The Engineering Exchange is always looking for new collaborators. If you are interested in our work or have an idea for a project, please feel free to contact us:

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Introduction

Since launching in March 2014, the Engineering Exchange (EngEx) at UCL has pursued an ambitious programme of projects and events in collaboration with community groups, academics, researchers and practitioners, in the fields of engineering and the built environment.

In the past year, the EngEx has received new grants and supported a range of projects, expanded its CPD delivery, and laid the groundwork for further growth through its new Co-Directors structure, as part of its aim to establish UCL as a world-leading centre for community engaged engineering research, teaching and entrepreneurship.

In 2016, the EngEx expanded from working within the Faculty of Engineering at UCL, to include support from UCL’s Bartlett Faculty of the Built Environment. It also trialled a membership model, which enabled it to work with industry partners to provide pro bono services in aid of community-led neighbourhood planning.

The EngEx believes that community engagement is a two-way process, with communities benefiting from access to leading-edge research outcomes, and researchers and students benefiting from community knowledge and problem identification. This forms the foundation of all work undertaken by the EngEx. This report outlines our aims, projects, training and budget over the past year, as well as our plans moving forward.

Image (above): At a recent community research forum, the EngEx trialled the Economy of Hours skills trading network as part of our ‘match-making’ system for community-university collaboration
Aims

EngEx activities are focused in three key areas:

Research: aligning engineering research with community needs. The EngEx supports researchers in developing community-based research projects and in working with communities to turn a specific need for technical knowledge into an appropriate research question and project. The EngEx supports researchers to incorporate upstream public engagement in their projects to better address the need for responsible, responsive research and innovation.

Skills: providing communities with access to engineering skills and knowledge. The EngEx provides a brokering service to match specific community needs for technical expertise with staff and students in UCL’s faculties of engineering and the built environment. For instance, communities may have needs for environmental monitoring, mapping or support in developing local sustainability plans.

Learning: integrating community knowledge and needs into engineering curricula and continuing professional development (CPD). The EngEx works with academic staff across departments and faculties to identify opportunities to embed community based projects into the curriculum. Our CPD course ‘Skills and Strategies for Community Engagement’ supports development of skills and capabilities in community engagement for practicing engineers and engineering researchers, and built environment specialists.

“The use of neighbourhood plans wasn’t something I’ve experienced before. Felt like a really positive way to influence planning policy.”
Project Partner, Max Fordham LLP
Projects

The Engineering Exchange develops and delivers projects in partnership with local community groups. Partner networks including Just Space, the London Sustainability Exchange (LSx) and the London Tenants’ Federation (LTF) help by notifying their members of opportunities, and community groups can approach the EngEx with ideas, questions or problems.

When a project is begun, either by responding to calls from the community or through ideas generated during EngEx events and activities, the EngEx ‘match-makes’ the community group with the relevant expertise, skills and interest from its register of engineers and built environment specialists. Outputs, timelines and potential follow-on work is then agreed between the project participants. Although there are no restrictions on the length of time, subject or activity resulting from the projects, they must address a specific, technical problem faced by a London community and be delivered in partnership between UCL and members of community groups located or operating in London. They must also fit within the schedules and time availability of both the engineers and the community groups.

Projects are considered successfully completed when the objectives are met and stakeholders have held a final meeting to offer feedback and close out. This is also an opportunity to determine if there is scope to take the project forward. The following projects have either been completed this year, or are still in progress:

CAMDEN AIR ACTION

Camden Air Action is an alliance of community groups and local residents working to raise awareness and take action on air quality in Camden. As citizen scientists, they have collaborated with Camden Council to gather air pollution data at more than 100 sites across the borough. They would like to be able to visualise this data and other related datasets, to inform community engagement with air quality policy and actions to reduce pollution and its impacts, and to improve understanding of car parking, which has an indirect influence on air quality through its impact on car ownership and use and traffic flows. Working with Dr Adam Dennett and students in the Centre for Advanced Spatial Analysis (CASA), the project aims to create two visualisation tools: one to support analysis of citizen science and official datasets related to air quality in Camden, and the other to support analysis of car parking issues in Camden.
CIRCULAR ECONOMY

The circular economy (CE) has attracted attention as a way to move from highly inefficient linear systems of production and consumption, towards more circular systems that are restorative by purpose and design, creating opportunities to improve local economic conditions and environmental impacts. Working with Just Space, Dr Aiduan Borrion from UCL’s Civil, Environmental and Geomatic Engineering department and Dr Teresa Domenech Aparisi of the UCL Institute for Sustainable Resources applied circular economy principles to the Old Oak Park Royal regeneration project in West London. The project used Material Flow Analysis to understand key resource flows coming in and out of the area and identified ways to harness the value of resources. The project compared scenarios (baseline, energy self-sufficiency and circular economy) to assess potential and possible trade-offs between strategies, and proposed policy recommendations to integrate CE principles into the regeneration project. Findings suggest a trade-off between ‘waste to energy’ and reuse/recycling approaches, and suggests avenues to reconcile renewable energy from waste and high recycling rates.

EVALUATING THE ENGINEERING EXCHANGE

Hannah Cane, a student on the UCL Geography MSc in Environment, Politics and Society, undertook a dissertation to evaluate the impact generated by the work of the EngEx. Hannah interviewed UCL and external participants from EngEx projects that focussed on air quality and pollution, and reviewed project management materials developed by the EngEx. Her work highlighted some key challenges of the EngEx engagement model, such as reasons for incomplete projects and difficulties in defining the purpose of the EngEx for different audiences, and successes, such as a strong ability to define problems and generate project ideas. She also offered recommendations for increasing the impact of the EngEx, such as improving clarity in messaging, increasing institutional buy-in within UCL, and ensuring clear objectives for each project.

NEIGHBOURHOOD PLAN

The Greater Carpenters Neighbourhood Forum (GCNF) developed a Neighbourhood Plan, outlining key planning policies and principles based on community and stakeholder needs and values. The GCNF assessed that the Plan would be strengthened by more rigorous sustainability evaluation and further detail in some areas, and sought an external evaluation, with the aim of gaining support around analysis of refurbishment costs, and to provide data required to take forward development of a master plan. To provide this evaluation, the EngEx engaged the pilot organisation of our Membership scheme, Max Fordham LLP: a London-based building services engineering and environmental design consultancy with specialised knowledge in environmental design and sustainability assessment. They provided benchmarking of the elements of the plan against existing planning policies and best practice.
SALVATION ARMY SHELTER

The Salvation Army in Ilford is preparing to deliver Project Malachi, which will provide temporary housing for homeless people in Redbridge. The development will consist of 40 self-contained units in 20 shipping containers, plus 5 containers for other use (including employment training such as Recycles, a bicycle refurbishment social enterprise). The aim is to provide a stable, secure platform for transition into more permanent housing and work. The units’ design is in an early stage of drafting, and members of the local community have identified potential benefits of incorporating green infrastructure principles, in order to improve resource efficiency, reduce environmental impacts and perhaps increase public buy-in. Supervised by Dr Manni Bhatti, MSc students from UCL’s Department of Civil, Environmental and Geomatic Engineering are assessing the feasibility of various design options, including (for example) waste management; grey water capture and recycling; solar energy, passive heat; roof gardens etc.

SILVERTOWN TUNNEL

Transport for London (TfL) submitted and had accepted for examination a formal application to the Planning Inspectorate for the Silvertown Tunnel project, to link to the A1020 Silvertown Way/Lower Lea Crossing on the north side and to the A102 Blackwall Tunnel Approach on the south side. However, local residents were concerned about the negative air quality impacts of increased traffic flow through the area, as well as the equity issues raised by expected tunnel tolls, and formed the No to Silvertown Tunnel group to investigate potential impacts. Dr Andy Chow of UCL’s Civil, Environmental and Geomatic Engineering department evaluated the TfL model analysis and developed a draft report based on examples from other cities where similar projects have led to increased traffic and air pollution. The work was used by the community group to inform their comments on the planning application, prior to the examination.
SOIL QUALITY

There is a strong movement to encourage the use of land in urban and urban fringe settings, for community food growing activities. However, this is not always matched with the support to understand more about the quality of the soil on these sites, such as prior use and possible contamination. The current London Plan references encouraging the use of land for food growing in its Policy 7.22 (‘Land for food’), but with no specific reference to soil. Robin Brown of Just Space and other participants at the EngEx/LSx Green Infrastructure community research forum identified opportunities to influence London policy in this area, as the draft new London Plan is scheduled to be out for public consultation in the autumn. In consultation with EngEx Co-Director Dr Carla Washbourne and with the input of specialists at Cardiff University, including Ishna Maanishi and Phil Renforth, this project thereby aimed to enable community groups to discover more about the soils in potential food growing sites, by producing a toolkit that will enable community groups to identify those areas appropriate for food growing with or without remediation and/or the measures necessary for remediation, as well as a framework for testing and using the toolkit.

WASH MONITORING

Boating communities situated in the Thames are concerned about potential impacts of the Thames Tideway Tunnel infrastructure project, both on their living conditions and on the river’s ecology. Tideway’s mandate includes working with local communities to minimise negative impacts and to improve the ecological health of the river. However, their data is unavailable to the public, and there is a desire in the community to measure baseline indicators in advance of building commencement in the Thames, to ensure damage to the waterway is minimal and in line with Tideway’s commitments. Supervised by Dr Helen Czerski, Stephen Peter Rowe, an MSc student in the Department of Mechanical Engineering, designed a wave height monitor to record surface disruption due to increased traffic during the construction phase.
The year in numbers

- Projects initiated: 19
- UCL students involved in EngEx activities: 13
- UCL staff involved in EngEx activities: 66
- Presentations to external audiences: 10
- CPD courses run: 1
- Videos produced: 7
- Project partner organisations: 6
- CPD learners: 13
- Members of the public involved in EngEx activities: 227
- Community forum participants: 62
- Projects completed: 4
- Community forum events: 1
- Projects on-going: 6
- Media coverage: 1
Research Programmes
Engineering Comes Home was an EPSRC-funded research project that took a bottom-up approach to the water-energy-food nexus, turning the traditional process of infrastructure design on its head. The project started with household needs and looked outward to design technologies and infrastructure, putting people and their everyday needs and desires first. It also acknowledged complex patterns of resource consumption in households, arising from interactions with socio-technical systems.

The objectives of the project were to:

- Demonstrate a new paradigm for infrastructure design starting from the home, looking out towards provision systems that meet household demands.
- Integrate thinking about water, energy, food, waste and data at the domestic scale to support user-led innovation and co-design of technologies and infrastructure.
- Test design methods to connect homes to communities, technologies and infrastructure. This can enhance positive interactions between data, water, energy, food and waste systems.

The project produced a toolkit for infrastructure co-design, available online (https://ech.iilab.org/), including:

- Method statements for co-design
- Tools to deliver co-design;
- Evaluation methods;
- Videos of the process in action;
- Academic and professional publications.

This project involved working with residents of the Meakin Estate and their landlord, Leathermarket JMB.

The UCL project team comprised Dr Sarah Bell, Director of the Engineering Exchange; Dr Aiduan Borron, Senior Research Associate in the Department of Civil, Environmental and Geomatic Engineering and Dr Charlotte Johnson, Research Associate in the Bartlett School of Environment, Energy and Resources.

Project partners included Dr Kat Austen and iilab, and Dr Robert Comber, Lecturer in Computer Mediated Communication based at Open Lab, Newcastle University.
GREEN INFRASTRUCTURE

Green Infrastructure (GI) includes a range of biological features in cities and has many potential benefits including reducing air and water pollution, reducing local flood risk, enhancing biodiversity and improving human health and wellbeing. However, there are gaps in the research about these benefits and any associated costs and risk. GI is an important policy area in the London Environmental Strategy, and community groups need a good understanding of the evidence about the effectiveness of GI in London in order to participate most effectively in debate and policy formulation, and to support their own initiatives and actions in this area.

The EngEx received a grant from the Natural Environment Research Council (NERC), as part of the ‘Engaging the UK public with the big issues of environmental science’ pilot scheme. This funding supported a one-day CPD course (see section Continuing Professional Development for details), a community research forum, a public panel event and report launch, a series of videos and a peer-reviewed report examining the scientific evidence for the effectiveness and risks associated with GI in London.

The forum brought together members of the London Sustainability Exchange (LSx) and Just Space networks with UCL researchers and academics interested in various topics relating to green infrastructure. Over the course of an evening, groups formed to ‘pitch’ their ideas for projects. Two of these projects have been carried forward, with support from the EngEx and UCL green infrastructure specialists (see ‘Salvation Army Shelter’ and ‘Soil Quality’ in the Projects section).

Image (lower, right) courtesy of London’s Surrey Dock Farms

The public panel, which doubled as a ‘soft’ launch for the first draft of the report, was also an opportunity to engage the public in contributing to the research outputs. Attendees were invited to participate in the report’s review process, alongside the more traditional academic peer review. We received 9 responses from members of the public, giving their views on the strengths and weaknesses of the draft report, as well as ideas for expanding the scope of the research. This feedback is being incorporated into the final draft of the report, alongside the comments from specialist peer reviewers.
SMART CITIES

The ways in which we define and engage with digital city systems is changing. This no longer lies exclusively in the hands of architects, designers, engineers, computer scientists and urban planners: open-source tools and open-data platforms are opening up collaborative opportunities for citizen participation. To address this challenge, a coalition of UCL-based research groups successfully applied for funding from the UCL Grand Challenges Small Grants fund. The coalition included the Institute for Digital Innovation in the Built Environment, the Bartlett Centre for Advanced Spatial Analysis (CASA) and the UCL Urban Lab.

The funding was used to host a public panel on the theme ‘Smart Cities’, called POWER TO THE CITIZEN! The event took place at BASE King’s Cross in July 2017. Speakers included architecture curator and critic Lucy Bullivant; Adam Dennett, lecturer in smart cities and urban analytics at CASA; the head of the GLA’s Smart London policy Steven Lorimer; architect Ava Fatah gen. Schieck from UCL’s Bartlett School of Architecture and Nicolas Fonty, architect in charge of inclusivity mapping project JustMap. The panel brought community groups, academics and digital practitioners into dialogue with the joint aims of understanding the challenges of engaging in this new paradigm; and with this knowledge, identifying new collaborative mechanisms for citizen-led digital city making.

In addition, UCL and the EngEx hosted an A-level student on a two-week STEM placement, as part of the i2scienceUK programme, which offers opportunities to talented students from disadvantaged backgrounds. After successfully applying for a competitive place in the programme, Oliver Gibbons spoke to academics, performed a literature review on smart cities, and helped to organise the panel event. He wrote a report on the concept of smart cities and its relevance for communities, an extract from which is included here:

Smart Cities: A confusing label

All it takes are a few online searches of ‘smart cities’ to realise that this is a cliché phrase.

‘There is no definition of a smart city’ seems to be repeated again and again. Some may argue that we already live in a smart city. In London all it takes is a quick swipe on your phone to find out when the next bus will arrive, how long your journey will take, or even recommend the quickest route to your destination when those dreaded delays appear. That’s why some argue that the term shouldn’t be used as a label for the perfect city where we are all connected, but rather to describe a city that is continuously progressing.

But in what way do cities progressively become smarter?

What type of smart city should we go for?

It’s clear that no two cities are the same, and it’s unlikely that technology companies will be able to create a ‘one size fits all’ smart city. Each city has different problems that make them unique, and who better to inform us about them than the citizens who spend years of their life walking through the same streets and experiencing the problems first hand? This is why citizen participation is vital to smart cities. We’ve all seen the enormous successes of social networks such as Facebook and Instagram where content is created solely by and for users. By creating this type of open
platform, but at city-scale, local people can create a city suited to their needs. This would be more resilient compared to cities that could not handle anything other than what they were designed to expect.

So how can you get involved in creating a smart city?

The best way is to get involved is in conversation. No two smart cities are the same and it is likely there will be different ways citizens can participate in their respective areas. Attending local events is a great way to find out about the smart city your local government is aiming for and how you can get involved. At many of these events, professionals outnumber citizens, showing one of the main reasons why our voices are not being heard. By taking an active role in the creation of a ‘smart city’ in your local area, you will have a positive impact on your life and the lives of others. This process will make your city increasingly efficient, more liveable and will allow governments to use information and communication technology to engage with your local community so that you can have an input when it comes to essential infrastructure and public services in the area.

Image (above): A-level student Oliver Gibbons wrote about smart cities and communities during a two-week placement at UCL, through in2scienceUK’

Images (right, from top): Nicolas Fonty, justMap; Dr Lucy Bullivant, built environment specialist; Prof Sarah Bell, Engineering Exchange
Continuing Professional Development

The EngEx has developed a number of continuing professional development (CPD) courses. The first of these is a one-day training called ‘Working with Communities: Practical Skills for Engineers’, which provides an introduction to useful skills and approaches for professionals and academics working with communities. The training offers case studies from community-based organisations, as well as skills sessions and opportunities to develop learners’ own project ideas. Case studies can be selected from a range of options, based on the interests of the participants in each cohort.

Following 3 successful deliveries of this training in 2015-16, this year the EngEx developed a tailored CPD focusing on green infrastructure, with funding from the Natural Environment Research Council (NERC). In addition to some of the practical skills sessions from the previous course, new case studies were included which looked at citizen science approaches to biodiversity and air pollution monitoring. The course was framed to address an environmental science audience.

There were 13 participants, including 2 UCL staff, 1 UCL PhD student, 4 industry participants, and 6 learners from other UK universities.

The EngEx is currently developing a multi-day course, Skills and Strategies for Community Engagement, which will enable learners to gain both practical skills for engaging with communities, and strategies for developing a community engagement hub at their own institution. The next training is planned to be delivered in March, 2018 (for more details and to book, visit the Engineering Exchange website).

TEACHING TEAM

The teaching team for each delivery depends on the interests of the cohort, and is comprised of UCL staff, engineers and community organisations. Current and past members of the teaching team include:

- Charlotte Barrow, Engineering Exchange, UCL
- Sarah Bell, Engineering Exchange, UCL
- Aiduan Borrion, Engineering Exchange, UCL
- Vera Bukachi, Engineering Exchange, UCL
- Laura Cream, UCL Public Engagement Unit, UCL
- Louise Francis, Mapping for Change, UCL
- Muki Haklay, Mapping for Change, UCL
- Kate Jones, Department of Genetics, Evolution and Environment, UCL
- Richard Lee, Just Space
- Agamemnon Otero, Repowering London
- Kim Townsend, UCL Public Engagement Unit, UCL

“Useful theory on engaging communities plus informative studies.”

CPD attendee
Increasing our capacity

One of our key aims in the next year will be to raise our profile within UCL in order to increase our capacity to meet the demand for community-engaged research. As one aspect of achieving this, the EngEx is very pleased to announce our new Co-Directors structure.

Our three new Co-Directors will develop their own community engagement, teaching & learning and internal outreach activities relating to their areas of academic specialism. The streams of activity, which build on our previous work, are as follows:

- **Dr Aiduan Borrion**, Lecturer in the Department of Civil, Environmental and Geomatic Engineering (CEGE) and the Engineering Exchange’s Education Coordinator, will focus on the circular economy and issues relating to waste and sustainable infrastructure.

- **Dr Ed Manley**, Lecturer in the Centre for Advanced Spatial Analysis (CASA) in the Bartlett Faculty of the Built Environment, will focus on smart cities technologies and big data, including data visualisation, monitoring and modelling and how these can be used to understand processes of urban change.

- **Dr Carla Washbourne**, Lecturer in the Department of Science, Technology, Engineering and Public Policy (STEaPP), will focus on evidence relating to green infrastructure including sustainable drainage systems, and how it impacts on air pollution, housing, regeneration, health, wellbeing and environmental quality.

“Excellent networking opportunities, including with different types of stakeholders.”

CPD attendee

Image (above, right): EngEx Co-Director and Education Coordinator Dr Aiduan Borrion teaches a session on Conducting a Life Cycle Assessment (LCA): from Theory to Practical Application
## Funding

### Income 2016–17:

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Ongoing funding for core staff and activities has been committed for 2016-2019 from the UCL Faculty of Engineering and the Bartlett Faculty of the Built Environment.
Publications


The EngEx Team

Images above from left:

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Contact Us

The Engineering Exchange is always looking for new collaborators. If you are interested in our work or have an idea for a project, please feel free to contact us:

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