Travel Behaviour: Evolution of Conceptual Framing and Modelling Approaches

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Modelling on the Move 7th December 2012
Coverage of Presentation

• Charting the evolving conceptual framing, or travel paradigm, over the last 60 years
• Illustrating how this has influenced policy formulation, data collection and modelling
• Incorporating impacts **OF** and **ON** transport
• Using food shopping, as a case study
• Speculate on likely future paradigm/modelling evolution
Introduction

• Each discipline and profession develops and evolves its own conceptual framing, or paradigm, which shapes:
  – Issues that are perceived and described
  – Problems that are diagnosed and prioritised
  – Solutions that are generated and evaluated

• Advances often happen through paradigm ‘shifts’ (Kuhn 1962)

• Sometimes there are concurrent conflicting paradigms (e.g. medical profession)

• Influence of the paradigm is no less strong in transport – though little recognised
Evolution of Conceptual Framing

• Can identify a ‘core’ paradigm and four successive enlargements of perspective:
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Each triggered by some practical issue not resolvable using existing perspectives
The Conceptual Enlargements

CP  Vehicle-based (core paradigm)

En1  Person trip-based

En2  Activity-based

En3  Attitudes-based

En4  Dynamics-based

NB: Not necessarily sequentially added
1. Vehicles

- Focus on accommodating the needs of motor vehicles
- With growth in incomes and population, increase in vehicle numbers seen as ‘inevitable’ – no option but to cater for this
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➢ So, more build roads and parking spaces

BUT: what if cannot physically do this?
[e.g. LTS: 5X motorway capacity!!]

OR it is politically unacceptable?
[e.g. London: ‘Homes Before Roads’]
Seeing things differently……

Edgar Rubin, 1915
2. Person Trips

• Primary focus switches from the vehicle to the persons transported by vehicles
• NOW, aim is to accommodate needs of travellers, not vehicles
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BUT, what if still have problems?
- Modal alternatives don’t meet people’s needs
- Cannot forecast complexity of responses
- ‘Too much travel’
Seeing things differently......

Edgar Rubin, 1915
3. Activities

• Emphasis switches from travel to the activities that generate need for travel

• Travel now mainly a derived demand: the means of moving through space, to take part in activities at different places
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➢ Switch of emphasis from mobility -> accessibility
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➤ Switch of emphasis from mobility -> accessibility

BUT: Many factors which appear to influence behaviour are subjective not objective?
Seeing things differently......

Edgar Rubin, 1915
4. Attitudes

- Recognition of importance of beliefs, attitudes and social norms in influencing behaviour
- Development of ITS forces interest in role of information
- Also, growing interest in social issues and meeting people’s needs

BUT – what about leads, lags and asymmetries in behaviour?
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- Recognition of importance of beliefs, attitudes and social norms in influencing behaviour
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  - Use information and marketing to influence behaviour
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BUT – what about leads, lags and asymmetries in behaviour?
Seeing things differently……

Edgar Rubin, 1915
5. Dynamics

• Recognition that decision-making not instantaneous:
  – Lags: constraints vary in their temporal extent
  – Leads: people may make anticipatory decisions

• Importance of turnover in explaining aggregate tempo of change
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- Recognition that decision-making not instantaneous:
  - Lags: constraints vary in their temporal extent
  - Leads: people may make anticipatory decisions

- Importance of turnover in explaining aggregate tempo of change

- Recognition that policies take time to take effect
Overview

Dynamics

Attitudes
Activities
Person trips
Vehicle trips
### Perspectives vs. Disciplines

<table>
<thead>
<tr>
<th></th>
<th>Perspective</th>
<th>Disciplines</th>
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<tbody>
<tr>
<td>CP</td>
<td>Vehicle-based Engineering</td>
<td></td>
</tr>
<tr>
<td>En1</td>
<td>Person trip-based + Economics</td>
<td></td>
</tr>
<tr>
<td>En2</td>
<td>Activity-based + Geography/planning/sociology</td>
<td></td>
</tr>
<tr>
<td>En3</td>
<td>Attitudes-based + Psychology</td>
<td></td>
</tr>
<tr>
<td>En4</td>
<td>Dynamics-based + Finance/marketing</td>
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</table>
How to achieve CO2 reductions:

- **Vehicle**: more fuel efficient vehicles
- **Person trip**: switch to lower carbon modes
- **Activity**: use tele-services, or trip chain
- **Attitudes**: encourage voluntary behaviour change and eco-driving
- **Dynamics**: target interventions at decision points in people’s lives, allow for build up over time
Legacy Effects on Street Design

• Until recently, urban road design rooted in vehicle-based core paradigm
• Priority given to vehicle movements, through a range of measures
• Lack of incorporation of later strategic transport planning perspectives:
  – Person trips: recognise non-motorised modes
  – Activities: ‘Place’ function of streets
  – Attitudes: quality of street environment
<table>
<thead>
<tr>
<th>Different Data Requirements</th>
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<td>• Vehicles</td>
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<tr>
<td>• Trips</td>
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<tr>
<td>• Activities</td>
</tr>
<tr>
<td>• Attitudes</td>
</tr>
<tr>
<td>• Dynamics</td>
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</table>

<p>| • Roadside counts and surveys |
| • Household travel diaries – GPS tracking |
| • Activity diaries &amp; time use surveys |
| • Attitude surveys |
| • Panel surveys &amp; long duration diaries |</p>
<table>
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<tr>
<th>Paradigm expansion</th>
<th>Vehicle trip based</th>
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| Widely used modelling capabilities | • Vehicle ownership/use forecasting  
• O-D zonal movements  
• Traffic route assignment | • Trip purposes & generation  
• Mode choice (generalised cost)  
• Disaggregate modelling | • Time of day switching  
• Tour generation?? | • Attitudinal modelling | • Short vs. long-run elasticities |
## Modelling Components under each Perspective

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• Tour generation?? | • Attitudinal modelling | • Short vs. long-run elasticities |
| **Limited modelling capabilities or applications** | -- | -- | • Activity set generation  
• Activity pattern scheduling  
• Modelling inter-personal linkages | • Modelling impacts of information provision or image enhancement | • Dynamic model estimation  
• Path dependency  
• Asymmetrical responses | -- |
Increasing recognition that:

• Transport has a range of +ve and –ve non-transport impacts, and

• Non-transport sectors have major impacts on transport – through evolution of socio-technical systems
Types of Transport Impacts

Environmental Impact

Proposed Measure, or Existing Situation

Social Impact

Economic Impact

£/$ Valuation

Distributional Impacts: Social Groups; Spatially, Temporally
<table>
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<tr>
<th>Affected Travel Behaviour</th>
<th>Non-transport influences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip frequency</td>
<td>Business policies and social practices</td>
</tr>
<tr>
<td></td>
<td>Scope for telecommunication substitution</td>
</tr>
<tr>
<td>Trip length</td>
<td>Business policies (e.g. dispersed or concentrated provision)</td>
</tr>
<tr>
<td></td>
<td>Land use patterns (density, mixed use or zoning, etc)</td>
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<td>Mode choice</td>
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</tr>
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<td>Street network patterns</td>
</tr>
<tr>
<td>Vehicle type (CO$_2$ emissions)</td>
<td>Taxation and charging policies</td>
</tr>
<tr>
<td></td>
<td>Sources of electricity generation</td>
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</tbody>
</table>
Health Centre Moves to Edge-of-Town Site

**Build consolidated health centre at edge-of-town**

- **Benefit to Sector**
  - Better health care
  - Efficiency savings

- **Disbenefit to Sector**
  - Increased car use:
    - More congestion
    - More CO\textsuperscript{2} Emissions
  - Reduced access by bus and on foot/cycle
  - Reduced economic vitality
  - Reduced social interaction
  - Less walking/cycling
  - More difficult bus journeys
  - Interchange
  - Less likely to book appointment
  - More no shows

- **Consequences**
  - Reduced physical exercise
  - Located away from other market town facilities
  - Reduced economic vitality
  - Reduced social interaction
  - Less walking/cycling
  - More difficult bus journeys
  - Interchange
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**SECTORS:**
- Health
- Economy/Society
- Transport
• Transport behaviour embedded in a wider socio-technical context
• Major changes in behaviour often arise from simultaneous changes in social/business practices and technologies in several sectors

The example of retail shopping patterns……
Daily

Trip

Butcher

Grocer

...
STC2: Late Twentieth Century
STC3: Emerging Pattern
### Comparison of Three STCs

<table>
<thead>
<tr>
<th></th>
<th>Building construction</th>
<th>Shop type/location</th>
<th>Grocery logistics</th>
<th>Home food storage</th>
<th>Grocery ordering</th>
<th>Grocery delivery pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STC One</strong></td>
<td>Brick and wood</td>
<td>Small, many, within built up area</td>
<td>Mainly locally sourced</td>
<td>Limited – cool room or marble slab</td>
<td>In person, paying cash</td>
<td>Daily collection on foot</td>
</tr>
<tr>
<td><strong>STC Two</strong></td>
<td>Steel frame and cladding</td>
<td>Large, few, often out of town</td>
<td>Globally sourced</td>
<td>Fridge freezer</td>
<td>In person, using cash or card</td>
<td>Weekly collection by car</td>
</tr>
<tr>
<td><strong>STC Three</strong></td>
<td>Not used</td>
<td>Not used</td>
<td>Globally sourced</td>
<td>Fridge freezer</td>
<td>By internet, using card</td>
<td>Deliveries direct to home</td>
</tr>
</tbody>
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Conclusions

• Transport academics and profession influenced by an evolving paradigm
• As working environment has changed, so need for paradigm enlargements
• But with a restraining historical legacy – especially methodologically - with vehicle-based perspective remaining at the core
• Further enlargements underway: e.g. work on social networks, ‘mobilities’ & travel patterns
• BUT what might a ‘revolutionary’ approach (a paradigm shift) rather than ‘evolutionary’ approach have led to?
  – Broader emphasis on movement, telecommunications and accessibility
  – More focus on activities, lifestyles and subjective quality factors
  – A stronger social science interest, with links to the economy and society
  – Explicit treatment of cross sector impacts
Thank you!

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