RSA

Projects

Cabbies, Costs and Climate Change

An engaged approach to fuel efficient behaviour

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About the RSA

The RSA has been a source of ideas, innovation and civic enterprise for over 250 years. In the light of new challenges and opportunities for the human race our purpose is to encourage the development of a principled, prosperous society by identifying and releasing human potential. This is reflected in the organisation's recent commitment to the pursuit of what it calls 21st century enlightenment.

Through lectures, events, pamphlets and commissions, the RSA provides a flow of rich ideas and inspiration for what might be realised in a more enlightened world; essential to progress but insufficient without action. RSA Projects aim to bridge this gap between thinking and action. We put our ideas to work for the common good. By researching, designing and testing new ways of living, we hope to foster a more inventive, resourceful and fulfilled society. Through our Fellowship of 27,000 people the RSA aims to be a source of capacity, commitment and innovation in communities from the global to the local.

About the Social Brain Project

The notion of a rational individual who makes decisions consciously, consistently and independently is, at best, a very partial account of who we are. Science is now telling us what most of us intuitively sense - humans are a fundamentally social species. Science cannot, however, tell us what to do with this knowledge, and it is up to us to shape our lives accordingly.

Since its inception in early 2009, the Social Brain project has sought to make theories of human nature more accurate through research, explicit through public dissemination, and empowering through practical engagement. We are now building on this work with a new initiative linking theory and practice, provisionally called the RSA Social Brain Centre, which seeks to support personal development and wellbeing, inform social and educational practice and improve financial and environmental behaviour.

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Executive Summary

On average the drivers drove 20% more fuel efficiently than their baseline measures, representing cash savings of £1146 per year for each cabbie

This report features a rare study of taxi drivers in their working habitats, and presents wider lessons about the challenges of efficient fuel use in the context of rising energy prices and climate change.[4] However you conceive the climate problem, efficiency is an important part of the solution.

Petrol prices have risen by 32% since 2009. While debates about how to deal with rising energy costs through fiscal levers and regulation will continue, this report highlights the role behaviour change can play in reducing costs.

Behaviour change is central to our attempts to address anthropogenic climate change for four main reasons: First, we need all the quantitative reductions in carbon in the atmosphere that we can get. Second, the impact of technology and regulation is relative to the responsiveness of human behaviour. Third, for all its abundant complexities, human behaviour can be changed fairly quickly, and speed is of the essence. Fourth, behaviour drives attitudes, and we increase the relevance of climate change most effectively when we connect it to the processes and outcomes that matter to people on a daily basis.

To better understand this kind of engaged approach to behaviour change, the RSA sought to help taxi drivers turn helpful information about fuel efficient behaviour into enduring dispositions. This exploratory study is part of RSA's more ambitious attempt to understand how to make positive behaviour habitual, performed without conscious thought, and contagious, through which positive behaviour spreads through social diffusion between individuals and groups.[5]

Shell's fuel save tips comprise a range of pieces of advice, from

One of the co-designed modifications we tested

choice of oil, driving speed, car weight, personal comfort and journey planning.[6] We chose to focus on the challenges of implementing these tips with Hackney Carriage drivers due to their professional interest in reducing the costs of driving, their driving expertise, and because of their potential capacity to influence a large number of passengers from a range of backgrounds. We worked with twenty drivers, two from each of the following cities: London, Birmingham, Manchester, Nottingham, Bristol, Glasgow, Norwich, Sunderland, Sheffield and Portsmouth.

This was an exploratory study designed to learn about the challenges of driving more fuel efficiently, and to raise awareness of the financial and environmental value of doing so. The aim was not to test a particular hypothesis, or quantify the effectiveness of any single approach, but to better understand the challenges of changing environmental behaviour for a particular subset of energy users.

The attempts to begin to make fuel efficient behaviour habitual and contagious included:

This was an exploratory study designed to learn about the challenges of driving more fuel efficiently, and to raise awareness of the financial and environmental value of doing so.

- An incentive to participate and win in a national competition
- Continual comparative online feedback
- Specialist advice on fuel efficient driving in real time contexts
- Informed reinforcement of driving and car maintenance advice

We also hosted a deliberative workshop with some of the cabbies, where we discussed some relevant findings from behavioural science to help them address the 'action gap' between knowing what to do and actually doing it, and to become more aware of their potential influence on other drivers. During this event, four modifications to the taxi 'habitat' were co-designed with the cabbies:

- A silk money bag to prime the idea of smooth driving
- Dashboard stickers to make feedback more immediately relevant
- A passenger journal designed to stimulate discussion on fuel efficiency
- A spring device giving audio feedback on harsh braking and acceleration

Telemetry devices were installed in the taxis, which recorded four

behaviours that are particularly wasteful of fuel: idling, over-revving, harsh acceleration and harsh braking. The drivers were measured over a month relative to a two-week baseline measure, and for two weeks after the competition. The fuel efficiency algorithm was weighted towards improvement in these four behaviours, relative to baseline measures, rather than overall performance, to help control for differences in vehicles and driving conditions. Four drivers were asked to keep a written diary of their fuel use in context, and two dropped out due to unforeseen circumstances, so the final quantitative data sample was fourteen drivers.

While the sample size is too small to draw conclusions about which particular interventions were most effective, the indicative results for the overall approach were promising. On average the drivers drove 20% more fuel efficiently than their baseline measures, representing cash savings of £1146 per year for each cabbie.[7]

The recommendations arising from the project as a whole are outlined in detail at the end of this report. They include making habitual behaviour (rather than just behaviour) the focus of interventions, making fuel efficiency a pass/fail criterion on the driving test, changing driving habitats to encourage fuel efficiency, incentivising taxi drivers to become ambassadors for fuel efficiency, providing more salient feedback, and making taxis greener.

Introduction

'The world's top climate scientists are now ringing the alarm bells at a deafening volume because the time to act has virtually passed, yet it is as if the frequency of the chime is beyond the threshold of human hearing.'

Clive Hamilton[8]

In the late autumn of 2011 we learned that the world pumped about 564m more tons of carbon dioxide into the air in 2010 than it did in 2009, an increase of 6%.[9] Levels of greenhouse gases are now higher than the worst case scenario outlined by climate experts four years ago.[10] Carbon dioxide stays in the atmosphere for decades, and for every year that we increase emissions like this, we will have to reduce them even more drastically, and therefore with even more difficulty in the future. Such increases are not merely a sign that we are failing to adapt to the challenge of climate change, but also a signal that relying exclusively on technological and market-driven fixes is foolhardy.

Bluntly stated, we are not getting it. As John Reilly, the co-director of MIT's Joint Program on the Science and Policy of Global Change put it: "The more we talk about the need to control emissions, the more they are growing."[11]

So what do we do? Climate change is a multi-dimensional global challenge, raising profound scientific, technological, political and ethical questions. Yet the mismatch between the scale of the challenge and existing efforts to address the problem point to something more troublingly prosaic. For those who are not working directly to address the issue, Climate change lacks salience. While it may be viewed as significant in general terms, for most of us it is not important enough, immediate and personal enough, to compel us to change our behaviour because of it.

The distinct and somewhat terrifying challenge of climate change is that by the time it becomes salient, with major impacts on people's lives and livelihoods, it may be too late to prevent irreversible degradation of our quality of life. Changing behaviour now is a critical part of the solution, but creating, motivating and supporting such change requires that

the issue becomes more salient in the population at large.

Scientific announcements, no matter how dire, do not seem to help in this regard. In this report we suggest that making an issue personally and repeatedly relevant to people is best achieved by focussing on the needs and interests of particular individuals within particular groups. This kind of approach requires targeted and discerning engagement, through a careful understanding of the needs, habits and opportunities of the people within the selected groups.

The winning driver, Bernie from Norwich, drove

45% better

than baseline, representing a personal saving of about £927 over a year

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This report details a modest attempt to increase the salience of climate change in general, and the importance of fuel efficiency in particular, for a selection of taxi drivers across the country. Our engagement with the drivers went well beyond simple information dissemination. The process as a whole included an incentive to participate and win a national competition, continual comparative online feedback, specialist advice on fuel efficient driving in real time contexts, informed reinforcement of driving and car maintenance advice, four modifications to the taxi 'habitat' including dashboard stickers to make feedback more immediately relevant, a silk money bag to prime the idea of smooth driving, a device to give audio feedback on harsh braking and acceleration and a journal to allow passengers to give feedback on the smoothness of the drive. We also offered some behavioural insight to deal with the 'value-action gap'

between knowing what to do and actually doing it.

This was an exploratory study conducted within the paradigm of participatory action research. The work was motivated by a desire to help taxi drivers drive more fuel efficiently and to raise awareness of the environmental and financial benefits of doing so. The principal aim was not therefore to quantify the effectiveness of any single approach, but rather to find out more about how a particular subset of energy users respond to efforts to help them change.

The drivers' change in behaviour was measured by telemetry devices installed in the taxis, which recorded four actions that are particularly wasteful of fuel: idling, over-revving, harsh acceleration and harsh braking. The drivers were measured for a two week baseline measure, then over a month during which a number of interventions were made, and finally for a subsequent two weeks. The fuel efficiency algorithm was weighted towards improvement in these four behaviours relative to baseline measures, rather than overall performance, to help control for differences in vehicles and driving conditions. Four drivers were asked to keep written notes of their fuel use, and two dropped out due to unforeseen circumstances, so the final quantitative data sample was fourteen drivers.

While the sample size is too small to draw conclusions about which particular interventions were most effective, the overall results were promising, with cabbies on average driving approximately 20% more fuel efficiently than their baseline measures. This represents a cash value of £1146 per year for each cabbie. The winning driver, Bernie from Norwich, drove 45% better than baseline, representing a significant prospective personal saving of about £927 over a year.[12]

This final report follows from our interim report, *Inside the Mind of a Cabbie*,[13] to detail the action research process, reflect on the results of the competition, and consider how this overall project might inform the wider discussion around more engaged forms of behaviour change in the context of climate change.

The overall results were promising, with cabbies on average driving approximately 20% more fuel efficiently than their baseline measures.

Behaviour

In light of the rising demand for energy, Dr Graham Sweeney at Shell argues that it is likely that by 2050, when we are expected to have 9 billion people, ¾ of whom will live in cities, 60% of the world's energy needs will still be met by fossil fuels.

Climate Change: Behaviour is not a side issue[*]

This report grows out of collaboration between RSA's Social Brain project and one of the world's largest energy companies, Shell. It is therefore worth briefly commenting on Shell's broader perspective on climate change, to place the emphasis on behaviour change and fuel efficiency in context.
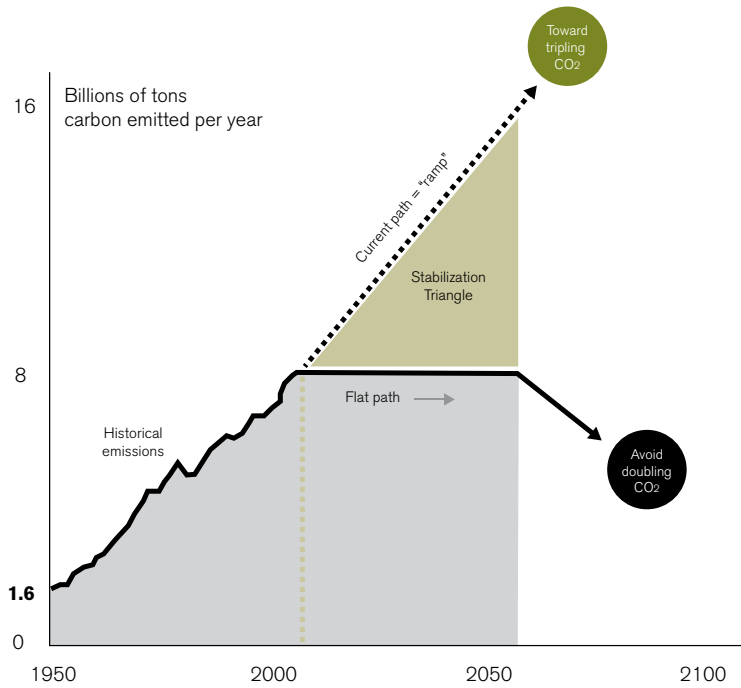
Shell's energy scenarios up to 2050 include a foreboding 'Scramble' scenario in which the path of least resistance in the present leads to heightened global tensions over fuel. However, there is also a 'Blueprints' scenario in which 'coalitions of interests begin to adapt to the scale of the challenge, and positive outcomes are built up from the distributed pursuit of individually modest opportunities and objectives.'[14]

This paper speaks to these modest but very necessary opportunities and objectives, and forms part of the effort to shift the public mood in support of the kinds of deeper solutions needed to deal with anthropogenic climate change.

A combination of high levels of economic growth in developing countries, the perceived imperative of economic growth in developed countries, and a rise in global population means that, short of a radical overhaul of the entire world economic and political system, the world's energy needs will continue to grow. The question of how that growing energy demand can be met in a sustainable way is extremely complex and increasingly urgent. Shell sum up the challenge for energy and planet in five words: 'more energy, less carbon dioxide'.[15]

[*] The following section provides the theoretical rationale for the value of this project in the context of climate change, and for RSA's approach to behaviour change that underpinned it. Those wishing to read about the practical project can go straight to the 'Experience' section.
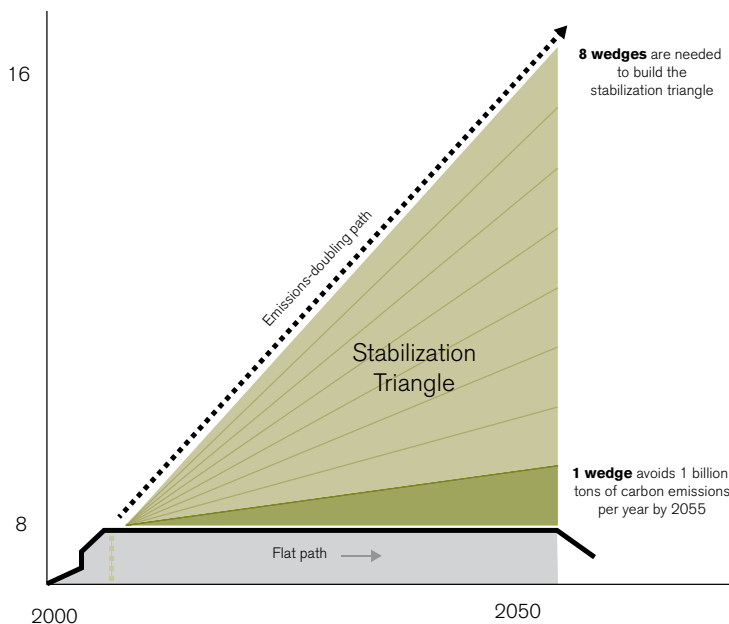
Fig 1: Stabilization Wedges, Carbon Mitigation Initiative, Princeton University

Billions of tons carbon emitted per year

16

8

1.6

0

1950   2000   2050   2100

Toward tripling CO2

Current path = "ramp"

Stabilization Triangle

Historical emissions

Flat path

Avoid doubling CO2

Fig 2: Eight Stabilization Wedges Required, Carbon Mitigation Initiative, Princeton University,

16

8

2000   2050

Emissions-doubling path

8 wedges are needed to build the stabilization triangle

Stabilization Triangle

1 wedge avoids 1 billion tons of carbon emissions per year by 2055

Flat path

In light of the rising demand for energy, Dr Graham Sweeney at Shell argues that it is likely that by 2050, when we are expected to have 9 billion people, ¾ of whom will live in cities, 60% of the world's energy needs will still be met by fossil fuels.[16] In this context, he sums up the Shell attitude to climate change by saying they are committed to 'doing the doable'. Dr Sweeney also emphasised the 'need to reposition our thinking so that action to support progress to a lower carbon world is recognised as adding economic value.'[17]

Shell's current approach includes producing more natural gas, developing lower-carbon biofuels, helping to advance carbon capture and storage (CCS) technologies, and working to improve energy efficiency in their operations. Shell has also campaigned for a more effective carbon market and have created their own value for CO_2. While the carbon price in Europe is currently between €6 and 8 per tonne[18] (UN Certificates of Emission Reductions and European Union Allowances both fell to a record low in late November), Shell uses a value of about £25 per tonne of CO_2 when evaluating all new projects.[19]

Technological innovation and carbon markets are significant and commendable responses to the climate change problem. At the same time, it is important to state that if it does transpire that 60% of our energy needs will be met by fossil fuels in 2050, this will be not be as a natural default, but as the result of strategic choices made by governments and energy companies. Moreover, the impact of that outlook is in tension with the vision of the International Energy Agency (IEA), often considered the gold standard on emissions and energy, and generally relatively conservative rather than alarmist in outlook.[20] The IEA's perspective is relevant because it suggests one of the main reasons that the window to prevent global temperature rises above safe levels is rapidly closing is the continual investment in fossil fuel infrastructure, supported by Government subsidies.[21]

Shell describes the energy problem by developing Margaret Thatcher's

TINA slogan into TANIA: 'There are no ideal answers'.[22] There will clearly be difficult trade-offs ahead, but it is worth placing what follows in this perilous context because even if we collectively managed a shared and sustained commitment to a significantly higher use of renewable forms of energy, there will still be an important question of how efficiently that energy can be used.

Many argue that reducing demand is the first step to reducing the carbon intensity of the energy system. For instance, the Institution of Mechanical Engineers argues that we should prioritise conservation and efficiency improvements over renewable (and fossil fuel) energy generation.[23] More recently, Jeremy Rifkind, who argues for a 'Third Industrial Revolution' in which individual households create their own renewable energy and share it as we share information online, suggests we have to start with efficiencies.[24]

Four reasons that behaviour change is pivotal

Rather than view behaviour change as some sort of bonus cherry on a cake made with policy, technology and economics, we view it more like the flour, a fundamental part of any viable climate change abatement or adaptation strategy. This perspective is grounded in four important points in ascending complexity.

1. The Behavioural Wedge
One of the clearest expressions of the challenge comes from the Carbon Mitigation Initiative at Princeton University with their concept of stabilization 'wedges'. To get on track to avoiding dramatic climate change, the world must avoid emitting about 200 billion tons of carbon, or eight 25 billion ton 'wedges', over the next 50 years. Each wedge represents one billion tons of carbon that have to be reduced, and it is thought we need eight such wedges to prevent carbon emissions continuing to rise, and to eventually reduce them below our current levels. These wedges include the impact of new technologies, the success of carbon capture and storage, improved regulation and so on.[25]

Recent research has developed the idea of a 'behavioural wedge' to add to existing wedges, i.e. the behavioural changes that would together amount to one of these 1 billion tons of carbon emissions. Such behaviour changes include household energy use, food consumption, waste management and transportation. A report by the National Resources Defence Council and Garrison Institute details the role of driving in this bigger picture:

'Every year, we waste 5 to 8 percent of our gasoline idling, largely due to a misconception that idling causes less wear and tear, and even less fuel consumption, than shutting off and restarting a car's engine. Reducing idling by 50 percent would have an immense impact, reducing greenhouse gas emissions by 40 MMtCO2e. Improper vehicle maintenance drags down vehicle fuel efficiency and wastes billions of gallons of gasoline every year. In 2005, underinflated tires alone caused more emissions than each of the 65 smallest greenhouse gas-emitting countries in the world.'[26]

So the first reason to care about behaviour is that the total amount of energy that can be saved from relatively minor behavioural changes is significant in purely quantitative terms.

2. The Behavioural Multiplier
A related, but somewhat distinct point is that the success of new technologies or regulations depends upon behavioural changes. For instance, new feedback mechanisms in cars require drivers to care about the new information they are receiving and be able to act upon it. Government regulation, for instance to increase incentives to save energy in the home requires popular uptake. The impact of these kinds of progress can be multiplied by a little or a lot, depending on the extent to which people change their behaviour accordingly.

3. The Relative Speed of Behaviour Change
One of the many counter-intuitive aspects of climate change is that the urgency of the challenge is related not just to progressively damaging rises in CO2 emissions and the possibility of 'tipping points', but the fact that

Even on the most optimistic assessment, technology alone cannot solve the problem in time. If we want to keep temperature rises within the two degrees, as the UN believes is imperative, we need other measures that, even if they do not amount to adequate solutions by themselves in the long term, have a direct impact in the short term so that long term prospects are improved. As things stand, technology is likely to be too slow, there is political drift, and no viable global carbon market, all of which makes changes in human attitudes and behaviour an imperative, not least because movement on that front may help to shift inertia elsewhere.

carbon stays in the atmosphere for about a hundred years. For those who believe that technology will solve the problem, this fact should be highly significant. Even after scientific breakthroughs, technological change and implementation takes a long time, and during that time the problem will have become that much worse, and progressively more difficult to solve.

An article in Nature in 2009 identified two common 'laws' of energy technology success in the past. First, it takes 30 years for a new technology to reach 1–2% of the global energy mix. Second, the new energy technology then grows more linearly to its final share dependent on economic competitiveness.[27]

Shell is one of many energy companies that believe these constraints also apply to related technologies, even if at first glance they may appear to be just around the corner, whether that be advanced biofuels from biomass, hydrogen fuelled cars, or even electric cars that are already rolling off the production lines. For example, at optimistic production rates it may take until about 2030 (20+ years) for 40 million electric cars to penetrate the US market and even then that would represent only about 16% of the American fleet.[28]

In Shell's two Energy Scenarios, mentioned above, the analysis suggested that even the most optimistic scenario, Blueprints, which assumed a trajectory of technology innovation never achieved before, would still result in levels of approximately 650ppm for all greenhouse gases and a temperature rise above 3°C in 2100 relative to pre-industrial levels. This outcome is significantly higher than the 450ppm and 2°C levels that are generally talked about as representing 'safe' limits.[29]

In other words, even on the most optimistic assessment, technology alone cannot solve the problem in time. If we want to keep temperature rises within the two degrees, as the UN believes is imperative, we need other measures that, even if they do not amount to adequate solutions by themselves in the long term, have a direct impact in the short term so that long term prospects are improved. As things stand, technology is likely to be too slow, there is political drift, and no viable global carbon market, all of which makes changes in human attitudes and behaviour an imperative, not least because movement on that front may help to shift inertia elsewhere.

4. Behaviour Drives Attitudes

It would appear to be common sense that attitudes and behaviour are linked, and that attitudes drive behaviour rather than vice-versa. On this common sense view, if you want people to behave in an environmentally friendly way they need to first care about the environment, and once that change in attitude is achieved, environmentally friendly behaviour will follow. However, the evidence on this issue is somewhat equivocal. Behaviours and attitudes are often disjunctive and we frequently say one thing and do another. Moreover, as indicated below, a great deal depends on how you frame, define, and measure behaviour and attitude. However, the balance of evidence is that behaviours drive attitude as much if not more than the other way round.[30] Moreover, the influence of attitude on behaviour seems to depend a lot on the extent to which behaviour is habitual, which is a large extent in the case of drivers in general, and taxi drivers in particular.[31]

One implication is that if you want to get somebody to care about the environment, don't preach to them about its importance, but get them to behave in an environmentally friendly way through some other form of stimulus or incentive and the importance may become clearer to them. In this context, an intelligent way to raise the salience of climate change is to frame the saving of fuel as a personal and environmental gain.[32]

Why does this matter? In addition to the behavioural wedge we need to save, the multiplier effect and the relative ease of changing behaviour quickly, working to change behaviour is potentially a way to galvanise other forms of action and by changing attitudes through people, to help build political will for social and government action on climate change.

What Kinds of Behaviour Change do we Need?

Given the importance of behaviour change, making sense of what we mean by behaviour is not of mere philosophical value, but directly informs how we might go about trying to change it. While we cannot explore this question in depth here, to make sense of the diverse range of approaches to behaviour change in this project a brief overview of these big questions is required. What is behaviour? What kinds of behaviour change do we need?[33]

Classic psychological behaviourism, popular in the nineteen sixties, was based on the idea that there is no meaningful difference between publicly observable processes in the form of actions, and privately observable processes like thinking and feeling. For classical behaviourists, if two drivers stop idling in response to the information that idling wastes fuel, there is little point in asking them whether they did it because they care about the money or the climate, or both, because the stimulus (information) and the response (behaviour) are not thought to be mediated by any scientifically accessible thought or feeling.

There are few self-respecting behaviourists of that mould in the world today. Increasingly sophisticated accounts of cognition, language acquisition, meaning making, reflexivity, cultural influences and neuropsychology mean that classical behaviourism has been rejected as a credible perspective.[34] However, when thinking about behaviour change it is easy to lapse into this kind of simplistic perspective on behaviour without realising you are doing it.

In its view of human cognition, *Nudge* is very different from behaviourism, but it is vulnerable to similar moral critiques. While the libertarian paternalism that underpins *Nudge* stems from an understanding of human biases and recognises mental processes, it still views behaviour in terms of individual actions responding to changes in environmental stimuli. While Sunstein and Thaler, the authors of *Nudge*, state that they respect individual freedom and their aim is to

maximise choice, the emphasis is on sending cues to the automatic system so that it responds differently to how it might have behaved without that cue, usually by increasing the likelihood of the choice predicted by those designing the nudge. While a classical behaviourist would change behaviour gradually through conditioning, nudges often have a more direct and immediate effect, but the model is still based on asymmetries of power and knowledge, and in this respect can be thought of as crypto-behaviourist.[35]

Such an approach has already shown its power and relevance, but it has some limitations.[36] Perhaps the most important limitation is that nudges tend to work on issues where people feel relatively indifferent between choices that are not of daily relevance, like organ donation or whether to opt into pension schemes, rather than on issues where desire, convenience and habit are paramount, like dietary choices or driving habits.[37] Major social problems, including the waste of energy, arise mostly because people often prefer to do things that aren't in their long-term interest or the collective interest. As environmentalist Tim Chatterton put it, 'it is easier to nudge people downhill than to nudge them uphill.'[38]

A less behaviourist, more autonomous form of nudging would recognise that people have the capacity to reflect on their choices in light of their values, and in response to what they learn about their habit-forming and decision-making tendencies. Such an approach, like the one we conducted with taxi drivers, is more labour intensive, and harder to scale, but may give us more chance to change not merely behaviours, but also some of the values and attitudes that underpin them.

Shell is to be commended for recognising the importance of having a theory of behaviour, rather than trying to measure or change it without any ontological basis. They view behaviour as a form of goal-pursuit, summarised as follows:[39]

"All our behaviours result from the pursuit of goals. We have a hierarchy of goals, from long-term abstract strategies for living, to very short-term, concrete, in-the-moment goals.

Ultimately all our goals derive from the biological imperatives we have to survive and reproduce, in the physical and social environments we grow up and live in. That means that while some of our goals are functional, many are symbolic – they are about signalling about ourselves to other people. Although we're aware of some of goals, and pursue them consciously, we have many others that we're not aware of, and pursue automatically, for example out of habit. Finally, people pursue multiple goals at the same time. Some complement each other, and make particular behaviours more likely. Others conflict, and compete in our minds to control our behaviour."

This approach goes beyond saying behaviour is a response to cues in the environment, and suggests that the perception of environmental cues will be viewed with respect to our goals. The goal-seeking perspective helps to differentiate behaviour from mere action and is very useful in the context of fuel efficiency. For instance, driving behaviour is often connected to symbolic goals, and may serve to signal freedom to oneself and status to others. The explanatory power of this perspective depends upon having a rich account of how we form and change our goals, and how our goals influence, and are influenced by others. Of course, the evolutionary perspective is only part of the story, and the RSA is interested in how goals change in light of conscious deliberation and self-awareness.

As we have argued in *Steer*, and *Transforming Behaviour Change*, the RSA believes that successful strategies for enduring behaviour change on issues of major importance will require us to pay greater heed to the relevance of reflexivity, with behaviour viewed in terms of how personal agency changes in light of critical self-awareness.[40] Our approach is holistic in that we believe in working with both controlled and automatic aspects of our behaviour, and it is reflexive in that it attempts to generate a kind of recursive self-awareness, in which knowledge about our own natures helps us to shape our own environments, interactions

and behaviour in ways that are aligned with a truer understanding of ourselves and our relationship to others.

This kind of perspective is different from prevailing views because it requires active engagement with people, and a deliberative and iterative process of discussing behaviour and attempting to change it accordingly. Such an approach is labour intensive, and challenging to scale, but for problems of a certain nature, we believe it is the most promising approach.

Fuel Efficient Behaviour as an Adaptive Challenge

The most common leadership failure stems from attempting to apply technical solutions to adaptive challenges.

Ron Heifetz[41]

Harvard Professor Ron Heifetz makes a useful distinction between technical problems and adaptive challenges in this regard, which highlights the kinds of behaviour change we are most interested in. Adaptive challenges require changes in attitudes and perspectives and not just behaviours, and they can only be addressed by the people who have them, which is why they are difficult to identify and easy to deny.

Understandably, policymakers prefer technical solutions, which use existing expertise to target discrete measurable problems, and although The approach of *Nudge* is informed by behavioural science, it remains a technical solution. Adaptive challenges tend to be messier and require people to change their view of themselves in certain ways, which is why policymakers tend not to engage with them as much, and perhaps rightly so. Individuals paying a few pounds extra for carbon offsetting is a technical solution to greenhouse gas emissions as is raising taxes on flying, while getting people to fly less for environmental reasons is an adaptive challenge. In the context of this study, while the technical problem of fuel efficiency is lack of awareness of the range of measures that can save fuel, and how much impact these measures can have, the adaptive challenge is more profound. How

Technical Problems vs. Adaptive Challenges

From Eric Svaren, Groupsmith.com Adapted from Ronald A. Heifetz & Donald L. Laurie[42]

Technical Problems	Adaptive Challenges
1. Easy to identify	1. Difficult to identify (easy to deny)
2. Often lend themselves to quick and easy (cut-and-dried) solutions	2. Require changes in values, beliefs, roles, relationships, & approaches to work
3. Often can be solved by an authority or expert	3. People with the problem do the work of solving it
4. Require change in just one or a few places; often contained within organizational boundaries	4. Require change in numerous places; usually cross organizational boundaries
5. People are generally receptive to technical solutions	5. People often resist even acknowledging adaptive challenges
6. Solutions can often be implemented quickly—even by edict	6. "Solutions" require experiments and new discoveries; they can take a long time to implement and cannot be implemented by edict
EXAMPLES	
- Take medication to lower blood pressure	- Change lifestyle to eat healthily, get more exercise and lower stress
- Implement electronic ordering and dispensing of medications in hospitals to reduce errors and drug interactions	- Encourage nurses and pharmacists to question and even challenge illegible or dangerous prescriptions by physicians
- Increase penalty for drunk driving	- Raise public awareness of the dangers and effects of drunk driving, targeting teenagers in particular

Adaptive challenges require changes in attitudes and perspectives and not just behaviours, and they can only be addressed by the people who have them, which is why they are difficult to identify and easy to deny.

do you turn information about fuel efficiency into the enduring disposition to behave fuel efficiently?

This distinction between technical solutions and adaptive challenges is therefore important for this project and climate change more generally. Information about what to do, and even evidence about what we have to do are important, but they are only part of the solution. While technical problems can be simplified, instrumentalised, and addressed with familiar tools, from a behavioural perspective, climate change is also an adaptive challenge, requiring us to face up to our complex relationships to knowledge, requiring fresh human reflection, responsibility and insight. This perspective explains the necessity for the preparatory work required to think about energy use and misuse as an adaptive human challenge,

by gaining a deeper understanding of a particular sub-set of motivated energy users.

While most of Shell's fuel saving tips were relevant to cab drivers, even those tips that were described as 'common sense' were not always things the drivers did on a regular daily basis. This kind of action gap between knowing what to do and actually doing it highlights that the challenge of turning information on fuel efficiency into fuel efficient habits is adaptive in nature. Rather than framing the challenge of fuel efficiency in terms of a discrete problem that can be directly solved, when viewed as an adaptive challenge, the task is to face up to the strengths and limitations inherent in our own natures, and examine the qualitative impact of a range of approaches.

Goal

You breathe automatically, you see automatically, but you think, decide and act habitually. Habits are driven by our automatic (principally limbic) system, and often feel automatic due to the way our brains predict events, and reward us when those predications are accurate, principally through the release of the 'feel good factor' in the form of dopamine

Fuel efficient behaviour as habitual and contagious[43]

The reflexive-holistic account of behaviour is well suited to adaptive challenges, and also has direct implications for the kinds of behaviour change you try to achieve. In this case, while time and budgetary constraints prevented an experimental test of our ideas or a longitudinal study, we wanted to use the opportunity to demonstrate how you might begin to go about working to make behaviour habitual and contagious. While neither task is easy, and the relationship between them is complex, the aim is to think about how fuel efficient driving might become an enduring disposition performed without conscious thought, and to consider ways in which such behaviours might spread to others through social diffusion. What follows gives an outline of why this perspective is a worthwhile goal in this context, and this argument

is unpacked in detail in other RSA reports.[44]

Habituation

"The chains of habit…are too weak to be felt until they are too strong to be broken."

Samuel Johnson

Driving is what Tom Vanderbilt calls an 'overlearned' behaviour. Most drivers form and then reinforce habits through repeated practice.[45] This feature of driving makes it especially difficult to change. Indeed, in a recent study of potential behaviour changes that might save energy, driving behaviours were considered to have only 25% 'behavioural plasticity' i.e. there is not that much scope for changing them. However, this figure is based on an educated guess and a particular theoretical perspective and should not be viewed as an immutable

law. By recognising habits as the main target, we may be able to design more successful behaviour change interventions.[46]

The centrality of habit emerges from viewing human behaviour as a three-part rather than two-part relationship. At the neuroscientific level, it is accurate to divide our brains into a controlled system and an automatic system, in which our automatic and largely unconscious behaviours are supplemented and informed by occasional conscious deliberation. However, when you consider the relationship of these two systems operating within the environment, our behaviour is mostly habitual, which means that we act without thinking in situations that appear familiar.

a recent study by Phillipa Lally at UCL suggests that it takes about

66 days

for a behaviour to become habitual

You breathe automatically, you see automatically, but you think, decide and act habitually. Habits are driven by our automatic (principally limbic) system, and often feel automatic due to the way our brains predict events – and reward us when those predications are accurate, principally through the release of the 'feel good factor' in the form of dopamine.[47] The point is that we adjust to new circumstances very quickly. It is hard for people to keep up enthusiasm for behaviour changes they start, like a new driving behaviour, because although you initially get dopamine rewards that reinforce the forming of a novel habit, after just a short time, this reward will wane and you will be relying on willpower, which we know to be scarce and depletable.[48]

Habits are important because they define who we are, but also because they can be changed. Despite this neurological basis for habituation, habits are acquired and conditioned behaviours rather than strictly automatic. They are second nature rather than first, and therefore amenable to the influence of deliberation and reflection, and also to changes in our environment. By using whatever conscious control you have, you can shape your living conditions, your 'habitat', such that your automatic system is not given the fuel of familiarity, and your habitual behaviour is not repeatedly reinforced in undesirable ways. Through deliberation, you can also begin to act on whatever is preventing you from behaving as you would wish to. For instance the taxi drivers spoke at length on the circumstantial constraints they felt in implementing the fuel efficiency advice, including pressure from passengers to drive quickly and keeping the car warm while waiting in a taxi rank.

We know a lot about how hard it is to change bad habits, and relatively little about how we form good habits. However, a recent study by Phillipa Lally at UCL suggests that it takes about 66 days for a behaviour to become habitual, by which she means completed without thinking about it.[49] This point explains why habituation has a social dimension. We rarely succeed in changing our habits and thereby shaping our lives in the way we want to if we 'go it alone' because we tend to give up before the new behaviour has become habitual. Instead we need what Avner Offer called 'commitment devices', often involving pledges to others that we will change our behaviour in certain ways over a period of time.[50]

We also need to pay close attention to the way the habituation process arises in ourselves. We need to respect that we are creatures of habit, and appreciate that changing habits will be conflictual, about one relatively weak part of our nature (conscious willpower) trying to overcome a relatively strong part (habitual behaviours). This recognition brings humility, and should prompt us to be more creative and resourceful in our efforts to change our behaviours.

Social Diffusion

Christakis and Fowler's research on social networks indicates the influence of our connection to others extends to three degrees:

'Everything we do or say tends to ripple through our network, having an impact on our friends (one degree), our friend's friends (two degrees) and our friend's friend's friends (three degrees). Our influence gradually dissipates and ceases to have a noticeable effect on people beyond the social frontier that lies at three degrees of separation. Likewise we are influenced by friends within three degrees but generally not by those beyond.'[51]

The three degrees of influence rule is one of the main network heuristics to emerge from a series of influential papers on a range of topics including obesity, happiness and smoking, in which Christakis and Fowler highlight the extraordinary power of social networks to influence behaviour, spread values and shape attitudes.[52]

Subconsciously or otherwise, we end up aping what our friends do and this mimicry is in turn passed on to others in the chain, influencing people several degrees of separation removed from ourselves. Cultural psychologist Michael Tomasello has described imitation as the link between biology and culture, and this adaptive trait – to want to do what others are doing – underpins the importance of social networks for spreading desirable behaviours.

In this respect, it is not surprising that social connectivity matters at a cognitive and emotional level, as social neuroscientist John Cacioppo explains:

"The telereceptors of the human brain have provided wireless broadband interconnectivity to humans for millennia. Just as computers have capacities and processes that are transduced through but extend beyond the hardware of a single computer, the human brain has evolved to promote social and cultural capacities and

processes that extend far beyond a solitary brain." [53]

Social networks are typically comprised of groups of varying sizes rather than individuals, so connecting with one group invariably means connecting with more than that group alone, if only because each individual member of a group typically belongs to other groups too. Membership of one group breeds membership of another in a multiplier effect that expands the growth and strength of the network exponentially. This bridging or linking capital is the kind of connectivity from which most people benefit. This point matters for the current project because individual drivers offer a one-to-many network, and drivers as a group represent a many-to-many network; by targeting taxi drivers as a group, you potentially connect with several other groups. In light of the new understanding of our connectivity, taxi drivers appear to be ideally placed to spread fuel efficient behaviour, and we attempted to address this in our methods (see below). [54]

Climate or cash: are we reinforcing the wrong kinds of values?

One of the main forms of information given about fuel efficiency, and the one that took prominence in this project is the information that tells you how much money can be saved from fuel efficiency. While the conventional wisdom on fuel-efficient behaviour is that it represents a win-win scenario of saving people money, while helping to protect the environment, there is an important perspective that challenges this view.

Financial incentives may work well in promoting fuel-efficient behaviour, and saving taxi drivers money, but it does not necessarily follow that financial incentives are the best strategy for tackling climate change more generally. Indeed, many have argued that appealing to financial self-interest reinforces certain values e.g. consumerism, competitiveness, self-interest, that are the root of the climate problem. While one may save fuel in one domain of life, for instance driving, the overall impact is less clear, because the underlying consumerist mindset is not challenged and may even be reinforced, while the money saved might be used to spend on fuel-intensive products or services, for instance long-haul flights.

Those who argue for this position, including WWF, Oxfam, Friends of the Earth, The Campaign to Protect Rural England and the Climate Outreach and Information Partnership believe that since existing approaches to the climate crisis appear to be failing, we need to try to work more directly to reinforce values that help us to address what they call 'bigger than self' problems like climate change. This strategy involves recognising that while some values are complementary, others are in direct opposition. With this in mind, it could be that attempts to save fuel for purely selfish financial reasons do not in fact represent environmental progress. [55]

We do not have a settled opinion on this issue at present, but feel it is an important one to be aware of. We tried to keep it in mind while thinking of how to help the drivers to help themselves save fuel, for instance by constantly reminding them of the bigger picture on climate change, and their social role in reminding passengers about saving fuel. Moreover, our research into the lived world of the cabbies suggested that financial incentives were far more likely to appeal than appeals to the environment. There is also an argument, outlined by values theorist Pat Dade, that appealing to the values that underpin material desire, and seeking to satisfy them, may be an important part of leading people to the higher values involved in caring about 'bigger-than-self' problems. However, this claim is contested and the question of where values fit into promoting environmental behaviour currently feels unresolved. [56]

The headline finding of this study is that each cab driver saved an average of £1146 a year. This is clearly good economic news, but one environmental question follows, and it remains an open one: How likely is it that this money will be used for goods or activities that are less energy consumptive than driving?

Our research into the lived world of the cabbies suggested that financial incentives were far more likely to appeal than appeals to the environment.

Experience

Keeping manual records helped drivers to realise the impact of driving conditions beyond their control on the amount of fuel consumed. For example, John wrote "When looking at the figures, I finally realised that heavy traffic has a disastrous effect on consumption"

Smarter Cab Drivers

While energy scarcity is an issue for everybody, those who fill up their fuel tanks on a daily basis as part of their working routine, like taxi drivers, are particularly motivated not to waste fuel. Moreover, other environmental concerns drive concerns for fuel efficiency as well as scarcity. While not the biggest polluter, taxis nevertheless contribute 4% of London's transport CO_2 emissions,[57] 12% of nitrogen oxides and 24% of particulate matter in the capital.[58]

A further reason for working with cab drivers relates to their potential role in social diffusion. Based on the understanding of the power of social networks mentioned above, taxi drivers, as spreaders of news and informal opinion shapers could function as powerful ambassadors, spreading advice on fuel-efficient driving to their colleagues and passengers. Indeed, cabbies have already served this function, to spread awareness of the Turner prize, and of TED talks.[59]

Recruitment

Drivers from ten cities were chosen to be the participants in the Smarter Cab Drivers project; Birmingham, Bristol, Manchester, Norwich, Nottingham, Portsmouth, Sheffield, Sunderland, Glasgow and London. In each of these cities, drivers were recruited via radio taxi companies. They were incentivised to take part with fuel vouchers for Shell diesel; each driver received £250 at the beginning of the process, and £250 on completion of the challenge.

All the drivers were male, were aged between 32 and 68 (average 49) and brought a total of 285 years of driving taxis (average 15) to the programme. Many of them had come to taxi driving as a second career, sometimes after professional driving in a different context – but often after something completely different.

The understanding of cabbies presented above helped us to frame the strategy for helping them to change their behaviour. The point was not for us to devise new levers to pull that will directly solve the problems they have in saving fuel (technical solutions) but rather to offer these insights to the cabbies to help them understand and address their own particular adaptive challenges.

We also hoped that these insights would help us to communicate behavioural principles to taxi drivers, while also allowing them to become more reflexive about their own natures and behaviours, and better able to design physical changes to their habitats in ways that will hopefully help them save fuel.

The above findings helped to inform behaviour-change interventions with taxi drivers at the RSA Workshop on June 16th, where we were mindful of the following issues:

Due to their recognition of the gap between knowing they should do something (e.g. drive smoothly) and actually doing it, the focus was not on information dissemination but on understanding that our brains can be viewed as two systems, like a pilot and an auto-pilot, and that the challenge with information is that it often only reaches the pilot, but has no impact on the auto-pilot. Given that most driving behaviour is automatic, the key is to find ways to shift habitual behaviours, which is why the workshop focused strongly on the relationship between driving habits and taxi habitats.

In light of the strong awareness of other drivers, and their explicit acknowledgment that this was an influence on their behaviour, we also sought to raise awareness of social contagion rather than explicit instruction. We therefore spent half of the time set aside for behavioural insight into a session on social norms and the power of social networks.

This device was partly to motivate drivers to overcome their fatalistic tendencies by showing that what they did had the potential to influence not only their passengers but also the people their passengers influenced i.e. that they may have great power to effect change.

We also felt it was very important to frame financial savings in tangible terms i.e. as a potential holiday, as the payment of discrete costs, and so always tried to stage the value of fuel efficiency in these more tangible terms.

There is a big challenge but also an interesting opportunity to consider imaginative ways to tap into the civic pride and ambassadorial role that drivers already latently feel. This was a further reason to emphasise the potential for drivers to be exemplars and spread fuel efficiency through their good example.

Likewise, there is already a strong public service ethos, but we need

Understanding the Drivers

In order to gain some sense of the context of taxi driving behaviour, we commissioned research in five areas that seemed most relevant: their worldview or personal outlook, their professional environment, their community, their behaviours and the physical habitat of the taxi. This research took the form of 'accompanied journeys'; a qualitative method that combines interviews with a participant at the beginning and end of a journey, together with observations.

The findings gained from this research were used to plan a deliberative discussion group that examined research insights in more detail, and allowed the drivers to discuss the findings together. The findings from the accompanied journeys and discussion group were published in an interim report: *Inside the Mind of a Cabbie*.[60]

There were twelve primary ideas that informed our approach. We found that that cabbies are:

1. …Working for their families
The overriding motivation for personal success strongly emerged as the desire to do one's very best for one's family. All the drivers who have children are socially ambitious for them, with some drivers educating their children privately, and others supporting their children through university.

"Until you have kids, you don't really understand it. You'd do anything for them, you'd give your life for them. I told my son, don't worry, whatever you need, a liver, a kidney, I'll give it to you."

2. …In it for the Money
While many of the drivers appeared to be socially engaged, and showed a strong concern for treating their passengers fairly, there was a clear sense that the bottom line was financial.

"We're all in it to make money — with responsibility of course."

3. …Fatalistic
Many cabbies have come into the profession due to circumstances beyond their control (e.g. job loss) and there are many aspects of the job beyond the cabbies' control (traffic, passengers, road works) so they develop equanimity in the face of shifting working conditions.

"When you get one [low-paying fare] after another, after another, and you know your day's wiped out."

"I take it a day at a time — if it happens it happens."

"The taxi god we call it."

4. …Patient
Drivers often have to wait for hours before picking up a fare. Only about a third of their working time is paid for, with the rest being waiting time or 'dead mileage'.

"If you drive a taxi you have to be very, very patient; nice people, bad people, traffic, accidents, everything — you have to be very patient."

5. …Independent
The feeling of autonomy is a major motivating factor, particularly being able to work whenever they like, and not being told what to do.

"You're not looking over your shoulder, you know… there's no one to tell you what to do."

6. …Ambassadorial
Most drivers expressed some fondness or allegiance for the place they work, and were aware that they were often the first people that visitors to their cities met. Many aspired to be ambassadors for their city.

"I like to make sure my passengers have a comfortable ride so they use me and my firm again and have a good impression of Birmingham."

7. …Tribal
The drivers defined themselves as a group, principally in opposition to other driving professionals, viewing private hire vehicles as rivals and bus drivers as aversive.

"You find that… a lot of people go into private hire driving in a recession, which dilutes the work for the hackney carriages as well."

8. …Mannerly
There appear to be subtle codes of etiquette among taxi drivers, and a shared sense of what 'doing the right thing' looked like on the road, with passengers, and why this spirit of public service is integral to the job.

"I treat people carefully. If it's a bad job, you just get on with it. The tip might be bigger at the other end. We're disappointed, but unfortunately there's a hardcore of people who'll slam doors, throw cases in… it's not funny, cos it's affecting our lives."

9. …Deeply concerned about the cost of fuel
Taxi drivers are acutely aware of how much mileage they get for their fuel, and troubled by the fact that the ratio of cost to profit is much less favourable than it used to be:

"I used to work off £10 and make my target, and since then I've had to double that and work longer hours to get what I want back."

10. …Waiting for more fuel-efficient vehicles:
While this project is about fuel efficient driving rather than vehicles, it is noteworthy that all the drivers felt the main barrier to fuel efficiency was the nature of the vehicles they had to work with:

"…Perhaps we should be attacking it from the other end; let's get some fuel efficient vehicles as taxis instead of the dinosaurs we drive at the moment that does 25 to 30mpg [miles per gallon] if you're lucky. I would like to be given the choice in Manchester, I'm sure people in London may like to be given the choice… there are a lot more vehicles that are fuel efficient"

11. …Ambivalent about climate change
The drivers' attitude to climate change developed in the course of discussions. Initially it was described by most drivers as an abstract and contested issue of limited relevance to their daily lives, but most drivers did feel it was likely to be a major issue in the future, and were concerned about the implications for their children.

"I think people are generally quite selfish, and it's got to be something that really affects them before it drives it home."

"…Where we're taxed massively for this climate change, you've got China laughing all the way to the bank with 6% growth and the biggest economy of the world. We're doing our bit and I'd like to see everybody do their bit."

12. …Aware of fuel-efficiency measures, but unsure of trade-offs
As expert drivers, the cabbies were aware of many of the ways in which they might save fuel, but they focused almost exclusively on tips relating to speed, starting and stopping, and often framed decisions on these issues as trade-offs in terms of other demands of the job:

"We all know how to drive fuel efficiently, we all know how to get more miles to the gallon, but unfortunately it's a compromise to get 80mpg or an extra job a day, and I would happily drive along the Broadway at 40mph so long as cabs didn't overtake me at 60mph, so that I'm 20 places back in the queue at the airport."

an expert discussion on what that might mean in practice, and we have indicated some possibilities in our recommendations below.

Although telemetry data was the default measure in the competition – recording aspects of driving behaviour directly from the engine - we decided to measure some drivers' fuel efficient behaviour differently, asking them to fill out a short daily manual log, and requiring them to keep a written diary of major observations and insights on their attempts to save fuel. We hypothesised that the small investment of time to record fuel used throughout the day might serve as a helpful commitment device, by making the feedback more tangible and meaningful to the driver. The process may heighten the reflexive process that is integral to the Steer approach to behaviour change, by connecting the requisite self-awareness involved in changing habitual driving behaviours with the self-awareness involved in experiencing the rewards of those changes.

Some of the comments the cabbies made in their journals confirmed that keeping manual records kept the issue of fuel efficiency foremost in their minds. For example, Philip noted that becoming aware through taking mileage readings helped him to make changes in his driving which led to a noticeable improvement in his fuel consumption. The narrative diaries kept by some of the drivers also revealed additional information such as the impact of the weather. On hot days, using the air conditioning was irresistible, but in John's case, his awareness of this increasing fuel consumption led to him noting "I must admit to feeling rather guilty when I do." Keeping manual records also helped drivers to realise the impact of driving conditions beyond their control on the amount of fuel consumed. For example, John wrote "When looking at the figures, I finally realised that heavy traffic has a disastrous effect on consumption". Some of the drivers who kept manual logs also seemed to enjoy keeping a record of the passengers they met each day, indicating that keeping a journal might have been positive in ways beyond simply raising awareness of fuel efficiency.[61]

Although the sample was too small to make definitive conclusions, it is noteworthy that on their self-report measures of fuel efficiency, the drivers who took manual recordings appeared to perform better than those who were measured through telemetry. Indeed, Phillip Caston saved the most fuel throughout the challenge. He saved 21 litres of fuel a week. If he continues to save fuel at the same rate all year, he stands to use 1109 litres less fuel. At a cost of 140 pence per litre, this equates to a potential annual saving of £1,552.

While there was little perceived value in tackling attitudes to climate change directly, we did want to open the cabbies up to the idea that their existing views on the matter may not be fully formed or grounded in sound evidence. The point was to suggest that whatever changes they made had value beyond the competition.

It is entirely possible that the mere fact the drivers knew they were taking part in a fuel efficiency study was the single biggest impact on their driving behaviour.

Changing Behaviours

We collected the drivers into two groups; all would undertake the full behaviour change programme, but ten would also receive extra attention in the form of a Steer workshop. Each group received a presentation of Shell's fuel-saving advice from Shell fuel scientist Peter Adams, which covered nineteen fuel saving tips; from driving smoothly to removing excess weight from the vehicle. Each driver also received a one-on-one driving lesson from AA driving instructors to gain experience in putting such tips into practice.

The Steer Approach and Co-creation

The ten drivers that received further attention attended a more advanced workshop designed to help the cabbies reflect on their own driving behaviour. During this workshop RSA staff presented some principles from behavioural science to help the drivers understand the influences behind their driving behaviour. This included one presentation explaining the basic systems that guide how the brain works, together with an understanding of how the drivers' physical habitat (including the inside of the cab) can shape their habitual behaviour. A second presentation covered the effect of an individual's social network on their behaviour, particularly looking at how behaviours can be 'contagious' – flowing from one person to the next.

Following both presentations, the drivers worked together to develop physical interventions (or 'nudges') that could reinforce and support behaviour change – informed by the behavioural principles presented earlier. This element of co-design was in sympathy with the emphasis on empowering people to change their behaviour, rather than 'doing' behaviour change to them. Rather than top-down 'choice architecture' co-designing interventions with the drivers gave them more control over the programme's direction.

Four ideas were generated during the workshop, which were further developed into a portfolio of interventions that could support fuel-efficient behaviour change.

Each intervention was mailed to those drivers that helped co-design them throughout the course of the challenge, with approximately one week between each.

The first intervention aimed to make fuel consumption and the relationship between speed and fuel more salient among drivers. The drivers' vehicles had relatively basic dashboards, without an economy gauge or tachometer – and with few markings on the fuel gauge and speedometer. Stickers for the dashboard were developed to make this interface more persuasive; converting the fuel gauge from showing either 'Full' or 'Empty' to indicating '£60', '£30' or '£0', and adding red stickers to the speedometer at higher speeds.

In addition to the stickers, the importance of smooth driving was encouraged by introducing silk into the drivers' habitats, aiming to prime the idea of 'smooth' driving. A black silk bag (intended for keeping change) was sent to each driver together with the stickers (Figure 3).

The second intervention aimed to encourage discussion between driver and passenger in an attempt to leverage the cab driver's role as spreader of information. This intervention took the form of a 'guest book', drawing on the insight uncovered during preparatory research that passengers were much like 'paying guests' in the driver's vehicle, and that drivers felt part of their position was to be an ambassador for their city.

The guestbook (Figure 4) contained information on each driver and the challenge, together with a number of informal tests that passengers could use to assess their driver's fuel efficiency. These included a line drawing of the relevant city, with instructions to trace the line as closely as possible; if the vehicle is driven smoothly, the line should be easier to trace.

The final intervention also aimed to encourage gradual acceleration, and grew out of the drivers' enthusiasm for vacuum gauges – a simple way of assessing the strain on an engine by monitoring its air intake, providing real-time feedback, a little like an

Figure 3

Figure 4

Figure 5

Figure 6

economy gauge. While vacuum gauges are simple additions, taxi regulations ruled them out, so other ways of providing feedback to reinforce and support smooth acceleration were sought. The idea of filling a capsule with liquid that would be disturbed if the vehicle changed speed too abruptly, such as a spirit-level device or 'snowglobe' were suggested, but dismissed as being susceptible to leaking.

The final idea was to provide audible feedback through a weight fastened to the top of a vertical spring; during normal driving the weight would remain vertical. However if speed changed too quickly, the weight would lean over, making contact with a metal ring and causing a buzzer to sound. The device was shaped to fit into each vehicles' built-in cupholder (Figure 5).

The Competition

Eighteen drivers took part in the competition, each aiming to reduce their fuel consumption simply through changing their behaviour. The competition took place in July 2011, and acted as a focal point for the whole programme, with extra attention paid to media profile during this phase.

The competition measured each driver's level of behaviour change before, during and after July. The winner was the most-improved driver, who received £500 of fuel vouchers and a £2000 donation to a charity of their choice as a prize.

Four fuel-efficient behaviours were taken into account, which were measured by monitoring the engine control unit in each driver's vehicle. These behaviours were: harsh acceleration, harsh braking, over-revving and idling. Fuel economy was also recorded. The data was uploaded from each driver's vehicle via the mobile phone network, allowing remote analysis and display of each driver's score on the Smarter Cab Drivers website.

Data were continuously recorded from mid-June (providing a two week baseline period) throughout July (the month of the competition) until the middle of August (to show
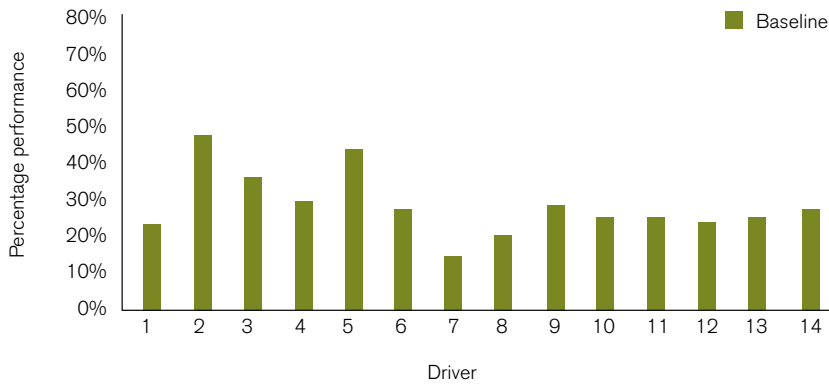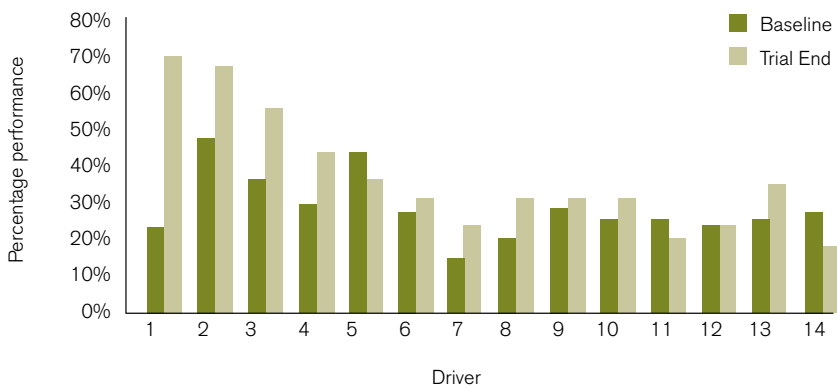
Figure 7

Figure 8

whether any behaviour change lasted longer than necessary to win the competition).

A target was set for each action in order to set a threshold for fuel-efficient behaviour. For example, 100 or fewer instances of harsh acceleration over a 100 mile distance was considered fuel-efficient – and a 100% score. Scores for the four measured behaviours were aggregated into an overall score for each driver.

A leader board was displayed on the Smarter Cab Drivers website, which displayed each driver's score in ranked order, as shown in Figure 6.

The leader board provided information in a way that allowed historical and comparative feedback. Historical feedback was given by an arrow next to each driver's score which indicated whether they had done better or worse than previous scores. The rank by performance allowed drivers to compare their score to their competitors. The leader board was continually updated, providing drivers with up to date information.

Results and Competition
The data recorded on the drivers' behaviour during the last two weeks of June showed their fuel efficiency performance varied quite substantially. This was as expected, given that drivers suggest they knew how to drive fuel efficiently, but not always conscientious in practice. Performance during the baseline ranged from 48% to 15% of a perfect score (i.e. meeting the pre-set target for that behaviour), shown in Figure 7.

There was also significant variation in drivers' improvements; with some improving their fuel-efficient behaviour by 45% and others actually deteriorating by small amounts, as illustrated in Figure 8. The average difference between the drivers' behaviour during the baseline and the competition was an improvement in performance of 8%.

In reviews of fuel efficiency studies, there is a major challenge of going beyond simple Hawthorne effects, i.e. being sure that the impact wasn't caused because there was some form of intervention rather than a particular intervention for a particular reason.[62] It is entirely possible that the mere fact the drivers knew they were taking part in a fuel efficiency study was the single biggest impact on their driving behaviour. Moreover, with so many variables involved in taxi driving behaviour (weather, geographic location, vehicle, time of day, number of passengers, experience of driver, personality etc) and such a wide range of interventions (research process, media attention, driving tips, deliberative workshop, the telemetry device) it is difficult to infer any causal relationships. Moreover, this challenge is compounded by few drivers giving full telemetry data (fourteen).

In this context, we felt that any statistical analysis of the findings would give pseudo-evidence that would be more likely to confuse than inform. With a larger sample, and more careful controls of the variables and interventions, there would need to be a mixed factorial ANOVA analysis. However, rather than see the lack of such an analysis as a weakness of our approach, we would suggest that in this particularour more qualitative and exploratory approach is consistent with our view of behaviour change, in which it is incumbent on the drivers themselves to become aware of the manifold factors that influence their behaviour, and take responsibility for their own behaviour change.

Feedback

Taking place in real-life, each driver faced unexpected situations, from long distance jobs that allowed them to put the fuel saving tips into practice without worrying about the next fare, to an industrial dispute with the council over taxi rank rules. Greater insight into the experience of the challenge may be seen by comparing an individual driver's progress with their comments along the route. Bernie Searle, the eventual winner with a 45% overall improvement secured the win by improving his acceleration by 33%, his braking by 10%, his over-revving by 54% and his idling by a massive 82%.

The Behaviours

The average driving change was an improvement of 8% on baseline, which was split across the four behaviours measured; accelerating or braking too harshly, over-revving and idling. The greatest improvement was seen in on over-revving, and the smallest improvement was on harsh braking, as shown in Figure 9:

The drivers' improvement in fuel efficiency was calculated from the measured behaviour change; the

- **Day 1: Preparation**
Bernie_Searle: "Tyres checked, windows up, golf clubs out of the boot (shame), all ready for the challenge, good luck everyone!"
- **Day 3 & 5: Quick win**
Bernie_Searle: "Wow, like these fuel saving tips, just completed a 14 hour shift, 330 miles on £60 worth of V Power in my TX4, never done that before!!"
Bernie_Searle: "Cant believe things are going so well, wish I had this fuel saving advice years ago, would have saved myself a small fortune!!"
- **Day 6: Camaraderie**
Bernie_Searle: "Well done Arshad, great result today! I seem to be slipping for some reason, although fuel consumption getting better by the day?"
Arshad_Ali1: "@Bernie_Searle Thanks mate, still not good as u. Do u drive a TX4? I've got an E7 & since monday I've done 500 Mls on 50 Ltrs."
Alistair_Kent: "Hey Bernie whats your secret.........."
- **Day 11 & 17: Unexpected benefits**
Bernie_Searle: "Took the Grandchildren to the beach yesterday, and guess what! Not a word from the wife about my driving!.........made a nice change!!!!!"
Bernie_Searle: "The Shell Smarter Cab Driver Challenge has not only saved me around 20% on my fuel costs, its made me a better and safer driver.....I think?"
- **Day 23: Taking it easy**
Adrian_Higgins1: "driving to save fuel make life more relaxing if you just take it nice and easy and accept you get what hire you get"
Bernie_Searle: "@Adrian_Higgins1 I'll second that Adrian, far less stress, for the same money, although I did get yelled at last night for driving too slow!"
- **Day 29: Real change**
Arshad_Ali1: "Last day of challenge. It has been great fun and also in the last 4 weeks must have SAVED around £80 in DIESEL. EXCELLENT!!!!"
Bernie_Searle: "@Arshad_Ali1 I'll second that mate, huge savings, I'm definitely converted!"
- **Just after the challenge**
Bernie_Searle: "Just been told I won the Smarter Cab Drivers Comp. Its all about taking part, but the £2,000 to my local Palliative Care Unit is so sweet."

Figure 9
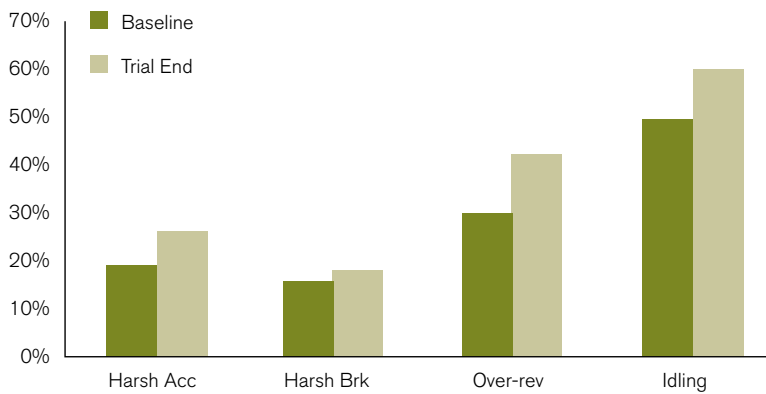
drivers' average efficiency during the baseline was 30.3mpg, rising to 36mpg during the challenge, a saving of about 19%.[63] The drivers clock up an average mileage of 500 miles/week, indicating that if they maintained such behaviour, they would save 12 litres each week, or 624 litres/year. At current diesel prices, such a saving would yield £16/week or £854/year– and 41 kg of CO2/year for each driver measured through telemetry. When we include the manual recordings, this figure rises to £1146 per year.

Post-competition Interviews

The drivers were interviewed approximately two months after the competition ended. They were asked about the effect of the programme on their driving, whether they had passed on information about fuel-efficient driving as part of the challenge and the effect of the deliberative workshop and interventions – including the leader board.

Effect on Driving

In general there were three responses to whether the programme had helped them adopt more fuel-efficient behaviour; (i) they did change their behaviour as a result, (ii) they were already doing all the actions, but the programme had raised their awareness, or (iii) it helped in the beginning, but only temporarily.

"During the month it makes you realise how much you have an impact on the environment. The changes I've made to my driving are things like looking ahead, decreasing speed, just basically judgement, not braking harshly, keeping my windows closed."

"Before I started I was using some of the techniques anyway, so it didn't have much effect. It just made me more aware"

"It did have an effect in the first instance but if there isn't someone to prompt you all the time, you revert back to the old fashioned way of driving."

Those for whom the programme had a beneficial effect were mostly motivated by the financial benefits:

"I'm saving money on fuel – it's making a big difference. Probably £4/5 every time I fill up – roughly £150 a month. Made a massive difference to me."

These self-reports do not necessarily correspond to the data. However, the data also has to be understood in context. For instance, one driver spoke very positively of the learning from the experience and reported that he was saving about £15 a month (less than average). The data suggested he did rather badly during the competition, driving below his baseline levels, but

does not take account of the fact that there was an industrial dispute in his city at the time, which made it harder to drive fuel efficiently.

Spreading the News

A major reason for working with cab drivers was their reputation as opinion formers, and key people within social networks. How did this work out in practice – did the drivers tell their colleagues and passengers about the programme, and about how to save fuel?

Again there was some variation; some told close colleagues and family about the programme, with the more outgoing using Twitter and enjoying the media coverage which resulted in more people asking questions about the programme. Drivers reported that some passengers were interested in the programme, particularly helped by the fact that some of the fuel-efficient behaviours were visible:

"I used to tell the passengers – they'd ask why turning the car on and off. They thought it broke down. They were interested and thought it was a good idea. Whether they went on to do it themselves I don't know. Nobody said they would but they definitely liked it."

"I talked to one or two passengers about it during the competition. I was saying if you miss your plane, blame Shell!"

The Deliberative Workshop & Co-Creation

We asked those drivers that experienced the added workshop, and were involved in the co-design of the interventions, whether this extra attention was beneficial. The drivers remembered these, but had a mixed appraisal of their effectiveness:

"[I remember] the noise thing. That made you aware to drive smoothly otherwise the noise. Worked sometimes but not all the time. I've still got it but I've not used it. I just don't need it. You become adapted to that style so it's second nature."

"Yeah, really good – they were a constant reminder of how you're driving. When we were there at the workshop and we all raised a few of our ideas. … I've taken the stickers off now. I've still got the buzzer in the car which I turn on from time to time, just to see how I'm doing. And I've got the silk bag. Someone nicked off with my guest book. And they took the pen. I was looking for it, and I thought I couldn't believe it. It was a stag do, from out of town."

"The little gizmos – the little alarm thing. It was a nightmare. It was more annoying than anything else, silly squeaky thing. … I got a few people to fill the guest book in. I think one fella just took the mick scrawling his line all over the place but most of them were pretty close to keeping the line. I suppose the book was about the best because you actually got an opinion from someone else. You were conscious that they were doing so it made you try harder."

While the presentations on behavioural principles fed into the creation of these interventions, most of the drivers found it difficult to remember specific examples:

"I remember us all coming up with different ideas. What our driving habits were. Don't remember anything about controlled/automatic thinking or social networks."

"Oh, no, not really. Um. Oh yeah, habits. Well I do know that before I had bad habits – and doing this had has made a difference. I have managed to change my habits. Transformed them. No, I didn't – sorry, I forgot about all that."

Based on our follow-up interviews, it is difficult to judge whether the drivers really had any appetite for self-awareness about their behaviour, and the overall impression is that they were more extrinsically motivated by feedback based on the money they were saving and their place in the competition. It is not clear what follows, but we believe the lack of impact may be related to the behavioural insight being crowded, and lacking in salience relative to the other features of the process that had more immediate relevance to the drivers.

The Leader Board

One of the interventions that all drivers received was the leader board. The drivers were asked what effect they thought this had on their driving behaviours. Some appeared highly motivated because of it:

"When you kept on seeing yourself in the same position you're thinking what are you doing wrong? Sometimes it was getting a bit demoralising not moving up the table, when you've done everything right. … It definitely made me competitive. I was thinking about it all the time. I used to check it 3 or 4 times a day when I was driving."

Other drivers seemed to quickly write it off:

"I thought the leader board was fixed. I never seemed to get any higher. I was doing everything right and I was noticing the difference when fuelling up but I wasn't getting anywhere! … It made me competitive in a way- you're competitive when you're saving fuel."

"It was initially, when you first started off and you first had it in your mind. Leader board had no

effect at all on me. There was a few that were driving different vehicles so I don't think it was an even playing field. Some were driving TX1s, others TX2s or TX4s and there was one even in a Peugeot. If everyone was driving the same vehicle then yes, I would have paid attention to it."

These comments suggest a failure of communication on our part because the competition was designed to be fair to the drivers. We did not want to disclose details of the algorithm on which they were measured because we wanted to encourage fuel efficiency that went beyond those four specific behaviours. However, with hindsight this may have been a mistake, because without knowing exactly which behaviours were measured in the competition, and how their baseline measures compared to the other drivers, the competition feedback was too opaque to motivate behaviour change, and it is understandable that drivers who weren't doing well assumed that the measurement conditions were stacked against them.

However, in general, the drivers responded with enthusiasm to the programme as a whole:

"It was a good project, a good insight into how to save fuel. Definitely learned a few more things. That guy came in from Shell … there were a few things that he said that were really good. I definitely use them when I'm driving my normal car (manual diesel)."

"It's been really brilliant. I'd recommend to anyone to go on one of these courses. If you just implement one or two of the tips – judge ahead, stop braking harshly, keep your windows up - you'll see the difference in the fuel you save. I've been through it and does actually work."

Reflections

The overall aim of active engagement with the taxi drivers and raising awareness of the importance of fuel efficient behaviour was therefore as important to us as our attempts to build an evidence base to justify particular policies, or a knowledge base to inform future research.

Research in the Context of a Campaign.

The relationship between Shell and RSA was open and constructive. We retained full editorial control of our reports, and our input was sought and respected at every stage of the process. As we have indicated above, whatever one's view of the climate change problem, increasing fuel efficiency, with some urgency, is an important part of the solution. The overall aim of active engagement with the taxi drivers and raising awareness of the importance of fuel efficient behaviour was therefore as important to us as our attempts to build an evidence base to justify particular policies, or a knowledge base to inform future research.

When research is driven by the desire to make an argument for a certain kind of social change, in this case an increase in fuel-efficient behaviour, the purpose of the research does not have to be merely to understand how that social change might come about, but also to play an active part in bringing it about. Engaged forms of research, in which the participants are reflexively engaged in the process, as knowledge-bearers and knowledge-makers; as actors and agents, are as much about changing behaviour as they are about measuring behaviour change. We saw the qualitative research with the drivers, the pilot experiment, and the awareness raising campaign as part of an overall process to enrich our understanding of opportunities and challenges in the field. For these reasons, the research we conducted was underpinned by an 'attitude of inquiry' in which we continually reflected on our purposes and assumptions, and the research process itself was emergent and responsive to events in the real world.[64]

That said, we had hoped to test the effectiveness of our approach based on steer and co-creation, and to learn how particular kinds of people change

their behaviour in light of what they learn about it. One consequence of our attitude of inquiry is that the role of behavioural insight, while still a relevant part of the process, was diluted by the other interventions. The details of these interventions emerged as the research process developed, and we were often torn between an idealistic view of what would give the most meaningful data, and pragmatism for the sake of the wider campaign.

For instance, we hoped to contrast a relatively engaged approach to behaviour change with the simple provision of information. In this respect, the AA driving instruction was not part of the research design, and nor was the fact that Shell's fuel efficiency tips were given in person, with chances for questions. Based on the relative excitement the cabbies showed towards knowledge about their cars and their driving, compared to their behaviour as such, our best guess is that these two interventions had much more impact on the drivers than our workshop on behaviour.

An orthodox view of research would say such interventions should have been prevented, and although we were aware that such developments complicated the argument we were trying to develop, we were not inclined to object because the research was taking place alongside this wider process of engagement and awareness raising. Moreover, in the context of a competition between regions, where local press make careful inquiries about the process, and prizes are at stake, it was important to guard against the claim that some drivers were receiving preferential treatment.

While we think a pragmatic approach to research was justified in this context, we believe there is definitely scope for a more rigorous study to test our ideas in a more targeted way. In this respect we hope to revisit the RSA's original research design for this project, which focussed on a larger sample of drivers in a single geographic area. Such a study would have made it easier to control for variables, and to be more confident of the potential efficacy of different kinds of interventions. By increasing

the sample size, removing the competitive and inter-regional element of the process, conducting deeper ethnographic research, and controlling between groups more carefully, we could learn more about the impact of our steer and co-creation workshops. On the other hand, we probably would not have raised awareness of fuel efficient driving to the extent that we achieved, in the national press and in several different regions across the country.

As a result of the real world developments that emerged, the behavioural interventions became progressively diluted in their relevance, making it harder for us to gauge their efficacy. However, the role of think tank research is typically to demonstrate the relevance of a set of ideas, and problem-find in ways that lead to new forms of research or policy developments. In this respect, we were glad to be part of a fascinating process, and hope the proposals that resulted from it are of value.

Proposals

If drivers are supported in converting new learning into long-term habits, efficiency gains can be increased

1. Make habitual behaviour the focus of interventions for change

Making habitual behaviour the focus of behaviour change interventions resonated strongly with the drivers, who recognised the 'action gaps' between knowing what to do and actually doing it. Information is important, but not enough, and those currently willing to give information about fuel efficiency should consider the behavioural challenges of acting on that information. If drivers are supported in converting new learning into long-term habits, efficiency gains can be increased.

So if Shell, or a car manufacturer, or the local council, currently give information on how to save fuel, they can improve the effectiveness of doing so if they also give advice about how to make such behaviours habitual. For instance, fuel efficiency tips could include advice about how to turn such behaviours into habits

e.g. strive to do it for at least 66 days – the approximate amount of time it takes to perform a new task without thinking - and you will find it begins to feel automatic, or work with mental accounting, by reminding yourself how exactly the money saved through these behaviours will be used.[65]

2. Make fuel efficiency a pass/fail criterion on the driving test

A further implication of the emphasis on habit is making fuel efficiency a more prominent part of driving lessons and a more significant part of the driving test. In this respect we would go beyond the DVLA's existing commitment to give feedback on fuel efficiency at the end of practical tests and support the Confederation for British Industry's call for driving efficiently to become a pass/fail issue. Given the importance of fuel efficiency outlined above, and the challenge of

changing acquired habits, there is a strong case for doing all we can to ensure that good ones are established in the first place.

3. Change driving habitats to encourage fuel efficiency

Council officers now have to meet increasingly difficult targets with lower budgets, and behavioural insight can potentially help with that. Local Authorities should therefore have shared access to expertise in behaviour change to better understand the likely behavioural effects of their planning decisions. For instance, Local Authorities could encourage fuel efficiency by modelling traffic flows and road layouts to minimise stopping and starting. Increased use of roundabouts rather than traffic lights may help, as could strategically located signs (e.g. near traffic lights) to remind drivers about the major forms of fuel waste (e.g. idling or over-revving). Moreover, more taxi ranks would help taxi drivers to avoid wasting fuel by needlessly driving around. The cost of this waste in fuel is ultimately passed on in higher taxi charges for passengers, so the minimal costs of creating such ranks may be a legitimate use of public spending.

4. Incentivise taxi drivers to become ambassadors for fuel efficiency

Taxi ranks are often the first thing seen by visitors to a new city. We found that cab drivers are proud of their cities and tend to assume a role of ambassador.[66] City councils who are motivated to improve their green credentials could take advantage of this by partnering with local taxi firms to demonstrate and spread advice on fuel-efficient driving. Passengers could be invited to ask their drivers about tips on fuel efficiency detailed in the taxi, for instance on screens or leaflets. Incentives for participating cabbies could take the form of council tax exemption for those who drive economically and spread the word, to acknowledge their value to the public good. It might also take the form of driving-specific reductions, for instance through subsidised MOTs or reduced road tax.

5. Provide salient feedback

All drivers could be better incentivised to adopt more fuel-efficient driving. While economy gauges provide good feedback on fuel consumption, modern vehicles could aggregate data from the engine management system to present each user of a vehicle with a simple eco driving score – displayed on the dashboard or via a smartphone app. Judging by the impact of the competition on the drivers' behaviour, such a score is likely to be most powerful when it shows comparative performance with others – perhaps other users of a family car, or members of an individual's social network. It would also be useful to make the feedback as salient and personal as possible, for instance, if the same trip to the supermarket costs £3.02 one day and £2.33 the next, the driver is more likely to reflect on their driving behaviour and improve it for the better.

6. Make taxis greener

Hackney Carriages are an iconic design that suits the cabbie's informal role as city ambassador. However while progress has been made on emissions standards, these vehicles' fuel-efficiency lags behind other vehicles. While behaviour change is an important starting point, manufacturers of Hackney Carriages need to be incentivised to create public icons that embody a more environmentally friendly message, either through increased competition or government support. Existing efforts to develop hydrogen fuel-cell taxis should be supported.

If the same trip to the supermarket costs £3.02 one day and £2.33 the next, the driver is more likely to reflect on their driving behaviour and improve it for the better.

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