International Transport Forum

Mobility Practices, Value of Time and Transport Appraisal
Discussion Paper

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Roundtable

David Meunier
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The International Transport Forum

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Introduction

Value of time (VoT) or, more precisely, values of travel time savings (VTTS) is a central notion in transport cost-benefit analysis (CBA). It represents the value of a reduction in the time taken by a particular journey. VoT is closely tied to the reliability of travel time, the comfort of travel conditions and other specific characteristics of the journey. These factors strongly influence the perceived quality of time spent in transit, as well as the opportunities and practicalities of using the travel time for other activities. All these factors also affect the utility (or disutility) during travel.

The social and spatial environment with which we conduct our daily activities can affect our transport choices and practices, as we meet our mobility needs and purposes. There is an increasing need to understand how the quality of transport and travel time interact with the social and spatial environment, especially as the steady uptake of new technologies (such as information and communications technology (ICT)) is changing mobility practices and patterns of travel over time. The inter-relationships between technologies and travel are not new, and the analyses of past evolutions outlined in this paper may offer some useful insights.

The first part of this paper provides an overview of how the methodologies and VoT used in the French's CBA guides have evolved since the early 1960s. This will focus on establishing potential link in how changes in individual mobility practices and use of time induced by technologies can affect VoT. The discussion is based on the experience in France and a few other countries, where information is readily available.

Then the paper will differentiate between utility that is generated from the quantity of time spent in transport and that due to the ability or possibility to conduct an activity during the journey. This differentiation is important when evaluating comfort and reliability, especially when the value of time spent during travel were to change significantly. The discussion will include different factors affecting individuals' utility associated with the values of in-vehicle travel time, outside-vehicle travel time (e.g. transfers, waiting), comfort and reliability.

The standard approach to valuing travel time savings typically focuses on different uses of segments of time, such as working during one's commute versus listening to music. But it would, ideally, make sense to look more in-depth into how people optimise their personal activity schedules. To understand the possibility for VoT to reduce to very low or zero values, in the third part of the paper, we will examine the trend in the values of time used in CBAs over the last decades.

From a public decision point of view, it would also be useful to re-consider the distinction between *collective value of time* (*valeur tutélaire*) to be used in a CBA, and *individual value of time*. The final part of this paper takes a longer-term view to consider the ways in which analysis of the use of time and individual choices may change over time.

Evolution of values of time in France

Value of time (VoT) has been used as a measurement in France since the early 1960s. Trade-offs between financial cost and travel time were analysed by observing people's choices between different routes (typically between motorways and other roads). At that time, VoT was established based on revealed preference analyses, rather than on any specific theory. The *collective value of time* (not distinguished by any factor or group of individuals) used in the CBA assessment guides was always equated to the *individual value of time* (distinguished by specific factor or group of individuals), with the exception of the 1986 guidelines (See Annex).

VoT has been updated in successive assessment guides with increasing differentiation to allow more accurate assessment of VoT of different demand response scenarios. Separate estimates for the Ile de France region (Paris and the surrounding area) have also been introduced. In addition to differentiating by mode and purpose, it is now possible to differentiate by distance. The latest assessment guide (released in 2014), draws heavily on the national report. Quinet (2013) differentiates VoT by mode and trip purpose, and also confirms the variations by distance travelled.

Based on a review of the literature and on findings from traffic modelling and mobility surveys, 'reference values' for urban environments are proposed in the Quinet report (2013). These recommended reference values (in 2010 prices) are presented in Table 1. These values are lower than those included in the previous national guide based on Boiteux and Baumstark (2001). Explanations for the lower values given by Quinet report (2013) included:

> *"From a technical point of view, the data taken from traffic models can give lower values than those obtained in the past, because the models factor in a growing number of variables to explain mobility choices. The inclusion, in particular, of an increasing number of explanatory variables for the purpose of modelling fixed effects specific to each mode, or frequency effects, transloading effects, etc. can tend to depress values of time resulting from the models." (translated from French)*

And, more closely connected to the subject of the roundtable discussion:

> *"From a microeconomic point of view, it might be the case that the fall in values of time reflects a reduction in the discomfort of travel time —conditions may have improved, for example, on all modes of transport — or an increase in its productivity — because people can now use their smartphones to check their email, read or play during the journey." (translated from French)*

Table 1. Values of time for urban travel in France, all modes

2010 EUR per hour

Purpose of travel	Nationwide	Île-de-France (Paris region)
Professional	17.5	22.3
Home to workplace/school/nursery	10	12.6
Other (shopping, healthcare, visiting, leisure, tourism, etc.)	6.8	8.7
No precision on purpose	7.9	10.7

Source: Quinet (2013).

In addition, estimates of VoT for inter-urban travel are also based on a review of values from different sources. The Quinet (2013) report details the choices made in establishing these values of time:

> *"Unlike the recommendations of the 2001 Boiteux and Baumstark report, these values are differentiated by mode of transport and also purpose of travel. Over short distances, they are lower than the values in Boiteux and Baumstark because the panel decided to select a system that was consistent across inter-urban values of time over short distances and urban values: under 20 km, travel for professional reasons was given the same value of time whether the journey was urban or inter-urban and regardless of mode of transport. Similarly, under 20 km, values of time for "other" purposes (urban) and "holiday" or "personal–other" (inter-urban) are identical, regardless of mode of transport." (translated from French)*

As shown in Table 2, VoT tends to increase with distance. In addition, it also varies with the purpose of travel and is higher for work-related travel than for leisure travel as the former tends to be more time constrained.

Table 2. Inter-urban values of time

2010 EUR per hour

Mode	Reason for trip	For distances less than or equal to 20 km	For distances between 20 km and 80 km			Values at 80 km	For distances between 80 km and 400 km				For distances greater than or equal to 400 km			For an unspecified distance (value for mean distance)	Average distance for mode (km)
Road passenger car	All reasons	7.9	0.090	x d +	6.1	13.3	0.006	x	d +	12.8	15.2			14.4	266.7
	Professional	17.5	0.202	x d +	13.5	29.6	0.016	x	d +	28.4	34.8			32.7	
	Personal holiday	6.8	0.031	x d +	6.2	8.7	0.012	x	d +	7.7	12.4			10.9	
	Personal other	6.8	0.067	x d +	5.5	10.8	0.019	x	d +	9.3	17.0			14.4	
Road coach	All reasons	7.9	0.166	x d +	4.6	17.9	-0.019	x	d +	19.3	11.9			13.9	293.8
	Professional	17.5	0.153	x d +	14.5	26.7	0.004	x	d +	26.3	28.0			27.6	
	Personal holiday	6.8	0.031	x d +	6.2	8.7	0.003	x	d +	8.4	9.8			9.4	
	Personal other	6.8	0.067	x d +	5.5	10.8	0.006	x	d +	10.4	12.8			12.1	
Rail	All reasons	7.9	0.246	x d +	3.0	22.7	0.011	x	d +	21.8	26.2			25.4	331
	Professional	17.5	0.429	x d +	9.0	43.3	0.000	x	d +	43.3	43.3			43.3	
	Personal holiday	6.8	0.250	x d +	1.8	21.8	0.000	x	d +	21.8	21.8			21.8	
	Personal other	6.8	0.265	x d +	1.5	22.7	0.000	x	d +	22.7	22.7			22.7	
Air	All reasons										0.001	x d +	53.2	54.2	1 208.9
	Professional										0.000	x d +	72.9	72.9	
	Personal holiday										0.000	x d +	52.2	52.2	
	Personal other										0.000	x d +	53.4	53.4	
All modes	All reasons	7.9	0.155	x d +	4.8	17.2	0.021	x	d+	15.5	0.006	x d +	21.6	19.1	
	Professional	17.5	0.218	x d +	13.2	30.6	0.029	x	d+	28.3	0.020	x d +	32.0	36.2	
	Personal holiday	6.8	0.055	x d +	5.7	10.1	0.022	x	d+	8.4	0.005	x d +	15.1	11.2	
	Personal other	6.8	0.215	x d +	2.5	19.7	0.003	x	d+	19.5	0.008	x d +	17.3	23.0	

In terms of VoT by inter-urban mode, it is the highest for air, followed by rail and then road. This hierarchy of mode-related values of time reflects the effects of self-selection of different mode choices. Among other things, factors that affect mode choice preferences include income levels relative to the financial cost of different transport options, trip purpose and the degree to which the journey or its conditions are imposed as well as personal preferences. These differentiated values of time, therefore, while admittedly dependent on the nature of demand, are also governed by the conditions of the transport being offered. Having differentiated VoTs sometimes raises practical questions as to how those values should be used to calculate changes in user surplus, at a very precise level of demand breakdown.

The quantity and quality of travel time: utility and values

The quantity and quality of travel time are interlinked, with the latter particularly important for public transport. In one aspect, the level of in-vehicle comfort can be measured in terms of the personal space available to passengers on board the public transport (e.g. in terms of number of people/m^2). It plays an important role in determining the travellers' utility (or disutility) and hence the values they place on travel time savings. Other factors affecting the level of comfort include walking and waiting time, seating opportunities/arrangements, ambience of the surrounding areas, ventilation and visual or audio conditions inside or outside the vehicle.

Outside-vehicle travel time

The outside-vehicle travel time components include time spent waiting, walking before and after travel, and transfers. By looking at the relative importance of these components, Quinet (2013) recommended scaling every minute during these times according to the level of discomfort, expressed at equivalent in-vehicle travel minutes (Table 3).

Table 3. Waiting time, walking time before and after transport and transfer time

Type of time outside vehicle	Equivalent minutes
Waiting time	1.5
Walking time before and after transport	2
Transfer time	2

Note: one minute of waiting time is perceived, in equivalent minutes, as 1.5 minutes of in-vehicle travel time.

The rationale for applying these 'discomfort penalties' was to take into account the perceived increased disutility in direct relation to the additional time required for waiting, walking and transfers.

Comfort during the public transport journey

The use of multipliers for time spent on public transport, to account for discomfort in the same way as walking, waiting and transfer times is proposed by Quinet (2013) as a way to measure comfort. The proposed multipliers indicate the higher the number of people standing per square metre, the higher the ‘penalty’ for each minute spent on that journey. The report goes on to say that:

> *"many studies propose monetary values to reflect the presence or absence of services in quantity (television, music, surveillance, food and drink, etc.). The solidity of these estimates is questionable, however, as is the statistical independence of the values estimated for each service, and it might be advisable to wait for the field to undergo further study." (translated from French)*

The multipliers selected were obtained from the results of surveys conducted for Parisian public transport (Table 4).

Table 4. Public transport value of time multipliers based on load factor

Seating arrangements - all modes combined (tram, metro, bus, commuter rail)	Public transport VoT multiplier K(p) as a function of the number of standing passengers (p) per m^2 in the vehicle	
	For situations where permanent seating is available	For p > 0
Seated	K(p) = 1.00	Ka(p) = 1.00 + 0.08*p
Standing (note)		Kd(p) = 1.25 + 0.09*p

Note: To illustrate, suppose a public transport service regularly has an average of three standing passengers per square metre, the perceived travel time by each standing passenger is determined by scaling up their VoT by a multiplier of 1.25+3*0.09 = 1.52. The VoT to be selected for this calculation should reflect the overall VoT for the individuals concerned (by mode, trip purpose and distance).

There are two-way relationships between personal spaces available to public transport passengers and their uses of travel time. Personal spaces affect feasibility of conducting non-information and communications technology (ICT) activities (e.g. sufficient space for reading newspapers) and ICT-related activities (e.g. using a tablet without being jostled). On the other hand, the availability of ICT affects how individuals choose to use these personal spaces.

If we were able to identify all the situations and values that transport users place on spending their time while in transit, there would be greater differentiation of VoT by activity type and other parameters. The number of combinations can be large especially as technology continues to advance (such as miniaturisation and augmented reality technologies) to allow a wide range of activities to be conducted to reduce the ‘discomfort penalty’. But what should be the right level of differentiation of VoT between various situations? Since not all new activities gradually made possible by ICT are related to time spent, should we adopt a more generic approach? Besides valuing “intrinsic” levels of comfort through adjusted VoT, should we simply introduce valuations of variations in the utility gained from engaging in the new activities?

Comfort in road transport

The concept of road transport comfort was first introduced in the mid-1960s. After the first motorways were built, analyses of choices between different road corridors or sections highlighted the importance of considering comfort in transport appraisal. This has subsequently led to value of comfort being established alongside travel time savings. While the approach to determine the values for comfort and time are interdependent, analyses of the notion of comfort were fraught with difficulties. At that time, comfort was largely confined to physical comfort on the road, reflecting the quality of road infrastructure. Motorways, for example, are more comfortable as they offer easier driving conditions and better road surfacing than other road types. Accordingly, the comfort parameter was expressed in terms of distance travelled, not in terms of time spent traveling.

Still, poor condition of road infrastructure was thought to cause stress to road users (1964 guideline) (Transport Ministries, 1961– 2014):

> *"A poor-quality road will cause road users excess tension. The calculations will, as a rule, simply consider that (the value of comfort) accounts for that advantage … the behaviour of users … factors in everything that relates to them, including their nervous tension." (translated from French)*

In general, the calibration of traffic models usually results in the identification of 'modal constants' that capture various intrinsic differences between modes that are perceived by their users. This can reflect comfort, but also everything that is not explicitly modelled in the utility function that is used by the model to estimate values of time, such as the mode's typical reliability conditions.

The level of comfort perceived by users has certainly changed over time, driven by infrastructure design standards affecting physical comfort conditions and the stress of driving, and also by improvements in vehicle quality (noise, vibrations, etc.). In practice, however, effort to update the 'road comfort' factor in transport CBA has remained as similarly low as that to update the value of time.

Over time, changes in physical conditions of road infrastructure and technical possibilities have changed and will change the use of time (reading, music, etc.) on board cars (e.g. autonomous vehicles) and consequently the level of perceived comfort.

Travel time reliability

The arduousness of journeys tends to increase with the random nature of the journey arrival time be it early or late. Arrival time in itself can be difficult to predict in advance for certain trips, locations and time. To take into account the impacts of journey time reliability, we need to consider a range of valuation techniques to establish an appropriate value of travel time reliability for use in transport appraisals. The valuation technique to choose will vary with trip duration, travel time distribution and information available. A general framework for evaluating reliability gains is outlined in Figure 1.

Figure 1: Recommended method for evaluating reliability gains

Recommended method: After analysing the average travel times for relevant origin-destination pairs in Step 1, select either Step 2.A or Step 2.B depending on trip duration and travel time distribution that apply to the project.

Step 1: Analysis of average travel times on origin-destinations affected by the project	
Step 2A: Trips of average duration less than two hours: • Application of Compensatory Variations Method • Sensitivity test on extreme values and on risk aversion in case the project modifies extreme values	Step 2B: Trips of average duration above two hours: • Mean-dispersion method with P90-P50 indicator if projected travel time distributions are *not symmetric* • Mean-dispersion method with standard deviation if projected distributions are *symmetric*

Simply expressed, and in particular excluding induced traffic by origin and destination (OD), the annual reliability benefits (A_R) by origin-destination are calculated according to the following formula:

$$A_R = \sum_{working\ days\ j} \sum_{h} \left(I_{Rf_{,j,h}} - I_{Rp,j,h} \right) \cdot RR_I \cdot VoT \cdot T_{h,j}$$

With:

I = reliability indicator in reference option (Rf) and project option (Rp), in minutes, at hourly period h and for days j

RR_I = reliability ratio associated with the reliability indicator I_{Rpjh}

$T_{h,j}$ = traffic (number of users) between OD at hourly period h and for days j used for the calculation of the reliability indicators (for example traffic from 9:00 to 10:00 on working days)

VoT = value of time (in EUR/min).

In this case, reliability is explicitly considered when calculating the change in utility that users may experience in response to changes in the variability in journey time. This does not involve changing the value of time which would depend on this variability. In fact, methods have been established that provide a valuation of reliability as a portion of the value of time in 'average conditions'. However, if VoTs were modified to take into account how travellers utilise their time while travelling, should this method continue to be used?

Furthermore, the value attributed to reliability is mainly dependent on what is intended or needs to be done at the destination, the obligations to be respected at the destination which, at first glance, have no close connection to the conditions encountered during mobility. Therefore, should values of comfort or reliability be expressed based on the values of travel time in 'average conditions'?

Table 5. Reference ratios for evaluating reliability according to the reliability indicator used

Indicator	Valuation: Reference ratios for Private Vehicle	Valuation: Reference ratios for Public Transport
P90-P50	0.9	1
Standard deviation	*0.8*	*0.9*
Average delays	1	1.1

Traditionally, the components of utility for individuals relative to comfort, reliability, non-productive time (transfers, waiting, etc.) have been analysed with reference to the values of time spent in mobility. This is very often in a directly proportional manner thereto, with coefficients resulting from the analysis of observed behaviour. To a certain extent, these coefficients reflect the importance of the other components in relation to the present issues of travel time gains. That said, these components of utility for individuals do not necessarily have a reason to respond to a reduction in the values of travel time, especially with regard to the aspects of the physical conditions of mobility linked to comfort, and especially with regard to reliability.

All in all, if the value of travel time is losing its significance or even its role as the major factor in the benefits of transport projects, it may be necessary to review the methods used to process the other components of utility for individuals.

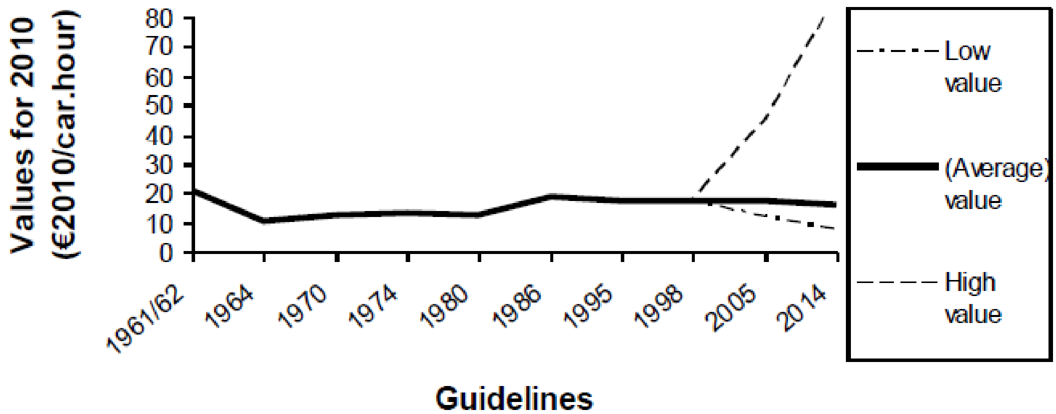
Changes in official values of time over time

This section explores the changes in the official VoT used in transport appraisal in France, Germany and the United Kingdom since 1960s. It aims to provide some context as to whether it may be reasonable to expect that future VoT may reduce to very low or even zero levels.

First, we illustrate the long-term evolution of travel time values for personal road vehicles used for inter-urban trips in France. Figure 2 (Dahl et al., 2016) clearly highlights the impact of VoT differentiations by distance or trip purpose introduced since 2004, as shown in the extreme values for the most recent years (dotted lines). On the other hand, the black line in the middle represents the change in the average VoT, which did not vary by much over the years from 1961 to 2014 (Transport Ministries, 1961 - 2014).

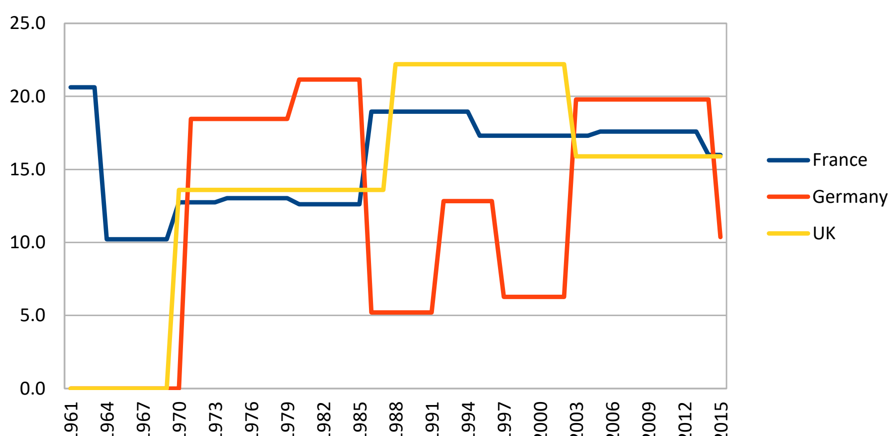
Dahl et al. (2016) also provide a comparison of the official VoT over time for three countries – France, Germany and the United Kingdom. These are plotted in Figure 3, which shows that the VoT for personal road vehicles have remained relatively stable over the past 50 years. While there were slight increases in the values for France and the United Kingdom from the 1970s, there was no clear trend with the German values. However, the variations in the VoT have been affected by changes in the methods used to establish the VoT for the base year when the guideline was issued, and in the rule for updating the values for the following years.

Figure 2. Car value of time, inter-urban trips
in 2010 EUR per car hour



Source: Dahl et al. (2016).

Figure 3. Values of time for 2010 according to successive guidelines



To express VoT established in a base year to future prices, many countries index VoT to Gross Domestic Product (GDP) per capita, assuming an elasticity of VoT with respect to GDP per capita of 1. In France this elasticity is assumed to be 0.7. GDP per capita has almost tripled over the reference period but VoT grew only by less than 60%. Several sources (e.g. Börjesson and Eliasson, 2018) seem to indicate an elasticity value quite lower than 1. In the earliest decades, this phenomenon can be partly explained by the gradual generalisation of household car ownership beyond the most affluent households. But it is also possible that, in the past, the underlying growth of the VoT linked to the increase in GDP per capita was offset by a reduction in its values due to better utilisation of time spent in transport.

To explore whether there has been an increase in time use while travelling and whether such opportunities might have affected the VoT, it would be useful to understand whether other countries also experienced a stagnant or low growth in VoT over a long time period. A radical change in the use of travel time and in the appreciation of its value by users may be near, but similar opportunities and interaction mechanisms have probably been at work in the past decades. A retrospective analysis of this kind would be useful for better anticipating future developments.

Further analyses of the co-evolution of value of time and individual choices

This section provides a forward-looking view on the possible developments in the analysis of use of time and individual choices. Transport cost-benefit analysis needs measures of value of time (VoT). It also needs to consider how VoT may evolve over time, with the use of appropriate models. If there are major changes in VoT, due to ICT or other reasons, the models should be able to pick up these changes appropriately to ensure the CBA methodology continues to be robust.

As the breadth of transport conditions (specific factors such as speed, supply components, co-ordination of actors in the transport sector, information and communications technology (ICT), etc.) increases, the need to differentiate these transport conditions also increases. When combined with the changes in individual circumstances, the changes in perceived utility can be significant. These changes will depend on the characteristics of the individuals concerned and the mode of transport chosen (for a given origin-destination pair). This means that VoT could be segmented into multiple subsets in addition to those already considered (such as trip purpose and distance). Segmentation could be by way of activity type and whether or not an activity is available or possible while traveling. If the utility for different activities can be defined and assuming they are proportional to the duration of the time when the activity is undertaken, the value of numerous combinations of VoT depending on travel conditions and activities available or performed could then be estimated.

However, changes in transport conditions have a variety of utility impacts that may not relate to changes in travel time:

- shorter travel times combined with changes in rail service schedules may make return trips possible within a day, thereby reducing the need and cost of an overnight stay in the destination. This would clearly result in a change in utility (or at least in generalised cost) with no direct impact on variation in travel time per se.
- the co-ordination of public transport service providers, and further fare integration, would reduce the transaction costs experienced by individuals in a manner which has little relationship with travel time but would increase utility.
- the availability of real-time information (through ICT) on expected delays or disruptions would assist individuals to better co-ordinate their daily activities and interactions with the wider society, and this additional utility has little to do with travel time per se.

Utility functions are typically expressed in terms of 'generalised costs'. Expressing the utility of a traveller by the weighted sum of the various time segments for their journey may limit the way how we account for impact of future development in ICT on transport conditions.

Transport conditions, insofar as travellers may anticipate them, influence how they optimise their activities. Can preparation for meetings and presentations be done comfortably during the train journey to the meeting venue, rather than doing it the day before? Will there be enough space and a quiet environment on the underground to enjoy finishing a book?

Mobility is not an activity per se but an intermediate activity required for the pursuit of certain other activities. For some activities, the level of activity is relatively constrained (home-to-work journeys), whereas in other cases it tends to grow as individuals become increasingly mobile. In the base model presented by Becker (1965), the performance of each activity selected by the household consumes time, and when the time consumed by all the activities is added together they must satisfy the overall time available per day. This means that, within this framework, the production times of the activities are mutually exclusive. However, when one travels for a specific reason and part of this travel time is used to perform another activity, the corresponding time is used to perform two separate activities. Moreover, in practice mobility is often linked to a succession of activities performed in different places, rather than a single journey for a sole activity. In addition, changes in practices, transport conditions and the possibilities afforded by new technologies are challenging the boundaries between working hours, travel time and leisure time.

Hensher (1977) sought to represent travel time spent working by taking into consideration the relative productivity of this time compared to normal working conditions in the workplace. More recent developments can be used to reflect more widely on the mixed use of time, for example Banerjee and Kanafani (2008) on the use of travel time for work and the increase in relative productivity as a result of wireless internet connections on trains; and Rosales-Salas and Jara-Díaz (2017), who examined housework and the trade-off with the use of paid external help.

Better representation is thus provided of the real situations arising, especially with the spread of ICT. This doesn’t necessarily represent other practical constraints on individuals, i.e. that the use of time is constrained by working hours, that activities are carried out in succession as part of a daily programme, which is more complicated than simply apportioning time between the various activities. Some of these models introduce distinctions between working hours, and other categories, which provide a partial response to these issues, but without necessarily representing the linkage between activities.

It would therefore be interesting to approach the issue of VoT from a general standpoint of how individuals optimise their programmes of activity, considering both theoretical and practical perspectives.

Activity-based models, developed over the past 20 years, have the capability to consider the trade-offs between activities and to simulate how they affect mobility and the sequence of journeys with multiple trip purposes or locations (e.g. a journey home/school drop off/work/school/shopping/home). The coefficient for travel time can be differentiated within the utility formulation of these models but the utility of the use of travel time itself is not modelled better than in a traditional model. For the most part, these models will clarify the optimisations of the use of total travel time to perform a programme of activities.

These models make it possible to imagine the further differentiation of the coefficients associated with travel time by the nature or quality of the activities available during the journey in question. This is the same way as for traditional models. The introduction of a submodule for optimising the use of activities available during the journey, thereby considering that there is a supplementary utility for the individual which is specifically associated with the journey would optimise individual activities. At the level above, the model would therefore simulate the optimisation of the individual’s ‘core’ activities, which are needed to establish their transport behaviour, and at the more detailed level of the execution of the journey, the ’ancillary’ activities during the journey, with naturally a possible interaction between the two levels like in nested logit models through logsum.

Physical mobility to carry out certain activities has become substitutable with advancements in ICT. For example, when purchasing a medium-sized object, instead of having to visit a store to choose said object and take it home, or, take time off to wait at home for it to be delivered, it is now possible, during a journey undertaken for another activity, to choose the object on the Internet and then get it delivered to a drop-off point coinciding with another journey that the individual intended previously, or decides as a consequence, to take in the following days.

ICT can therefore blur the barriers between the activities which structure travel and the ancillary activities. In order to model the type of change resulting from ICT, it would therefore be necessary, for example, to introduce a distinction between activities which always generate mobility, and activities which may or may not generate mobility, depending on the choices of the individual and the technical possibilities at their disposal.

Another effect of some ICT developments is to reduce the individual time consumption required for certain activities. For example, some people dream of a smart refrigerator to manage household food supplies, place orders as required and arrange delivery by self-flying drones, with no human intervention. This effect of reducing the time spent on daily and constrained tasks by increasing the amount of time available leaves room for leisure (or professional) activities which will be less necessary or useful for the individual than in their initial situation. In doing so, everything else being equal, the marginal utility of time not spent travelling would tend to fall, thereby in turn reducing the relative value of less travel time.

It should not be forgotten that the value of travel time gains actually depends on the opportunity relative to other uses of this time. If, in future, ICT are going to have a significant impact on the possible use of travel time, it will also be the case for other personal time. There may not be a big difference between the two effects, except perhaps for drivers of personal road vehicles who would be completely liberated from this task by the introduction of level 5 driverless vehicles (full automation).

For the time being, the current enhancements of activity-based models in order to integrate changes resulting from ICT seem, rather than seeking to add an extra level of activity representation and individual trade-offs to their already high complexity, to be trying to represent the impact of ICT on more traditional variables (speed-flow curves, sensitivity tests on reduction of values of time), as in Childress et al. (2015).

Recent developments nevertheless show that the consequences of a more detailed representation of the relationship between the consumption of goods or activities and uses of time can be significant (Jara-Diaz et al., 2016). Going further by specifically representing the more complex trade-offs afforded by ICT could therefore result in significant impacts on the estimation of the relative values of time, while enabling, which may be just as important as the development of the value of time, a more appropriate representation of quantitative changes in mobility demand as result of ICT development.

Is it justified to continue to equate the collective value of time used for public choices and the value perceived by the individual? Deeper insights into individual choices should not obliterate this important question for public policies: This issue is not trivial, as discussed back in the sixties and by recent authors. Mouter and Chorus (2016)distinguishes between diverse stated preferences of the same individuals, expressed from a user perspective or from a citizen perspective. Instead, these insights should give way to further research, as the collective and individual interest of ICT-linked activities may differ, depending notably on the externalities they may induce. The importance of this issue could be growing with the complex impacts of ICT on our daily activities and mobility behaviour.

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Annex: Framework instructions for the socio-economic evaluation of transport projects

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Mobility Practices, Value of Time and Transport Appraisal

This paper discusses whether changes in mobility practices affect value of travel time savings. It considers the relationship between the theory of the value of time and its practical application in traffic models and cost-benefit analysis. The discussion covers the need to distinguish variations in utility due to changes in the quantity and quality of time spent in travelling, the relationships between changes in value of time and mobility practices and between collective and individual values of time.

All resources from the Roundtable on Zero Value of Time are available at: www.itf-oecd.org/zero-value-time-roundtable.

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