Worthwhile Time in Transport:
Capturing the Subjective Value of the Travel Experience by Smartphone

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Univerzitný vedecký park
Žilinskej univerzity v Žiline

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Presentation plan

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- Motivation for research
  - “Worthwhile time” conceptual framework
  - …and why it matters
- Capturing Perceived Travel Experience
  - “Mobility and Time Value” (MoTiV) app
  - Collecting travel experience data at a European-wide scale
- Conclusion and future work

Motivation: the travel time “gift”

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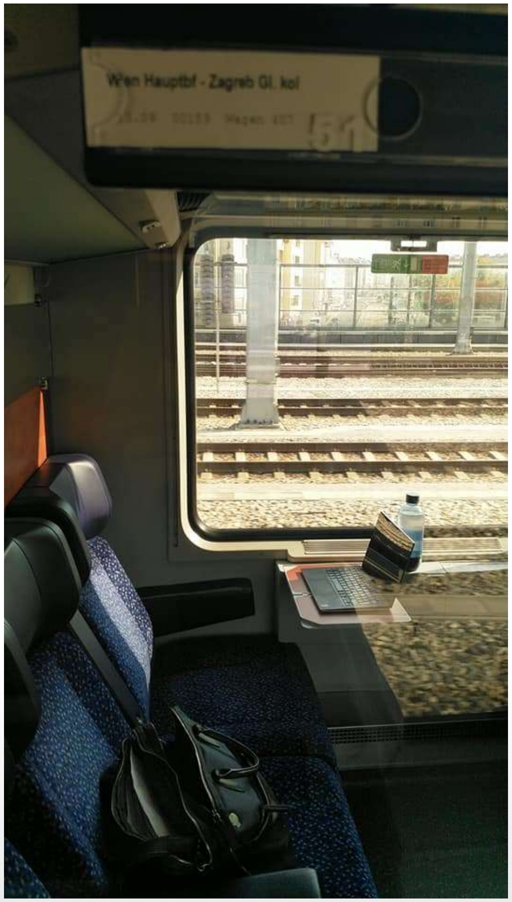

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Reasonable Travel Time

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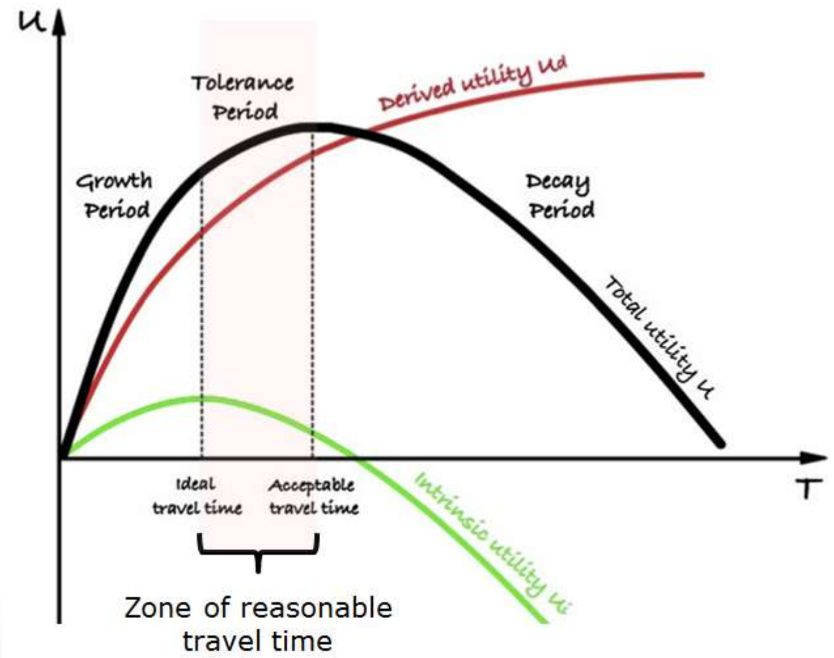
Reasonable Travel Time is the door-to-door journey time

that is acceptable to the individual traveller

for reaching a particular destination, and its associated activities,

given the conditions provided to turn 'lost time' into 'worthwhile time' while travelling



Banister, D., Cornet, Y., Givoni, M., Lyons, G.: From Minimum to Reasonable Travel Time. In: Transportation Research Procedia, World Conference on Transport Research (WCTR). , Shanghai (2016)

Milakis, D., Cervero, R., van Wee, B., & Maat, K. (2015). Do people consider an acceptable travel time? Evidence from Berkeley, CA. *Journal of Transport Geography*, 44, 76–86.

Measuring the travel experience

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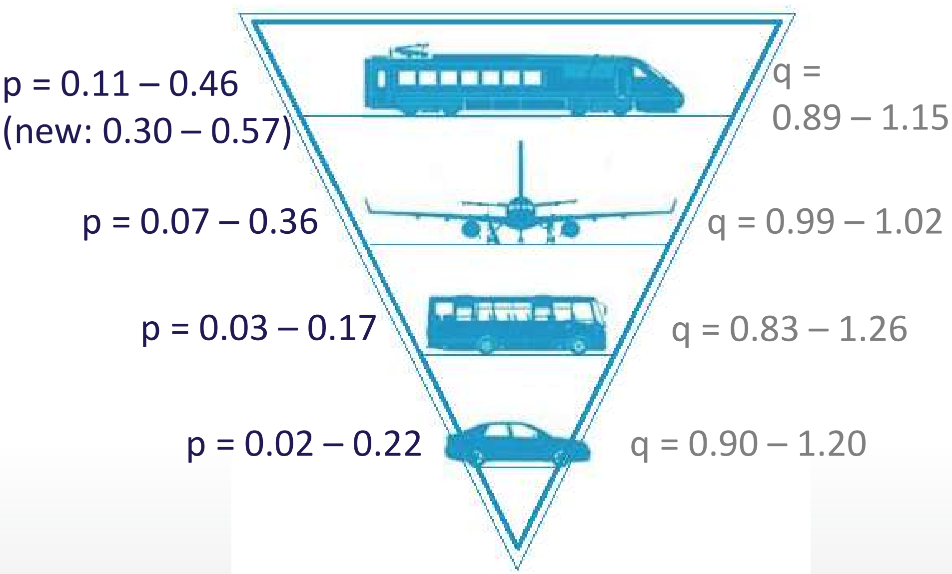
Hensher formula

- p = average amount of time spent working while travelling
- q = relative productivity of work done while travelling compared with in the office



Expressing the above ideas mathematically let;

MP = marginal product of labour

VL = the value to the employee of leisure relative to travel time

VW = the value to the employee of work time in the office relative to travel time

r = proportion of travel time saved used for leisure purposes

p = proportion of travel time saved at the expense of work done while travelling

q = relative productivity of work done while travelling compared with in the office

MPF = value of extra output generated due to reduced fatigue.

Then the value of savings in (long distance) business travel time (VBTT) is given by:

$$\boxed{VBTT = (1-r-pq)MP + (1-r)VW + rVL + MPF \qquad (1)}$$

It is this expression which we would ideally like to measure, and which we call a synthetic value of time. Next we discuss, in turn, issues concerned with the measurement of MP, VL, VW, MPF, p, q and r.

Wardman, M., & Lyons, G. (2015). The digital revolution and worthwhile use of travel time: implications for appraisal and forecasting. *Transportation*, 43(3), 507–530.

The bigger picture

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- **Why "worthwhile time" instead of "productive time"?**
  - Quality of living is not only about "effective" and "productive" use of time
  - Need to extend "time and cost savings" objective with other relevant dimensions and indicators of value
- **Liveable Smart City Transition:** enhance perceived and experienced "quality of time" for higher quality of life (QoL)

EUR per person-hour	Commuting/ Leisure/ Other	Work/ Business trip
Travel time	12.14 €	51.64 €
Delays (bicycle, car)	18.21 €	77.45 €
Delays (public transport)	36.42 €	154.91 €
Waiting Time	24.28 €	103.27 €
Transfer time	18.21 €	77.45 €

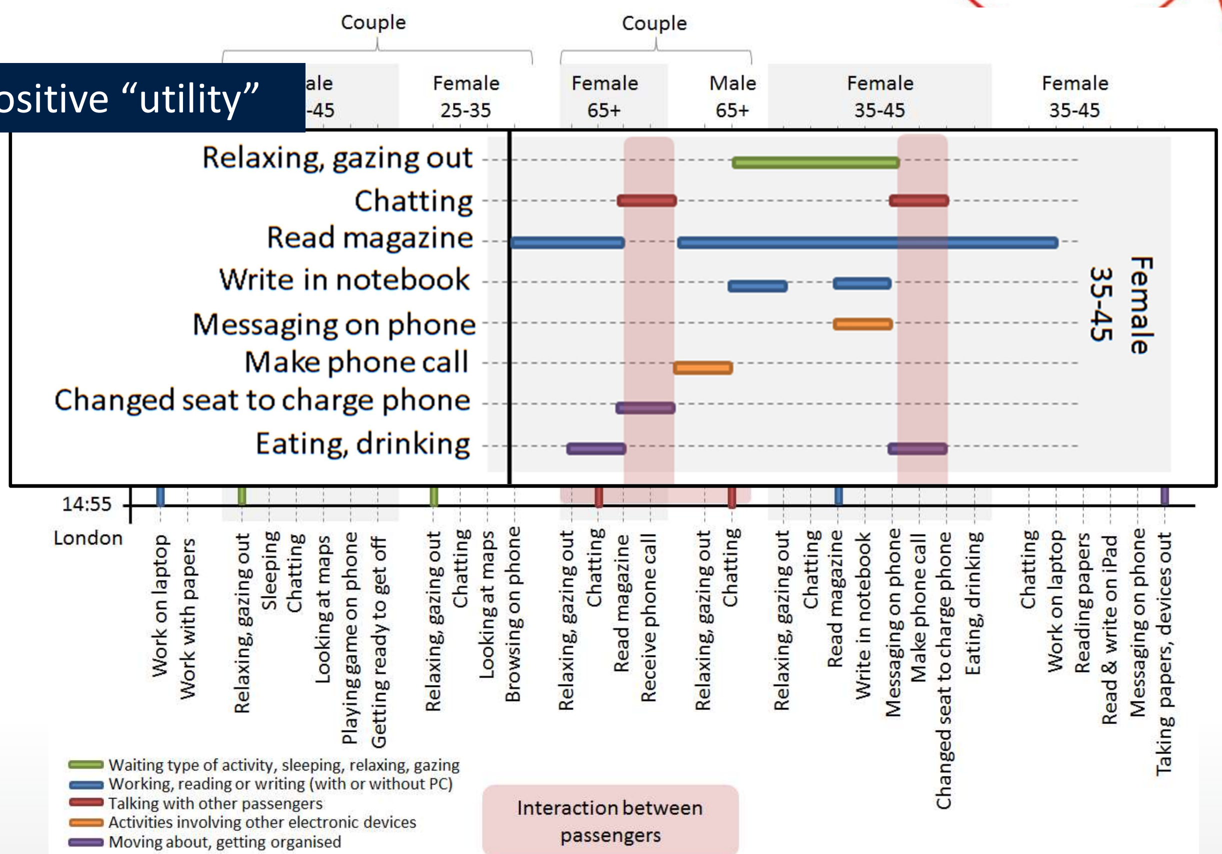
Example of monetary travel time values used by the Danish ministry of Transport (2018 values).

Multitasking is varied and prevalent

Structured observations of multi-tasking onboard Eurostar

(10 min. intervals)

Positive "utility"



Keseru, I., & Macharis, C. (2017). Travel-based multitasking: review of the empirical evidence. Transport Reviews, 38(2), 1–25.

MoTiV Conceptual Framework:
Value Proposition of Mobility (VPM)

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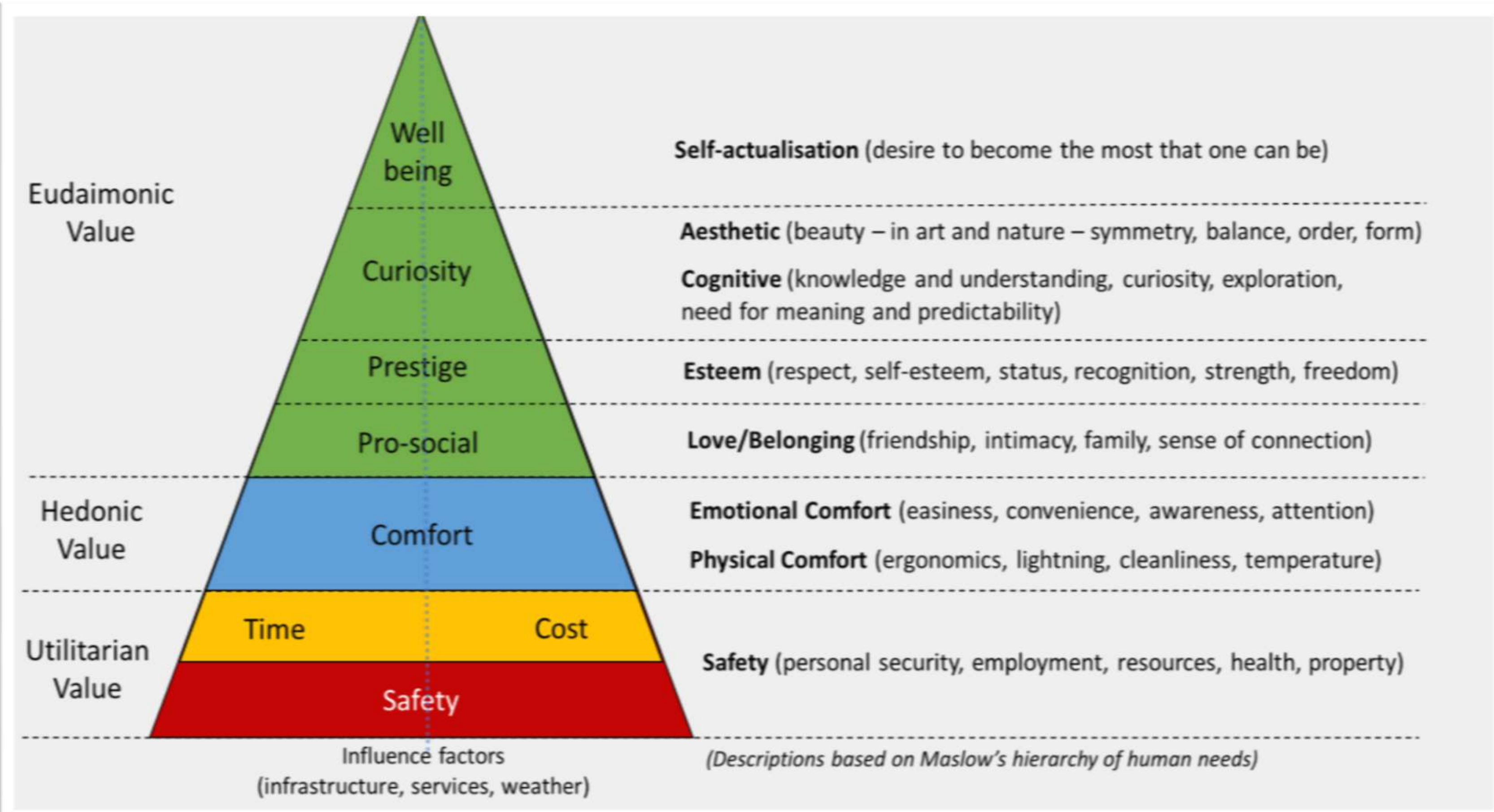

"Mobility and Time Value" (MoTiV)

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- Using smartphone it is possible to collect mobility and activity data
- Quantified Self (QS): in transport planning domain
  → "Quantified Traveller"
- Combine the emerging views on VTT with the potential offered by QS approaches
- Capturing the perceived travel experience via smartphone.

About MoTiV: project figures

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- **European-wide exploration of "Mobility and Time Value"**
  How value of travel time is perceived and experienced across transport modes, generations, genders and cultures

- **30-month project:** Nov. 2017 – Apr. 2020 (now: M11)
- **Overall funding:** ~2M EUR
- **Small consortium:** 7 partners
  - 3 academic institutions/research organisations (UNIZA, SK; Eurecat, ES; INESC-ID, PT)
  - 2 business partners (routeRANK, CH; CoReorient, FI)
  - 1 mobility consultancy organization (TIS.pt, PT)
  - 1 European-wide association (ECF, BE)

  and additional Linked Third Parties affiliated with ECF

Approach

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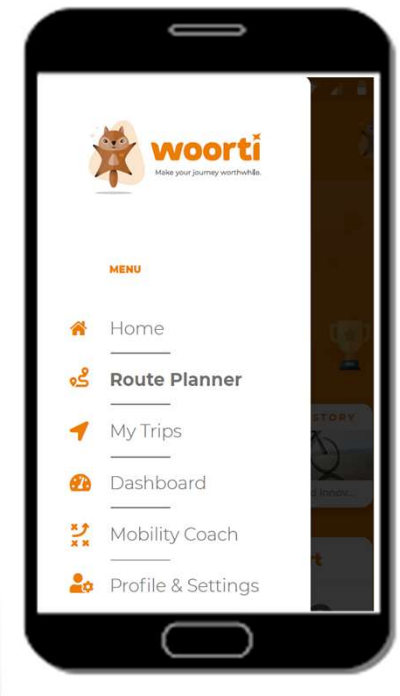
- **Smartphone-based data collection via the Woorti app**
  - Focus on the individual travel experience
- **Continuous collection of mobility/activity behaviours**
  - Smartphone-based sensing of mobility behaviour
  - Traveler's input on experience
- **Smart mobility coach ("quantified traveller" approach)**
  - Trends and statistics for self-learning and increased awareness
- **Variables to collect:**
  - Socio-geodemographic, attitudinal, trip-related, comfort-related, activities-related, equipment-related, context and spatial variables, satisfaction with experience
- **Target**
  - Minimum 5.000 valid samples (active app use for minimum 2 weeks) from as many users from at least 10 EU countries
  - Multimodal: walking, cycling, public transport, car use, shared mobility, long-distance train, plane
- **Release of Open Dataset** at the end of the project



App Architecture – Key Modules

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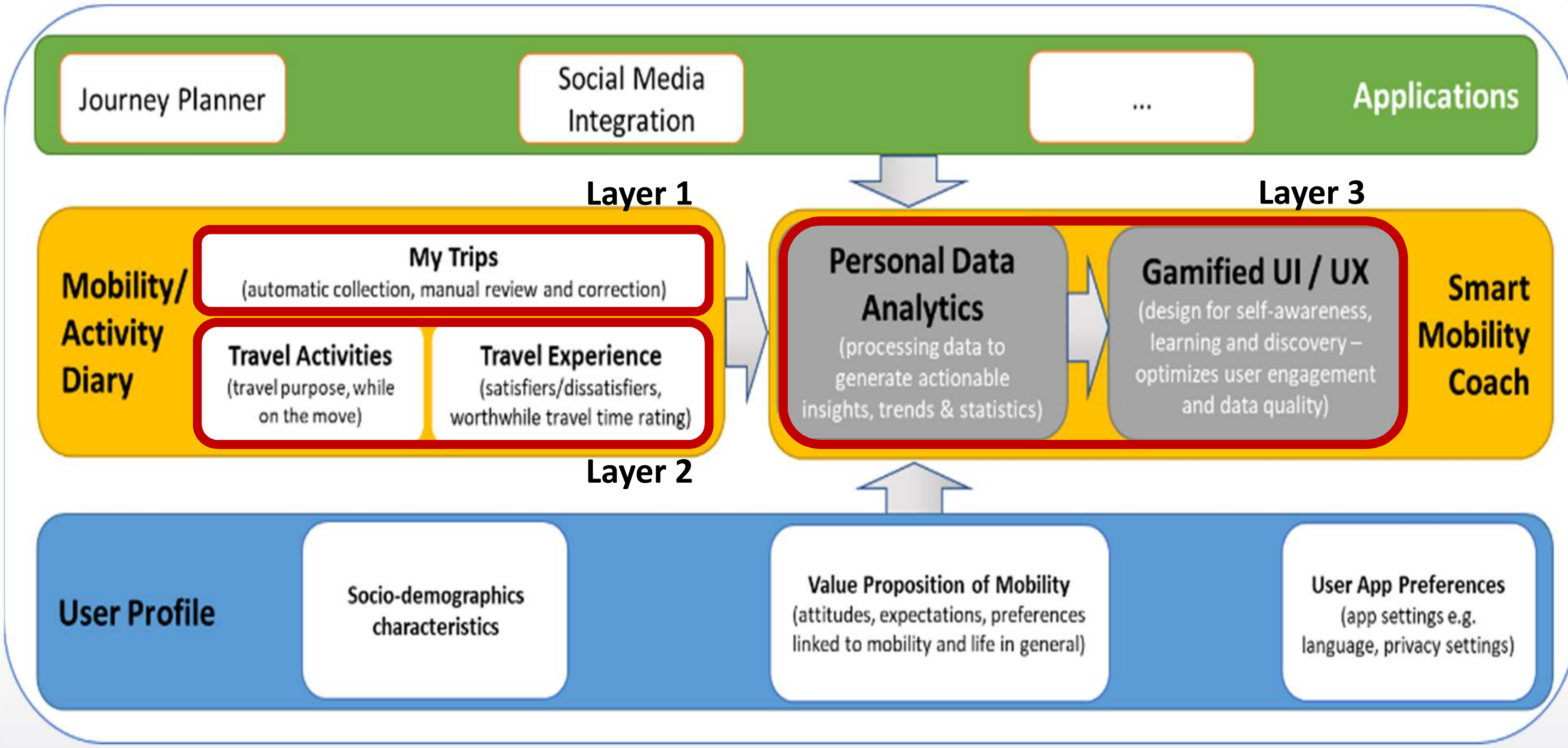
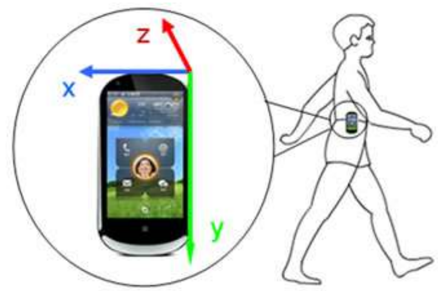
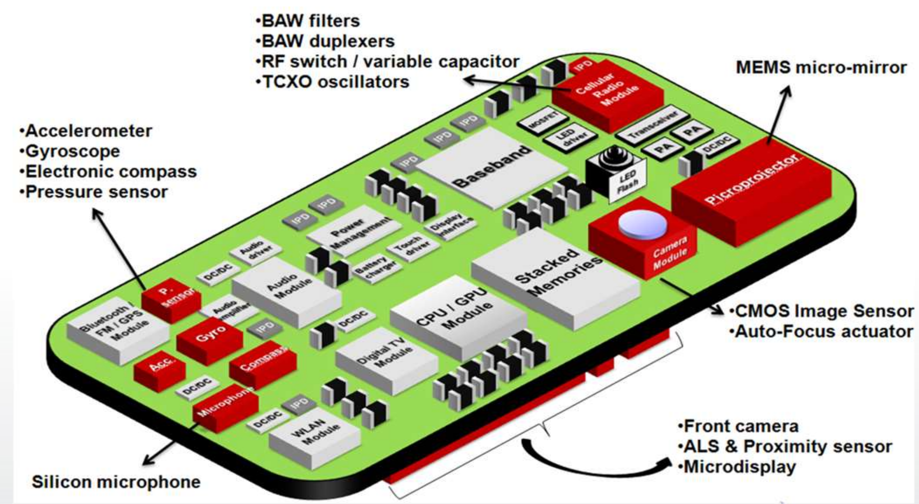


Layer 1 - Trip Detection

- Mobile sensor data are collected from device by app in background
- Combining GPS and accelerometer data to classify a user's movement
- Many existing apps: MOVE, TravelVu, etc.
- Main challenge: battery consumption…





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Layer 2 – Experience data

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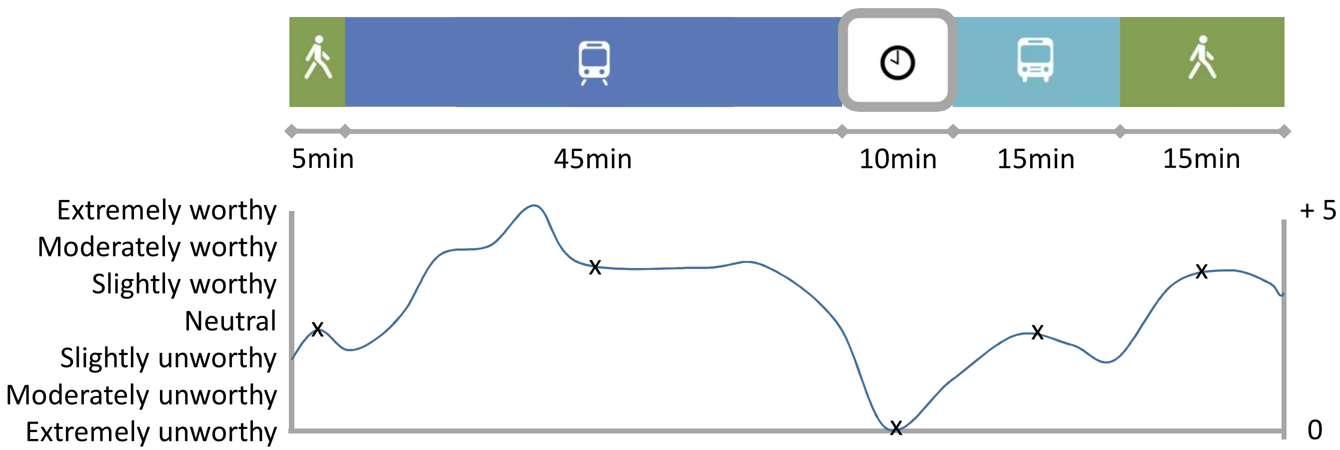
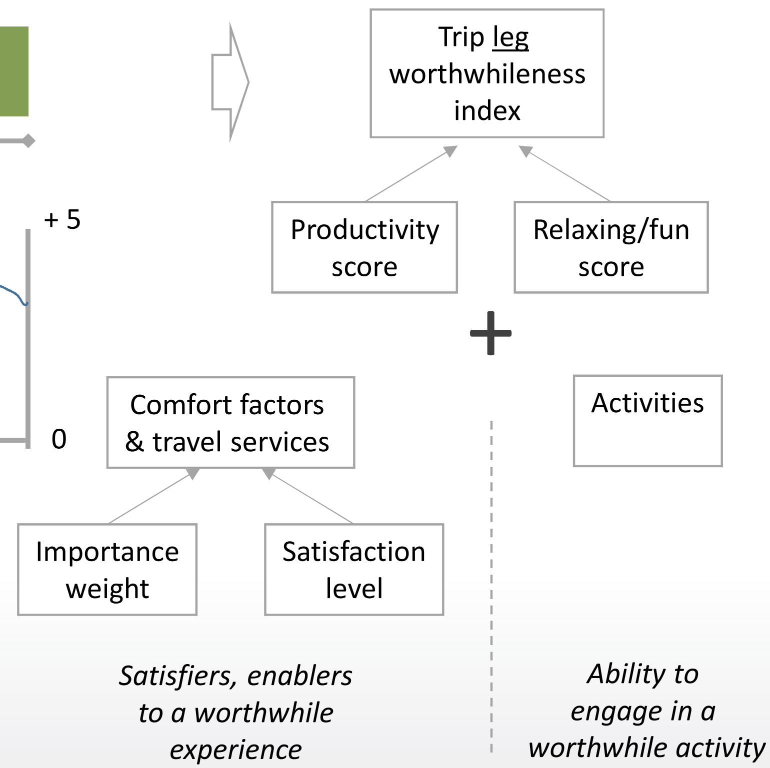


Main components of worthwhile time on a door-to-door trip



Satisfiers - factors

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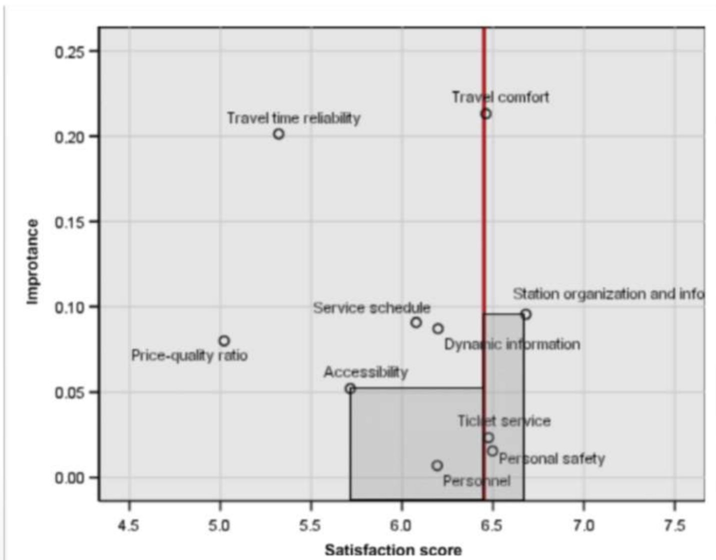
Importance and satisfaction with each factor

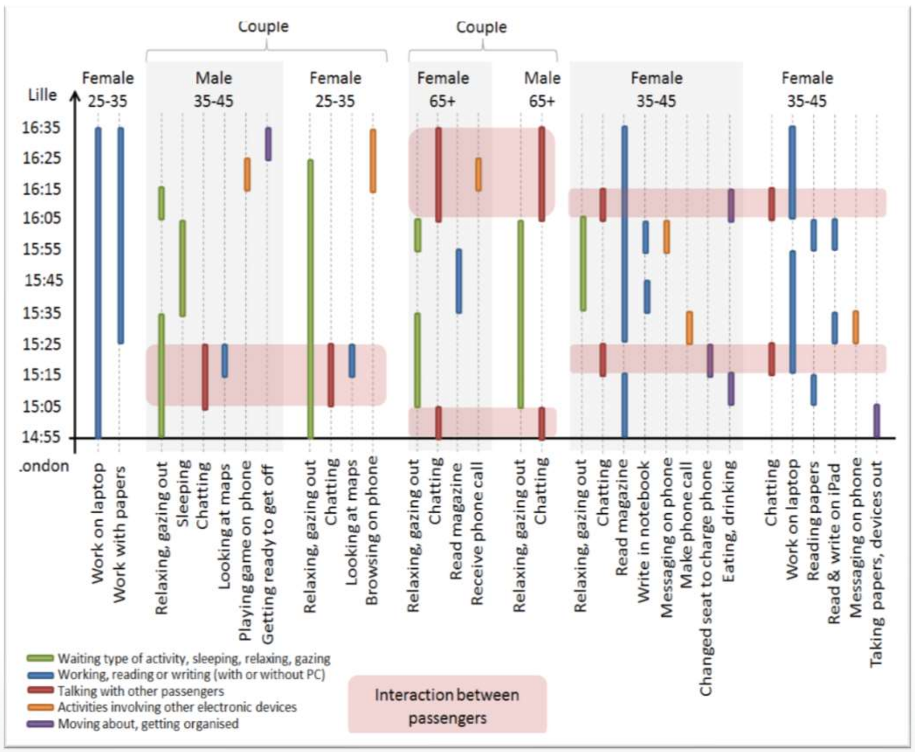


Comfort factors	cleanliness - inside
	cleanliness - outside
	maintenance (upkeep and repair, condition of seating, walls, tables etc.)
	seating availability - onboard
	seating availability - benches
	personal space
	crowdedness
	privacy
	pleasantness - ambiance
	pleasantness - design
	pleasantness - views/scenery
	air quality - ventilation
	air quality - temperature
	air quality - pollution
	noise
	smoothness - jerkiness, motion-sickness
	smoothness - pavement, floors
	accessibility (for people with special needs or disabilities)/ease of being able to get onboard

prosocial	companion
	companion - pet
	companion - child, escort
	helpfulness and attitude of other people/travellers
Safety / security	personal security / safety
	safety - protected infrastructure (bicycle: lane, path or track)
	safety - lighting
	safety - motorised traffic volume
	safety - motorised traffic speed
reliability	delay
	frequency
	congestion/traffic level

Services availability	availability of staff
	helpfulness and attitude of staff
	space for luggage
	space for bicycle
	space for pram
	toilet facilities
	food/drinks
	shopping/retail
	entertainment (magazines, TVs, entertainment system)
	power sockets
	tables
	silent area
	provision of information
	signage
	access infrastructure (escalators, lifts)
	parking (all modes)
	car charging

Activities



travel activities	Sleeping/snoozing
	Relaxing/daydreaming/doing nothing
	Reading for leisure
	Working/studying (reading/writing/thinking)
	Talking to companion/other passengers
	Enjoy the view/Window gazing/People watching
	Listening to music/radio/podcast
	Watching a film/video
	Text messages/phone calls – work
	Text messages/phone calls – personal
	Checking emails
	Internet browsing
	Accessing social networking sites
	Eating/drinking
	Caring for someone travelling with you (including children)
	Playing games (electronic or otherwise)
	Being bored
	Being anxious about the journey (e.g. delays or where to get off)
	Planning onward or return journey
	Exercising
	Personal maintenance and hygiene
	Other: Please write in

Mockups

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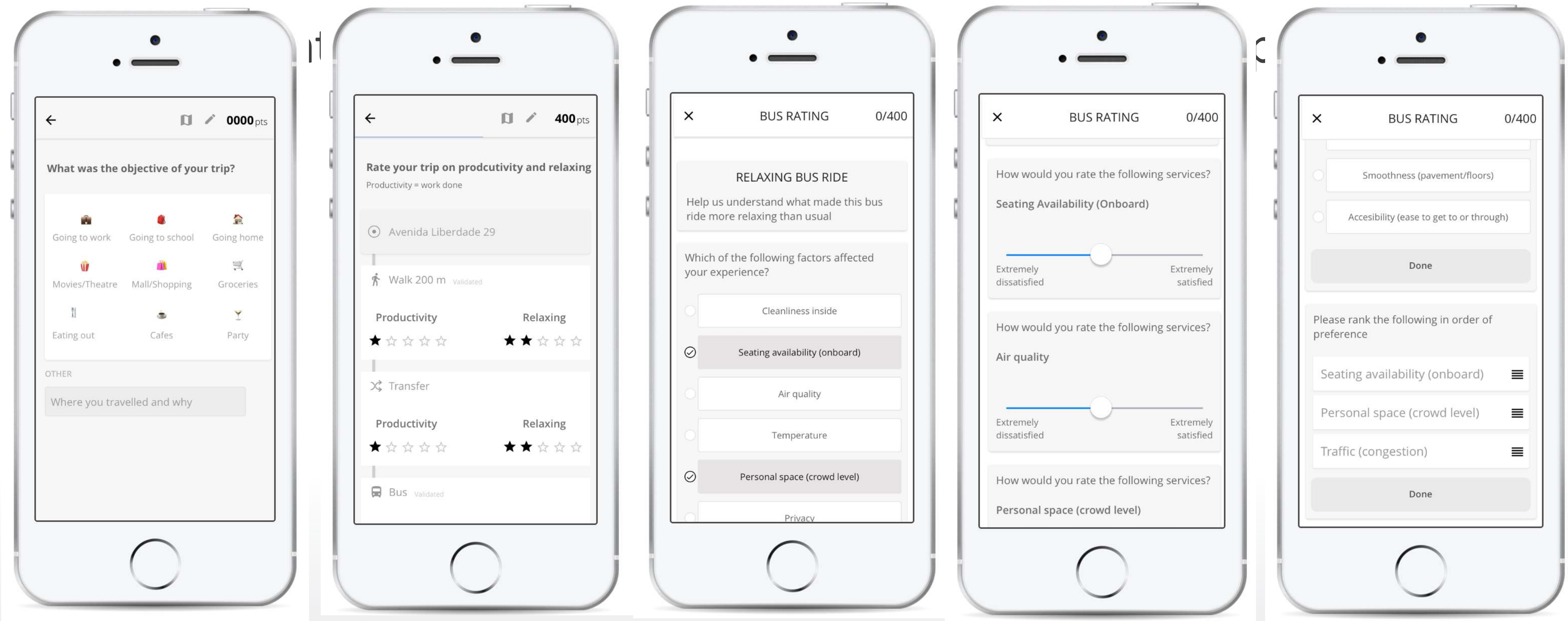

Automatic/Semi-automatic data

- Comfort factors
  - Accelerometer, gyroscope → jerkiness
  - Microphone → noise
- Activities
  - Destination information fetched online
- Calculated from mode detection and distances travelled
  - CO_2 emissions
  - Health/exercise → calories burnt
- Delays compared to schedules

Layer 3 – Personal Data Analytics

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#	RTT	Name	Purpose	VPM
1	Door-to-door trips	Door-to-door time	To explore how the choice of modes and route is influenced by the door-to-door travel time and experience.	Time
2		Reliable door-to-door time	To explore how VTT is influenced by the reliability of the planned travel choice.	Time
3		Trip planning time	To explore how time spent on travel planning and preparations impacts travel choices and VTT.	Time
4		Time constraints	To explore how VTT is influenced by perceived hard time constraints.	Time
5		Acceptable travel time	To explore how VTT is influenced by the acceptable travel time.	Time
6		Travel time budgets	To explore how closely the Travel Time Budget (TTB) matches with a constant 70+-10 minutes per day after factoring in time considered worthwhile.	Time
7	Destination activities	Trips purposes	To investigate the urgency and importance of activities conducted at destination.	All dimensions
8		Diversity of location activities	To explore how the amount of worthwhile time is influenced by the range and diversity of activities at the destination or locations on the way.	Comfort
9		Modal distances	To explore how many urban trips are short distances.	Safety, Well-being
10	Travel experience	Proportion of worthwhile time	To explore how VTT is influenced by the share of worthwhile travel time out of total travel time.	Comfort
11		Unwanted efforts	To explore how VTT is influenced by physical, cognitive or emotional effort related to the travel.	Comfort

19 research hypothesis: design of KPIs to feedback to users is ongoing

#	RTT	Name	Purpose	VPM
12	Travel experience	Travel activities	To explore how VTT is influenced by the range and diversity of activities while travelling.	Comfort, pro-social
13		Smartphone-based activities	To explore how VTT is influenced by smartphone apps and the time spent on them.	Comfort
14		Value of travel activities	To explore how VTT is influenced by the perceived worthwhileness of a trip leg.	Comfort
15		Travel comfort factors	To explore how VTT is influenced on the perceived comfort of the locations or while travelling.	Comfort
16		Jerkiness as a proxy for comfort	To explore how comfort while travelling is influenced by vibration, jerkiness and shocks.	Comfort
17		Transfer and waiting experience	To explore how comfortable transfer and waiting times are.	Comfort
18		Traveller needs and equity	To explore how the choice of travel speed is influenced by the user's demographic characteristics.	Cost, safety
19		Attitudes towards mobility and time	To explore how VTT is affected by the traveller's attitude about transport modes and time.	Well-being, curiosity, prestige, pro-social

Incentivisation

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- ‘Burden’ on the participants requires incentives
  - Dependent on the user needs and preferences
- Personal data analytics
  - New perspective on own travel data
- Gamified UI/UX
  - Points-based surveys, perks and prizes as part of campaigns
- Smart Mobility Coach
  - Possibility to compare with others, increase self-learning and self-awareness

+ much attention given to campaign management

Conclusions

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- From older idea that considers travelling as wasted time to more holistic approaches to the study of VTT
- Smartphone-based data collection
  - Adoption of a Quantified Self approach
  - Understanding travellers’ perception
- A way to implement smart cities by engaging citizens in participatory processes of digital governance

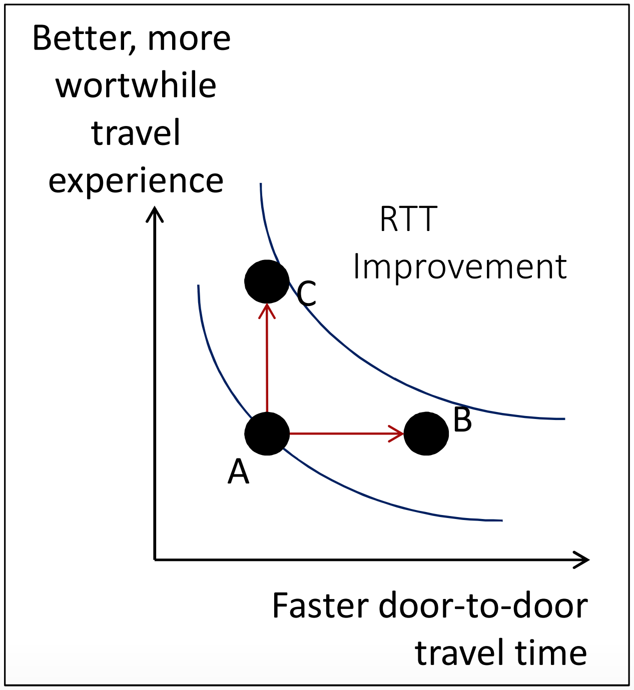
woorti

Make your journey worthwhile.

Implications for planners

- Minimizing travel time can be costly and counterproductive e.g. environmental impacts

- Transport planning should **aim to improve Reasonable Travel Time** when looking at investing in transport



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Any Questions?

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