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Chapter 35
Travel Mode Choice

Stephen G. Stradling
Edinburgh Napier University, Edinburgh, UK

Abstract

In addition to safety and public health concerns about the number of people killed or seriously injured in road traffic collisions every year, the seemingly inexorable increase throughout the world during approximately the past century of driving of fossil-fuel powered vehicles has become an important environmental research concern. Driving impacts the environment through greenhouse gas emission, pollution, and land take. When faced with a journey to make, how we choose among travel modes and what attitude and behavior changes might prompt the choosing of more sustainable travel modes are explored in this chapter.

Keywords

Climate change, die-hard drivers, environmental attitudes, journey experience, mode choice, mode shift, mode substitution, transport psychology

1. INTRODUCTION AND SOME HISTORY

Whereas many previous chapters have examined in detail what people do when they drive cars, this chapter shifts the focus to "Why do we drive?" and how can transport psychology contribute to encouraging a shift to more sustainable and less planetary damaging modes of transport? It begins with some conceptual analysis and historical background to human patterns of moving around; takes as given the need to reduce the impact of fossil fuel-powered transport on the planetary niche we humans occupy and places the transport changes needed in a larger context of changes in consumption patterns; summarizes studies on attitudes to travel change in the United

Kingdom; considers the personal costs of such changes in terms of both energy expenditure and lifestyle patterns; briefly examines the journey experience of three travel modes—car, motorcycle, and urban bus—to identify what psychological needs different travel mode choices offer to meet; examines segmentation among people's attitudes toward car use and the environment, finding a fourfold typology of die-hard drivers, car complacents, malcontented motorists, and aspiring environmentalists; considers the feasibility of people substituting car trips with more sustainable travel modes, distinguishing between those unable to change and those unwilling to change; and concludes by summarizing current methods for attempting to affect the necessary changes, some informed by psychological research and theory and some not, before it is too late to bring about the adaptation and mitigation to natural, managed, and human systems needed to avoid a warming world with its "unprecedented combination of climate change, associated disturbances (e.g., flooding, drought, wildfire, insects, ocean acidification), and other global change drivers (e.g., land-use change, pollution, overexploitation of resources)" (Intergovernmental Panel on Climate Change, 2007, p. 11).

Why do we move around at all? Because we can, because we have to, because we like to is the simplest formulation dividing out the different kinds of motive forces driving (sic) travel behaviors and transport choices. All life-forms move, even if only to orient daily toward the sun while remaining rooted in the earth. Animal life typically requires movement for sustenance, shelter, and mate selection to enhance individual and species survival. One corollary of this formulation is that if we want to change individual travel behavior, we need to vary the travel opportunities, lifestyle obligations, and/or personal inclinations shaping an individual's activity space.

The relatively new field of transport psychology examines psychological factors influencing travel and transport choices and behaviors. Research from this field suggests (at least) three axioms likely to apply in the consideration of what facilitates or constrains people moving around—their travel choices:

A1: Travel is an expressive activity; there are affective as well as instrumental components to travel behavior and choices.

A2: Persons vary in their travel choices and in the perceptions, conceptions, and values that inform those choices. This variation is both between types of persons (demographic groups and attitude-based segments) and within individuals in situations with different travel agendas.

A3: People are simultaneously adaptable and resistant to change. They can and do cope with changing circumstances or operating conditions (new car, car fitted with driver assistance and vehicle control systems, congestion, fuel crises, and inclement weather); they value the comfort

and convenience of habits and routines, having typically expended some search effort in acquiring them.

Human beings are large-brained bipeds who, although rarely in possession of perfect information, make fast, smart-enough choices based on heuristics that save computation time, avoid frozen stasis, and thus enable action in and on the world. However, we are also, as the title of Aronson's standard textbook on social psychology notes, social animals, needing opportunities for social participation and interpersonal interaction and also support networks to alleviate the stress of dealing with the slings and arrows of daily hassles and the occasional, but inevitable, larger misfortunes; we also like the sense of autonomy, feeling in control, when presenting an identity in public places.

Garling (2005) characterized the core determinants of personal travel behavior as in Figure 35.1. The temporal ordering of travel choices in Garling's model is as follows:

1. Activity choice What shall I do?
2. Destination choice Where shall I do it?
3. Mode choice How shall I get there?
4. Departure time choice When shall I go?

Activity choice—"What do I need to do next?"—is primary in this formulation. The emphasis on "I" here means that the choice of activities reflects—expresses (A1)—the complex biological and social identities of persons. Travel demand is driven by what people need or want to do and where they have to go to do it—their perceived travel obligations. The transport system shapes how they might get there and how much time they should allow—their matrix of travel opportunities. Some do and some do not enjoy themselves while doing it (A1 and A2; see also the section on journey experience)—shaping their inclinations to travel by different modes. Changes—to activity choice, destination choice, mode choice, departure time choice, or the intelligence of the transport infrastructure—will be perceived as a challenge or an annoyance or both (A2 and A3). (This analysis applies to personal travel choices. Freight transport, which also burns much fossil fuel, requires a somewhat different, more instrumental account.)

In 1964, Russian archaeologists found the remains of a wooden ski preserved in the acid soil of a Siberian peat bog that they dated to approximately 6000 BCE (Woods & Woods, 2000). A 4500-year-old rock carving in Norway shows a skier using a single pole for propulsion on skis probably 3 m long. Skis may be the earliest example of technological innovation being used to amplify the speed and distance of individualized land-based travel above our natural endowment

of a long-distance walking speed of approximately 4 mph (6 kph) and short-distance running speed of perhaps 15 mph (25 kph).

The potters of Mesopotamia, between the rivers, are thought to have invented the wheel—"wooden discs spun in a horizontal position used to shape lumps of clay into vessels" (Woods & Woods, 2000, p. 34)—at least 5000 years ago. There is evidence of the wheel being rotated from horizontal to vertical and used on sledges to facilitate freight transport by the Sumerians and also in India and China soon after 3500 BCE and in Egypt by 2500 BCE. By 1400 BCE, Egyptian craftsmen were making "strong, light wheels with separate rims, spokes, and hubs" (Woods & Woods, p. 35) that were used on fast chariots by elite soldiers and wealthy civilians. Thus, approximately 3500 years ago, technological innovation was driving specialization of form and function, and access to fast wheeled vehicles was serving as a marker and amplifier of status differentials.

Transport modes may be classified into three types: wholly self-propelled modes, such as walking, running, and swimming; augmented modes that amplify bodily effort, such as rowing, cycling, and skiing, or focus natural resources, such as sailing and paragliding; and fuelled modes, whether hay-powered such as horse-drawn carriages and farm wagons or motorized modes such as motorcycle, car, SUV, van, truck, bus, tram, ferry, train, and plane, which currently deplete natural fossil fuel resources. Technological effort and expertise is currently being directed at harvesting more of the earth's natural resources such as biomass, hydrogen, wind, and solar energy to source sufficient quantities of renewable fuel to continue powering individual motorized modes in the future.

As successive transport innovations have been introduced—horses, mules, camels, trains, electric trams, buses, subways, cars, and commercial aircraft, along with their associated infrastructure—the effective radius of people's activity patterns has grown with increases in the speed of transport. However, there seems to be an average annual travel time budget per person that is relatively constant and has remained so historically and spatially. The UK National Travel Survey indicates that average travel time has held steady at between 350 and 380 h per person per year, or approximately 1 h per day, during the past 30 years (Department for Transport (DfT), 2006, Table 2.1). International compilations of travel time data show that this figure of approximately 1 h applies across all cultures and states of development for which data may be discerned (Metz, 2004). Indeed, Metz, following Marchetti (1994), argues that the origins of this average travel time of 1 h per day may date from the earliest human settlements, where the mean area of the territory of long-established villages was approximately 20 km^2, corresponding to a

radius of approximately 1.6 miles (2.5 km) or approximately 1 h's walk from the periphery to the center and back—from farmstead to market and home again—at 4 mph (6 kph).

2. IMPACT OF MOTORIZED TRANSPORT ON THE PLANET

Ponting (2007) asserts that after the agricultural revolution, which gradually but inexorably facilitated population growth across the planet,

> "the second great transition in human history involved the exploitation of the earth's vast (but limited) stocks of fossil fuels. It led to the creation of societies dependent on high energy use. This was a fundamental change—until the nineteenth century every society across the globe had very few sources of energy and the total amount of energy they could generate was small. This transformation was at least as important as the development of agriculture and the rise of settled societies. In its impact on the environment its effects were far greater and took place over a shorter period of time. Until this transition all the forms of energy used by human societies were renewable… The last two centuries have been characterized not just by the use of nonrenewable fossil fuels (coal, oil, and natural gas) but by a vast increase in energy consumption. (p. 265)

Direct impacts of motorized transport on the planet include global warming through the production of greenhouse gases from the burning of fossil fuel; vehicle emissions affecting local pollution and health; vehicle noise; land take for roads, parking, and other infrastructure; extraction of materials for manufacture; and waste from scrapped vehicles. To maintain the habitability of the planet, transport choices need to be smarter choices. Transport psychology, an applied science, involves understanding and influencing transport choices.

This chapter takes as given that it is true, if inconvenient (Gore, 2006, 2007), that

- the world is warming, and a further rise of 3 or 4°C could be catastrophic for continued human habitability;
- warming is partly driven by an increase in greenhouse gas (GHG) emissions;
- GHGs are emitted by motorized transport powered by fossil fuels (in addition to the particulate problem with otherwise more efficient diesel fuel and also the carbon cost of the manufacture, distribution, and disposal of vehicles and supporting infrastructure, including future electric vehicles); and
- GHG emissions need to be reduced to maintain the rather narrow habitable planetary niche to which humans are adapted.

As we enter the era of peak oil, problems with energy security and scarcity generating diplomatic incidents and oil wars, increased emissions fueling anthropogenic climate change,

increased road congestion, and rapid growth in domestic and international aviation, there is an urgent need to burn less carbon-based fuel as we go about our daily business (Industry Taskforce on Peak Oil & Energy Security, 2008; Transform Scotland Trust, 2008).

Table 35.1 shows a "wish list" compilation (Hounsham, 2005) of the behavior changes needed to reduce anthropogenic GHG emission levels, indicating that changes to transport behavior form just part of a large array of consumption behaviors needing remediation.

What are the avenues for changing human travel behavior, making it less fossil fuel dependent? In 2007, the DfT noted that

> The [UK] Government fully recognizes the need to tackle the problem of CO_2 emissions, and is taking action to:
>
> encourage more environmentally friendly means of transport;
>
> improve the fuel efficiency of vehicles;
>
> reduce the fossil carbon content of transport fuel; and
>
> increase the care that people take over fuel consumption while driving. (DfT, 2007b, p. 2)

Improving the fuel efficiency of vehicles and reducing the fossil carbon content of transport fuel (Figure 35.2) are supply-side measures, whereas encouraging use of more sustainable forms of transport and more fuel-conscious driving, for example, are demand-side measures. In 2010, Paul Clark, UK Parliamentary Under Secretary of State for Transport, in a speech to the Brake Best of the Best Fleet Safety Forum Conference in Birmingham, England, noted the following:

> The Department's strategy is firmly focused on reducing CO_2.
>
> Passenger cars generate over 58% of greenhouse gases from transport. Nearly 40% of CO_2 emissions come from cars on commuting and business journeys. What's more, these journeys also have the highest proportion of single car occupancy.
>
> If eco driving becomes part of the periodic training for the Heavy Goods Vehicle Drivers' Certificate of Professional Competence, a preliminary assessment suggests that up to £300m in fuel costs—and 600,000 tons of CO_2—can be saved annually if 90% are trained and drive in that manner. That is a telling statistic and we will be consulting shortly on how to achieve such an uptake.
>
> Where it is necessary to drive, then smarter driving techniques can help reduce emissions and improve safety in all types of vehicles. This has been clearly demonstrated through schemes like the Department's Safe and Fuel Efficient Driving program SAFED.SAFED

> trains company van and lorry drivers to use their vehicles more fuel efficiently and more safely. There are numerous case histories showing that companies can enjoy significant cost savings by engaging with the scheme.

Unfortunately, as has been noted by several researchers (Midden, Kaiser, & McCalley, 2007; Vlek & Steg, 2007), the adoption of cleaner cars may still lead to overall increases in environmental burden through sheer growth in activity volumes as well as through rebound effects that are the result of successful implementation of a more efficient technology, which compensates for some of its environmental gains or even negates them entirely by stimulating additional, unanticipated resource consumption and/or use of the technology.

Thus, supply-side measures such as improving the fuel efficiency of vehicles or reducing the fossil carbon content of transport fuel may actually stimulate demand by increasing distances traveled. Indeed, in the worst-case scenario, motorists, given more environmentally friendly cars and fuel, may believe they can thus drive more frequently, farther, and faster (with self-talk taking the form, "If I drive a car that is better for the environment, I can drive it more frequently/farther/faster without causing any more damage to the environment than I was before. And if I drive just a little bit more often/farther/faster I'll still be doing less damage than I was before."). This is akin to the risk compensation or behavioral adaptation drivers show in consuming car safety benefits as performance benefits ("With ABS and side air bags I will be more protected from the consequences of driving less safely—and can thus drive less safely!") (Organisation for Economic Co-operation and Development, 1990; Stradling & Anable, 2008).

In his foreword to Moser and Dilling's (2007) *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change*, Robert W. Kates (2007) writes the following:

> My colleagues Anthony Leiserowitz, Tom Parris, and I have recently argued that at least four conditions are required for … accelerations in collective action. These include changes in public values and attitudes, vivid focusing events, an existing structure of institutions and organizations capable of encouraging and fostering action, and practical available solutions to the problems requiring change.

This chapter next collates some evidence, from Scotland and the United Kingdom, on the demand-side changes that are necessary and particularly on motorists' readiness for reduction in car use, focusing on the first of Kates' conditions—changes in public values and attitudes.

3. PUBLIC VALUES AND ATTITUDES ON CAR USE AND CLIMATE CHANGE IN THE UNITED KINGDOM

A module of questions about public attitudes on climate change and the impact of transport were included in the Office for National Statistics' Omnibus Survey of August 2006 (DfT, 2007):

- 81% of UK adults said they were very or fairly concerned about climate change.
- 62% believed that "Individuals should try to limit their car use for the sake of the environment."
- 44% agreed that "Air travel should be limited for the sake of the environment."

Respondents were asked, "Which transport modes, if any, do you think are major contributors to climate change?" Overall, 80% said cars, 78% vans and trucks, 75% airplanes, 62% buses and coaches, 30% motorbikes, 25% ships and ferries, 24% trains, and 1% answered "None of these." The relative rank ordering of their responses from most to least polluting roughly accords with the objective evidence, but perhaps most critically, hardly any (1%) thought that "none of these" motorized transport modes were major contributors to climate change.

In terms of readiness to take personal remedial action, 78% of respondents agreed that they would be prepared to change their behavior in some way to help limit climate change. Those who were very or fairly concerned about climate change were more likely to say they would change their behavior than those who were not very or not at all concerned.

The survey asked, "In the next 12 months which, if any, of the following things are you likely to do due to concerns about climate change?" Overall, 90% said recycle household rubbish; 71% be careful about using energy at home (e.g., TVs on standby); 66% use energy-saving lightbulbs; 51% walk some of the short car journeys you currently make; 44% buy more energy-efficient products; 40% cut out some nonessential car journeys; 32% use public transport for some current short car journeys; 29% share car journeys with others to reduce total journeys made; 18% cycle some of the short car journeys you currently make; 12% use other forms of transport instead of flying; and 9% reduce the number of flights you make.

The report summarized this pattern as showing

- propensity for recycling behavior change amongst 90%
- propensity for household energy reduction amongst 89%
- propensity for car-related behavior change amongst 77%
- propensity for plane-related behavior change amongst 17%

Thus, in August 2006 when the survey was undertaken, just prior to the release in the United Kingdom of *An Inconvenient Truth* (Gore, 2006) and concomitant substantial media coverage of

the issue, already most (90 and 89%) of the UK public were persuaded of the need to modify their recycling and household energy use behavior, many (77%) of the need for reduction in car use, but few (17%) of the need for reduction in flying.

4. THE COSTS OF CHANGE

A transport economist might summarize these findings as showing a readiness for change conditioned by the costs of changing. What would be the costs to the individual of changing? It has been suggested (Stradling, 2003, 2005, 2007a, 2007b) that all travel choices involve the interaction of three overarching factors: obligations ("What journeys do I have to make?"), opportunities ("How can I make those journeys?"), and inclinations ("How would I like to make those journeys?"). Changes to travel patterns first require people to articulate these questions about their current and planned travel—to show "travel awareness"—and second will involve changes to patterns of life (obligations), provision of alternatives (opportunities), and current preferences (inclinations).

Joseph (2008, p. 15) noted that "economic appraisal still gives value and priority to small time savings (even though surveys and businesses say they value reliability more)" in the evaluation of proposed transport infrastructure projects. Transport psychology, when dealing with the costs of change from the standpoint of individual behavior, might begin by pointing out that all journeys involve a cost to the individual traveler in the expenditure of calories, concentration, and concern (Stradling & Anable, 2008), and thus an "energy cost," as well as the expenditure of time and money—the availability of all of which will "condition," in the economist's sense, the likelihood of making a journey and of making it in a particular manner.

Three types of "personal energy costs" in trip making have been suggested (Stradling, 2002a, 2007a, 2007b):

1. Physical effort when traveling is used for maintaining body posture in walking, waiting, or carrying. Comfortable seats will reduce the amount of such effort expended. Negotiating an awkward interchange while burdened with infants and baggage will increase it. In Scotland, 11% of adults report difficulty standing for 10 min and 12% difficulty walking for 10 min (Stradling et al., 2005), constraining their travel mode preferences.
2. Cognitive effort is needed to collect and process information before and during a journey. Route familiarity will reduce the amount of cognitive effort needed. Habitual journeys typically impose a lower cognitive load, which is part of the reason why forming travel habits is attractive.

If the journey needs constant monitoring of progress and the seeking out or interpretation of information, this will tend to increase cognitive load. Both too much and too little cognitive effort are unattractive, but a Goldilocks amount—just right—will tend to make the journey interesting and engaging (Stradling, 2001).

3. Nervous energy is expended on worry about whether the journey will be successfully and safely accomplished. Uncertainty about connection and arrival ("I don't enjoy it. I'm in a rush and worry [whether] the bus will be on time, to get [me] to work") or personal vulnerability ("I wouldn't like to be there after dark—the bus station has a reputation") will tend to increase the amount of emotional spend on a journey (Stradling, 2002a).

This suggests that the reason why "surveys … say they value reliability more" (Joseph, 2008) is psychological: Service reliability enables travelers to meet their travel plans and obligations—they can rely on it—whereas an unreliable transport service entails

- uncertainty and worry, and thus additional affective effort;
- making remedial plans, entailing additional mental effort; and
- undertaking remedial actions, requiring additional physical effort.

5. THE JOURNEY EXPERIENCE

5.1. Cars

The actual or anticipated journey experience associated with different travel modes will affect travel mode choices. Although the disbenefits of car travel and threats to the quality of life from car traffic are increasingly apparent (Adams, 2000; Engwicht, 1999; Garling, Garling, & Loukopoulos, 2002; Garling & Steg, 2007; Goodwin, 2001; Litman, 1999; Newman & Kenworthy, 1999; Royal Automobile Club (RAC), 1995; Semlyen, 2000; Sloman, 2003; Stradling, 2002b, 2002c), car ownership continues to rise worldwide, despite a growing policy focus on reducing car dependency and achieving a shift in travel mode choice.

Were the automobile an organism, we would deem it as having been remarkably successful in carving out an environmental niche and in adapting the behavior of its host to its requirements. In little more a century, cars have colonized the planet. Future historians may well characterize the twentieth century as the century of the fossil-fueled car, during which approximately 1 billion cars were manufactured (Urry, 1999), of which more than 500 million (Shove, 1998) are currently occupying the streets, garages, car parks, and grass verges of the world.

What is the hold that this most successful of technological developments has over the human psyche, sufficient to induce "car dependence" (Newman & Kenworthy, 1999; RAC, 1995)? In the latter half of the past century, the car established itself as the dominant mode of travel in developed countries, whether measured by distance, frequency, or duration of travel. Even so, data for Great Britain, indicating that the car is used for approximately 60% of the average 1-h daily travel time (Stradling, 2001), suggest that the average car is idle for more than 23 h out of 24 h, consuming parking space and inexorably depreciating in value but not actually moving. However, although stationary for more than 95% of the day, the car while waiting in some convenient location embodies the potential for travel and for access to distant destinations—"I could just jump in the car and go, if I wanted to"—and this potential for spontaneous travel is one of the psychological attractions of the car (Stradling, 2002a; Stradling, Meadows, & Beatty, 1999, 2000).

A number of studies attest to the car as a symbolic object (Maxwell, 2001; Sachs, 1984) and to the importance of affective motivation rather than instrumental motives such as availability and directness in choosing a car over other transport modes (Abrahamse, Steg, Gifford, & Vlek, 2004; Bamberg & Schmidt, 2003; Ellaway, Macintyre, Hiscock, & Hearns, 2003; Exley & Christie, 2002; Gatersleben, 2004; Gatersleben & Uzzell, 2003; Jensen, 1999; Mann & Abraham, 2006; Maxwell, 2001; Reid, Armitage, & Spencer, 2004; Steg, 2004; Steg & Gatersleben, 2000; Steg, Geurs, & Ras, 2001a, 2001b; Steg & Tertoolen, 1999; Steg & Uneken, 2002; Steg, Vlek, & Slotegraaf, 2001; Stradling, 2002, 2003; Stradling, Carreno, Rye, & Noble, 2007; Stradling, Hine, & Wardman, 2000; Stradling, Meadows, & Beatty, 1998, 2001; Tertoolen, van Kreveld, & Verstraten, 1998; Wall, Devine-Wright, & Mill, 2004; Wardman, Hine, & Stradling, 2001; Wright & Egan, 2000) and in influencing driving style (Lajunen, Parker, & Stradling, 1998; Stradling, 2003).

In the United Kingdom, the future travel behavior intentions of young people between the ages of 11 and 18 years are dominated by the desire to drive and/or own a car (Derek Halden Consultancy, 2003; Line, Chatterjee, & Lyons, 2010; Storey & Brannen, 2000), with predrivers aspiring to the perceived benefits of car driving: "Like you're in control of loads of speed aren't you?" (boy, aged 14 years; Step Beyond, 2006).

A core component apparent from studies of the attractions of the car is the sense of autonomy—feeling in control. Many car drivers appreciate the autonomy that the automobile conveys: "I just like driving … I only go places when I can drive"; "One of the reasons I like driving is because I'm in control" (Stradling, 2007a); "What do you enjoy most about driving?"

"I suppose it would just have to be the independence, the feeling of freedom it gives and just the actual feeling of driving yourself, the speed, the cornering.… I just like the feeling of being able to control a vehicle in a competent manner" (Stradling et al., 1998). Many, although not all, users of public transport lament the lack of autonomy: "The problem I have with public transport is that I don't feel in control"; "You don't feel in control at all on public transport and you're worried about connections all the time so you're having to be aware of what the time is every moment"; "Last year I came in by public transport for about 2 weeks. It was hell. Freezing to death on platforms waiting for trains that were late. You're not in control of your life—that's the only way I can describe it, you're just not in control" (Stradling et al., 1998).

Young drivers aged 17–24 years score highest on a scale measuring the sense of identity gained from becoming a driver, a part of the expressive component of driving (A1; Stradling, 2007a), endorsing items such as the following:

Driving a car …

- is a way of projecting a particular image of myself.
- gives me a feeling of pride in myself.
- gives me the chance to express myself by driving the way I want to.
- gives me a feeling of power.
- gives me the feeling of being in control.
- gives me a feeling of self confidence.
- gives me a sense of personal safety. (Stradling, Hine, et al., 2000)

The automobile promises both autonomy and mobility, and the mobility conferred by the car brings access privileges. In Scotland, 97% of those in the top household income quintile have access to a car for private use compared to 32% of those in the bottom quintile (Stradling et al., 2005). Those from households with access to a car travel more often, farther, and for longer durations, thereby increasing the number and variety of destinations to which they have access. Ratings of convenience of access from home to local life-support services such as money (bank or building society), food (supermarkets and local shops), and health (general practice clinic and hospital outpatient department) are higher for those with a car; they enjoy more frequent social interactions with their support network of relatives and friends and are thus less likely to suffer social isolation; more visit sports and cultural facilities; they report better health status, and fewer of them have disabilities causing difficulties with traveling; they rate themselves higher on indices of civic participation; more of them live in nicer neighborhoods; and fewer of them had used the local bus service in the past month (Stradling et al., 2005).

These are just some of the benefits—instrumental, symbolic, and affective (Steg, Vlek, et al., 2001)—that would be diminished were car use constrained, and they will likely form a central part of drivers' calculation of the costs of change.

Of course, such benefit does not come without cost. In an era of highly reliable cars, we grind toward gridlock as we suffer increasingly from congestion, resulting in unreliable journey times, and as Featherstone (2004) notes,

> Automobility makes possible the division of the home from the workplace, of business and industrial districts from homes, of retail outlets from city centers. It encourages and demands an intense flexibility as people seek to juggle and schedule their daily set of work, family, and leisure journeys … on the calculation of the vagaries of traffic flows. (p. 2)

Also, the task load a driver endures on a car journey in search of the psychological satisfactions is high. Driving is a skill-based, rule-governed, expressive activity requiring real-time negotiation with co-present transient others with whom the driver is currently sharing the public highway and seeking safe and timely arrival while avoiding intersecting trajectories. There are task demands at the strategic, tactical, and control level. Speed is varied to manipulate perceived task difficulty (Fuller, 2005). Panou, Bekiaris, and Papakostopoulos (2005) characterized eight operational levels to the driving task, and Table 35.2 adds two more. Driving is an attractive travel mode choice despite consuming calories, requiring concentration, causing concern (Stradling & Anable, 2008), and making many demands on the driver.

5.2. Motorcycles

There are a number of important differences between driving a car and riding a powered two-wheeler, including the sources of psychological satisfaction and hence the journey experience (Broughton, 2006, 2007, 2008; Broughton & Walker, 2009; Broughton et al., 2009; Mannering & Grodsky, 1995). Broughton (2007) showed motorcyclists photographs of various road scenes and asked them to rate on 5-point scales how risky and how enjoyable riding would be in each. He identified three types of bikers, shown in Figure 35.3. For a small group, approximately 8% rated enjoyment increased as rated risk increased and enjoyment peaked at high risk levels. They were labeled "risk seekers." Their motivations for riding and while riding were different from those of the other two, equal-sized groups—risk acceptors (48%; for whom rated enjoyment peaked at middling levels of rated risk) and risk aversive (48%; for whom enjoyment peaked at

low risk)—both of which, although to differing degrees, ride despite the risks rather than because of them.

Factor analysis of ratings of features of the photos (Broughton, 2005; Broughton & Stradling, 2005) showed two sources of enjoyment for bikers in general: speed in a straight line and the mastery challenge of taking the right line through bends (some preferred one, some the other, and some liked both). Riders readily attest to both speed and bends "feeling good" and to enjoyment of the ride being a prime motivation for biking, suggesting a high expressive component (A1) in riding.

5.3. Urban Buses

One barrier to increased bus patronage has been held to be the image of bus services as "a transport mode that has become associated with young people … elderly people … and people on low incomes … i.e., a mode of last resort" (Bus Partnership Forum, 2003, p. 9). However, a study in Edinburgh, Scotland (Stradling et al., 2007), found image to be the factor of least concern to urban bus users: In descending order of endorsement, the factors that generated dislike or discouragement of bus use were as follows:

- Feeling unsafe (e.g., "Drunk people put me off traveling by bus at night")
- Preference for walking or cycling (e.g., "I prefer to walk")
- Problems with service provision (e.g., "No direct route")
- Intrusive arousal (e.g., "The buses are too crowded," "The seats are too cramped," "People using mobile phones," and "The drivers often brake too harshly")
- Cost (e.g., "The fares are too expensive")
- Preference for car use (e.g., "I feel more in control when I drive")
- Disability and discomfort (e.g., "There are not enough hand rails inside the bus")
- Self-image (e.g., "Traveling by bus does not create the right impression")

These factors all show social and affective concerns with the quality of the urban bus travel experience as well as more instrumental reasons for service dissatisfaction. Drunks and groups of youths on the bus were perceived as threatening, and the effect was amplified during the hours of darkness. The uncertainty of waiting for the bus, especially at night, was also a source of anxiety to some bus users. Such factors may, in the limiting case, induce avoidance behavior: "I refuse to travel to Leith or West Edinburgh by bus at night. I don't feel safe and other passengers can be very intimidating" (female, age 28 years); "I would like to travel to and from Leith in the

evening, but I don't because the direct buses are infrequent and I am fearful of the bus stops and of drunks" (female, age 56 years).

One respondent in the study by Stradling et al. (2007) indeed disliked the core premise of public transport: "What do you like and dislike about traveling by bus in Edinburgh?" "General dislike of public transport as have to travel with general public" (female, age 26 years). However, a number of comments revealed that public transport was, for some, an opportunity to engage in positive interpersonal interactions with fellow passengers—social exchange—whether with friends, acquaintances, or co-present strangers: "I enjoy traveling by bus in Edinburgh, because you can see what is going on and sometimes you can get into conversation with other passengers" (female, age 58 years). Engwicht (1993, 1999), in characterizing cities as inventions to maximize exchange opportunities and minimize travel, regarded "streets as a dual space for both movement and exchange" (Engwicht, 1999, p. 19) with "plenty of opportunities for spontaneous exchanges on the walk to the public transport stop, and while riding with others" (p. 19). However, for the bus, as with other forms of public transportation, there is permanent tension between the exchange and movement roles. On a bus, the rules of social exchange including the etiquettes of co-presence apply when "having to travel with the general public" and endure enforced proximity while respecting private space, whereas for the bus as occupier of a movement space, destination choice is constrained by routes, service frequency and journey duration are fixed by timetabling, and fare collection and verification of travel entitlement govern place and pace of entry.

Russell (1980, 2003) characterized affective states in a typology involving two orthogonal dimensions—pleasant/unpleasant and activated/deactivated—giving four emotion quadrants. In describing what they liked about bus travel in Edinburgh, a number of respondents indicated a state of mind that is in contradistinction to the annoyances and intrusions of "unwanted arousal" and may be the reverie that unwanted distractions intrude on. This state of mind appears to involve being transported while switched off. It is smooth, tranquil, undisturbed, relaxed, absorbed, engaged with the moment yet "elsewhere," and is pleasurable without being ecstatic. It exemplifies the passive nature of being a passenger.

Figure 35.4 uses Russell's scheme to suggest possible transitions between pleasant and unpleasant states (arrows)—between greater and lesser amounts of journey pleasure and thus, potentially, between greater and lesser amounts of customer satisfaction and repeat patronage. The ideal urban bus journey experience is pleasant/deactivated, and bus rides that bring about unpleasant/activated journey experiences are to be avoided.

6. ATTITUDES TOWARD CAR USE AND THE ENVIRONMENT

Current attitudes toward car use in the United Kingdom may be characterized as ambivalent. Table 35.3 shows results from a number of surveys that demonstrate this ambivalence in simultaneously espoused attitudes (Dudleston, Hewitt, Stradling, & Anable, 2005; Stradling, 2006; Stradling, Hine, et al., 2000).

Table 35.4, using data from the British Social Attitudes survey collected during the summer of 2006 (Stradling, Anable, Anderson, & Cronberg, 2008), shows both consensus and differentiation. A substantial majority of both the general adult population ("all adults") and motorists in Britain ("drivers") are convinced and concerned about the influence of transport on climate change. Indeed, two-thirds agree, with only 1 in 10 disagreeing, that "for the sake of the environment, everyone should reduce how much they use their cars." Similar numbers agree that individual efforts should be made and will contribute. However, approximately one-fourth of both drivers and adults in the United Kingdom still espoused the position that "people should be allowed to use their cars as much as they like, even if it causes damage to the environment." More high-mileage drivers, likely to be particularly affected by constraints on car use, support unlimited car use, with 35%of high-mileage drivers (>10,000 miles/16,000 km a year) agreeing with the statement compared to 15% of low-mileage drivers (<5000 miles/8000 km a year). Even so, that means there are many, indeed a majority (62%; 3% responded "don't know"), of high-mileage drivers who do not think that people (such as themselves) should be allowed to use their cars as much as they like, despite the ensuing inconvenience.

From a series of questions on attitudes toward car use and the environment, drawing on work by Anable (2005), cluster analysis derived four discernibly different groups of motorists (Dudleston et al., 2005; Stradling, 2007a): die-hard drivers, car complacents, malcontented motorists, and aspiring environmentalists. The segments differ in the extent to which they exhibit attachment to the car, are willing to consider alternative modes, are already multimodal, feel willing and able to reduce their car use, are aware of transport issues, acknowledge the transport contribution to environmental problems, and say they are prepared to bear additional cost for continuing car use:

Die-hard drivers (DHD) (~24% of UK drivers) like driving and would use the bus only if they had to do so. Few believe that higher motoring taxes should be introduced for the sake of the environment, and many support more road building to reduce congestion.

Car complacents (CC) (29% of drivers) are less attached to their cars but currently see no reason to change. They generally do not consider using transport modes other than the car, and faced with a journey to make, they will commonly reach for the car keys.

Malcontented motorists (MM) (23% of drivers) find that current conditions on the road, such as congestion and the behavior of other drivers, make driving stressful. They would like to reduce their car use but cannot see how. They say that being able to reduce their car use would make them feel good, but they believe there are no practical alternatives for the journeys they have to make. In Scotland, more members of this group live in accessible rural areas.

Aspiring environmentalists (AE) (23% of drivers) are actively trying to reduce their car use, already use many other modes, and are driven by an awareness of environmental issues and a sense of responsibility for their contribution to planetary degradation (Anable, 2005; Dudleston et al., 2005; Stradling, 2007).

Table 35.5 shows examples of differences between the four car driver groups.

Most motorists, especially DHDs and even AEs who are keen to cut car use, like traveling in cars: Cars are comfortable, convenient, convey autonomy and mobility, and promise the benefits of speed, which is why cutting car use is a challenge. However, many drivers, except the DHDs and CCs, find that car use can be stressful and is thus, potentially, to be avoided. Most of the CCs—and more than in the other segments—do not consider other mode options but simply get in the car. Although equivalent proportions of MMs and AEs are trying to use the car less, hardly any of the MMs think it will be easy, unlike the AEs. MMs see themselves as willing but unable; they have the inclination to cut car use but lack the opportunity.

More of the DHDs and CCs would like more roads built to ease congestion; many more DHDs support unrestricted car use and the “right to automobility” and also think global warming threats are exaggerated. On the other hand, more AEs think car users should pay higher taxes, and more say they are prepared to pay them if the revenue is directed to public transport improvements.

Cluster analysis also identified three types of nondrivers from the third of Scottish households that do not have access to a car:

Car skeptics **(**8% of adults) are travel aware, environmentally aware, managing without a car, and more likely to use bicycles and to support constraints on unfettered car use.

Reluctant riders (7% of adults) tend to be older and less well off, involuntarily dependent on public transport, and where possible travel as passengers in other people's cars.

Car aspirers (7% of adults), more of whom are unemployed, from lower social classes, and environmentally unaware, need better access to destinations than their current high bus use provides and for this and other reasons aspire to car ownership.

7. SUBSTITUTING MORE SUSTAINABLE MODES FOR CAR USE

Do motorists make all their journeys by car? In asking them to cut their car use and substitute more sustainable modes, are they being called upon to venture into the unknown? Studies in Scotland (Stradling, 2005, 2007a) show that although most drivers drive frequently, with 96% reporting using the car "once or twice a week" or more often, almost half (46%) report traveling as a passenger in a car with the same frequency, and 9% take a taxi that often. More than half (56%) have used bus and train, 1 in 6 say they cycle once a month or more often, and 8 of 10 say they walk for at least 10 min once a week or more often. Indeed, only 1.1% of Scottish drivers use only one mode and thus do all their traveling by car. Six in 10 report use of—and thus familiarity with—five or more modes.

In three studies of travel awareness (Dudleston et al., 2005; NFO World Group & Napier University Transport Research Institute, 2001, 2003), Scottish drivers were asked how often they undertook various lifestyle maintenance activities and, for those they undertook, how often they used various travel modes, including car, to access these activities. Those who undertook each activity by car were then asked whether it would be practical for them to use each of four more sustainable modes (walk, cycle, bus, and train) for that activity. Table 35.6 shows, for a set of trip types currently undertaken by car, the percentage of drivers who say they could undertake such trips by each of four other modes (rows may total more than 100% because some respondents indicated it would be practical for them to use more than one alternative mode). The activities are arranged in ascending order by the percentage saying that "none of these" would be a practical alternative for them, thereby indicating the substitutability of trip types from most (child escort to school: only one-fourth of parents would not be able to do it otherwise) to least (supermarket shopping: slightly more than half say they could not do it other than by car, which leaves 43% who could).

Farrington, Gray, Martin, and Roberts (1998, p. 3) deemed as structurally dependent on the car "those who are dependent … because there are no viable alternatives" and as consciously

dependent on the car "those who rely on their vehicle but could realistically undertake their journeys by alternative modes." The former are unable to switch modes, whereas the latter are unwilling.

Overall, only 11% of car drivers in Scotland indicated that they could not practically use a bus, train, walk, or cycle for any of their journeys and are thus structurally car dependent. They see themselves as having no opportunity to do otherwise. Seven percent were consciously car dependent: They could realistically undertake all the current car trip types about which they were questioned by more sustainable modes, but they had no inclination to do so. These two figures establish the ends of the potential modal shift distribution—those who cannot and those who will not cut car use. The segmentation analysis on driver types detailed previously provides additional differentiation of the terrain.

8. DEMAND-SIDE BEHAVIOR CHANGE

Transport researchers in the United Kingdom (Cairns, Davies, Newson, & Swiderska, 2002; Cairns et al., 2004; Government Operational Research Service, 2005; Rye, 2002; Steer Davies Gleave, 2003) have attempted to estimate the effects of mobility management measures on future car use. Mobility management measures are techniques that seek to persuade and assist people in changing travel habits and patterns. Cairns et al. (2004) concluded that if such demand-side measures were given greater policy priority in the United Kingdom, they have the potential to achieve a reduction in peak urban traffic of approximately 21% (off peak, 13%) and a UK nationwide reduction of all traffic of approximately 11%. They suggested that workplace travel plans could achieve between a 10 and 30% reduction in solo car use, school travel plans between 8 and 15%, and personalized travel planning initiatives between 7 and 15%. On the other hand, in a meta-analysis, Möser and Bamberg (2008) suggest rather lower effects because, in practice, transport evaluations typically employ one or more of the following:

- A one-group pre-post test design
- Weak analytical techniques to synthesize the data obtained (e.g., narrative-style analysis)
- Sample sizes too small to allow statistical effects to be established—unrepresentative samples
- A tendency to report only "good practice" case studies

Researchers in the neighboring domain of health psychology have collated a number of tested techniques for changing the behavior of individuals (Abraham & Michie, 2008). Such

techniques, which typically go beyond reasoned argument in attempting to inculcate demand-side behavior change, might successfully transfer to transport psychology interventions—an empirical matter germane for investigation. Table 35.7 provides a brief description of 26 techniques of demonstrated effectiveness.

Abraham and Michie (2008) also give the theoretical provenance of each technique. To date, however, there is no consensus among researchers in transport psychology regarding the best theoretical framework to explain or inform change in travel mode choice (Anable, Lane, & Kelay, 2006; Darnton, 2008). Accounts have been proposed using the norm activation model (Hunecke, Blobaum, Matthies, & Hoger, 2001), theory of planned behavior (Bamberg, Ajzen, & Schmidt, 2003; Heath & Gifford, 2002), grounded theory (Gardner & Abraham, 2007), the model of action phases (Bamberg, 2007), and the transtheoretical model (Gatersleben & Appleton (2007).

The MaxSem model (Carreno, Bamberg, & Rye, 2009), shown in Figure 35.5, attempts to combine a stage approach with social psychology constructs of the kind listed in Table 35.7, such as goal intention (technique 4), behavioral intention (technique 10), and implementation intention (technique 16) (Bamberg, 2000). Each construct is hypothesized to be at its most applicable at a particular stage in the change process and, indeed, its application at other points may be otiose or worse. Thus, the model seeks to identify which vectors will press the person toward forming a goal intention at the precontemplation stage; toward forming a behavioral intention at the contemplation stage; toward agreeing to an implementation intention at the preparation/testing stage; and preventing relapse (Table 35.7, technique 23) during the establishment of a new, more sustainable, travel habit at the maintenance stage.

9. CONCLUSIONS

This chapter discussed in some depth travel mode choices. Travel mode choices vary with person characteristics such as age, gender, and disability; with household characteristics such as income, location, and transport availability; with journey purpose; and with attitude/value clusters. They also vary with environment characteristics, such as land use; the location of trip origins, such as homes; and trip destinations, such as jobs, shops, and recreations. Travel links the places where

people go to lead their lives and meet their obligations (Stradling, 2002a, 2002b; Stradling, Meadows, et al., 2000).

The UK data show high levels of public concern; reasonably accurate knowledge of which transport modes are most to blame; evidence, following the pioneering work of Linda Steg and colleagues (Steg, 2004; Steg & Gatersleben, 2000; Steg, Geurs, et al., 2001a, 2001b; Steg & Tertoolen, 1999; Steg & Uneken, 2002; Steg, Vlek, et al., 2001), of the importance of affect in travel mode choice; different psychological satisfactions (as well as different risks) associated with different motorized modes; and differentiation among different segments of the population defined by their attitudes toward car use and the environment.

Although there are barriers to change, with car-dependent places, car-dependent trips, and car-dependent people requiring different, detailed remediations from "hard" engineering and infrastructure measures (e.g., building more dedicated cycle lanes to enhance the opportunities for cycling) to "soft" psychological measures (e.g., segmenting citizens by their inclination for change and designing targeted persuasions), there are prospects for demand-side reduction in car use in the United Kingdom. There seems to be a readiness for change.

Evidence from elsewhere is less heartening. Although many of the world's population have long held the inclination to meet their travel obligations by car but have been unable to afford to do so, increasing affluence in developing countries means that many more now have the opportunity to own and drive automobiles. The ACNielsen Car Aspiration Index for 2004 (ACNielsen, 2005) showed large countries (e.g., China, India, and the Philippines) with currently low levels of motorization but high levels of aspiration toward car ownership. Impact equals population multiplied by consumption (Figure 35.6). The global impact of GHG emissions from fossil fuel-powered motorized vehicles is the product of the number of such vehicles (population) multiplied by the average GHG emission rate (consumption). Although supply-side changes such as increased engine and fuel efficiency are reducing the unit rate of consumption of fossil fuels and emission of GHGs, these are undermined by rebound effects that offset carbon gains, and the size of the worldwide fossil-fueled vehicle fleet is increasing inexorably. This is why the challenge to transport psychology to help the world burn less fossil fuel, and soon, is a demanding one.

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Figure 35.1 Core determinants of travel behavior. *Source*: Reproduced with permission from Garling (2005).

Figure 35.2 Road transport CO_2 policy measures in the United Kingdom. *Source*: Department for Transport (2007).

Figure 35.3 Rated risk and enjoyment of powered two-wheeler users. *Source*: Reproduced with permission from Broughton (2007).

Figure 35.4 Russell's (1980, 2003) typology of affective states and the urban bus journey experience

Figure 35.5 MaxSem model of travel mode change. *Source*: Reproduced with permission from Carreno et al. (2009).

Figure 35.6 Global GHG emissions from fossil fuel-powered vehicles

Table 35.1 Behavior Changes to Current Human Consumption Patterns Needed to Reduce Greenhouse Gas Emissions

- **Transport:** Minimizing use of cars, trying public transport, and walking or cycling to get from A to B
- **Holidays, leisure, and travel:** Choosing locations, activities, and transport modes to help the environment
- **Rubbish:** Minimizing waste, recycling, composting, and disposing properly of unwanted goods
- **Food purchasing:** Buying local produce, choosing organic items, avoiding depleted wild foods, adopting "seasonality," choosing vegetarianism, and growing food at home
- **Energy use in the home:** Turning down heating, using low-energy lighting, switching off appliances, reducing energy demand through less "home mechanization," insulating, and sourcing greener energy
- **Chemicals:** Reducing release of damaging or polluting chemicals through use of detergents, bleaches, garden chemicals, etc.
- **Sourcing materials:** Refusing items made from depleted resources (e.g., tropical timber) while actively seeking those made from recycled materials (e.g., waste paper)
- **Water use:** Cutting consumption, cutting waste, home gathering, and reusing
- **Consumer hardware:** Repairing rather than replacing, passing on unwanted goods, and disposing of items at the end of their life properly
- **Green investment:** Choosing environmental savings accounts, mortgages, etc.
- **Active participation:** Donating and joining and taking part in green activities

• **Voting:** Casting votes on environmental grounds
• **Bearing witness:** Promoting environmentally friendly behavior to others
Source: Hounsham (2005).

Table 35.2 Ten Components of the Driving Task

1. Strategic tasks	Activity choice and mode and departure time choice. Discern route alternatives and travel time.
2. Navigation tasks	Find and follow chosen or changed route; identify and use landmarks and other cues.
3. Road tasks	Choose and keep correct position on road.
4. Traffic tasks	Maintain mobility ("making progress") while avoiding collisions.
5. Rule tasks	Obey rules, regulations, signs, and signals.
6. Handling tasks	Use in-car controls correctly and appropriately.
7. Secondary tasks	Use in-car equipment, such as cruise control, climate control, radio, and mobile telephone, without distracting from performance on primary tasks.
8. Speed task	Maintain a speed appropriate to the conditions.
9. Mood management task	Maintain driver subjective well-being, avoiding boredom and anxiety.
10. Capability maintenance task	Avoid compromising driver capability with alcohol or other drugs (both illegal and prescription), fatigue, or distraction.

Source: Components 1–8 from Panou et al. (2005).

Table 35.3 Ambivalent Attitudes on Car Use in the United Kingdom (*n* = 656–791)

Driving a car gives me freedom to go where I want when I want 95%
Driving a car is a convenient way of traveling 93%
I like traveling in a car 84%
BUT
Driving a car is stressful because of congestion on the roads 53%
Driving a car is stressful because of the behavior of other drivers 53%
AND
I am trying to use my car less 43%
I would like to reduce my car use but there are no practical alternatives 57%

Table 35.4 Attitudes on Car Use and the Environment in Britain

		All Adults	Drivers
		n = 3220	*n* = 2233
The current level of car use has a serious effect on climate change.	Agree*	80%	82%
I am concerned about the effect of transport on climate	Concerned	81%	84%

change.			
		n = 930	n = 541
For the sake of the environment, everyone should reduce how much they use their cars.	Agree Disagree	66% 10%	66% 11%
Anyone who thinks that reducing their own car use will help the environment is wrong—one person doesn't make any difference.	Disagree	59%	62%
People should be allowed to use their cars as much as they like, even if it causes damage to the environment. High-mileage drivers (>10,000 miles/16,000 km per year)	Agree Agree	23%	24% 35%

*Agree = strongly agree + agree; concerned = very concerned + fairly concerned; disagree = strongly disagree + disagree.

Source: Stradling et al. (2008).

Table 35.5 Proportions of Each Driver Type Agreeing with Environmental Attitude Items

	DHD	CC	MM	AE
Weighted percentage over four UK samples, n = 3471	24%	29%	23%	23%
Percentage strongly agree + agree				
I like traveling in a car.	98	82	82	73
I find car driving can be stressful sometimes.	25	28	66	67
I am trying to use the car less.	8	29	62	83
Reducing my car use would make me feel good.	5	21	65	78
I would like to reduce my car use but there are no practical alternatives.	49	54	81	46
Being environmentally responsible is important to me.	61	76	85	89
Environmental threats such as global warming have been exaggerated.	39	19	20	9
People should be allowed to use their cars as much as they like, even if it causes damage to the environment.	48	13	19	7
For the sake of the environment, car users should pay higher taxes.	4	5	17	39
I would be willing to pay higher taxes on car use if I knew the revenue would be used to support public transport.	11	9	38	46
It is important to build more roads to reduce congestion.	72	23	60	30

AE, aspiring environmentalists; CC, car complacents; DHD, die-hard drivers; MM, malcontented motorists.

Table 35.6 Substitutability of Current Car Journeys: Percentage Who Could Substitute Current Car Journey by Other Mode

n = 392–1598	Walk	Cycle	Bus	Train	None of These
Take children to/from school*	59	3	16	<1	28
Town center shopping	23	2	43	13	31
Visit friends or relatives	39	9	28	11	35
Evenings out for leisure purposes	26	1	34	9	42
Leisure activities during the weekend	21	9	27	12	48
Take children to leisure activities*	29	4	27	4	49
Go away for a weekend	<1	<1	20	40	53
Travel to work†	15	10	28	9	55
Supermarket shopping	19	3	26	<1	57

*Respondents with children in the household.

†Respondents who travel to work by car.

Table 35.7 Behavior Change Techniques Effective in Health Interventions

Technique	Description
1. Provide information about the behavior–health link	General information about behavioral risk, such as susceptibility to poor health outcomes or mortality risk in relation to the behavior.
2. Provide information on consequences	Information about the benefits and costs of action or inaction, focusing on what will happen if the person does or does not perform the behavior.
3. Provide information about others' approval	Information about what others think about the person's behavior and whether others will approve or disapprove of any proposed behavior change.
4. Prompt intention formation	Encouraging the person to decide to act or set a general goal—for example, to make a behavioral resolution such as "I will take more exercise next week."
5. Prompt barrier identification	Identify barriers to performing the behavior and plan ways of overcoming them.
6. Provide general encouragement	Praising or rewarding the person for effort or performance without this being contingent on specified behaviors or standards of performance.
7. Set graded tasks	Set easy tasks, and increase difficulty until target behavior is performed.
8. Provide instruction	Telling the person how to perform a behavior and/or preparatory behaviors.
9. Model or demonstrate the behavior	An expert shows the person how to correctly perform a behavior (e.g., in class or on video).
10. Prompt specific goal setting	Involves detailed planning of what the person will do, including a definition of the behavior specifying frequency, intensity, or duration as well as specification or at least one context (i.e., where, when, how, or with

	whom).
11. Prompt review of behavioral goals	Review and/or reconsideration of previously set goals or intentions.
12. Prompt self-monitoring of behavior	The person is asked to keep a record of specified behaviors (e.g., in a diary).
13. Provide feedback on performance	Providing data about recorded behavior or evaluating performance in relation to a set standard or others' performance—that is, the person receives feedback on his or her behavior.
14. Provide contingent rewards	Praise, encouragement, or material rewards that are explicitly linked to the achievement of specified behaviors.
15. Teach to use prompts/cues	Teach the person to identify environmental cues that can be used to remind him or her to perform a behavior, including times of day or elements of contexts.
16. Agree behavioral contract	Agreement (e.g., signing) of a contract specifying behavior to be performed so that there is a written record of the person's resolution witnessed by another.
17. Prompt practice	Prompt the person to rehearse and repeat the behavior or preparatory behaviors.
18. Use follow-up prompts	Contacting the person again after the main part of the intervention is complete.
19. Provide opportunities for social comparison	Facilitate observation of non-expert others' performance (e.g., in a group class or using video or case study).
20. Plan social support/social change	Prompting consideration of how others could change their behavior to offer the person help or (instrumental) social support, including "buddy" systems, and/or providing social support.
21. Prompt identification as role model	Indicating how the person may be an example and influence others' behavior or providing an opportunity for the person to set a good example.
22. Prompt self-talk	Encourage the use of self-instruction and self-encouragement (aloud or silently) to support action.
23. Relapse prevention	Following initial change, identify situations likely to result in re-adopting risk behaviors or failing to maintain new behaviors and help the person to plan to avoid or manage these situations.
24. Stress management	May involve a variety of specific techniques (e.g., progressive relaxation) that do not target the behavior but seek to reduce anxiety and stress.
25. Motivational interviewing	Prompting the person to provide self-motivating statements and evaluations of his or her own behavior to minimize resistance to change.

26. Time management	Helping the person make time for the behavior (e.g., fit it into a daily schedule).

Source: Abraham and Michie (2008).

Figure 1. Core Determinants of Travel Behavior (from Garling, 2005)

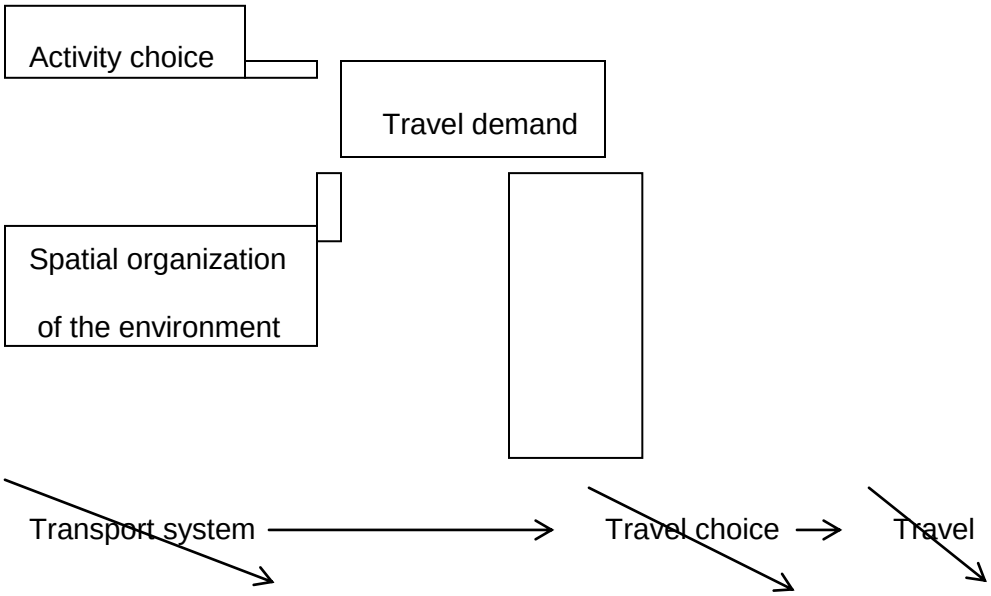

Figure 2. Road Transport CO2 Policy Measures in the UK (from Department for Transport, 2007)

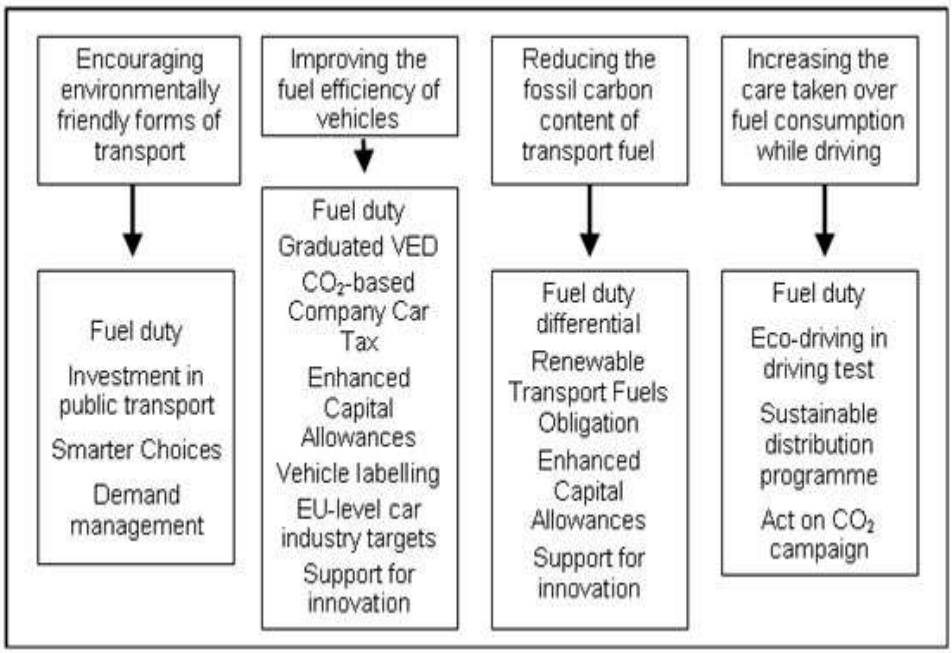

Figure 3. Rated Risk and Enjoyment in Powered Two-Wheeler Users (from Broughton, 2007)

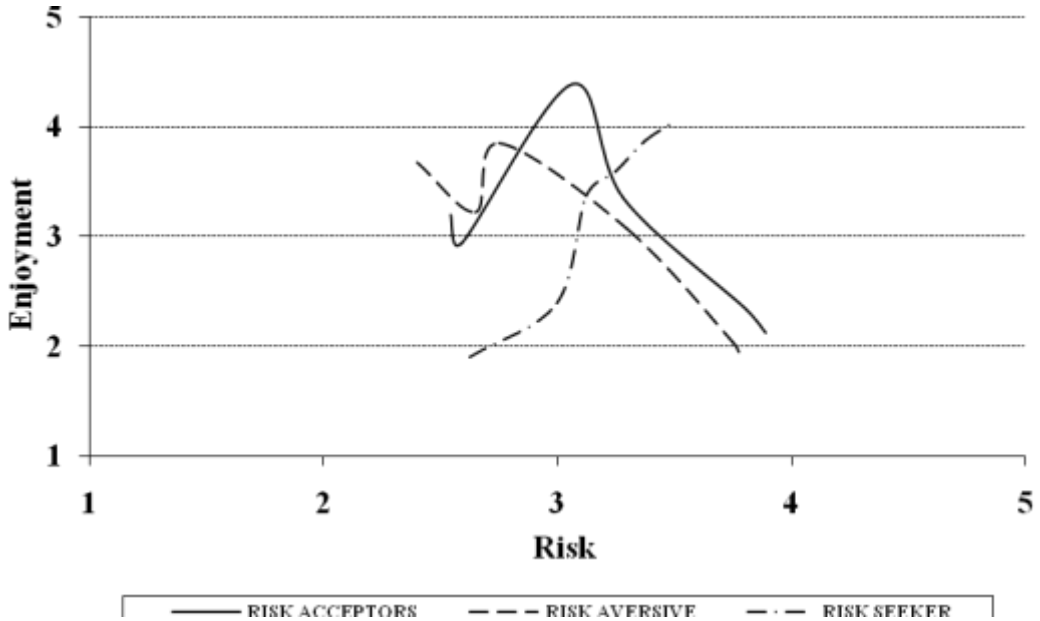

Figure 4. Russell's (1980, 2003) Typology of Affective States and the Urban Bus Journey Experience

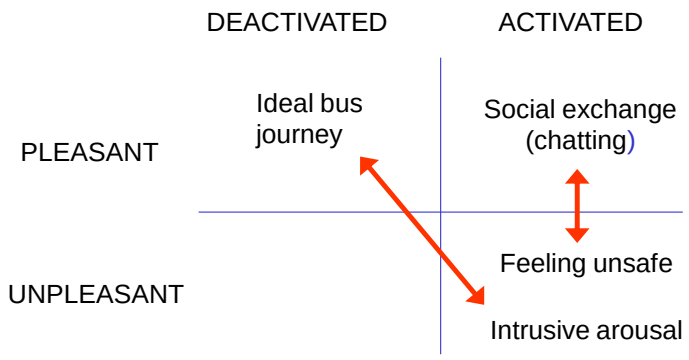

Figure 5 MAXSEM Model of Travel Mode Change (from Carreno et al, 2009)

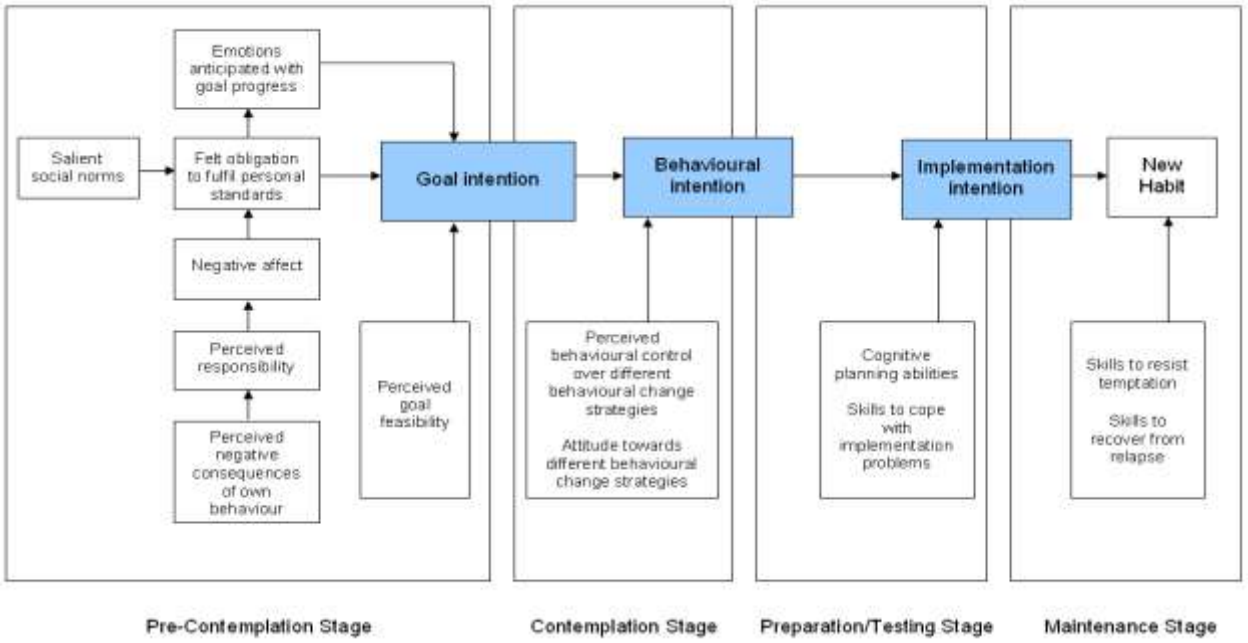

Figure 6 Global GHG Emissions from Fossil Fuel Powered Vehicles