



Behavioural economics and its implications for transport

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ABSTRACT

Increasing attention is being paid to behavioural economics in the social sciences and in public policy. We attempt to gather up the effects based on previous reviews of the literature and show the implications for transport and energy consumption. We show that there are several behavioural aspects of incentives on individual behaviour. We also show that there are a number of contextual factors on individual behaviour, such as messengers, norms, defaults, salience, priming, affect, commitment, and ego. We show the implications of this research for experimentation, and the measurement of wellbeing. In particular, we argue that transport research should use field experiments to carefully demonstrate causality in the evaluation of interventions.

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1. Introduction

Behavioural economics has become increasingly popular over the last decade. Many popular books, such as *Nudge* (Thaler and Sunstein, 2008), *Predictably Irrational* (Ariely, 2008), *Influence* (Cialdini, 2007), *Yes!* (Goldstein et al., 2007), *Priceless* (Poundstone, 2010), and *Thinking, Fast and Slow* (Kahneman, 2011) have become international best sellers. Moreover, in the public policy arena, behavioural economics is starting to become a foundation for policy-making in the UK (Dolan et al., 2010). In the US, Cass Sunstein (co-author of *Nudge*) is currently Administrator of the White House Office of Information and Regulatory Affairs in the Obama administration. Behavioural economics is also playing a major part in development policy (Karlan and Appel, 2011), financial policy (Thaler, 1993; Elliott et al., 2010), and in microeconomics more generally (see DellaVigna, 2009).

The literature in behavioural economics is expanding rapidly. We seek to gather up these studies in ways that resonate with those interested in transport behaviours, and attempt to document some of the work that is directly relevant to transport and climate change mitigation. We gather these up into a framework called MINDSPACE, which is a mnemonic for the contextual factors that impact on behaviour (i.e. messenger, incentives, norms, defaults, salience, priming, affect, commitment, and ego). We are interested in understanding the influences on behaviour rather than behaviour per se, so we focus on evidence from field experiments (mainly natural ones), where the causal effects on behaviour can be robustly assessed and has both very good internal and external validity. We also discuss some of the welfare implications from this

research, especially with respect to how we assess whether a person's life is going better or worse as a result of a change in behaviour (using subjective wellbeing).

The importance of changing individual transport behaviour cannot be underestimated from the point of view from climate change. The problem, however, is that there is a market failure in transport that warrants policymakers attempting to change behaviour. The market failure results from two main reasons. First, the price of energy is not as high as it should be since the externalities from carbon are not currently accounted for in the price of fuel. If the cost of the externality were addressed by a carbon tax or a cap-and-trade system, individuals would be incentivised to consume less energy.

Second, there are transaction costs and information barriers that prohibit people from behaving in a more rational way. An example is provided by Larrick and Soll (2008), named the 'MPG illusion'. They found that people systematically misunderstood miles per gallon (MPG) as a measure of fuel efficiency. People rely on linear reasoning about MPG, which leads them to undervalue small improvements on inefficient vehicles. Changing the standard to gallons per mile would allow consumers to understand exactly how much petrol they are using on a given car trip or in a given year and, with additional information, how much carbon they are releasing. This example demonstrates that information on its own is sometimes not enough. Understanding the link between behavioural economics and transport has not been fully developed, although there have been some attempts to link some behavioural work with climate change (e.g. Brekke and Johansson-Stenman, 2008). We acknowledge that we are purely interested in focusing on individual behaviour in this paper, while many of the papers in this special edition focus on higher levels of aggregate behaviour (for instance see Geels, forthcoming).

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The field of behavioural economics and science is becoming very large so in this paper we will attempt to summarise the main avenues from the literature, and relate to how they might impact on behaviours and policies relating to climate change. We will stress how this research area relies on robust and clear empirical methodology to actually understand what causes a change in human behaviour. So this will focus on understanding how field experiments can help advance the research in this regard. We will then move onto how to capture the welfare consequences from a change in behaviour, since traditional welfare analysis in economics being based mainly around people's preferences as a measure of their wellbeing. Given that behavioural economics has shown that people do not always have consistent preferences, we will state how people's experiences can be used to complement this measure of wellbeing. Using people's experiences, known as subjective wellbeing (SWB), allows us to measure how life is going for someone as they experience it. These three areas (impact of contextual factors on behaviour, field experiments, and subjective wellbeing) link up for form the current literature in behavioural economics and should and can be applied directly to transport studies and issues around climate change and other human issues.

So in the next section we analyse the main avenues of changing behaviour from studies that have empirically attempted to demonstrate behaviour change (using MINDSPACE). In Section 3 we demonstrate how greater research is needed using experimentation to demonstrate causality in transport research. Section 4 highlights the further need of incorporating measures of subjective wellbeing with data on transport behaviours. We will focus on SWB since it is a method that can assess people's wellbeing without relying on people having consistent preferences. We will at all times relate to transport and climate change mitigation, but it is important to acknowledge at the outset that most areas of behavioural economics have not directly considered transport or climate change mitigation or adaptation.

2. The background to behavioural economics

2.1. Some issues with incentives

The foundations of behavioural economics can be attributed to Simon (1955) and Kahneman and Tversky (1979). Their framework was based on observations that people did not always have consistent choices. A summary of their work can be found in many of the standard textbooks in behavioural economics, such as Kahneman and Tversky (2002), Camerer et al. (2003) and DellaVigna (2009). The main effects of incentives on behaviour can be summarised by seven different effects. We find that people:

1. Really dislike losses.
2. Focus on changes.
3. Overweigh small chances.
4. Think in discrete bundles.
5. Value right now very highly and inconsistently.
6. Care about other people.
7. Can be negatively impacted by incentives.

2.1.1. Disliking losses

Losses loom larger than gains – losing £10 causes more pain than finding £10 causes pleasure (Kahneman and Tversky, 1979). In a study of incentives in health, participants were asked to deposit money into an account, which was returned to them (with a supplement) if they met weight loss targets (Volpp et al., 2008). This proved to be an effective intervention and shows how powerful the framing of losses might actually be for transport. Such positive impacts are also found on productivity using bonus frames

(Hossain and List, 2009). Waygood and Avineri (2011) show that such loss aversion is important to perceptions about transport and safety, although changing perceptions does not necessarily mean changing behaviour. So it could be that people are more sensitive to losing 10 min on a travel journey than gaining 10 min on a travel journey, and the same applies to paying for travel.

2.1.2. Focus on changes

Reference points matter in people's preferences. For example, Camerer et al. (1997) found that New York taxi drivers make labour supply decisions "one day at a time", setting daily income targets and quitting working once they reach that target. It would be more efficient for them to work more on good days and quit early on bad ones. Avineri (2006) argues that reference points could be very important in modelling and predicting behaviour in transport networks (also see Avineri and Choris, 2010; Li and Hensher, 2011). Although determining the selection of the reference point is currently not very clear in many studies, and can be endogenous within and across individuals. So the reference points that people choose are not always salient to the researcher or are not elicited, so we have very little information on the actual reference points chosen. Reference points can also change over time for the same individual.

2.1.3. Overweigh small chances

There is now ample evidence that people overweight low probabilities (Tversky and Kahneman, 1992; Gonzalez and Wu, 1999), and this explains the widespread desire to gamble on low-probability events (e.g. lottery tickets) and to insure against low-probability catastrophes. Johnson et al. (1993) showed that consumers' decisions about insurance are impacted by distortions in their perceptions of risk and by alternative framing of premiums and benefits. In particular, they made health insurance more attractive by making the cause of hospitalisation more specific and available. When subjects were first asked how much they would pay for insurance against any disease and then any accident (thus isolating vivid causes), the price reported was more than twice that reported (how much they would pay for insurance) for protection for any reason. Given that different transport modes involve different risks of morbidity and mortality, and that people do not consistently understand these risks (Dolan et al., 2008a), further work is needed to understand such overweighing of small probabilities.

2.1.4. Think in discrete bundles

We think of money as sitting in different "mental accounts" – salary, savings, expenses, etc. – and we are reluctant to move money between such accounts (Thaler, 1999). This means that policies may encourage people to save or spend money by explicitly 'labelling' accounts for them, but still leaving freedom to choose how the money is used. Mental accounting means that identical incentives vary in their impact according to the context: people are willing to take a trip to save £5 off a £15 radio, but not to save £5 off a refrigerator costing £210 (Thaler, 1985).

Barr (2004) describes the Puerto Rican Banco Popular's Acceso Popular account, which has a \$1 monthly fee, no minimum balance, free ATM transactions, and free electronic and telephone bill payment. To encourage savings, Acceso Popular has a savings account into which small sums (initially, \$5 per month) are automatically transferred from the Acceso Popular transaction account. The savings account pays modest interest. Funds may only be withdrawn by going to the bank and account holders must pay a fee to see a bank teller more than once a month to discourage withdrawals. Banco Popular opened nearly 60,000 such accounts in 2001, with half of those activating the savings 'mental' account in their accounts. Mental accounting could be important for

analysing transport expenditure or the time spent travelling within a particular time period (see Schafer and Victor, 2000).

2.1.5. Value right now very highly and inconsistently

We prefer to live for today at the expense of tomorrow. We usually prefer smaller, more immediate payoffs to larger, more distant ones. £10 today may be preferred to £12 tomorrow. But £12 in eight days may be preferred to £10 in a week's time. This implies that we have a very high discount rate for now compared to later, but a lower discount rate for later compared to later still. This is known as 'hyperbolic discounting' and it leads people to discount the future very heavily when sacrifices are required in the present (Laibson, 1997) – for example, to ensure improved environmental outcomes in the future (Hardisty and Weber, 2009). There is evidence that the immediacy of reward has an impact on the success of schemes to treat substance misuse disorders (Lussier et al., 2006). This is important for the transport and climate change debates, since people might rationally weigh the short-term very highly, but they might have inconsistent weighting across time. This inconsistency might lead to an over-depletion of natural ecosystems and an over-production of greenhouse gas emissions. So if any transport and climate change mitigation behaviour is to be prescribed, it is best if the choice is on behalf of future behaviour (which is usually consistent), and not based on today (which is usually inconsistent).

2.1.6. Care about other people

There is increasing evidence that suggests that we care about other people. For instance, the evidence using dictator games (Forsythe et al., 1994) and ultimatum games (Fehr et al., 1993) shows that people give to another person when there is no self-interest in doing so, and care about being treated fairly. These games are constructed so that people have little incentive to give money to another person, but yet we observe that they do. Field evidence of this is provided by Gneezy and List (2006) and Bandiera et al. (2005). So other people's wellbeing is a function of our wellbeing, and these links could be stronger within family ties (Powdthavee, 2009). So understanding how transport behaviour can be changed if we care more or less about other people (family, friends, neighbours, etc.) seems an important area of further understanding. There are some stipulations in Brekke and Johansson-Stenman (2008) and Shogren and Taylor (2008) about how social preferences can be used for environmental negotiation and policy-making. This work also directly relates to how much weighting we give to other less fortunate people in project appraisal.

2.1.7. Can be negatively impacted by incentives

Behavioural economics also provides some arguments against using incentives altogether. It has been claimed that monetary compensation tends to lead to intrinsic motivation being 'crowded out' or partially destroyed (Frey and Oberholzer-Gee, 1997). It appears that once an activity is associated with an external reward, a person will be less inclined to participate in the activity in the future without further rewards (Benabou and Tirole, 2003). A meta-analysis of experimental studies found that extrinsic rewards undermined motivation (Deci et al., 1999). For example, putting an explicit price on a behaviour can cause unexpected and perverse outcomes (Gneezy and Rustichini, 2000). Unintended consequences have already been described in relation to pay for performance programmes in primary health care, and were often related to the way in which incentive programmes were designed and implemented (McDonald and Roland, 2009).

2.2. Context

The contextual impact on information can be further categorised by MINDSPACE (Dolan et al., 2010, 2012) – see Table 1 below.

MINDSPACE is a mnemonic that summarises the main effects of context on human behaviour. It should be used as checklist to understand human behaviour for academics and policymakers. By context we mean the overall environment of the choice. This could be associated with the physical environment (in terms of how it is designed), the people and culture around the decision-makers, or the information delivered during the choices. So context in this case is all encompassing, and allows us to place decision-makers into an overall context (and not in a decision-making silo). The I in MINDSPACE is dealt with above, so we shall go into the other elements below.

2.2.1. Messenger

We respond to who and where the message comes from, as well as to the message itself. There is increasing evidence that information has more weight if experts deliver it. For example, Webb and Sheeran (2006) found that health interventions delivered by research assistants and health educators were more effective in changing behaviour compared with interventions delivered by either trained facilitators or teachers. The large review by Duran-tini et al. (2006) found that similarities between the messenger and the individual increase the weight given to the information. In particular, they found that those from lower socioeconomic groups are more sensitive to the characteristics of the messenger. Our feelings to the messenger can be important for the effectiveness of information or incentives to change behaviour. If we have a negative emotion against someone (which could be a result of a prior bad experience with the person), we are more likely to discard that information from that person (Cialdini, 2007). So the individuals or organisations that provide us information about the costs and benefits of transport behaviours might be important for understanding and changing transport behaviour. So for any effective messenger to be used for climate change, it might be better that they are just generally trusted (e.g. doctor, lawyer, police, etc.) and not just environmental organizations who might not necessarily be trusted as much.

2.2.2. Norms

Social and cultural norms are the behavioural expectations, or rules, within a society or group (Dolan et al., 2012). People often take their understanding of social norms from the behaviour of others, which means that they can develop and spread rapidly. Some social norms have a powerful automatic effect on behaviour and can influence actions in positive and negative ways. Their power may come from the social penalties for non-compliance, or the social benefit that comes from conforming. Social norms are also heavily related to herding behaviour and social pressure (see DellaVigna, 2009). There is a large literature in sociology and geography on the role of social norms on behaviour, but very little quantitative evidence collected in experimental settings has emerged showing causal effects from norms to behaviour.

Two of the best examples of such quantitative evidence relate to energy. Cialdini (2003) found that when a hotel room contained a sign that asked people to recycle their towels to save the environment, 35% did so. When the sign used social norms and said that most guests at the hotel recycled their towels at least once during their stay, 44% complied. Finally, when the sign said that most previous occupants of the room had reused towels at some point during their stay, 49% of guests also recycled. So recycling increased by 70% once the appropriate norms had been highlighted. Allcott (2011) analysed the work of OPower, which initiated a large-scale project that sent letters to consumers that provided social comparisons between a household's energy use and that of its neighbours (as well as simple energy consumption information). The scheme was seen to reduce energy consumption by 2% relative to the

Table 1
MINDSPACE – the role of context on behaviour.

Messenger	We are heavily influenced by who communicates information
Incentives	Our responses to incentives are shaped by mental shortcuts
Norms	We are strongly influenced by what others do
Defaults	We ‘go with the flow’ of pre-set options
Saliency	Our attention is drawn to what is novel and seems relevant to us
Priming	Our acts are often influenced by unconscious cues
Affect	Our emotional associations can powerfully shape our actions
Commitments	We seek to be consistent with our public promises, and reciprocate acts
Ego	We act in ways that make us feel better about ourselves

Note: This is taken from Dolan et al. (2010) and Dolan et al. (2012).

baseline. Such effects have been replicated in the UK social housing sector (see Dolan and Metcalfe, 2012).

Social norms can, however, have unintended consequences. For example, Cialdini (2003) placed two signs in different areas of a national park. One sign urged visitors not to take wood and depicted a scene showing three thieves stealing wood, while the second sign depicted a single thief – indicating that stealing is definitely not a social norm. The first message, subtly conveying a norm, increased the amount of wood stolen by 8%, while the other sign increased it by 2%, therefore, policymakers may actually validate and encourage harmful actions by making them appear the norm rather than the exception. So if a small number of people are emitting a great deal of carbon dioxide emissions within a population, alluding them to the fact that they are outside of the norm (i.e. descriptive norm) and that this has a negative impact on society (i.e. injunctive norm), then behaviour change may be more likely to occur.

2.2.3. Defaults

Many decisions we take every day have a default option, whether we recognise it or not. Defaults are the options that are pre-selected if an individual does not make an active choice (Dolan et al., 2012). The best examples of defaults come from financial behaviour. Madrian and Shea (2001) consider the effect of a change in a default on the contribution rates in retirement savings in the US. Before the change, the default is non-participation in retirement savings; after the change, the default is participation at 3% in a money market fund. In both cases, employees can override the default. Madrian and Shea (2001) find that the change in default has a very large impact: 1 year after joining the company, the participation rate in 401(k)s (the retirement vehicle) is 86% for the treatment group and 49% for the control group, which is a very large effect size. There is also evidence that the use of opt-out defaults can be effective for organ donation rates (Johnson and Goldstein, 2003), choice of car insurance plan (Johnson et al., 1993), car option purchases (Park et al., 2000), and consent to receive e-mail marketing (Johnson et al., 2002). Again the effect sizes from these studies are very large. So defaulting people into clean energies and technologies, and efficient homes (such as the Green Deal) and vehicles seems like a feasible approach for climate change policy.

2.2.4. Saliency

Our behaviour is greatly influenced by what our attention is drawn to (Kahneman and Thaler, 2006). People are more likely to register stimuli that are novel, accessible and simple (Dolan et al., 2012). Simplicity is important here because our attention is much more likely to be drawn to things that we can understand – to those things that we can easily ‘encode’. A seminal example of this is the field experiment by Chetty et al. (2009), who chose 750 products subject to a sales tax that is normally only applied

at the till, and put additional labels next to the product price, showing the full amount including the tax. Putting the tax on the label, rather than adding it at the till, led to an 8% fall in sales over the 3-week experiment. They provide further non-experimental evidence that taxes that are included in posted prices reduce alcohol consumption significantly more than taxes added at the register.

Saliency also explains why unusual or extreme experiences are more prominent than more constant experiences. Our memory of experiences is governed by the most intense ‘peak’ moments, as well as the final impressions in a chain of events (Kahneman et al., 1993; Stone et al., 2000). In other words, we may prefer the dentist that gave us three hours of steady discomfort over the one who gave us a sharp pang of pain, because that pang is particularly salient. Saliency, in the form of anchoring, has been shown to be important for decisions about consumer value (Ariely et al., 2003). So overall, the salient cost or experience of travelling and the end cost or experience may have a disproportionate impact on our transport behaviours. Changing the saliency of certain costs and/or experiences may be able to change transport-related behaviours.

2.2.5. Priming

Priming shows that people’s subsequent behaviour may be altered if they are first exposed to certain sights, words or sensations (see Hertel and Fiedler, 1994). Priming is formally defined as “the procedural feature that some previously activated information impacts on the processing of subsequent information” (see Hertel and Fiedler, 1994), and is a prominent topic in social and cognitive psychology (e.g., Kay et al., 2004; Smeesters et al., 2003; Utz, 2004). Priming seems to act outside of conscious awareness, which means it is different from simply remembering things (see the reviews by Wilson (2002) and Bargh et al. (1996)). As an example relating to words, Dijksterhuis and Bargh (2001) exposed people to words relating to the elderly (e.g. ‘wrinkles’), which meant they subsequently walked more slowly when leaving the room and had a poorer memory of the room. In other words, they had been primed with an elderly stereotype and behaved accordingly. Drouvelis et al. (2010) found that being primed with words associated with cooperation made people give more in a public contribution game – by around 40–50% larger donations.

These types of effects are real and robust: they have been repeatedly proved in many studies. What is less understood is which of the thousands of primes that we encounter every day have a significant effect on our behaviour. Priming is therefore perhaps the least understood of the MINDSPACE effects (Dolan et al., 2012), and no empirical studies have been found on transport and priming (apart from walking). Priming could be used in transport to get consumers in a certain ‘mood’ – by priming people with words and images about peak oil, potential fuel shortage in the (near) future and possibly climate change, they may chose for more fuel efficient cars when making a decision about what car to buy.

2.2.6. Affect

Emotional responses to words, images and events can be rapid and automatic, so that people can experience a behavioural reaction before they realise what they are reacting to. Moods, rather than deliberate decisions, can therefore influence judgments, meaning they end up contrary to logic or self-interest (Zajonc, 1980). Bertrand et al. (2010) analysed the impact of affect using direct mail advertisements for loan offers, where the advertisements were varied in the deal offered. It was found that including a picture of an attractive, smiling female increased demand for the financial product by the same amount as a 25% decrease in the loan’s interest rate. This is a very large change in financial behaviour.

Negative affect has been especially important in health behaviours. For instance, attempts to promote soap use in Ghana were originally based around the benefits of soap – but only 3% of mothers washed hands with soap after toilet use. Researchers noted that Ghanaians used soap when they felt that their hands were dirty (e.g., after cooking or travelling), that hand-washing was provoked by feelings of disgust. As a result, the intervention campaign focused on provoking disgust rather than promoting soap use (see Curtis et al., 2007, for more details). Soapy hand washing was shown only for 4 s in one 55-s television commercial, but there was a clear message that toilet use prompts worries of contamination and disgust, and requires soap. This led to a 13% increase in the use of soap after the toilet and 41% increase in reported soap use before eating. In relation to transport, it could be that when people are in an aroused mood, they are more likely to use their car (in comparison to public transport) (see Xu and Schwarz, 2006). There is currently little experimental empirical evidence to understand affect and arousal during different transport behaviours or behaviours relating to climate change.

2.2.7. Commitment

Individuals tend to procrastinate and delay taking decisions that are likely to be in their long-term interests (O'Donoghue and Rabin, 1999). Many people are aware of their will-power weaknesses and use commitment devices to achieve long-term goals (Becker and Mulligan, 1997). It has been found that even the very act of writing a commitment can increase the likelihood of it being fulfilled, and commitment contracts have already been used in some public policy areas (Cialdini, 2007). There have been a range of instances where individuals are willing to self-impose costly deadlines to help them overcome procrastination (Ariely and Wertenbroch, 2002). Ashraf et al. (2006) found that people with higher rates of time preference sometimes desire commitment devices for saving. Commitment devices have been used for a range of behaviours, such as improving physical behaviours (Williams et al., 2005) and charitable behaviours (Bremen, 2009), again with very large effect sizes. The later example from Brennan shows large and significant effects of pre-committing to giving more to charity in the future. Like defaults, there is a large potential to get people to pre-commit to future clean energies and technologies, and efficient homes and vehicles.

2.2.8. Ego

At least in Western societies, we attempt to behave in ways that support the impression of a positive and consistent self-image. When things go well in our lives, we attribute it to ourselves; when they go badly, it is the fault of other people, or the situation we were put in – an effect known as the “fundamental attribution error” (Miller and Ross, 1975). An example of this is provided by Landry et al. (2006), where male respondents donate more to charity when approached by more attractive female solicitors for door-to-door fundraising. The ego here is working to maintain a positive self-image from the view of the opposite sex. We also seek to be consistent, and the foot-in-the-door strategy is a classic way of taking advantage of this (Cialdini, 2007). Nonetheless, people's transport behaviour may be linked to their ego and identity, so changing this through using saliency could change people's behaviour.

3. The approach to evaluation and causality

These behavioural effects above make it more likely that what we intend to do is not necessarily a good guide to our future behaviour (Sheeran, 2002; Webb and Sheeran, 2006). This is because individuals cannot forecast how they will behave in a context that is very different to the ‘cold’ state in which their intentions are

elicited. So the research in behavioural economics is at odds with many of the traditional theories of behaviour change that have dominated the field, such as the theory of planned behaviour (Ajzen, 1991), value belief norm theory (Stern et al., 1999), theory of interpersonal behaviour (Schutz, 1958), and self-determination theory (Ryan and Deci, 2000). Such theories still have a large impact on discourse of transport research (see Line et al., 2010; Lang et al., 2011; Pronello and Camusso, 2011; De Vos et al., 2012).

The meta-analyses of intentions predicting behaviour change have found little predictive power (Webb and Sheeran, 2006). This is related to the gap between values and behaviour discussed among others by Shove (2010). So only a small amount of the variance in behaviour change from causal studies can be attributed to intentions. Emphasis on causal is important since we are intending to explain and predict behaviour change and not just describe behaviour or describe its correlates. So there are potentially a number of problems with empirical research that uses only intentions (e.g. stated preferences) to predict what will change behaviour. The evidence on the inability and problems with market research methods has been well documented by Graves (2010). To take one example from MINDSPACE, when people are asked about whether their energy behaviour will change as a result of social norms (found in Allcott (2011), and Dolan and Metcalfe (2012)), they believe that it will not change their behaviour (Nolan et al., 2008), despite the evidence that it actually does change their behaviour.

All of the well-known theories mentioned above to some extent rely on attitudes and intentions driving behaviour change. Effectively, there are three main problems with asking people about their intentions and future behaviour. First, a great deal of our behaviour is automatic and what we attend to in our day-to-day lives is very different to what we attend to in interviews. The elements of MINDSPACE show that we are heavily influenced in ways we are not aware of – and in ways that we sometimes would not believe. The reflective system is not totally divorced from the automatic system in the brain, but greater emphasis and appreciation has to be given to the automatic system. This means that the theories, such as the theory of planned behaviour, do not capture most of what drives human behaviour, since humans are blind to their own blindness (Kahneman, 2011).

Second, people are not very accurate at predicting the future and how they will feel in the future. There is a large body of evidence that suggests individuals over-predict the intensity of feelings in the future and hence their behavioural actions in the future. Gilbert et al. (1998) and Loewenstein et al. (2003) have found that people are prone to affective forecasting, so asking them about the future is not a good guide to how they will, both, behave and feel in the future. This evidence from this area is well documented in DellaVigna (2009).

Third, asking people about their behaviour will make it even more likely that they behave that way in the future – so researchers can actively manipulate behaviour by purely researching about the behaviour. Take two examples from randomized field experiments, one from voting (Gerber et al., 2003) and one from development projects (Zwane et al., 2011). Gerber et al. found that asking people whether they intend to vote, actually makes them more likely to vote in the future. Zwane et al. analysed three field studies in health behaviours. They find that being randomly assigned to a survey about the behaviour, people were more likely to behave in line with the survey. Hence, being surveyed increases use of water treatment products and take-up of medical insurance, which suggests that the researcher can actively shape behaviour by just asking about the behaviour, which threatens the internal and external validity of research in that area. Asking people to retrieve information that is in line with the researchers' beliefs helps shape memory recall and hence future behaviour (Finn and Roediger, 2011).

So there is a need within transport to start to conduct field experiments in behaviour. Field experiments come in a few guises, but the main thing to note about field experiments is that they are based on randomisation into different interventions, where people cannot select the intervention they receive (thus controlling for selection bias). Such experiments can take place in a controlled setting like a laboratory but with real people (artefactual field experiment), in the real world where people know the experiment is taking place (framed field experiment), or in the real world where people do not know that they are participating in an experiment (natural field experiment). The interested reader should consult Harrison and List (2004) and List (2009).

Natural field experiments are starting to become the gold standard in program and option evaluation because of their potential for strong internal and external validity (Harrison and List, 2004), and are becoming popular within public policy. The success of research organisations, such as the Jameel Poverty Action Lab, have resulted from continued field experiments.¹ While there is an appreciation to use more experimental methods with behavioural science within transport (see Gaker et al., 2010), more needs to be done to show what actually causes a change in observed transport behaviour. We cannot find any studies within transport that have used natural field experiments to demonstrate causality. This is quite striking given that the transport field has an abundance of data to enable randomisation of information or incentives across the population. We can only speculate here as to why this is the case, but it maybe a mixture of relying too heavily on intentions in empirical research and many researchers have a vested interest in keeping that methodology going (this is especially true of the commercial market research industry).

4. Implications for welfare and the measurement of wellbeing

All of this research on contexts suggests that revealed behaviours (i.e. people's choices) might not be a good guide to their subsequent wellbeing. The best empirical example of this to date is from Gruber and Mullainathan (2005), where smokers became happier after cigarette taxes increased. The research into subjective wellbeing (SWB) has shown a number of factors that impact on SWB (see Frey and Stutzer, 2002; Dolan et al., 2008b), although the area is still in its infancy in terms of causality and temporal scales.

SWB ratings have shown to be highly correlated with actual behaviour, e.g. suicide (Di Tella et al., 2003; Bray and Gunnell, 2006), and key physiological and neurological variables (Steptoe et al., 2005; Blanchflower and Oswald, 2008). So there is good validity of SWB in measuring underlying utility despite these measures being subjective. It seems that people can rate how they are feeling about their lives or episodes of their lives (Van Praag and Ferrer-i-Carbonell, 2005). SWB is very similar to affect in MINDSPACE (Section 2.2.6), but there is a clear distinction between the two. Affect in MINDSPACE is an input into behaviour, so our visceral feelings will change how we perceive information and incentives and then change our behaviour. SWB is used as an output of that behaviour change – i.e. whether people actually felt good about their lives, of which that behaviour may be a small part of the overall assessment. Both SWB and affect share similar characteristics (i.e. feelings), but the latter is a more transitory input whereas the former is a more stable output, and it is used to understand all behaviours in life, not just the ones policymakers would like to change.

There is increasing evidence on the economic and social factors (income, employment status, health status, relationships and

macro-economic variables) associated with SWB ratings (Di Tella and MacCulloch, 2005; Dolan et al., 2008b). There is some evidence to suggest that air pollution (Luechinger, 2009), noise pollution (Van Praag and Baarsma, 2005), and other externalities, such as terrorism (Metcalfe et al., 2011), can affect SWB but there has been little causal work examining how the physical appearance and construction of the neighbourhood affects SWB (see Dolan and Metcalfe, 2008). There are some correlations between transport and SWB. For instance, White and Dolan (2009) found that commuting home from work is one of the least pleasurable activities during the day. Stutzer and Frey (2008) found that commuting over 2 h a day negatively impacts on life satisfaction, and Roberts et al. (2011) found that women are more likely to be negatively impacted by commuting than men. There is some research in the transport studies literature on understanding SWB in a transport context (Abou-Zeid and Ben-Akiva, 2011; Duarte et al., 2010; Jakobsson Bergstad et al., 2011), but the empirical work is cross-sectional, with unrepresentative samples and not controlling for individual heterogeneity in people's responses. Ettema et al. (2010) argue that transport could potentially impact both on people's evaluations of their lives and on their moment-to-moment hedonic affect, but there clearly is a lack of research in this area.

Researchers and public policy should care about SWB since it allows us to measure our experiences, as opposed to our desires (through preferences) or needs (through objective lists). Therefore, if we had a policy that changed the travel behaviour of a population but caused people to have lower SWB, i.e. higher suffering, we should recognise that this behaviour change is not all positive. Additionally, transport projects might not work in the field since they may lower the experiences of individuals and hence reduce take-up of the policy/project. In fact, this suffering should be incorporated into any cost-benefit analysis or cost-effectiveness analysis of transport projects and policies. We can start to value the suffering consequences attributed to changes in behaviour or life events (see Dolan et al., 2011a), which can have an input into transport appraisals.

The importance of these SWB measures has increased since the infamous Sarkozy Commission (Stiglitz et al., 2009) argued that "Research has shown that it is possible to collect meaningful and reliable data on subjective as well as objective well-being. Subjective well-being encompasses different aspects (cognitive evaluations of one's life, happiness, satisfaction, positive emotions such as joy and pride, and negative emotions such as pain and worry): each of them should be measured separately to derive a more comprehensive appreciation of people's lives... [SWB] should be included in larger-scale surveys undertaken by official statistical offices". As a result of this, the UK Office for National Statistics is using the recommendations from Dolan et al. (2011b) to measure SWB across the UK from 2011 using its integrated household survey. The questions being used are:

1. Overall, how satisfied are you with your life nowadays?
2. Overall, how happy did you feel yesterday?
3. Overall, how anxious did you feel yesterday?
4. Overall, to what extent do you feel that the things you do in your life are worthwhile?

All questions are on a 10-point scale. There is potential to use these data for transport policy once the data is released in mid-2012 and beyond. These questions, along with more time-use and affect data, can be used by researchers to test a number of interesting questions related to transport and climate change mitigation. Immediate questions that may be addressed are: does spatial distance one needs to cover to access a given mode of transport impact on SWB? Do policies to reduce from carbon dioxide from transport make people feel better? Do commuting mode and

¹ Please see Poverty Action Lab website: www.povertyactionlab.org/.

duration impact on SWB in the workplace? There could potentially be many more from this, and other datasets.

5. Concluding remarks

Behavioural economics has shown that many contextual factors can influence and change our behaviour. To re-iterate, messengers, the perception of incentives, norms, defaults, salience, priming, affect, commitment and ego all matter to behaviour. Transport researchers should appreciate these contextual factors in people's real behaviour. Research should demonstrate how important these factors are in the transport context, and how the combination of factors might be even more beneficial for changing behaviour and reducing energy consumption and greenhouse gas emissions in the transport sector.

Notwithstanding this, there are several on-going issues in this area that researchers should be aware of. These six issues needed to be fully addressed in future research. Firstly, behavioural economics assumes that we use the two systems of the brain – the reflective and the automatic – when making decisions, although some social psychologists would argue that a great deal of the behaviour originates from the automatic system driven by the unconscious (see Wilson, 2002). Understanding the relative weight given to each system in making transport and mobility decisions seems a very interesting area of future research.

Secondly, there are other domains that are characterised by market failure, such as health (Marteau et al., 2011), that are beginning to understand how behavioural economics can be used to address the failures. More needs to be done in geography, more generally, to understand how behavioural economics can be incorporated into geographical theory and modelling (initial attempts are provided by Strauss (2009a,b), Clark (2010), Jones et al. (2011) and Pykett (2011)).

Thirdly, behavioural economics is starting to have an impact on public policy because of its ability to change behaviour at a very cost-effective rate (Dolan et al., 2012). So the benefit–cost ratios of many behavioural economic projects or policies are far higher than alternative ways of attempting to change behaviour (Allcott and Mullainathan, 2010). Therefore, one of the reasons why behavioural economics is starting to be used more frequently is because it delivers more 'bang for the buck' and allows scarce resources to be allocated more efficiently. Nonetheless, there needs to be more research on the magnitude and durability of these effects, especially with respect to transport behaviours, i.e. whether it delivers long-term cost-effectiveness and whether the effects are reinforcing.

Fourthly, we need more evidence from different cultures around the world, as most evidence is from developed countries. This will be done through proper evaluations conducted via field and natural experiments. Only through proper evaluations with good identification strategies for causality will we be able to rule out the problem of second-best (Shogren and Taylor, 2008). This is where the links with human and physical geography and economics could become strong.

Fifthly, the effect sizes in the empirical studies discussed in Section 2 are very large considering the costs of the interventions, but more needs to be done on determining how linking up the individual elements of MINDSPACE could be even more cost-effective for climate change policy. More discussion and evidence is needed to determine whether transport policy can be solely centred around behavioural science, or whether it is a contributory tool to the current policy environment. We are very clear though in the need for transport studies to use field experiments.

Sixthly, further research needs to also understand the wellbeing consequences from changing transport behaviour. There is a large

potential for researchers in transport to link up behaviour change with changes in wellbeing. This will enable behaviour change in transport to reduce actual suffering and improve people's lives, while at the same time reducing the carbon dioxide emissions from transport.

Taken together, a focus on the impact of contexts for behaviour, field experiments, and the measurement of people's experiences, will allow researchers to fully answer the important questions in transport studies and climate change now and in the future.

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