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Too Good to be True:
An Assessment of the Melbourne Travel Behaviour Modification Pilot

Carfree, Low Car – What's the Difference?

Urbanisation and the need for sustainable development. Everywhere and nowhere

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Editorial

The papers in this issue of WTPP all connect in different ways to the needs, aspirations and conditions associated with reduced car traffic and much improved opportunities for the sustainable modes especially walking and cycling. We have frequently identified the crucial importance of cycling in this journal and the degree to which it is misunderstood or simply ignored in the world of transport professionals. One of the worrying aspects of cycling in places like London and New York is that it is increasingly seen as the preserve of relatively young, affluent professional males. Given that these people could be in a rather powerful sports car or 4WD it is still something to celebrate that they are on bikes but we need to pay more attention to all ages, both genders and different degrees of physical aptitude and risk taking behaviour.

Walking has the potential to cast the net very wide indeed and make a substantial contribution to health, lively communities and low carbon futures. This is nothing new. The debate about walking and its potential has been massively enriched by the presence of excellent NGOs, creative architects like Jan Gehl, a substantial literature pioneered by Mayer Hillman 30 years ago and more recently by Rod Tolley. The startling thing about walking is how bad it really is in most parts of the world and how large is the gap between the rhetoric and the practice.

It is tempting at this point to make a list of all the bad things that we see on our daily walk trips and conclude that something should be done about it, but two recent publications strongly indicate that this approach is not as likely to be as successful as a much more up-beat approach painting a picture or a vision of a much better future and what it would look like and feel like. The two pieces of work that point in this direction are the Low Carbon Transport study from the Stockholm Environment Institute (SEI), University of York and the report "Sell the Sizzle: the new climate message" from Futerra (see references).

The SEI report produces a robust scientific analysis of how we can largely de-carbonise the UK transport system by 2050. Comparing its maximum impact scenario with what emissions are likely to be by 2050 on a business as usual scenario it estimates that a 76% reduction in overall CO_2 emissions is possible. It then goes beyond the science to paint a picture of what life would actually look like in UK 2050 in a low carbon transport society. It paints a picture of a calmer, cleaner, greener, more accessible system. People will spend a lot less time stuck in jams and commuting, neighbourhoods and communities will be rich in service provision e.g. shops, jobs and post offices and walking and cycling will be the norm on streets with much reduced traffic levels and with no exhaust pollution. The very young and the elderly will receive significant improvements in quality of life through much improved opportunities to move around easily and at low cost and the lack of pollution and noise will improve health and contribute to reduced obesity.

High levels of walking and cycling in this study are no longer vague aspirations and poorly supported policy objectives.

They actually happen because changes in the physical environment make them happen.

The Futerra study raises this general approach to transport futures to a fine art based on how to communicate attractive messages about much improved futures. Whilst we have some reservations about the language around "selling the sizzle rather than the sausage" the point is well made and undoubtedly attractive. We strongly recommend this approach to communicating clear visions of a bright, attractive, happy future based on lots more walking and we strongly recommend the insights of Steve Melia and his co-authors in this issue about car-free and low car futures. These are very clear and attractive visions of the future

The paper by Helmut Holzapfel in this issue is also visionary. He sets out a clear case for reductions in miles driven, flown or travelled by high speed rail. He shows that distance intensive life styles are just another aspect of rather pointless consumerism and that there are considerable advantages in changing this and moving to a "new slowness".

John Whitelegg
Editor

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Abstracts & Keywords

Too Good To Be True? An Assessment of the Melbourne Travel Behaviour Modification Pilot

Anthony Morton and Paul Mees

Travel Behaviour Modification (TBM) uses individualised marketing to change public perceptions of the attractiveness of walking, cycling and public transport, with the aim of bringing about mode shift. TBM is attractive to policy makers because it promises changes to travel patterns without the need for expensive or controversial alterations to substantive transport policies. The Australian government has allocated $18.3 million from its Greenhouse Gas Abatement Program for the TravelSmart brand of TBM and state and local governments have also joined the programme. The Victorian government is a strong supporter, and claims that a trial of TravelSmart along Melbourne's Alamein rail corridor in 2003 reduced car driver trips by 10 per cent, and increased public transport, walking and cycling trips by 23-27 per cent.

Some of the governmental support for TBM may be a form of 'greenwash', in which responsibility for environmentally unsustainable transport policies is deflected from transport policy makers to the public. In these cases, TBM may be a form of public relations disguising the fact that no real changes are being made to transport priorities. For this reason, and because TBM consultants naturally have an interest in seeing their 'products' succeed, it is important that the results claimed for TBM programmes are carefully scrutinised.

One TBM intervention that has received considerable scrutiny is the TravelSmart programme conducted in South Perth in 2000, which was the subject of a spirited debate at the 2003 ATRF. Our review of the South Perth public transport data, and subsequent data from the 2001 census, casts doubt on the claims of substantial increases in public transport patronage.

The most likely cause of the discrepancy between the results reported from TBM trials, and independent data like patronage counts and census results is an issue that was not extensively discussed in the 2003 ATRF debate, namely statistical 'artifacts' arising from interactions between the TBM researchers and participants. Such interactions include 'expectancy bias' in which the pressure that (self-selected) TBM participants feel to report a positive outcome leads to an over-statement of the extent to which behaviour has changed. This can in turn lead to sampling and non-response biases, as people who have not in fact changed their travel behaviour are reluctant to report the fact.

Close examination of the results of the Alamein TravelSmart pilot reveals these effects at work. In particular, it reveals that a statistically significant number of those who agreed to participate in the trial did not complete the 'after' survey enabling comparison with their travel

behaviour before TBM. The most likely explanation for this is a reluctance to report that their behaviour had not, in fact, changed. Our analysis also reveals that the statistical weighting techniques employed in analysing the survey data had the effect of magnifying any errors in the original data, rather than correcting the errors. Our overall conclusion is that it cannot be safely inferred from the survey results that the Alamein pilot produced any significant change in travel behaviour.

The South Perth and Alamein results provide strong evidence that statistical artifacts are responsible for much, and possibly all, of the mode shift apparently produced by TravelSmart programmes. We make a number of recommendations for improving the evaluation of such programmes in the future, and caution that until these changes are made, policy makers should be sceptical of the claims made on behalf of TBM techniques.

Keywords: Melbourne, TravelSmart, walking, cycling, public transport, transport policy, individualised marketing, travel patterns, change

Carfree, low-car – What's the Difference?

Dr Steve Melia, Prof. Graham Parkhurst and Prof. Hugh Barton

This paper aims to propose a definition and typology of carfree development and to assess the benefits and problems associated with it. It aims to contrast these with the concept and practice of 'low car' development.

Through a review of the literature and study visits to European carfree areas, 3 types of carfree development were identified: the Vauban model, Limited Access model and pedestrianised city centres with substantial residential populations. Differences in the previous definitions of carfree development reflect two different aspects of the concept: exclusion of vehicles from the residential area, and places where people live without owning cars. The definition proposed here reflects both of these, although neither was absolutely implemented in the examples visited. Although intermediate cases are possible, in practice clear differences are apparent between the carfree and 'low car' developments reviewed in the literature and studied in one case, in the UK.

The study visits supported the claims in the literature that carfree developments help to reduce problems created by traffic in urban areas. They facilitate active travel and independent play amongst children. Their main problems relate to the management of parking and vehicular access. Low car developments by contrast can offer similar benefits to policymakers, but fewer benefits to residents.

Keywords: Carfree development, benefits, problems, 'low car' development, Vauban, 'Limited Access', pedestrianised city centres

Urbanisation and the need for sustainable development. Everywhere and nowhere

Helmut Holzapfel

This article challenges the dominant ideology that suggests that ever increasing levels of mobility are a good thing. The apparently inexorable growth of all categories of traffic but especially car miles driven must be challenged. The growth in distances routinely travelled by car distorts concepts of space and time and damages landscape and we now inhabit a distance-intensive world. The consumption of distance and the urge to be everywhere results in people being nowhere. This is a global problem and the world cannot sustain Californian or German levels of mobility applied to China and India. The distance intensive life style is strongly associated with stress and the urge to do more things in smaller units of time. The disadvantages of this lifestyle paradigm now outweigh the advantages and there is an urgent need to change social and other values to move in a different direction. The article concludes by looking forward to a world where localism and regionalism are celebrated and near things are appreciated as calmer and intrinsically more satisfying than distant things. Ubiquity may lose its power and proximity will gain respect and attention.

Keywords: mobility levels, traffic growth, landscape, distance intensive lifestyle, stress, localism, regionalism

Too Good To Be True? An Assessment of the Melbourne Travel Behaviour Modification Pilot

Anthony Morton and Paul Mees

1. Introduction

Governments, planners and analysts across Australia agree that mode shift from the automobile to walking, cycling and public transport is desirable for environmental, social and health reasons, but in all our major cities trends are heading in the opposite direction. Various remedies have been proposed, but all have their drawbacks. Road pricing, for example, is widely supported by transport planners, but is extremely unpopular with the public. Curtailing road expansion in favour of increased investment in public transport would be popular with environmentalists and many community groups, but is strongly resisted by road authorities and motoring organizations. Wouldn't it be nice if there was an inexpensive, pain-free way of moving towards sustainable urban transport?

Enter Travel Behaviour Modification (TBM), represented in Australia by TravelSmart (an adaptation of the IndiMark® concept) and Travel Blending®. TBM uses individualised marketing to change public perceptions of the attractiveness of more sustainable modes, with the aim of changing travel behaviour. Before we consider the effectiveness of TBM, it is worth reflecting on why this approach might be expected to gain wide support.

1.1 A political economy of Travel Behaviour Modification

The attractiveness of TBM to governments is obvious: it is much cheaper than investing in infrastructure or services, and less controversial than schemes like road pricing. At the other end of the scale, the source of attraction is indicated by the trade-mark symbols attached to products like Indymark®: TBM programs tend to be the property of consultants who, naturally, believe in their product and wish to sell it.

There is another, potentially more controversial, reason TBM might be popular. Programmes like TravelSmart can shift responsibility for solving transport problems from governments and transport planners to the public. Instead of asking why public transport is so poor or why pedestrians are marginalised to benefit motorised traffic, the approach seems to be telling the public that things are not as bad as they seem and to 'change its attitude'.

TBM therefore has the potential to be conscripted as part of what Beder (2000) calls 'greenwash' campaigns, in which governments and businesses responsible for environmental damage seek to deflect attention from themselves to individual members of the community. Indeed, Beder's description of the unofficial motto of greenwash campaigns is similar to that of TBM consultants: "It is easier and less costly to change the way people think

about reality than it is to change reality" (Beder 2000: 109).

A similar point is made less 'politically' in a review of TBM techniques by the UK Department for Transport:

> It is clear that the techniques will only work 'on their own' where there is a large gap in perception between what exists and what people believe exists. For public transport, where services and travel quality [are] much higher than perceived, personalised approaches can have very large effects, but where such a gap does not exist the travel behaviour effects could be negligible…. It would seem that they need to be thought of as an integral part of a strategy rather than as some form of 'public relations' exercise, when nothing substantive is being done to address strategic transport priorities (DfT 2002: 8.3).

1.2 TravelSmart in Australia

Commencing in Perth in 1997, TravelSmart has spread to all mainland capital cities, assisted by its adoption in 2003 by the Federal government. TravelSmart received $18.3 million from the Federal Greenhouse Gas Abatement Program, and remains the only transport project to have been funded under the program. Local government has become involved with TBM, through a Federally-funded initiative of the International Council for Local Environmental Initiatives called Cities for Climate Change™.

The enthusiasm of the Federal government for TravelSmart contrasts starkly with that government's hostility to other initiatives that might promote sustainable urban transport, from a carbon tax to funding for urban public transport. Numerous other local and state governments that are backing the programme are similarly notorious for their lack of interest in real change to transport priorities.

One such government is that of Victoria, which in 2002 released the *Melbourne 2030* metropolitan strategy, proposing to increase the share of motorised trips by public transport from 9 per cent to 20 per cent by 2020. Two years later, responding to criticism that no funding or other serious initiatives had been provided to meet this ambitious target, the government released *Linking Melbourne*, a "comprehensive and integrated transport plan". *Linking Melbourne* contained no commitment of funding either, but it did endorse TravelSmart in glowing terms, reporting that a pilot programme on the Alamein corridor in 2003 had reduced car driver trips by 10 per cent and increased public transport, cycling and walking by 27, 23 and 26 per cent respectively (DOI 2004: 35).

The Victorian government's support for TravelSmart appears to be a classic case of 'greenwash' as defined by Beder (and DfT, UK), since it is a substitute for, and diversion from, 'hard' policy changes. But this should not be allowed to obscure the potential of the technique: if the results reported for the Alamein trial are valid, TravelSmart has the potential to make dramatic changes to mode share at

modest cost. While 'greenwash' and the large sums of public funding now potentially available to TravelSmart consultants have the potential to encourage wishful thinking about the program's potential, these factors do not automatically compel a negative verdict. Rather, they point to the need to examine very closely the credibility of the reported changes in travel behaviour.

1.3 Debating the effectiveness of TBM

There was a spirited debate about the effectiveness of TravelSmart at the 2003 ATRF. Stopher and Bullock (2003) raised a series of concerns about the reliability of reported behavioural changes and associated environmental benefits, focussing on a review of the results reported for TravelSmart/IndiMark® programs in Perth. A rebuttal was presented in a multi-author paper (Roth et al 2003), which in our view answered some, but not all, of the concerns raised in the original paper.

In particular, Stopher and Bullock commented on bus boarding data showing a large increase in patronage in South Perth in 2000, coinciding with a TravelSmart program there. This increase had been relied on as confirmation of mode shift changes reported in surveys (Socialdata 2003: 13-14). The problem is that the increase in bus patronage appears to have occurred in February, while the individual marketing component of TravelSmart ran from March to June (Stopher & Bullock 2003: 10-11). The UK Department for Transport review expressed similar concerns about the Perth bus patronage data (DfT 2002: 5.26).

Roth et al respond (2003: 9) that "[t]he installation and commencement of the IndyMark® intervention began at the end of January 2000. Stopher's assertion that it began in March 2000 is incorrect." This response is not convincing. It is true that aspects of the South Perth programme began at the end of January, but the main activity at this time was the installation of improved signage at bus stops (DoT 2000: 4). The individualised marketing component did not commence until March, and one key component, home visits from bus drivers, did not start until April (DoT 2000: 7).

So not only must something else have caused patronage to rise in February, but there appears to be no discernible effect during or following the actual TBM programme. In fact, the most likely cause of the patronage increase was not individualised marketing, but improved bus services introduced in South Perth in January 2000 (Socialdata 2003: 14).

Further doubt on the validity, or at least the durability, of the behaviour changes brought about by TravelSmart in South Perth comes from census data on mode share for the journey to work. The 2001 census was conducted a year after the conclusion of the TravelSmart project, which covered the whole municipality of South Perth. Moriarty and Kennedy (2004) report the following census results for South Perth and the adjacent Central Metropolitan and Victoria Park districts (table 1), where no TBM programmes took place.

Table 1: Mode share for journey to work, 1996 and 2001 (per cent)
(Source: Moriarty & Kennedy 2004)

	Central metro		Victoria Park		South Perth	
Year	1996	2001	1996	2001	1996	2001
Car	78.2	75.5	76.1	75.9	83.7	81.9
Public transport	11.9	13.2	15.8	16.8	10.7	11.2
Walk/cycle	8.1	9.5	5.9	5.6	3.9	4.8

The mode share for walking, cycling and public transport increased across inner Perth, as it did over the same period in inner Melbourne and Sydney. The most likely explanation is an increase in the share of workers employed in the central business district, due to the combined effects of central employment growth and gentrification of the inner city. It is difficult to see any impact from the previous year's TravelSmart programme in South Perth, since the change was similar to that recorded in adjacent districts.

1.4 The central issue: reliability of survey results

These results are difficult to reconcile with the survey results reported in the South Perth study, which reported similar large changes to those claimed for Melbourne's Alamein corridor in 2003. This highlights a concern about the mode share changes reported from TBM projects which was not raised by Stopher and Bullock (2003), but which has been noted by Moriarty and Kennedy (2004), namely the influence of errors arising from survey 'artifacts'.

2. A social psychology of Travel Behaviour Modification

To obtain credible results, a TBM evaluation study must be designed to control for any foreseeable source of bias or systematic error. Those conducting the evaluation will therefore take sensible precautions such as comparing the outcomes for the target group with those for an appropriately selected control group (members of which are excluded from TBM interventions), and endeavouring to survey the same individuals before and after the TBM intervention.

However, any study of the effectiveness of TBM is necessarily a study of human behaviour. The fact that the experimental subjects are people (rather than inanimate objects) introduces a set of subtle yet potentially significant sources of systematic error, usually called 'artifacts' in the psychology literature where they are extensively studied.

> We have learned that much of the complexity of human behaviour is inherent, but we have also learned that some of this complexity may result from uncontrolled aspects of

> the research situation, especially from the interaction between the researcher and the participant....
>
> Artifacts are not simply inconsequential effects in a research design; they may actually jeopardise the validity of the researcher's inferences from his or her results. Another way of saying this is that artifacts are unintended or uncontrolled human aspects of the research situation that confound the investigator's conclusions about what went on in the study (Rosnow and Rosenthal 1997: 2–3).

2.1 The expectancy effect

One example of an experimental artifact is *expectancy bias*. This occurs when experimenters' expectations about the result of a study inadvertently become a self-fulfulling prophecy due to feedback effects between experimenter and participant.

> Behavioral researchers, like other scientists generally, conduct research specifically to test hypotheses or expectations about the nature of things. When the researcher's hypothesis or expectation leads unintentionally to behavior toward the research participants that increases the likelihood that the researcher's expectation will be confirmed, we call this an *expectancy effect* (Rosnow and Rosenthal 1997: 42–43).

It is important to understand that expectancy effects and other artifacts are problematic in the *evaluation* phase of a TBM project, even where they present no difficulty for the TBM intervention itself. If a positive attitude on the part of TBM campaigners contributes to a greater shift in travel behaviour than a neutral or negative attitude, one is entitled to draw a positive conclusion to that effect. But if a researcher testing the effectiveness of a TBM campaign behaves in a way that induces participants to *say* they changed their behaviour when in fact they did not, the result of the entire study is thrown into question. The former is a useful marketing tactic; the latter is an expectancy artifact.

In other situations, expectancy effects are controlled through the familiar 'blind experimenter' approach, where experiments are designed to ensure that the data collector does not know whether the experimental target group or a control group is being observed. In TBM evaluation studies, although travel mode shifts are typically tested against those in a control group, there is scant indication that the target group is treated relative to the control group in a properly 'blind' fashion. As will be seen below, expectancy bias can intrude even in the statistical analysis of data after it has been collected.

2.2 The 'good subject' effect, and the behavioural guilt trap

Many artifacts identified in behavioural research arise from the experimental participants themselves. Among the most fundamental is what psychologist Martin Orne (1962, 1970) dubbed the 'good subject' effect, which arises from the participant's desire to please the researcher:

> [Orne] noted that, at the conclusion of many of his experiments, the participants often asked questions such as 'Did I ruin the study?' After postexperimental interviews with his participants, Orne deduced that what they had meant was 'Did I perform well in my role as experimental subject?' or 'Did my behaviour demonstrate what the study was designed to show?' (Rosnow and Rosenthal 1997: 64)

Because the usual method of evaluating TBM programs is through self-reporting surveys rather than direct observation of travel behaviour, TBM studies are particularly vulnerable to participant-related artifacts. They are also more vulnerable to 'good subject' effects when the experimental target is a group that self-selects as wanting to change their behaviour. The effect can also arise in a different but related form, where the motive is not so much to please, as to avoid being evaluated negatively by the researcher. Social psychologist Martin Rosenberg (1969) provided early experimental evidence of this effect, which he called *evaluation apprehension*.

> [Rosenberg] said that typical participants approached the psychology experiment anticipating that the experimenter would evaluate their psychological competence. Not surprisingly, most participants became apprehensive about being evaluated negatively (or at least not positively), and they developed their own hypotheses about how to win approval and to avoid disapproval (Rosnow and Rosenthal 1997: 68).

While Rosenberg's observations were in a psychological context, a similar effect occurs whenever participants' behaviour is evaluated against a socially desirable norm, for example when studying the effectiveness of programmes aimed at getting people to quit smoking or to increase their fitness. This kind of *behavioural guilt* is also to be expected in TBM studies, particularly when the target group self-identifies as seeking behaviour change.

Another way to view the psychology of the TBM participant is using the concept of an 'investment trap' described by Plous (1993: 243–244). When people are selected, or select themselves, into a program where they receive incentives such as free tickets, travel advice, and home visits by behaviour-change consultants, they become conscious of the ever-growing investment being made in their personal travel behaviour. When the time finally comes to complete the 'after' survey, there is an understandable reluctance among those whose behaviour has not changed to admit this fact.

Rosnow and Rosenthal (1997: 81–85) discuss strategies for minimising the occurrence of 'good subject' and related artifacts, for example by making the study objectives deliberately vague; by introducing bogus objectives; or by using strategies that encourage honest reporting, such as subject anonymity. Unfortunately, typical TBM studies display all the characteristics that lead to questionable results in this regard: they use before-and-after survey techniques,

spaced relatively close together in time, on volunteer participants who are identified to the researchers, told exactly what behaviour is 'desirable', are themselves motivated to report a desirable change in behaviour, and whose own reports are relied on by the researchers to obtain their results.

2.3 Sampling and non-response bias

Darrell Huff's classic work on common errors in statistical reasoning (Huff 1954) begins with a warning on the inherent bias in a self-selecting sample. There is now a very large body of research pointing to systematic ways in which volunteers differ in aggregate from the general population. Rosnow and Rosenthal (1997: 97–104) collect the results of several hundred studies and conclude that several systematic differences exist: for example, volunteers tend to be more educated, be more seeking of approval, and have higher social status than nonvolunteers. When recruited for specific studies, volunteers tend to be those who are particularly interested in the topic under investigation and have an expectation of being favourably evaluated.

The distinction reveals itself also when surveys are used to obtain data for studies, as is usual practice in TBM. The systematic error that arises due to the difference between respondents and nonrespondents is termed *nonresponse bias* in the literature. In general one cannot quantify the extent to which nonresponse bias alters a result (save that the effect is likely to be small in the fortunate case where the response rate is high). However, knowledge of the general characteristics of volunteers and the particular characteristics of the study situation usually allows the researcher to predict the direction in which the bias is likely to occur.

In the case of TBM surveys there are two important predictions that follow from what is known about volunteering behaviour. First, those who have a high interest in transport issues and are strongly motivated to change their travel behaviour are more likely both to respond at the outset and to continue responding throughout the study. Second, those who are caught in the behavioural guilt trap of the previous section have a strong incentive not to respond to the 'after' survey; this enables them to avoid being unfavourably evaluated on the one hand, and to avoid giving a false report on the other.

3. A case study: TravelSmart in Alamein

By way of illustrating the principles of the previous section and the manner in which they may bias a real study, we now turn to a detailed analysis of the results of the Alamein TravelSmart pilot study referred to in the Introduction.

Our analysis is necessarily limited to the publicly available results presented in the final report for the TravelSmart Alamein project (SocialData / ITIR 2004). This report is the source for the claim in Linking Melbourne that the project produced increases in walking, cycling and public transport mode share of up to 27 per cent, and reductions in car mode share in the order of 10 per cent. These

Table 2: Reported mode shares before and after TBM (per cent)
(Source: SocialData / ITIR 2004: 43)

Mode	Target Group			Control Group		
	Before	After	Change (%)	Before	After	Change (%)
Walking	12	14	+17	13	12	-8
Bicycle	1	1	+18	1	1	-3
Motorbike	0	0	0	0	0	+1
Car as driver	52	49	-10	54	56	+3
Car as passenger	26	25	-6	24	24	+1
Public transport	9	11	+12	8	7	-12

behaviour shifts are supposed to have resulted solely from the IndiMark® brand of TBM conducted over two months in 2003, without any alterations in the quality of transport service. If true, this would constitute significant evidence in favour of the efficacy of TBM.

(Note: for the sake of clarity in what follows, all figures for changes in transport mode share are *relative* changes except where specified otherwise. Thus, if public transport used to represent 10 per cent of trips and now represents 11 per cent of trips, the change in mode share is 10 per cent, not 1 per cent.)

3.1 When 27 per cent really means 12 percent

In fact, at least half of the reported mode shift results from a basic error of interpretation. The target population for the study was a group of 6,465 households in the vicinity of the Alamein train line in Melbourne. Also surveyed was a separate 'control' group of 413 households from the same geographical area. The mode share results for the target group and the control group are reproduced as Table 2 above, taken from Table 5.6.3 of the Socialdata report.

It should be noted that in order to obtain accurate figures for the percentage change in mode share, we have had to use other tables in the report (Table 5.6.7 for the target group, and Table 5.6.4 for the control group). Throughout the report, all percentages are reported only to the nearest integer—hence the reporting of the motorcycle mode shares as zero. This means that using just those figures reported in Table 5.6.3, for example, the actual change in public transport mode share in the target group could be as much as 35 per cent (8.5 per cent to just under 11.5 per cent) or as little as 10 per cent (just under 9.5 per cent to 10.5 per cent). Fortunately, Table 5.6.7 presents the before-and-after statistics as absolute numbers of trips rather than just percentage mode shares, and it is evident from this table that the change in public transport mode share

resulting from SocialData's analysis is in fact 12 per cent.

So why did *Linking Melbourne* report the mode share change as 27 per cent? Because in the discussion following Table 5.6.3, the SocialData report explains that the mode share change should be inferred that, but for the TravelSmart intervention, the target group's mode shares would have changed by the same amount. So, they explain, the public transport mode share of the target group would actually have *fallen* by 12 per cent without the marketing action, but instead rose by 12 per cent; the real effect of the intervention is therefore 1.12 divided by 0.88, or a 27 per cent increase.

There are several problems with this reasoning. First, the influence of trends or seasonal influences on transport mode shares at the population level over a period as short as six months can be discounted; as Seethaler and Richardson (2003: 25) explain, the available evidence indicates that no such effects currently exist:

> For public transport... the report of Booz Allen Hamilton… does not provide results that would indicate any long-term trend or strong seasonality.... All in all, the analysis of VATS 1994–1999 data indicates no specific need to adjust for seasonality when conducting 'before' and 'after' studies related to a TravelSmart policy implementation. However, attention needs to be paid to choosing the same weekdays for the 'before' and the 'after' surveys to control for the existing patterns with regards to the day of week.

'corrected' for the 'control group effect'. Essentially the researchers have noticed that the mode shares in the control group changed between the 'before' and 'after' studies, have assumed that this is evidence for an actual mode shift (due to "seasonal and external influences") rather than a sampling artifact, and have

Second, the reported 12 per cent fall in public transport mode share (from 8 per cent to 7 per cent) in the control group does not in any case appear to be statistically significant. The appropriate significance test here is a standard difference-of-means test with binary outcomes (use or non-use of public transport) with N = 413 and a 1 per cent difference in sample means. (The sample size N is based on households rather than persons or trips, because it is factually inaccurate to regard trips by members of the same household, or trips by the same person at different times, as logically independent events.) The test relies on one statistic not provided in the report, namely the actual number of households that changed from use to non-use of public transport, or vice versa, between the two surveys. But even making the worst-case assumption that all the change was from use to non-use, and none in the other direction, the null hypothesis that the underlying means are equal is barely rejected at the 95 per cent significance level (and thus not rejected at any higher level of significance).

One also cannot completely discount the psychological factors operating within the control group, members of whom could not have failed to notice that their travel

habits were surveyed in detail once, then once again after six months, a sure signal that behaviour change research is taking place. It is entirely possible that if individuals in the control group knew (or had simply inferred) that others in the area were taking part in a TravelSmart campaign, they might manifest a 'good subject' effect of their own by (consciously or otherwise) under-reporting their public transport, walking and cycling and/or over-reporting their car use to ensure that the researchers got the comparative result they wanted.

The 'control group effect' should therefore be presumed to be an artifact resulting from chance variations, particularly as on prior evidence one does not expect any such systematic change within the control group over such a brief period. Thus the 'real' figure for public transport mode shift is the 12 per cent actually obtained for the target group—assuming that this figure represents a correct interpretation of the survey data. As we show next, even this cannot be taken for granted.

3.2 When 12 per cent might mean zero

While it is debatable whether the control group would have received strong enough cues to be prompted into 'good subject' behaviour, there can be no doubt that among the participants within the target group, all factors leading to the expression of participant-mediated artifacts are in operation. That is: the study objectives are clear to the participants; the participants are motivated to report behaviour in line with those objectives (whether or not they actually did behave in this way); and they are given the opportunity to influence the results via the self-reporting nature of the surveys.

To have a significant misleading effect on the final results, the magnitude of the errors resulting from operation of behavioural guilt traps and other such artifacts need not be large. The study report itself is candid about the fact that even small changes in reported behaviour from the surveys can greatly affect the evaluation results:

> It is worth noting that a significant reduction in 'car as driver' trips needed a change, on average about one trip per week. Therefore, *a very small change in household behaviour is significant in aggregate results!* (Socialdata / IRL 2004: 33, emphasis in original)

Based on the discussion in Section 2, the study is vulnerable to the following effects in particular:

- nonresponse bias arising from reluctance of those caught in the 'behavioural guilt trap' either to report a failure to change behaviour or to make a false report; and

- systematic under-reporting of car use or over-reporting of public transport use (whether intentional or not) in the 'after' survey resulting from the 'good subject' effect.

The response rates for the target group are noted in a table on page 41 of the Socialdata report. In all, 636 households responded to the 'before' survey, which represents 73 per cent of the total

sample. When these same 636 households were contacted for the 'after' survey, 530 responded, giving a response rate of 83 per cent. Put another way, 27 per cent of households failed to respond to the 'before' survey, and of those who did respond, 17 per cent failed to answer the 'after' survey. Interestingly, if one considers total persons rather than households the response rate for the 'after' survey drops to 79 per cent; this indicates that larger households were somewhat less likely than smaller households to respond at this final stage.

Nonresponse bias can therefore enter at two stages—'before' and 'after'—and in each case biases the result to the extent that there is a systematic link between travel behaviour and likelihood of nonresponse. Because a matched sample is used to measure the change in behaviour, nonresponse to *either* survey alters the composition of the sample in *both* survey results. Thus, the final result will be biased whenever the actual change of behaviour differs significantly between respondents and nonrespondents to either survey, and in each case will exaggerate the reported behaviour change if the actual change was lesser among the nonrespondents.

Intuitively, one might expect that nonresponse to the 'before' survey is an indicator of non-interest in the TravelSmart process as a whole, and therefore that the 27 per cent of households who did not respond at this stage would, if surveyed, display less behaviour change as a group than the 73 per cent who did respond. The bias resulting from narrowing the survey sample to just this latter group is then likely to be significant.

The case of those who failed to respond to the 'after' survey is quite different, as these people *were* motivated to respond to the 'before' survey. But as we noted above, a significant factor in nonresponse to the 'after' survey is likely to be 'guilt effect' from program participants who failed to change their behaviour. So in both the 'before' and 'after' cases there are sound reasons to expect nonrespondents to have changed their behaviour less than respondents, and therefore to expect the nonresponse bias to exaggerate the apparent behaviour change. The likely bias from reporting errors due to the 'good subject' effect will compound this effect.

3.3 Weighting of results or amplification of artifacts?

In an attempt to compensate for nonresponse bias, the report's authors have applied a 'weighting' procedure to the survey figures. When carefully examined the effect of this procedure is to *amplify* the most likely source of bias, not correct it. The procedure is described as follows:

> For the target group there was a weighting of the after data (which was not needed for the before data).... the distribution of the IndiMark® groups ('I', 'R' and 'N') in the survey sample was corrected accordingly to the one in the IndiMark® campaign to balance differences in the response behaviour of the single groups. People not participating in the IndiMark® campaign were

> considered as occurring [*sic*] no changes in their travel behaviour (Socialdata / IRL 2004: 42).

In the TravelSmart exercise itself, households were classified into four groups: those interested in increasing their use of sustainable transport ('I'); those who already use sustainable transport regularly but would like further support ('R with'); users of sustainable transport who require no further support ('R without'); and those not interested in further contact ('N'). The 'I' and 'R with' groups received the full marketing treatment, so we may for simplicity speak of them collectively as the 'participants' and the remaining groups (as well as those not successfully contacted) as the 'non-participants'. The participants accounted for 3,505 of the 6,465 households in the target area, or 54 per cent.

In simplified form, the 'weighting' procedure (as inferred by us from the above statement) scales the results by appropriate factors to reconstruct what would presumably have been observed, had the proportion of participants in the final 530-household survey sample matched the 54 per cent proportion in the population. This is done on the basis that the entire observed behaviour change is attributable to the participants, and none to the non-participants. For example, if the proportion of participants in the sample is only 27 per cent rather than 54 per cent, all differences between the 'before' and 'after' figures should be doubled to obtain the 'true' result across the entire population.

It is, of course, the objective of this evaluation exercise to demonstrate that TravelSmart is an effective way to increase the use of sustainable transport. To introduce this as an assumption during the analysis provides a convenient short cut to such a demonstration, but is logically questionable. In fact this leads to a form of expectancy artifact, albeit one resulting from the optimistic treatment of data rather than of people. In the presence of 'good subject' artifacts, the two mutually reinforce and lead to a larger error than either acting in isolation—*even when the assumption is true*.

We illustrate this point with a hypothetical example. Suppose that the 636 households in the 'before' survey are a perfectly representative sample, and 343 of them (54 per cent) become full participants in the TravelSmart campaign. Among the entire participant population, one-third make a minor change from 10 per cent to 11 per cent public transport use while the other two-thirds make no change at all. Again let the survey sample be perfectly representative, so that 114 of the 343 participants (one third) increase their public transport use while the rest do not. In keeping with Socialdata's assumptions, the non-participants also make no changes in their public transport use.

The 'after' survey collects just 530 responses out of 636; we suppose this is due to 106 households (all participants who did not change their behaviour) being caught in a behavioural guilt trap and failing to respond. The final sample of 530 includes 237 participants (114 of whom changed their behaviour) plus 293

non-participants; thus the proportion of participants in the final sample is 45 per cent rather than 54 per cent.

In this example, the average absolute mode shift to public transport in the target population is 0.18 per cent (1 per cent, times one-third, times 54 per cent). In the raw survey result, the 'good subject' artifact raises the average mode shift to 0.22 per cent. To this the weighting procedure applies a scaling factor of 1.2 (54% divided by 45%) resulting in a reported mode shift of 0.26 per cent (in absolute terms). Rather than correct for the nonresponse bias, the weighting has amplified it, making the result look 43 per cent better than it is.

(In a very similar hypothetical example, the change from 10 per cent to 11 per cent public transport use is actually the result of misreporting by 114 respondents keen to play the role of good experimental subjects. In this case there is in fact no mode shift in the population, but the procedure leads to the reporting of a mode shift of 0.26 per cent regardless.)

3.4 Evidence for artifacts

It may be argued that to this point, our case for an exaggerated mode shift result has been speculative rather than empirical. Is there any statistical evidence in the reported figures supporting the hypothesis that artifacts are present? The answer is yes.

A crucial test is whether the proportion of programme participants is significantly less in the 'after' survey than in the 'before' survey. If this is the case it indicates a systematic tendency for participants to be less willing than non-participants to respond to the 'after' survey. Since non-participants have no special motivation to respond at higher rates than participants, while participants have already expressed a motivation to cooperate in a behaviour-change experiment, this in turn suggests that some participants are being deterred from responding, most likely as a result of having no 'good news' to report. In any event, a statistically significant difference in the proportion of participants between a survey sample and the population should call into question any result drawn from the sample, simply because of its manifestly unrepresentative nature.

The Socialdata report provides no explicit figures on the numbers of each IndiMark® group present in the survey sample. Nonetheless, Table 5.6.2 in the Socialdata report compares the mode share figures for the target group before and after the weighting procedure described above. Since the effect of weighting is to increase the public transport mode share at the expense of car trips, it can be inferred that the proportion of participants in the survey sample is indeed less than the 54 per cent in the population.

To test the significance of the discrepancy, we again have recourse to Table 5.6.7, which implies that the reported mode share for 'car as driver' after weighting is 48.8 per cent to three significant figures. From Table 5.6.2, the mode share before weighting is 50 per cent to the nearest integer. Therefore, the weighting procedure has reduced the

'car as driver' mode share by at least 0.65 per cent in absolute terms.

Again from Table 5.6.7, the mode share for 'car as driver' in the 'before' survey is 52.3 per cent, to three significant figures. The absolute reduction in mode share indicated by the *raw* survey result is thus no less than 1.8 per cent (to 50.5 per cent) and no greater than 2.8 per cent (to 49.5 per cent). It follows that the mode shift has been scaled by an amount no less than 1.23 (2.8 plus 0.65, divided by 2.8), and so the proportion of participants in the survey sample can be no greater than 54% divided by 1.23, or 44 per cent.

Thus, despite the fact that the report provides no direct information about the number of participants and non-participants in the survey of 503 households, we have been able to show that the proportion of participants cannot be greater than 44 per cent. Again applying a difference-of-means test with binary data, the difference between 44 and 54 per cent with a sample size of 530 is shown to be statistically significant at levels beyond 99.9 per cent (the Z-statistic is 4.62). It is thus extremely unlikely that such a discrepancy could have arisen by chance.

So the survey results themselves reveal that a significant number of participants in the TravelSmart programme did not respond to the follow-up survey, suggesting that they had not changed their behaviour. Although the results do not permit direct testing for the opposite 'artifact'—i.e. people exaggerating the extent to which their travel behaviour did change—it is likely that this phenomenon is also present.

4. Conclusion

TBM programs such as TravelSmart carry the promise of 'something for nothing'. They appeal to policy makers because they claim to increase the use of sustainable transport without requiring significant changes to transport policies. Whether motivated by 'greenwash' or a genuine desire to improve the environment, such policy makers have a strong incentive to want TravelSmart trials to succeed. TravelSmart consultants also want trials to succeed, because this will vindicate their belief in their own product (as well as ensuring future consultancies). Members of the public participating in the trials also have incentives, arising from 'good subject' effects and associated processes, favouring a positive outcome. The combined effect of these 'political economy' and 'social psychology' influences is to create a high likelihood that changes in travel behaviour apparently caused by TravelSmart are in fact wholly or largely artifacts.

Careful analysis of TBM evaluation studies, such as the South Perth programme and the Alamein pilot project, confirm the presence of artifacts and suggest that the promise of something for nothing may be too good to be true. Most such TBM studies have ignored the very significant human factors, well-documented in the psychology literature, that can introduce systematic errors into the research results. Typically, studies are designed in a way that exacerbates these factors and magnifies the resulting errors, as we

have shown in the case of the Alamein study.

Unfortunately, the nature of the study objectives makes it difficult to avoid the intrusion of artifacts such as the 'good subject' effect, the behavioural guilt trap, and nonresponse bias. The main problems arise from the use of a self-reporting survey framework that provides the opportunity for participants to act on a motivation to report desirable behaviour, or to avoid reporting undesirable behaviour by not responding.

We recommend that the following changes be made to the evaluation of Travelsmart and other TBM programmes:

1. The evaluation of TBM programmes should be carried out by parties completely independent of the consultants conducting the TBM intervention itself—as is occurring, for example, with the TravelSmart trial in the Melbourne municipality of Darebin. Independent evaluation will not of itself overcome the problem of artifacts, but it is a good start.

2. Assessment of changes in travel behaviour should not be carried out primarily through self-reporting-based surveys. Instead, information sources that are less likely to be contaminated by artifacts should be preferred, such as census data, counts of public transport boardings and pedestrian flows, odometer readings and other measures of VKT, possibly even GPS data. A good discussion of possible methodologies appears in the paper at this conference by Stopher, Greaves, Xu and Lauer.

3. It may be that in order to obtain credible results, researchers will have to resort to different survey methodologies whereby the researchers themselves observe and report on travel behaviour by the target group. Ideally this should be done in a 'blind' fashion, where the observers are denied knowledge of whether the people being observed are experimental participants or not.

In the meantime, researchers and policy makers should be skeptical of the claims made on behalf of Travel Behaviour Modification techniques such as Travelsmart. At present, we have no reliable evidence that they produce real changes in travel behaviour.

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Carfree, low-car – What's the Difference?

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1. Introduction

Carfree development is a relatively recent response to long-standing concerns about the effects of motor vehicles on the urban environment. Although the relationship between cause and effect remain contested, and no consensus exists on the appropriate policy responses, the proposition that increasing car ownership and use creates particular problems in urban areas has been largely accepted.

Amongst the many proposals advanced to address these problems some have advocated carfree development (Reutter, 1996, Crawford, 2000), several examples of which have been built across Europe in recent years, although it has occupied a relatively marginal place in this debate so far.

This article begins by reviewing the different types of carfree development found in the literature and visited during the course of this study. From this, three types of carfree development are proposed, leading to a definition in Section 4. Section 5 briefly reviews some examples of 'low car' development leading to a proposed definition. Section 6 considers the main benefits claimed for carfree developments and the evidence for these, along with some problems. Section 7 reviews evidence on the benefits and problems of low car development.

All of the developments described as 'carfree' involve some degree of compromise with pressures for vehicular access and parking. Thus the distinction between 'carfree' and 'low car' involves a judgement. Nevertheless, there are important differences between the two concepts relating to the immediate environment and benefits to residents.

The article concludes with a discussion of implications for transport policy in urban areas, and gaps in the knowledge base, where more research is needed.

2. Carfree Development in Europe and Elsewhere

There are many areas of the world where people have always lived without cars, because no road access is possible, or none has been provided. The term carfree *development* implies a physical change: either new building or changes to an existing built area. There have been some recent attempts to define carfree development (see, for example: Morris et al, 2009), following practice around Europe. These attempts at definition have generated some problems. Morris et al include 'low car' as a form of carfree development, which would appear to be a contradiction in terms, although the distinction between the two is far from clear.

In UK planning policies (e.g. DETR, 2001) the term 'car free'[1] usually refers solely

[1] Although the spelling of the terms is often inconsistent, UK documents tend to separate (car free) or hyphenate (car-free) the adjective. Apart from quotations, 'car free' will be used to distinguish the UK definition from the European-derived definition proposed in this study.

to the absence of parking. Some London boroughs (e.g. Camden LB, 2009) with extensive Controlled Parking Zones, define car free housing by a planning condition precluding occupants from applying for a residents' parking permit. Over time, the growing proportion of such housing has served to constrain levels of car ownership within these zones.

Underlying the various definitions are two different aspects of carfree developments i.e.:

- residential (or mixed use) areas from which vehicles are excluded, and/or
- housing where people live without owning a car

The UK definition ignores the first aspect and assumes that parking restrictions will achieve the latter. Most of the continental European examples exhibit some element of both, and in seeking a definition, this article will focus on developments which exhibit both, although neither has been absolutely implemented in any of the examples.

The broadest study of European carfree developments was conducted by Scheurer (2001). His thesis refers to six recently built carfree developments (and some others which would not be considered carfree as defined here) of which four were sufficiently advanced to include in his survey: Vauban (Freiburg), GWL Terrein (Amsterdam), Autofreie Musterseidlung Florisdorf (Vienna) and Slateford Green (Edinburgh). Two other planned developments mentioned by Scheurer have since been built: Saarlandstrasse (Hamburg) and Stellwerk 60 (Cologne). Four of these developments were visited during the course of this study.

Many cities in Europe and elsewhere have pedestrianised city, town and district centres. The vast majority are mainly commercial in nature, although some include some residential properties. Most research on pedestrianisation has focussed on commercial centres and travel to them; relatively little attention has been paid to the extent of, and potential for, residential populations within pedestrianised centres. The literature (Tsubohara, 2007, Ligtermoet, 2006) did suggest, however, that Groningen in the Netherlands contains one of the largest examples of a city centre with a residential population, from which through traffic has been removed.

3. Typology and Examples

To explore and compare the different types of carfree development, study visits were arranged to: Groningen and five carfree new developments: Vauban (Freiburg), GWL Terrein (Amsterdam), Saarlandstrasse and Kornweg (Hamburg) and Stellwerk 60 (Cologne). These six examples were chosen to provide a range of differing sizes, contexts, and approaches to the carfree concept. In each case, stakeholders including municipal planners and organisations representing residents were interviewed. Observations were made of access arrangements, travel behaviour, social interactions and children's travel and play.

These examples suggested **three types** of carfree development described below:

- Vauban model

- Limited Access model
- Pedestrianised centres with residential population

3.1 The Vauban Model

Vauban, with a population of just over 5,000, unlike the other examples discussed here, has no physical barriers to the penetration of motor vehicles into the residential areas. Although the term *autofrei* (carfree) is sometimes used in connection with Vauban, this is not how most residents would describe it. The City Council prefers the term *stellplatzfrei*, to describe the majority of streets where this rule applies. Vehicles are allowed down these streets at walking pace to pick up and deliver but not to park, although there are frequent infractions. Residents of the *stellplatzfrei* 'areas must sign an annual declaration stating whether they own a car or not. Car owners must purchase a place in one of the multi-storey car parks on the periphery, run by a council-owned company. The cost of these spaces – €17,500 in 2006, plus a monthly fee – acts as a disincentive to car ownership. The planned parking capacity – 0.5 per dwelling – was higher than the other examples described below. At early stages of its construction, Scheurer (2001) and Nobis (2003) found just over half of households owned a car, but today, many of the parking spaces are unused. There have been no more recent surveys but parking levels suggest a substantial majority of households do not own cars there today.

Although vehicles are physically able to drive down the residential streets, and the no-parking rules are not effectively enforced, in practice, vehicles are rarely seen moving on the *stellplatzfrei* streets. Signs emphasise that children are allowed to play everywhere, and in the absence of moving traffic, children are more evident (Figure 1) than in the more conventional home zones and traffic-calmed streets common elsewhere in Freiburg.

Figure 1: *Stellplatzfrei* street, Vauban, Freiburg

Figure 2: Access to Stellwerk 60, Cologne

3.2 The Limited Access Model

Unlike Vauban, in GWL Terrein, Stellwerk 60, Saarlandstrasse and Kornweg, as well as several others described in the literature, various arrangements physically restrict the access of motor vehicles to the residential areas. These more common arrangements may be described as the Limited Access Model.

Saarlandstrasse and Kornweg are relatively small, with 111 and 64 dwellings respectively. In these cases, a few parking spaces (ratios 0.15 and 0.2) intended for visitors and deliveries are close to the housing, surrounded by semi-private space where vehicles cannot penetrate. These small developments are able to provide a traffic-free environment because of their particular situations – the Saarlandstrasse site is partly surrounded by water and Kornweg is effectively a traffic-free cul-de-sac.

GWL Terrein and Stellwerk 60 are both larger: around 600 and 400 dwellings respectively. Stellwerk 60 includes some houses as well as apartment blocks, with pedestrianised streets between them. Removable bollards restrict access to the core of the site. A residents' organisation controls these bollards which are removed for a limited range of vehicles such as removal vans and emergency vehicles, but not for general deliveries, which are done by hand, sometimes using trolleys or cycle trailers (Figure 2). In the case of GWL Terrein, the blocks of up to 8 storeys high have been built around semi-private space where vehicles cannot penetrate (Figure 3). Entrances to the blocks are all fairly close to the perimeter, where some time-limited parking is available. Peripheral parking, mainly in multi-storey blocks is provided at a ratio of around 0.2 in both sites, allocated by ballot in GWL Terrein, and separately sold in Stellwerk 60.

Figure 3: GWL Terrein, Amsterdam

Figure 4: Groningen Inner Ring road

3.3 Pedestrianised Centres

Whereas the first two models apply to newly-built carfree developments, most pedestrianised city, town and district centres have been retro-fitted. Pedestrianised centres may be considered carfree developments where they include a significant number of residents, mostly without cars, due to new residential development within them, or because they already included dwellings when they were pedestrianised. Groningen is a city in the North of the Netherlands with a population of 181,000, including about 46,000 students (City of Groningen 2007, cited in: Pucher and Buelher, 2007). Its city centre, an area of roughly a square kilometre, is partially pedestrianised and entirely closed to through motor traffic: there are several car parks accessible on an 'in and out' basis. Groningen is unusual because of the size of the residential population within this largely traffic-free centre: 16,551, a population which has been growing in recent years (Gemeente Groningen, 2008).

The original decision to restrict through traffic was implemented in 1977 (Tsubohara, 2007). Since then, the process has continued incrementally, with nearly half of the streets now pedestrianised (some of them allowing bicycles). These are mainly shopping streets although there are a few apartments above or behind the shops. Some of the other streets are open to general traffic only at certain times of the day. An Inner Ringroad encircles the centre, providing a fairly slow bypass for general traffic (Figure 4). Priority in its design has been given to cycling and public transport.

Parking for non-residents has been progressively restricted to car parks towards the edge of the centre. A total of 2,340 parking spaces (900 on-road) are reserved for the residents, amongst whom car ownership (28.7 per 100 households) was roughly half the city average and a third of the national average (Gemeente Groningen, 2008). Although no separate statistics were available, the concentration of students, who generally have lower levels of car ownership, is believed to be higher in the centre than elsewhere in the city.

4. Definition of Carfree Development

In proposing the above typology and a definition a degree of circularity is unavoidable. The developments studied were chosen because they have been described as carfree, or partially carfree. Based on absolute criteria, none of them would be described as entirely carfree. Their defining factors may be identified as follows:

Definition of Carfree Development

Carfree developments are residential or mixed use developments which:

- Normally provide a traffic free immediate environment, and:
- Offer no parking or limited parking separated from the residence, and:
- Are designed to enable residents to live without owning a car.

Though none of these is unique in itself, and each requires a judgement, their combination encompasses all three types and distinguishes them from other forms of development. Each of these is discussed in turn.

The phrase 'normally' in the first criterion implies the need for a judgement. Clearly vehicles are not excluded from the streets of Vauban, nor are they always excluded from pedestrianised centres but the traffic-free environment which obtains most of the time is a factor common to all three.

Similarly for the second criterion on parking: none of the examples visited, nor any of those reviewed in the literature had achieved zero car ownership. In most cases some limited parking for residents (ratios between 0.15 and 0.5 per dwelling) explicitly allowed a minority of them to own cars.

The third criterion reflects the observation that all the European examples were designed with a range of sustainability objectives including measures to facilitate living without owning a car. These measures varied according to the scale and location of the development, from cycle storage facilities in all cases, car club vehicles in the larger ones, to the extension of the tram network along the main street of Vauban. 'Design' in this context may also include the choice of location: for the smaller developments, proximity to the existing public transport networks was always an important factor.

5. Definition of Low Car Development

As with carfree development there is no agreed definition of low car development. Morris et al (2009) state that reduced parking standards are the defining feature, although they do not explain how "reduced" should be interpreted.

Six developments which may be considered 'low car' were reviewed in a study for the UK's Department for Transport (DfT, 2005). The parking ratios were considerably higher than the carfree developments described in Section 3 – varying from 0.7 to 1.5 spaces per dwelling. 1.5 was the national maximum parking standard in the UK at that time (DETR, 2000), although the national standards were not uniformly applied, and were subsequently abandoned (CLG, 2006). The developments in the DfT study combined these parking standards with residential travel plans, designed to encourage modal shift amongst the residents.

Following the approach in the previous section, low car development may be defined as follows:

Definition of Low Car Development

Low car developments are residential or mixed use developments which:

- Offer limited parking, and:
- Are designed to reduce car use by residents.

As with the definition of carfree development, the term 'limited' requires a judgement, which will vary according to the context. The principle is that the combination of parking provision and parking controls constrains the level of car ownership: if more parking were available, higher levels of car ownership, more typical of the surrounding area, would result.

6. Benefits and Problems of Carfree Developments

Although the literature on European carfree developments is limited, it does

provide some fairly strong evidence that they reduce car use and increase walking and cycling. The literature also suggests some other potential benefits, which this section will review.

Scheurer's (2001) surveys found levels of car ownership varying between 8% of households in Vienna Florisdorf to 54% of households in Vauban, which was at an early stage in its development. Scheurer's method of measuring modal share was rather unusual, asking respondents to fill in the frequency of trips per month under seven specific categories with no 'other' category, so comparisons with all-purpose modal share statistics may not be precise. Nevertheless, a clear pattern of very low car use (5% - 16% of journeys) and high levels of walking and cycling (38% - 73%) emerges from his surveys.

Another survey of Vauban was conducted two years later when nearly half of the planned housing was occupied. Nobis (2003) found a similar proportion of carfree households ("over 40 %") and using different questions from Scheurer confirmed the low level of car use: cycling was the most frequent mode for commuting, shopping and leisure. Both of these studies were conducted before the extension of the tram system to Vauban in 2006, which may have influenced both car ownership levels and travel patterns.

6.1 Social and Health Benefits

The studies of European carfree development have mainly concentrated on the mobility aspects, but they contain some evidence of other benefits.

Ornetzeder et al (2008) explored questions of social cohesion and social contacts in Vienna's Florisdorf carfree development. 85% - 87% of respondents agreed that there were "good neighbourly relationships", "solidarity within the settlement" and that people helped each other. They found that residents of the carfree project had more friends within the settlement than those of the slightly larger reference settlement (average 16 versus 7). They also knew more people by sight (101 versus 62). The authors ascribe these differences to the carfree nature of Florisdorf, although there were also differences in the extent of resident involvement in the planning of the two developments.

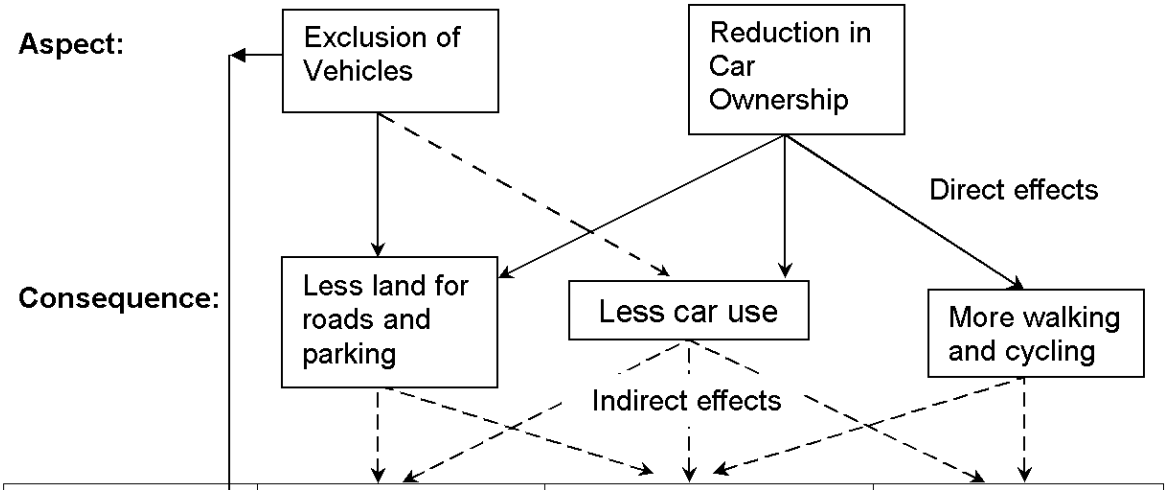
Scheurer also comments on the favourable environment for children in Vauban, where household sizes were particularly high. Nützel (1993) found that children were allowed to play out on the carfree streets of Nuremberg-Langwasser at a younger age (average 3.8) than on conventional streets nearby (average 5.6). The observations made during this study would support these findings. There was considerable evidence of young children playing and cycling without direct supervision in several of the developments visited.

No specific research has been found on the health impacts of carfree development, although some benefits could be deduced from the observations about travel patterns and traffic generation.

6.2 Does Carfree Development Address the Problems Caused by Urban Car Use?

It may be considered self-evident that a policy which reduces car ownership and use would help to alleviate the problems caused by car use in urban areas. There are, however, a number of complicating factors.

The analysis so far suggests that the two aspects of carfree development outlined in Section 2 have a number of direct and indirect effects, as illustrated in Figure 5.



Benefits for:	Environment	Quality of Life	Health
Residents	Better air quality Less noise More green space	More shared/open space More social interaction Reduced risk and fear of road accidents Children more independent More viable local services.	Increased fitness and reductions in associated disease Reduced respiratory illness Improved mental health
Wider local area	Better air quality Reduced need for development land	Reduced congestion More viable local services.	Reduced respiratory illness
National/Global Environment	Reduced CO_2 and other emissions Retention of more green land		

Figure 5: Benefits of Carfree Development

The indirect relationship shown between Exclusion of Vehicles and Less Car Use illustrates the effects of making parking less convenient and increasing the advantages of walking for short distances.

The European studies provide fairly strong evidence for the three intermediate consequences. Ornetzder et al (2008) found evidence to support two of the ultimate benefits: sociability, as discussed above, and reductions in CO_2 emissions: residents of the carfree area had a carbon footprint lower than a more conventional reference development nearby, and considerably lower than the national average.

The benefits for residents, from carfree developments in general, may be inferred with a reasonable degree of confidence, although their extent would depend upon the individual circumstances of each development. The benefits to the wider local area and the global environment are more problematic. Whether they will be achieved in practice would depend upon a number of other factors, including other policy or design issues.

The land-related benefits would depend on how the land saved from parking and roads was re-allocated, between gardens, open space and increased density of dwellings (which might reduce building on undeveloped land elsewhere). Reduced congestion would depend upon wider policy and practice in the city and immediate area surrounding the carfree development. Some of the benefits shown would depend upon behavioural change amongst residents, on which there is some evidence from the European studies. Carfree developments could reduce driving and increase active travel for two reasons:

- They attract residents predisposed towards non-car travel
- They change the behaviour of residents (compared to conventional developments)

If the lower car use in carfree developments were solely due to the former, then the national and global benefits would not be achieved, and the benefits to the wider local area might be achieved at the expense of other areas.
The evidence from the European studies suggests that carfree developments do indeed change the behaviour of residents. Nobis found that 81% of the carfree households in Vauban had previously owned a car; 57% gave up their cars after moving there. Scheurer found proportions varying from 10% (in GWL Terrein) to 62% (in Florisdorf) of households had reduced their car ownership since moving to the carfree developments. In Florisdorf Ornetzeder et al (2008) found only one car owner (who was violating the rules of occupation) amongst the 50% of male and 30% of female residents had previously owned a car. 41% of respondents said they were "using the bicycle much more than before".

6.3 Problems: Parking and Vehicular Access

The main problems of carfree developments relate to parking and the control of vehicular access. Scheurer found dissatisfaction amongst 39% of residents with the arrangements in

Vauban. Carfree households were unhappy that some car owners were flouting the rules by parking on the s*tellplatzfrei* streets. Some car owners were unhappy about the inconvenience of parking separated from the housing. Nobis found, overall carfree households were more satisfied with the arrangements than car owners. This finding is consistent with Borgers (2008) who found that car owners in the Netherlands preferred parking to be adjacent rather than separated from their housing (there was no mention of any carfree housing in the sample).

Overspill parking can also be a problem. The Vauban system of annual declarations and expensive parking spaces has given some residents an incentive to cheat, by registering cars in other names and parking them nearby. Freiburg City Council had taken legal action against two persistent offenders. The suburban location of Vauban made parking enforcement more difficult. There were no parking controls in the adjoining district of Merzhausen, and statutory enforcement of parking rules within Vauban itself was rare. Vehicles were often parked on the *stellplatzfrei* streets in contravention of the rules, although this did not significantly detract from the traffic-free nature of these streets, as there were very few vehicle movements.

The Limited Access model avoids the latter problem, although overspill parking in the surrounding area was sometimes an issue. Most of the examples were in more urban locations than Vauban. In GWL Terrein, parking in the surrounding areas was already controlled, so the development did not significantly change the parking situation there. In Stellwerk 60 some complaints had been made about overspill parking, which was addressed by the extension of controls in the surrounding area.

The criteria for exceptional vehicular access to Stellwerk 60 had caused differences of opinion amongst the residents. One contested issue was whether older or disabled residents should be allowed to drive into the interior of the site. The rules adopted by the residents' association allowed minibuses for older and disabled residents, but not private cars, inside the site.

7. Benefits and Problems of Low Car Developments

Comparing the potential benefits of low car development to those shown in Figure 5, the benefits related to the exclusion of vehicles would not normally apply. Those related to reductions in car ownership could be expected to apply to a lesser extent than in carfree developments. Although there might be some minor benefits from lower car ownership, the environmental and quality of life benefits for residents would depend on the exclusion of vehicles.

The UK DfT (2005) study mentioned earlier focussed on the process of developing residential travel plans; most of the case studies had yet to begin construction at that time. As part of a wider study (Melia, 2010b) one of these – Poole Quarter in Dorset – was surveyed during 2007. The findings support the view that low car developments well sited in respect to public transport and local

services can reduce car use and increase active travel compared to conventional developments, but there was little evidence of the improvements to the local environment observed in the European carfree developments.

Poole Quarter was a new development of low-rise flats and town houses near the centre of a town with a population of 139,000. The dwellings completed at the time of the survey each had one parking space. The travel plan aimed to promote sustainable movement through information and incentives such as discounts on public transport. Of the 97 households (43%) who returned questionnaires, 81% owned a car, but only 15% owned more than one – considerably lower than the surrounding area. 26 had reduced their car ownership on moving there, mainly from two cars to one, and 32 reported lower car use. 57 reported walking more and 19 reported cycling more. These changes were partly explained by proximity to the town centre, bus and rail stations but the parking limitations also contributed. Telephone interviews revealed some evidence of self-selection: some people who moved there were seeking greater accessibility. Others moved there for other reasons, but still reported a change in their travel behaviour. Several reported that their attitudes towards travel by alternatives to the car had become more positive following their moves, consistent with the evidence from the European carfree developments.

The site had been developed at higher than usual densities for that area (108 dwellings/hectare). This meant that even with the lower than usual parking ratios the area between the housing was largely filled with parked cars. An area designated as a home zone (Figure 6) was rarely used, as intended, for children's play; a lack of green spaces or play areas was cited as a problem by 31% of respondents. The most frequently cited problem, by 57%, was lack of parking. Conflict between neighbours over limited parking spaces was mentioned by several interviewees. When residents were asked why they moved to Poole Quarter, most mentioned the accessibility of the site, but none mentioned anything relating to the low car concept or the travel plan – this was a notable difference from the European carfree developments.

Figure 6: Poole Quarter 'home zone'

Returning to Figure 5, the benefits of low car developments such as Poole Quarter flow entirely from a reduction in car ownership; these are benefits to the wider area or the global environment, but not for residents. A similar point may be made about the UK concept of 'car free housing'.

8. Potential Demand and Feasible locations for Carfree Development

All of the analysis of benefits presupposes a potential market for housing with reduced car ownership. In the European cities where carfree developments have been built, such a market clearly exists, and anecdotal evidence suggests that property values may be higher in such developments (Melia, 2010b), although there has been no specific study on this as yet. There is some evidence that car owners tend to prefer parking adjacent to their homes, although environmental improvements and accessibility to public transport routes may compensate for this to at least some extent (Borgers et al, 2008).

Melia (2010b, 2010a) has studied the potential demand for housing in carfree developments in the UK. Two surveys were conducted: a national online survey of members of cycling and environmental groups and a postal survey of the Bloomsbury and Kings Cross areas of Inner London, where car ownership is particularly low. The questionnaires were followed up by in-depth telephone interviews with some of the respondents. This study found that potential demand exists for owner occupied and rented accommodation, mainly amongst Carfree Choosers – people who live without a car by choice. These people have higher incomes than other non owners of cars. They tend to be younger than average and are more likely to live alone. They are particularly concentrated in the inner areas of larger cities and their preferences for neighbourhoods and housing types tend to favour urban high density living.

A substantial minority amongst them would prefer to live in smaller settlements or less urban locations but their transport needs mean that in practice, most such locations are not suitable. Many of these people acquire a car, often reluctantly at first, following such a move. For the small minority of Carfree Choosers who live outside large cities proximity to good rail services is often a prerequisite, although more research is needed to establish the specific factors which enable people to choose carfree living in different locations.

This study also explored, through interviews with developers and a senior civil servant, why very few carfree developments – none of any size – have been built in the UK so far. The reasons related partly to the innate conservatism of the UK housing industry (Ball, 1999), partly to the lifestyles and attitudes of developers and partly to a belief that parking exerts a strong positive influence on property values. This belief is based mainly on comparisons between similar properties with and without parking. The effects of traffic and traffic-removal on property values are not generally considered, as there is little evidence on this from within the UK.

9. Conclusions: Differences between Carfree and Low Car Development

Although the proposed definitions allow for hybrids and intermediate cases, the evidence reviewed here suggests some important differences in concept and outcomes between carfree and low car developments. The three defining criteria of carfree developments: the

traffic-free environment, limited separated parking and design to support carfree living all contribute to the range of benefits illustrated in Figure 5. Low car developments constrain car ownership but do not provide a traffic-free environment, nor do they necessarily support carfree living: the aim at Poole Quarter was more limited: to reduce car ownership to one per household. This approach leads to less traffic generation with benefits for the wider local area and the global environment but brings very limited benefits to the residents of the development.

The traffic-free environment is generally valued by the residents of European carfree areas, and this may increase property values, although more research is needed to quantify this. As this does not apply to low car developments, it may be argued that they offer 'the worst of both worlds' to their residents: with no tangible benefits to offset the disadvantage of limited parking. It may be possible to design low car developments in ways which bring greater benefits to the residents. To the extent that this involves separating or removing traffic, this would lead to a hybrid or intermediate case.

The main problems of carfree development relate to parking management within the development and/or surrounding areas. These problems are not confined to carfree developments: any development where parking is constrained is likely to encounter challenges in this respect. Although the availability of parking is generally much lower in carfree developments, car ownership also tends to be lower.

The evidence reviewed in this article suggests that where feasible, carfree developments offer significant benefits to policymakers – a wider range of benefits than low car developments. This is particularly true in circumstances where minimal traffic generation is required. As these are often in high density urban areas, these are also the areas where potential demand is concentrated and where the benefits to residents of a traffic-free environment are also likely to be greatest.

Figures (all photographs taken by Steve Melia)

1. Children in Vauban
2. Stellwerk 60, Cologne – Bollards not Removed for Normal Deliveries
3. Interior of GWL Terrein
4. Groningen Inner Ringroad
5. Benefits of carfree development
6. Poole Quarter 'home zone'

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Urbanisation and the need for sustainable development
Everywhere and nowhere

Since the creation of the railways, the desirable lifestyle has been in constant motion, always expanding and demanding that everything – goods and people – move and be moved. It may only have been a phase in human history

Helmut Holzapfel

The Swiss people launched a remarkable initiative in 2000, intended not just to restrict road traffic in Switzerland but to halve it. They collected thousands of signatures and won enough votes for the project to be put to a popular referendum. This failed to change the law, but did win a surprisingly high approval rate: 21.9% of the population voted in its favour.

Moritz Leuenberger, then Swiss minister for transport, said at the time he could not understand the project, since the need for mobility "is simply there". That may be true, but there is also discontent, even in the distinguished Swiss Council of States. During the debate about traffic, Councillor Thomas Onken addressed a letter to the project, in which he explained that he had "some reservations but also a lot of sympathy" for the proposal.

What does the project mean for the rest of Europe? Must we drive around ever more and ever further? A few years ago writers such as Sten Nadolny (1) and the cultural historian Wolfgang Sachs (2) coined the words "the New Slowness" to open the discussion and make the first effective critique of a society of restless haste. They said that for millennia mankind had to rely on the limited speed of man and animal to get anywhere. Only in the past 200 years have the distances that people can cover expanded dramatically. This expansion has decisively changed our perception of space, landscapes and more generally of space and time. And by now, this expansion seems to be indispensable and irreversible. People have forgotten that care, clarity and reflection require time.

A "distance-intensive" lifestyle has emerged and is taken for granted, at least in modern industrialised societies; it has become a typical way of living shaping attitudes and behaviour for part of the population. A distance-intensive lifestyle means large distances covered in ever-smaller units of time, not only in personal travelling, but by the products consumed. Even in health food shops, Argentinean honey or apples from oases in the Brazilian jungle are freely available. The lifestyle means constant availability and spatial accessibility for people and products: Australian or Californian wine, strawberries at Christmas, most likely from South Africa. People fly from Hamburg to Milan for an evening at the opera, and back the next morning. And they live in the suburbs in a detached house with a double or triple garage outside (an SUV is a must); the house is in a beautiful location, yet a blot on the landscape.

The reality of modern consumerism

The disadvantages of the lifestyle gradually become apparent: being everywhere, people are increasingly

nowhere. The freedom they search for far and wide means more than dependence on transport systems. Since everyone wants to get everywhere else, everywhere looks the same; same products, same supermarkets. And since everyone wants to go somewhere else and consume products from all over, transport infrastructure is congested. If we consume yogurt made from milk and fruit sourced all over Europe, we shouldn't be surprised about a lorry jam on the motorway near London or Milan.
Realistically, still only a very small minority of the world's population subscribes to the lifestyle. If everyone were to do so, conditions would be unimaginable. If the travel habits of the European manager class were to be copied by the population of China, London, Paris and Berlin would be full of Chinese. And if the Chinese all built detached homes to European standards, they would have to invade neighbouring countries for extra land.

The lifestyle of course depends on being first, on doing what others aren't yet; those whose lives are distance-intensive don't consider that soon everybody will copy them. Alas, in this status race, every winning entry is soon passé. An internet provider in South Africa suggests that you've got to take a supersonic flight in a BAC Lightning fighter jet at 22 km up to celebrate your birthday now. But your neighbour may have already booked it.

The lives of lifestyle devotees are becoming stressful. The German business weekly *Wirtschaftswoche* recently told them how to switch off, but not everybody listened: a manager said he uses his spare time intensively given that it's limited, rushing from a light aircraft to go hunting. A few pages further there is medical advice for "unexplained" problems. On further analysis those managers seem to suffer from the Sissi syndrome, named after Elisabeth, "Sissi", wife to Franz Josef, the 19th-century Austro-Hungarian emperor. She suffered from depression but fought it by constant travelling on rail, horseback and ship.

A distance-intensive lifestyle can't easily be explained by popular psychology. It has to do with power, position, technology and serious instability in modern societies. Being ubiquitous is important, especially to those who feel insecure about their authority. Dictators have always been keen to have their portrait in every office or public building, a way to be everywhere. When the German government under Kohl protested to television stations that the Chancellor was seen too little on TV, and when he was it was from the wrong angle, his popularity ratings must have been low.

Near to me

Alternatives to a distance-intensive life do exist. Many people can't afford the time or costs of constant travelling; lower-income groups, the elderly, often women, continue to inhabit our towns and villages when everyone else is away. But the number of restless travellers is still growing because it's not easy to quit the race. Any step away is often obstructed by power and technology: those who don't travel, don't go to meetings, don't want to be everywhere, quickly seem insignificant. Modern managers can't afford that. New media

don't help much. The mobile phone is always ringing, summoning its owner to pressing deadlines; the internet is so fast it generates time-related pressures on reality from virtual information. Distance-intensive living has nearly destroyed its own alternatives: setting up home 50 km out of town without schools and shops won't free migrants of their two cars.

Nobody wants to return to an isolated way of life, eking out an existence in a mountain valley. But distance-intensive behaviour is at a point where the disadvantages almost outweigh the benefits, and have already done so in some areas. Logistics providers at warehouse chains have already tried out delivery models for urgent goods, sending out two radio- and GPS-equipped vans on different routes to their stores at the same time. One will arrive promptly; the second will be diverted by radio to provide back-up elsewhere. Yet this complex system functions in the centres of congested Istanbul, Athens and Paris no faster than a 19th-century stagecoach.

A change of lifestyle cannot be imposed; it has to evolve from insight, wise restraint and changes in perspectives on social values. In some areas this is already visible: buying food from ever farther away is no longer quite so popular. Local products – especially food – are already showing that nearness has strengths, and can compete with distance. After much neglect the region has been revived as a unit, in which experiences that today are sought after further away may still be possible. People can find more calm in nearness. Bike rides can reveal undiscovered qualities in closeness, in lieu of sitting in weekend traffic jams on the motorway. But members of the jet set, who want to discover fresh peace and quiet ahead of the advancing middle classes, are poor propagandists for the new nearness. What are needed are role models rather than moral appeals. And restoration of the qualities that once characterised cities in Europe could perhaps work.

The initiative in Switzerland had a flaw: it wanted legal sanctions. Halving traffic isn't unthinkable (we would only have to go back to the volume of 1970), but it makes little sense to leave this to the state. Perhaps those behind the initiative noticed that themselves: after the referendum people began to devote far more time to creative activities in their localities. Already people are voting for improvements to the local environment. Perhaps when the boredom of a travelling, timesaving society reaches a critical point, ubiquity may lose its power, and proximity will regain respect and attention.

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