

## Analysis framework and results of the SBB Green Class pilot studies

**Setting:** Two large-scale (189 participants), long-term (1-year) and high-resolution (24/7 user-labelled GPS tracking) pilot studies [1] to test multi-modal mobility flat rates. Participants are equipped with a GA 1<sup>st</sup> or 2<sup>nd</sup> class, bike- and car-sharing credit and either an Electric Vehicle (EV) with P+Rail or an Electric Bike.

**Analysis:** Survey and GPS travel diary data was analysed over time and compared to Swiss mobility microcensus data.

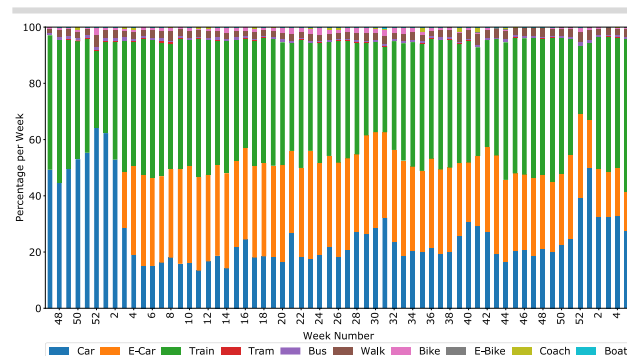
### Results:

- Users integrate new mobility options into their mobility mix.
- New mobility options are used in combination with trains and local public transport.
- Replacing the conventional car with an electric car led to significantly lower average CO<sub>2</sub> emissions.

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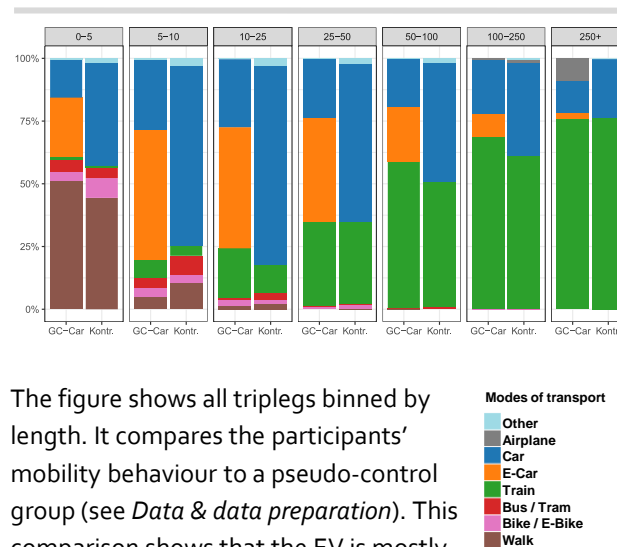
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### Result 1: Modal split



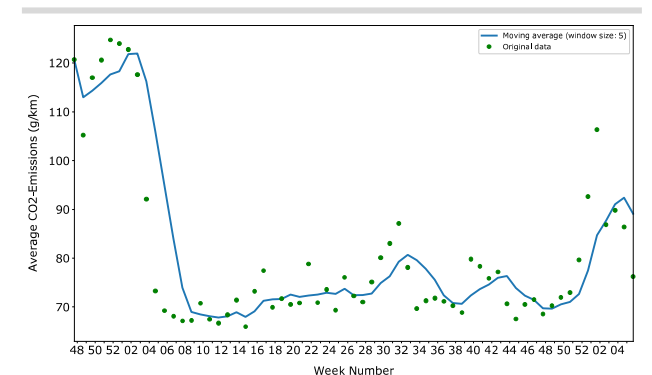
The modal split of the participants of the Green Class (GC) E-Car pilot study shows that the electric vehicle (EV) becomes a permanent part of the participants' mobility mix. Furthermore, the EV is used in combination with public transport and mostly replaces trips made with the conventional (fossil-fuel based) car.

### Result 2: Mode choice



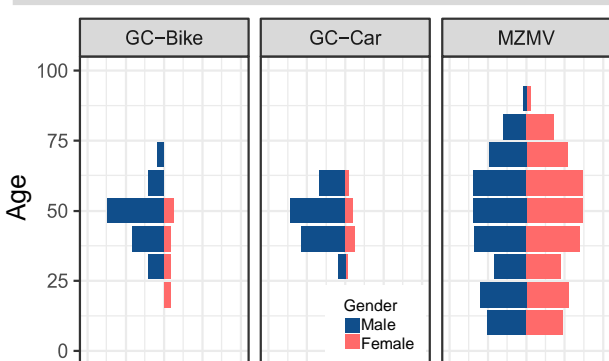
The figure shows all triplegs binned by length. It compares the participants' mobility behaviour to a pseudo-control group (see *Data & data preparation*). This comparison shows that the EV is mostly replacing the conventional car and not train and public transport. Furthermore, there is a preference for the EV for shorter distances.

### Result 3: CO<sub>2</sub> reduction



The moving average of the weekly CO<sub>2</sub>-emissions of Green Class E-Car participants shows a strong reduction at the beginning of the project (~week 7). CO<sub>2</sub>-emissions stay on a low level except for peaks during holidays. The reduction can be explained by the replacement of the fossil-fuel based car with the EV while conserving the share of public transport.

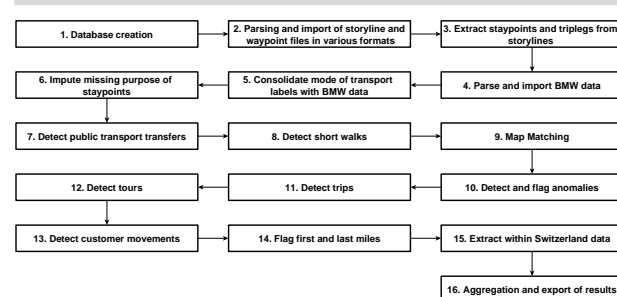
### Mobility package and participants



**E-Car pilot study:** 139 participants with train pass (GA 1<sup>st</sup> Class), BMW i3 EV, P+Rail parking space, mobility car-sharing and PubliBike bike-sharing.

**E-Bike pilot study:** 50 participants with train pass (GA 1<sup>st</sup> or 2<sup>nd</sup> Class), Stromer E-Bike and mobility car sharing. Both samples are not representative for the Swiss population in terms of gender, age, average household income and mobility. All participants were tracked ~6 weeks before the project started.

### Data & data preparation



**Preparation of travel diary data:** Participants are tracked using an app based on tracking technology from MotionTag [3]. We perform several preprocessing steps shown in the workflow above.

**Comparison to mobility microcensus data:** We generate a pseudo-control group by filtering and re-weighting the Swiss Mobility and Transport Microcensus according to the demographics of the GC participants using an iterative proportional fitting approach (IPF) [4].

### Expected impact

Many of today's urgent challenges, especially climate change and green house gas emissions are closely linked to the movement of people and goods. A possible path towards a more **sustainable transport sector** is given by the concept of **Mobility as a Service (MaaS)**. **SBB Green Class** is one of the first large pilot projects for a **multi-modal mobility flat rate**. Despite the non-representative sample, the results are a detailed observation of **MaaS first movers** that have access to a comprehensive mobility package.

The results show that **users integrate the new mobility options** into their mobility mix in the long term and use them in **combination with public transport**. In particular, replacing the conventional car with an electric car leads to significantly lower CO<sub>2</sub>-emissions on average.

In the future, we expect that MaaS offers will become more common and more affordable and therefore will be adopted by a substantial portion of the population.

### References

[1] <https://www.sbb.ch/en/travelcards-and-tickets/railpasses/greenclass/about-sbb-green-class/pilot-projects.html>  
[2] Bundesamt für Statistik (BFS) und Bundesamt für Raumentwicklung (ARE) (2017) Verkehrsverhalten der Bevölkerung - Ergebnisse des Mikrozensus Mobilität und Verkehr 2015

[3] <https://motion-tag.com/en/>  
[4] Stephan, F. F. (1942) Iterative method of adjusting frequency tables when expected margins are known, *Annals of Mathematical Statistics*, 13 (2) 166–178

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