

Evaluating the Unknown: Strategies for Assessing New Initiatives in Transport, with Particular Reference to Walking

Ian Ker

Abstract

Transport strategies have changed direction very substantially in the past decade or so, but the methodology of evaluation has not kept up, often because the linkages between new initiatives and outcomes are not clearly-enough defined or well-enough quantified. In addition, evaluation methodologies, in practice if not always in theory, often assume that 'more is better' and have difficulty coping with change that includes changes in what we do (activity patterns) as well as how we get there (travel). Our tools favour the status quo and, consequently, new initiatives often have great difficulty getting funding.

The renewed emphasis on walking is a case in point, not only in respect of conventional evaluation issues, but also because of the importance of 'new' issues such as health and fitness, energy economics, greenhouse and new dimensions of road trauma.

The paper discusses issues that conventional transport planners are either not aware of or wish would go away, outlines a framework for incorporating these into assessment and evaluation and presents an application of this framework to the marketing of a pedestrian strategy for Perth. This framework is derived from one developed for a travel demand management initiative in Perth and has application to a range of initiatives and programs (eg cycling programs) where the conventional is inadequate.

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Ian Ker is an economist by training who has worked for so long with engineers and planners in the 31 years since he graduated from the University of Durham, England, that he is reasonably literate in a number of disciplines.

He has worked in most areas of transport, but has managed to keep his feet on the ground - apart from a brief encounter with local ownership of aerodromes, he has worked with land and sea transport. He has been involved in policy development, planning and research in relation to freight transport, railways, ports and shipping, bicycles and access for people with disabilities.

In all this he has sought to apply socio-economic evaluation principles to decision-making, often in the face of limited data and lack of established methodology.

Before taking up a position with the WA Department of Transport in 1987, he worked for:

- the National Freight Corporation (UK),
- the British Road Federation,
- the Australian Road Research Board,
- Westrail (Western Australian Government Railways),
- the WA Director General of Transport's Office,
- the Bridgetown Licensed Club (as Secretary/Treasurer - when he re-learnt to drink whisky and play a mean game of pool), and
- himself (as a freelance planner/researcher).

He is currently Director, Integrated Policy, in the recently re-established Office of the Director General of Transport, where he has responsibility for the development of methodology and process for improving decision-making in respect of transport infrastructure investment.

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Introduction

Transport strategies have changed direction very substantially in the past decade or so, but the methodology of evaluation has not kept up, often because the linkages between new initiatives and outcomes are not clearly-enough defined or well-enough quantified. In addition, evaluation methodologies, in practice if not always in theory, often assume that 'more is better' and have difficulty coping with change that includes changes in what we do (activity patterns) as well as how we get there (travel). Our tools favour the status quo and, consequently, new initiatives often have great difficulty getting funding.

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Why is the Unknown Important?

In the absence of the unknown, the future is pre-determined. If we have no concept of different (and unknown) ways of doing things, there will be no change except that which is thrust upon us from elsewhere. Change thrust upon us from elsewhere forces us to be reactive rather than promoting the ability to choose our own future.

The very fact that we choose to change direction demonstrates a high level of concern about the known future and a desire to create an alternative future, which inevitably contains elements of the unknown - either in terms of the destination or the journey.

Plus Ça Change, Plus Ç'est la Meme Chose

It is rare for changes in the direction of transport policy and strategy to be matched by changes in the methods used to develop and assess individual transport initiatives, whether they be infrastructure investments or more radical options such as demand management. In the few instances where funding paradigms have been changed to reflect the new directions (eg ISTEPA and TEA-21 in the USA), the practice is largely driven by formula rather than by assessment at the project level.

At best, models are 'adapted' to new questions, but rarely satisfactorily.

More commonly, existing models and methods are applied to new problems (ie to answer questions for which they are not designed). Even the *New Approach to Appraisal* (DETR, 1998), whilst it requires identification of a range of options to address an identified problem (Chapter 3), still relies on traditional models for estimating impacts of those options. Most of these models have no capability to address cycling and walking, many are limited in respect of public transport - and few, if any,

allow assessment of potential changes to how people make decisions about transport use.

Induced Traffic

The UK Standing Advisory Committee on Trunk Road Assessment drew attention to, and demonstrated the reality of, the issue of induced traffic (SACTR, 1994). The New Approach to Appraisal (DETR, 1998) requires that induced traffic effects are taken into account, but it is questionable whether available transport/traffic models are capable of doing this adequately.

On the perils of modelling (as seen by Patrick Troy in 1967 (Troy, 1967) - quoted in Davidson (2000))

“Melbourne had recently embarked on a massive million dollar study designed to project its future transport needs to the year 1985. Troy noted some ‘interesting and disturbing features’ of these studies. The basis of the standard methodology was the projection of future land use from which, in turn, the projected volumes, types and directions of transport movements were derived. The trouble with this method, he argued, was that these estimates of future land use were predicated on the very transport developments that they were designed to serve. ‘One effect of the transport plans, if implemented, would be that they would virtually ensure the development of the trend town plans on which they were based’, he noted. ‘In this sense, it is positive planning, but hardly the type to be encouraged.’”

Davidson goes on to note that “Thirty years after that paper ... Melbourne is recovering from another binge of highway construction”. [Note: Melbourne is not the only Australian Capital City in that position]

Graeme Davidson is an historian. Truly may he repeat the words of George Santayana that “Those who do not remember the past are condemned to repeat it.”

Understanding the Unknown: Pilot Projects

Demand management is a relatively new concept in transport, although not in some areas of commercial activity - for example, power utilities in the USA in the 1970s, faced with increasing costs and difficulty in getting approvals for new power generating capacity, gave away energy-efficient light bulbs to their customers as a more cost-effective strategy than increasing power generation.

Until very recently, demand management in transport was seen almost entirely in supply-side terms - high occupancy vehicle lanes, congestion pricing, van pools. In principle, these were amenable to evaluation through conventional models, but rarely were measures large or systematic enough for this to be done in practice.

More recently, interest has been generated in initiatives to change people's travel behaviour through 'soft' measures using information, opportunity and incentive aimed at individuals and households. These initiatives are known as TravelSmart (Perth, Western Australia) and Travel Blending (Adelaide, South Australia).

There are significant differences in the key elements of TravelSmart and Travel Blending, but they shared an inability to demonstrate their effectiveness through

conventional models. Both TravelSmart and Travel Blending proceeded through pilot projects (James, 1998; Ampt & Rooney, 1998) to establish the level of impact that could be achieved. These pilot projects were then evaluated (Ker & James, 1999; Tisato & Robinson, 1999) using conventional benefit-cost frameworks.

In both cases, using highly conservative approaches and assumptions, very high returns were demonstrated – between 13:1 and 17:1 for TravelSmart (Ker & James, 1999, Table 6) and around 6:1 for Travel Blending (Tisato & Robinson, 1999).

Limitations of Pilot Projects: Durability of Impacts

The effectiveness of learning declines over time unless the message is continually reinforced.

With individualised marketing to change travel behaviour, the experience of changed travel behaviour, itself, was thought to be an effective reinforcing mechanism, provided the quality of the experience does not deteriorate. This has since been reinforced by follow-up surveys, but at the time of the pilot project evaluation was supported only by limited evidence. The evaluation, therefore, assumed a relatively rapid rate of decay, in which the residual effectiveness fell to 15% after 10 years (Ker and James, p713).

Travel Blending, in Adelaide, adopted the alternative approach of developing activity and cost scenarios to ensure that there was no decay in the benefit stream over time (Tisato & Robinson, p697).

Limitations of Pilot Projects: Information and Feedback

The South Perth pilot project of TravelSmart was constructed according to a rigorous experimental design, to ensure that the true effectiveness of the intervention were being measured, uninfluenced by extraneous factors. The pilot was, therefore, not publicised and all changes in travel behaviour amongst the 'experimental group' were checked both before and after (and longer term) against the behaviour of a 'control group' that had no information about the project.

Preliminary results from the broadscale application of individualised marketing to the City of South Perth, with no such restrictions on information, indicate that the shift from car to public transport (one of four key behaviour changes in TravelSmart - the others being shift to cycling and walking and travel to local rather than regional destinations for some trips) could be as much as twice that in the pilot.

Limitations of Pilot Projects: Scale and Network Effects

Because pilot projects are small in scale, relative to the total system, it is tempting to assert that the impacts on the overall users of the network are small and can be ignored (eg Tisato & Robinson, 1999, pp692/3). However, where costs are non-linear and increasing functions of activity (as with congestion), the unit benefit from a small change is greater than that from a larger change, as Tisato and Robinson recognise in their prospective evaluation for Adelaide, where "as road traffic volume approaches capacity ... network benefits begin to swamp other benefit components" (p700).

Consequently, it is important to be comprehensive in pilot project evaluation to ensure that the results properly reflect the true impacts. Even where scale and network effects might not be obvious, a comprehensive evaluation of the pilot is necessary to minimise

the risk of important factors being excluded in putting the case for larger-scale programs.

Understanding the Unknown: Prospective Evaluation

Circumstances are not uniform across a city and pilot projects in particular areas are not necessarily representative of what would happen in other areas. Nor do we have models that enable us to translate the impacts to different circumstances.

Using results of pilot projects for evaluating proposals for larger-scale implementation will under-estimate the benefits of the larger project, for reasons of information, feedback, scale and network effects. It might also over-estimate the costs where set-up and development costs can be amortised over a greater number of participants. There might also be factors that will make a program more or less effective in other areas.

These factors can be critical in determining whether a pilot project gets translated into a broadscale application.

In the case of the South Perth TravelSmart, extension from the pilot to the full project was straightforward, since the pilot had been undertaken through a random sample of the whole population of South Perth. Extending beyond South Perth to the full 10-year proposed program (covering over 40% of the total Perth metropolitan population - Transport, 1999) was more difficult, for a number of reasons, including differences in:

- the physical pattern and density of activities and associated transport systems that make alternatives to the car less (or more) suitable alternatives to the car;
- the extent to which additional capacity (mainly public transport) is required to accommodate the additional non-car trips in a way that provides a self-reinforcing experience to new users and maintains the level of service for existing users;
- the extent to which new public transport trips will be bus or rail (or, in some cases, ferry), which have very different cost structures and, hence, financial impacts.

In most cases, the direction can be identified but the absolute magnitude cannot. However, it is possible to identify the key elements that contribute to the success of the pilot (socio-demographic, land use, transport systems, densities in the case of TravelSmart) and rate prospective locations according to these criteria. Inevitably, the range of values will have a high degree of professional judgement (is A 50% or 75% of B?), but the order is likely to be robust (A is less conducive than B which is less conducive than C). If necessary, the judgemental component can be reduced by the application of sensitivity analysis.

Prospective analysis has been used to support the WA application for Greenhouse Gas Abatement Program funding for TravelSmart.

Understanding the Unknown: Hypothetical Evaluation

The Perth Metropolitan Transport Strategy (MTS, 1995) sets out objectives and targets for greater sustainability of transport in the Metropolitan Region for the period to 2029. Included in this is a target to reverse the continuing decline in walking for transport so that the proportion of trips on foot increases from 10% (1991) to 12.5% (2029). Continuation of recent trends would see walking reduce to 5.8% of trips by 2029.

A pedestrian strategy has been developed (Transport, 2000), to guide the implementation of MTS strategies and achieve its objectives in respect of walking (Transport, 2000).

In the absence of specific costs for implementing the walking strategy and of information of the effectiveness of measures that will form part of the strategy, it is not possible to carry out a comprehensive evaluation of the proposed pedestrian strategy. However, a benefit assessment can provide guidance on how much expenditure is justified to achieve a given level of impact. This then narrows the area of uncertainty to how effective expenditure on a given strategy is likely to be.

Hypothetical Evaluation of the Perth Pedestrian Strategy

Walking is the most environmentally-friendly mode of transport, using virtually no resources other than time, shoe leather and food (for 'fuel'). Walking generates no significant negative externalities, other than (at present) through a higher road trauma rate than car driving. However, the long term evidence for Western Australia indicates that cycle trauma, as measured by hospital admissions, increases at around one-third of the increase in cycle usage. A similar effect is likely to exist for walking, but its magnitude has not been quantified.

In the case of travel behaviour change from car to cycling or walking, the accident rate for the non-motorised modes would also reduce because of the lower volume of car traffic and, hence, fewer conflicts with motor vehicles.

Benefit Assessment Framework

The benefit assessment follows the framework established for the evaluation of the individualised marketing trial in South Perth (Ker & James, 2000), although not all elements are applicable here.

Some impacts have been excluded because they are likely to be small. For example:

- Direct impacts on public transport usage (and hence the capacity requirements) are likely to be small, although a greater willingness to walk will encourage people to use public transport, which often involves a walk to the bus stop or train station;
- Impacts on traffic congestion are likely to be small as walking is most suited to local trips – and, hence, trips largely on local rather than arterial roads.

A number of other impacts have not been quantified in this benefit assessment, simply as a pragmatic response to the availability of information.

In all cases, the direction of the omitted impacts will be beneficial and the assessment, therefore, conservative.

Values

The values attached to those impacts that have been assessed are the same as for the 'central' evaluation of the individualised marketing trial in South Perth. For discussion of key aspects of the derivation and application of these values, see Ker & James (2000), Section 4.

Benefit Assessment

The direct financial benefits to the user (ie the person who previously drove a car) are equivalent to 17.2 cents per kilometre. These are based simply on the savings in variable running costs for a car. Some people/households might decide that they are then able to do without a second car, in which case there would be additional fixed cost savings (vehicle registration, depreciation, interest on capital). However, in these circumstances it would be likely that other changes in travel behaviour would be made and a simple benefit-evaluation is of limited use.

The socio-economic benefits are of a similar scale, 18.0 cents per kilometre. Within this overall value, there is only one negative and that is the increase in pedestrian road trauma. It is important to note, however, that:

- the net mortality/injury impact on individuals who change from car to walking is small, after taking into account the health and fitness benefits. [Note also that the estimated health and fitness benefits relate only to mortality, not to other improvements in well-being as a result of exercise through walking.]
- the net mortality/injury impact for society is a benefit, taking into account health and fitness benefits and the reduction of road trauma through reduced car traffic.

Table 1. Benefits of Walking: Per 1000 kilometres transferred from car to walk

Item	Per 1000km	Present Value @ 7% per 1000km/year	
		10 Years	30 Years
Financial Benefit to Individual			
Private Vehicle Operating Costs	\$172		
Socio-Economic Benefits			
Private vehicle operating costs (net of tax)	\$113	\$819	\$1,446
Improved health and fitness due to exercise - reduced mortality	\$84	\$607	\$1,071
Road trauma (increased walking)	(\$95)	(\$687)	(\$1212)
Road trauma (reduced car use)	\$34	\$246	\$435
Air pollution costs to community	\$20	\$145	\$256
Greenhouse gas emissions	\$20	\$145	\$256
Traffic noise	\$3	\$22	\$38
Water Pollution	\$2	\$11	\$19
Total Socio-Economic Benefits	\$180		
Net Present Value (NPV)		\$1,308	\$2,309

Note: Figures in brackets indicate **disbenefits** or increased costs

Interpretation

The benefit assessment is based on a straight transfer of travel from car as driver to walking. This is only one (albeit the major one) outcome of implementing strategies to encourage walking. Others include:

- increased use of public transport, as people become more willing to walk to bus stops, train stations or ferry terminals;

- change of trip length, if people substitute walking to local facilities for driving to distant ones;
- change in number of trips, if people substitute more frequent shorter trips to buy smaller amounts of groceries each time.

These additional effects can be brought into a full evaluation, but would be unlikely significantly to change the overall conclusions. The behaviour change will only take place if individuals perceive there to be net benefits to them as individuals and all of the non-personal impacts move in the same direction.

The MTS targets require an increase in 2029 of 449,000 walk trips per day compared to the trend value. Assuming that:

- the increase is achieved progressively over the period from 2000 to 2029;
 - walk trips are transferred from car driver and car passenger in proportion to the current levels of use (ie 5 car driver trips for every one car passenger trip);
 - walk trip lengths remain unchanged at 0.75km per trip; and
 - there is no real increase in the unit values applicable to the impacts of the change;
- the present value of the benefits of achieving the MTS targets is around \$57 million.

If there is a requirement for public expenditure programs to provide a benefit:cost return of 4:1, this justifies expenditure of nearly \$2 million a year for the next 10 years - over and above the current expenditure on pedestrian-related programs such as footpaths.

Some part of the achievement of the walk trip target will result from other initiatives, but it is clear that investment of \$1-2 million per year in the walk strategy itself is warranted, if it can achieve the desired mode share. Since the Perth Walking strategy does not include major infrastructure elements, this level of expenditure is significant.

Some Methodological Issues

Abolishing the Concept of Externalities

An externality may be defined as an unintended consequence impacting on others rather than the decision-maker. The very name 'externality' implies that it is peripheral to the decision being taken, but these are very real consequences for society as a whole.

The treatment of externalities, in turn, places boundaries around evaluations. In the private sector, except where bound by regulation, the focus is on direct financial consequences - everything else is an externality. In the public sector, the boundaries are broader (hence we carry out socio-economic, as well as financial, evaluations), but we still tend to ignore impacts that spill over State or national boundaries. If we all do this at the project level, irrespective of high level principles that might be adopted, then impacts that transgress institutional boundaries will never be effectively addressed.

Numerator or Denominator

The evaluation of travel demand management (and, by extension, walking initiatives) throws into clear focus the issue, sometimes regarded as of theoretical interest rather than practical importance, of what is counted in the numerator (as positive or negative benefits) and what in the denominator (as costs) in calculating the benefit-cost ratio.

The common convention is for capital costs to be included in the denominator, with all other impacts, including changes to operating costs and so-called 'externalities', in the numerator. Whilst it has been argued, on theoretical grounds, that the denominator should include all those items that are in limited supply (and therefore are 'capital' by nature – for example, does it really matter whether public funds are 'capital' or 'operating' in calculating the return on public finance from a project? (Transfund, 1999)), the argument has less often been extended to externalities. And yet many 'externalities' represent finite resources in the short to medium term (eg air quality) and impacts might not be reversible (eg death from traffic crashes or, except in the long term, global warming).

The issue is of no importance for calculating net present value. Nor is it of obvious importance for benefit-cost ratios when the comparison is between similar projects or projects that have a similar range and level of impacts – for example, different ways of increasing road capacity to meet demand. It is, however, critical when the comparison is between alternative ways of addressing a problem with widely-different, or even opposite, impacts on externalities.

In the case of travel demand management, the present value of actually- or potentially-non-reversible impacts was several times greater than that of the financial cost of undertaking the project (Ker & James, 1999, Table 6). Adopting the 'externality capital' approach potentially creates the conceptually-difficult problem of negative capital cost for such an initiative – but does not mean that doing so is wrong.

Taking this further, if we evaluate the overall transport system regarding fossil fuels as capital (not income), the returns from investing in fossil-fuel intensive modes (such as roads for cars) will be significantly reduced relative to more fuel-efficient modes (public transport) and modes that use only renewable fuels (cycling and walking).

Road projects, on the other hand, at best have relatively small externality benefits and, where the induced traffic syndrome is apparent, can have substantial net externality costs. While individual road projects might make only a small difference to the costs of car travel and will not, therefore, induce measurable additional traffic, cumulatively projects must induce traffic. To argue otherwise is to ignore one of the fundamentals of economics and human behaviour – that consumers respond to lower prices (including shorter travel times) by consuming more.

Caveats: Ranges, Thresholds, Discontinuities and Non-Linearities

It is important to recognise that, whatever approach to evaluation of the unknown is adopted, there might well be exceptions to the 'linear extrapolation' hypothesis. Indeed, we should take this as a 'given', since it is the linear extrapolation of current models and evaluation paradigms that force us to adopt these approaches in the first place. Our approaches will also be limited, but they should be less so than the current ones.

One of the most common errors in evaluation is failure to recognise when models are being extrapolated beyond their valid bounds. Models are based on sample data collected from a particular range of circumstances; within this range, it is in principle, possible to calculate error bounds on estimates of future values.

Beyond that range, the error bounds widen and estimates become less reliable - yet it is rare for this to be acknowledged at either the modelling or the evaluation stage. The numbers take on a life of their own.

This error is even greater when the initiative being evaluated makes qualitative as well as quantitative changes to the travel experience or where the changes are so great that they significantly alter user expectations and the basis for user choices.

For example, going from a run-down, very basic diesel suburban rail system to a modern electrified system (as happened in Perth in the late 1980s/early 1990s) involves many changes other than the most obvious (to planners) one of changes in travel time. From the potential user's perspective, it might matter much more whether you get a seat in a smooth, fast train than in an slower, rough-riding one - because you can do something while seated. Similarly, shorter travel times and higher train frequencies will change expectations, so fluctuations in performance become more critical.

In walking terms, changing the nature of the pedestrian space from a largely movement one to one that genuinely facilitates and encourages exchanges between people (eg by providing places for people to gather and to sit) will affect the whole basis of the walking activity and, hence, people's willingness to walk (Gehl, 1994).

Conclusion

The innovator makes enemies of all those who prospered under the old order and only lukewarm support from those who would prosper under the new.

Nicolo Machiavelli (quoted in Lyons, et al, 1999)

Change, except where the status quo is threatened by cataclysmic pressures, is almost always more difficult than continuing as we are. Change always brings uncertainty and the unknown, and most people are, by and large, risk averse.

In transport and evaluation, the 'old order' is supported by 50 years of intensive research and data collection. This has, in turn, established a particular way of approaching solutions to problems, sometimes known as 'predict and provide'

The 'new order' must rely on limited information and hypothesis and hence has great difficulty competing for policy decisions and funding. By judicious use of small-scale pilot projects, prospective evaluation and 'hypothetical' evaluation, it is possible to use conventional evaluation tools, such as benefit-cost analysis, to demonstrate the real value of alternative approaches to transport issues.

In Western Australia, this has been done, in various ways, for travel demand management, showing socio-economic returns well in excess of those from infrastructure investment, and the Perth Walking strategy, for which it has demonstrated the justification for investment of around \$2 million a year on top of existing programs.

Since the Perth Walking strategy does not include major infrastructure elements, this level of expenditure represents a substantial program.

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