

The effects of (shared) micro-mobility

Dr. Daniel J. Reck | 23 November 2022

Several new mobility options have been introduced to cities in the past couple of years



<https://www.voanews.com/economy-business/e-scooters-put-swedish-startup-road-positive-cashflow>

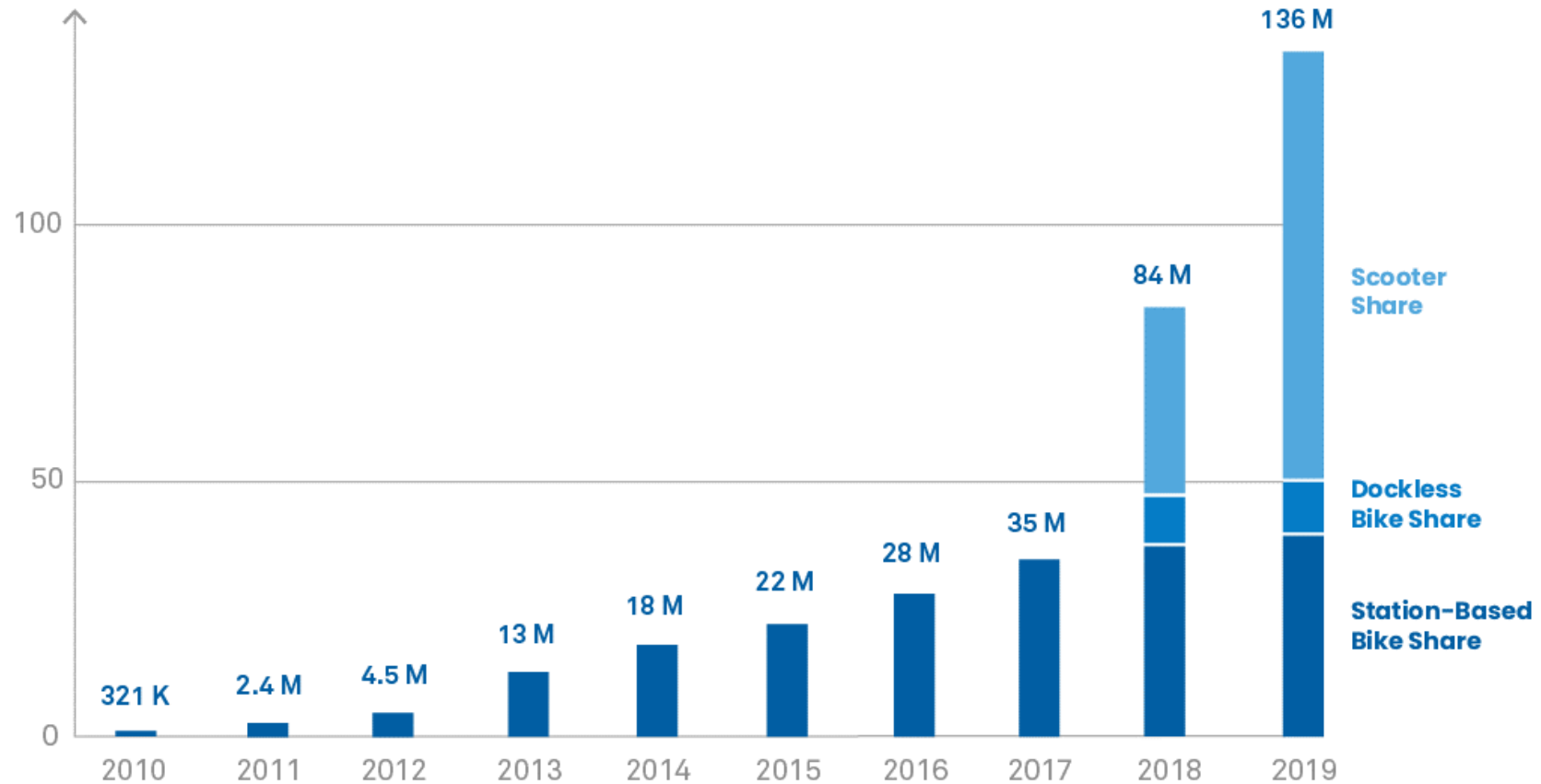


<https://seattletransitblog.com/2020/05/14/with-ubers-investment-lime-is-getting-back-into-the-local-bike-share-game/>



<https://www.aa.com.tr/en/americas/us-envoy-concerned-by-ubers-departure-from-colombia/1725652>

Shared micro-mobility services have seen particularly fast roll-outs and adoption rates



Source: NACTO (2020)

... and have challenged city administrations in many places

The Atlantic

The Bike-Share Oversupply in China: Huge Piles of Abandoned and Broken Bicycles

ALAN TAYLOR | MARCH 22, 2018 | 30 PHOTOS | IN FOCUS

<https://www.theatlantic.com/photo/2018/03/bike-share-oversupply-in-china-huge-piles-of-abandoned-and-broken-bicycles/556268/>

bz

Mit dem E-Trotti zum Rheinschwimmen: Beim Tinguely-Museum häufen sich die geliehenen Fahrzeuge an

Laura Ferrari

24.06.2022, 05.00 Uhr

Jetzt kommentieren

Merken Drucken Teilen

<https://www.bzbasel.ch/basel/basel-stadt/sharing-angebote-mit-dem-e-trotti-zum-rheinschwimmen-beim-tinguely-museum-haeufen-sich-die-geliehenen-fahrzeuge-an-Id.2308269?reduced=true>

Effective planning and regulation is hindered by knowledge gaps

Use of micro-mobility

- How does the use of different micro-mobility options differ across space and time?
- How do users choose between different micro-mobility options?

Users of micro-mobility

- How do user groups differ between micro-mobility options?
- Are there any equity concerns?

Interactions with other modes

- How do micro-mobility options affect the use of other transport modes?
- Which do they substitute?
- What are their environmental implications?

Data and methods

How can emerging data sources be used to advance our understanding of micro-mobility travel behavior?

Adapted from: Transportation Research Part D: Transport Environment - Call for Papers for Special Issue: Understanding and planning shared micro-mobility (15 Feb 2020)

Overview of contributions on (shared) micro-mobility

All papers available
open access online

Use of micro-mobility



Reck, D.J., H. Haitao, S. Guidon and K.W. Axhausen (2021) Explaining shared micro-mobility usage, competition and mode choice by modelling empirical data from Zurich, Switzerland, *Transportation Research Part C: Emerging Technologies*, **124**: 102947.

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PhD thesis: Reck, D.J. (2021) Modelling travel behaviour with shared micro-mobility services and exploring their environmental implications. <https://doi.org/10.3929/ethz-b-000510400>

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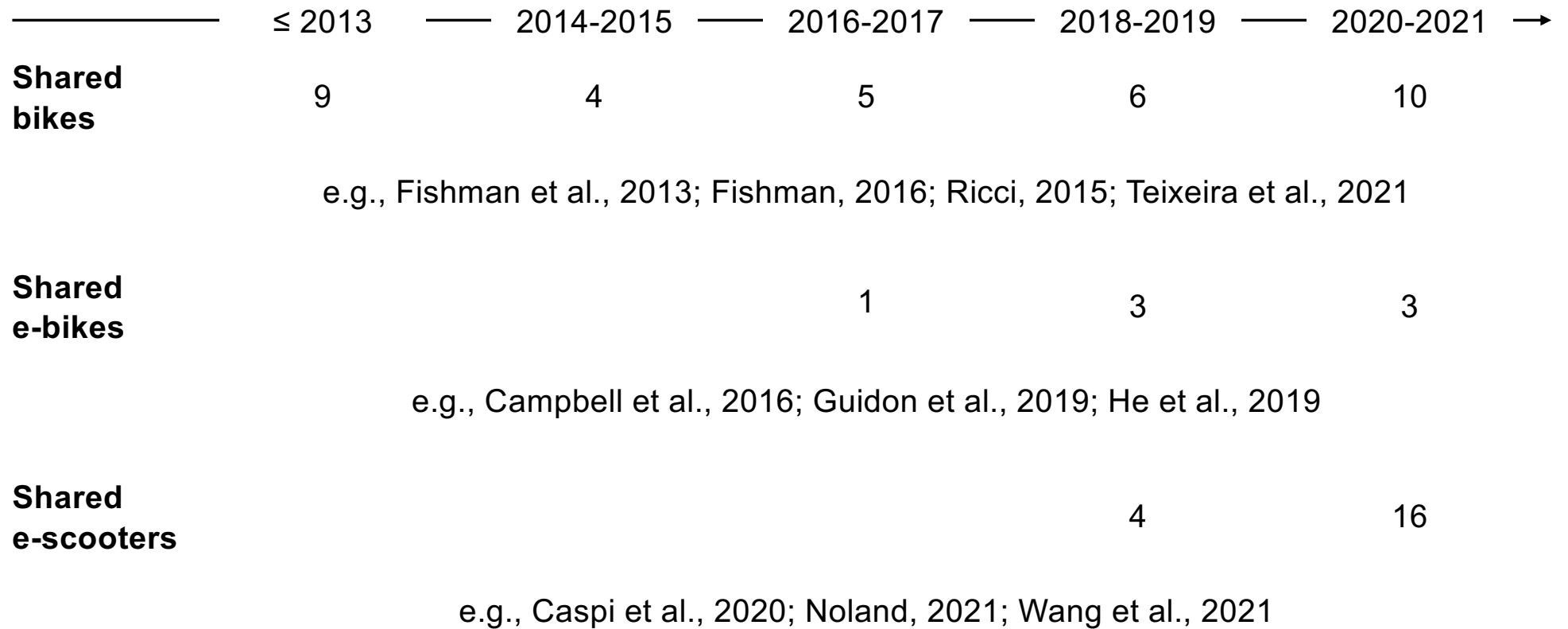


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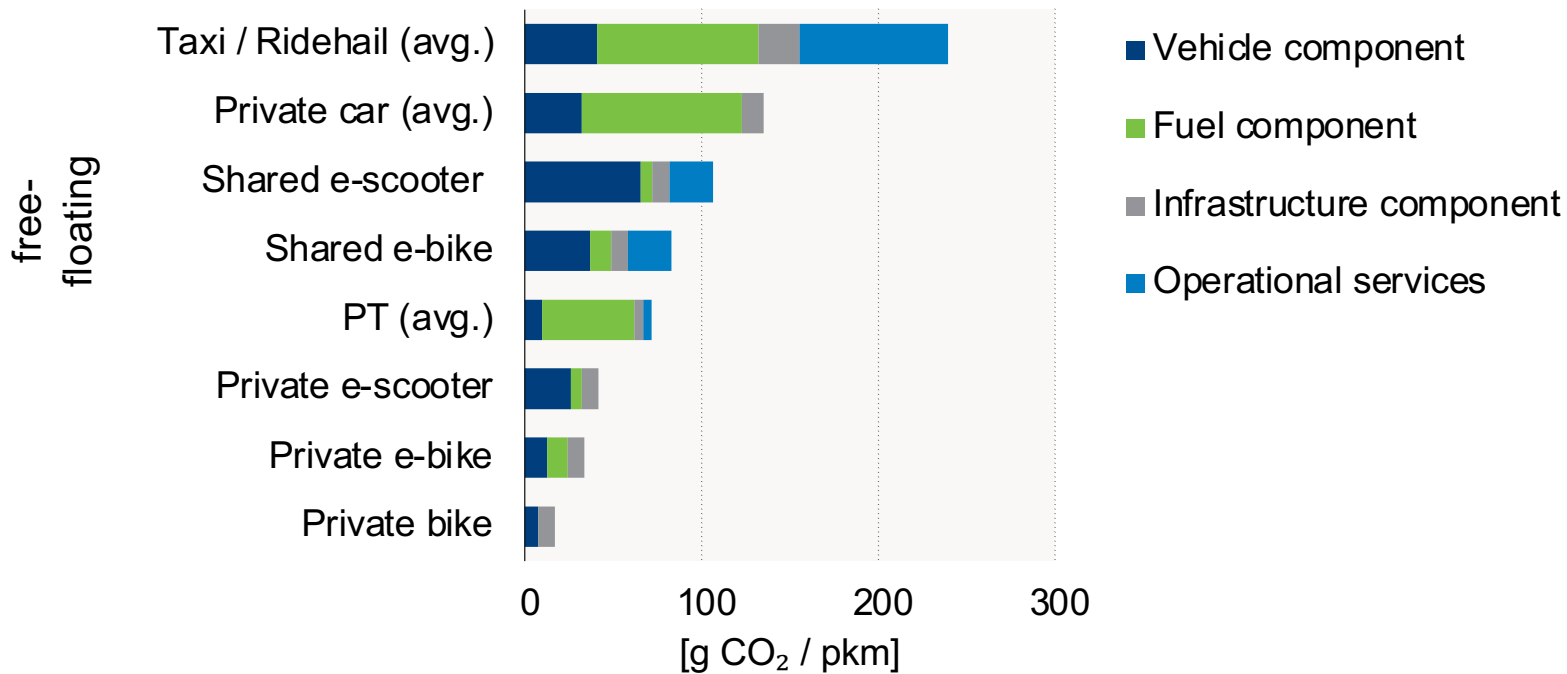
Environmental impacts of (shared) micro-mobility

(Peer-reviewed) literature on shared micro-mobility



Life cycle assessments (LCA) analyse the CO₂ emissions of (shared) micro-mobility

- ITF (2020), de Bortoli and Christoforou (2020), Hollingsworth et al. (2019)



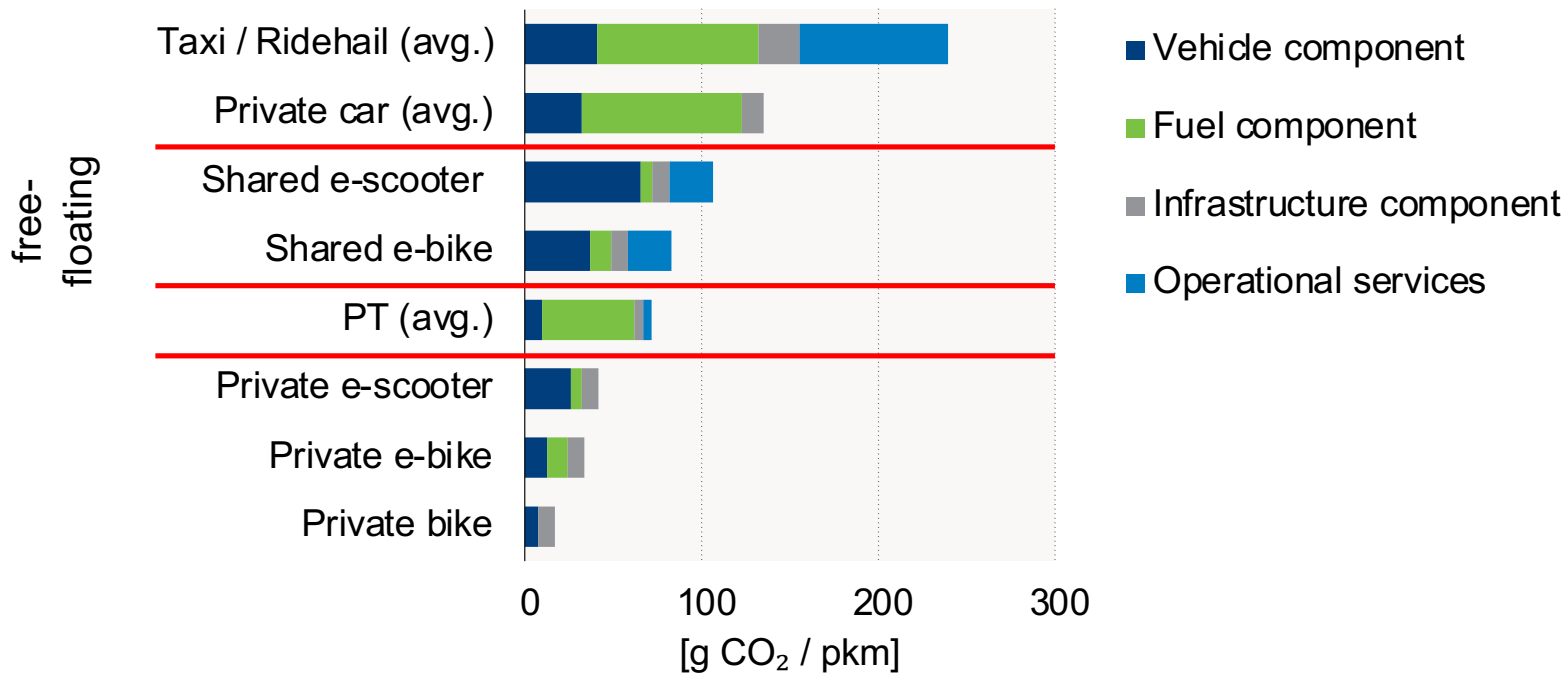
Source: ITF (2020)

Participating organizations in ITF workshops leading to 09/2020 report

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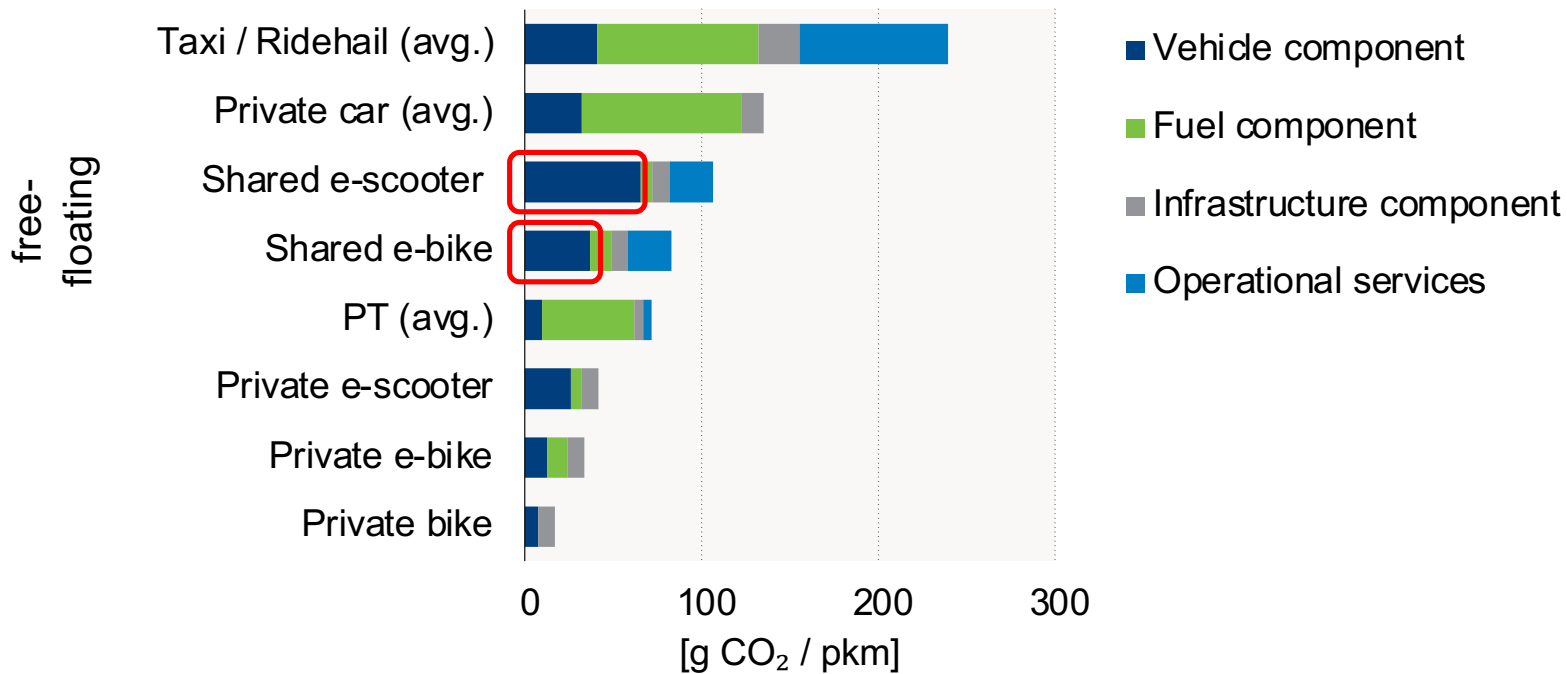
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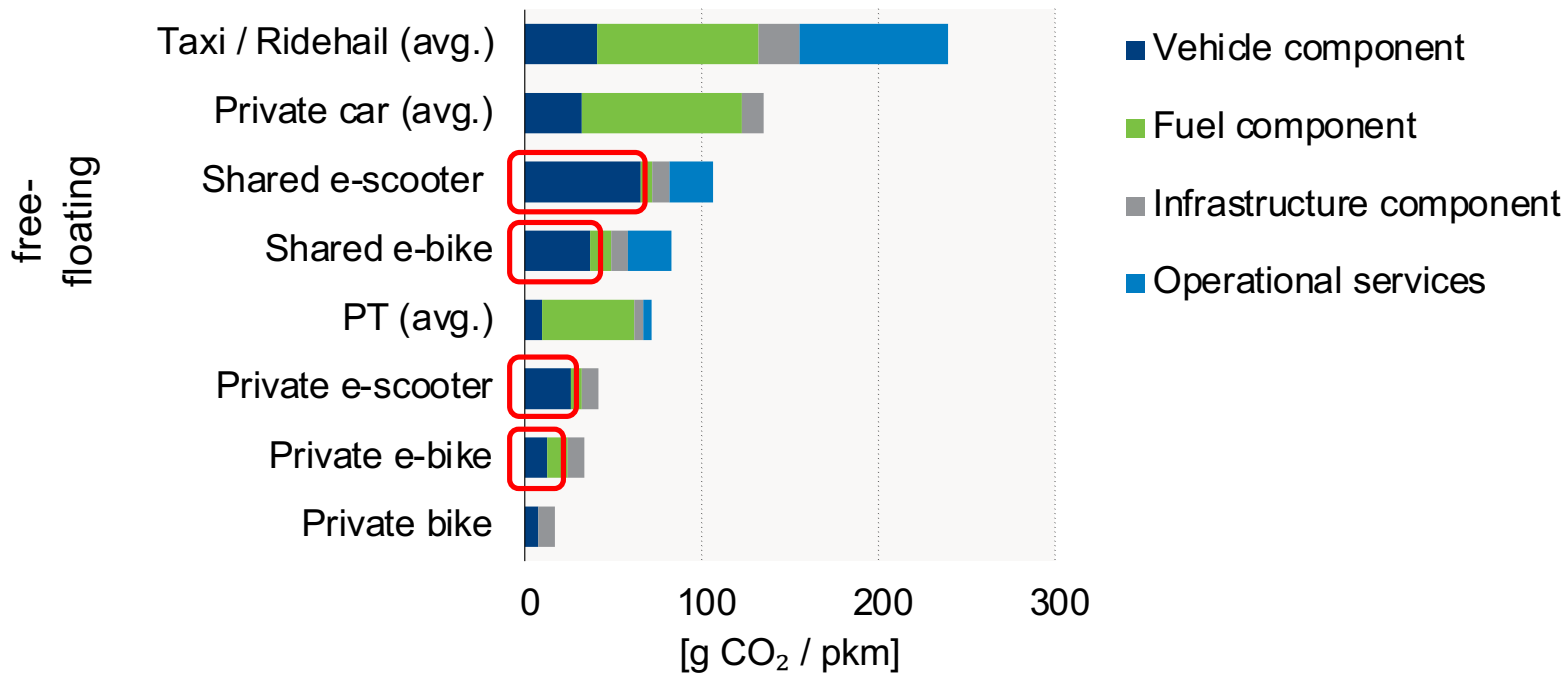
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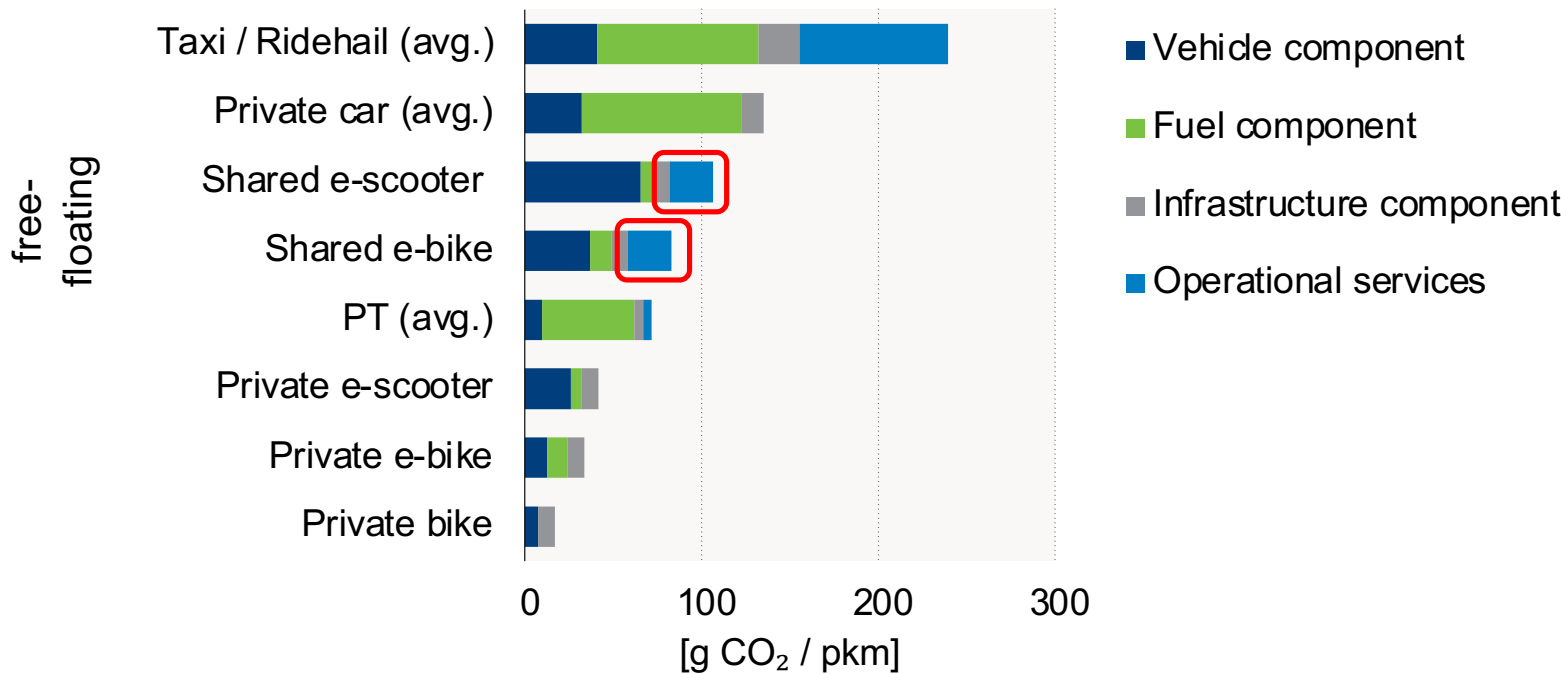
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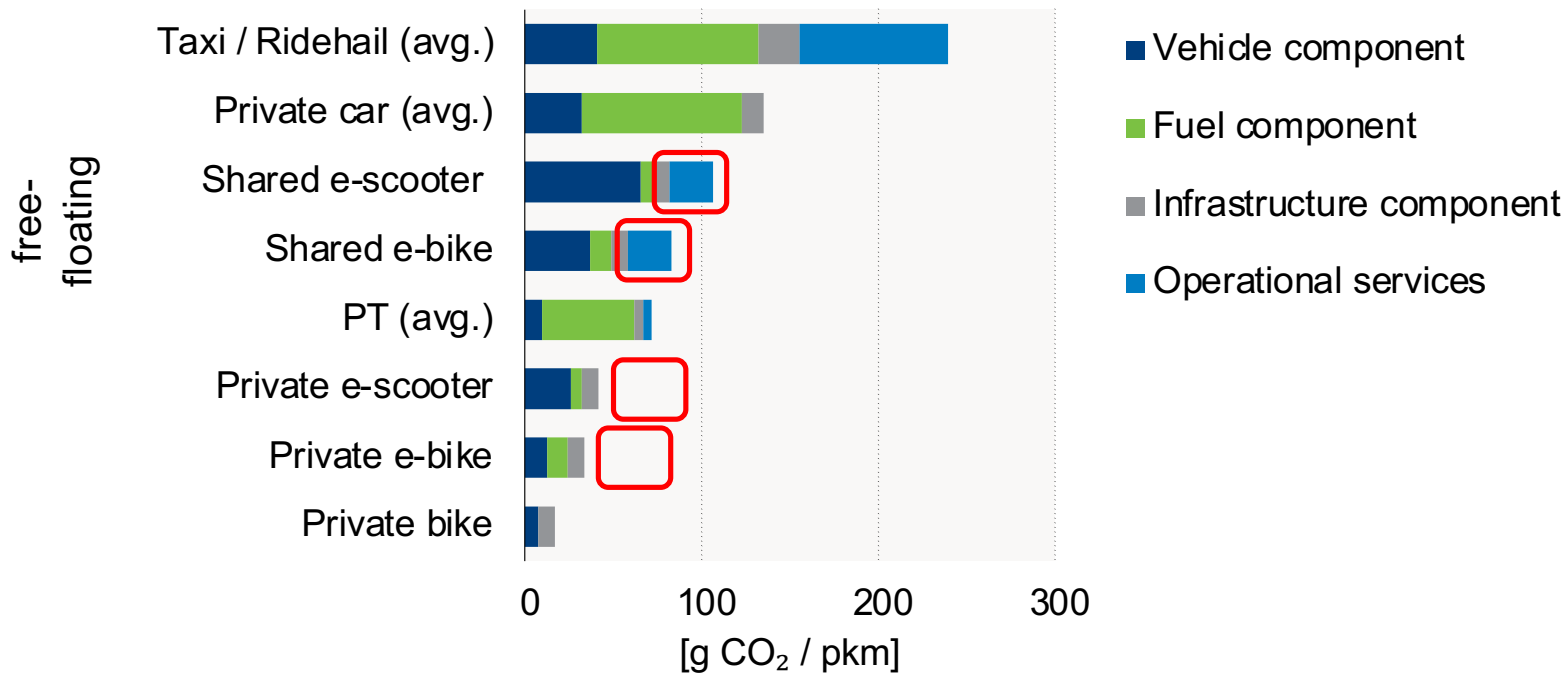
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Summary of findings of 2019/2020 life cycle assessments

ITF (2020), de Bortoli and Christoforou (2020), Hollingsworth et al. (2019)

1. Shared micro-mobility services are **more sustainable** (in terms of CO₂ / pkm) than private cars
2. Shared micro-mobility services are **less sustainable** (...) than public transport
3. Shared micro-mobility services are **less sustainable** (...) than private micro-mobility vehicles

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However, life cycle assessments only provide part of the answer.

How sustainable are shared micro-mobility services really?

- Consider two scenarios of replaced modes
 - A. Shared e-scooter
 - replaces trips otherwise walked (40%)
 - replaces trips otherwise conducted with PT (60%)
 - induces 10% new trips

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A. Shared e-scooter (106 g CO₂ / pkm)

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- We need substitution patterns to evaluate how sustainable a new transport mode is.
- Which substitution patterns do we observe in reality?

Two approaches to elicit substitution rates and derive net CO₂ emissions

Survey-based approach (well established)

- Did you conduct a trip with an [e-scooter, e-bike, ...] in the past 7 days?
- If yes, would you have made this trip if this vehicle had not been available?
- If yes, which alternative transport mode would you have chosen?

Choice model based approach (new)

- Estimate mode choice model
- Set availabilities of mode of interest to 0
- Estimate alternative choices

Two approaches to elicit substitution rates and derive net CO₂ emissions

Survey-based approach (well established)

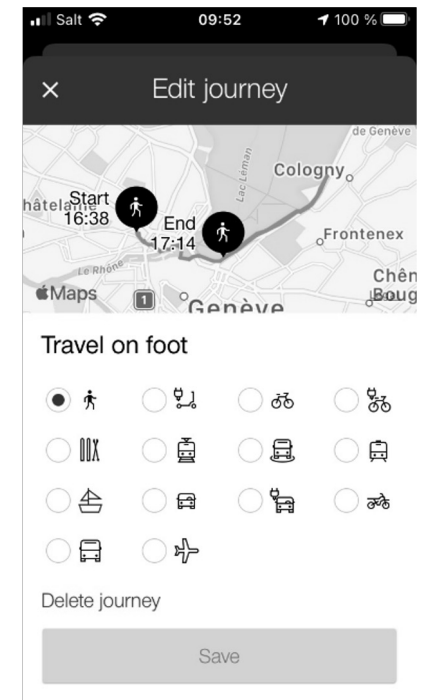
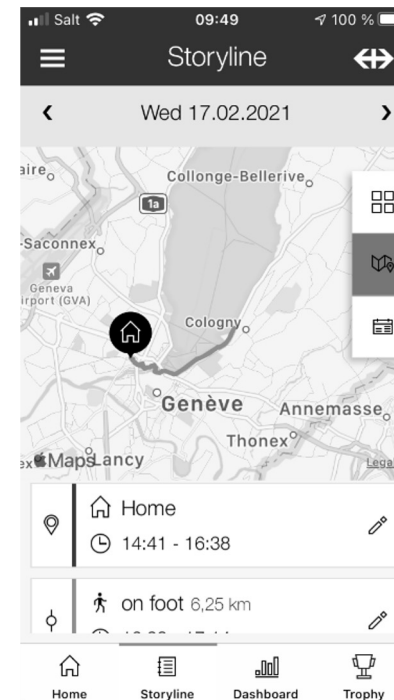
- + Easy & cheap to conduct
(1 survey is enough)
- Survey responses often biased
(recall bias, social desirability bias)
- Responses valid only for last trip
- Metric: trips. But replaced distance is more important to calculate environmental impact

Choice model based approach (new)

- Difficult & expensive to conduct
(GPS tracks + booking data)
- + Less behavioral biases
(revealed preferences)
- + Responses valid for more trips as they are based on preferences
- + Different metrics possible, incl. precise replaced distances

Study design

- Study design
 - 06/2020: 1st survey
 - 07-09/2020: 3 months GPS smartphone tracking
 - 10/2020: 2nd survey
- Recruitment
 - 10 000 invitations sent by cantonal statistical office (ZH)
 - 90 CHF incentive
 - 540 participants completed entire study
 - 65 716 observed trips
- Additional data sources
 - Booking data
 - Vehicle availability
 - Weather data



Substitution rates

Substituted mode	Substitution rates (km-level) by micro-mobility mode			
	E-Bike (personal)	E-Bike (shared)	E-Scooter (personal)	E-Scooter (shared)
Walk	9%	9%	19%	25%
PT (avg.)	29%	43%	27%	38%
Car (avg.)	48%	15%	25%	15%
Bike	14%	29%	27%	13%
E-Bike (personal)		5%	1%	2%
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Calculating micro-mobility net emissions

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Net emissions [g CO₂ / pkm]		-54	25	-16	51

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A current perspective

- How low would CO₂ emissions of shared micro-mobility need to be so that they become more sustainable than the transport modes they substitute in our study?
 - Shared e-scooters: < 55 g CO₂ / pkm
 - Shared e-bikes: < 58 g CO₂ / pkm

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- Which CO₂ emission values are currently reported?
 - Shared e-scooters: 100 g CO₂ / pkm (Krauss et al., 2022)
 - Shared e-bikes: 68 g CO₂ / pkm (Krauss et al., 2022)

Conclusions and implications

- Dockless shared e-bikes and e-scooters (still) emit more CO₂ than the transport modes they replace
- What can we (continue to) do?
 - Durability
 - Charging stations
 - Incentives
 - Integration
- Personal e-bikes and e-scooters (already) emit less CO₂ than the transport modes they replace
 - Subsidize personal sales (e.g., JobRad)
 - Incentivize their use (e.g., bike to work)
 - Improve / expand cycling infrastructure (E-Bike City ?!)

Thank you for your attention.

Questions?