Changes in mobility practices, value(s) of travel time and consequences for cost-benefit analysis

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Outline

• Introduction

  The value of time (VoT) in French CBA guidelines

  Other benefits usually linked with VoT

  Quantitative evolution of VoT over 50 years

  Prospective impacts of changing mobility practices on CBA and project evaluation

• Conclusion
Introduction

● Value of time (VoT) is central in transport CBA

● Reasons to think that ICT developments will impact VoT perceived by travelers

● Need to go back to what VoT is, how it has evolved in CBA, and how issues linked to VoT could evolve in reaction/adaptation to ICT developments and other factors possibly impacting mobility practices

→ Proposition to review how VoT « grew up » in a specific country (France) so as to get hints for possible futures
Value of time savings in CBA France

• Value of time in the early '60s:
  • « In the beginning was the Number... »:
    observation of route choices: travel times versus costs → simple derivation of VoT for cars, consistent with Jules Dupuit's surplus approach

• « collective value equal to individual value »

• Consistency

\[
\Delta S = \text{VoT} \times \Delta T
\]

traffic model: \( \Delta T = f(\text{VoT},...) \)
CBA and reference VoT: what for?

Need for « sound comparability » of socio-economic performance estimates, to help prioritising projects competing for national funding

→ Common methods
+ equity / neutrality / redistribution + cost of building assumptions locally

→ national reference values (mandatory use)

vs « pure economic value », much more variable in practice and more consistent with travel behaviour

→ Increased differentiation of VoT in guidelines over 50 years

Parallel diversification of traffic models

→ VoT for NPV ≠ VOT for models
Differentiation of VoT in French CBA guidelines
Differentiation of VoT in French CBA guidelines

- Differentiation: due to auto-selection (trip purpose, income level, ...)
- Differentiation of VoT by distance per se, or non-linear preferences in time?
- Versus road comfort
**Other benefits usually linked with VoT**

Other components of individual utility: Comfort:

<table>
<thead>
<tr>
<th>Traveler's situation</th>
<th>Multiplier $K(p)$ ( p = \text{nb standing pax} / \text{m}^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seated</td>
<td>( K(p) = 1 )</td>
</tr>
<tr>
<td>Standing</td>
<td>( K_d(p) = 1.25 )</td>
</tr>
<tr>
<td>( p = 0 ) (seats available)</td>
<td>( K_a(p) = 1 + 0.08 )</td>
</tr>
<tr>
<td>( p &gt; 0 )</td>
<td></td>
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</tbody>
</table>
Other benefits usually linked with VoT

Other components of individual utility: Reliability: again, $\Delta S$ is supposed to be proportional to VoT using a « reliability ratio » multiplied by VoT and by an indicator of TT spreading. Both estimate coefficients from measure of $\Delta S/(\text{VoT} \times \text{TT})$

→ VoT is so central in CBA that other (dis)benefits of the traveler have naturally been anchored to it.
Quantitative evolution of VoT over 50 years

• Value of time in successive French guidelines, for the year the guideline was issued, for cars, in €2010:

vs GDP/capita multiplied by ≈ 2.7

• But still overwhelming importance of TT gains in most projects, although environmental impacts may represent 10% to 30% in some cases
Quantitative evolution of VoT over 50 years

- First study report (1960): update VoT relatively to households' consumption per capita (abandoned in first guidelines until 1995 since « neutralised by increasing access to cars for lower income households »)

- VoT evolution depends on revenue increase but also on structural evolution of demand (access to cars,..), or rather on interactions between demand and supply (lower costs, increasing revenues,..)

- $\epsilon_{\text{Income}}$ seems to be rather low and possibly diminishing: linked to evolution in TT uses ? Possible to study these past evolutions and their impact on VoT, for feedback useful for prospective analyses « ICT uses vs VoT »?
Importance of evolution rules: flat rules ($\varepsilon = 0$) seem to underestimate, and rules with $\varepsilon = 1$ seem to overestimate.
No clear picture: seems to increase slightly in France and UK, while German approaches show no definite trend; methodological changes for estimating VoTs may have also had an important impact. In any case, not the clear and rather strong impact income increases would have been expected to have

→ broader international comparisons might be useful and help explain if/why role of € would tend to decrease (consistent with « richer / more valuable use of TT in the past »)?

Source: Dahl et al, Transportation Research Procedia 13, 2016
Prospective impacts of mobility changes on CBA

- increased differentiation of VoT?
- types of impacts of ICT
More diversified activities during transport, due to ICT?

- would mean higher differentiation of TT uses due to ICT

- then to an increased differentiation of VoT?
Impacts of ICT : on what ?

- also on activities during leisure time (out of transport)
  → if similar evolutions as activities during transport, minor changes in the end for VTTS ?

- on comfort / reliability?
  ➢ disutility of physical discomfort is not obviously linked to ICT-induced changes and, if ITCs impact, not necessarily in relation with TT (ex : transport supply integration reduces transaction costs, help better organise individual daily programme, this is not proportional to TT ; nor, for reliability, on board information on TT variation)
  ➢ If VoT evolves sharply, does it make sense to go on relating comfort and reliability (dis)benefits proportionally to VoT ?
  ➢ ICT applications may be less easily used when comfort/reliability levels decrease (other activities too...)
Impacts of ICT on VoT: for CBA?

- how would VoT evolutions due to ICT be measured? And anticipated, since CBA needs projections?

- RP? Needs models able to capture changes due to ICT

- SP? Survey using an increased diversity of situations depending on ICT activities' possibilities while traveling?
  → continuation of the traditional approach « increasing differentiation of VoT » (or parallel surplus variations estimates due to ICT activity choice)

- but anyway, how to feed the new information back into traffic models? They would still need to evolve to capture ICT impacts
Impacts of ICT: on VoT only?

- Back to: \( \Delta S = \text{VoT} \times \Delta \text{TT} \):

  - ICT may influence both terms, directly or indirectly
    → probably, need to adapt traffic models for better TT estimates
  
  - How to capture ICT impacts on transport choices?

- If VoT decreases: importance of costs > time in GC
  → more traffic for low speed transport?

- Choice of transport mode / route depending on ICT possibilities?

- Influence of routing ICT

- …
Impacts of ICT: possible evolutions of models

- models already need adaptations due to evolutions of transport supply, themselves closely linked to ICT (carsharing, easy bike rental in cities, real time scheduling of transport services, ...)

- as regards use of time while traveling:
  - What of time-cost models if distribution of VoT → 0 ?
  - Refinements of usual models, whether applied traffic models / 4 step or more theoretical (recent refinements from Hensher/De Serpa with « mixed activities » : would lead to combinatory explosion of differentiated cases again

- but ICT impact is not limited to ICT induced activities while traveling during an exogenously imposed trip:
  - Ex : on-line buy at home or while traveling, then delivery at home or pick-up on route (in stations for instance)
  - In fact, ICT may impact the whole organisation of individual activities, not only how pleasantly flows time while traveling
Impacts of ICT: ABM models?

- activity-based models are already complex, but their approach could be more adapted to representation of ICT changes.

- for the moment they just seem to consider ICT changes induced on classical parameters ("what if VoT diminishes, or if speed-flow curves evolve due to ICT/ autonomous vehicles,.. »):

- but it could be worth considering developing ABMs using a modular approach, modeling on different levels the choices of schedule for « main » activities that determine travel needs, and the choice of activities while traveling:
  - Ex: on-line buy at home or while traveling, then delivery at home or pick-up on route (in stations for instance)
  - In fact, ICT may impact the whole organisation of individual activities, not only how pleasantly flows time while traveling.
Conclusion

• The VoT issue remains central for CBA, although less dominant.
• VoT past evolution, together with analyses of past evolution of activities while traveling, would be worth studying.
• If VoT evolves sharply, disconnection from VoT of the valuation of other impacts such as comfort, reliability?
• Ever-increasing differentiation of VoTs due to increased diversity of activities offered by ICT?
• Need to consider ICT/VoT issue for CBA together with ICT issue for TT estimation and traffic models evolution, both because:
  • \( \Delta S = \text{VoT} \times \Delta TT \)
  • VoT possible evolution needs adapted models to be estimated, and to be anticipated for CBA.
• Evolution of models to capture both (secondary) activity choice while traveling, and main activities scheduling linked to trip/travel organisation: post-ABMs?
• We should not forget the issue « collective versus individual VoT ».
Thanks for your attention

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