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Introduction to Special Section on Theoretical Perspectives on Climate Change Mitigation in Transport

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Decarbonising transport

Over the last 50 years, the transport of people, goods and information have all increased exponentially, and this reflects the societal and economic benefits of ever growing levels of mobility. Transport has become an important sector of the global economy in its own right, and it forms an essential function in maintaining the interconnectivity of the globalised World. There are also important feedback effects between transport and economic development, where high quality transport infrastructure can promote economic growth if other conditions are also positive (Banister and Berechman, 2000).

Cheap natural resources have encouraged people, firms and others globally to benefit from the opportunities to travel further and at a lower cost, with average daily distances travelled in developed countries now exceeding 100 km per person (Schäfer et al., 2009). But transport is totally dependent on oil and in the EU it now accounts for over 71% of all oil used (EU, 2011), and as oil prices continue to rise (currently over $120 per barrel of Brent Crude), the need to improve efficiency becomes clear. This imperative is reinforced by the potential instability in the sourcing of oil, price volatility, high growth levels of demand (in particular from the Far East), and in the debates over the future of oil (OPEC, 2009).

In addition, the energy input is directly linked to the amount of carbon emitted from transport, and there is no technology currently available to reduce the amount of carbon produced by burning one litre of fuel. Transport now contributes about 25% of global CO_2 (IEA, 2011). Transport is the only major sector of the economy where emissions continue to grow, as the increased demand for travel outweighs the technological gains. The growth in oil consumption in transport (1973-2010) has exceeded 110% (IEA, 2011), and the growth in CO_2 emissions from transport have increased by 44% (1973-2007) (IEA, 2009). There have been some efficiency gains, but the overall trend is still strongly upwards, with little sign of change in the near future. To achieve reductions in energy consumption and emissions levels in transport, it is essential that far greater efficiency and technological innovation become the twin foci of a leaner, cleaner transport industry, as high prices and resource depletion mean that cheap energy for transport is no longer a

reality. There is agreement over the need for substantial decarbonisation of the transport sector, but the effectiveness of conventional policy measures and thinking seem to be limited, whether "hard" or "soft" measures have been applied.

With respect to "hard" measures, the prices of fuels are at historically high levels, yet demand seems to be inelastic, as transport is seen to be an essential activity. Transport (aviation) has now joined the EU Emissions Trading Scheme (2012), but the price of carbon is currently at historic low levels (€7 per tonne of CO_2, in May 2012). When the market develops the carbon credits are likely to be bought by the airlines and the cost passed onto travellers, and this may have some impact on demand. There is some evidence that 'hard' regulatory measures have contributed to an improvement in average energy efficiency of the car vehicle fleet. European New Car CO_2 Regulation (EC443/2009) has mandated sales weighted average CO_2 reductions from motor manufacturers. UK average new car CO_2 emissions fell 4.2% in 2011 and it has fallen by over 23% since 2000, with new cars now being 18.0% cleaner than UK average. Cars producing less than 130gCO_2/km now account for almost half the 2011 market – 46.8%, as compared with 10.6% in 2007 (SMMT, 2012). However, increases in travel demand have meant that little change has been observed in terms of overall energy consumption. 'Soft' measures, such as information programmes and awareness raising schemes, seem only to influence changes in behaviour at the margins or over small geographical and temporal scales of application (Cairns et al., 2008).

Two possible explanations for the muted effects of most hard and soft measures might be that individuals and firms are insensitive to pricing and other measures such as information, when it comes to transport decisions. This explanation is counter to the well-established economic principles of elasticities and rational behaviour. Alternatively, it could be argued that our understanding of the behaviour of individuals and firms is incomplete, and that there are other social and cultural factors that may be as (or more) influential than the conventional economic factors that are central to current understandings of behavioural change. Underlying both explanations are issues such as path dependence and rebound effects, both of which reflect on our understanding of governance and transport. The current organisational and institutional structures may be inappropriate when it comes to addressing climate change and transport, as transport is

seen to be instrumental in maintaining and enhancing the global economy, rather than contributing to the need to keep within the environmental carrying capacity of the planet (Meadows et al., 2006).

This may also explain the preference for technological solutions, as this would allow the current and future patterns of activity to continue, and continue to grow, but with less energy intensity. Yet the evidence from the recent past is that even though energy efficiency in transport has improved, this has been more than outweighed by the increases in travel. Technological efficiency needs to be matched by a more fundamental understanding of the underlying social and cultural processes of behavioural change so that less energy and carbon lifestyles can evolve. As suggested elsewhere (Banister et al., 2011), a full range of alternatives need to be mobilised in addressing the carbon intensity of existing transport systems, including the potential to reduce travel demand. Measures would include effective pricing of CO_2 consumption, participatory awareness and information programmes, and possible new unconventional instruments, such as bans on commercial advertising and glamorisation of high CO_2 vehicles and certain types of carbon intensive travel in urban areas.

The papers in this Special Section of the Journal of Transport Geography extend the debate over the reasons why it has been so difficult to reduce energy use and carbon emissions in the transport sector. It is not to suggest that the approaches being used are wrong, but that they only explain part of the story, and that there are new contributions that the social sciences can make to the understanding of travel behaviour that go beyond technological optimism and rationality as understood in neoclassical economics. It is in this spirit that the papers in this Special Section address some of the means by which social sciences can contribute centrally to our understanding of behaviour, and implicitly to enhance our reasoning as to why reductions in energy use in transport are so difficult to achieve, and certainly the scale of change that is required to meet the challenging targets set for global CO_2 reduction. Implicitly, the approaches brought together here should also help refocus thinking so that policy intervention in these areas can be made more effective in terms of the types of intervention that might be most appropriate, and to the effectiveness and permanency of those interventions.

The research priorities according to geographers and transport scholars

As part of the background to the papers in this Special Section, two short surveys among (academic) researchers were carried out, one at a transport conference (UTSG[1]) in January 2011 and the other at a geography conference (RGS-IBG[2]) in September 2010 to establish the research priorities for social scientists interested in climate change, energy and transport (Table 1). There were three parts to the survey. For the different types of transport all topics were seen to be important (except maritime transport), with automobile dependence scoring highest, but with the geographers (RGS-IBG) there was a greater emphasis placed on long-distance transport, air transport, and holiday travel and tourism.

With respect to strategies for decarbonisation, preferences were given to interventions in the built environment and mobility management rather than those relating to technological innovation and pricing/budgeting. Transport researchers gave more weight to local issues, such as a higher priority for walking and cycling, mobility management and city wide public transport. The geographers gave slightly more emphasis to economic measures (especially budgeting) and the role of international governance in stimulating low carbon transport. The third category covered potential barriers to and effects of decarbonisation, and here there was uniformity across the two samples in the need to address policy barriers. The issue of barriers to policy implementation comes out as being the overriding priority across all topics for research. In addition, the importance of studying the attitudes towards low carbon transport among the public and transport industry is well recognised. Perhaps this reflects beliefs among the participants that those attitudes may act as barriers to decarbonisation?

Respondents were also asked to list other topics that should receive the highest priority in academic research, but were not covered in Table 1. This open question produced 40

[1] UTSG – Universities Transport Studies Group – this annual conference is where all those Universities in the UK involved in transport research meet.
[2] RGS-IBG – Royal Geographical Society-Institute of British Geographers – the major UK annual conference for geographers

items with little overlap. The only topics to be mentioned more than once relate to links between transport systems and practices with other systems (3x), peak oil (2x), the intricacies of emissions measurement and accounting (2x), the role of technology in mitigation (2x), and the role of infrastructure (2x). Two more general categories can be identified that include a series of more specific but related themes: policy implementation and integration issues (5 items), and behaviour change and attitudes (4 items). Climate change adaptation was mentioned only once. This is one of the reasons why this Special Section focuses on climate change mitigation and does not pay explicit attention to adaption.

[Insert Table 1 about here]

In addition to the closed and open questions asked above, respondents were also questioned on the contribution of the wider social sciences to the study of climate change, energy and transport, in particular about novel theories, paradigms and/or methodologies that might be used. This question caused difficulties for many respondents as 16 out of 42 left it unanswered (38%). Nevertheless, 35 suggestions were given by the other 26 respondents. Behavioural economics (5) and attitude theories from behavioural/social psychologies (4) were mentioned most often. There were also four items that could be grouped together as (different traditions within) social theory (including, for instance, theories of social practices). Other suggestions related to systems thinking (3), transition theory (3), state of change thinking in health research (3) and economics/economic theory other than behavioural economics (3). The remainder were useful but uniquely given suggestions that could not be grouped together easily.

The overall conclusions reached from the two surveys were that there is a tremendous diversity in responses, but some consensus that a more fundamental understanding of travel behaviour and practice is needed and that current methods only present part of that understanding. Secondly, the current emphasis on technological solutions to decarbonising the transport system may help, but in itself it does not provide the solution, as there are many other factors that determine behaviour. Issues relating to overcoming the barriers to effective policy implementation, the links between the built environment and travel, and mobility management all feature strongly in the survey responses.

Thirdly, there do seem to be several complementary and novel methodologies that can be used to improve the understanding of travel decisions that at the same time begin to address issues relating to complexity, the heterogeneity of responses, and how changes over time and space might take place.

The papers and beyond

There are three core papers in this issue, each of which introduces new methodological thinking on the potential for decarbonising the transport sector, and each of these papers is followed by a shorter complementary paper by authors whose research is more directly focused on transport and mobilities. The complementary pieces both comment on the strengths and weaknesses of the approach, and its potential usefulness in addressing the key topics identified here (Table 1). The first by Frank Geels examines the underlying dynamics of low carbon transport through a multilevel sociotechnical transitions approach, exploring the means by which innovations can establish themselves in mature markets, such as transport. The corresponding reflective piece is by Lorraine Whitmarsh who highlights the integrative force of the multi-level perspective but also suggests extensions and improvements to the approach. The second core paper is written by Matt Watson and introduces practice theory and the means by which daily practices are shaped in terms of what people do. Central to practices are not products, but 'doings', and the actions taken to accomplish the practice (Ingram, et al., 2007). The complementary piece is by Thomas Birtchnell who offers suggestions on how this theory might be scaled up. The third paper by Robert Metcalfe and Paul Dolan examines the implications of behavioural economics for transport, both in the context of the current debate over "nudges" (Thaler and Sunstein, 2008), and more generally in the way in which different options are presented to people. Erel Avineri reflects on the role and implications of behavioural economics from within the transport research community.

In addition to these three core papers and the shorter complementary papers, there are two other contributions to this Special Section. The paper by Tim Schwanen, David Banister and Jillian Anable takes the crosscutting theme of habits and attempts to

reinterpret the current thinking of habit as routine, repetitive and reinforcing behaviour that is extremely difficult to change. The perspective taken is positive in that it tries to build upon good habits and practices, and the means by which collective customs and social norms can be changed. The final paper by John Urry provides a short retrospective on all the material presented in this Special Section, placing the complementary approaches within the bigger picture, as some of the approaches suggested are concerned more with small-scale changes that can be introduced immediately, whilst others are more concerned about systemic change and fundamental rethinking of policy objectives. Overall, the intention has been to both introduce new social science based ideas to the analysis of climate change, energy and transport, and to answer some of the topics raised in the two surveys carried out as part of this research, particularly as it relates to the major concerns over automobile dependence, policy implementation, the built environment and travel, and mobility management.

The material brought together in this Special Section goes a considerable way in bringing out the contributions the social sciences can make to understanding the complexities and difficulties of decarbonising (passenger) transport and to offering new lines along which the development of low carbon transport can be stimulated. But much more thinking needs to be done on a wide range of topics, and we draw this editorial to a close by highlighting some of the challenges to be addressed. One challenge pertains to overcoming the contrast between the predominantly individualistic understandings of behaviour that dominate in economics (including behavioural economics), psychology and mainstream transport research on the one hand and the much greater emphasis on social collectives – however understood or defined – in sociology, science and technology studies, (cultural) geography and mobilities research. The contributions by Watson and Schwanen et al. address this challenge but much more work is required in linking the micro level of individual and household to the macro level of sociotechnical system.

Closely related to this issue is the question of temporal scale and dynamics of change. Geels in his contribution is very clear that a sociotechnical transition takes several decades. Watson and Schwanen et al. also allude to the long term in their discussion of change in respectively practices and habits. From a climate change perspective this time

frame is very problematic: transport needs to be decarbonised sooner rather than later, especially if developing and emerging economies are to enjoy their – in a historical perspective – fair share of economic development and transport. Perhaps insights from behavioural economics can be applied in the Western world to reach a range of cost-effective 'quick fixes' in terms of reducing carbon emissions from transport. But it is crucial that insights from behavioural economics are used as a complement to and not in lieu of more structural change (i.e. sociotechnical transition). This is not a criticism of behavioural economics as such; our point is that caution is required in how behavioural economics and the policy relevant insights it affords are positioned in exchanges between academics, policymakers and politicians. The task is to arrive at policy prescriptions that are sensitive to geographical context and that combine the short term benefits enabled by behavioural economics with the longer term benefits that can be gleaned from more systemically oriented frameworks like Geels' multilevel perspective.

A third challenge is geographical in nature. The work brought together in this Special Section has a narrow geographical focus: all authors are affiliated with UK academic institutions and most of the pieces focus implicitly or explicitly on transport in North-West Europe and North-America. In many ways this narrow focus is understandable – these are the regions with the most mature carbon-dependent transport systems and North-West Europe is arguably the global region where the urgency of the need to decarbonise transport is recognised most widely. In other ways this focus is problematic: insights, logics and policy prescriptions regarding behaviour and systemic change in transport derived in West Europe and North-America by scholars living and working in those regions – and the UK in particular – may not extend to other geographical contexts. As geographers, we would contend that the transferability of insights, logics and policy prescriptions must be problematised rather than assumed. We hope, therefore, that the work brought together in this Special Section invites researchers beyond the UK, North-West Europe and also North America to qualify and enrich the thinking about how the social sciences can contribute to transport's decarbonisation.

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Table 1: Topics related to climate change, energy and transport that should be accorded the highest research priority according to the sampled researchers (n=42) [a]

	Number of respondents identifying the topic as priority	Percent of respondents identifying the topic as priority	Percent of RGS-IBG attendees in respondents identifying the topic as priority
Types of transport			
Long-distance transport	6	14.3	83.3
Freight transport	4	9.5	50.0
Maritime transport	0	0.0	
Air transport	5	11.9	80.0
Business travel	3	7.1	33.3
Transport in the non-western world	7	16.7	42.9
Holiday travel and tourism	4	9.5	75.0
Automobile dependence	11	26.2	36.4
Strategies for decarbonisation			
Electric vehicles	3	7.1	0.0
Alternative fuels	2	4.8	100.0
Cycling and walking	2	4.8	0.0
City-wide public transport	4	9.5	25.0
Built environment and travel	10	23.8	60.0
Telecommunications	1	2.4	0.0
Mobility management	10	23.8	30.0
Personal carbon allowances in transport	4	9.5	75.0
Decarbonisation through pricing	1	2.4	100.0
International governance to stimulate low carbon transport	6	14.3	66.7
(Potential) barriers to and effects of decarbonisation			
Barriers in policy implementation	21	50.0	52.4
Transport industry's attitudes towards low carbon transport	7	16.7	57.1
Public attitudes towards low carbon transport	8	19.0	62.5
Social equity effects of decarbonisation	6	14.3	66.7

[a] Each respondent was asked to select three topics which s/he felt should have the highest priority; 41 participants did so and one indicated only two topics, which resulted in 125 responses (i.e. the sum of all frequencies in the 'total responses' column).
Source: Questionnaires distributed at the 2011 UTSG (n=21) and 2010 RGS-IBG (n=21) conferences.