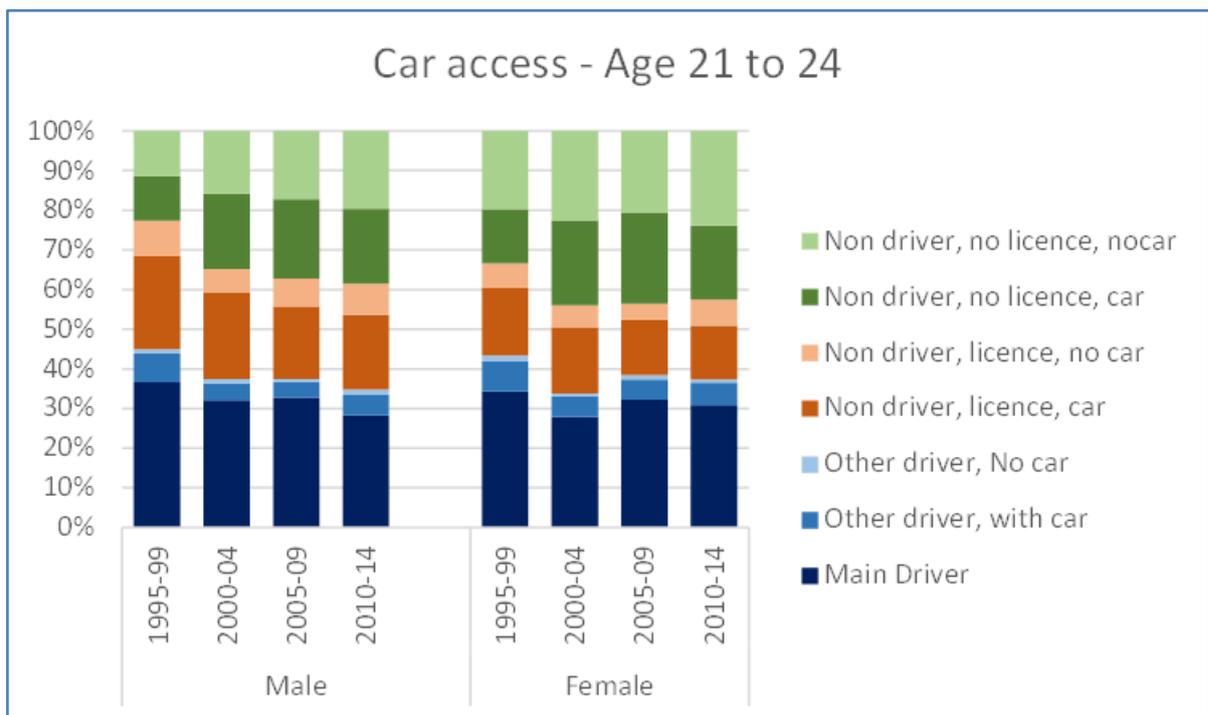


# The Transport Economist

The Journal of the Transport Economists' Group



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TEG Committee 2018-2019

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# **Evaluating rail projects in Scotland**

Keith MacKenzie, Transport Scotland

Arup

24 January 2018

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## **Background**

Keith MacKenzie presented Transport Scotland's evaluation guidance followed by the key findings of pilot studies and the Borders Railway Stage 1 evaluation. Under the Railways Act 2005, Transport Scotland was given new responsibilities including enhancement of lines and stations. Scottish Transport Appraisal Guidance (STAG) was produced, and a review of evidence following completion of large projects found that cost and demand forecasts had typically been optimistic.

## **The initial evaluation approach**

Transport Scotland began with development of a draft evaluation approach. A 2-stage evaluation was proposed:

- Stage 1 occurs 2-3 years after completion and includes a high-level assessment of whether the scheme would meet objectives, a review of data, and a lessons learned/process evaluation approach.
- Stage 2 would be carried out 5-10 years after completion and include surveys and a recalculation of the BCR. The approach was discussed at a workshop in 2013 and some amendments were made. A key recommendation was that evaluation should be proportionate to the size of the scheme. The need for a baseline should be explicitly stated and use of a logic model was proposed.

Transport Scotland identified three pilot projects: Laurencekirk new station, Larkhall-Milngavie and Airdrie-Bathgate.

## **Laurencekirk**

Laurencekirk reopened in 2009 at a cost of £3.5 million and was considered a success.

Passenger numbers in the first year were double the forecast. Key lessons learned were that process evaluation should be carried out early, before staff move on.

The output objectives were not SMART, and this has been a lesson for subsequent evaluations. It was also difficult to isolate journey time effects because of other changes.

### **Larkhall-Milngavie**

Larkhall-Milngavie cost £35 million and included a 4.7 kilometre track reinstatement, a 1.6 kilometre track extension, four new stations and a doubling of frequency to four trains per hour.

Actual demand was 26% higher than forecast and journey times to Glasgow Central reduced by 10 minutes. A return of £2.77 for every £1 spent was identified.

The output objectives were achieved, and there was evidence of better accessibility and modal shift, but no evidence of significant new business investment.

### **Airdrie-Bathgate**

Airdrie-Bathgate opened in 2011. It delivered a new four trains per hour service between Edinburgh and Glasgow, as a result of new track and electrification, at a cost of £300 million.

Evaluation showed a 31% increase in passengers, compared to 14% nationally, and a 57-minute reduction in peak journey time.

Evaluation findings were mixed. Access to labour markets had improved, but it was too early to see impacts on GVA or employment, and impacts on motorway congestion are not clear.

## **The revisions to the evaluation approach**

These pilots fed into a second workshop and recommendations for appraisal and evaluation. STAG now has a greater focus on evaluation, and requires better recording of assumptions and archiving. Baseline data should be collected before the project begins, and a counterfactual produced. Timing is important, because some impacts such as land use changes could take 10-15 years. New Evaluation Guidance was produced.

## **Borders Railway**

Keith presented the Stage 1 evaluation of the Borders Railway, which was the longest new railway to be constructed in 100 years, with 30 miles of track and seven new stations from Edinburgh to Tweedbank. The scheme was almost ten years in development and delivery.

Objectives were to promote access to and from the Scottish Borders and Midlothian; to improve social inclusion; to prevent decline in the Borders population; and to create modal shift.

Process evaluation was carried out on the basis of interviews with stakeholders. This concluded that the project was well-run and delivered under budget. Baseline secondary data has been published in a report.

The Stage 1 research aim was to assess how well the scheme met its objectives, and to examine the impact on visitor numbers, and views of users and non-users, through surveys and a review of secondary data. User surveys covered 10% of passenger journeys, while telephone surveys looked at barriers to use.

1.3 million trips were forecast, and total actual travel was within 2% of the forecast, but with geographical differences. Use was higher at Borders stations and lower at Midlothian ones.

The survey found that 60% of users were from the Scottish Borders and that 60% of trips from Borders stations were to Edinburgh. Tweedbank, with a large catchment area and free parking, was the largest single station of origin. The route generated 50,000 annual trips, enabling people to access new journey opportunities and giving them better access the airport.

An estimated 40,000 car trips were saved, and a minor impact on car ownership was reported. 15% of users have no access to a car, suggesting some improvement in social inclusion, but a review of the bus network showed reductions in bus frequency, possibly triggered by a shift from bus to rail. Satisfaction with the rail service is high, with 80% rating it good or very good.

There was some evidence of an impact of the railway on choice of home and employment location.

## Discussion

**Stephen Bennett** asked how the project could be considered a success when it took ten years for it to be delivered. **Keith** said that it took a long time to get approval, but delivery was successful. However, the extended timeframe made it more difficult to evaluate the scheme, as many changes had taken place since the business case was produced.

Steven Finch (Department for Transport) asked why there was a Year 2 evaluation, when that had not originally been planned. Keith said that this was not a Stage 2 study, and had a focus on tourism driven by the sponsor group. The Stage 2 study will take place five years after Year 1.

**John Cartledge** (London TravelWatch) asked about the distribution and regeneration impact. Stated objectives included access to and from the Scottish Borders and Midlothian, but the objective of preventing decline only applied in one direction. **Keith** replied that Larkhall-Milngavie has not demonstrated any regeneration benefits, and Airdrie-Bathgate is cross-Glasgow, so it is difficult to identify impacts, whereas the impact on the Borders is easier to evaluate. The Scottish government aims to tackle inequality and to prevent depopulation. The challenge is to set the correct objectives: these need to be SMART, and lessons have been learned from the pilot studies, where it was sometimes difficult to monitor performance against the objectives.

**Martin Crookston** (Architecture and Design Scotland) ask how much freedom Transport Scotland has to diverge from the Green Book. **Keith** said that there was a lot of freedom. STAG and the evaluation guidance are Transport Scotland's own guidance, but they have much commonality with the Green and Magenta Books.

**Tom Worsley** (ITS Leeds) noted that demand forecasting is notoriously difficult, and that work on the impacts of new stations showed that forecasts could be very different from actual use. He asked what lessons could be learned from the evaluations. **Keith** said that forecasting was particularly difficult with a new railway. The evaluation team also had the challenge of understanding the original forecasts, which took the mid-point of

a range of forecasts. Modelling capability is now better than when the work began, and it is essential to keep records of the forecasting methodology, so that it can be reviewed at evaluation. Stage 2 will re-examine the forecasts.

**David Spurling** asked if the Borders railway could be extended to England. **Keith** said that options for extension to Hawick were being considered. Any decision to extend to England would be for both governments.

**Dick Dunmore** (Steer Davies Gleave) asked if there was a process for identifying any unexpected impacts of any of the schemes. **Keith** advised that close engagement with stakeholders was key to understanding some of the local impacts. Visit Scotland and local authorities were consulted on the Borders evaluation. **Dick** said that it would be interesting to see if the tourist industry would introduce any complementary measures, such as shuttle buses linking to the railway, particularly at Tweedbank.

**Tom Worsley** asked whether any work had been done to test the forms of questions used in surveys. **Keith** said that no testing had been done. There had been a long campaign for the Borders railway, so responses were likely to be favourable.

Someone asked how Wider Economic Benefits (WEBs) will be measured. **Keith** replied that there is WEBs guidance in STAG, but that evidence is limited, and WEBs will not be applicable to all schemes.

**Ed Pearson** (Virgin Trains) asked whether the evaluation should be measured only against Transport Scotland's objectives, and whether the Borders scheme was future-proofed for double-tracking. **Keith** noted that the original objectives were a key part of the evaluation, but government objectives change over time. Social inclusion and sustainable growth are both more important now than when the scheme was commissioned. The issue of expansion is likely to depend on political aspirations.

**Tim Elliot** asked how the benefit-cost ratio (BCR) could be recalculated, given the long timescale between inception and opening. It is essential that accurate records are kept, so that sunk costs are captured. **Keith** said that a number of factors changed in the intervening years, including discount rates and

appraisal periods, but that the BCR is most important in providing a level playing field between projects. **Tim** noted the importance of comparing apples with apples in reviewing BCRs.

**Joanna Jedrasiak** (Arup) asked how house prices were treated in the counterfactual. **Keith** said that house price data had been used in the Laurencekirk evaluation. **Dick Dunmore** commented that house price changes could not normally be either expected or detected in the case of fairly small schemes.

**Peter White** (University of Westminster) noted that the original forecast BCRs were fairly low, and asked when the recalculated BCR will be available for Borders. **Keith** said it will be produced at Stage 2. BCRs in Scotland are often lower than in England, particularly for schemes in lightly-populated areas.

**Gregory Marchant** asked if there had been any evaluation of softer items, such as WiFi or passenger information. **Keith** said that the budget was limited, and that the work had focused on use of the assets.

**Peter Gordon** (Editor, *The Transport Economist*) asked what discount rate had been used. **Keith** said it was the Treasury rate.

**Dick Dunmore** concluded by asking attendees from the Department for Transport whether and lessons had been learned from the Transport Scotland work. **Steven Finch** replied that DfT had been involved in the workshops that **Keith** had described, and had found them helpful in developing DfT's own evaluation guidance.

Report by Carol Smales

# Agent Based Modelling

Helen Bowkett, Arcadis & Visiting Professor,  
University of the West of England

Arup

28 February 2018

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## Introduction

Helen introduced her talk by saying that she would discuss:

- some of her thoughts on modelling;
- Agent Based Modelling (ABM), including a live demonstration; and
- a case study on buses, mode choice and habits carried out as part of her PhD at the University of the West of England (UWE).

She thanked her PhD supervisors, Dr Kiron Chatterjee and Prof Graham Parkhurst.

Helen had wide experience of building and using strategic transport models in areas such as route assignment and Local Sustainable Transport Funds (LSTF) bids for walking, cycling and Personalised Travel Planning (PTP). She said that models were good, and could be very useful for the understanding of systems and to aid decision-making, but wondered "Are they the answer to everything?". For example, assignment models may be wrong at the detailed level, so do they really get the right answer on average? In addition, they cannot take into account interventions such as PTP.

Given this context, she was keen to take the opportunity to study at UWE.

## Why model?

*"A model is a simplified representation of a more complex phenomena, process or system". (Barnsley, 2007).*

A model has a number of benefits:

- The process of building the model often leads to an increased understanding of the model's subject.
- A model can enable policymakers to investigate the likely consequences of various policy options.
- A model provides evidence to assist in decisions that need to be taken, for instance over the allocation of the transport budget.
- Clear reporting of the output of model runs can be used to share the knowledge and understanding gained from creating and running the model.

Helen cited "Why model" (Joshua M Epstein, 2008) which proposed 16 reasons for modelling in only 3-4 pages.

Models generally reflect their background in neo-classical economics: key assumptions include rationality, perfect knowledge and the existence of a state of equilibrium in the market. In practice, they have historically had to deal with other issues, such as the restrictions of computer technology (she referred to modelling the East London Line extensions within 10MB of memory) and data availability.

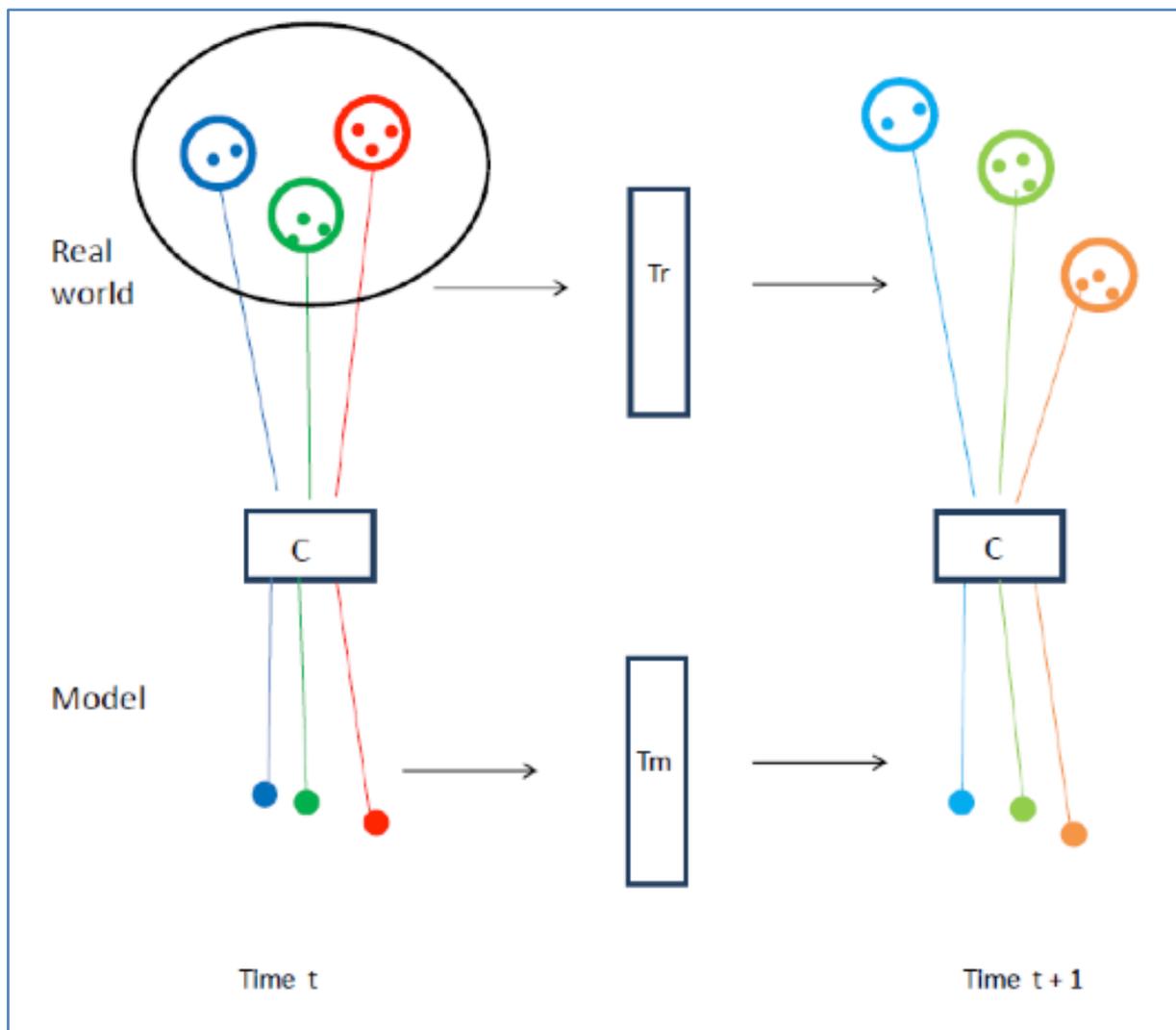
Maps are also a type of model: they distil the essential information and reveal insights otherwise obscured by the detail. Holland et al (1986) extended the metaphor of maps to the process of modelling a system that changes over time:

- It is not sufficient for a model to represent accurately the current state of the system it is modelling.
- It should also contain representations of the key processes at work in that system, including those that will be important in the future.

Figure 1, adapted from Holland et al, illustrates some of the issues:

- C are classification rules used to simplify the real world by aggregation.
- Tr are transmission processes in the real world.
- Tm are transmission processes in the model.

Figure 1: transmission processes in the real world and in models



Critical realism, a philosophical school of thought, suggests:

- The **real** world is whatever exists, regardless of whether we understand it or not. It does not have to be a physical object, and could be a mechanism such as gravity.
- The **actual** world refers to what happens when real world mechanisms are activated, such as an apple falling.
- The **empirical** world is defined as the domain of experience. It is the things we actually observe or experience, such as the apple hitting our head.

This suggests a number of issues for modelling.

First, there is a need to be explicit about which world is being modelled: the real, the actual or the empirical.

Second, there is a danger of attributing causality to mere conjunction of events. Sayer (2009) notes that *“Explanation depends on identifying causal mechanisms and how they work, and discovering if they have been activated and under what conditions. Events arise from the working of mechanisms which derive from the structures of objects and they take place within geo-historical contexts.”*

Third, does the modelling contain sufficient depth to capture all the relevant mechanisms at work? The processes operating in the system can lead to the emergence of other structures. Danermark et al (2001) note that *“The outcome of the mechanisms – the events we can observe – is a complex combination of the influences from other mechanisms reinforcing each other while others counteract each other’s manifestations.”*

Fourth, the social world operates mainly through a series of open systems. Transport models need to delineate part of an open system to create a closed system: where are the boundaries, and hence which factors are considered to be exogenous to the model? The assumed boundaries of these exogenous factors can change, and the influence of the exogenous processes may change over time.

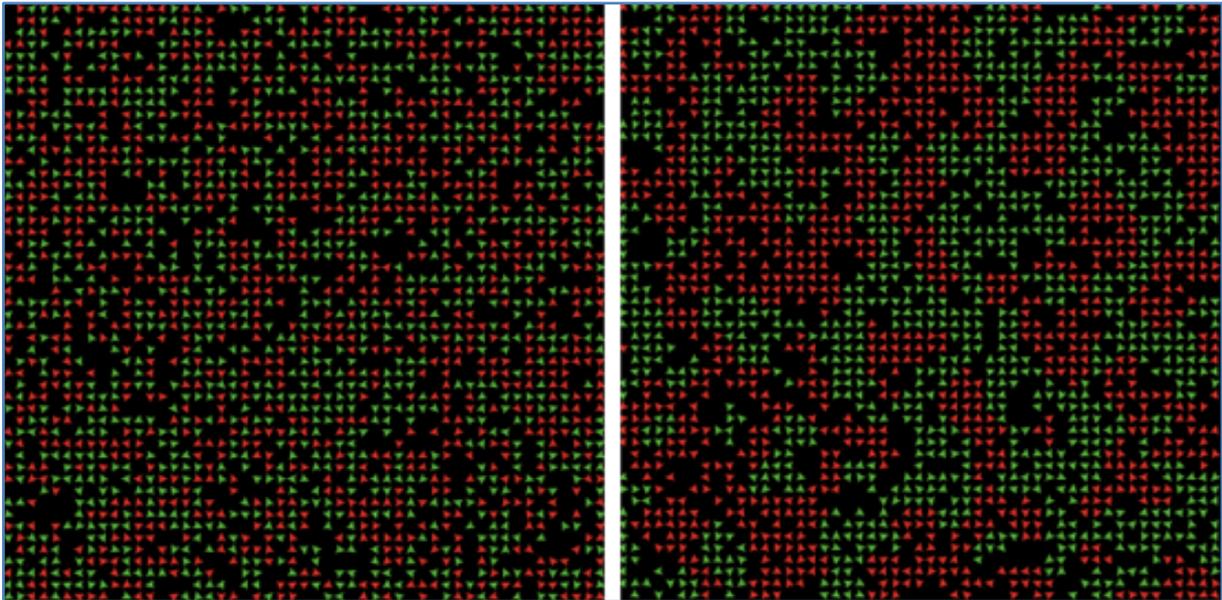
## **Agent Based Modelling**

Agent Based Modelling is derived from microsimulation models proposed by Orcutt in 1957. He put forward a “bottom-up” approach, modelling each individual decision-maker in a system using rules. The overall change in the system is calculated by aggregating the individual changes. This approach has been used by organisations such as HM Treasury, for example in its “Impact on households” distributional analysis of budgets. Car-following models of traffic are another form of microsimulation.

Helen showed a screen from free Java-based modelling software AnyLogic, which has been used extensively in health and other sectors.

Helen presented a live example, Thomas Schelling’s segregation model, illustrated in Figure 3.

*Figure 3: Schelling's model of segregation*



The model investigated the propensity to self-segregation in a society of red and green people, who could move, over a number of time periods, until they were comfortable with their neighbours. The model was originally tested with paper on the floor and was modelled in the illustration in NetLogo. It showed that, even if people were happy for up to 70% of their neighbours to be of the other colour, initial mixing (left) would over time become pronounced segregation (right).

*Figure 4: birds flock using simple rules*



Another example is how phenomena such as the movement of flocks of birds can be explained (Boids simulation, Craig Reynolds, 1987) using simple rules:

- separation, steer to avoid crowding local flockmates;
- alignment, steer towards the average heading of local flockmates; and
- cohesion, steer to move towards the average position of local flockmates.

The film industry now uses these modelling rules to generate flocks of birds: individual dots follow the rules and are then replaced by bird images.

In Agent Based Models, agents need to be heterogeneous; to have personal attributes which may include history and memory (the future depends on the past), bounded rationality and behavioural rules; and to act in networks. Another common feature is imperfect knowledge (such as reacting only to local conditions).

### **Case study: Agent Based Modelling of mode choice**

Helen completed the presentation with a description of a model she had built for her PhD, using a 2011 dataset of 626 interviews of journey to work behaviour, including personal details and preferences revealed through a Stated Preference (SP) model of:

- four modes: car, train, bus and cycle;
- five journey times: 15, 30, 45, 60 or 75 minutes;
- four journey costs: 150, 200, 250 or 300 pence (with trend increases over time based on WebTAG); and
- four levels of CO<sub>2</sub> emissions: 1, 2 3 or 4 kilograms.

The model used 626 agents, each with the individual characteristics of an interviewee (“I don’t cycle because I can’t” or “I can’t use bus because ...”). It then modelled their choice of mode for the same 5-mile journey to work over ten years.

The environment provided the time and cost of travel and the model was run weekly for the ten years. Commuters would use the same mode as the previous period, unless triggered to make an intentional choice by events such as moving house (moving

rates based on the British Household Panel Survey, BHPS), changing job (based on OECD data) or becoming old enough to qualify for a concessionary bus pass. Under these circumstances, they would choose the mode with the highest utility.

Figure 5 shows one of the findings, a trend decline in the number of bus commuters, and Figure 6 illustrates how the availability of concessionary fares influences the number of bus commuters.

Figure 5: modelled decline in the number of bus commuters

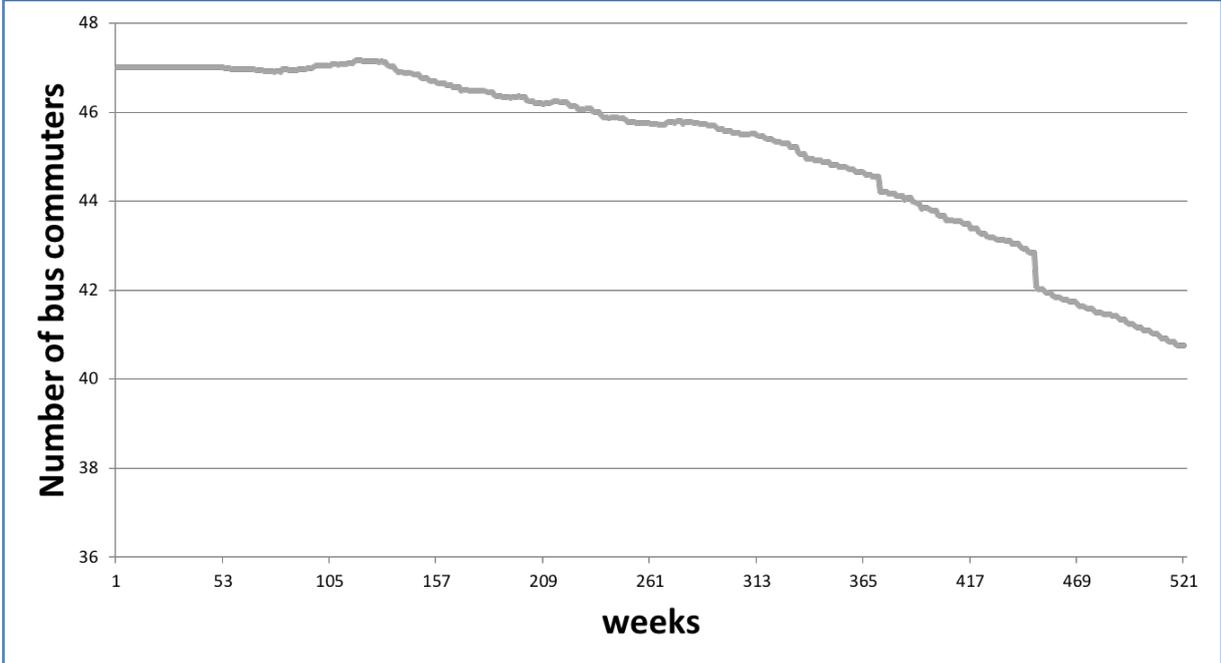
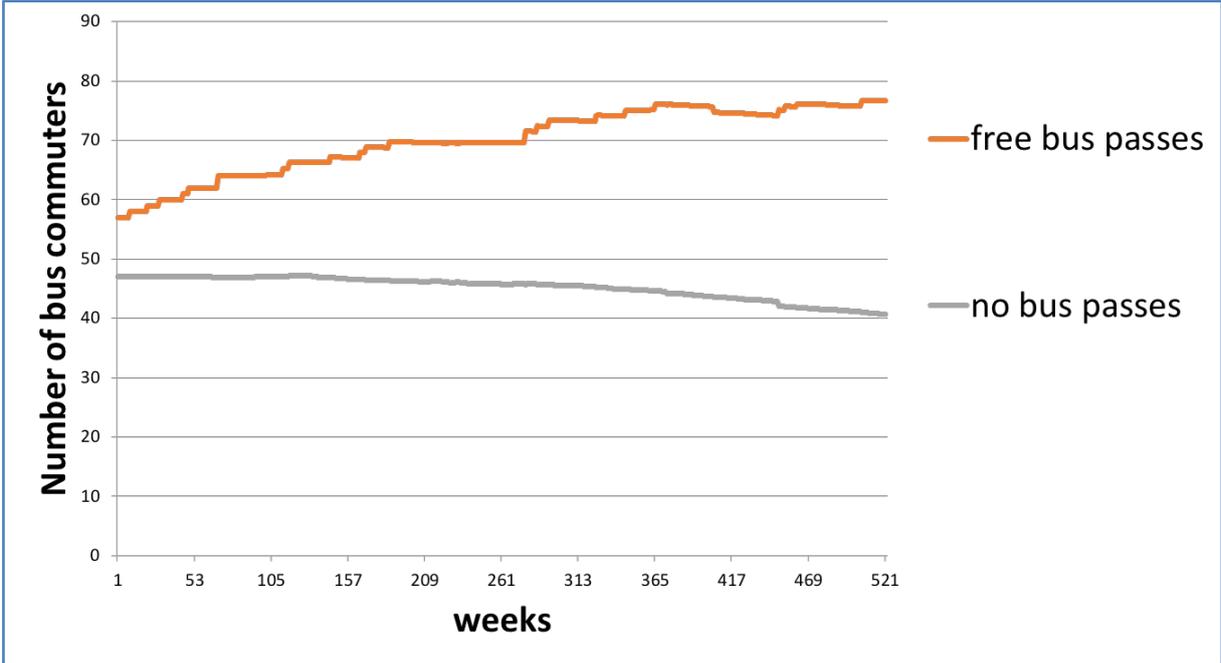


Figure 6: modelling the effect of free bus passes



Helen also discussed the effect of habits, which have been described as: automatically repeated behaviours (Verplanken et al 1997); script-driven (Garling et al, 2001); and weakened by contextual changed (Verplanken 2008).

Triandis’s Theory of Interpersonal Behaviour, illustrated in Figure 7, showed how intentions could be influenced by habits.

Figure 7: the influence of habits on intentions

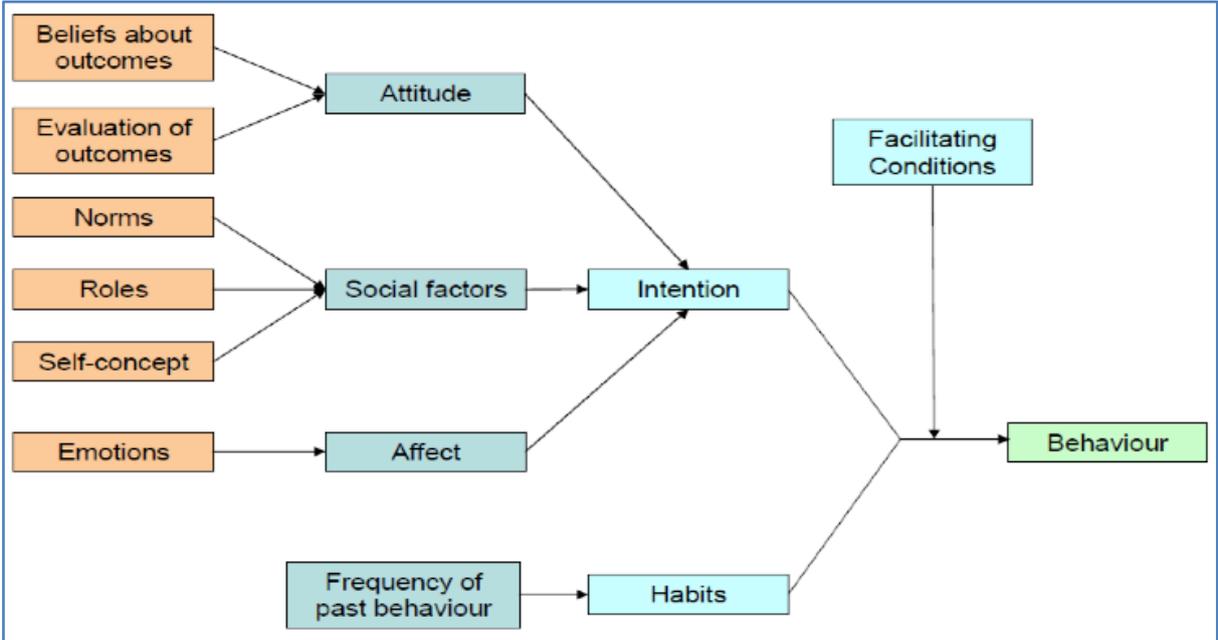
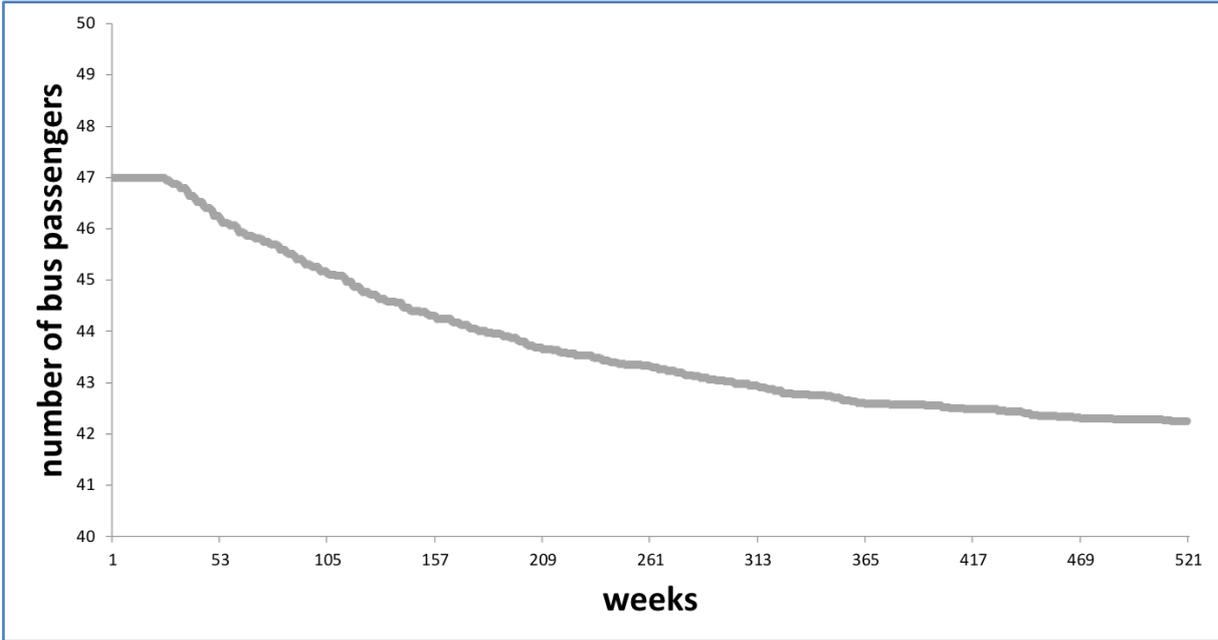


Figure 8 shows the modelled effect of a 10% rise in bus fares.

Figure 8: modelling the effect of a 10% rise in bus fares

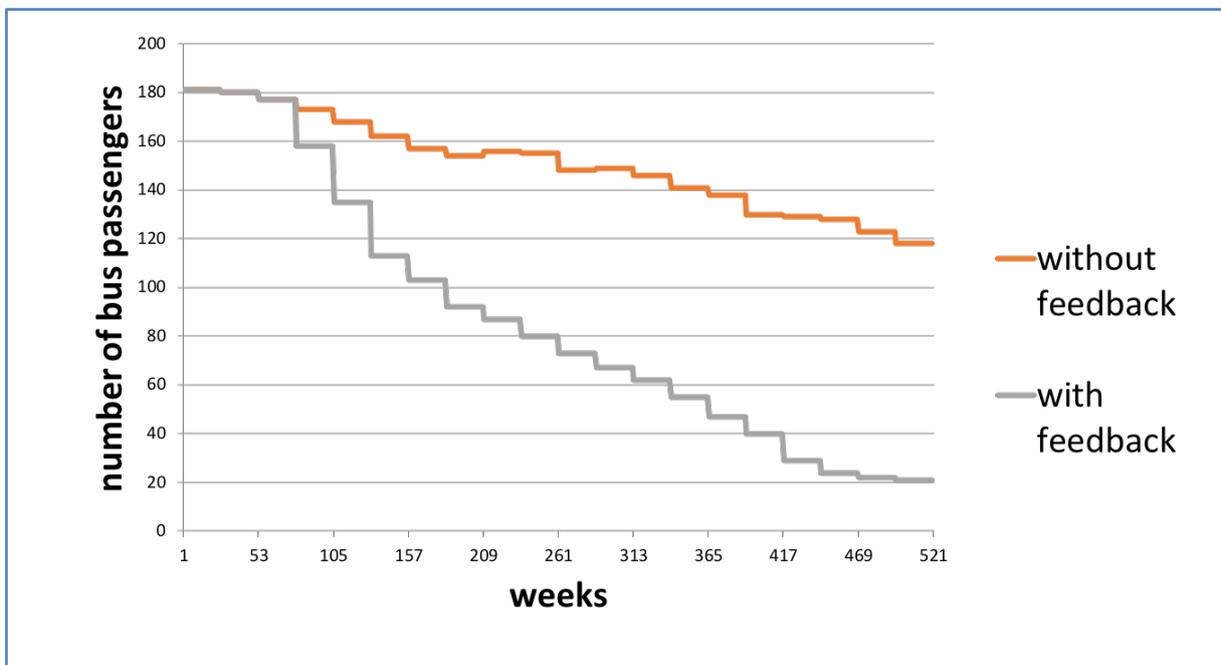


Initially there is no modelled effect, as habitual behaviour continues, but then some of the agents pass a trigger event, after which there is a slow decline to a new level.

One satisfactory result of this approach is that it reproduced the common observation that elasticities are higher in the long run than in the short run: the effective elasticities in Figure 8 are -0.24 after one year, -0.41 after two years, and -0.91 after seven years.

The model was also used to investigate the effect of feedback if operators remove buses when passenger numbers fall, as shown in Figure 9. The modelled assumption was that one bus per hour would be removed if average loads fell below 20 passengers.

*Figure 9: modelling the effect of service reductions*



The figure suggests that this feedback would lead, over time, to the loss of the majority of services.

## **The relevance of ABM to policy**

Helen summarised the potential relevance of ABM to policy:

- It makes it possible to model a wider range of policy initiatives. ABM models are used extensively in health and the environment, where there is “less obsession with assuming equilibrium”.
- The time and cost of options can change over time.

- The facilitating conditions can change over time.
- The occurrence of trigger events can change over time.
- Models based on individual behaviour aid understanding of who is affected by policies.

## **The relevance of ABM to economics**

Helen summarised the relevance of ABM to economics:

- It is a useful addition to the toolkit, but is not a “wonder tool” and is not suitable for tackling all issues.
- It can reduce the impact of aggregation bias from costs and preference functions, which are often highly aggregate. Models can produce widely different results by grouping people differently.
- It allows for a greater level of psychological realism.
- The framework is idea for relaxing other standard economic assumptions and including other insights, such as peer influence.

## **Further reading**

- Agent-Based and Individual-Based Modeling: A Practical Introduction, by Steven F. Railsback, Volker Grimm (ISBN 9780691136745)
- Agent\_Zero: Toward Neurocognitive Foundations for Generative Social Science (Princeton Studies in Complexity) by Joshua M. Epstein (ISBN 0884530932907)

## **Discussion**

**Stephen Burke** (London Borough of Enfield) asked whether parameters such as “the 70% assumption” (in Schelling’s model) could be replaced by a distribution. **Helen** confirmed that this could be done, but that it raised the risk that the model required more input assumptions than the data would support.

**Tim Yates** noted that he had read an Economist article on the impact of RMT strikes on commuters, which had suggested that these had acted as “trigger events” after which commuters had found, and then stuck to, new commuting patterns. **Helen**

agreed that this was interesting, and suggested that triggers could be important. One of the interesting features of her model was that, in the longer term, some travellers shifted from bus to car as increasing bus prices triggered a shift.

**Robin Morphet** (The Bartlett Centre for Advanced Spatial Analysis) asked whether ABM could be used to replicate existing models and hence to explore their implicit assumptions. **Helen** thought that this was an interesting idea. ABM could be used to test different assumptions on preferences, heterogeneity (such as a distribution instead of “the 70% assumption”), or to aggregate agents in different ways, which had been shown could change results and produce different predictions. Aggregation effects could affect model results, such as the common aggregation by journey purpose rather than (for example) propensity to trade money for time.

**David McEwen** (freelance Tourism Statistician) wondered whether 626 interviews was sufficient for a model. **Helen** had worked with what was available.

**Peter White** (University of Westminster) wondered what had been assumed in the bus model about car availability. **Helen** said that access to a driving licence was assumed to depend on age. **Peter** then asked whether the growth in travel on concessionary fares actively incentivised the operators to increase supply and hence frequency. The “no net loss, no net gain” compensation arrangement will also compensate for any additional capacity which became necessary. Wales may be more generous, but then there would be no need to add buses if additional off-peak passengers would fit within capacity. **Helen** agreed that this was a potential issue, but said that she had used a relatively crude simplification in the bus model. She also added a warning to be wary of those who oversell ABM, use of which still requires “domain knowledge”.

**Tim Elliott** (Independent) reported that he was a holder of a bus pass, but that if it was taken away it might still be necessary to subsidise services directly to achieve the same, or equivalent, social outcomes. He asked what assumptions had been made about real income, such as for retirees. **Helen** said that the modelling had included a probability of retiring, with retirees being replaced by younger people “as is”, rather than attempting

to predict in what way younger people would differ. This illustrates how preference functions are unlikely to be stable over time, as successive generations begin with different preferences. She thought that an awareness of these effects could inform thinking on how Public Service Obligations (PSOs) for buses should be specified.

**Dick Dunmore** (Steer Davies Gleave) noted that Helen's analysis had shown how elasticity could vary over time, but wondered whether, even if there were no time lags, the effective elasticity curve could be quite complex, once thresholds and triggers were taken into account. **Helen** said that the model had effectively calculated an average elasticity.

**Tom Worsley** noted that some people may not trade money for time, which may mean that we need to revisit the problem and to consider other trade-offs which are even harder to model. **Helen** said that Stated Preference (SP) work by Stefanne Hess of ITS Leeds had shown that people do not always trade, and that some always choose the cheapest or fastest route, or the same mode. She also noted that ABMs may have too much segmentation, while other modelling approaches have too little: is there a useful middle in which there is only sufficient segmentation to avoid aggregation bias? One possibility for model calibration and validation was that it might be possible to transfer data (for example on preferences) from one model to another.

**Peter Gordon** (Editor, The Transport Economist) asked whether the accuracy of the bus model had been checked. **Helen** said that it had not, and that there was a whole issue of how such models could be calibrated and validated. For example "pattern validity" could at least be used to check whether ABM predicted patterns which were seen in real life but not in other models. **Peter** also asked how much ABM was related to psychology: open face-to-face interviews often revealed very different patterns of behaviour and preferences to those found in response to closed or multiple-choice questionnaires. **Helen** said that it would be beneficial to have better information on what modelling simplifications were appropriate.

Report by Dick Dunmore

# **Young people's travel patterns - what's changed and why**

Phil Goodwin (University of the West of England) &  
Gordon Stokes (University of Oxford)

Arup

28 March 2018

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## **Overview**

The Department for Transport (DfT) commissioned a review of evidence on young people's travel patterns. The work was done by a team of eleven specialists from the University of the West of England and Oxford University: Kiron Chatterjee, Phil Goodwin, Tim Schwanen, Ben Clark, Juliet Jain, Steve Melia, Jennie Middleton, Anna Plyushteva, Miriam Ricci, Georgina Santos and Gordon Stokes.

This included a review of UK and international literature and new analyses of existing data. The speakers considered it disappointing that there was no new data gathering.

[www.gov.uk/government/publications/young-peoples-travel-whats-changed-and-why](http://www.gov.uk/government/publications/young-peoples-travel-whats-changed-and-why)

The study was mainly undertaken in the UK with DfT sponsorship, and most attention was given to the reduction in car use, focusing on changes since the early 1990s. The main age group considered was 17-29, but some analysis extended to those in later life.

Explanations of change included social, economic and lifestyle trends, both within and outside transport, so the study was not limited to transport. It also examined what happens as people grow older.

Possession of a driving licence among young people peaked in 1992/4, with 48% of 17-20 year olds and 75% of 21-29 year olds holding a driving licence. By 2014, driving licence holding had fallen to 29% of 17-20 year olds and 63% of 21-29 year olds, an extraordinarily large drop, reversing a 50 year rise.

Figure 1: trends in possession of driving licences since 1975/6

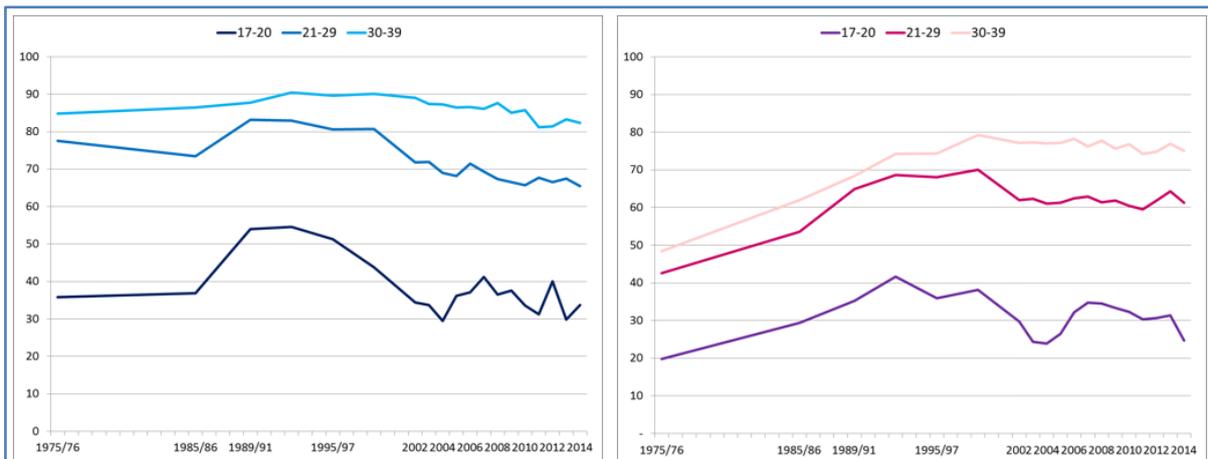
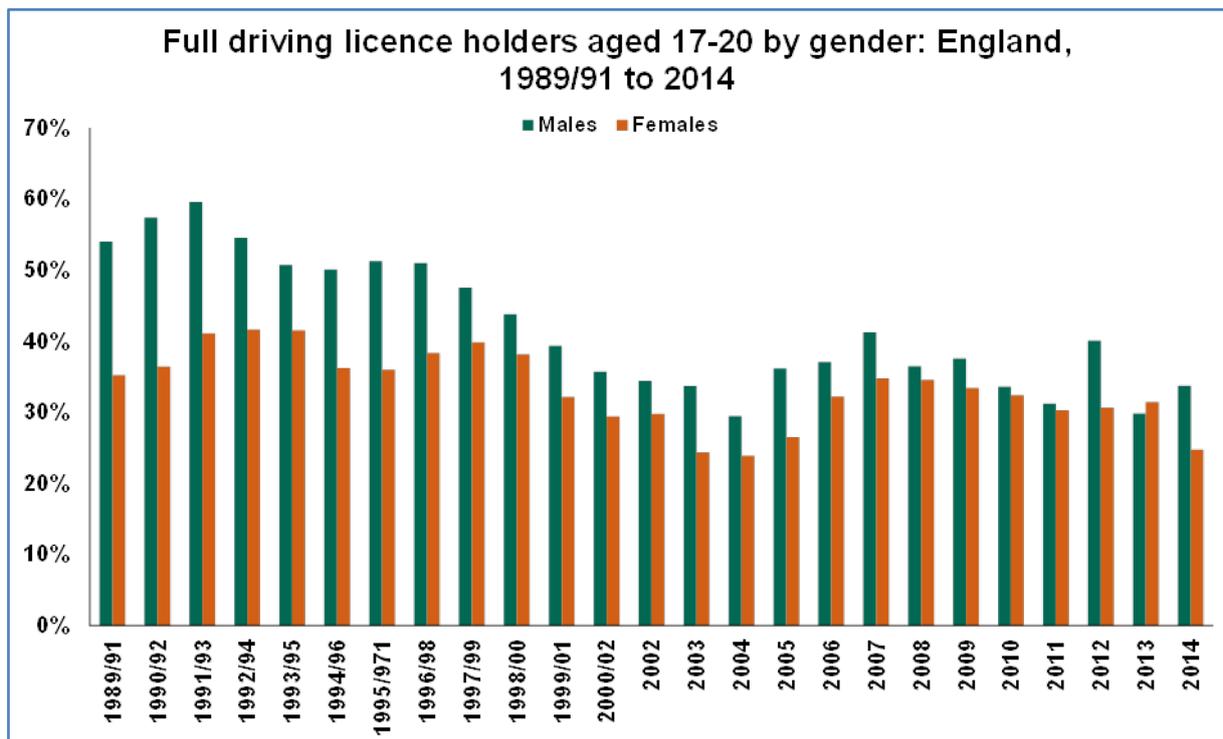


Figure 1: Percentage of Men with Driving Licence by Age Group in England 1975/76 to 2014 (source: NTS0201 from DfT (2015))

Figure 2: Percentage of Women with Driving Licence by Age Group in England 1975/76 to 2014 (source: NTS0201 from DfT (2015))

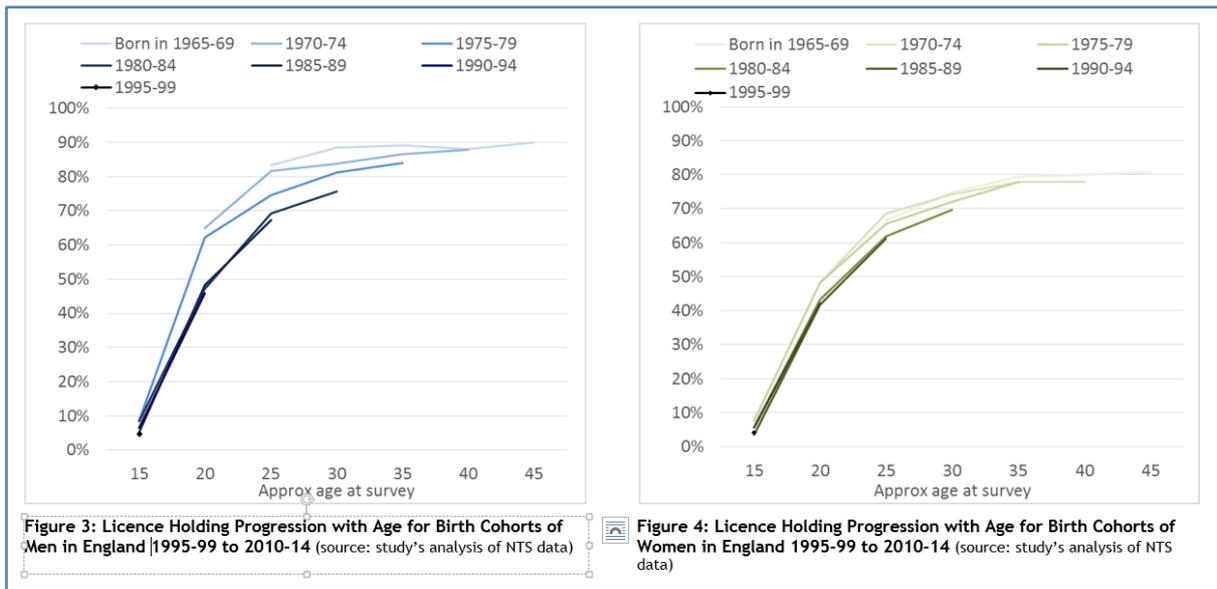
There has been a steady decline in driving licence acquisition of those reaching driving age since 1993, except for the period 2004 and 2007, with a larger decline for men than women.

Figure 2: trends in possession of driving licences since 1989/91



Each line shows National Travel Survey data on how likely people are to hold a licence. There has been a progressive decrease for licence holding for each age cohort. There has been less change in recent years, which may or may not indicate the approach of a new equilibrium.

Figure 3: acquisition of driving licence by year of birth and age



## Car use

Between the 5-year periods 1995-99 and 2010-14 there was a 36% drop in the number of car driver trips per person made by people aged 17-29, with a fall of 44% for men and 26% for women. In the early years, only the number of men driving fell but, by 2010-14, the difference in the number of car driver trips between young women and young men became negligible.

Figure 4 shows the average number of miles driven per year by gender, which is higher for men and peaks around 50. The fall has been highest for men (left) up to the age of around 60.

Figure 4: car driver miles by age, 1995-99 to 2010-14

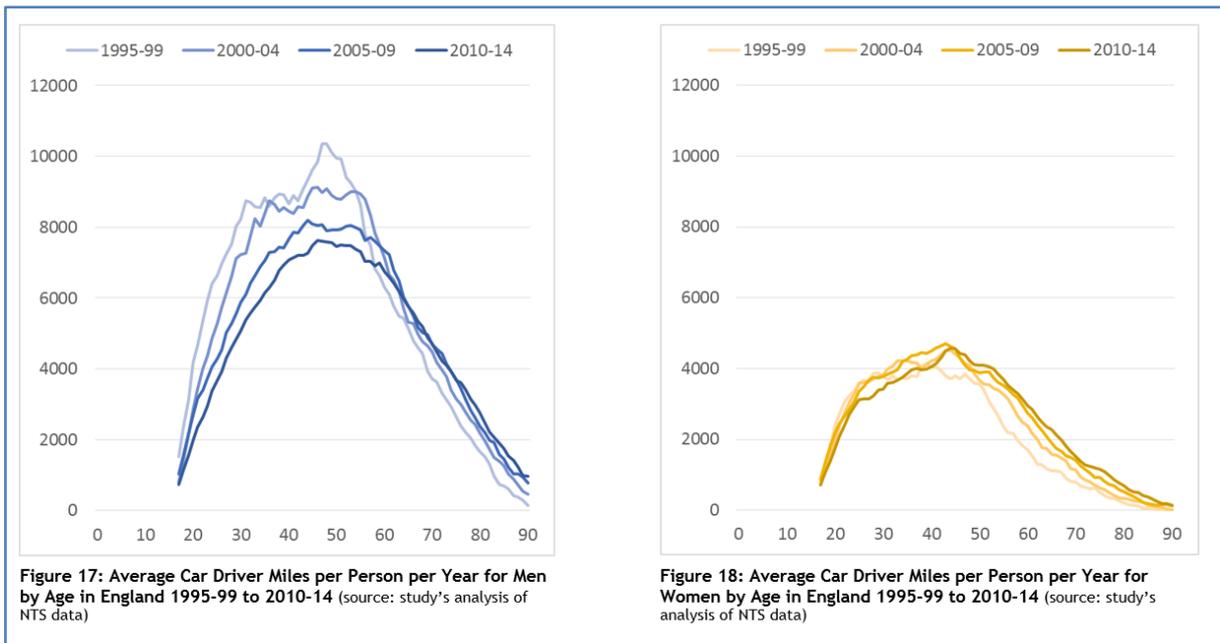
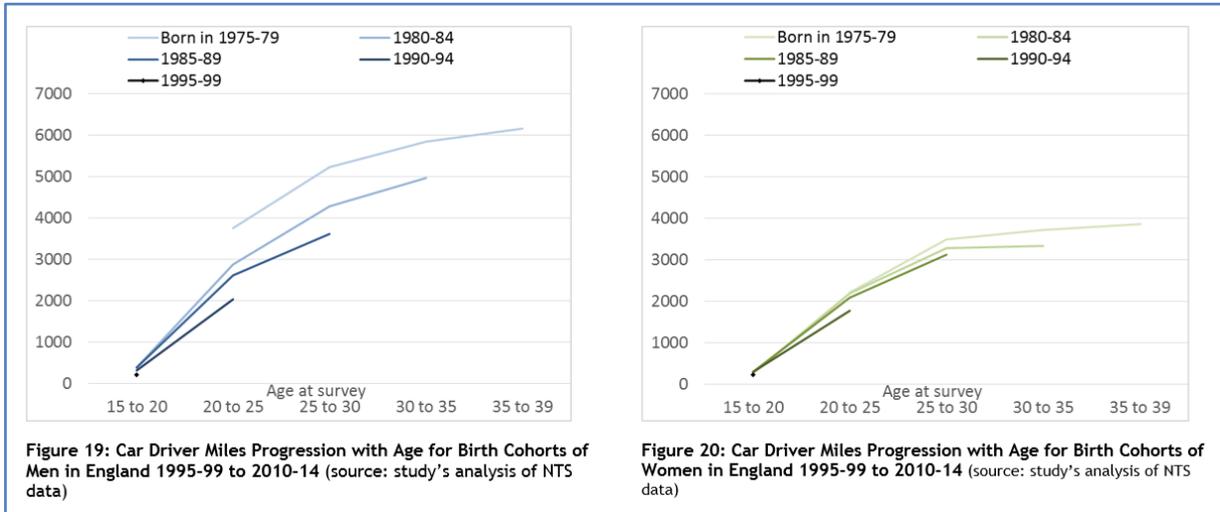


Figure 5 shows that the car driving progression has been falling significantly over time for men, but only marginally for women, and there is little difference in those below 30.

Figure 5: car driver miles by year of birth and age

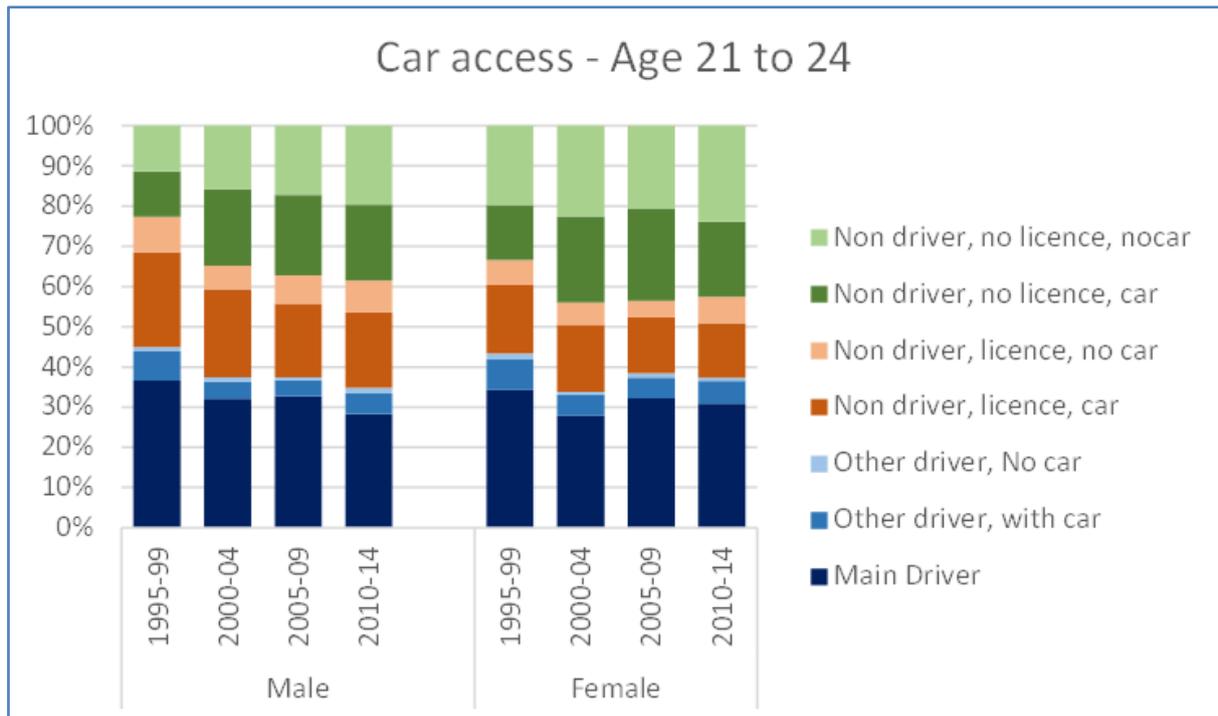


## Car access

Figure 6 shows that there has been a significant increase in young people living in households:

- with a car that they cannot drive themselves; or
- without a car.

Figure 6: access to car at age 21-24, 1995-99 to 2010-14



## Fewer trips overall

Between 1995-99 and 2010-14:

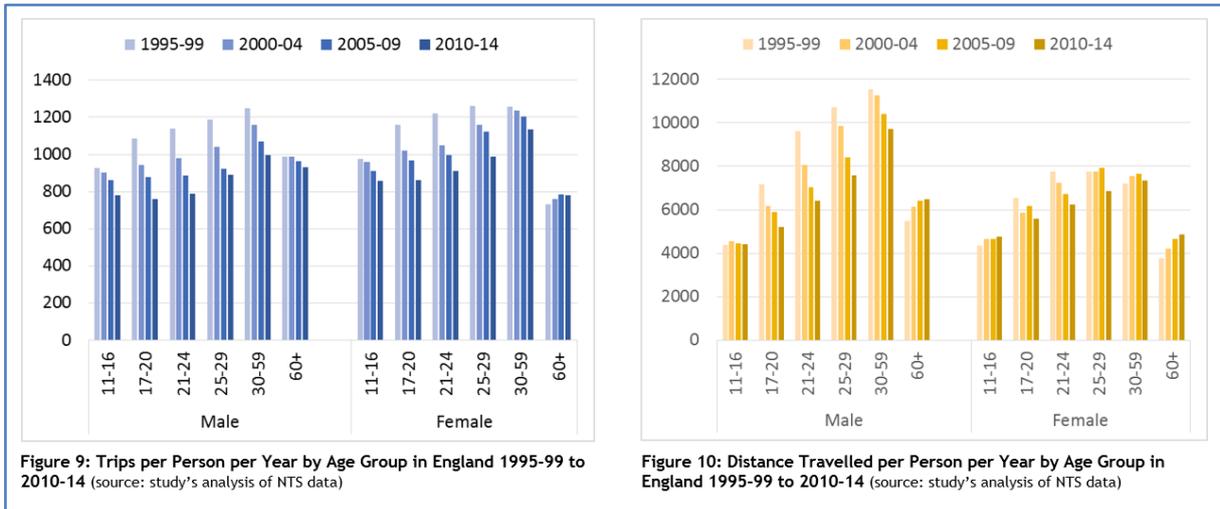
- Total trips per person fell by 28% for young men and 24% for young women.
- Public transport trips per person increased slightly.
- Walking trips per person fell.
- Cycling trips per person remained broadly constant.

The general trend since the early 1990s has been for each cohort of young people to own and use cars less than the preceding one, a very important effect. As individual young adults have moved into their thirties, the proportion with driving licences and the amount they drive have both increased, but not sufficiently that their car use has caught up with the growth in previous cohorts: it is more than a delay effect.

The growth in car use with age has slowed. Those who learn to drive later, drive less. However, this is not a new feature confined to the millennials or current economic conditions: the trend reversal began around 25 years ago, and was first noted by Barbara Noble, the Chief Statistician at the DfT in 2005.

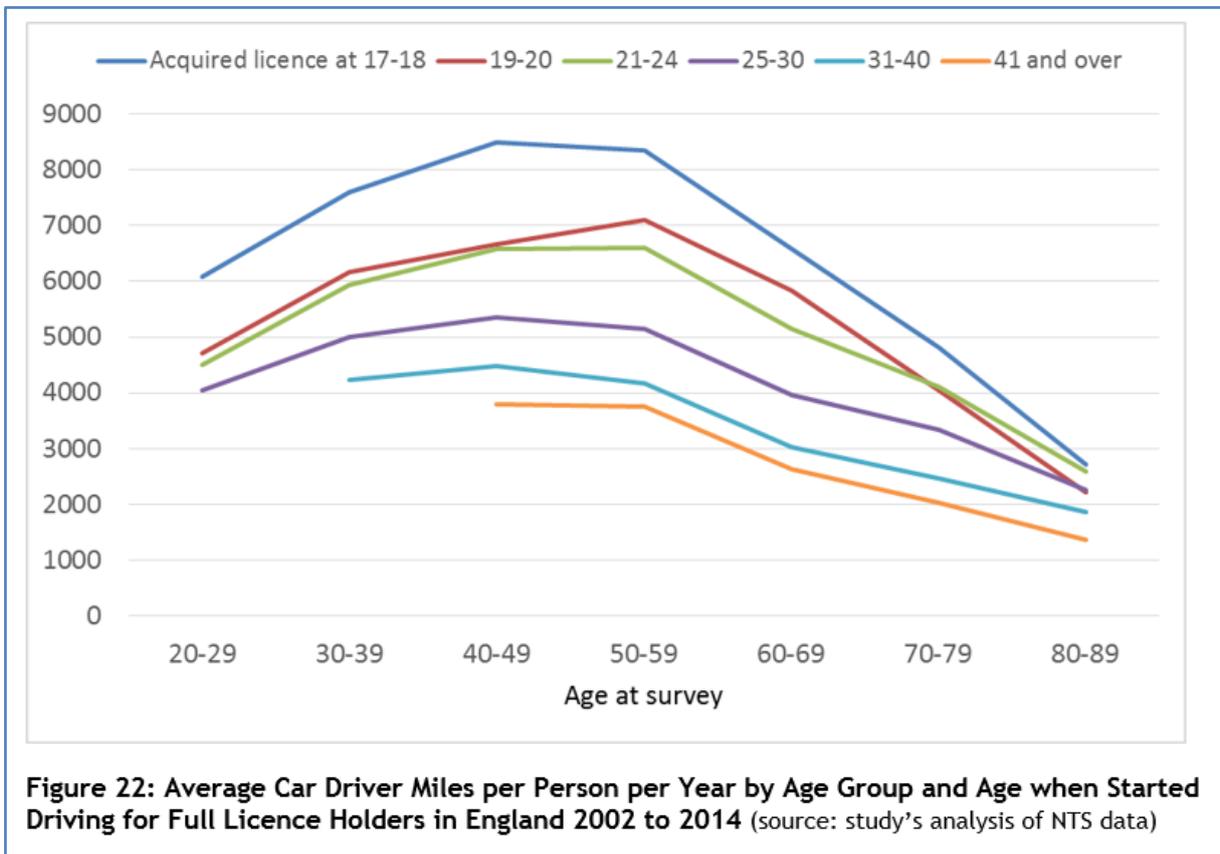
Her paper had no traction at the time, perhaps because it had been too early. The effect is not just confined to the new generation and goes beyond economic conditions.

*Figure 7: fall in total trips per person, 1995-99 to 2010-14*



Most of the increase in distance travelled is due to access to a car.

*Figure 8: car driver miles by driving licence acquisition and age*



**Figure 22: Average Car Driver Miles per Person per Year by Age Group and Age when Started Driving for Full Licence Holders in England 2002 to 2014** (source: study's analysis of NTS data)

## Summary of causes

Table 1 summarises factors which may affect licence acquisition and their relative importance. Note that in a study of this type the answers may depend on the questions asked.

*Table 1: factors affecting licence acquisition*

Category	Factor	Effect
Demographic situation	Postponing parenthood	Weak ↓
	Increasing cohabitation	Weak ↓
	Migration to the UK	Weak ↓
Living situation	Living with parents longer	
	Declining home ownership	Strong ↓
	Increasing urbanisation	Strong ↓
Socio-economic situation	Increasing higher education	Weak ↓
	Increasing women's employment (only until 2000)	Strong ↑ Neutral
	Increasing service sector work	Neutral
	Increasing low-waged, uncontracted work	Strong ↓
	Declining disposable income	Strong ↓
Information and communications technology (ICT)	Increasing ICT use	Weak ↓
	Using mobile devices to arrange everyday life	Uncertain or neutral
	Using ICT on public transport	
	Increasing gaming	
Values and attitudes	Extended youth	Strong ↓
	Rising pro-environment attitudes	Neutral
	Decline in car as status symbol	Weak ↓
Transport and mobility	Stricter driving licence regime	Weak ↓
	Increasing car insurance costs	Weak ↓
	Increasing spending on transport	Weak ↓
	Rise of shared mobility	Weak ↓

A higher proportion of young people are continuing into higher education, which is associated with different travel behaviour and re-urbanisation. There is less disposable income among the

young, owing to an increase of precarious jobs with lower pay, such as in the gig economy or self-employment.

This is combined with a delayed transition into “adulthood” and the conventional lifestyle, with later starting of families. There is less face-to-face interaction, with more time spent at home, although neither is decisive.

Car costs, especially insurance, are increasing, and technology is changing, although the effect of this is less clear. There has been an increase in mobile phone use, although this can have effects in both directions.

We cannot (yet) estimate the separate contribution of each factor as they are interactive and highly correlated.

### **Example: the effects of delayed parenthood**

Table 2 lists some of the evidence of effects of delayed parenthood on various aspects of travel behaviour.

*Table 2: evidence of the effects of delayed parenthood*

<b>Travel behaviour</b>	<b>Evidence of effects of parenthood</b>	<b>Effects of delayed parenthood</b>
Driving licences	Individuals with children are more likely to have a driving licence (Berrington & Mikolai, 2014)	Weak decrease in licence holding
Car access	More likely to acquire a car (Clark <i>et al</i> , 2016a)	Moderate decrease in car access
Mode use	Lower car use expected due to lower licence holding	Moderate decrease in car use
Car driving distance	Men with children drive more whereas women with children drive fewer miles (Berrington & Mikolai, 2014)	Unaffected in aggregate
Trip frequency	Women living with their own children spend less time travelling (SDA time use)	Weak increase in trip frequency

However, licence acquisition is also related to:

- transport with higher driving costs, particularly insurance;
- a higher cost of learning to drive; and
- more alternatives to driving in urban areas.

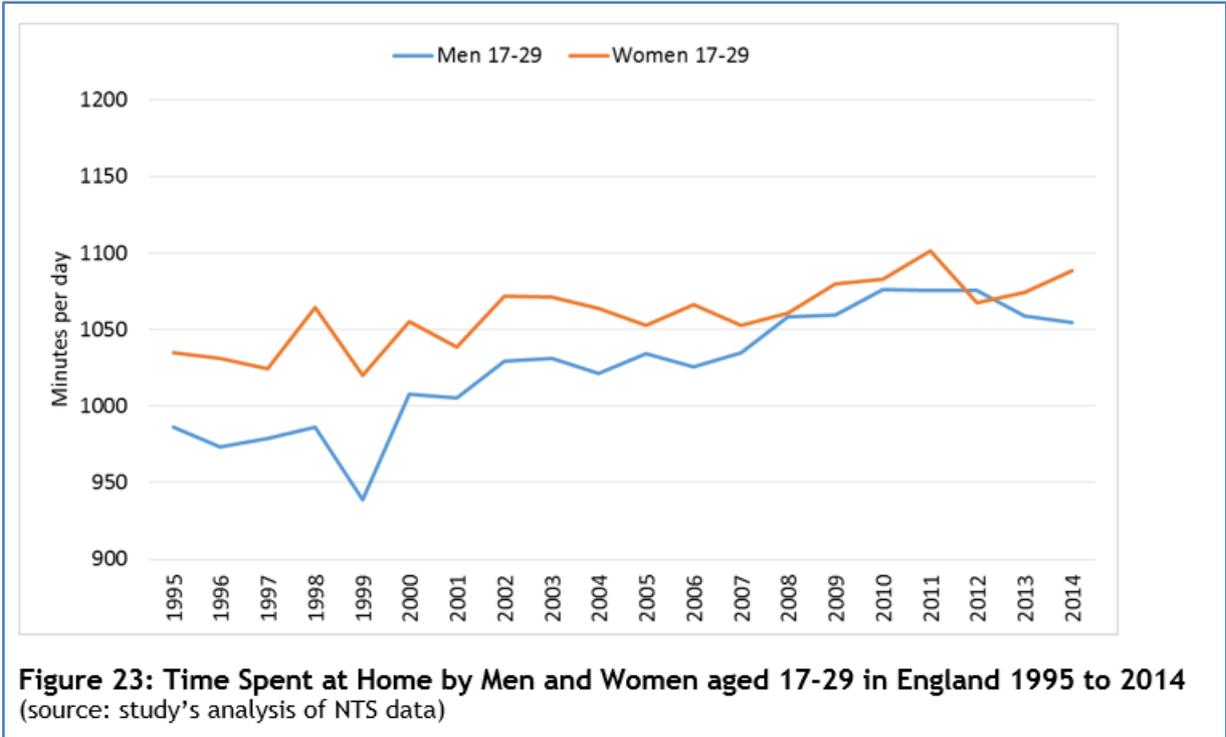
The effect is to reduced licence holding, car access, car use and car driver miles. However, the evidence for this is limited.

The literature shows a decrease in expenditure by the under-30s on vehicle purchase, and a trend increase in expenditure on transport services between 2005-06 and 2014. Costs dominate as the reason for not learning to drive, but interviews show that costs other than insurance are not well understood.

DfT has suggested that forecasts for the aggregate trend in vehicle miles in the UK would be explained well by GDP, fuel price and population, subject to having correct forecasts for those input variables. However, the age results suggest that such aggregate variables would not capture differences in specific segments, or the geographical differences correlated with them, or long term processes connected with the shift of choices as generations evolve.

Asking “Why don’t you drive?” implies that driving is the norm. However, National Travel Survey (NTS) data suggests that young people (especially men) are spending increasing amounts of time at home. (Only time spent at home was robust enough to measure using the NTS.)

Figure 9: time spent at home according to NTS, 1995-2014



## Implications

These changes have long term implications. The first generation affected are now in their 40s, so the changes in young people's travel builds up slowly, over a lifetime.

Even if (some of) the causes reverse direction, it does not necessarily mean that the growth patterns of the 1950s to 1970s will be restored, as habits are formed and some will have learned new patterns of mobility less dominated by the car. We may not have seen the full effects yet. There is no self-evident reason why some of the more important causes, such as higher education, marriage and children, re-urbanisation or the gig economy would reverse (or that it would be desirable to try to reverse them) although of course they could.

Age has never been an important forecasting variable, but perhaps it should be:

- It is likely that increased pressures on the elderly result in increased financial pressures on both the young and the old.
- A cross section showing what young and old do now does not show what the young will do as they get older.

We may need:

- to use different forms of data in forecasting models, notably to give explicit attention to age and aging and to the economic affects specific to different groups, rather than just considering aggregate income change;
- to adapt surveys and data for factors such as shared mobility;
- to examine each cohort's behaviour; and
- to examine different scenarios for the future.

## Discussion

**Dick Dunmore** (Steer Davies Gleave) noted that in many other countries the rich live in the city centre and the poor live in the suburbs: could the English cities now be reversing to converge on this pattern? What if those in the centre do not need a car and those in the suburbs cannot afford one? **Phil** replied that there was a lot of grey area in between. Density is decisive, and

we may see the growth of high density areas: as ever, land use planning is very important. **Gordon** agreed about higher densities, but many settlements are too small for them to be self-contained or to have good public transport, so the car remains the main means of travel. However, the Oxford to Cambridge will see growth along an arc, and transport links will affect policy. **Tom Worsley** asked if the existing stock of houses will prevent a change in land use. **Phil** did not believe that autonomous vehicles will affect public transport use in the short term.

**Tim Gent** (Atkins) commented that the peak car effect is now out of people's minds, and that traffic is growing again in line with GDP. The strong indicators of demand were location, the cost of motoring, and disposable income. The recovery of the economy is swamping aging effects. **Gordon** replied that travel per person is still stable regardless of GDP, and that there is the question of which generation is increasing travel, which is likely to be by women. There is no particular evidence that the young are becoming more likely to get a licence. **Phil** commented that young people's income may not track GDP, but the biggest problem is tracking change with the available data. We must base likely long-term changes in the future on those occurring in the past. John Tanner was the last person to get traffic forecasts correct.

**Stephen Bennett** (TEG Auditor) asked if the authors had examined regional trends. Gordon said that they had only compared urban and non-urban and dense and less dense. **Phil** noted that it used to be a case of "London and everywhere else", but that this is no longer true, and that the denser non-London areas are showing some similarity with London. No work was done on variations between regions.

**Jeremy Drew** (Independent Consultant) said that the speakers were inferring that the young were less likely to get licences later in life. What of other factors? **Phil** replied that they had empirically observed that those who learn to drive later drive less. He agreed that this did not necessarily indicate causality, and that there may be other factors such as where people live. **Gordon** said that we talk of formative years. **Phil** noted that there had been much research in other areas about habits but,

while marketing is all about maintaining habits, transport is about breaking habits.

**Gregory Marchant** (TEG) had observed that young people at his local gym, at least those doing apprenticeships, see a need to learn to drive as part of the need to do the job, and not in terms of recreation. He also thought that walking and cycling might be increasing. The peak use of cycles in Brighton was on Friday and Saturday nights, which was having a devastating effect on night bus use. **Gordon** said that people aged 17 and 18 in full time work were the one group for whom an increase in licence-holding had been observed: this was consistent with the observation about those in apprenticeships. The number of longer walks was steady, but the number of shorter walks was falling, although this may be due to problems in recording data and in linking trips.

**Dan Phillips** (Arup) wondered what effect changes in employment patterns are having. There are now more jobs in the city centre, and people can do more work with a mobile on public transport. **Phil** replied that the issue of trades and this example are frequently mentioned, but that neither have been the subject of focused research.

Report by Peter Gordon



## TEG Committee 2018-2019

At the TEG AGM 28 March 2018, a new Committee was elected as follows:

- Dick Dunmore  
[dick\\_dunmore@hotmail.com](mailto:dick_dunmore@hotmail.com)
- Margot Finley  
[Margot.Finley@arup.com](mailto:Margot.Finley@arup.com)
- Peter Gordon  
[petersgordon@blueyonder.co.uk](mailto:petersgordon@blueyonder.co.uk)
- Gregory Marchant  
[gregorymarchant.teg@btinternet.com](mailto:gregorymarchant.teg@btinternet.com)
- Carol Smales  
[SmalesCa@tfl.gov.uk](mailto:SmalesCa@tfl.gov.uk)
- Gerard Whelan  
[gerard.whelan@kpmg.co.uk](mailto:gerard.whelan@kpmg.co.uk)
- Tom Worsley  
[tomworsleyx@aol.com](mailto:tomworsleyx@aol.com)

Subsequently, Tim Gent expressed an interest in joining the Committee.

The new Committee will meet on 23 April 2018 and allocate members to roles.

Details will appear on the TEG website at  
<http://www.transecongroup.org/committee.htm>



The Transport Economists' Group, formed in 1973, provides a forum for people involved in transport economics to meet regularly and discuss matters of mutual interest. Membership is open to economists working in transport and others whose work is connected with transport economics.

The aim of the Group is to improve the quality of transport management, planning and decision-making by promoting lectures, discussions and publications related to the economics of transport and of the environment within which the industry functions.

Meetings, held at Arup's Central London HQ at 13 Fitzroy Street from September to June (except December), consist of short papers presented by speakers, drawn from both within the Group's membership and elsewhere, followed by discussion.

The Group's Journal, "The Transport Economist", is published three times a year reporting on meetings and other activities of the Group. It reviews recent publications of interest and contains papers or short articles from members. The Editor welcomes contributions for inclusion in the journal, and can be contacted at [petersgordon@blueyonder.co.uk](mailto:petersgordon@blueyonder.co.uk).

The current membership of over 150 covers a wide range of transport modes and types of organisation. Members are drawn from transport operators, consultants, universities, local and central government and manufacturing industry. All members are provided with a full membership list, updated annually, which serves as a useful source of contacts within the profession. Applications from people in all sectors are welcome.

Applications for membership should be made on a form which can be downloaded from the Group's website at [www.transecongroup.org](http://www.transecongroup.org).

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TEG Committee 2018-2019

Details of meetings are provided on our website at

<http://www.transecongroup.org/meetings.htm>

