Report, March 2014

Transport and our environment

Report of a round-table gathering of UCL researchers, 16th December 2013

A meeting involving researchers from two schools, four faculties and seven departments

Report on a round-table meeting on transport and our environment

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Introduction

Nicola Christie, Director of UCL Transport Institute, introduced the Institute and explained that Environment (broadly defined) is one of a set of priority research themes (see cover image) that have been chosen to guide the work of the Institute in its first two years. The themes are connected by a focus on quality of life, supported by a strong emphasis upon equity.

She also set out the primary goals of the institute:

- To foster collaboration on transport research across UCL
- To engage meaningfully with citizens, policy-makers and practitioners

The remainder of this report summarises the short presentations given by 12 UCL researchers who attended the meeting, each of whom was asked to describe both their prior research relating to transport and their interests for future research.

Figure 1: Logo for Cities for Human Locomotion

Stephen Marshall

Reader in Urban Morphology and Planning, Bartlett School of Planning

Stephen's background is in engineering and transport planning but he has over time moved more into urban planning. He supervises three doctoral students working on transport projects and co-ordinates a module for 3rd year undergraduates on transport policy and planning. He also is the Bartlett Faculty Graduate Tutor (Research), responsible for doctoral research students, and suggested an effort be made to connect up doctoral students working on transport across UCL.

Stephen has worked on several European projects (DANTE, TRANSLAND, TRANSPLUS, ARTISTS, PLUME), and has written or co-authored several books.

He presented four areas of research interest/activity:

- Streets-based urbanism / design and planning of the built environment (Marshall 2005)
- Road hierarchy and classification – related to promoting sustainable modes (Jones et al. 2007)
- Cities for Human Locomotion (a collaboration with CASA and ARG) – related to promoting environmentally-friendly mobility (also equity, health, travel time savings, etc) – see Figure 1
- Street network representation and simulation – for promoting sustainable modes and integration of transport and the built environment

Paul Hellier

Research Associate, Department of Mechanical Engineering

Paul's research focus is how better to design future fuels. He is interested particularly in what aspects of a fuel's molecular character make it perform better or less well. The work is prompted by the move from fossil fuels, via bio-fuels, towards future fuels, which presents a challenge to design fuels that both are sustainable in production terms and satisfy exhaust emissions standards. He uses research engines and specialised delivery systems to conduct his research which involves the collaboration of combustion engineers, process engineers, chemists and others.

Paul gave an example of being approached by a biologist who had produced a genetically modified organism similar to algae (see Figure 2) and who wanted to know how it would perform as a fuel. Though the original molecule was not itself suitable, Paul was able to suggest a number of variations that might be, leading to an iterative process of molecule development and testing.

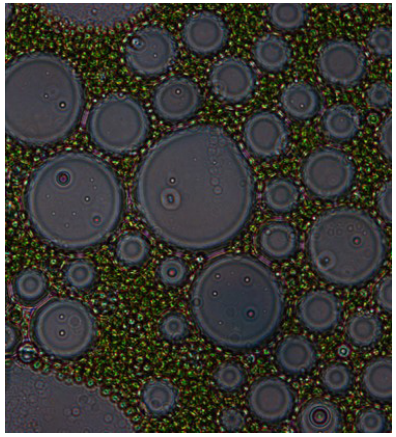

Figure 2: An algae-like potential fuel

Julio Dávila

Director, Development Planning Unit

A civil engineer by training, Julio obtained subsequent qualifications in urban planning, latterly working on infrastructure. The project he described was research into the successful Metrocables cable-car scheme in Medellín, Colombia (see Figure 3), the first application of this transport technology in a high-density, low-income area to support the journey to work. The scheme has been transformative, drawing large passenger numbers and performing well in terms of environmental sustainability. But, in order to understand the social and institutional sustainability of this model, Metrocables was compared with a similar (as yet unbuilt) scheme elsewhere in Colombia. This showed how important accompanying interventions are if such a scheme is to succeed. This is an important finding for mayors around the world who may be attracted to such a scheme because it looks good and is comparatively affordable.

Julio also spoke about the Development Planning Unit's general focus on developing countries/cities (or "the global south"). Other than Julio, Caren Levy is the other academic in DPU who has worked extensively on transport. Julio also mentioned Musleh Uddin Hasan who has recently finished his doctoral project on rickshaws in Dhaka, Bangladesh.

Andrew Smith

Principal Research Associate, UCL Energy Institute

Andrew's past experience involved working on various emissions models and inventories in the UK and Netherlands. His post at UCL's Energy Institute is now within the RCUK Centre for Energy Epidemiology, one of six "Centres of Excellence in End-Use Energy Demand" awarded by the Engineering and Physical Sciences Research Council (EPSRC).

Four of the approximately 12 staff in the Centre work on transport: two are discrete choice modellers; one is a specialist maritime researcher; and the other an aviation modeller. Their interest is transport energy use and consequential greenhouse gas emissions, which they study using epidemiological techniques borrowed from the health sector.

Andrew spoke about the following strands of work:

- Data framework of datasets relating to end-user energy demand, including "all the transport datasets that we know about"
- A combined transport and buildings model – understanding how people spend time inside and between buildings
- A plan to produce a statistics yearbook, being a combination of all the data he and colleagues are able freely to redistribute
- Writing of best practice guidelines on the role of modelling and on systematic reviews
- Using GPS sensors for freight surveys: both covert (putting GPS sensors in the post and then attempting to infer mode of transport) and open (placing sensors on freight fleets to enable calibration against hard information on transhipment)
- A database on fleet energy efficiency retrofit work

Figure 3: Metrocables, Medellín, Colombia

Helena Titheridge

Senior Lecturer, Centre for Transport Studies

Helena's background is as geographer, and she has gradually moved more fully into transport via energy modelling. She is very interested in the assessment of sustainability (in all its senses) and associated reporting tools for use by local authority officers. With respect to transport, her interests include the impact of transport systems and travel choices on the environment (in terms of greenhouse gases, local pollutants, noise and biodiversity) and the impact of the environment on our transport systems and travel (for example, the practical and emotional impacts of flooding).

Helena also spoke of encouraging greater use of public and active transport and the identification of policies that will support this, including the use of activity-based modelling and improved understanding of how structural factors such as marital status and household composition affect choices. She mentioned her supervisee Therese Bajada who is working on bus reform in Malta, and another (Chien-Pang Liu) looking at the relationship between land use and public transport use in Taiwan, with a view to addressing mismatches of supply and demand.

Joanna Marshall-Cook

Sustainability Advisor (Carbon and Projects), UCL Environmental Sustainability Team

Joanna spoke about her team's plan to make of UCL a "living lab" – the use of the institution as a test-bed for data collection methods, measures and policies in collaboration with UCL researchers – explaining that she and colleagues are open to new suggestions.

Her team has recently finished a revision of UCL's travel plan which has a focus on converting trips from public transport to active modes (walking and cycling) given that the vast majority of trips to/from UCL already do not involve private motorised transport. To support this, the team has developed a set of proposals for cycling improvements (see Figure 4) and is developing an approach to personal travel planning. There is also an aim to reduce air travel on the part of academics and other staff where possible. And can international students be encouraged to travel less frequently back to their home countries, perhaps by improving the social experience at UCL?

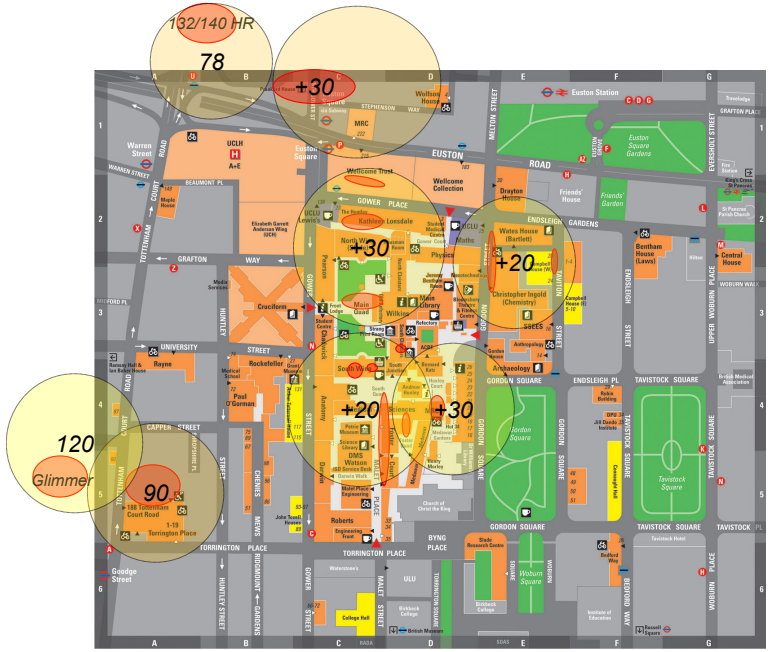

Figure 4: UCL Bloomsbury campus - draft cycle parking proposals

As UCL currently receives 118 deliveries per day, the team is working with a logistics partner to consolidate goods off-site. And there are also plans to trial a fuel derived from used coffee being developed by Bio-Bean, a company run by UCL alumni.

Pavlos Aleiferis

Reader in Thermofluids, Department of Mechanical Engineering

Pavlos is chair of the Energy and Environment Group and works on the internal combustion engine and the need to respond to the increasingly demanding regulations limiting emissions. He performs highly detailed analysis of how fuels perform within an engine, using laser-based diagnostics, computational fluid dynamics and emission monitoring, most recently as part of the JLR Centre of Excellence in Gasoline Engine Research.

In addition to seeking efficiencies in engines using conventional fuel, Pavlos looks at other fuels such as ethanol, butanol, compressed natural gas, liquefied petroleum gas and hydrogen, which present their own challenges, such as lack of infrastructure in the case of hydrogen. There is a general search for sustainable fuels that do not compete with food chains. In addition to having a general interest in the links between transport and sustainability, he referred specifically to wishing to understand better the difference between engine performance "in the lab" and when driven for real on the roads, prompting some discussion of initiatives such as eco-driving.

Richard Dennis

Professor of Human Geography, Department of Geography

Richard introduced himself as a geographer and historian who has done much of his research on cities. He spoke in particular about an "opportunistic" piece of research stimulated by the 150th anniversary of the London Underground (see Figure 5). The original underground lines were found to have insufficient ventilation given the primitive rail technology used to drive the trains, leading to the need to "open up" the Underground by introducing ventilation shafts. The question of where to put the shafts created significant planning conflict at the time. In connection with the Underground's anniversary, Richard mentioned an article in an issue of the London Journal he had jointly edited (Dennis 2013a), as well as a contribution to a book on the subject published by the London Transport Museum (Dennis 2013b).

In addition to studying the experience of travelling on the Underground and how this has changed, Richard is more generally interested in transitions such as those of technology (steam to electric/diesel) and practice (eg the banning of smoking) and studies both the social science and the arts/humanities sides of these topics. He uses sources such as letters to newspaper editors, contemporary novels and cartoons. He would like to conduct research in future on topics such as smoking on the Underground, accidents and crime.

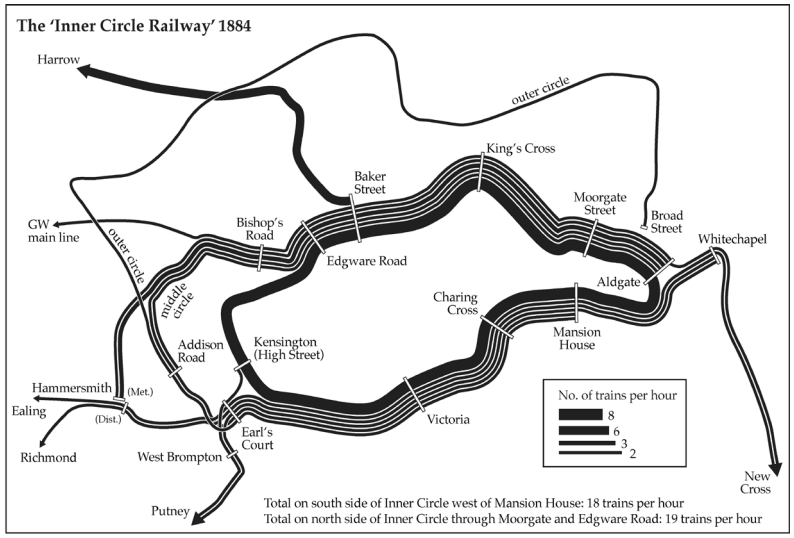

Figure 5: London's urban railway network in 1894

Hannah Daly

Research Associate, Energy Systems Team in the UCL Energy Institute

Hannah is a mathematician by training and did her doctoral project on modelling energy policy and personal transport in Ireland, which involved simulating the effect of various policies on carbon dioxide emissions and energy demand. Her speciality is energy systems modelling – linear optimisation models of a region's energy system leading through to demand (which may include passenger and freight transport); she is currently working on the UK TIMES model, which the Department of Energy and Climate Change uses for policy analysis and to inform the forthcoming fifth carbon budget. She is also working on a global version of TIMES which includes climate feedback but which suggests little mitigation from transport.

This issue prompts Hannah's over-riding interest in transport: a desire to improve upon the currently simplified way in which transport is represented in energy models. She feels that the perception that transport can only mitigate climate change to a limited extent derives from the poor representation in such models of travel demand, with behavioural responses to policies typically simulated using "add-ons" rather than being integrated within the whole. She is working on a way to introduce modal shift so that policies such as public transport improvements can be assessed alongside more classical mitigation measures such as carbon capture and storage.

Hannah's other transport interests include the distributional impacts of reducing car demand (through carbon taxes, for example) and the work of a doctoral student she supervises (Xuebing Wang) who is looking at impacts of different carbon mitigation schemes on the Chinese aviation industry. Hannah would particularly like to engage with researchers who have data on road infrastructure and cost.

Ian Raper

Project Manager & Tutor, Mullard Space Science Laboratory, UCL Dept of Space & Climate Physics

Ian introduced his work in terms of the development of complex measurement instruments that are attached to satellites, pointing out the extent to which we now rely on such technology to support way-finding (through global navigation satellite systems – GNSS – and associated tools such as sat-nav), driverless vehicles, surface traffic management and air traffic management (the automation of take-off and landing). Satellites also play an essential role in telecommunications, bridging gaps in terrestrial networks, for example.

Ian set out two distinct interpretations of *environment* from his perspective: management and monitoring. An example of the first is the satellite-assisted management of traffic flows, an example of the second being climate measurement at a large scale. He also spoke of windfall benefits: a project which used satellites to check the accuracy of rail mapping revealed that the acceleration and deceleration of trains were suboptimal, which enabled a fuel saving. Ian's particular transport research interests relate to ways in which GNSS can

be disrupted, both unintentionally and intentionally.

In addition to the satellite-related work, MSSL hosts the UCL Centre for Systems Engineering which runs a module on rail systems engineering as part of its masters programmes. The Centre has also carried out work (in association with BAe Systems and Alexander Dennis) on hybrid bus technology and fuel cells (Emes et al. 2009).

After this explanation of the earth-bound applications of MSSL's work, discussion turned to the possible topic of space travel as a "mode" of interest, including the possibility of designing space vehicles.

Daniel Oviedo Hernandez

Doctoral Researcher, Development Planning Unit

Daniel is working on the topic of poverty and the voice of the absent in marginal areas of developing countries, with specific interest in access to the urban core. He studies themes relating to mobility such as informality, resilience, and resistance to an inconvenient system. In particular, he has, together with Etienne von Bertraub, looked at the role of civic involvement in the development of cycling infrastructure in Bogotá and Guadalajara, Colombia. His aim was to understand how different social movements influence the distribution of cycling infrastructure, with reference to equity and access for poor people.

Daniel is also looking at accessibility of elderly people in collaboration with Helena Titheridge; and has worked recently with Nicola Christie on a literature review for the Joseph Rowntree Foundation on transport and poverty. Another particular interest relates to an agreement with a research network Urban Knowledge Network Asia which will enable exchanges to take place involving researchers across Indian and Chinese universities. His aim is to use these connections to examine the governance of bus rapid transit systems and how transfer of the technology between different cities in the global south has worked, starting with the examples of Curitiba (Brazil) and Bogotá.

Robin Hickman

Senior Lecturer in Transport Planning and the City, Bartlett School of Planning

Robin runs the MSc in Transport and City Planning at the Bartlett School of Planning, so said he may be able to put Joanna Marshall-Cook in touch with students keen to collaborate on UCL's living lab. Prior to joining UCL, Robin was for many years a consultant.

He set out four areas of research interest:

- Visioning and back-casting for transport – a method he has used in the UK and overseas to help define optimal policy trajectories for low-carbon transport (Hickman & Banister 2014)
- Urban structure and travel – relating location of development, its form and layout to what that might mean for travel (Commission for Integrated Transport 2009). A Handbook on Transport and Development will shortly be published (Edward Elgar)

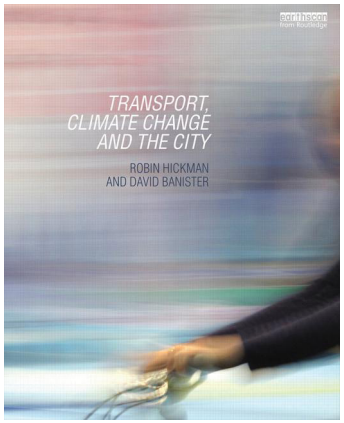

Figure 6: Transport, Climate Change and the City

- Instrumental and affective dimensions of public transport – drawing on work he did as part of the European SYNAPTIC project, Robin looks at the prospect of designing public transport so that the experience of using it is enhanced (Hickman et al. 2013)
- Transport strategy development in Asia – Robin has worked on one best practice guide for sustainable transport (Hickman et al. 2011) and another on interchange design in China (Chen et al. 2014).

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Image credits

Figure 1 - Stephen Marshall; Figure 2 - Paul Hellier; Figure 3 - UCL Development Planning Unit; Figure 4 - UCL Estates; Figure 5 - Richard Dennis; Figure 6 - Routledge, Taylor & Francis Group

UCL Transport Institute has been established to foster cross-disciplinary research on transport across UCL and to increase the policy impact of UCL's transport research.