tim took us through his design and making processes, his materials and tools, and entertained with some fantastic stories about the history and culture of the arcade game.



## Tom Pellereau (Evening Talk)

Winner of the BBC's 'The Apprentice' 2011 Tom Pellereau came to talk to members about 'how to create your own future'. He discussed his successes, failures and the lessons learnt along the way, describing how he made his dream come alive, from the initial designing in his kitchen at home, to realising the finished product, and finally working alongside Lord Sugar.

Tom is currently offering our members the opportunity to apply for an internship with him and his team.





## Grand Opening (March 2013)

Our first open day gave guests a chance to explore the new Makerspace, see the Materials Library in its new home, and have a go at some pewter casting, wax carving and 3D printing.

Our giant lump of non-Newtonian silly putty was the star of the show, complete with hammers so that visitors could see it stiffening and shattering relative to the rate of deformation applied to it.





## Plastic Fantastic Open Day (April 2013)

For our second open day we decided to explore the theme of plasticity, with activities including the sculpting of an infinitely remouldable, low-melt and thermo-soft plastic (polymorph), 3D Printing with ABS and PLA, and laser cutting of acrylic.

The highlight of the open day was probably the vast lump of bread dough we made, with help from our volunteers, who became expert kneaders by the end of the day. This giant mass of stretchy, long gluten chains allowed us to explore polymers in a very squishy, hands-on way, whilst also preparing us to make the centerpiece of John Vernon Lord's classic children's book: The Giant Jam Sandwich.



## Luminescence Public Open Day (May 2013)

Visitors were able to watch demonstrations by neon artists who were blowing, bending and filling cold cathode ray tubes live in the Makerspace.

They were also invited to explore the art and science of luminescence through interaction with materials from the library. Visitors had a go with 'invisible' UV face paint and mouldable glow-in-the-dark polymorph plastic, and took away laser-etched test tubes filled with glow-in-the-dark liquid. It was a very busy, luminescence-filled day.





## Strings & Things Public Open Day (June 2013)

The highlight of this open day was undoubtedly sailors' ropework expert Des Pawson, who gave a live demo of nautical knotting, using his traditional rope-making equipment to spin coils of rope from raw coir (coconut) fibres, with the help of some willing volunteers and members of the public.

Members of the public had a go at knitting copper, knotting wool, wrangling a giant nylon Knitting Nancy, as well as getting their hands on some of the wondrous, stringy substances in our Materials Library.





## Foam Public Open Day (July 2013)

This extravaganza explored the many different kinds of foam we find around us in the world. Guests got a chance to handle our ethereally-blue sample of aerogel, a foamed silica material that is 99.9% air, and one of the lightest solids in the world. An enormous selection of foams were available from our Materials Library for people to explore, including foamed chocolate, memory foam, edible starch foam packaging pellets and an expanding polyurethane foam chair.

Activities included sculpting with florists' oasis, carving meringues and moulding with air dough. Outside in Malet Place we had a competition to see who could whisk the best foam, exploring the ways in which sugars, fats, acids and salts affect their structure. This activity finished with a potentially messy finale, where competitors held their bowls of foam over their heads to test how solid their peaks were.



## Trees Public Open Day (September 2013)

This September, the Institute of Making opened its doors for the last public open day of the year. Visitors explored amazing tree-related materials and got hands-on in the Makespace. Highlights included a bubble gum blowing competition, maple syrup tasting, 'spot the fake amber', the world's toughest rubber, wood turning, paper pulping, log sawing, laser cutting of paper, and making super-bouncy balls from latex.

Special guests included Barn the Spoon, an expert woodworker who was busy carving spoons from willow logs under the shade of the Scots Pine we had erected in the Makespace, and Paper Pulp Helmets, three graduates from the Royal College of Art who demonstrated their process of making cycle helmets for Boris bikes from pulped copies of discarded Metro newspapers.





## First Birthday Public Open Day (March 2014)

To celebrate our first year at UCL, we opened our doors to the public once again for a day of birthday-themed festivities. Over 600 people attended and enjoyed a jam-packed afternoon of activities.

Outside, we had an ice cream van dispensing free '99s to all, alongside our homemade liquid nitrogen ice cream stall, enabling visitors to taste the difference between the two manufacturing techniques. To entertain the ever-growing queue we held a paper aeroplane competition using different papers and folding techniques.

Inside we had some of our favourite materials from the library out for handling and discussion, alongside pewter casting, silicone mould-making and airdough party food production. No birthday party is complete without balloons, so we also had six giant helium balloons (not too many in recognition of the scarcity of helium) in order to explore neutral buoyancy: visitors used blu tack to find the point of equilibrium where the balloon hovered in mid air, neither rising nor falling.

Finally, there always has to be a party gift to take home, so the first 500 people to leave received a small jar of 'invisible balls' with instructions for how to hydrate them.

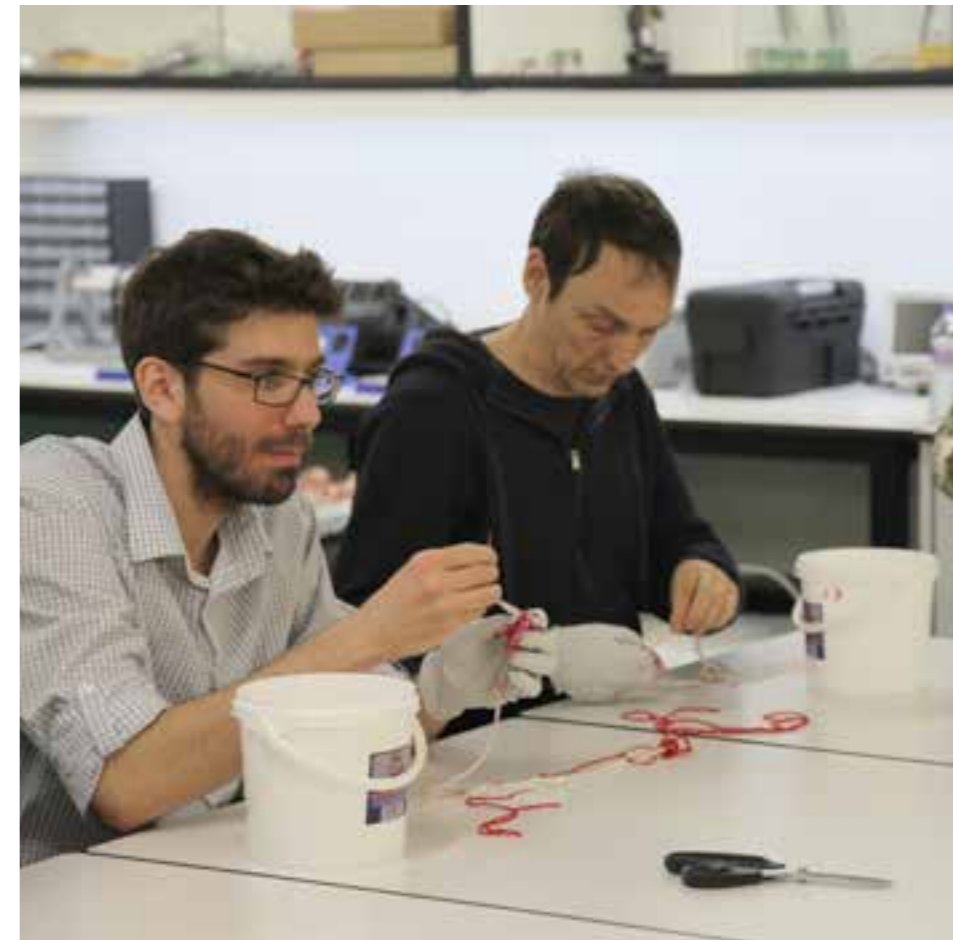




## Materials at the Centre (Research Event)

Our first research workshop at UCL brought together a diverse group of researchers to discuss the academic study of materials properties, craft, and the role of making in research. English professor Steven Connor explored our fascination with particular substances and emotional reactions to them: the fetishisation of the rustle of silk and creak of leather, phobias of spilling of salt, and the sensation of sugar crunching underfoot. In a hands-on session that took place around the Makespace, Geoarchaeologist Ruth Siddall put pigments under the microscope, and discussed her own vast and wonderful collection of pigments used in works of art from the Bronze Age to the present day. Sculptor Anja Borowicz made oil pastels and talked about her use of powdered clay in her work, its uses as an artistic and industrial medium, and its semantic associations. Engineering postgraduates Maria Nelson and Helene Jones demonstrated the principles of bio-compatible scaffolding using 3D printed dissolvable PVA structures, inks and woven fibres.

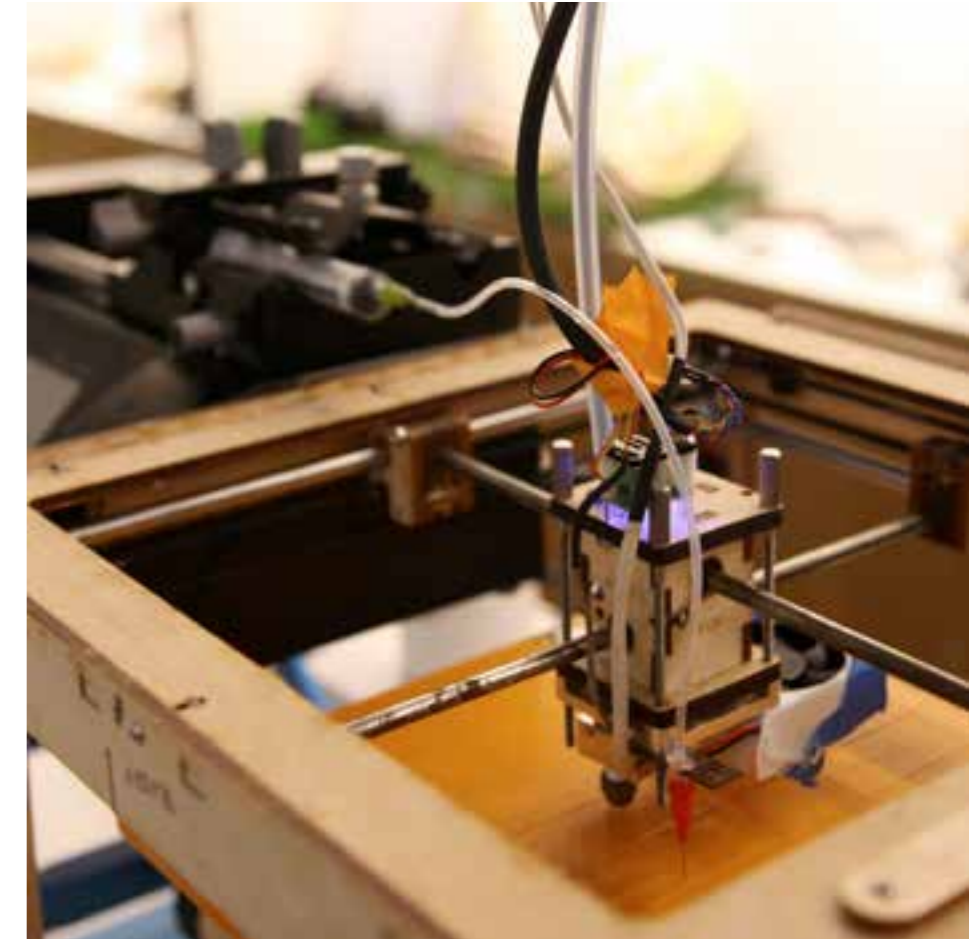
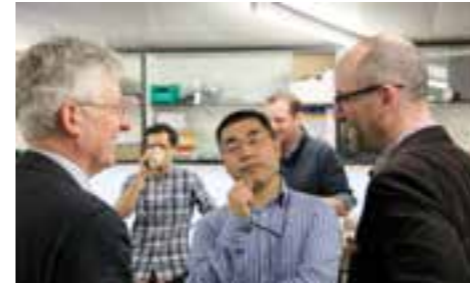
In the afternoon, Chemist/Art Historian duo Emma Richardson and Petra Lange-Berndt explored the effects that unpredictable plastic materials have on the reception, interpretation and conservation of works of art. Historian of Science Simon Werrett discussed early scientists' relationships with materials, exploring how lodestones, red inks and adhesives fired the early modern imagination. Finally, science writer Philip Ball reflected on the day, kicking off a lively discussion about the role of materials and making in research.



## 3D Manufacturing (Research Event)

This workshop gathered together researchers from architectural, fine art, biomedical, chemical, engineering, computer science, museological and anthropological backgrounds for an interdisciplinary discussion of 3D Manufacturing. Computer science PhD student Antonio Castañeda kicked off with a fantastic overview of what has been happening in 3D printing in hackspace and maker communities over the last few years. The morning session then explored innovative materials and processes: Simon Leigh from Warwick University discussed his work printing conductive plastics and electronic components; David Huson from UEA showed his self-glazing ceramics, and Maria Nelson and Gowsh Poologasundarampilai from Imperial presented their research into the printing of bioactive materials.

In the afternoon guests explored the variety of printers and innovative examples of printed objects dotted around the Makerspace, and experimented with a couple of short and playful activities. The afternoon session focused on novel designs, uses and topologies in 3D printing: Niloy Mitra from UCL Computer Science demonstrated his 'shadow art' work that is essential for the optimisation of physically-realizable 3D sculptures, and Richard Beckett from the Bartlett discussed digitally printed masonry and 3D manufacturing at an architectural scale. The day culminated in a demo session of machines and printed objects, including a new stereolithographic machine made by start-up Invention Works and a printer made from scratch by one of our Makerspace members Tom Catling.





## Making Repairs (Research Event)

A group of repair enthusiasts from multiple disciplines gathered for a day-long workshop interrogating the materials and technologies that make repair possible, and the cultural imperatives that encourage it. Geographer Rebecca Collins started the day with a discussion of the reasons we repair, explored through a study of teenagers and their ‘mindful mending’ practices. This was followed by Environmental Engineer Julia Stegemann’s discussion of cement as a proposed, but problematic, solution for environmental contamination. Artist Celia Pym talked about her work with darning, exploring the mending of clothing as a demonstration of love, care and attention.

Civil Engineer and Archaeologist duo Kate Crawford and Alice Samson shared their conversations about what archaeological understandings of Pre-Columbian Caribbean house repair can lend to humanitarian ideas of what people need from shelter in the present day. Computer Scientist Kazim Pal discussed his PhD research exploring digital techniques to remotely restore and read badly burnt and distorted vellum from historically significant documents like the Great Parchment Book. Maker Jasleen Kaur led a hands-on ‘bodging’ session where we got to have a go at inventive repurposing. Finally, a curated collection of participants’ repaired objects was used as the focus for a discussion about embodied skill, our emotional attachment to objects, and what is learnt in the process of repairing.







*“The workshop is a place of radiant thinking, and it is fully equipped with advanced facilities, two floors with distinct space designed to show it off. I am impressed by the friendly atmosphere here and Richard (our technician) is highly respectable for he takes helping us as more than a job. With his help, I have established friendship with many people, and used machines that are really interesting. I could not make the windmill without Rich. It is amazing and fun to make something by your own hand, as if I am a little inventor. Life in the workshop is the most precious memory during my study in UCL. Everyone is sure to achieve a lot of skills and friendship here.”*

(Jia Li, MSc Mechanical Engineering, 2013)

*“The unique collection of materials provides a focus for interdisciplinary conversations, and the many events, training sessions, workshops and open days happening at the Institute have provided me with many opportunities for creative collaborations.”*

(Dr Simon Werrett, Science and Technology Studies, 2014)



## The Makespace

Prior to the opening of the Makespace in March 2013, we had to anticipate the facilities, tools and the areas of making that our members would want. Over the last year a number of areas have revealed themselves to be hugely popular and have required either more dedicated space or further investment in facilities. This continuing evaluation means the Makespace can adapt to the material and practical demands of its members.

The areas of significant demand are:

- Laser Cutter. Rarely is the laser cutter not in use: it is fully booked every day. To offset this demand we have recently ordered a new desktop laser cutter for smaller jobs.
- Makerbots. Our Makerbot 3D printers operate on a first come, first served basis. Before we open at 10am, there is more often than not a queue of members waiting at the door in order to use them. Our Makerbots have printed all sorts of things, from models of earthquake-damaged buildings to 21<sup>st</sup> Century teapots.
- Ceramics. Clay has proved to be a very popular material with wheel-thrown and hand-built making popular among Institute of Making members.



In response to this, we have created a dedicated ceramics area for the making, storing and drying of fragile clay pieces and have introduced a series of ceramic-related inductions for specific techniques and processes related to working with clay.

- Sewing Machines. Institute of Making members have been very creative in their use of the sewing machines, not only for making clothing but also for making architectural models and inflatables. Demand for inductions for the sewing machines has been very high.
- Woodworking. The staple of any workshop, woodworking continues to be popular with members for many practical purposes. Woodworking is also a great way for members to get comfortable using the wide variety of tools available, from hand tools to digital milling machines.



## The Materials Library

The Materials Library was a pre-existing collection but has grown and developed in its new home at the heart of the Institute of Making. The idea behind the Materials Library is to provide a home for some of the most wondrous materials on earth, gathered from sheds, labs, grottoes and repositories around the world. It is a resource, laboratory, studio, and playground for the curious and material-minded to get inspiration, conduct hands-on research, and get involved in interdisciplinary inquiry and innovation.

A few highlights of the collection that have proved a hit with members and public audiences are:



## *Aerogel*

This is one of the lightest solids on earth. Made by NASA for catching stardust, it is 99.8% air. It has a foam structure, rather like a meringue, but the pores of the foam are at the nanoscale – unimaginably small. This structure gives the material a specific optical effect; that of blueness. In other words, this material is blue for the same reasons that the sky is blue, not because of a pigment but due to the way in which light is scattered as it passes through it.



### *Silly Putty*

This flesh-coloured silicone-based polymer is a runny yet bouncy putty that you may have experienced as a child. It is categorised as a non-Newtonian fluid and exhibits an unusual mix of elastic and viscous properties, for when left to its own devices, it flows and puddles but hardens if a force is applied. For example, if the putty is rolled into a ball and left on a surface, within a few hours it will have flowed into a puddle shape. Alternatively, if you take the ball of putty and throw it onto the floor it will reveal its elastic properties and bounce, whilst if you take the ball of putty and hit it with a hammer the force will cause the putty to shatter. Material similar to this silly putty has recently been developed for use in protective clothing as an advanced form of impact protection.





### ***Ferrofluid (Magnetic Liquid)***

On first inspection this magnetic liquid is easily mistaken for oil, given its dark colouration and ability to flow. When placed in a magnetic field however, it becomes a gel and forms complex geometrical patterns that reflect the magnetic field lines. These rippling, intricate geometries take shape because ferrofluid is composed of: 1) a liquid - typically an oil – which allows it to flow when there is no magnetic field, and 2) nanoparticles of iron oxide that align with a magnetic field to restrain the fluid flow. Ferrofluids contain an emulsifier to ensure the iron oxide particles and oil mix together perfectly to achieve this unusual material behaviour.

Ferrofluid was developed in collaboration with NASA in the 1960s to address the issue of moving fuels in zero gravity. Today it is used in lubricants, as a seal in hard disks, and in car suspension systems. Ferrofluid also has a strong following of artists who apply its unique properties to generate unique shapes in their work.





*“The Institute of Making is one of the biggest experiments being carried out at UCL. It will probably take ten years before we really know its true value.”*

(Mark Miodownik, Institute of Making, 2014)

*“A big thank you must be said to each and every person who comes through our doors and ‘gets it’. Although we exist to celebrate materials and making, it is the people who make the project fly, and we are very lucky to have such a brilliant team of staff at the Institute of Making, as well as a highly engaged cohort of members.”*

(Zoe Laughlin, Institute of Making, 2014)

In its first year the Institute has been extremely successful in its role of championing making and materials throughout UCL and internationally, attracting a large and diverse membership of 2616 staff and students, creating impact both in terms of student experience and research excellence – and linking them together into a creative and innovative UCL community of makers that already has a global profile.

We have learnt a lot in this year and we will continue to build on that success. We are planning a major research conference on Materials & Society in June 2014, and aim to continue our role as a multidisciplinary materials research hub at UCL, but also a place of individual exploration and expression.

We already have a full events schedule lined up for 2014 including the Art of Measuring season and a week-long Festival of Stuff. We are planning to introduce new types of events that can cater for the diverse interests of our membership such as factory tours. We have an ambition to find ways to

champion the unsung heroes of the workshops across UCL, without whom UCL teaching and research would not be possible: the technicians.

Creating the Institute itself has been, and continues to be, an experiment in making, not just the physical infrastructure but also a multidisciplinary community at UCL.







Hawkins, G. 2011. Packaging Water: Plastic Bottles as Market and Public Devices. *Economy and Society* 40(4) pp.534-552.

Ingold, T. 2007. Materials Against Materiality. *Archaeological Dialogues* 14(1) pp.1-16.

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Lloyd Thomas, K. 2007. *Material Matters: Architecture and Material Practice*. Routledge, London.

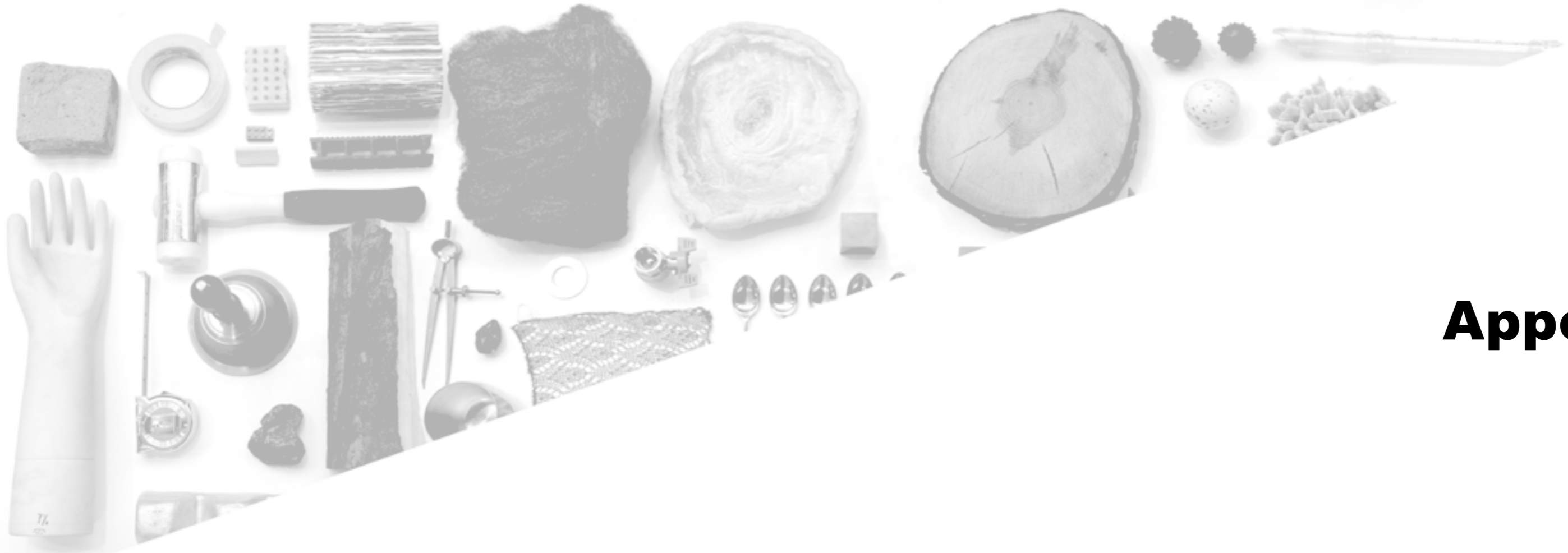
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Wilkes, S. 2014. *In Search of Sustainable Materials: Negotiating Materiality and Morality in the UK Materials Industry*. PhD Thesis, University College London.





# Appendix



## Summer Studentship Projects

### 2012

*Co-substituted Calcium Phosphate Nanocomposite for Skeletal Tissue Repair and Regeneration*

Student: Joanna Baawa Ameayaw (Medicine, King's College London)

Supervisors: Dr Jie Huang (Mechanical Engineering), Prof Lucy DiSilvio (King's College Dental Institute at Guy's Hospital)

*Paving the Way for the Design of Fabrics That are Kinder to the Skin*

Student: Manpreet Padwal (Medical Physics)

Supervisors: Prof Peter Rich (Structural and Molecular Biology), Prof Alan Cottenden (Medical Physics and Bioengineering)

*Quantifying Cell-Matrix Interactions and Migratory Responses in Collagen-Based Tissue Engineering Scaffolds*

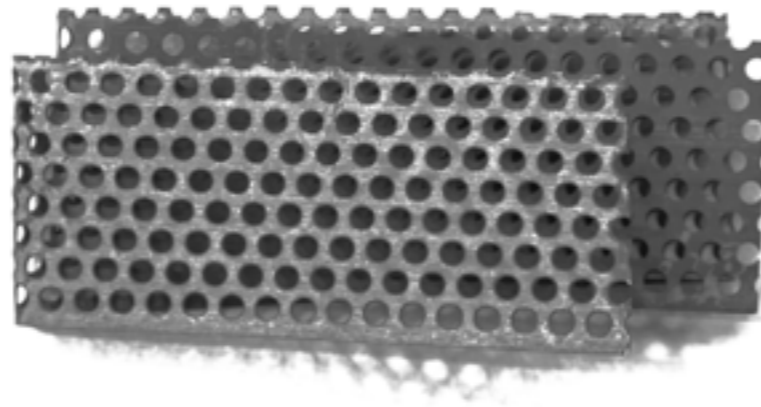
Student: Amir Ardakani (Medicine)

Supervisors: Dr Rebecca Shipley (Mechanical Engineering), Prof Robert Brown (Institute of Orthopaedics and Musculoskeletal Science)

*Vapour-Deposited Nanomaterials for Microreactors*

Student: Ian Godfrey (Chemistry)

Supervisors: Dr Chris Blackman (Chemistry), Prof Asterios Gavriilidis (Chemical Engineering)



*Weaving the Window: Exploring Materials and Processes That Transmit Light*

Student: Jana Bercelova (Slade)

Supervisors: Melanie Jackson (Slade), Prof Susanne Kuechler (Anthropology)

*What London is Made Of: Using Field Spectroscopy to Create a Library of Spectral Reflectance and Emissivity of Urban Materials in Central London*

Student: Simone Kotthaus (Geography)

Supervisors: Prof Sue Grimmond (Geography, King's College London), Prof Mark Miodownik (Mechanical Engineering)

*X-Ray Diffraction on Semiconductor Nanowires*

Student: Mohammed Kashim Bin Subhan (Physics)

Supervisors: Dr Paul Warburton (Electrical Engineering), Dr Peter Sushko (Physics & Astronomy)

### 2013

*Building Icy Worlds*

Student: Alexander Guest (Physics & Astronomy)

Supervisors: Dr Geraint Jones (Mullard Space Science Laboratory), Dr Peter Grindrod (Earth Sciences)

*Can We Make Cutlery Coated with  $\alpha$ - (Gray) Tin?*

Student: Andrew Breeson (Chemistry)

Supervisors: Prof Andrea Sella, Dr Darren Caruana (Chemistry), Prof Mark Miodownik (Mechanical Engineering)

*Creating a Fluid System That Can Cool and Auto-Regulate at a Predetermined Reference Temperature*

Student: Rhys James Williams (Medical Physics)

Supervisors: Dr Adam Gibson (Medical Physics & Bioengineering), Prof Ian Ford (Physics & Astronomy)

*Design and Development of a Novel Stent Graft Based on Smart Materials*

Student: Ebba Montgomery Lijeroth (Mechanical Engineering)

Supervisors: Dr Gaetano Burriesci (UCL Department of Mechanical Engineering), Prof Jay Humphrey (Engineering & Applied Science, Yale University), Prof George Tellides (Medicine, Yale University),

*In Vitro Model for Evaluation of Skeletal Tissue Repair*

Student: Chun Law (Mechanical Engineering)

Supervisors: Dr Jie Huang (Mechanical Engineering), Prof Jonathan Knowles (Eastman Dental Institute)

*Investigation of Novel Electrodes for Dielectric Electro-Active Polymers*

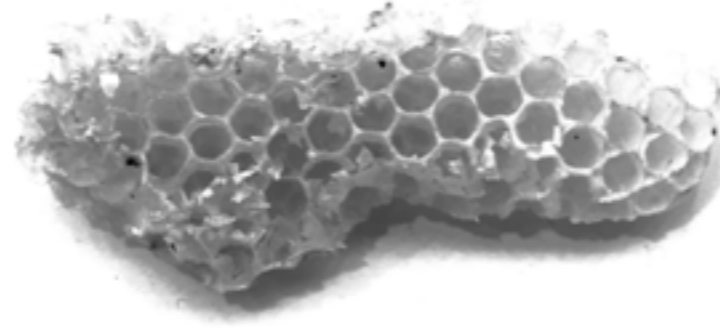
Student: Tudor Besleaga (Mechanical Engineering)

Supervisors: Dr Adam Wojcik (Mechanical Engineering), Dr Neil Curson (Electrical Engineering)

*Making an Atheist Place in a Religious Space: the Materialities of the Sunday Assembly*

Student: Gareth Breen (Anthropology)

Supervisors: Prof Charles Stewart (Anthropology), Dr Ben Campkin (Bartlett School of Architecture)



*Rapid Prototyping of Clinical Ultrasound Imaging Simulators with 3D Polymer Printing*

Student: Jordan Wan (Medical Physics)

Supervisors: Dr Adrien Desjardins (Medical Physics and Bioengineering), Prof Monty Mythen (Surgery and Interventional Science)

*Vapour-Deposited Nanomaterials for Microreactors 2*

Student: Leila Hedayat (Chemistry)

Supervisors: Dr Chris Blackman (Chemistry), Prof Asterios Gavriilidis (Chemical Engineering)

## Research / Teaching Projects

### *Architecture Materials Workshop*

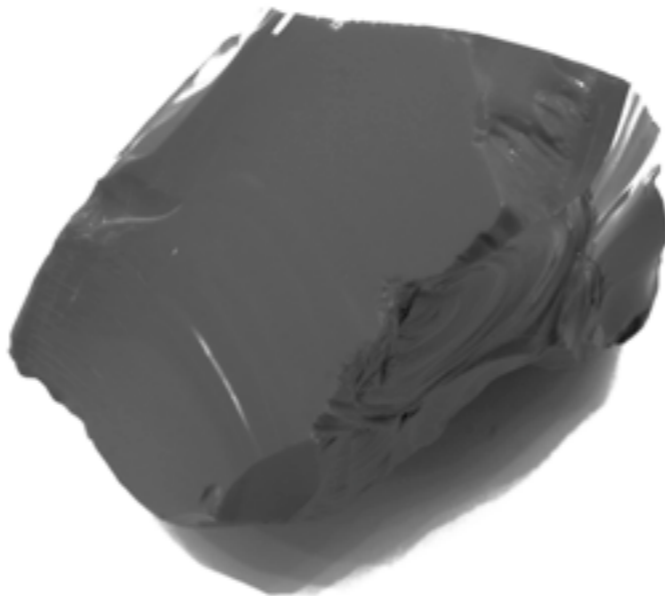
Researchers: Sarat Babu (VEIV), Richard Beckett (B-MADE, Bartlett), Polyfloss.

### *UCLoo Makeathon*

Researchers: Dr Sarah Bell (Civil Engineering), Dr Barbara Penner (Bartlett School of Architecture), Dr Tse-Hui Teh (Bartlett School of Architecture), Ellie Doney (Institute of Making), Richard Gamester (Institute of Making)  
Students: Talfan Evans (CoMPLEX), Joy Faucher (Biochemical Engineering), Jasmine Hui (Civil, Environmental and Geomatic Engineering), Alex Fedorec (CoMPLEX), Ben Oldham (CoMPLEX), Tang Yunchao (Bartlett School of Architecture), Danielle Willkens (Bartlett School of Architecture).

### *Material Invention Workshop*

Researchers: Rachel Philpott (Loughborough University), Katie Gaudion (Royal College of Art).  
Members: Antonio Garcia (Computer Science), Greg Nordberg (Civil Engineering), Keith Lau (Mechanical Engineering), Cristina Amati (Computer Science), Vicky Webb (Library Services), Kamila Suankulova (Physics & Astronomy), Aleksandra Najda (Anthropology), Sagal Ali (Cultural Heritage), Mohamed Jama (Chemistry), Molly Johansson (Anthropology), Sarah McFalls (Anthropology), Stefania Galetanu (Social Cognition), Andrei



Luchici (Mechanical Engineering), Sancheevan Karunanithy (Mechanical Engineering), Ali Zolfaghari (Bartlett), Nai-Rung Huang (Slade), Alaena Turner (Slade), Annie Kim (Bartlett), Sepehr Semsarzadeh (Mechanical Engineering), Fangli Liu (Bartlett), Toby Call (Biochemical Engineering), Alastair Smith (ISD), Niamh Riordan (Slade), Hunain Arif (Chemical Engineering), Hannah Varga (Anthropology), Emilia Atuesta (Anthropology), Javier Elkin (Neuroscience).

### *Darwin (or) Bust*

Researchers: Kate Davies (Bartlett), Inigo Dodd (Bartlett), Emmanuel Vercruysse (Bartlett), Mona Hess (MPE and Civil Engineering), Richard Gamester (Institute of Making), Suzanne Ruddy (Life Sciences), Mark Carnall (Grant Museum), Jack Ashby (Grant Museum), Ellie Doney (Institute of Making).  
Members: Tom Svilans (Bartlett), Cristina Amati (Computer Science), Graeme Smith (Electronic Engineering), Tom Catling (Physics & Astronomy), Josephine McNally (Life Sciences), Kelvin Wong (Computer Science), James Mould (Physics), Andrew Breeson (Chemistry), Jo Howcroft (Bloomsbury Theatre).



## Small Research Grant Winners

### *Brain Activation With Magnetic Fields and Targeted Iron Oxide Particles*

Investigators: Yichao Yu (Centre for Advanced Biomedical Imaging), Chris Payne (Centre for Clinical Pharmacology and Therapeutic), Vitaliy Kasymov (Life Sciences), Dr Alexander Gourine (Neuroscience, Physiology & Pharmacology), Prof Quentin Pankhurst (Centre for Materials Research), Prof Mark Lythgoe (Centre for Advanced Biomedical Imaging)

### *Cleaning Materials: Effects of Cleaning Materials and Maintenance on Whole Life Analysis of Manufactured Items*

Investigators: Dr Kaori O'Connor (Anthropology), Prof Julian Evans (Chemistry), Dr Paola Lettieri (Chemical Engineering), Prof Susanne Kuechler (Anthropology)

### *Creating a Modular, Kinetic Octohedral Robot*

Investigators: Ruairi Glynn (Bartlett School of Architecture) and Dr Peter Bentley (Computer Science)

### *Creating a Library of Spectral Reflectance & Emissivity of Urban Materials in Central London*

Investigators: Dr Simone Kotthaus (Geography, King's College London), Prof Sue Grimmond (Geography, KCL), Prof Martin Wooster (Geography, KCL) and Prof Mark Miodownik (Mechanical Engineering)



### *Dinner With Picasso*

Investigators: Alaena Turner (Slade), Gary Woodley (Slade) and Prof Andrew Leak (French, SELCS)

### *Enacting and Re-enacting the Cast: Robot-Actuated Ceramic Casting*

Investigators: Kate Davies (Bartlett), Emmanuel Vercautse (Bartlett), Giles Corby (Slade), Lilah Fowler (Slade) and Prof Ed Allington (Slade)

### *How Can 3D Printing Shape Engagement With Museum Objects*

Investigators: Nick Booth (Museums and Public Engagement), Claire Ross (Centre for Digital Humanities)

### *Materials Histories: Emotions, Transformations, Restorations*

Investigators: Dr Leonie Hannan (History and Museums and Public Engagement), Dr Simon Werrett (Science & Technology Studies) and Dr Anna Maerker (History, King's College)

### *Metal Skies and Shades of Brick: Urban Print and Palette*

Investigators: Dr Hilary Powell (Bartlett School of Architecture) and Prof Julian Evans (Chemistry)

### *Modelling Blood Flow and Manufacturing Scaled-Up Representations of Tumour Vasculature Using 3D Printing*

Investigators: Dr Rebecca Shipley (Mechanical Engineering) and Dr Simon Walker-Samuel (Centre for Advanced Biomedical Imaging)

*Nanomaterial-Based Sensors for Urban Environmental Monitoring*

Investigators: Gwyn Evans (Security Science), Louise Francis (Civil Engineering), Dr Claire Ellul (Civil Engineering), Alistair Leak (Security Science), David Buckley (LCN), Prof Neil Skipper (LCN)

*Novel Application for the Material Boron-Doped Diamond (BDD)*

Investigators: Dr Tom Varley (Chemistry) and Prof Alexander MacRobert (Surgery & Interventional Science)

*Prototypes for Maximising Optically-Generated Ultrasound (OGUS) Amplitude*

Investigators: Dr Ben Cox (Medical Physics) and Dr Christoph Salzmann (Chemistry)

*RF Sensor for Identifying Targets Using Micro-Doppler Signatures*

Investigators: Dr Matthew Ash (Electronic and Electrical Engineering), Dr Matthew Richie (Electronic and Electrical Engineering) and Dr Kevin Chetty (Security & Crime Science)

*The Social Perception and Uptake of Polyester Fabrics and Fleece*

Investigators: Shweta Barupal (Anthropology), Dr Paola Lettieri (Chemical Engineering), Dr Margarita Glebe (Archaeology), Prof Susanne Kuechler (Anthropology)



## Recipients of the Prof. Heinz Wolf Materials Bursary

Aaron Eveleigh	Nixie Tube Speedometer
Alexandr Gerrity	Heat & Haute Couture - Using Destructive Techniques in Textiles
Alikaterini Padimitriou	Evolutionary Performance of Carbon Fibres
Amanda Campbell	Biodegradable Structures
Angeliki Bakogiani	Smart Materials Interactive Installation
Annie Herbert	Lamp Revamp and New Cool Piano Stool
Anthony D'auria	Hybridising Steel and Concrete Tectonics
Bernadette Devilat Loustalot	Materialising the Immaterial: 3D Printing of Chilean Historic Villages Digitally Recorded Using 3D Scanning
Calum Bowden	Digital Intimacy
Charlie Harrison	LED Dancing Suit
Dale Markowitz	Liquid Voxels
Daniel Venn	Making Faces With Ferrofluidics
Dominika Janula	Love and Strife
Eliza De Silva	Digital Thresholds
Elizabeth Jane Dickson	Fusing Recycled Glass: Refusing to be Deterred by Multiple Coes
Emily Yan	Digital/Analogue Fabrication of Soft and Flexible Hybrid Plastics
Esteban Castro	Evolutionary Performance of Carbon Fibres



Francesca Silvi	Resilient Systems
George Waller	Active Monitor Speakers
George Konstantinou	LED Video Tiles
Georgia Preston-Maher	Moulding the Human Mitral Valve
Giuseppe Miccoli	Smart Materials Interactive Installation
Gladys Ching	Interference Architecture
Graeme Smith	Box of Leaves
Graham Benham	Modern Dining Table of Eclectic Materials
Isabelle Yap	DIY Algae Photoreactor
Jack Reilly	Nanobrewery
Jack Reynolds	Electroplating
Jacqueline Edge	Tiffany-Style Leaded Glass Door Panel
James Cook	3D Printing an Innovative Bicycle Helmet
James Mould	Platonic Solids Sculpture Series
James Trundle	The Burrow of a Mouse
Jennifer Caroline Campbell	Polymorph Plastic, as a Hand-Made, Yet Synthetic, Painterly Object.
Jessica Knights	Sonically Transforming Washi Paper
Jihum Kim	Designing a New Type of Building Façade System
Lan Lan	A Cross Area Collaboration - Forensic/Fine Art/3D Technology/Design
Li Xie	Hand-Made Composite Table Tennis Blades
Lisa Koeman	The Visualisers Toolkit
Marcin Komar	Evolutionary Performance of Carbon Fibres
Marcos Karasaminis	Desktop Lab Assistant 1.0
Matthew Topping	Constructing Mosquito Cages



Michelle Downes	Mental Health is Your Wealth
Ming The	Novel Epinephedrine Autoinjector
Nicholas Debruyne	The (Super)Natures of Wax
Olivia Pearson	Fibrous Iridescence
Prashanthan Ganeswaran	Bowled Over by Design
Richard Winter	From Car Tyre to Concrete
Rory Keenan	Material Composites of Airborne Manufacture
Sarah Wiseman	Breaking The Mould: Taking Silver Out of its Comfort Zone
Shirley Lee	The Ergonomic, Tessellated Adaptive Pod
Steve Dodier-Lazaro	Coffee Table
Taaha Hussain	Arduino Lamp
Talfan Evans	Local Topographical Reconstruction in Layered Laser Cut Wood
Thomas Pearce	Orchestrating The Edge, Controlling Lidar Edge Noise
Thomas Wyatt	A Magic Mirror
Tom Catling	Restoring A Vintage Model Maker's Lathe With Traditional Techniques
Tudor Besleaga	Reliability of Transparent Electrodes For Dielectric Electro-Active Polymers.
Valerie Kong	Runaway Nomad Land
Will Mitchell	Optimising Rainwater Harvesting Storage Tanks Using Geomembrane Plastics
Will Usher	An Exploration of Wood Finishes
Xianze Hong	Umbrella for Never Losing

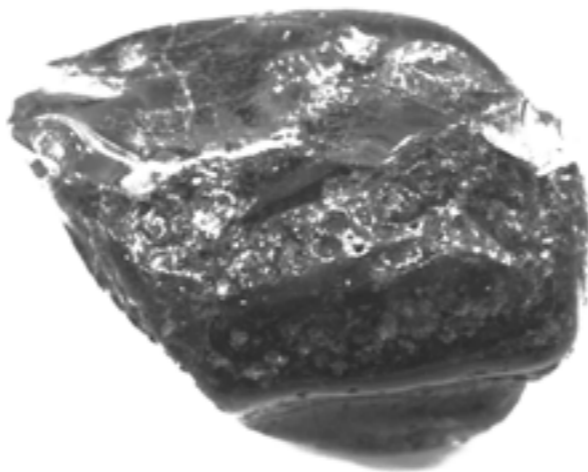


Yao Lu	Creating Water Repellant Steel
Yichao Yu	Set Piece for a Sci-Fi Play Named “The Closed Loop”
Yilin Yao	Evolutionary Performance Of Carbon Fibres
Ying Jin	Programmable Ferro-Liquid Sculpture
Yva Jung	Suitcase Binding Project
Zhibo Su	Light Alarm Clock for Healthy Days

## Full Events List

**33 Total events:** 7 public open days, 14 masterclasses, 4 talks, 6 research events and 2 week-long events.

16<sup>th</sup> March, 2013. *Grand Opening* (Open day) Public event.  
19<sup>th</sup> April, 2013. *Materials at the Centre* (Research event).  
26<sup>th</sup> April, 2013. *Blacksmithing* (Masterclass) Members event.  
27<sup>th</sup> April, 2013. *Plastic Fantastic* (Open day) Public event.  
10<sup>th</sup> May, 2013. *Flintknapping* (Masterclass) Members event.  
17<sup>th</sup> May, 2013. *Materials Invention* (Masterclass) Members event.  
24<sup>th</sup> May, 2013. *Neon Light Making* (Masterclass) Members event.  
25<sup>th</sup> May, 2013. *Luminescence* (Open day) Public event.  
29<sup>th</sup> May, 2013. *Animatronics* (Masterclass) Members event.  
4<sup>th</sup> June, 2013. *Arduino - Interactive Objects* (Masterclass) Members event.  
25<sup>th</sup> June, 2013. *Folding Knife* (Masterclass) Members event.  
29<sup>th</sup> June, 2013. *String & Things* (Open day) Public event.  
3<sup>rd</sup> July, 2013. *Low-Cost Laser Scanning* (Masterclass). Members event.  
17<sup>th</sup> July, 2013. *Low-Cost Laser Scanning* (Masterclass). Members event.  
19<sup>th</sup> July, 2013. *Science of Cooking* (Masterclass) Members event.  
27<sup>th</sup> July, 2013. *Foam* (Open day) Public event.  
28<sup>th</sup> September, 2013. *Trees* (Open day) Public event.  
30<sup>th</sup> September - 4<sup>th</sup> October, 2013. *Wood Week*. (Open to all UCL).  
30<sup>th</sup> September - 4<sup>th</sup> October, 2013. *Jim Steele* (Masterclass) Members event.



2<sup>nd</sup> October, 2013. *Stickdressing* (Talk) Members event.  
3<sup>rd</sup> October, 2013. *Barn the Spoon* (Masterclass) Members event.  
21<sup>st</sup> October, 2013. *3D Manufacturing* (Research event).  
25<sup>th</sup> October, 2013. *Flintknapping* (Masterclass) Members and Public event.  
28<sup>th</sup> October, 2013. *Art History Forum* (Research event).  
7<sup>th</sup> November, 2013. *Smell and the City* (Masterclass) Members and Public event.  
21<sup>st</sup> November, 2013. *Roja Dove: An Olfactory Experience* (Talk) Members and Public.  
28<sup>th</sup> November, 2013. *Digital Humanities Forum* (Research event).  
2<sup>nd</sup> January, 2014. *sKINship* (Masterclass) Members and Public event.  
4<sup>th</sup> February, 2014. *Tim Hunkin Tinkering* (Masterclass) Members event.  
4<sup>th</sup> February, 2014. *Tim Hunkin* (Talk) Members and Public event.  
13<sup>th</sup> February, 2014. *Tom Pellereau; Inventing your Future* (Talk) Members event.  
17<sup>th</sup> February, 2014. *Making Repairs* (Research event).  
18<sup>th</sup> February, 2014. *Bodging and Repairing with Jasleen Kaur* (Masterclass) Public event.  
19<sup>th</sup> February, 2014. *Bodging and Repairing with Jasleen Kaur* (Masterclass) Members event.  
24<sup>th</sup> - 28<sup>th</sup> February, 2014. *Mould Making Week* (Masterclass) Members event.  
14<sup>th</sup> March, 2014. *Members' Birthday Celebrations* (Members Awards) Members event.  
15<sup>th</sup> March, 2014. *First Birthday Celebrations* (Open day) Public event.

## Institute of Making Publications

Conreen, M., Laughlin, Z. and Miodownik, M. 2007. Strange Material. *Proceedings of Ars Ornata Europeana*, Manchester.

Howes, P. and Laughlin, Z. 2012. *Material Matters: New Materials in Design*. Black Dog Publishing, London. ISBN:978-1907317736

Laughlin, Z., Naumann, F. and Miodownik, M. 2008. Investigating the Acoustic Properties of Materials with Tuning Forks. *Materials & Sensations* Pau (France) Oct. 22–24.

Laughlin, Z., Naumann, F., Conreen, M., and Miodownik, M. 2009. Investigating the Acoustic Properties of Materials with Tuning Forks. *Proceedings of the MINET Conference: Measurement, Sensation and Cognition* 10-12 Nov. pp. 124-126. National Physical Laboratory, London.

Laughlin, Z., Conreen, M., Witchel, H. and Miodownik, M. 2009. The Taste of Materials: Spoons. *Proceedings of the MINET Conference: Measurement, Sensation and Cognition* 10-12 Nov. pp. 127-128. National Physical Laboratory, London.

Laughlin, Z. 2010. *Beyond the Swatch: How can the Science of Materials be Represented by the Materials Themselves in a Materials Library?* PhD Thesis, King's College London.



Laughlin, Z., Conreen, M., Witchel, H. J. and Miodownik M. 2011. The Use of Standard Electrode Potentials to Predict the Taste of Solid Metals. *Food, Quality and Preference* 22(7) pp. 628-637.

Laughlin, Z. 2013. Jenseits des Musters: Forschung in der Materials Library. In Peters, S. (eds) *Das Forschen Aller: Artistic Reserach als Wissensproduktion zwischen Kunst, Wissenschaft und Gesellschaft. (The Research of All: Artistic Research as Knowledge-Production between Art, Science and Society)*. pp. 121-140, Transcript Verlag, Germany. ISBN: 978-3-8376-2172-3

Laughlin, Z. and Howes, P. 2014. The Sound and Taste of Materials. In Karana, E., Pedgley, O. and Rognoli, V. (eds.). *Materials Experience: Fundamentals of Materials and Design*. pp. 39-49. Butterworth-Heinemann, Oxford. ISBN: 978-0-08-09359-1

Miodownik, M. 2007. Toward Designing New Sensoaesthetic Materials. *Pure Applied Chemistry* 79(10) pp. 1635-1641.

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Miodownik, M. 2013. *Stuff Matters: The Strange Stories of the Marvellous Materials that Shape Our Man-made World*. Penguin Books, UK. ISBN: 9780670920549.

Miodownik, M. 2013, The Institute of Making. *Materials Today* 16 pp. 458-459.

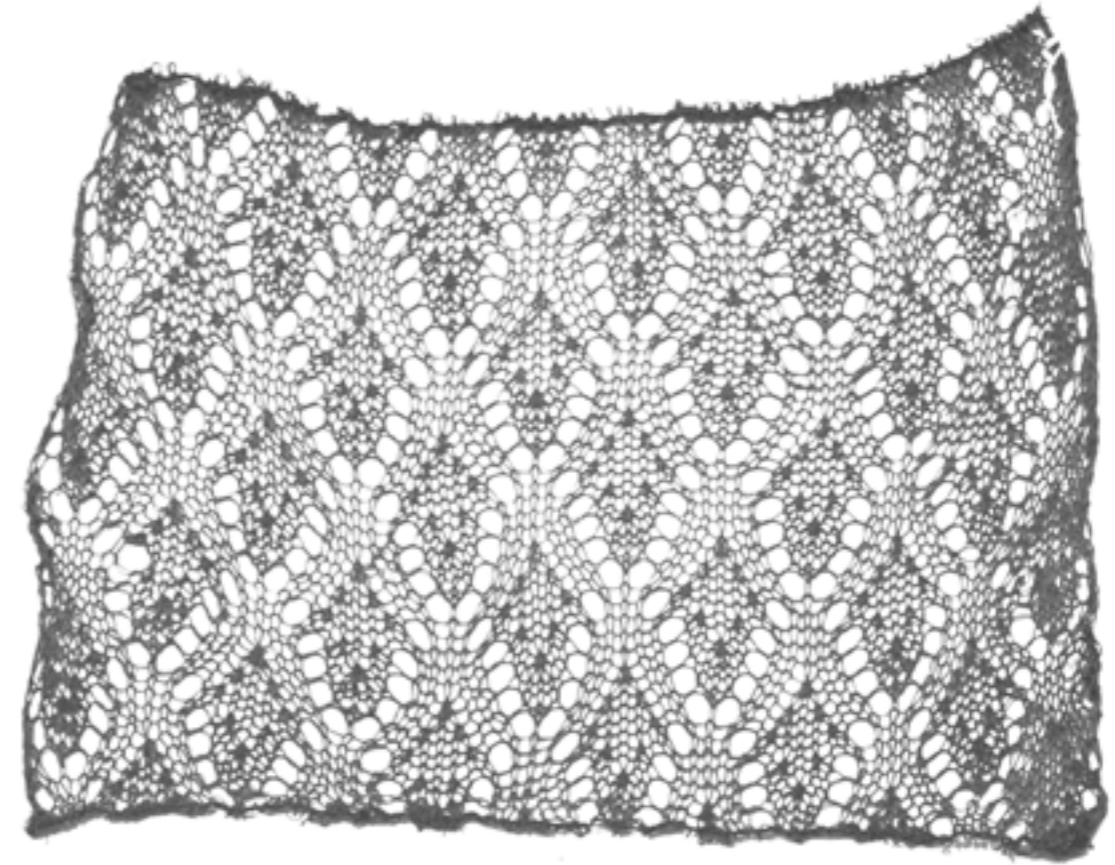
Piqueras-Fiszman, B., Laughlin, Z., Miodownik, M. and Spence, C. 2011. *Tasting Spoons: Assessing How the Material of a Spoon Affects the Taste of the Food*. *Food, Quality and Preference* 22(7) pp. 628-637.

Wilkes, S. 2011. Materials Libraries as a Vehicle for Knowledge Transfer. *Anthropology Matters* 13(1). Available at: [www.anthropologymatters.com](http://www.anthropologymatters.com)

Wilkes, S. 2014. *In Search of Sustainable Materials: Negotiating Materiality and Morality in the UK Materials Industry*. PhD Thesis, University College London.

Wilkes, S. forthcoming (2014). Sustainability and the Co-Constitution of Substances and Subjects. In Kuechler, S. and Drazin, A. (eds.), *Materials Transformations: Anthropological Accounts of Materials and Society*. Bloomsbury, London.

Wongsriruksa, S., Howes, P., Conreen M. and Miodownik, M. 2012. The Use of Physical Property Data to Predict the Touch Perception of Materials. *Materials & Design* 42 pp. 238-244.





## Media Coverage

### Institute of Making

Institute of Making Opens at UCL. Wild Culture, 12<sup>th</sup> March 2013.  
Available at: <http://www.wildculture.com/article/institute-making-opens-ucl/1109>

Institute of Making: To Help us Reconnect with ‘Stuff’. Telegraph, 1<sup>st</sup> April 2013. Available at: <http://www.telegraph.co.uk/culture/art/art-news/9964950/Institute-of-Making-to-help-us-reconnect-with-stuff.html>

The Institute of Making. Architectural Association Conversations, 28<sup>th</sup> January 2014. Available at: <http://conversations.aaschool.ac.uk/the-institute-of-making/>

### Materials Library

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*Dara O'Briain's Science Club Series*. BBC2, Aug 2013.

*Any Questions?*, 2013. BBC Radio 4, 23<sup>rd</sup> August 2013.

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## Birthday Award Winners

Outstanding Maker Award  
Perseverance Award  
The Spirit of the Makerspace  
Most Experimental  
The Head-Turner  
Attention to Detail  
Public Engagement  
Most Helpful Academic  
Development Award  
Master of Masterclasses

Will Usher  
Bernadette Devilat  
Olivia Pearson  
Nai-Rung Huang  
Yva Jung  
James Moreland  
Nadia Abdoul  
Mark Handley  
Tom Catling  
Nai-Rung Huang  
Mohamed Jama  
Prashanthan Ganeswaran



## The Institute of Making Team

Ellie Doney – Makespace Manager

Elizabeth Corbin – Materials Library Researcher

Martin Conreen – Director of Making

Mark Miodownik – Director

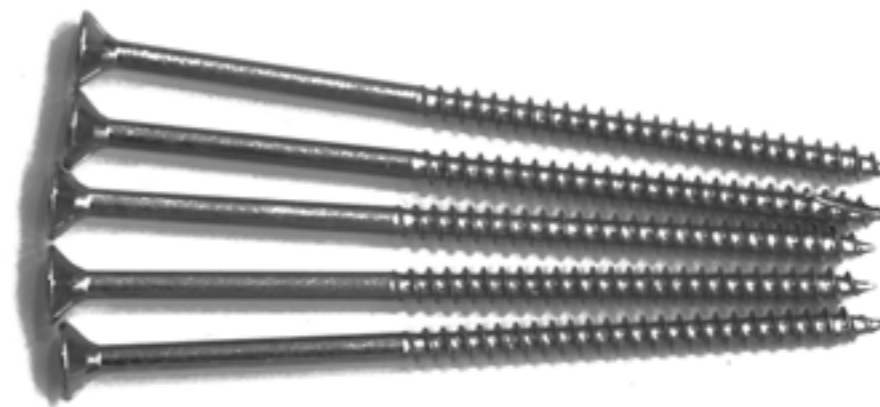
Olivia Alice Clemence – Events Coordinator

Richard Gamester – Makespace Technician

Sarah Wilkes – Research Manager

Zach Eastwood-Bloom – Assistant Makespace Technician

Zoe Laughlin – Creative Director





## Steering Committee

Andrea Sella - Professor of Inorganic Chemistry, UCL

Anthony Finkelstein - Dean of Engineering Sciences and Professor of Software Systems Engineering, UCL (Chair)

Bob Sheil - Professor of Architecture and Design through Production, and Director of Technology and Computing, Bartlett School of Architecture, UCL

Chris Wise - Expedition Engineering and Professor of Civil Engineering Design, UCL

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

Sally MacDonald - Director, Museums and Public Engagement, UCL

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

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



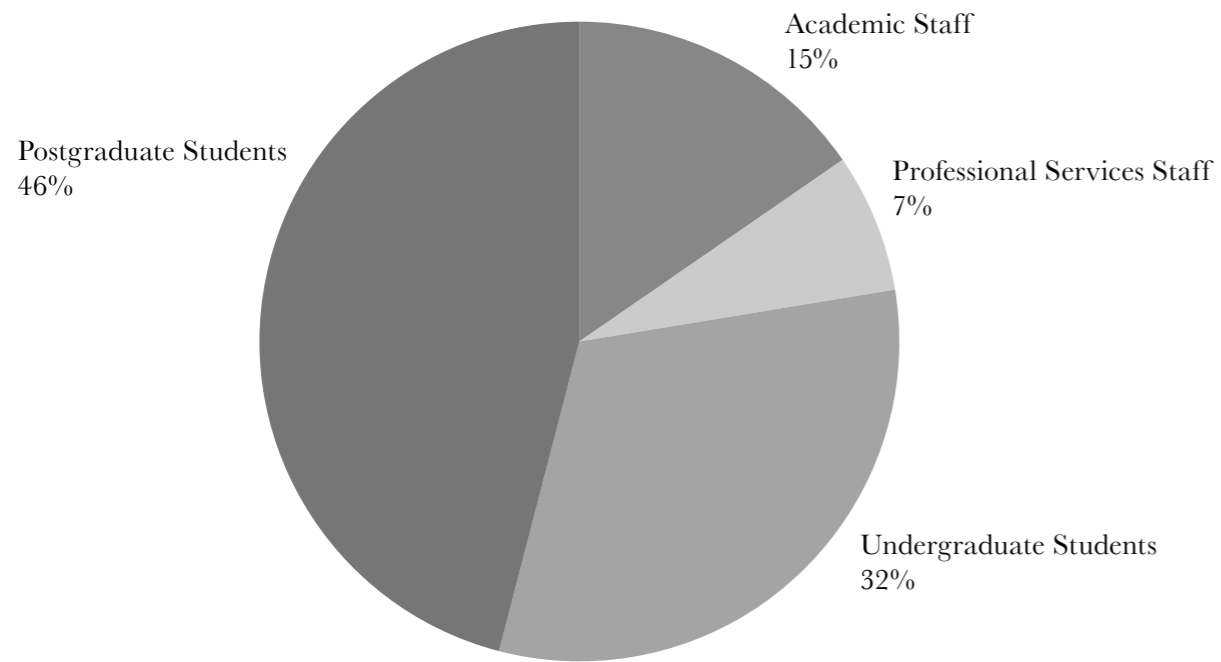
## Funding, Donations & Commercial Support

Alan Brener  
Atkins  
Chris Nolan  
Emma Thomas  
EPSRC  
European Union  
Jeremy Anderson  
Leverhulme Trust  
Robert Nichols  
UCL Engineering



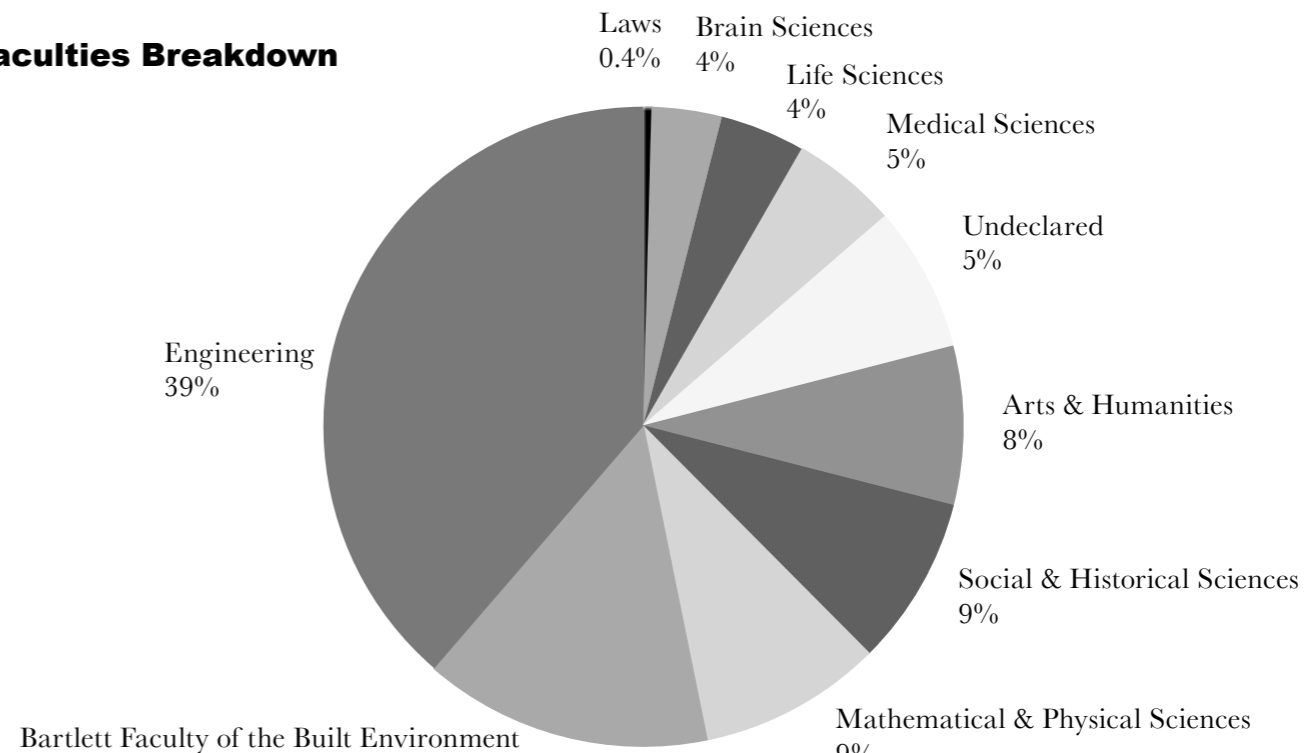
# Full Statistics of Membership

## Membership Breakdown



218

## Faculties Breakdown



219

## Member Numbers

**Total 2616**

(06/03/2014)

### Gender

Female 910

Male 1164

Undeclared 542

### Position

**Staff 572**

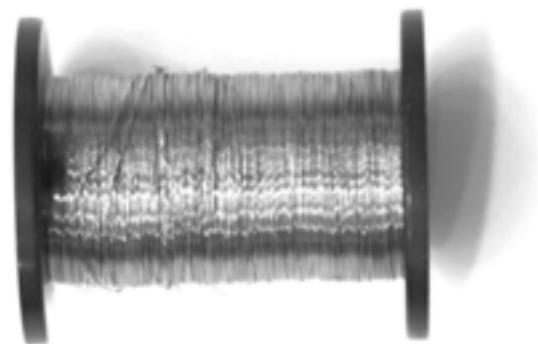
Academic Staff 390

Professional Services Staff 178

**Students 2044**

Undergraduate Students 802

Postgraduate Students 1165



### Faculties

Laws 10

Brain Sciences 85

Life Sciences 104

Medical Sciences 128

Arts & Humanities 192

Social & Historical Sciences 205

Mathematical & Physical Sciences 222

Bartlett Faculty of the Built Environment 348

Engineering 927

Undeclared 176

### Schools

SLMS 317

SLASH 407

BEAMS 1497

Undeclared 395



## Thanks

Abi Abdolwahabi  
Alan Brener  
Andrea Sella  
Angela Clemo  
Angharad Milenkovic  
Anna Clark  
Anthony Finkelstein  
Antonio Garcia Castaneda  
Bob Sheil  
Brendan Bryne  
Catherine Dean  
Chris Wise  
Christine Simms  
Christopher Nolan  
Diane Davis  
Emily Skinner  
Emma Thomas  
Gaurav Sharma  
Gerald McBrearty  
Giles Corby  
Graeme McPhillips  
Hannah Umar

Hayley Midwinter  
Jack Ashby  
Janic Nielsen  
Jeremy Anderson  
John Stewart  
Kate Oliver  
Kevin Drake  
Lauren Sadler  
Lee Wilkinson  
Liz Walker  
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