

## **Crossing Disciplines to Address Urban Sustainability**

James Paskins, Sarah Bell, Ben Croxford, Muki Haklay and Simon Julier

University College London, Gower St, London WC1E 6BT

Ph. +44 207697224

[j.paskins@ucl.ac.uk](mailto:j.paskins@ucl.ac.uk), [s.bell@ucl.ac.uk](mailto:s.bell@ucl.ac.uk), [b.croxford@ucl.ac.uk](mailto:b.croxford@ucl.ac.uk), [m.haklay@ucl.ac.uk](mailto:m.haklay@ucl.ac.uk), [s.julier@ucl.ac.uk](mailto:s.julier@ucl.ac.uk)

Corresponding author

Sarah Bell, [s.bell@ucl.ac.uk](mailto:s.bell@ucl.ac.uk)

## **Abstract**

This paper presents findings from the evaluation of Bridging the Gaps: Sustainable Urban Spaces (BTG), a novel interdisciplinary sustainability research funding programme at University College London (UCL), funded by the UK Engineering and Physical Sciences Research Council (EPSRC). All of the EPSRC's Bridging the Gaps programmes aim to initiate and support interdisciplinary collaboration within a university. The programme at UCL was designed to create research collaborations that addressed problems in the area of sustainable urban spaces, an area that features complex problems that are often at the interface of different academic disciplines. The programme initially focussed on building relationships in the three faculties which make up the UCL School of the Built Environment, Engineering Sciences and Mathematical & Physical Sciences, but subsequently brought in participants from other faculties. Bridging the Gaps has brought together researchers working on different elements of a problem, allowing each of them to contribute approaches from their own discipline. This paper presents feedback from participants in the programme. Respondents discuss their experience of cross-disciplinary working, and how important it is for their work. We address the question of whether the benefits are outweighed by the complexities of crossing disciplines, as well as investigating the role that programmes like Bridging the Gaps can play in making the process easier. We will address the challenge of creating the conditions for interdisciplinary working and ways in which we can use our experience to minimise the barriers in the future.

## **Introduction**

The problems of sustainability do not respect academic and professional disciplinary boundaries. The need for interdisciplinary research and practice in urban sustainability has been recognised since the earliest years of the environmental movement. Research funding agencies have made significant efforts to fund interdisciplinary projects and programmes in urban sustainability and other fields. Creating new knowledge that fundamentally addresses the nature of the problem rather than reflecting the names of university departments has proved more difficult than it seemed it should. Interdisciplinary work is much harder than simply bringing together scientists and scholars with complementary expertise. The barriers to interdisciplinary work are philosophical, methodological, managerial and social. In the UK the Engineering and Physical Sciences Research Council (EPSRC) Bridging the Gaps (BTG) programme is an important opportunity for universities to start to address some of these barriers. At University College London (UCL), Bridging the Gaps provided opportunities for 63 researchers to engage in truly novel research partnerships that address the problems of urban sustainability.

Bridging the Gaps: Sustainable Urban Spaces was a programme to fund new research collaborations between researchers working in different departments on the topic of urban sustainability. The programme was designed to maximise opportunities to instigate and support novel collaboration, with a particular emphasis on early career researchers. This paper addresses the need for interdisciplinary research and presents the UCL BTG programme as an example of

how to instigate interdisciplinary research for sustainability. It presents the results of the evaluation of the programme and concludes that a range of activities and initiatives are needed to support interdisciplinary work, including funding, time and changes to research assessment methodologies.

### **The need for interdisciplinarity**

As has been noted by others (Ramadier, 2004) the compartmentalisation of research communities that occurs as scientific fields develop, leads to the formation of different disciplines. Forming departments based around disciplines has the advantage of concentrating expertise and allowing limited resources to be allocated in ways that best suit the members of that department, sharing expensive equipment is only one example. Other benefits include the efficiency of communication and interaction that can occur within a discipline with a shared worldview (Bruce et al., 2004).

As universities grow and departments are formed, it is possible that research can become limited by the shared worldview, training, or investments made by a department. There is a tension between the efficiency and focus afforded by working purely within a disciplinary, and the freedom to follow the needs of a research question afforded by cross-disciplinarity. It has been argued (Klein 1990) that working in disciplines puts limits on the questions that are asked and the methods employed.

There is also a pressure, from policy makers and funders, for the academic community to address complex socio-scientific problems. These are the kind of

problems where it is unlikely that one discipline can provide the answer, making collaboration across departments a necessity. Because of the socio-cultural, political, economic, or psychological context of real-world problems, it is often necessary to bring more than one point of view to a problem. Working across disciplines allows research teams to be formed around a problem, allowing problem-orientated approaches to complex problems (Brewer, 1999). On a more practical note, it is often the case that a researcher's department just does not have that one piece of equipment, or the expert in an area, that they need to make progress on a research question.

Whatever the drivers for interdisciplinary collaboration, it is likely that it will be an increasingly important part of the research landscape. Interdisciplinary working is both a practical necessity, and, as suggested by Eddy (2005), antedisciplinary, that is the first stage in the formation of new disciplines. One of the ideas behind Bridging the Gaps is that research can be more problem driven and less constrained by the resources of a particular department, and the difficulties in collaborating across departments.

### **Bridging the Gaps at UCL**

University College London (UCL) is a large multi-faculty university spread across a number of sites, mostly in central London. The Bridging the Gaps programme, which ran from 2008-2011, initially focussed on building relationships in the three faculties which make up the 'Bartlett School of the Built Environment', 'Engineering Sciences' and 'Mathematical & Physical Sciences' but also began to bring in participants from other faculties. The range of research ideas has also

grown to include the social, as well as technical, aspects of urban sustainability (Bell et al 2011).

The programme provided a range of opportunities for new collaborations on urban sustainability, allowing participants to apply for funding for activities which most suited their needs. The funding opportunities included:

**Open Programme** – this provided small research funding to explore an urban sustainability idea (up to £2,000).

**Seminar Funding** – funding to cover the costs of arranging interdisciplinary seminars.

**Staff Exchange** – this provided a follow on fund for the Open Programme participants, it paid for teaching buyout, allowing the participants to spend time in each other's departments while working on a cross-disciplinary research idea.

**MSc Competition** – each award from this competition was awarded to a pair of academics. Awards were won for interesting urban sustainability research projects, the award (£6,000) was then used to pay an MSc student, co-supervised by the academics.

**Sandpit Funding** – Bridging the Gaps has held two sandpit events, each event has taken a group of academics out of their usual workplace for two days. Over the course of the sandpit, sustainability challenges and possible solutions were identified (based on nanotechnology in the first sandpit and networked sensors in the second). Research projects were then devised from the intersections of challenge and possible solution. Each sandpit distributed a fund of £30,000 between the research groups. The majority of participants in the sandpits did not know each other before the event.

**Escalator Funding** – the escalator funds are only available to previous participants, and are designed to allow the most promising research collaborations to continue.

**Grant Writing Support** – This fund provided a fund to help a pair of academics write a cross-disciplinary grant application. The funding was used to pay for an assistant to work on the grant application with the researchers.

**Champion's Events** – These events were held for our departmental representatives. A typical event involved a visit to a department where we find out about the work of their research groups.

The requirements for funding were that the project addressed problems of urban sustainability, the team include collaborators from at least two departments, the collaborators had not been on a funded project before, and that the team was led by an early career researcher. The programme funded more than 40 collaborations, including the following selection:

Investigating the potential of the slime mould organism [Physarium polycephalum] as an architectural-biological sensor and indicator of environmental change	Bartlett School of Architecture and The Cancer Institute
(Open Programme)	

---

Building a system schematic and simulation model of the London water supply and its dependence on the Thames Basin	Civil, Environmental and Geomatic Engineering and Chemical Engineering
(Open Programme)	

---

Questioning the sustainability of post-industrial urban landscapes	Bartlett School of Planning and Geography
(Open Programme)	

Enhanced laboratory experiments and field study for street-scale pollution dispersion modelling (Escalator Fund)	Civil, Environmental and Geomatic Engineering and Statistical Science
Children, Well-being and Disability: Re-visiting India (Escalator Fund)	Development Planning Unit and Leonard Cheshire Disability and Inclusive Development Centre
A New Hydride Fuel Cell Hybrid for Zero Emissions Vehicles. (MSc Competition)	Chemical Engineering and Chemistry
Duracoat: Using nanoscience to protect wood (Sandpit)	Bartlett School of Planning, Genetics, Evolution and Environment, Physics and Astronomy and Bartlett School of Graduate Studies
Climate change and the burden of water-related disease: evidence from urban areas of East Africa (Grant Writing Support)	Geography and The Institute of Child Health

## Results

We were interested in how well Bridging the Gaps had been received and how effective it had been in fostering interdisciplinary collaborations. Feedback was sought in four different areas: firstly details about the participant, including previous experience of collaborating with different departments; secondly, feedback about the research idea, particularly the importance of cross-disciplinary collaboration; thirdly, feedback about the role of Bridging the Gaps funding; and finally, about future plans for collaboration. The feedback includes



participants from the sandpit events, the MSc competition and the open programme.

### *About the people*

The feedback makes it clear that some participants are absolute newcomers to cross-disciplinary collaboration, while others see it as an absolute necessity for their research area. The process of cross-disciplinary working was seen by most as broadly positive.

“Collaboration across disciplines and departments is most of the time very fruitful as it provides you with an opportunity to complement skills and knowledge.” (PH)

This is perhaps not surprising, as we are seeking feedback from a group of people who have not only been interested enough in cross disciplinary working to apply to the scheme, but who have also been successful in their application. Even so, a number of difficulties with the process of cross-disciplinary working were expressed. For example one respondent (NK) found that collaboration can be “quite frustrating ... there is a reason why there is a gap”, he explained that “sometimes it is impossible to build bridges, people can become entrenched”.

A further issue is that most activities associated with the collaborations are in addition to the participant’s usual duties. The time required for the collaboration was cited in a number of cases.

“Researchers may spend time transferring knowledge to cross-disciplinary colleagues ... with no immediate benefit.” (KJ)

Another negative was related to the longer term prospects of a collaborative research project, in particular the chances of securing significant external funding for the research idea.

“despite [pushing] for more of it ... the research council peer review system hasn't entirely caught up with the reality of cross-disciplinary research.”

(RC)

This sentiment was echoed by KJ, who felt that cross-disciplinary grant applications put the applicant in “double-jeopardy” as the review panel would come from two or more research communities.

Overall, most participants felt that the negative factors were outweighed by the positive factors, and that this style of working was already necessary (in the case of LC), or soon would be. AO suggested that “if the problem is of a truly cross-disciplinary nature ... then the benefits will definitely outweigh the complexities.” NK felt that balancing the positive and negative factors was “very subjective” and choosing whether or not to work across disciplines was “about one's professional objectives and the things that make one's job worth doing.”

#### *About the ideas*

In almost all cases the participants had not made a previous attempt to get funding for the research idea. In many cases this is because the exact idea did not exist before the participants became involved with Bridging the Gaps, in the case of the sandpit activities the ideas were generated as part of the event. However, in some cases, the research idea, or elements of it are already being pursued.

Most respondents cited the value of a cross-disciplinary approach to their research idea. In the case of AO the research required theoretical understanding of both chemical engineering and nano-scale processes related to energy conversion, making “a cross-disciplinary collaboration ... necessary”.

The reasons for seeking cross-disciplinary collaboration include the requirement for equipment or expertise that did not exist in the participants own department. As well as bringing in expertise, the collaboration was also seen as an opportunity for learning for the participants, LC commented that “I have gained ... understanding outside my background”. RB felt that cross disciplinary working allowed him to take his “research into different areas and to a bigger audience”, while AO felt that Bridging the Gaps had helped her to gain a “broader vision of the possible impact of her research”.

A disadvantage of forming wholly new collaborations, such as happened at the sandpit events, was revealed, NK commented that the collaboration might not continue after Bridging the Gaps, as the topic “is too remote from my current research”.

#### *About Bridging the Gaps funding*

In some cases Bridging the Gaps funding, or an activity run by Bridging the Gaps was essential to starting the collaboration. For instance, JT thought that his collaboration involving nanostructured catalysts “would have been very difficult without [the Bridging the Gaps sandpit]”. More simply NK told us that “The entire project would not have been possible without Bridging the Gaps funding”. For KJ,

the programme not only made introductions that would not have been possible otherwise, but also funded a research student to work on the project. In other cases although it wasn't necessary, Bridging the Gaps did provide the impetus to start the collaboration, as RC explained "[The MSc competition] did provide the incentive ... and we might not have been creative enough to think of the idea on our own!"

Another option for the participants is that the research would have gone ahead in a different form, PH thought the work would have been "much more limited with less resources". The resources provided by the programme translated into time (through teaching buy-out), research assistance, software and equipment.

In addition to the direct benefits, some participants gained skills from the other people that they were working with, JT reported that he had picked up the skill of how to "efficiently prepare for large funding" from another member of his group.

### *In the future*

The final area covered by the feedback was the future plans of the participants. Do the participants plan to take their ideas further, and will they continue working across disciplines after their involvement in the programme is at an end?

In general respondents reported that as a result of Bridging the Gaps funding they were more likely to apply for external grant funding for cross-disciplinary work, or that they had previously been active or interested in applying for cross-disciplinary research funding. An example of the latter response comes from PH, "[cross-disciplinary working] was already part of my working practice", however,

involvement in the programme has made her “think a bit more about cross-disciplinary research with other people at UCL.” Cross-disciplinary working also introduces participants to different ways of working, “I liked the straightforward way physical scientists approach things” (NK).

In some cases Bridging the Gaps involvement is leading directly to an application for a larger fund. LC, for instance, has found that Bridging the Gaps “is helping us to get some preliminary results that can support [an application to] a larger fund such as FP-7 or EPSRC.”

As part of the feedback about future plans, the respondents were asked to identify obstacles to cross-disciplinary working. AO identified the challenge as finding someone who can look at “exactly the same question ... but from a different perspective.” A response that has come through from both this exercise, and informal feedback, was lack of funding, summed up by LC as “Money is the huge obstacle”.

The issue of time was once again raised when suggesting what might help future collaborations. One participant (NK) wanted “more time available to do research in general”. An alternative to giving academic staff more time to do research, through teaching buyout, for instance, is to provide research assistance, AO suggested a fund that would pay for short-term research assistance “to explore whether certain ideas would work”.

Information about what is available across the university, in terms of both people and equipment, was suggested as something that would assist collaborations. PH thought that “better knowledge about other departments and ... staff” would assist cross-disciplinary working. LC wanted to have access to a list of “all the specialist equipment held by UCL”, as this would not only avoid the risk of duplication, but could also act as a guide when seeking partners for a collaboration.

RC stressed the importance of being open to the other participants in a collaboration. He feels that collaboration can work when the parties are “genuinely interested in collaborating and learning from each other.” Whereas collaborations are less successful when the interest is in the “multidisciplinary pot of cash and [the team] cobbles together a proposal without taking the trouble to talk to each other in detail beforehand”.

Another obstacle (mentioned by NK) was the disciplinary nature of the Research Assessment Exercise (RAE), a periodic review of the quality of the quality of a university’s research. The RAE, and its successor the Research Excellence Framework (REF), can have a significant impact on a department’s funding. This is a similar concern to the concern about panels assessing research grant application.

## **Conclusions**

It can be seen that the participants in the Bridging the Gaps programme were open to the idea of cross-disciplinary working. In some cases this style of working was already familiar to them, in others it was seen as a vital component of their

research. Participants not only identified positive aspects of cross-disciplinary research, they also highlighted the negative factors, particularly the time taken and the complexities involved.

Apart from funding, and some preliminary work does not require large amounts of funding, it seems that the most valuable thing for researchers is information. Information about who is interested in collaborating on research, and information about what facilities are available. Running the Bridging the Gaps Champion's Events has shown us how quickly researchers come up with ideas for collaborations when they meet research groups and get a chance to hear about their research. Some of the barriers mentioned, such as "entrenched" individuals, are difficult to address, and others, such as peer review, are beyond the scope of the university.

Looking beyond the university, it is clear that the participants in this research feel that the increasing calls for cross-disciplinary research, encouraging researchers to network and collaborate, must be matched by a system that understands cross-disciplinary research. At the moment, there is clear frustration that many aspects of the system (grant proposals, journal reviewers and Research Assessment Exercises) seem to undervalue cross-disciplinary working, or at least be unsure of how to properly assess it.

In conclusion, it is clear from this exercise that cross-disciplinary working is seen as the future, or indeed the present, for many of the participants. It is also clear that cross-disciplinary working presents challenges beyond the usual

responsibilities of an academic staff member. At its best, the Bridging the Gaps programme, has allowed researchers to take a more problem-focused approach to the urban sustainability issues. It has done this by overcoming the barriers associated with crossing disciplines, and allowing intelligent people, with different skills, to focus on the same problem.

### **Acknowledgements**

This project was supported by funding from the EPSRC Bridging the Gaps programme.



## References

- Bell S. Paskins J. Haklay M. Croxford B. and Julier S. Bridging the Gaps Final Report. University College London. 2011. Available on-line [www.ucl.ac.uk/btg](http://www.ucl.ac.uk/btg), last accessed on 21 July 2011.
- Brewer G. The challenges of interdisciplinarity. *Policy Sciences* 1999; 32:327-337.
- Bruce A. Lyall C. Tait J. and Williams. R. Interdisciplinary integration in Europe: the case of the Fifth Framework programme. *Futures* 2004; 36:457-470.
- Eddy S. "Antedisciplinary" Science. *PLoS Computational Biology* 2005; 1(1):e6.
- Frost S. and Jean P. Bridging the disciplines: Interdisciplinary discourse and faculty scholarship. *Journal of Higher Education* 2003; 74:119-150.
- Klein J. *Interdisciplinarity—History, Theory and Practice*. Wayne State University Press, Detroit, 1990.
- Ramadier T. Transdisciplinarity and its challenges: the case of urban studies. *Futures* 2004; 36:423-439.