Nudging Travellers to Make Better Choices

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1. Introduction

Much of the behavioural assumptions of travel choice models can generally be traced back to neoclassical economics and the paradigm of rational man. For example, travellers’ responses to risk and uncertainty associated with journey attributes are commonly modelled by normative behaviour models developed by Von-Neumann and Morgenstern (1944) and extended by Savage (1954). The individual traveller is commonly seen as a rational human (‘homo economicus’) who, through choice-making, tries to do her best in maximizing her utilities and minimizing the risk/uncertainties involved in her choices. However, insights and theoretical understandings from cognitive psychology and behavioural economics are now emerging through the literature to paint a more complex picture of decision making processes. Empirical studies provide evidence that in real life the behaviour of travellers is typified by limited cognitive resources and bounded rationality (‘homo psychologicus’), and it has been argued that normative behaviour models provide only limited explanation to travellers’ behaviour (for reviews, see Gärling, 1998; McFadden, 1999). Recent evidence show that even when provided with explicit information on their travel choices, travellers turn out to interpret and value this information in a way that systematically violates the assumptions of rational behaviour (Avineri and Prashker, 2003, 2004, 2006). Some of these deviations from the predictions of rational models are systematic, consistent robust and largely predicted, and therefore can not be simply described by a “taste variation” component, and can not be cancelled in the aggregated level. “Predicted irrationality” (a term phrased by Ariely, 2008) can be incorporated in the models of travel choice, to improve their predictive value.

Ben-Akiva and Lerman (1985, p.32) described the theory of choice as a collection of procedures that define the following elements: (i) decision maker, (ii) alternatives, (iii) attributes of alternatives, and (iv) decision rule. The attractiveness of an alternative in the mind of a traveller is described as a vector of the attributes values (that is later reduced to a scalar, “utility”, as an index of the attractiveness of an alternative). If indeed travellers behave as rational human beings, and specifically if travellers’ preferences exhibit consistency and transitivity (ibid., p. 38), than the way alternatives are presented to the decision maker should not matter much. However, as argued in some of the studies reviewed in this paper, it is not just information content that may be influential; travellers may be also affected by the manner in which information on the alternatives and their attributes is presented – the number of alternatives, the inclusion of inferior choices in the choice set, the wording (or ‘framing’) of the information, the order in which information is presented, the choice
of measurement units, and other characteristics of the choice environment are relevant and important factors influencing choice and; therefore the context in which information is presented might be considered as a ‘fifth element’ that takes part in the definition of the theory of choice making.

One of the goals of transport researchers exploring the systematic biases and errors in travellers’ choices is to contribute to the ever-going improvement of travel choice models, and to the development of alternative models that might provide better explanation of travel choice and better predictive values. Another, and perhaps more ambitious goal would be to explore how this understanding of travel choice could be applied in measures to influence the choices made by travellers – in order to help them to make better decisions for themselves, to improve the performance of the overall transport system, and to reduce some of the external costs (economic, environmental, or social) associated with choices made by individual travellers. This approach is very much in-line with Thaler and Sunstein’s argument in favour of the “libertarian paternalism” approach, as a way to help people to make the ‘right’ choices without restricting their freedom of choice. In their recent book (“Nudge: Improving Decisions about Health, Wealth, and Happiness”, Thaler and Sunstein, 2008) they suggest the incorporation of small features in the environment to attract people’s attention and highlight the ‘right’ choices for them and alter their behaviour. The art and science of ‘nudges’ could inspire the further design of information provided to travellers, to help them make better choices. This paper reviews some of the relevant literature and brings few examples that illustrate the use nudges and the potential of “choice architecture” in a travel behaviour context.

2. Making Choices: The Libertarian Approach

Folklore suggests that at the end of the 17th century, Jean-Baptiste Colbert, controller general of finance under King Louis XIV of France, asked a local industry man how the government might help his and fellow industrialists with their business. The answer he got was “laissez faire” which literally means “allow to do” or “leave us alone”; government intervention in the market is not required – it might even be harmful. This term is often used to refer to a range of economic policies of allowing events to take their own course, suggesting that forces of the economy should be left alone to behave as per their own economic laws. In another usage of the term it advocates the minimization (or elimination) of government intervention in most or all aspects of society (and not just in economics).

The libertarian approach has a strong relation to the “homo economicus” assumption. It is generally assumed that humans are rational and can be approximated to act according to their interests - in a way that maximises their opportunities given their preferences (which are generally exogenously determined). People, through the workings of the market, know best – and therefore they should be “free to choose” (Friedman and Friedman, 1980, cited in Thaler and Sunstein, 2008).
3. How to Internalize the Externalities? The Problem of Congestion and the Classic Economic Solutions to Influence Choice Making

Transport systems and their performance, arising from the travel choices made by individuals, have always fascinated economists. They make excellent case studies to illustrate issues of external costs and benefits, market failures, social dilemmas and the “tragedy of the commons”, and stimulate the debate on the need for government intervention. An on-going debate that has recently attracted a lot of attention from researchers, planners, politicians and the general public is related to the problem of congestion and the measures to reduce it.

In congested traffic networks the travel time on each road is a function of supply and demand; the supply is represented by the capacity of the road (the maximum volume of traffic it could possibly carry) and the demand is represented by the actual traffic volume (the number of vehicles on the road). Since travel choices made by individual users have a direct effect on the performance of the overall traffic network, understanding how drivers make choices is an area of great interest not just for economists but also for transport practitioners involved in the planning, design and management of traffic networks.

Since the closure of the last turnpike toll in 1895, roads in Britain have (until recently) all been free at the point of use, although tolls are still levied on few specific British roads and road bridges. The provision of roads and the management of traffic on roads are seen by many as one of the few remaining market-free sectors of the economy.

While congestion is not a new concept, its negative effects are becoming stronger and stronger, and road users in many cities and countries experience gridlock on a scale that has never been experienced before. Congestion has several effects on travellers, businesses, agencies and cities. One significant element is the value of the additional time and wasted fuel. While the true costs of congestion are largely unknown, there is a consensus that they generate a huge cost to the national economy. For example, according to the CBI (Confederation of British Industry), congestion is estimated to cost the UK economy as much as £20 billion per year in resources and lost time1.

A classic libertarian approach to the problem of congestion might be “do nothing” and let the free market to regulate traffic in a very natural way. It may be argued that when traffic congestion worsens, people will be deterred from driving, or from using specific roads in specific times, and will find alternatives that minimize their travel times and costs. But even classical libertarians2 are aware of flaws in this approach, caused by “market failures”. A number of imperfections prevent markets from reaching the optimal allocation of resources in a way that maximize benefits for society. One of the main arguments in favour of government interventions is the failure of individuals (consumers or producers) to consider the full social costs and benefits associated with their choices. Generally, when travelling, we only consider our private marginal costs of making a particular journey – that is, the costs (financial, 

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1 The origin of the figure for the current cost of congestion in the UK is unclear. It is though to be based on the figure of £15 billion derived by CBI in 1989 (Scottish Government, 2006).

2 For example, Adam Smith saw some role for government in economic life. He believed that the government should provide public works, such as public roads, canals and bridges that, he assumed, would not be worthwhile for individuals to provide (Henderson, 2007). He favoured that these goods should be paid proportionally to their consumption.
time, convenience, etc.) incurred by the individual to make that additional journey. Other costs to society (such as pollution, global warming, noise, accidents risk), as well as the congestion opposed on other road users, are largely ignored by the individual traveller in her decision making process that leads to route, mode, departure time or other travel choices. Braess (1968), Arnott and Small (1994) and others have shown paradoxical results have been known to be present in transport research, resulting from selfish behaviour of network users who ignore the negative externalities they impose on others.

The large cost of congestion, coupled with environmental concerns about greenhouse emissions generated by cars, have stimulated debate about how to better manage traffic on the road network. Governments are looking for ways to reduce congestion through demand management measures. Some of the measures explored and applied in tackling congestion are based on restricting the demand to travel that leads to congestion; physical restrictions such as pedestrianization of roads used for car traffic, reducing capacity of the road by having it narrowed it or converting lanes to bus lanes, traffic calming and other restrictions on the movement of personal and freight transport on specific roads and/or specific times have been applied.

Another solution to this market failure is to internalise some or all of these external costs of travel so that road users can make more informed decisions, as they are better able to judge the scale of costs that will incurred, in relation to their private benefits. A range of economic interventions generally exploit elasticity relationships to achieve politically or economically justified objectives. The key to the success and effectiveness of an intervention would be, according to neoclassical economic theory, to “get the prices right”. Governments can, via a mixture of taxes and subsidies, correct perceived market failures — or "internalize the externalities". This economic concept is related to road-user charging, a concept highly favoured by many policy makers due to its economic and political rational. From early contributors, such as Pigou (1920), to Vickrey (1969) to more recent works such as Daganzo (1985) and Arnott et al. (1993) different approaches were suggested to how the values of policy variables, such as taxes on fuel, public transport subsidies or road pricing charges should be set in order to achieve better equilibrium on the traffic network. While the approaches are different from each other, what they generally share is a strong intuition that responses to such values are explained and described by the normative assumptions of rational theory.

Proposals to introduce charges for road usage have been mooted since the 1960 (Smeed, 1964). Despite strong arguments in favour, it has remained politically controversial, and only in the past decade have concrete proposals put forward and some schemes put in operation, such as Durham and London congestion charging schemes.

When “getting the prices right” might not be enough? In the next two sections we bring two main arguments in favour of measures based on Thaler and Sunstein’s (2003) libertarian paternalism. First, the first argument is mainly in favour of the ‘paternalistic’ part in it: due to travellers’ bounded rationality and slow learning processes an economic intervention might not achieve it goals, or might not achieve it fast enough. The second argument is in favour of the ‘libertarian’ aspect with it: economic interventions are largely seen by the public as a restriction of their freedom of choice and therefore schemes like road pricing attract resistance and low public and political acceptability.
4. Bounded Rationality and Slow Learning Processes

Our expectations with respects to the effects of information provision on travel choices made by road users are largely based on rational man theory and therefore are mildly optimistic. People rationality was found to be restricted by their cognitive limitations (Simon, 1957). Specifically, travellers are not necessarily utility maximizers, risk averse, or rational learners. For example, Avineri and Prashker (2005) studied the route-choice decisions of 70 people under different scenarios of journey time variability. People were found to base their decisions on imperfect knowledge gained from personal experience. A completely rational person will trial alternative routes, say, ten times. But, in actual fact, people's rationality is bounded - they base their decision on route (or mode) choice from a much smaller sample. They illustrate how travel choice predictions based on rational behaviour, ignoring the behavioural aspects of travellers' decision-making, can be not only inaccurate but, in some situations, completely wrong.

Of one the concepts of transport modelling that has been much criticized by many is traffic equilibrium as a state to which aggregated travel choices will be converged to (see, for example, Goodwin, 1998). One critique is that even when such equilibrium is theoretically possible (which is by itself doubtful), the process that leads to it is extremely slow, because of the cognitive limitations in decision makers’ learning processes. Moreover, the equilibrium might never be achieved because of the slow learning speed. This general phenomenon has been largely observed in repeated choice tasks in which an uncertain payoff scheme is involved. The (in)convergence of strategies played by Bayesian learning agents is discussed in the game theory literature (for example, Jordan, 1995; Lehrer and Smorodinsky, 1997) and the behavioural science literature (for example, Myers, 1976; Herrnstein, 1997).

Exploring travellers’ learning and choice making, Avineri and Prashker (2006) made the observation that people’s perception of the travel time distribution is biased. Typically, people use sample data to infer population characteristics. Since sample expectation and sample variance are biased estimates of population expectation and population variance, to the extent that people use sample data in their perception of population distribution, their perception is different from the true values.

A common belief about providing travellers with travel time information is that it will increase the rate of utility maximization. However, simply providing travellers with information does not guarantee that they will learn faster to maximize their utilities. In some situations (as observed in laboratory experiments), the propensity to choose the route with the less expected travel time may be decreased (instead of increased) when information about travel times is provided.

Exploring the effect of information, Avineri and Prashker (2006) report on the findings an experiment in which two groups of respondents were introduced to the same two-link network problem, but provided with different instructions (see Table 1). The only difference between Scenario’s 2 instructions and Scenario’s 1 instructions is the additional static information that was provided to Scenario’s 2 subjects at the beginning of the experiment, “Route A’s average travel time is 33 min; Route B’s average travel time is 30 min.” Figure 1 presents the experimental results, described as the proportion of route A choices at both scenarios. It looks like it took long time to the respondents to learn that route B is slower than route A, and even after 100 trials the proportion of route A choices is relatively high (30%). However, providing
respondents with information on the average travel times on each of the routes did not speed up the process — on the contrary, it looks like their choice became more random, with both routes have the same choice proportions (see Figure 1).

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<tr>
<th>Experiment instructions — Scenario 1</th>
<th>Experiment instructions — Scenario 2</th>
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<td>You are about to participate in a route–choice decision making experiment. There are two alternative routes, A and B, to get from your work to your home. You have no information about the travel time, the distance or the travel speed on either of the routes. During the experiment, you will be asked to perform 100 daily trips. Every time you will be asked to choose one of the routes (A or B) in order to get from work to home. After a choice is made, you will be informed how long your trip was (in minutes).</td>
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Table 1. Experiment Instructions. From Avineri & Prashker (2006).

![Figure 1. Route Choice with Static Information (Laboratory Experiment Results): Proportion of route A choices, presented in blocks of 20 time periods each, for both scenarios (with and without information).](From Avineri & Prashker, 2006)

Travellers’ slow learning, mainly explained by cognitive limitations of their learning process, is only one of the reasons why “getting the prices right” might not guarantee that a new and efficient equilibrium will be achieved, or that it will be achieved in a reasonable time. When large schemes to change (travel) behaviour are introduced, the speed of change is a critical factor in their operational, economic and political success. This is one of the reasons why policy makers should be interested, in addition to economic measures, in a set of ‘soft’ paternalism tools to raise the awareness of
individuals to the new “set of rules”, to break habitual behaviour, and to nudge individuals to choose what might be the best choices for themselves. It might happen anyhow (although not guaranteed), but it might also take too long.

5. Economic Interventions are seen as Restriction of Choice

Government interventions in the market is to “get the prices right” correct market failure (such as road pricing) are advocated by many economists and policy makers, and are largely favoured for their economic rational and sound behavioural assumptions. It was found that prices have an important influence on demand and therefore schemes based on changes to the price structure, such as road pricing, are considered to be effective in changing travel behaviour. But the large effect price has on the demand might be a significant explanation why such interventions might find large-scale resistance from the public and rather negative attitudes towards them.

Exploring attitudes towards road pricing and other demand management measures, Musselwhite and Lyons (2009) found that people would prefer to have their journey and freedom restricted by congestion than by a demand management principle. Thy report of a feeling among participants of interviews and focus groups of being ‘all in it together’ where no one person had caused the limit on freedom and everyone suffered; demand management was seen by them as interference from government in which different people suffered a loss in freedom to different degrees and unfairness of this was highlighted. Notwithstanding the degree of acceptance of a congestion problem needing to be solved, there was the feeling that people should have the freedom to drive on the roads they wanted to, when they wanted to. Emotive responses highlighted the importance of freedom to travel and participants cited rights, freedom and civil liberties.

6. The Relevance of Libertarian Paternalism to Changing Travel Behaviour

The argument brought in section 4 on travellers’ bounded rationality, coupled with the argument made in section 5 on the importance of “freedom of choice”, illustrate how changing travel behaviour is not a simple matter that can be simply solved by just “getting the prices right”. This is where libertarian paternalism can come to the rescue. This means there should always be freedom of (travel) choice but there should also be nudges in the direction of doing the right thing, “correcting” the unintended cognitive errors and biases we have in our decision making processes. The following sections illustrate several ‘nudges’ to change travel behaviour.

7. The Power of Defaults

A default is the option that individuals receive if they do not explicitly request something different. Defaults have strong influence on behaviour – and they tend to become a habit. For example, where money is transferred into a voluntary pension scheme by default, fewer people will choose to opt out, and the pension contributions
will be much higher than when people have to opt in (Thaler and Sunstein, 2003, 2008). “Green defaults” where found to be an effective way of presenting information in order to encourage pro-environmental behaviour (see, for example, Pichert et al., 2007).

Default options for individuals could be set to promote a relevant “desired” behaviour. One application might be in the design of journey planners. Some journey planners provide travel information on more than one mode of transport (see, for example, figure 2). The designers of a journey planner could choose to provide travellers by default with information about car transport, even for if they are planning to use public transport – this default might increase the attractiveness of car transport. On the other hand, setting public transport as the default mode could nudge people to consider this as the first option. No matter how defaults are set, it is be important not to restrict the choices available for the traveller – making information on all alternatives available.

Figure 2. A Screen of “Transport Direct” (www.transportdirect.info)

8. Framing and “Loss Aversion”

People tend to feel and behave differently when information about their choices is presented (or ‘framed’) as gains or losses. The following illustrates three possible ways of presenting the same information on two commuting choices.
Figure 3. An Example of Framing.

Under the rational choice model, the format of the information should not matter. However, since people are more sensitive to losses, they might find the cycling option specifically attractive in the third alternative. This is a rather simple example of how the designers of travel information systems can help people to make more sustainable travel choices simply by choosing a specific format to present information about time (and other attributes) of the alternative choices.

“Loss aversion” is a main feature in Tversky and Kahneman’s (1979, 1992) “Prospect Theory”. Prospect Theory’s “value function” (see Figure 4) presents how outcomes are perceived as ‘gains’ and ‘losses’ against some ‘reference point’ by a decision maker. Travellers’ pattern of risk attitudes revealed in their route choices can be described as risk aversion when the outcomes of alternative choices are framed as gains, and risk seeking when outcomes are framed as losses. The value function is assumed to be concave in gains and convex in losses, a pattern that is consistent with the experimental evidence on domain-sensitive risk preferences. To capture loss aversion, the value function is assumed to have a kink at the reference point, with a sharp slope ratio.

The effect of framing and loss aversion are of specific interest and relevance the modelling of choice under risk and uncertainty. Avineri and Prashker (2004) conducted route-choice stated-preferences experiment to study the effect of framing and loss aversion. A questionnaire, inspired by Kahneman's and Tversky's (1979) experiments, presented simple route-choice problems. Evidence was found of two known violations of rational choice theory. The first one is known as the Allais Paradox (or “certainty effect”), which is demonstrated by a situation were the extreme underweighting of high probabilities, which fall short of certainties, makes (low) certain travel times outcomes to be very attractive. Evidence of another violation of expected utility theory, inflating of small probabilities, was also shown, based on a set of stated-preferences route-choice problems. Their experimental results were explained by prospect theory. Also demonstrated by Avineri and Prashker (2004) was how the choice preferences exhibited in response to two route choice problems, equivalent by their mathematical interpretation of the choice alternatives, are different due to different framing of the outcomes.
9. The Effect of the Value Reference Point on Traffic Equilibrium

The effect of framing and loss aversion are of specific interest and relevance the modelling as discussed in the previous section, travellers tend to behave differently when travel time associated with route choices are presented as gains or as losses. Imagine two passengers, A and B, who are used to have a commute time of about 20 minutes. Travelling to work today, A has experienced a 30 minutes journey time, while B commute time was only 10 minutes. A would consider his experience as a ‘loss’ while B might see herself as a ‘winner’. Winning and loosing in this context is measured against some reference point, in this example – a commute time of 20 minutes. Moreover, A will lose more satisfaction than B will gain satisfaction from a 10 minutes change.

Incorporating loss aversion into the modelling of transport networks is illustrated by a simple route choice problem (full formulation and analysis of the problem are given in Avineri (2006)). Travel time on each route is a function of the traffic volume on the route, the route capacity, and a random component of travel time that was not related to congestion. Carrying the same traffic volume, route A would perform better than route B and on average will have the lower travel time. On the other hand, the different random time components make route A to be the ‘riskier’ one. The route choices of 200 drivers who travel daily on this two-link network were simulated on the network, assuming all drivers exhibit loss aversion in their choice behavior, against a certain reference point. Making use of the functional forms and parameter values estimated by Tversky and Kahneman in the development of Prospect Theory, Wardrop's principle of user equilibrium was extended to capture loss aversion.

In a “traditional” traffic equilibrium 137 of the 200 drivers choose route A, and 63 choose route B, with a travel time of 24 minutes on each route. The predictions of a
traffic equilibrium model based on loss aversion were found to be very sensitive to the value of the reference point; for low values of the reference point route A looks more attractive for drivers than it would be for higher values of reference point, as can be seen from figure 5.

In a “traditional” traffic equilibrium, a driver who has a reference point of 15 will consider the journey time on either route (24 minutes) to be a loss, and therefore she will seek more risk; this makes route A, the more risky route, to become more attractive for such a driver. On the other hand, for a driver who has a reference point of 30 minutes the traditional equilibrium travel times will be perceived as “gains”, and therefore she will tend to reduce the risks; this makes route B, the more risky route, to become more attractive for such a driver.

This sensitivity of the traffic equilibrium to the value of the reference point, and the concept of loss aversion, may be relevant not only to transport modellers (who would like to improve the predictive value of their models) but also to network operators and policy makers. The last ones are interested in finding ways to influencing travel demand in order to improve traffic flow and reduce congestion. Economic interventions, such as road pricing, suffer from low support from the public. The above example illustrate the potential of a more libertarian approach; setting a reference value to distinguish between ‘losses’ and ‘gains’ in journey times might be used as a kind of a ‘nudge’ to influence route choice and, when appropriately applied, lead to a better performance of the traffic network – without restricting drivers’ choices.
10. Salience

A specific challenge ATIS (Advanced Travel Information Systems) designers are faced with is how to provide travellers with information on the environmental costs of their journeys. A growing number of travellers are already aware of and have concerns about the greenhouse emissions they generate. When informed about environmental impacts, they might make sustainable choices. However, many of the negative impacts of our travel choices are not salient. For example, it is difficult to the driver to easily imagine the air pollution and climate change caused by carbon emissions. Carbon emissions are invisible to travellers; it is therefore difficult for them to associate their travel behaviour with environmental costs. Without feedback, a behavioural change is less likely. Providing drivers with “real-time” information on their carbon emissions might make them ‘visible’, and could make it easier for them to do the right thing. Specifically generating an annoying effect to accompany overproduction of carbon effective could be an effective nudge. A similar idea has been applied following the 1937 explosion of the New London School at Texas because of a gas leak that was not noticed; since than odorants are added to natural gas which is naturally colourless and odourless.

Thaler & Sunstein (2008, p.193-194) suggested the use of ‘environmental nudges’ to reduce energy consumption. They cite Thompson (2007) who explored Southern California Edison efforts to get their customers to conserve energy. Early attempts to notify people of their energy use with e-mails and text messages did no good. What worked was to give people something called an “Ambient Orb”, a little ball that changes its colour according to the consumption level. It is reported than in a period of weeks, users of the orb reduced their energy consumption during peak times by 40 percent.

A recent research (Toledo et al., 2008) reports on the effect of in-vehicle data recorders on drivers’ behaviour; this on-board technology collect and record information on the movement, control and performance of the vehicle. It was found that drivers, through the provision of daily feedback on their performance, tend to improve their safety behaviour. Using the same technology to provide drivers with environmental costs, against some targets or against previous performance could provide them with a psychological incentive to change their behaviour.

11. Designing ‘Social Nudges’

Many studies in social psychology report that the presence of other people leads to change their individual behaviour and enhances individual’s performance on simple tasks. People do many things by observing others and copying. Moreover, people are encouraged to continue to do things when they feel other people approve of their behaviour.

Social Learning, which can be defined as a process of learning by observing the behaviour of others, was found to be influential and important (e.g. Pingle, 1995; Offerman and Sonnemans, 1998; Kameda and Nakanishi, 2002) although hardly explored in travel behaviour context (Sunitiyoso et al., 2009). In a laboratory experiment Sunitiyoso et al. (2009) studied the effect of social information on travel
choices. In the experiment, participants face a situation of whether or not to contribute to an employer-based demand management initiative to reduce employees’ car-use. Interaction between travellers is mediated by the server/experimenter which provides participants with two schemes of social information about other participants’ behaviour. It was found that giving participants access to social information about others’ behaviours influence their behaviour, and could increase the level of contribution.

12. Choice Architecture in the Design of Bus Timetables

One of the important factors relevant to the travel choices made by public transport users is the waiting time at a bus stop or terminal, which passengers generally desire to minimise. The mean waiting time for a bus service, \( E(W) \), is

\[
E(W) = \frac{E(H)}{2} \left[ 1 + \frac{\text{Var}H}{E^2(H)} \right]
\]

where \( E(H) \) is the mean headway and \( \text{Var}H \) is the variance of buses’ headway (Holroyd and Scraggs, 1966). For example, if buses arrive at a bus stop on random times which form a Poisson process with frequency of 6 busses per hour, the value of the expected waiting time would be 10 minutes – twice of the waiting time in a deterministic situation with the same intensity. Passengers, provided with information on bus frequencies, might tend to develop over-optimistic expectations about their predicted waiting time. This so-called “waiting time paradox” arises because the time interval observed by a passenger is effectively “point sampled” and is length-weighted with respect to the “typical” time interval. This is probably the most known situation of size-biased (or length-based) sampling.

Avineri (2004) analysed the responses of subjects to two different formats of timetables: one was schedule-based and the other headway-based, both providing the information on the same service. As expected, providing passengers with information about buses’ headways lead to misinterpretation of such information and affect the passengers’ reference point, and through gain-loss perceptions influence their choice behaviour. The study provides recommendations on the design of public transportation information systems (and generally suggests avoiding the headway-based bus timetables that might lead to the experience of loss, against an optimistic waiting time expectations). The choice of presenting information on a bus timetable in one format or another is another example of the use of choice architecture and nudges.


Another application area of choice architecture is in the design of questions included in referendum polls. In some situations, the general public is invited to provide their views and opinion on important matters, such as large transport schemes. There is a variety of tools to have the public involved, from consultations and public hearing to referendum polls. In referendums, the participant is usually required to check a “yes”
or a “no” box to indicate whether or not she supports the scheme. There are many ways to influence the choice made by the participants; nudges could be based on the use of defaults, the manipulation of reference point, the framing of loss aversion or social norms.

The wording of the referendum question could be a way to influence the distribution of responses. A referendum to determine the future of Greater Manchester’s £3.2bn transport investment package and road pricing scheme (TIF) was recently held. A ‘yes’ vote would secure the funds for improving public transport across Greater Manchester. How crucial the wording of the GM TIF proposal referendum question could be to the result was explored in opinion polling. When the question was phrased in a positive tone i.e. ‘whether the respondents thought that the councils should accept the Government’s offer’ 53% of the sample supported the city region’s TIF proposals. When the question was rephrased to ‘to what extent do you support this offer’ the support fell to 41%. Businesses seem to be less supportive of the plans. The percentages of support for the two questions set respectively were 42% and 30% (Local Transport Today, 5th to 18th Sept. 2008).

Another question, recently studied by Rose and Hess (2009) (although in the context of the design of stated preferences surveys rather than referendum polls) is the effect a ‘status quo’ (or ‘opt out’) alternative has. This has been widely debated in many discipline areas (for a review, see Rose and Hess, 2009), but appears to have been largely ignored within the transport literature.

In the design of referendum polls there might be a concern of becoming “over paternalistic” – ideally we wouldn’t like it to be an honest and true way of recording public opinions and attitudes.

14. Summary and Conclusions

Much of literature about modelling travellers’ responses to information on the attributes of their travel alternatives takes a rather normative approach, i.e. it is concerned with the question “How should rational travellers behave in response to information?” Behavioural assumptions of transport models can generally be traced back to neoclassic economics, assuming individual travellers behave as rational economic human beings who try to do their best in maximizing their utilities. However, much of the predictions of these models are in conflict with the findings of alternative and more descriptive models of travel choice, inspired by works of cognitive psychologists and behavioural economists, whose modelling approach is more concerned with the question “How do travellers behave in response to network uncertainties?” Often, the behavioural assumptions on travellers’ perception of reliability, and travellers’ responses to risk and uncertainty are made without reference to existing theories in the behavioural sciences. It may be required to relax some of the assumptions of rationality and produce a series of different prescriptions or predictions about travel behaviour. We therefore see the context in which information is presented as a relevant and important element that should take part in the definition of the theory of choice making, together with (and sometimes with some strong relations to) the other known elements (decision maker, alternatives, attributes of alternatives, and decision rule; Akiva and Lerman, 1985, p.32).
Although this paper mainly addresses researchers and developers of travel behaviour models, it carries a strong message to practitioners and policy makers as well. Models of bounded rationality can be applied not only to the prediction of travellers’ choices, but also as a toolbox to develop measures of behavioural change, as a supplement to a main policy which its main measure is to improve the transport system or to set a new price structure that fairly represents the externalities in the transport system.

A behavioural change policy that is merely based on “getting the prices right” might suffer from two main limitations. First, due to travellers’ bounded rationality and slow learning processes, it might not achieve its goals, or might not achieve them fast enough. Secondly, demand management was perceived as something that reduced people’s freedom to travel – it was initially seen as something that would restrict rather than create choice. It therefore suffers from resistance and low public and political acceptability. In this paper we advocated the libertarian paternalism approach as having the potential of dealing with both of these problems at the same time.

The effectiveness and acceptability of economic interventions and demand management measures to change travel behaviour may be enhanced if more consideration and emphasis is given to the design of the information context. The libertarian paternalism approach is not offered as an alternative to other measures but as a complementary measure. In some cases, synergy between the pricing and a soft intervention by nudges could be an effective policy; ‘Getting the prices right’ by taxes and subsidies could be the first step of a transport policy; however the effect of pricing policies on behavioural change is limited – partly because of individuals’ bounded rationality; travellers do not always associate their behaviour with the relevant costs and this slows down the process of behavioural change. Nudges can help individuals to overcome cognitive biases, to highlight the better choices for them, and to increase the effect and speed of behavioural change - without restricting choices or limiting travellers’ freedom of choice. In liberal democratic regimes, where the public and political acceptability of regulation and enforcement are low, the libertarian paternalism approach, through the nudging of travellers, could be one of the most promising approaches to deal with the need for a radical and urgent behavioural change.

A specific application area in which choice architecture might be relevant and effective in changing travel behaviour is the design of advanced traveller information systems (ATIS). The last ten years has seen a rapid evolution of the field of travel information provision. The technological level of today’s systems, the widespread availability of travel information services, together with the insights from behavioural sciences makes the incorporation of nudges into travel information systems easier and cost-effective. This could be the trigger to achieve the behavioural change we urgently need.

References


