Design for Cycling data collection by smartphone app

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Are you using a cycling app?
Introduction

• Various cycling tracking apps (e.g. Endomondo, Strava..)

• Bicycle navigation, touring app.. (Cyclemaps, MapMyRide..)
Many cycling related apps....

- **ORCYCLE** - Portland State University has developed a smartphone app to collect route, infrastructure, crash, and safety data for use by public agencies, measure also comfort and stress.

- **B-Riders** project in the province of Brabant. B-Riders are commuters who switch from car to bicycle. They are coached by an app, and receive a financial reward for each kilometre cycled during peak hours.

- **Fietstelapp** – cyclists counting app in NL

- **FillThatHole** – UK app warn cities on bad road condition

- **Bikelane, RADwende, Lanespotter, CityMapper, Bicycle parking** – helping cycling advocacy
Apps for travel survey

• For example: TRavelVU, MODALYZER
Challenges

• The apps offer the technological and easier way how to get the traditional data about travel habits
• considering the smartphone as personal tool, there is a wide scale of unbeaten opportunities
• We can easily ask various questions and gain automatically various data from various areas
Status quo - we know about the cycling benefits

Source: www.ilovebicycling.com/the-benefits-of-cycling-they-are-many/
There are many areas from various sources – problem not in 1 app

- Trip purpose, travel mode
- Satisfaction with cycling infrastructure
- Measuring comfort
- Contribution to economy,
- Health...
- Carbon footprint impact..
Our goal - design the cross-sectoral app

• Going further than measuring only the performance (GPS route..)
• Interesting in social behaviour, psychology.. (Mood, feeling)
• Focus on the individuality (the reason WHY?)
• Personal Value of Travel Time
• Benefit for all – authorities, NGOs, researchers
What we know

- Each person (cyclists including) is an individual
- There can be various classification of cyclists
- i.e. Portlands 4 type classification

Source: https://www.portlandoregon.gov/transportation/article/158497
Slovak based survey – still ongoing

- Everyday (almost every day and not afraiding to ride with cars)
- Recreational (cycle only exceptionally, on weekends, bicycle touring, etc.)
- Careful cyclist (cycle only exceptionally, especially after cycling paths or on walkways, rarely on roads with cars)
- Enthusiastic cyclist (fan/supporter of cycling, mainly using other modes of transport, bicycle more if there were more cycling paths)
- Racer/athlete (bicycle especially because of sport, racing, excercise, I do not use bicycle as the main mode of transport)
- Never ever - Never cycle and he/she will never at all
Factors comparison among cyclists types

<table>
<thead>
<tr>
<th>types of cyclists</th>
<th>road safety</th>
<th>secure bicycle parking</th>
<th>cycle infrastructure</th>
<th>travel time saving</th>
<th>ride smoothness/comfort</th>
<th>health flexibility and independent of movement</th>
<th>travel cost saving</th>
<th>joy of ride</th>
<th>sport/exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>enthusiastic</td>
<td>4.70</td>
<td>4.41</td>
<td>4.07</td>
<td>3.36</td>
<td>3.95</td>
<td>4.30</td>
<td>4.20</td>
<td>2.68</td>
<td>4.70</td>
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<tr>
<td>careful</td>
<td>4.67</td>
<td>4.22</td>
<td>4.56</td>
<td>3.22</td>
<td>4.22</td>
<td>3.44</td>
<td>3.78</td>
<td>2.44</td>
<td>4.22</td>
</tr>
<tr>
<td>recreational</td>
<td>4.70</td>
<td>4.44</td>
<td>4.33</td>
<td>3.42</td>
<td>3.96</td>
<td>4.00</td>
<td>3.74</td>
<td>2.81</td>
<td>4.41</td>
</tr>
<tr>
<td>racer</td>
<td>4.46</td>
<td>3.54</td>
<td>3.23</td>
<td>2.46</td>
<td>4.00</td>
<td>4.62</td>
<td>3.23</td>
<td>2.00</td>
<td>4.77</td>
</tr>
</tbody>
</table>

Scale from 0 (min) to 5 (max)
Importance of parameters for cyclists types

- Road safety
- Secure bicycle parking
- Cycle infrastructure
- Travel time saving
- Ride smoothness/comfort
- Flexibility and independent of movement
- Travel cost saving
- Sport/exercise
- Joy of ride
- Health

Cycling & Society annual symposium 6th and 7th September 2018, Bristol
## Factors comparison between gender

<table>
<thead>
<tr>
<th></th>
<th>road safety</th>
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<th>ride smoothness/comfort</th>
<th>health</th>
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<th>travel cost saving</th>
<th>joy of ride</th>
<th>sport/exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>males</strong></td>
<td>4,52</td>
<td>4,04</td>
<td>3,90</td>
<td>3,40</td>
<td>3,88</td>
<td>4,12</td>
<td>4,05</td>
<td>2,74</td>
<td>4,51</td>
<td>3,41</td>
</tr>
<tr>
<td><strong>females</strong></td>
<td>4,6</td>
<td>4,42</td>
<td>4</td>
<td>3,89</td>
<td>4,04</td>
<td>4,2</td>
<td>4,26</td>
<td>2,92</td>
<td>4,62</td>
<td>3,38</td>
</tr>
</tbody>
</table>

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Current research

- Comfort and stress level (Figliozzi, 2016; Comfort and stress level (Figliozzi, 2016;)
- Weather (Motoaki, 2015)
- Health (Chekroud et al., 2018)
- Air pollution (Nyhan, 2016)
- Social contacts (Avila-Palencia et al., 2018)
- Preferences (Griswold et al., 2018)
- Infrastructure (Calvey, 2015)
- Vibrations (Gao et al., 2018)

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Current research methods

• Paper surveys,
• Online surveys,
• Face to face interviews,
• Sensors data collection,
• Smartphone surveys,
Is it possible use just 1 tool for data collection?
Not like this
Requirements for app design

• Need to be easier as is possible
• User friendly design based on UX
• Use the maximal potential of smartphone
• Cross-cutting areas:
  • Traditional parameters as in travel mobility surveys (trip purpose, mode, etc.)
  • + sensors data (GPS tracking, smoothness, HR, fitness..) - progress goes further
  • +input from users (mood, feeling, evaluation, feedback)
Proposal

Automatic detection
- Time/weather
- Location
- Ride smoothness
- Heart rate/calories
- Noise/Pollution

Semiautomatic/need to confirm
- Transport mode
- Trip purpose/activities

Manual input
- Mood
- Evaluation
- Worthwhileness/productivity
- Health status
- Local surveys (i.e. cycling advocacy group)

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Personal Valuation of Travel Time
Future challenge

• OPENSOURCE app (i.e. MEILI,E-Mission)
• Scalable based on the progress of sensors development (.e.g. the measure feeling/mood is nowadays problematic, but maybe in 10 years it will be common part)
• Added value (e.g. route/journey planner, gamification..)
• OPEN DATA , CITIZENS SCIENCE
Various users groups and factors to be measured

- To have comparable results allow in the app to collect various data about cycling preferences
- Variability in parameters sensing
- For some cyclists the infrastructure is crucial, for other not
- Aspect of weather, safety, parking conditions
- Focusing on the value of travel time
MoTiV project

- The Mobility and Time Value “MoTiV” project addresses emerging needs and perspectives on Value of Travel Time (VTT),
- data collection with sample at least 5000 for at least 14 days (January to May 2019) in 10 EU countries (at least)
- Smartphone App will be available at the end of 2018
- OPEN DATASET (2020)
Really?

- Traditional Value of Time paradigm – Time is money (using in CBA for project evaluation)
- But is it always true?
- What about if the travel time can contribute to other aspects linked to well being, health, social interaction or relax?
- Ride on bike (touristic, relax, riding with children, doing exercise..)
The Hensher formula determines a value of travel time saving (for business travel) for person who can be productively during travel.

Expressing the above ideas mathematically let;

\[ MP = \text{marginal product of labour} \]
\[ VL = \text{the value to the employee of leisure relative to travel time} \]
\[ W = \text{the value to the employee of work time in the office relative to travel time} \]
\[ r = \text{proportion of travel time saved used for leisure purposes} \]
\[ p = \text{proportion of travel time saved at the expense of work done while travelling} \]
\[ q = \text{relative productivity of work done while travelling compared with in the office} \]
\[ MIP = \text{value of extra output generated due to reduced fatigue} \]

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

\[ VBTT = (1-r-p)MP + (1-r)pVL + rW + MIP \]

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, W, MIP, p, q and r.

Source: Fowkes et al., 1986
Probably most suitable: Latent class analysis

Source: Motoaki & Daziano, 2015
Interested in...

- What kind of activities are you doing when you are cycling (and not only)

- Buying newspaper: home → work → shop → home
- Talking with friend: work → home
- Preparing presentation: home → work
- Sleeping, listening music: work → home
- Riding 70 km as exercise: home → work → home
- Drop off children: home → work
- Pick up children: work → home
Do Nothing

The future is inevitable

Source: https://wordlesstech.com/time-travel/
Users’ consent and rights

• A necessary condition to start data collection and processing will be users’ consent.

• Among the rights ensured, users will be able to revoke their consent any time and also to access, to rectify, to erase and to restrict the processing (articles 15 – 19, GDPR Regulation).

• Moreover, the MoTiV app will provide a “stop-tracking” option.
Collected data nature

- Data collection will concern variables related to mobility, behavior/activity and other influence factors.
- Data storage will also include demographics information (e.g.: nationality).
- Sensitive data will not be included (e.g.: revealing ethnic origin).
- OPENDATA – anonymisation of data
- Data will be collected only for a limited frame of time and furthermore in compliance with the principle of data minimisation (article 5 (1) c, GDPR Regulation).
Users’ knowledges

• Users will be informed about which data is collected and for which purpose.

• Also, users will be informed about who has access to their personal data and the way they are processed.

• This information will be shared through the knowledge of two documents: the MoTiV Information Sheet and the Informed Consent form.
Potential problem

- IT skills for some groups (elderly people)
- Smartphone availability
- Data post processing
- Sample size
Result

• Dynamic Value of Travel Time during door to door travel
• Corresponding to the individuality,
• Circumstances (not always happy),
• Distinguish among the trip purposes,
• Evaluation of the cycling investment
Thank you for your attention!

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