PhD Studentship: EPSRC SCALE Project

(Ref CASA/09/06/SCALE3)

Further Particulars

The SCALE Project

This project is to explore how changes in energy costs pertaining to travel and location in the urban system alter the configuration of trips between urban activities as well as their location. The main objective is thus to explore savings in energy costs due to travel. However in presenting the impact of cost changes, we need to explore unexpected changes in travel and location patterns. The framework we adopt is to embed urban models based on spatial interaction, network infrastructures, and spatial agglomeration into dynamic frameworks that generate nonlinearities, characteristic of complex systems, articulated as catastrophes, bifurcations, and self-organised criticalities that involve phase transitions.

The substantive objectives of the project are as follows

1. To explore how changes in model parameters that control interaction in urban travel models lead to rapid and discontinuous changes in modal split, a fast dynamics.

2. To explore how changes in model parameters lead to changes in location involving a slower dynamics than mode switching

3. To explore how changes in network infrastructures through the addition or deletion of links in networks and the arrangement of network into particular 'idealised' structures lead to reductions in energy costs.

4. To explore how changes in network capacity relate to congestion and energy savings, and to road pricing.

5. To explore how changes in location such as densification can lead to changes in energy costs

To achieve these aims, we intend to develop three related models: first, a generalisation of entropy maximising models into a constrained dynamic framework based on Boltzmann-Lotka-Volterra (BLV) equations which enable the phase space of travel costs and locations to be examined; second a generalisation of this framework based on the Turing- Krugman (TK) model of positive feedback, reflecting spatial agglomeration in the location of urban activities; and third a model of network infrastructure optimised to change travel costs. Our fourth model ties all of these together in a model of land use and transport for Greater London so that specific 'what if' question with respect to changes in energy costs can be examined.

The methodological objectives of this project are as follows.

1. To extend the BLV models so that the key parameters are linked directly to energy costs.

2. To link these BLV models to the TK models which are based on generalising spatial interaction to the concepts of trade in highly localised contexts that Krugman has pioneered.

3. To link these models to physical network infrastructures with respect to their interactions and to evolve new algorithms for optimising such structures consistent with the BLV and TK models.

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4. 4 To provide an extended logic to the already existing land use transport model of London built for the Cities Theme of the Tyndall Centre using the methodological innovations developed above.

As part of this quest, a series of policy objectives will be defined as follows:

1. To illustrate how surprising and unexpected changes can occur in cities as energy costs change, in terms of mode switching and the emergence of new centres.

2. To examine how standard road pricing such as congestion charging can be upset by rapid changes caused by changes in energy costs.

3. To examine how small changes to network infrastructure can lead to large energy savings and to explore the conditions under which these are possible

We will implement these through a series of objectives that relate to how we interface this science with policy makers in the following ways:

1. To show how we can reinterpret these models visually by engaging decision-makers in exploring and improving their logic through web-based dialogue.

2. To demonstrate how state of the art complexity science can be used to explore highly practical questions that face decision-makers in both routine and strategic contexts.

About the PhD Studentship

The studentship is an EPSRC studentship and EPSRC rules apply (see http://www.epsrc.ac.uk/PostgraduateTraining/default.htm). The student will work with Dr. Shi Zhou (s.zhou@ucl.ac.uk) who is based in the Department of Computer Science at UCL and will be involved in the development of network science to the problems of rapid change in transportation networks with a specific focus on large cities such as London. It is envisaged that the student would learn the rudiments of the science of networks in the first year and would begin to develop various types of models that involves phase transitions in the flows and structure that such networks comprise, particularly with respect to different types of transport in large cities. Funding is available for 3 years in terms of fees paid at the UK/EU rate and the usual EPSRC stipend as detailed below. The student will be involved in the entire project and will interact with all the researchers in CASA, the Centre for Transport Studies and the Department of Computer Science (see http://gow.epsrc.ac.uk/ViewGrant.aspx?GrantRef=EP/G057737/1)

How to Apply

The closing date for this position is Tuesday 7th July 2009

To be considered for this position, please submit the following documents by the closing date:
1. a letter of application
2. a CV listing education history (institution name, start and end dates of courses, qualification gained), details of membership of any professional organisations, details of current or most recent employer (name and address of current organisation, job title, salary and duties), details of previous employment and how your knowledge, skills, and abilities would enable you to fulfil this studentship, plus the names and addresses of two referees.
3. The successful applicant will have to also apply to UCL for admission to the PhD programme in Computer Science. This will need to be accomplished after this application whose purpose is to establish suitability and interest.

Please email applications to s.curtis@ucl.ac.uk clearly stating the post reference (**CASA/09/06/SCALE3**) number in the subject line.

About CASA

The Centre for Advanced Spatial Analysis (CASA) is an initiative within University College London to develop emerging computer technologies in several disciplines which deal with geography, space, location, and the built environment. As an interdisciplinary research centre expertise is drawn from archaeology, architecture, cartography, computer science, environmental science, geography, planning, remote sensing, geomatic engineering, and transport studies. This generates a unique blend of personnel who operate from CASA and associated departments within UCL. CASA is a department within the Faculty of the Built Environment.

For more information about CASA, please visit **http://www.casa.ucl.ac.uk**

Information about the Department of Computer Science and the Centre for Transport Studies can be found from their respective web sites: **http://www.cs.ucl.ac.uk/** and **http://www.cege.ucl.ac.uk/cts**

Stipend

Fees will be paid at the UK/EU rate, the stipend is £15,363 for 2009/10.

To be eligible for a full award (stipend and fees):

A student must have:

1. Settled status in the UK, meaning they have no restrictions on how long they can stay
   and

2. Been 'ordinarily resident' in the UK for 3 years prior to the start of the grant. This means they must have been normally residing in the UK (apart from temporary or occasional absences)
   and

3. Not been residing in the UK wholly or mainly for the purpose of full-time education. (This does not apply to UK or EU nationals).

   To be eligible for a fees only award:
4. All EU nationals are eligible to receive fees only if they do not have settled status in the UK

   Note: These eligibility criteria are based on the Education (Fees and Awards) Regulations 1997 and subsequent amendments, covering England, Northern Ireland, Scotland and Wales.