17 Time and Travel

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17.1 Introduction

When putting together a book based on detailed research carried out by a huge range of authors, it is often difficult to give it a clear structure as the inputs are so varied. That diversity is often an advantage as it gives the reader a clear perspective on the nature and range of work being carried out in North America and Europe on transport and telecommunications. However, the really difficult task is given to the individual writing the final chapter, whose task it is to draw the very disparate themes together and to make some new insights into where research effort should be directed in the future. This is a challenging task, and the approach adopted here is to build upon some of the key common themes that have come out of the contributions to the book. The intention is to both give a flavour of the diverse material in the book and to focus on a series of related key questions that still need to be addressed by transport researchers on both sides of the Atlantic.

More useful is the possibility of highlighting important themes that seem to reoccur in several of the chapters. Often they are raised in very different contexts, and their use in this chapter has really been to trigger thoughts on future research directions.

The title of this concluding chapter reflects its main theme, namely the issue of time, but it also alludes to some of the main issues facing decision makers with respect to transport and telecommunications. Three themes will be developed. The first relates to the treatment of time in transport analysis, as this has been a crucial driving force. Related to this is the theme of congestion and the means by which delays can be addressed not just in land transport, but in all forms of travel. Is there a limit to the amount of travelling that people (and goods) are prepared to undertake? The third theme is more of a composite one as it relates to recent concerns over security in travel and the risks involved, with the opportunities that are presented by ICTs (Information and Communications Technologies). The new technology is relatively risk free, at least in a life threatening way, and it does now offer a new virtual mobility to complement physical movement. There may be mutual lessons to be learned.

17.2 The Nature of Time

Traditionally, time has been treated as a framework or an "environment" within which social activities are carried out (Giddens 1979), rather than as a central focus of social theory. This means that time (and space) has really existed independently. The focus of the scientific approach has been based on the use of neo classical economics to build models to help explain the physical structure and functioning of cities. This logic has led to the unavoidable need for travel and transport, and the analysis of both the amount of travel and the evolution of cities have been shaped by distance, time and the Euclidean landscape (Graham and Marvin 1996). The question raised in this chapter is whether these physical constructs are still valid as the temporal (and spatial) boundaries have collapsed with the use of near instantaneous telecommunications and fast transport, as the world moves towards an "integrated global cultural system" (Harvey 1989).

In addition to these traditional physical constructs of time, there are more sociological constructs (Hassard 1990) that explore the variable experiences of shorter and longer term time. These are sometimes also called instantaneous and glacial time (Macnagthen and Urry 1998). Here it is argued that traditional constraints of time have been relaxed, as more activities are no longer "time bounded". This new flexibility includes social actions, such as work shift patterns, leisure opportunities, and career changes. It also includes valued time in between activities and time alone, or time spent waiting and listening (to music). At the macro level it relates to the globalisation of markets and the importance of time for production and distribution processes, and the expected lifespan in terms of product disposability. All these factors have in large part resulted from improvements in transport and communications technologies (Viger 2002).

Peoples' expectations of the distances that can be covered and the activities available have all been expanded. But importantly, the question raised by the sociologists is whether this is occurring through choice or whether this has been imposed as a result of necessary lifestyle changes. The simple trade-off, between job and home location as moderated by distance, has been replaced by a more complex equation involving housing affordability, location of schools and services, multiple workers, and flexible employment patterns (by time and location). Short-term constraints result in demand patterns that can accommodate all these requirements. Macnagthen and Urry conclude that "feelings of powerlessness appear to be compounded by the apparent mismatch between competing temporalities, with peoples' longer-term desires and aspirations developing in opposition to the "short-termism" and instantaneous time imperatives largely brought about by living in a globalised society" (1998, p. 232).

Time use has become immediate, and many of the longer term issues relating to the environment are not considered. O'Neill (1993) refers to this as the "temporal tragedy", as irreparable damage is imposed on the ecological conditions as the time horizon for these concerns is much longer. This chapter tries to unpack some of these concepts so that insights can be given into how new notions of time can be accommodated into transport modelling and analysis.

17.3 The Treatment of Time

We now have the experience of 50 years of urban transport models, since the pioneering research of Mitchell and Rapkin (1954) at the University of Pennsylvania. They put forward the theory that the demand for travel was a function of land use, and following on from this basic premise, it was argued that if land use could be controlled, then the origins and destinations of journeys could be determined – "urban traffic was a function of land use". There followed a series of large-scale land use transportation studies using this basic relationship (including the classic Chicago and Detroit studies), with changes in land use being taken as the principal exogenous variable. The large scale aggregate city-wide studies marked the genesis of transport planning as a modelling activity.

Underlying much of the subsequent analysis has been a concern about saving travel time. Much of the modelling and evaluation work concentrated on testing options that reduced travel time. The theoretical justification was that travel was a derived demand and that the value of the activity at the destination outweighed the costs of getting there. This meant that journey lengths should be as short as possible (in the sense of their generalised costs), but the recent empirical evidence seems to contradict the theory. As a result of investment in the transport infrastructure, congestion would be reduced and travel times would improve, but by making transport cheaper (faster) longer journeys would also be encouraged and new trips would take place. The question that this raises is whether there is any individual or societal benefit from this new situation.

At the individual level, the travel time saved can be used to visit other destinations (or more distant attractive destinations) or carrying out non travel activities, and the overall utility is enhanced and travel can still be seem as a derived demand (Mokhtarian and Chen 2002). At the aggregate level, an investment could encourage greater agglomeration, then the net effect might be positive, but conversely if it encouraged greater sprawl there may could increase social and environmental costs. This in turn relates back to the land use and transport relationships established in the 1950s. More recently, there has been the equally difficult challenge of linking transport investment to economic development, and bringing additional non-transport benefits to the local economy. If such a relationship can be established there is a double dividend from the transport investment, but if the net effect is merely a transfer of economic activity from one location to another, then there may only be transport benefits (Banister and Berechman 2000).

One underlying future issue is the treatment of time. From much of the analytical research carried out, the concern over travel time reduction has been overestimated, and researchers should begin to look at more sophisticated measures of time that are related to particular situations, and to develop more sociological constructs to complement the physical interpretations of time. Two different points will be made here.

17.3.1 Transport as a Derived Demand or as a Valued Activity

With respect to the work journey, travel time is important, but as travel patterns change and there is an increase in leisure based travel, travel time may become a positively valued activity. The notion that all travel is a derived demand is becoming weaker, as incomes rise and as leisure time becomes more valuable (Mokhtarian and Salomon 2001). Escape theory (Heinze 2000) hypothesises that leisure mobility is an attempt to compensate for a declining quality of life and travel opportunities are sought to get away from ones everyday environment to do something completely different. Such a line of argument leads to a fundamental dilemma about whether all travel is a derived demand. The traditional view that travel is only undertaken because of the benefits derived at the destination is no longer generally applicable. Substantial amounts of leisure travel are undertaken for its own sake and the activity of travelling is valued.

If this conclusion is correct, it has enormous implications for transport analysis as most conventional analysis is based on the premise that travel distances should be short and that travel time should be minimised. A corollary concerns the impact of the new technology on travel flexibility. The new technology provides tremendous opportunity and choice in leisure activities, whether this means time spent in the home at the terminal, or taking the opportunity to book a last minute holiday overseas, or adapting existing activities (such as shopping). In each case there seems to be a strong complementarity between the old (transport) and the new (ICT) technologies. Travel can be replaced by more “at home” activities, whilst in other cases more spontaneous travel is generated, and in a third group there is a modification of existing activities, as shopping for example becomes a multitasking activity through a combination of the Internet (e.g. viewing, deciding and buying) and travel (e.g. collection or delivery).

The knowledge base is extended and this may again result in more travel, but more important is the transfer of power from the producer to the consumer. Increasingly, users will control their leisure and shopping activities tailored to their own specific requirements (at a price). Consumers will determine what type of leisure activity they participate in, where and when it takes place, and who actually goes with them – and the range of alternatives will also increase substantially.

17.3.2 Time Minimisation and Reasonable Travel Time

The second point is the increasing contradictions between the desire to speed up and the desire to slow traffic down. For evaluation purposes, much of the user benefit (often over 80 per cent of total benefits) is derived from the savings in travel time, which in turn is based on the desire to travel as fast as possible between two places. Several conclusions can be drawn from the empirical literature on the subject. First, having higher flexibility, relative to the various time constraints, tends to increase the value of time. For example, the study by MVA (1987) has shown that people with variable work hours have values of time, which are 15–20 percent higher than that of other workers. Similarly, the ability to

schedule activities tends to increase estimated values of time (Small 1982). Higher tax rates have an opposite effect (Forsyth 1980).

A second major conclusion is that non-linear relationships exist between income and value of time. Thus, studies have shown that values for in-vehicle time is less than the hourly gross wage rate, but it is an increasing function of income since rising income implies larger opportunity costs of time-saved. Waters II (1992) has estimated the elasticity of value of time with respect to income to be about 0.8, though this general elasticity value depends on trip length, mode use and trip purpose. Gunn (1991) reports smaller effects of income on values of time, except for business travel.

A further conclusion is that users place a higher weight on wait and walk time relative to in-vehicle time. Usually, the value of these time components is 2–3 times that of in-vehicle time. In this regard, inter-modal transfers, which implies additional wait time, entail heavy opportunity costs of time and therefore should be weighted accordingly (Small 1992).

Finally, the common practice is to use the same values of time for small and for large blocks of time saved. This practice has been challenged on the grounds that small time blocks saved (e.g., 5–10 minutes) are valued less by trip makers than larger ones (e.g., 20–25 minutes). Following this rationale it might be argued that the total value of time saved for a large group of people where each saves only 3–5 minutes is negligible. Obviously, it is possible to introduce counter arguments, for example, that for some activities small time savings are a sufficient prerequisite for undertaking them. In general, the use of average value of time across people probably accounts for this problem, mainly because a small but a significant number of people place a very high value even on small time blocks.

This is not the place to enter the debate on how these values are time-saving are derived, or how they are used by the beneficiaries or in the analysis. But there does seem to be an inconsistency in the travel time savings argument within cities, where much effort is now going into slowing traffic down for environmental and safety reasons. Although it is not explicitly stated, a certain level of congestion on roads is now seen as “desirable” and in many locations (e.g. residential streets and around schools), new low speed limits have been introduced, together with appropriate enforcement measures (e.g. speed cameras).

So on the one hand, there are the perpetual complaints from industry that the time lost in congestion is costing business money, and on the other hand as a contradictory transport strategy that both tries to speed traffic up and slow it down. The notion of a transport system with no congestion has never been a realistic objective, and much of the recent debate has been over what should be considered as a reasonable level of congestion. The key policy objectives now becomes that of reasonable travel time, rather travel time minimisation. People and businesses are already concerned about knowing how much time it should take to travel to their destination with a reasonable degree of certainty. It is the reliability of the system that is crucial.

These two points are both important in terms of the rationale behind transport planning, as many of the methods used cannot handle travel as a valued activity or travel time reliability. But they also have important implications for travel plan-

ning, if it is to embrace the concepts of a sustainable urban development. It strongly argues for the sister disciplines of urban planning and transport to become fully integrated as one subject area. It also means that the focus for research has switched from the physical dimensions (urban form and traffic) to the social dimensions (people and accessibility). The variable impact of ICT is also a new dimension as activities that traditionally required travel can now be carried out remotely at an almost zero cost to the user. Lyons and Kenyon (2003) have argued that the growth in virtual mobility has substituted for the increase in physical mobility, and that it should also be included in new concepts of accessibility.

It is not just in passenger travel that new interpretations of time need addressing. In the freight sector, time is also a key element in distribution costs and the design of robust logistics systems. Time itself seems to be more easily accounted for in the planning of freight distribution systems, but it is the frequency and to a lesser extent the reliability of the service that is important to shippers (Chap. 9). But here there is variation in terms of the importance of costs, time, reliability and frequency by commodity type, value, mode and distance of haul. With respect to the long distance maritime alternative for example, frequency and reliability improvements are more important than time reductions (Chap 10).

A recent UK survey of 65 freight haulers, representing several market sectors, all types of operators and a wide geographical distribution, was carried out to assess the incidence and impact of network unreliability (CfIT 2002). For about 22 per cent of haulers, journey time unreliability was less than 10 per cent, and these were mainly operators in agricultural businesses in rural areas or those with night time distribution arrangements. A further 52 per cent of haulers recorded a 10–25 per cent range of journey time unreliability, and these operated in general haulage and distribution. The next 22 per cent reported journey time unreliability of between 25 and 50 per cent, and the operators here were mainly in food and retail distribution and construction supplies. The final 4 per cent recorded journey time unreliability of over 50 per cent of scheduled times. Overall, the additional costs to industry averaged 5 per cent, but this ranged between 1–2 per cent in 24 per cent of cases to over 10 per cent in 13 per cent of cases. The main compensating reactions of operators have been to time shift with an earlier departure time (79 per cent), or to deliver out of peak hours (65 per cent), or to plan for additional journey times (75 per cent), or to have some rerouting to less congested roads (57 per cent).

All this debate seems to suggest that the renewed interest in travel time budgets may be misplaced (e.g. Hupkes 1982; Schafer and Victor 2000). The argument that local destinations are being replaced by more remote destinations as travel speeds increase within a fixed 70 minute time constraint may only tell part of the story. As leisure time and incomes increase, the time available for travel also increases so that there is no budgetary constraint. This may already be happening if international travel is included in the national statistics for travel time. For example, in the UK travel time per person per year has been increasing only slowly over the last 18 years (Table 17.1 – total increase about 12 per cent), but this only covers national travel, not overseas travel, where most increase in distance and

time has been taking place. Air travel by UK residents in the EU accounts for a further 45 billion passenger kilometres (+6 per cent).

Table 17.1. Travel time in the UK

Year	Travel Time per Trip	Travel Time hours per person per year
1985/86	19.8	337
1991/93	20.5	361
1996/98	20.4	357
1999/01	21.2	360
2002	22.5	378

Source: Office of National Statistics (2003).

Table 17.2. Travel time variability in the UK by age, gender and purpose variables (1998–2000)

Age and gender	Average trip time (mins)	Hours per person per year	Trip purpose	Average trip time (mins)	Hours per person per year
<17	18	270	Commuting	24	66
17–20	23	388	Business	38	22
21–29	22	423	Education	19	22
30–38	21	424	Escort education	12	9
40–49	22	443	Shopping	17	61
50–59	22	406	Other escort	15	21
60–69	21	349	Personal business	17	29
70+	21	245	Visit friends at home	22	50
				18	14
			Visit friends other	21	22
Male	22	387	Sport/entertainment	55	27
Females	20	334	Holiday/day trip	23	18
			other including walk		
All ages	21	360		21	360

Source: ONS (2002), Table 4.4.

In their comparative review of travel time budgets, Mokhtarian and Chen (2002) came to two clear conclusions, namely that at the aggregate level there does seem to be some stability in travel time, but at the disaggregate level, there is considerable variability. This variability can be seen as a function of social characteristics, location and the characteristics of the destination. Table 17.2 gives some comparable data for the UK on the variability in travel times by age, gender and trip purpose. To this list, we would add the problem of measurement, as in the UK time use studies have concluded that published National Travel Survey data un-

derestimates travel time by 24 per cent (Noble et al. 2000). The reason for this is the recording of time in 15 minute time periods that do not have sufficient detail to allow for short (walk) trips. This means that for 2001, the average time spent travelling each day in the UK is 80.1 minutes, as compared with 64.5 minutes recorded in the National Travel Survey, and that the average trip time is about 30 minutes per trip rather than 22 minutes (Table 17.1).

17.4 Congestion Charging

The second theme also relates to travel time and the problem of matching supply and demand. In the roads sector, it is now accepted that new construction will not solve the problem of congestion, and that even if there were resources available it would not be desirable. Hence, there has been a clear move away from supply based solutions to those that rely on demand management through giving priority to particular users of road space, and by raising the costs of travel more generally. But in most situations, space is still allocated inefficiently through time and congestion, rather than through price.

Paying for road use is the one means by which congestion and travel time variability can both be reduced (with corresponding increases in speed). The most recent UK evidence suggests that congestion accounts for between 41 and 81 per cent of the marginal external costs (Table 17.3), with operating costs, accidents and environmental costs also contributing in different proportions. All these external costs are difficult to measure, but with respect to congestion and travel time variability, the normal expectation is the difference between actual travel time and free flow travel time, together with estimates of the standard deviation around that value (Oscar Faber 2002). Under uncongested conditions, the expectation is that the variability in travel time is about 5 per cent of the average journey time, but as the road becomes more congested, this variability increases to between 15 and 45 per cent of the average journey time[1]. More generally, it seems that on UK motorways (1998/99), about 66 per cent of delays are due to congestion, 10 per cent to roadworks, and 24 per cent to other traffic incidents (accidents and adverse weather) (Frith 1999).

It is here that there is a clear distinction between the researcher and the policy maker. If there was any one issue in transport that is clear, it is that pricing policy should be the principal means by which road space is allocated. Where direct pricing methods have been used (for example in Singapore, London and Oslo), the results have been dramatic, with short-term elasticities being much higher than expected. Yet action seems to be slow, and many decision makers seem reluctant to accept the risks, and to take action despite the clear messages coming from the research community and the demonstration effects from the successful schemes that have been implemented.

[1] These empirical values were taken on sections of the M25 London orbital route under congested and uncongested conditions, see Abou-Rahme et al. 1998).

Table 17.3. Marginal external costs by vehicle type (2000)

Vehicle Type	Operating costs %	Congestion %	Accident Costs %	Air Pollution %	Noise %	Climate Change %	Total (pence per vkm)
Car	0.5	81.3	9.1	4.4	2.2	2.5	11.95
LDV	0.5	72.5	5.2	14.8	3.7	3.3	13.71
HGV-Rigid	14.0	56.5	5.4	15.9	4.7	3.5	31.17
HGV-Artic	20.2	57.1	2.8	10.5	5.2	4.2	42.92
PSV	14.8	41.1	12.7	22.8	5.2	3.4	40.62

LDV light delivery vehicle, *HGV* heavy goods vehicle, *PSV* public service vehicle (bus).
Operating costs include depreciation.
Source: Sansom et al (2001).

The barriers of public and political acceptability still remain (Banister and Pucher 2004), and this must be an issue that the research community should address. It is not just carrying out high quality technical analysis with a set of interesting conclusions. Part of the total package must be to strengthen the links between research and practice, looking at the means by which research findings can be translated into practice. Too much good research is presented on a "take it or leave it basis". As Hall (2003) has perceptively commented "it is easy to Talk the Talk: the real challenge is to Walk the Walk". History will judge the success of the research by what impact it has had in changing thinking and actual outcomes in terms of successful implementation.

Transport research is full of good ideas and high quality analysis, but its impact does not seem to have been as dramatic as might have been expected. This may in part be due to the complexity of the issues being investigated, the different approaches used, and the varying outcomes of the research, but even where there does seem to be almost unanimous view (for example on demand management and congestion charging), it is not translated into practice. But then again, many policy processes take time to develop from the ideas stage to the implementation stage, and in transport it seems that most innovative and radical ideas are either not implemented at all, or are introduced in a weakened form so as to be ineffective (Rietveld and Stough 2004).

The same arguments about congestion are now being debated with respect to air transport, where capacity utilisation rates are in excess of one. It seems appropriate that some form of congestion charging and slot auctions should be introduced to allocate priority. In Europe, delayed flights account for between 17–30 per cent of all arrivals and 8–24 per cent of departures, somewhat less than the US levels of 22–40 per cent of arrivals and 19–38 per cent of departures. The average delay for the delayed flights in the US is about 50 minutes as compared with the 20 minutes average in Europe. Weather and congestion are the two most important causes in the US, but it is mainly just congestion in Europe (Chap. 13).

Unconstrained growth with large scale infrastructure expansion has been the strategy adopted at many international airports, but demand at certain points in

time is still exceeding supply, and this continues to create delays, particularly when combined with the limitations of air traffic control systems. Interestingly here, it seems that the costs arising from delays of up to 15 minutes are not counted, nor is the tendency for the scheduling of longer flight times between congested hub airports to accommodate delays and unreliability in actual travel times. The situation is similar to the targets set for reliability and punctuality of rail services, which have to be within 5 minutes of scheduled time on the UK railways. Again, the scheduled times are being extended, partly to achieve greater reliability.

The question here is over the transferability of methods from one sector to another, both in the theoretical sense that ideas are equally relevant, and in the operational sense of the actual techniques used. Demand management is now commonly applied in many cities and on the railways, and it is now being increasingly used for long distance road travel. Its application to the fast growing air sector is now a priority so that the full social and environmental costs can be internalised. This will mean substantial increases in the costs of air travel, and at the same time will redress some of the imbalances between the charging structures used for the different modes of transport. Some (rail and bus) contribute more to their full social and environmental costs than others (air and car).

Recent world events have also resulted in substantial reductions in demand for air travel. Terrorist action (11th September 2001) resulted in US airspace being closed for 5 days and another more general event (the SARS virus in 2003), both substantially reduced air travel (by over 30 per cent) on routes across the North Atlantic and to the Far East (Chap. 14). Such dramatic reductions in demand suggest that some air travel is discretionary or can be delayed, but it also has important lessons for the airlines in terms of their reactions and learning about the risks involved. The global uncertainties and risks provide a new dimension to the questions of the methods used for demand forecasting for the airlines, both at the strategic level, and at the tactical and operational levels. It also raises longer term implications about whether increasing runway capacity, based on these optimistic demand forecasts, is the most appropriate solution to airport congestion.

17.5 Transport and ICT

In an uncertain world, any strategy should involve risk assessment and the use of complementary means to achieve objectives. This is where transport should be seen as working together with ICTs to provide systems that both work efficiently and are robust. There seem to be strong similarities between transport and ICT, in terms of the processes of diffusion and market penetration, as levels of knowledge and skill increase, and as costs are reduced. But ICT penetration seems to be occurring at a much faster rate, particularly recently. Although in transport there are capacity limitations, it seems that with broadband and satellite communications there are potentially no capacity limits for ICTs. The main risks with ICT are the

external factors such as terrorism or a virus (spam mail must be included as a form of virus) disrupt the system or effectively "block the infinite capacity".

It also reflects the need to stay connected and highly accessible, both in a physical (transport) context, and in a virtual (ICT) context. But more important is the complementarity found within networks. Accessibility tends to be viewed as the impact of one new link on the network as a whole. However, many investments are strongly complementary and they do not need to be consumed in fixed proportions as they form systems. Competition is really taking place between systems and not individual products. So accessibility should not only be viewed as the changes in one particular system (e.g. rail), but the new competitive position of that system in relation to other systems (e.g. road). The real value of improvements in the quality of the network is that it provides the opportunity for people and businesses to take part in the network, even if they choose not to. There is an optional benefit. The value of membership to one user is positively affected when another user joins and enlarges the network (Katz and Schapiro 1994). New concepts of networks and accessibility are required to determine under what conditions the competitive position of one network will be changed as compared with another on at least three dimensions – to influence expectations, to facilitate coordination and to ensure compatibility.

Such innovations are evidenced in the scale free and small world network properties that evolve in large complex networks through self organising processes and preferential attachment (Chap. 11). New nodes tend to attach themselves to other vertices that are well connected, and traffic is routed through a relatively few highly connected vertices. This means that the diameter of the network is small in comparison with other network structures and movement is more efficient, as there is a substantial amount of local clustering. But there is also an increase in the risks if one or more of the highly connected nodes become disconnected.

The impact of investment (or lack of it) is important in establishing the image of an area and hence its attractiveness to new development. This in turn will impact on the local labour market so that high quality (and high income) labour will be attracted. Transport and ICT investment may act as the trigger mechanism to this process. The alternative explanation seems to lead to the conclusion that only existing locations will ever be attractive, as they have first mover advantages and will always be more accessible in this broader sense than other new or peripheral locations.

This discussion again brings us back to the notion of time, but in a composite form that allows an activity to be carried out efficiently and reliably within a reasonable time. Time is also not being used in a "single" physical sense but increasingly in a "multi" physical and social sense. As more time is being devoted to travel activities and more time is wasted in congestion and delay, manufacturers and individuals have become more creative in providing the means to use travel time to communicate, to work, to play games and to organise one's life. The notion that travel time is wasted time needs to be reconsidered, and this is one area where ICT has been instrumental in allowing multitasking.

This is where ICT has complementarity with transport in its ability to substitute for travel under certain conditions and also to provide a service for transport (for

example through integrated ticketing and journey planning). Increasingly it seems that the weakest link in any travel activity is at the interchange points, as this is where uncertainty arises. As noted earlier, the higher values of time assigned to wait time and interchange time are well researched. But with increasing delays in the system, these interchange links become more important. Apart from the dilemmas it poses for individual travellers or shippers, it raises questions on the amount of redundancy there should be in the system. It also helps explain the rationale behind taking a mode of transport that minimises the number of changes, even though it may not provide the "best" alternative. The use of the car rather than rail or taking a direct flight rather than hubbing are two examples of this phenomenon. The goal of a "seamless" transport system is dependent on the quality of the services provided, the information about the systems including the ease of using it, and the expectation that you will arrive safely and on time.

17.6 Conclusion

Two main conclusions can be drawn from this chapter as it relates to the broader theme of the book, namely methods and models. The first is that the growing integration of transport and telecommunications modelling means that there is a convergence of approaches, so that a new generation of methods are needed that combine elements of each. Some of the chapters demonstrate such an approach, but there are problems with data and more importantly the key variables to be included in such an analysis. The concept of time and its use seems to be central to both transport and telecommunications, and it can perhaps be used as the driving force (or key variable) in explaining patterns of travel and the use of telecommunications.

But there is also a necessity to move beyond current thinking about time as a constraint, to exploring its role as providing new opportunities for travel and activity participation. New concepts of time are required that combine the traditional physical measures with approaches that embrace notions of choice in time use, control over time, multitasking in time, time immediacy, and time dependence. Most of these concepts relate to instantaneous use of time, and more attention also needs to be given to longer term (glacial) time, and the changing patterns of time use over time. The social constructs of time seem to be equally important as the physical constructs of time. This is the second issue.

This concluding chapter has tried to extract some common themes from the other preceding chapters and place them within a wider framework. This has been done for two main reasons. One is to suggest that there are common strands that can be drawn between the often disparate transport analysis that is being carried out on both sides of the Atlantic. The other is to put the case that researchers must place more emphasis on the communication and dissemination of results of their work. They must move on from too much of an isolationist view of research towards engagement with policy makers and other key actors to explain and convince them of the need to take action. Delay and inaction are sometimes appropri-

ate, but in the transport sector it seems to be the norm even where there are very clear and consistent messages arising from the research. In the past, too much emphasis has been placed on research output and publication, almost for its own sake. That must change. The new challenge for researchers in North America and Europe must be to make their knowledge and understanding of transport more relevant and accessible to decision makers, and for it to be presented in such a way that they cannot afford not to act on it.

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