CHANGING RESEARCH AND POLICY PERSPECTIVES: IMPLICATIONS FOR TRANSPORT PERFORMANCE, THE ECONOMY AND THE ENVIRONMENT

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Transport research and policy formulation are subtly and pervasively influenced by the paradigm that underpins academic and professional thinking: this strongly affects the kinds of problems that are identified, how they are diagnosed and the solutions that are proposed. The paper shows how the evolution of the prevailing transport paradigm over the past fifty years has left its mark in shaping the research and policy agendas over time, and considers the implications of this for how we have dealt with transport performance, the economy and the environment. However, rather than the classic 'paradigm shift' found in the scientific disciplines, where one set of concepts replaces another, in transport we can more observe a process of accretion, where a core paradigm has additional dimensions added to it over time. However, there have been major lag effects in the development of new modelling and appraisal methodologies that reflect this paradigm expansion. As a consequence, many of the more recent developments in policy analysis have been constrained by past thinking.

1. INTRODUCTION

Both in our professional and personal lives, we see the world through a series of filters and lenses. Confronted with the same situation, people will observe and interpret it differently, and come up with different kinds of remedies, based on their perspectives on the world and their previous experiences. Political parties epitomise collective differences of this kind, which are also prevalent in fields such as medicine, where a chiropractor or acupuncturist would view and treat a patient in a very different way to a conventional medical practitioner.

This framework of concepts and supporting tools within which a professional group operates has been termed a 'paradigm'. While there may be competing paradigms in operation at the same time, as in the medical example above, Kuhn (1962) first introduced the notion of major advances in science through 'paradigm shifts'. He postulated that scientific revolutions occur when scientists encounter sufficient anomalies or questions that cannot be adequately answered within the current paradigm, to question accepted norms and to search for a new framework for discovery and analysis that better explains the anomalies.

Paradigms have also played a fundamental role in transport research and policy making, but one which has been given little explicit attention to date. I illustrate this proposition by looking in some detail at the changing nature of strategic transport planning since World War Two, and how this has affected our treatment of transport performance, the economy and the environment; and then, much more briefly, at a more micro level at changes in the way in which we have approached the design of urban streets. In both cases, I argue that we have witnessed an expansion in the prevailing paradigm, rather than a formal paradigm shift; but the consequences of this have been no less dramatic for the ways in which transport issues are identified, diagnosed and addressed.

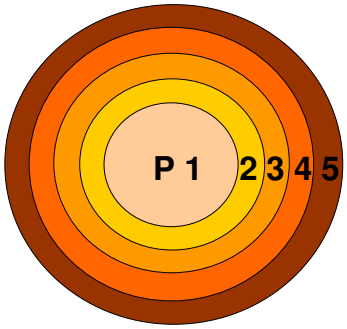
2. TRANSPORT PLANNING: EXPANDING HORIZONS

In transport planning, as practiced in many countries around the world, we can identify an initial, foundational paradigm, and four subsequent rounds of paradigm expansion, or additional perspectives, over the past fifty years. In most cases, this started in the 1950s with an emphasis on accommodating growing numbers of vehicle movements, and has expanded in several phases to most recently acknowledging the importance of attitudes as an influence on behavioural change.

Rather than simply replacing what went before, each new perspective has enriched our overall understanding of transport and travel behaviour. It has posed its own research questions and lines of enquiry, and framed the policy debate in a different way. Each has also placed different demands on data collection and analysis, and has led to different requirements for modelling and evaluation.

However, there have been major lags in translating new concepts into practical methodologies, so that some modelling and scheme evaluation methods still carry a legacy of being grounded within the initial vehicle-based paradigm first developed over half a century ago – and in some cases, these methods have constrained thinking - at least for a while.

The five paradigm enlargements or perspectives briefly introduced in this paper start with the vehicle-based (P1), then trip-based (P2), followed by activity-based (P3), dynamics-based (P4) and finally attitude-based (P5). Note that the emphasis in this paper is on person movements, in cars or using other transport modes; while some of the same arguments could be applied to the movement of goods traffic, this is not considered here.



While these five enlargements are presented as discrete events, in practice it is recognised that there are not always clear cut distinctions at the boundaries between them. For example, should trip tours be regarded as lying within a trip-based or an activity-based paradigm? Or, is habits part of the dynamics or attitude-based paradigm? Similarly, the paradigm expansions have not strictly followed the sequential path set out here. While it is broadly true that the early sequence was: vehicles -> person trips -> activities, the dynamics and attitude perspectives started to appear in parallel with these first three – although the order of presentation in this paper reflects the times at which they started to have a major influence on transport research and policy in Australasia, the UK and the USA.

2.1 Vehicle-Based Perspective

The formal development of transport planning in the UK and Australasia began in the late 1950s and early 1960s, using methods imported by Alan Voorhees and others from the USA. The focus was on catering for the anticipated rapid growth in motor traffic associated with the growth in car ownership following the post-war recovery, which in the case of the UK was – largely correctly – foreseen in the Buchanan report ('Traffic in Towns', MoT, 1963) and in early traffic studies in London and some of the other conurbations.

The growth in motor traffic was viewed as being an inevitable consequence of the increases in household incomes (a viewpoint embodied in these early models), and wholly beneficial economically and socially. While Buchanan warned of the environmental deterioration that would result in urban areas if nothing were done to accommodate the car, it is noteworthy that the emphasis of Traffic in Towns was largely on redesigning our urban areas to accommodate that growth, rather than on trying to constrain increases in car use.

As a consequence, the transport solutions to the problem of growing traffic levels were typically building new roads, increasing the capacity of the existing road network, and providing additional parking spaces; relatively little attention was paid to redesigning existing urban areas, in the way that Buchanan had advocated. This was the start of the 'motorway age' in the UK (Starkie 1982), with the development of the national motorway network and high capacity urban road networks (e.g. in Birmingham and Glasgow).

Quite soon, however, it became evident in the UK – and in many of the other more developed European countries - that it would not be possible to cater for unrestrained car use in larger urban areas. This led to a policy impasse: what to do about the pressures for traffic growth in urban areas, if major road building is not an option? While part of the solution lay in using the existing roads network more intensively (through the introduction of one-way streets, on-street stopping restrictions and co-ordinated traffic signals at junctions, see Hart, 1976), the major breakthrough came by a redefinition of the problem – the first paradigm expansion. Rather than trying to cater for unlimited car movement in urban areas, the primary policy objective was switched, to cater for growing person movement instead, using a variety of transport modes. Car travel became one option, of several.

2.2 Person-Trip Perspective

Within this person trip perspective, the emphasis is on moving *people* from their origin to their desired destination, in the most efficient and attractive manner. So the form of vehicle movement becomes of secondary rather than primary importance - it is simply an enabling technology. As public transport systems (buses, underground, trains) use the available space in high density areas much more efficiently, and can accommodate much higher numbers of people per unit area, the solution to the conundrum as to how to cater for the rapid growth in vehicle demand is to switch much of it to other modes of transport.

In policy terms, the focus now switches to instruments that encourage a modal shift from car, in particular through improved public transport services, coupled with some restrictions on parking provision in higher density areas. Interestingly, there was relatively little consideration of walking and cycling in the early days of the person trip-based perspective; we can speculate that this was in part due to historical methodological factors. The vehicle-based models had been aggregate and strategic in nature – focussing on inter-zonal not intra-zonal trips – so there was little interest in shorter trips, and many data collection exercises had excluded walking and cycling trips altogether.

However, as early as the mid-1970s, some commentators were beginning to question whether this was providing a real understanding of why people travel, and whether it would be possible or desirable to cater for unlimited growth in person trips, even if some of them could be switched to non-car modes. This questioning was stimulated by several factors: evidence of limited success in getting car drivers to switch to alternative modes, lack of understanding of the factors behind trip generation – and the 1973/74 oil crisis, which provided a warning of the dangers of becoming a heavily vehicle-dependent society.

The 'oil shock' led to observed short-term reductions in traffic and travel (coupled with increases in time spent on non-travel, in-home activities such as watching television), and brought home the need for a deeper understanding of factors underlying travel behaviour, that did not simply rely on extrapolating past patterns of growth. Heggie (1978), for example, in a study of the influence of early car restraint policies in Oxford, identified twelve forms of household adaptation, most of which could not be readily analysed within a trip-based paradigm.

These concerns simultaneously stimulated the funding of major academic research projects in the UK and the USA, to improve our understanding of travel behaviour – resulting in the development of a further paradigm expansion.

2.3 Activity-Based Perspective

From an activity-based perspective, travel is just one of many daily activities, typically consuming 4% of daily time budgets. It provides a space-shifting mechanism that enables people to move from one location to another, to take part in a succession of activities that draw on facilities or involve groups of people at each location. From this perspective, it is now meeting people's activity participation requirements which is of primary concern, and travel is secondary. Within this enlarged perspective, it becomes possible to address the question 'is your journey really necessary?', to consider trade-offs between travel and other activities, and to assess the wider impacts of transport policies on people's lives.

The early research drew on and combined previous work on activity choices by Chapin (1965, 1974), an American planner, and on activity time/space constraints by Hagerstrand (1970), a Swedish Time Geographer. The 'activity-based approach' '(Jones *et al,* 1983) introduced a number of new concepts into travel behaviour analysis, including;

- The recognition that activity participation is influenced by physiological factors (e.g. need to sleep and eat), as well as socio-economic roles (e.g. employee or carer) and personal preferences (e.g. certain leisure activities); in particular, it stressed the influence of stage-in-the-family-lifecycle on household activity/ travel patterns.
- The importance of activity and trip timing, and scheduling requirements in constraining choices and explaining observed behaviour patterns, with overall daily time budgets as a further constraining factor.
- The importance of inter-personal linkages and multi-person travel decision making in travel and activity choices.

- In-home activity substitution, through tele-services or other home-based activities, and
- Viewing person trip generation rates as resulting from a balance between choices about participating in in-home and out-of-home activities, and decisions about the complexity of trip chaining patterns.

The activity-based approach has provided policy makers with an enlarged set of policy instruments and perspectives, and has also encouraged closer links between transport and land use planning – with the latter dealing with space for non-transport activities. For example, travel behaviour can be influenced by increasing densities or encouraging mixed-use development, by reducing constraints on the timing of activities (e.g. flexi-time at work to encourage peak spreading), or by encouraging home working and the use of tele-services as a substitute for personal travel.

In particular, this perspective has facilitated a debate about whether the primary aims of transport policy should be to cater for mobility *per se* or for accessibility - a debate that has grown in relevance in recent years with policy concerns about facilitating social inclusion and encouraging sustainable lifestyles. Over time, this has provided a rationale for 'reducing the need to travel' without harming economic or social life as a consequence of reductions in movement, and has also tended to give more equal attention to the contribution of walking and cycling in facilitating daily activity patterns.

During the 1980s, another set of concerns began to emerge, relating to the lack of attention that had been paid to changes in travel/activity behaviour over time, and some problems that had arisen in forecasting behavioural responses (e.g. evidence of asymmetric responses to price changes and 'ramp up' effects). This led to the development of a fourth major perspective that has had an important influence on transport research and transport policy.

2.4 Dynamics-Based Perspective

The vehicle-based, trip-based and activity-based perspectives had primarily looked at behaviour patterns cross sectionally – at one point in time – albeit taking into account different needs at various stages in the family lifecycle. The dynamics-based perspective recognised that behavioural response is not instantaneous, that there may be major leads and lags in decision making, that responses may be asymmetrical, and that decisions may be conditioned by previous experiences. An early recognition of some of these factors was provided by Goodwin (1977), who highlighted the significance of habit and hysteresis in travel behaviour, and within a decade there was an broad range of research providing a dynamic perspective on transport issues, from car ownership modelling to public transport demand estimation (Jones, 1990).

The dynamics perspective has provided researchers and policy makers with an awareness that individual changes in behaviour are much greater than the observed net aggregate changes might suggest (similar to the distinction between gross and net migration), that long-term elasticities are generally much higher than short-term ones (Goodwin, 1992), so that policy initiatives may take several years to take full effect, and that habit plays an important role in daily travel/activity behaviour, in limiting responsiveness to policy or market initiatives, in the short term.

While this perspective has added an important new temporal dimension to all three previous perspectives, it has not added directly to the range of variables used to account for observed behaviour (other than by using lagged terms). Its main influence in policy terms, therefore has not been to add new types of instrument to the policy tool box, but rather to encourage a longer term view of impacts, and to point to the advantages of targeting existing instruments on people at points of transition in their lives, when they are actively considering their travel and activity options. This aspect has proved particularly important given the greater involvement of the private sector in funding major transport schemes, where the speed of 'ramp up' has a major influence on cash flow and financial viability.

During the development of the dynamics perspective, the emphasis has still been on working with quantitative variables (e.g. travel times and costs), although sometimes recognizing that perceived values may differ considerably from objectively measured values. With the growth in development of ITS technologies to provide better travel information, the greater market focus in public transport provision following the privatisation of bus and rail services in many countries, and a growing interest in using marketing tools to encourage walking and cycling, it became evident that there were important subjective aspects of decision making that needed to be better understood. This led to an infusion of ideas from social psychology, and the broader development and application of a fifth perspective in transport planning, whose roots can be traced back to at least the 1970s.

2.5 Attitude-Based Perspective

Car companies, such as General Motors, have long taken an interest in the attitudes and perceptions of their customers as an input to their product development, and some public transport operators had started to seriously market their services by the 1970s (Hovell *et al,* 1975). With the development of trip-based disaggregate demand models in the 1970s, some researchers took advantage of the opportunities this afforded to include attitudinal variables in their analysis. However, these contributed relatively little to the explanation of mode choices - Hartgen (1974) found that such variables only contributed 10%-20% of the total explanatory power of his models - and so this was not seen as a major policy priority, at that time.

A second strand of attitudinal work was stimulated through the development of stated preference techniques, which enabled transport operators and product developers to identify optimal combinations of attributes that would result in goods and services which would appeal to particular market segments (e.g. Louviere *et al*, 2000). Such packages commonly included both objective and subjective attributes. These methods have been extensively applied in order to estimate consumer preferences, market demand and to value product attributes (e.g. time) and the negative externalities of transport (e.g. noise and accidents).

A third important strand of attitudinal work has sought to investigate the wider subjective components of travel decision making, drawing on ideas such as the Theory of Planned Behaviour (Ajzen, 1991). This has helped to identify the range of personal and peer group factors that can affect perceptions, attitudes and intended behaviour, in relation to the conventionally better understood objective decision variables (e.g. travel times and costs).

However, most of this work has been directed at enabling the policy solutions that originated within the first three perspectives (e.g. providing more attractive modal alternatives to car travel) to be investigated and applied in a more rigorous and sophisticated manner. It is only relatively recently that this attitude-based perspective has led to the development of new policy instruments, notably through the application of initiatives such as 'TravelSmart' in Australia and the Smarter Choices initiatives in England (Cairns *et al*, 2004), using a range of information and marketing techniques to encourage voluntary reductions in car use.

In addition, as transport policy has put increasing emphasis on restraining car use, and there have been attempts to introduce more restrictive measures such as congestion charging, the nature and role of public opinion has become of greater research and political importance.

3. IMPLICATIONS FOR POLICY AND METHODOLOGY

3.1 Implications for Policy Formulation

As noted at the start of the paper, each perspective has served to enlarge rather than replace the previous paradigm – although certain stakeholders may choose to operate within a particular perspective (e.g. the vehicle-based perspective of the motor industry), As a consequence, this process has tended to lead to transport issues being seen as less simplistic and more complex over time, and has expanded the armoury of potential policy instruments.

In the case of **Transport Performance**, the absorption of additional perspectives has led to an expansion in scope over time, both in terms of what is classed as 'transport' and what is considered 'good performance'. For example:

- Vehicle-based: focus on minimising journey times for private vehicles
- Person-trip-based: concern for how the transport system serves the needs of other modes too (buses, cyclists, pedestrians), leading to a move towards minimising person delay
- Activity-based: understanding of the role of transport in facilitating activity-scheduling leading to growing awareness of the importance of reliability, and of having a good tele-communications network as a complement to efficient transport networks
- Dynamics: associated with growing interest in network performance in real time, and its ability to recover from shocks of different kinds (e.g. traffic accidents)
- Attitude-based: users' perception of network performance, often leading to consideration of a wider range of factors, such as quality of service provision, and personal security.

From the viewpoint of the **Environment**, the widening conception of what transport is and how it affects people's daily lives has led to greater concern about exposure to noise and air pollution. When it comes to tacking CO_2 emissions, each strategic perspective offers its own set of potential, generally complementary, solutions:

- Vehicle-based: more fuel efficient and/or alternative fuelled vehicles
- Person trip-based: switch to lower carbon modes

- Activity-based: use tele-services, or trip chain
- Dynamics: target interventions at decision points in people's lives, allow for build up over time
- Attitude-based: encourage voluntary behaviour change and eco-driving.

Some of these enlargements in perspective have also broadened our understanding of the relationship between transport and the **Economy**. From a vehicle perspective, transport and road building/maintenance support large numbers of people in employment, and when this is expanded to a person trip perspective, account is also taken of those employed in providing services through other modes of transport; the growth in metro construction can also be seen as the outcome of adopting a trip-based perspective. The activity-based perspective, coupled with closer ties to land use planning, has strengthened our understandings of the relationships between transport investment and the growth of the non-transport sectors of the economy. There has also been a growing recognition within different parts of the public sector of the benefits of improved mobility and accessibility, from the enlargement of job markets and agglomeration benefits, to improvements in public health from a growth in walking and cycling.

3.2 Implications for Data Collection, Modelling and Appraisal

Data collection

Each of these five perspectives has its own requirements for data collection, from roadside interviews (vehicle-based) to one-off household surveys (trip-based) to panel surveys (dynamics-based); from the recording of trips to the recording of time use (activity-based); and from the reporting of behaviour to the measurement of perceptions and attitudes (attitude-based).

Generally speaking, the profession has kept pace with demands for new kinds of data, aided by advances in counting and tracking technologies (licence plate recognition, smart cards, mobile phones, GPS, etc.), as well as by drawing on best practice from other disciplines (e.g. marketing), although the falling response rates in personal interview surveys is a worrying trend.

Modelling

Experiences in relation to modelling have been more mixed. The vehicle-based perspective saw the development of the first suites of transport models, consisting of vehicle trip generation, origin-destination (between traffic zones) and traffic assignment modules. Modelling from a person trip perspective led to a switch from vehicle to person trip generation (with an interest in different trip purposes), and required the addition of a modal split module (e.g. Hutchinson, 1974), which was associated with the development of the concept of 'generalised cost' (i.e. the combining of various time and cost components of trips into a composite measure), and the move to disaggregate choice models. The resulting four-stage trip model is well established and still forms the mainstay of many transport modelling exercises.

The inclusion of the activity-based, dynamics and attitudinal-based perspectives into mainstream models has been patchy, at best, as shown in Table 1.

Paradigm expansion	Vehicle trip based	Person trip based	Activity based	Dynamics based	Attitude based
Widely used modelling capabilities	• Vehicle ownership forecasting • Traffic route assignment	• Trip generation • Trip distribution • Mode choice	• Time of day switching	• Ramp-up effects when forecasting	
Limited modelling capabilities or applications	–	–	• Activity set generation • Trip/tour generation • Modelling inter-personal linkages	• Dynamic model estimation • Asymmetrical responses	• Modelling impacts of information provision or image enhancement

Table 1: Modelling requirements and capabilities under each perspective

While there have been significant advances in many aspects of activity-based modelling (Timmermans, 2005), very little of this work is as yet used in operational models outside the Netherlands and the USA (except in relation to time-of-day switching in models examining the potential impacts of congestion charging). There have been several attempts to 'bridge' trip-based and activity-based perspectives, by developing trip tour models from travel diary data, but with varying degrees of success. As a consequence, many of the policy measures associated with this paradigm cannot yet be adequately addressed by standard quantitative models. For example, to what extent can tele-services reduce the need to travel? In addition, activity-based approaches encourage consideration of the impacts of transport policy measures and travel choices on other household members and other aspects of daily life, but very few models have included such wider activity pattern effects. [For a recent exception, see the work by Hensher *et al* (2008) on joint decision making in car purchase decisions.]

Similar problems arise under the attitude-based paradigm; here we cannot generally forecast within conventional models the effects of improved information through ITS, or of the Smarter Choices initiatives on travel behaviour, involving the use of marketing campaigns to improve the awareness and image of non-car modes.

In the case of the dynamics paradigm, the problem is slightly different in nature. Here several techniques are available to capture these aspects of decision making, from incorporating leads and lags in model estimation, to simulating population turnover; but they are not widely used by practitioners, due to lack of suitable data and limited estimation skills within the transport profession.

Appraisal

In the case of appraisal there has been more divergence between countries. But in the UK at least, until recently the techniques have lagged even further behind the development of the newer perspectives than is the case with modelling, in terms of their ability to fully operationalise these factors. Taking the UK as an example, Table 2 shows that most of the quantified and monetarised variables used in national appraisals are still associated with the vehicle-based or trip-base perspectives. This

means, for example, that the appraisal of sustainable transport strategies has to satisfy appraisal requirements that were originally developed to justify investment in car-related infrastructures.

Paradigm expansion	Vehicle trip based	Person trip based	Activity based	Dynamics based	Attitude based
Generally used appraisal variables	• Operating costs • Accident costs • Air pollution and noise	• Travel time savings by purpose	• Health benefits		• Quality of a journey
Missing or very limited variables		• Travel time variability	• Value of activity participation • Value of access/choice • Value of generated travel	• Implications of turnover on valuation • Option values for potential future needs	• Value of improved information • Value of enhanced quality

Table 2: UK Appraisal requirements and capabilities under each perspective

In particular:

- Vehicle-related effects dominate the monetarised parts of the appraisal process, from operating cost savings, to the negative impacts of air and noise pollution and road traffic accidents.

- The main contribution of the person trip-based perspective is through the value of travel time savings, for different trip purposes, which is readily convertible into average vehicle values. Only recently have serious efforts been made to measure the benefits of reductions in travel time variability.

The later perspectives introduce a range of new variables, circumstances and potential policy options which need to be fully appraised, but current methods only do so in a qualitative manner. In particular:

- Virtually nothing from the attitude-based perspective has yet fed through into formal evaluation, with the exception of some recent work on the quality of the journey experience when walking and cycling.
- Most of the benefits of ITS cannot yet be directly captured in appraisals (e.g. benefits of enhanced information and reduced stress)
- From an activity perspective, it might be more efficient to undertake an activity set with reduced amounts of travel (through trip chaining, site consolidation, or in-home activity substitution), but at present reductions it trip rates tend to be viewed as a disbenefit: time savings per trip count as a plus, but we have not looked at time savings per day.

These more recent perspectives also question more fundamentally some of the underlying tenets of existing evaluation procedures. For example:

- Current economic appraisals of travel time savings count the full time savings for existing users, and discount these for up to 60 years ahead. Yet, given the relatively high turnover rates in practice (dynamic perspective), the existing users are nearly all replaced with 'new' users within a few years, so should the full benefits continue to be applied, when the 'rule-of-a-half' is applied to new users?
- Appraisal focuses on valuing unproductive travel time *savings* (e.g. driving time) rather than on valuing productive time *spent* (e.g. working time on a train) – so this encourages transport investment on roads (where time is spent less productively) rather than on rail (where there is more potential to use time productively).
- Metz (2008) has noted that, since travel time budgets have remained stable over decades (activity + dynamic perspective), it is evident that, in aggregate, travellers do not retain time savings but exchange these for longer distances – so, in the long run, there are no time savings. This suggests that evaluation should be measuring the benefits of gains in accessibility, not reductions in travel times.

4. URBAN ROADS: A PARTIAL PERSPECTIVE

For centuries, the public highway has been regarded as a movement space, and legislation and practice have strengthened this situation. Yet within urban areas the network of streets that make up the highway represent around 80% of public space, and most buildings and urban activities front onto streets. As a consequence, most urban activity and much urban identity is closely associated with the urban street network, which as a consequence has important economic and social/community functions that extend well beyond vehicle movement.

In most countries, highway and traffic engineers have been given the main responsibility for developing and maintaining urban street networks, and they have at their disposal sophisticated techniques for ensuring the smooth flow of road traffic. While streets often appear to function well from this narrow perspective, there has been growing concern about the resulting dominance of road traffic (in terms of air pollution, noise, traffic accidents, severance and visual impact), and about the lack of attention given to the important 'place'-related functions of streets. As conditions for motor vehicles have improved, those for other street users and street-centred activities have deteriorated.

I would argue that the unsatisfactory situation we now find ourselves in on many urban streets results from the historical development of a highway-based paradigm that has strongly influenced thinking and practice. This has close links with the strategic, vehicle-based transport planning paradigm described earlier in this paper. Most countries have adopted formal road classification systems based on the scale and nature of the movement function of each part of the network, from motorways down to access roads. Such classifications give primacy to vehicle movement, and non-movement functions are only encouraged and accommodated at lower levels in the hierarchy.

As urban designers and other non-engineering professionals have become increasing engaged in debates about the functions of streets in urban areas, this has led to the publication of a number of reports and guidelines, all characterised by their

emphasis on streets as multi-functional spaces, and an associated recognition that streets are places for people and not just movement conduits for vehicles.

Accommodating this wider perspective has necessitated a paradigm enlargement that recognises both the movement and place functions of streets (e.g. UK DfT 'Manual for Streets', 2007, and the work by Curtis and Tiwari, 2008 in Perth). This broader perspective of street functions has been formalised in the publication 'Link and Place' (Jones *et al*, 2007), which proposes that all streets are classified two-dimensionally, according to the importance of their Link and Place functions. The traditional five level road classification (which broadly equates to Link function) is matched by a corresponding number of Place categories, resulting in a two-dimensional matrix of 25 ('5 by 5') cells that better reflects the diversity of streets types. [See the companion paper in this conference, by Jones and Boujenko (2009).]

This matrix not only accords equal importance to Link and Place street functions, but also recognises the existence of streets with both a high Link and high Place status (e.g. the traditional main street) and the need to accommodate both sets of needs where demands are in conflict – rather than automatically giving priority to Link/ movement needs. The design logic of this approach is that the amount of space allocated to Link activities might vary along a corridor – even if the Link function status is unchanged – if the importance of the Place function varies significantly from one street section to the next.

As in the case of the transport planning paradigm, we find that there is a strong tendency for the well established Link/vehicle movement perspective to be much better represented in the available analytical techniques. This makes it difficult, in situations of strong competition for space/capacity, for Place function needs to be given appropriate priority alongside Link function needs – where in the latter case it is much easier to make a quantitative and monetarised case for action.

Table 3 summarises some of the methodological imbalances in the treatment of Link and Place. Note, for example, that in dealing with Link provision, we value the benefit to be gained from providing a design element (e.g. travel time savings from adding a bus lane), whereas on the Place side we have no direct measures of the value of activities and so resort to measuring the value of the design element (e.g. seats).

LINK:	**PLACE:**
• Full design standards	• Partial design standards
• Quantitative PIs	• Qualitative PIs
• Modelling of flows, etc	• Lack of modelling
• Evaluation of benefits of measures to users: – VoT savings [NOT value of bus lane!]	• Evaluation of measures – no direct valuation of user benefit: (e.g. VoT SPENT)

Figure 3: Imbalances in Methodological Treatment of Link and Place Functions

5. CONCLUSIONS

In this paper I have sought to illustrate the important – though little recognised or understood - role played by paradigms in shaping our debates and actions in relation to the transport problems we face. First, at the broad level of strategic transport planning, and then more locally in relation to street design.

While I have presented these as two discrete case studies, in practice thinking in street design is influenced by strategic considerations. In fact, until quite recently, approaches to street design have lagged well behind the expansion of transport planning perspectives, and have been strongly rooted in the original vehicle-based paradigm. For example, the person trip perspective would suggest that street Link capacity should be measured in terms of person not vehicle movement, but this is still rarely done. The recent consideration of Place might be regarded as analogous to adopting an activity-based perspective.

Although I have argued that it has been the development of new perspectives which has advanced strategic transport research and the policy agenda, this has not always been the case historically. On some occasions it has been policy ideas that have forced new conceptual thinking (e.g. the role of tele-working), and at other times policy and practitioner thinking has been consciously constrained by the available methodologies.

One of the best examples of the latter in the UK was the use of the fixed origin-destination matrix in assignment modelling. This was adopted during the 1960s, within the vehicle trip-based paradigm, as a known simplification when computing limitations made it impractical to iterate with trip destination choices, and in a policy environment where the objective was to cater for – not constrain – the growth in traffic demand. However, over time, the recognition that this was a pragmatic simplification was lost, and the belief emerged among practitioners – which was transmitted to policy makers - that vehicle trip demand was inelastic and so had to be catered for, or switched to other modes. It took the SACTRA report (SACTRA, 1994), and subsequent empirical studies, to demonstrate the fallacy of this assumption (Cairns *et al*, 1998).

Looking to the future, there is still considerable scope for the later paradigm expansions to further enrich the policy debate, and stimulate new research avenues. In the case of the activity-based work, for example, the use of this paradigm to investigate cross sector impacts has hardly been considered. Similarly, there is scope to make much greater use of the attitudinal knowledge in psychology and social psychology, to encourage further behavioural change, or to re-frame debates about traffic restraint and sustainable lifestyles. There is also a long way to go in bringing our modelling and appraisal methods in line with conceptual thinking.

The more recent paradigm expansions have been associated with an influx of academics and professionals from other disciplines. For example, econometricians have contributed to work in dynamics, and psychologists to the attitudinal work. This leaves scope for further paradigm expansions. For example, by drawing on the work of Urry (2007) and others, to develop an explicit sociological perspective on travel behaviour.

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