On-demand and shared mobility from a city perspective: how to reap the benefits and mitigate the risks?


Source: http://www.masabi.com/mobility-as-a-service/
Passenger transport is changing

Source: Bloomberg
Discussions on impact ongoing and resulting net effects largely unclear

- Congestion
- Emissions
- Accessibility
Discussions on impact ongoing and resulting net effects largely unclear

- Congestion
- Emissions
- Accessibility
Observation


VS

Observation


Emerging question from a societal perspective

How to *integrate* emerging mobility options with public transport and *incentivize* sustainable use?
Mobility as a Service (MaaS)
Mobility as a Service is not (entirely) new

“The Mobility Manager accomplishes its goals by linking together all travel modes – bus, taxi, vanpools, express bus, specialized services, carpools etc. at an informational level and, in most cases, at a transactional level as well”

US DoT, 1991, p. 16
In: Mulley (2017)
Conceptualizing Mobility as a Service (1/3): Elements

- App
- Platform integration
- Service bundling
How is the Mobility-as-a-Service ecosystem different from the current ecosystem?

Conceptualizing Mobility as a Service (3/3): Topologies

Terminology

- MaaS Bundles
- Multimodal mobility plans (analogy: mobile phone plans for mobility)
- (Partial) origins in Marketing literature: bundling
- Common examples (outside of transport):
  - Fixed-price menus
  - Personal computers
  - Telecommunications
MaaS bundles - state of practice (commercial, non-trial)
Whim (Helsinki, FI; West Midlands, UK; Antwerp, BE)

<table>
<thead>
<tr>
<th>Plan</th>
<th>Cost</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>Whim Urban 30</td>
<td>€59.7</td>
<td>30 days</td>
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<td>HSL 30-day ticket</td>
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<tr>
<td>City bike</td>
<td></td>
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<tr>
<td>Taxi (5km)</td>
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<tr>
<td>Rental car</td>
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<thead>
<tr>
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<tbody>
<tr>
<td>Whim Weekend</td>
<td>€249</td>
<td>30 days</td>
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<tr>
<td>HSL 30-day ticket</td>
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<td></td>
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<tr>
<td>Public transport</td>
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<thead>
<tr>
<th>Plan</th>
<th>Cost</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Whim Unlimited</td>
<td>€499</td>
<td>month</td>
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<tr>
<td>Unlimited HSL single tickets</td>
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<tr>
<td>Pay as you go</td>
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</tr>
<tr>
<td>Public transport</td>
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</tbody>
</table>

https://whimapp.com/plans/
swa Augsburg (Augsburg, DE)

https://www.sw-augsburg.de/mobil-flat/
UbiGo (Stockholm, SE)

- Modes: PT, carsharing, rental cars, taxi
- Customizability
- Metrics and budgets:
  - PT day-passes: 10-60
  - Carsharing hours: 6-36h
  - Rental cars days: 1-30d
  - Taxi trips: pay-as-you-go
- Credit roll-over option
- Households as relevant unit
- Pricing principles: volume discount and a flexibility bonus

https://www.ubigo.me
MaaS bundles - state of research
Research on MaaS bundle design has commenced with stated preference surveys

Main stated preference studies worldwide

- Ho et al. (2018, 2020)
  - Explore preferences within MaaS bundles, willingness to pay (WTP) for components and willingness to subscribe in Sydney (AUS) and Tyneside (UK)
  - Sydney: Infrequent car users most likely adopters, non-users the least; WTP for some components (PT day pass) lower than current daily caps -> cross-subsidies / business model

- Matyas and Kamargianni (2018)
  - Estimate willingness to subscribe to MaaS bundle in London (UK)
  - Most respondents in London do not prefer shared modes (car-sharing, bike-sharing, taxi) in their plans, uptake depends on current modal mix

- Matyas and Kamargianni (2018)
  - Compare WTP of bundles and stand-alone transportation services in Zürich (CH)
  - Higher WTP in bundle: public transportation, carsharing and park-and-ride
  - Lower WTP in bundle: (e-)bicycle-sharing and taxi services
Revealed preference data can add a valuable perspective

- All authors note dependence of future uptake of MaaS bundles and current modal mix
- Corresponds with studies on habitual travel (e.g. Gärling and Axhausen, 2003)
- Yet, revealed-preference data has not been used for research on the design of MaaS plans
- Idea: understand current multimodal mobility behavior to compose future MaaS plans
First revealed preference study on MaaS bundle design

- Reck and Axhausen (2019)
  - Analysis of a two-year panel of Danish students at DTU (Copenhagen) to investigate which MaaS bundles fit their mobility traces best
  - For most students (~85%), a PT season tickets is financially viable to purchase
  - Interestingly, the demand for both carsharing and bikesharing seems to vary too much across weeks/months for these two modes to be included as recurring budget in MaaS plans
  - A pay-as-you-go scheme seems more adequate here (or, alternatively, roll-over option or household sharing)
Observation

- Bundle designs (research and practice) greatly differ in terms of design criteria (e.g., included modes, metrics, target unit, time frame, customizability, incentive structure, caps, roll-over option)
- Example: taxi included in 7 of 8 analyzed bundles, but differences in how budget is measured (‘metric’):
  - time-based metrics (minutes, hours)
  - number of included (free) trips
  - distance-based metrics (km, miles)
- This complicates comparison of outcomes as they might be attributed to differences in design
# Main components of MaaS bundles

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Examples</th>
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<tbody>
<tr>
<td><strong>Necessary design criteria</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modes</td>
<td>Modes of transportation included in the bundle.</td>
<td>Public transportation, carsharing, (e-)bikesharing, e-scooters, taxi, car rental</td>
</tr>
<tr>
<td>Metrics</td>
<td>Way in which a mobility budget / the mobility consumption of one mode is measured.</td>
<td>Time-based (minutes, hours, days), distance-based (km, miles), trip-based (number of trips)</td>
</tr>
<tr>
<td>Target unit</td>
<td>Entity the bundle is sold to.</td>
<td>Individuals (residents, tourists), households, employee groups</td>
</tr>
<tr>
<td>Time frame</td>
<td>Period of single recurrence of a subscription.</td>
<td>Weekly, fortnightly, monthly</td>
</tr>
<tr>
<td><strong>Additional features</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discounts</td>
<td>Type and granularity of rebate.</td>
<td>Trip-based (20% / $5 off each trip), budget-based (subscription fee or top up $50, pay $45)</td>
</tr>
<tr>
<td>Caps</td>
<td>Limit to discounts, also referred to as budgets, depend on the metric.</td>
<td>Time-based (30 included hours), distance-based (300 included km), trip-based (10 free trips)</td>
</tr>
<tr>
<td>Customizeability</td>
<td>Bundles can be fixed or customizable.</td>
<td>NA</td>
</tr>
<tr>
<td>Roll-over option</td>
<td>Transfers unused credit to the subsequent time period.</td>
<td>NA</td>
</tr>
</tbody>
</table>

MaaS bundles - open questions & ongoing research
How does MaaS (in general) and MaaS bundles (in specific) impact travel behavior and car ownership?
Main components of impact measurement

- Measurement of travel behavior
  - Booking data, tracking data
  - Control group
- “Disruption“ (MaaS app / bundle introduction)
  - Variety
  - Frequency
  - Sequence
- Modeling of travel behavior
  - Short-term impact (e.g., emissions)
  - Long-term impact (e.g., ownership)
Preliminary results for Augsburg (Germany)

- **Timeframe:** 01.10.2018 – 30.09.2019
- **MaaS goal:** customer retention
- **Trial goal:** learn about customer travel behavior under the influence of a subscription bundle
- **50 participants**
- **Competitively priced at 75 € / month** (vs ≥ 110 € for stand-alone services)
  - City-wide PT pass (zones 10 & 20)
  - 30 h carsharing (any vehicle, unlimited km)
  - Unlimited ≤ 30 min bikesharing

Research questions

How does the subscription bundle affect travel behavior?

- Carsharing
- Bikesharing
- Bus/tram
- Private car
Comparative time series analysis shows increase of carsharing demand among treatment group, yet below budget size.

Graph showing the comparison between Mobil-Flat and Control groups over time from 2017 to 2019. The introduction phase is marked with a dashed line. The graph indicates an increase of 23% and a decrease of 3% compared to baseline.

How does MaaS (in general) and MaaS bundles (in specific) impact travel behavior and car ownership?
Discussion
References