

Ein multi- und intermodales Erreichbarkeitsmodell für Arbeitsstandorte (EMMA)

Empowering multi- and intermodal workplace accessibility analysis

Modelling intermodal and multimodal workplace accessibility with the help of open source tools

ETC Conference, 2020-09-09

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Outline

1. Project context
2. Background: the role of the workplace location
3. Accessibility Model
4. First results
5. Relevance for policy & practice
6. Questions & Discussion

1. Project context: EMMA's goals

„Development, application, and assessment of a model to optimize the accessibility of workplace locations in terms of multimodal and intermodal mobility“

- (1) Identification and quantification of relevant impact factors on workers' mobility behavior
- (2) Development of an accessibility model that enables sustainable development of workplace locations
- (3) Application of the model in the metropolitan region (regional scale) as well as on a smaller scale on selected cases studies in order to develop and assess scenarios for future development
- (4) Contribution to a better understanding of multimodal and intermodal accessibility analysis for workplace location development

2. Background: the impacts of the workplace location

- "Mobilität in Deutschland 2017", Munich data:
 - Share of *job related* trips is increasing: 25% in 2008, 34% in 2017
 - Share of *to work* among all trips in Munich similarly: 13% (2008) → 19% (2017)
- Most overcrowded PT vehicles and traffic congestion happen during the peak hours!
- **individual level:**
 - impact on the daily mobility behaviour / mode choice (e.g. Silva, Golob, & Goulias, 2006)
 - Daily routines and trip chaining for other activities (e.g. Bell, 1991)
 - long-term mobility decisions: car ownership, public transport subscriptions (e.g. Beige & Axhausen, 2012)
 - Daily mobility experience → "elevator small talk"

2. Background: the impacts of the workplace location

How does the location of a workplace influence mobility behavior and car ownership of its workers?

Some selected findings from the literature:

- the built environment impacts mobility behaviour through the 4 D's: *density, diversity, design, distance to public transport* (Cervero and Kockelman, 1997; van Wee, 2002)
- Levinson (1998): "*living in an area with relatively high accessibility to jobs is associated with shorter commutes*"

So far, the focus has been the residential location. **What about the workplace as a destination?**

- if a workplace is relocated from a central area to a non-central area, car use increases (Bell, 1991; Hanssen, 1995; Naess and Sandberg, 1996; Aarhus, 2000; Vale, 2013; Sprumont et al., 2014; Zhao, 2017)

2. Background: the impacts of the workplace location

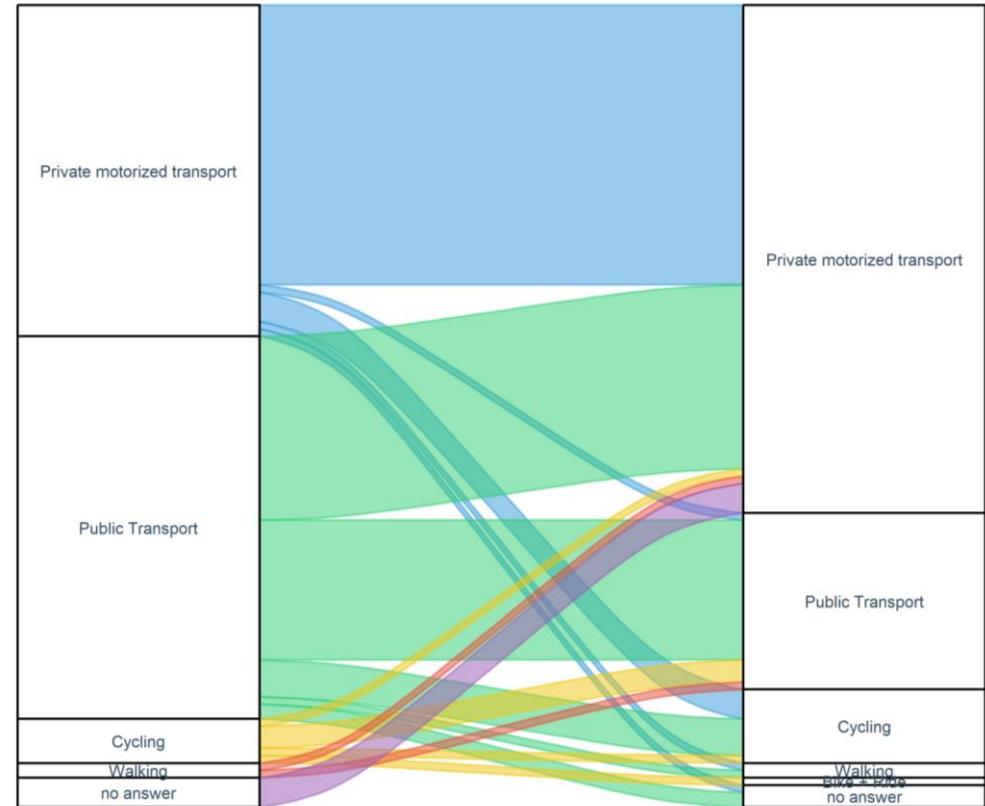
How does the location of a workplace influence mobility behavior and car ownership of its workers?

Vale (2018:) "*(the) built environment of destinations has been pointed out as more important than the built environment of origins in explaining mobility patterns for several travel modes (...), especially if the destination is a regular, consistent destination such as the workplace*".

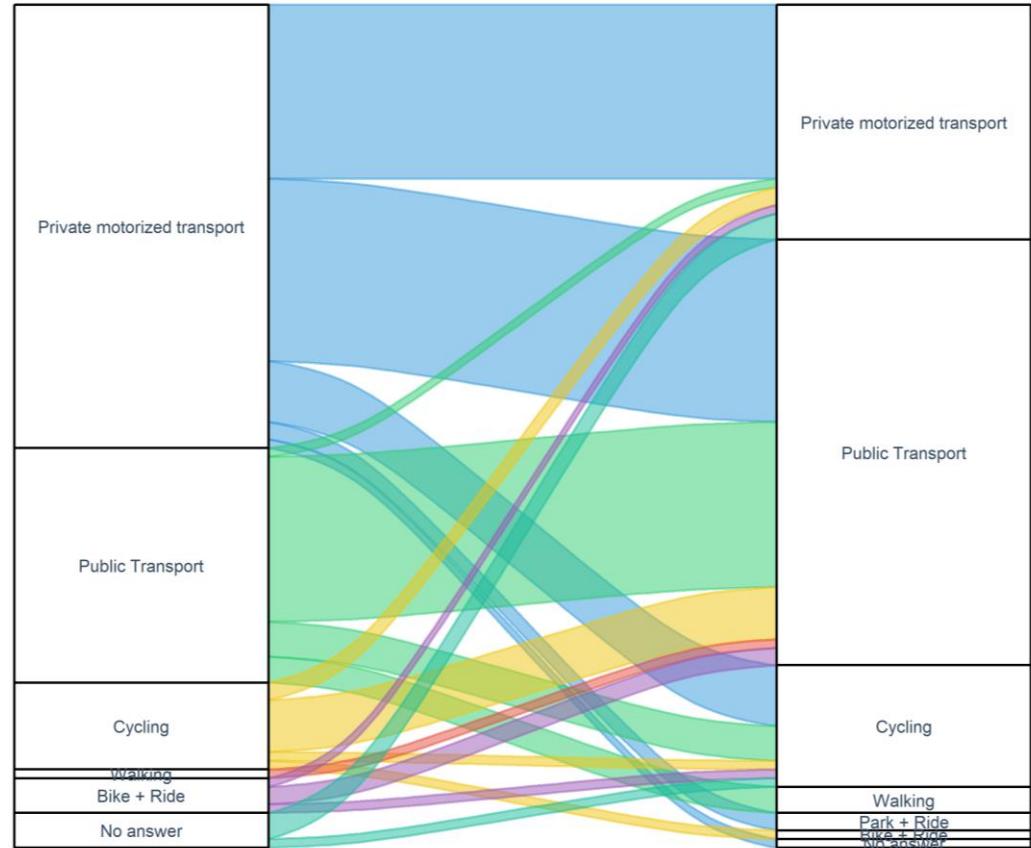
Problem: If we observe relocations, there are other socio-economic, attitudinal, but also practical factors that impact the ex-post commuting behavior.

Solution: We look at data where the workplace is changing, but other factors stay stable.

**What happens if
the new workplace
is in an "other"
location, and was
before centralized
urban?**



When it changes
in the **opposite**
direction ("other")
→ "urban"), we
observe the
opposite effect:



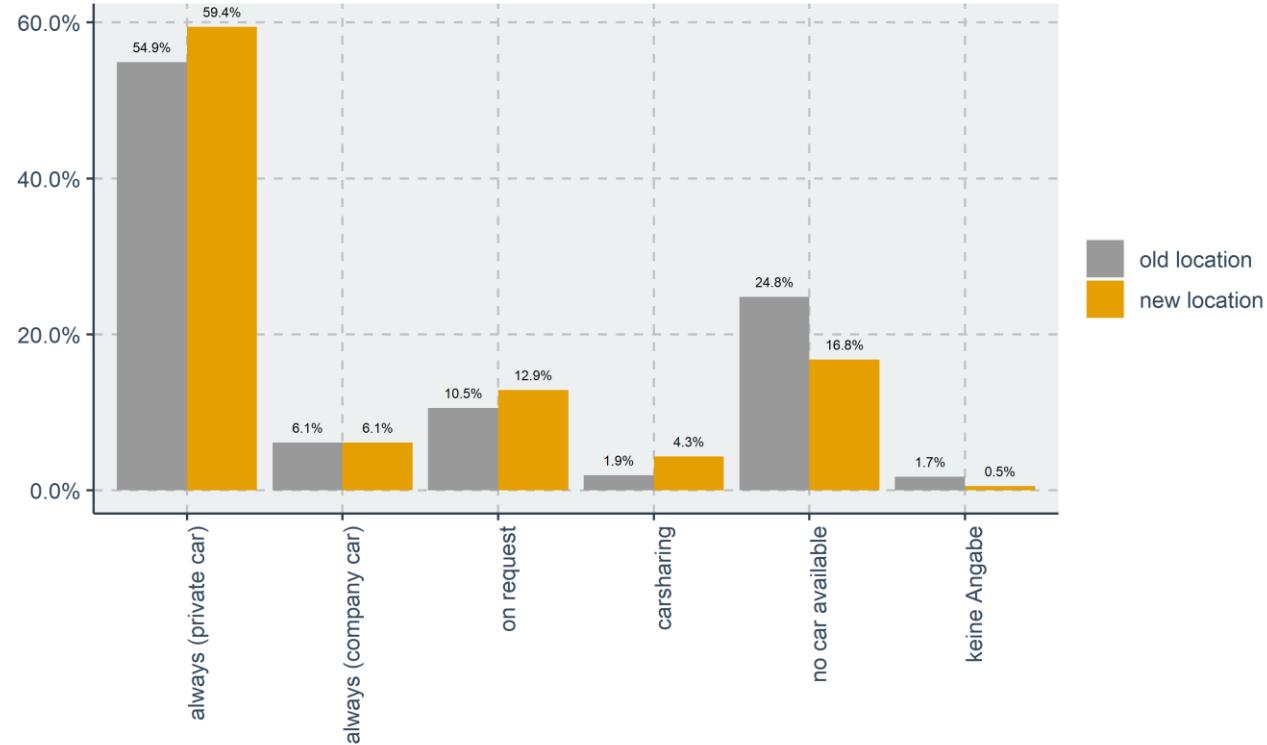
What do we learn from this?

- strong **inter-dependence** of the workplace location and the mode to work!
- relatively strong **elasticity** in the mobility behaviour of workers: the workplace relocation is a tipping point in life and the mobility routines are re-evaluated.
- For policy and practice, this hints at a potential for **behavioural change**:
 - "workplace location changers" should be addressed in **targeted mobility management programs**
 - The high impact of the workplace location calls for strategic regional workplace development with attention to the workplace locations' accessibility.

What about car ownership?

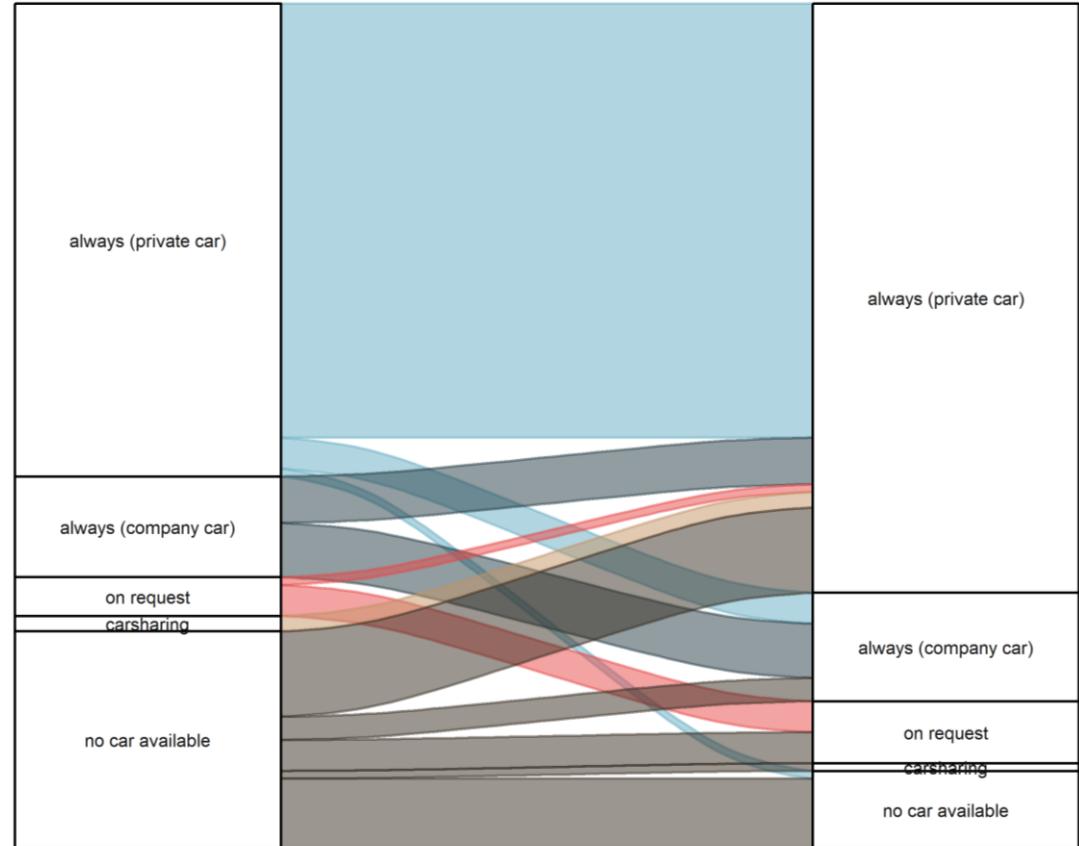
Car Availability

before and after workplace location change



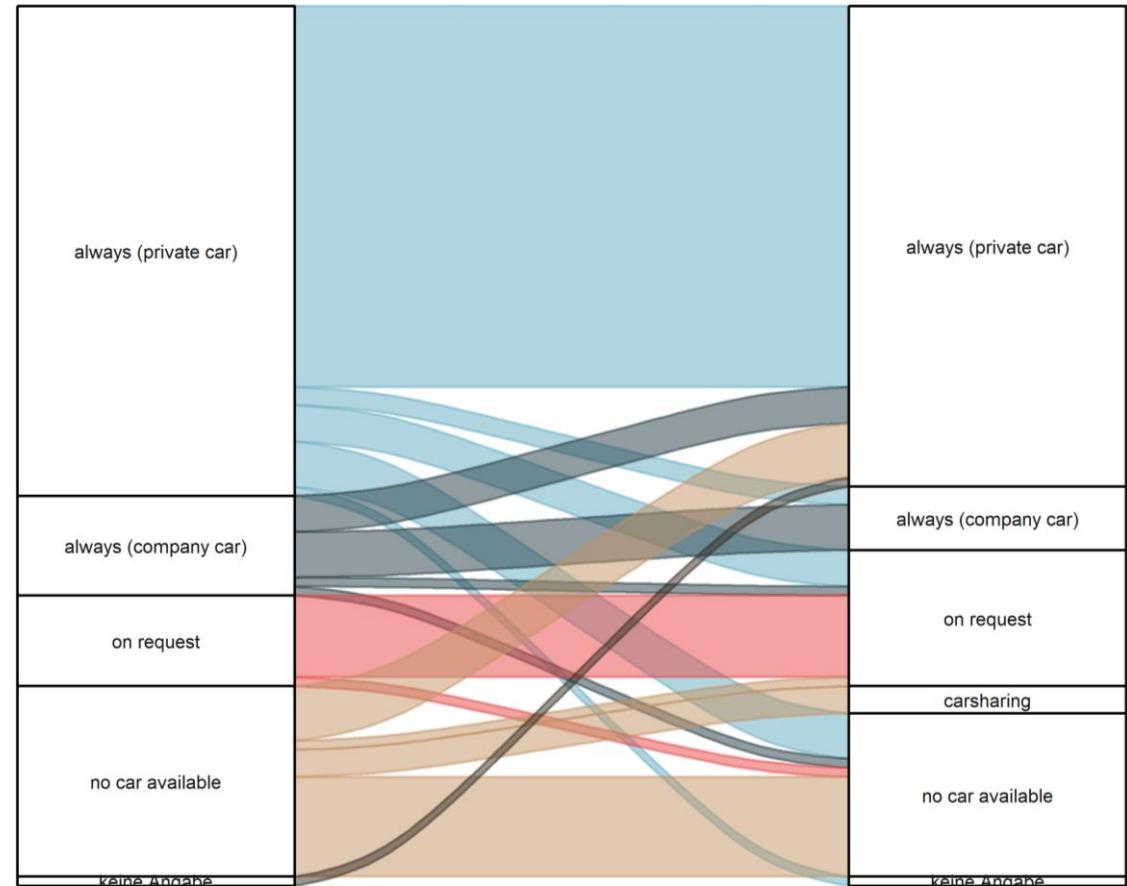
Car Ownership: Flows

**Change from
"urban" to
"other"**



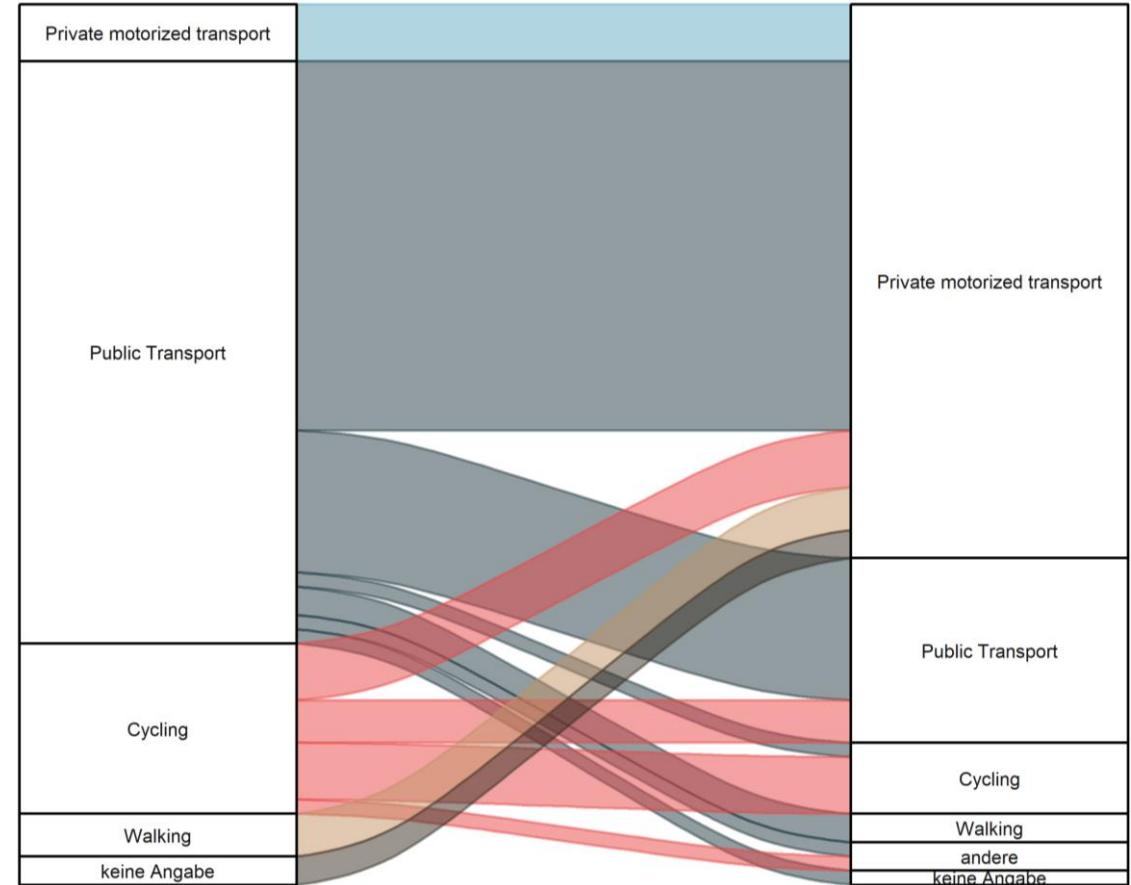
Car Ownership: Flows

**Change from
"other" to
"urban"**



Car Ownership: Flows

**What happens
after increasing
car ownership?**



What do we learn from this?

- The **elasticity** of car ownership is very low when it comes to **reducing car ownership**
- "If people feel they need a car, they will get one" – **workplace locations** should not be responsible for this perceived necessity!
- **Preventing car ownership** is easier (and more realistic?) than reducing car ownership
- Reducing the **negative impacts** of "passive car ownership" becomes relevant
- Reduce on-street parking / increase prices

How are we organizing workplace development in reality?

... in the Region of Munich:

- **We don't.** (at least not in a coordinated way throughout the region).
 - *Kommunale Planungshoheit* ("municipal planning autonomy"): municipalities decide where and how many jobs can be created through land use planning
 - Companies eventually make the *real* decision!
- **Consequence: The criteria for workplace locations are usually economic:** Workplaces, taxes, production factors for the companies.

3. Accessibility?

*“the extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s) (at various times of the day)”.
Geurs, K.T., van Wee, B., 2004*

$$A_i = \sum_j D_j f(c_{ij})$$

- A_i = Accessibility to destinations D from point/zone i
D_j = Activity destinations (opportunities) at points/zone j
c_{ij} = Generalised costs (time, price, comfort) of the trip
cf. Hansen, 1959

Monomodal / multimodal / intermodal

- State of the art accessibility analysis it **mostly monomodal or multimodal**
 - multimodal:
 - Comparative: modes are compared
 - Combined: integrated indicator
- However, intermodal trips **are frequent** and have a high **practical relevance**
- New mobility services (bikesharing, on-demand shuttles, e-scooters, ...) have their greatest potential **in combination with transit**, not as an alternative
 - Both in terms of sustainability, performance, and pricing

How can accessibility modelling help?

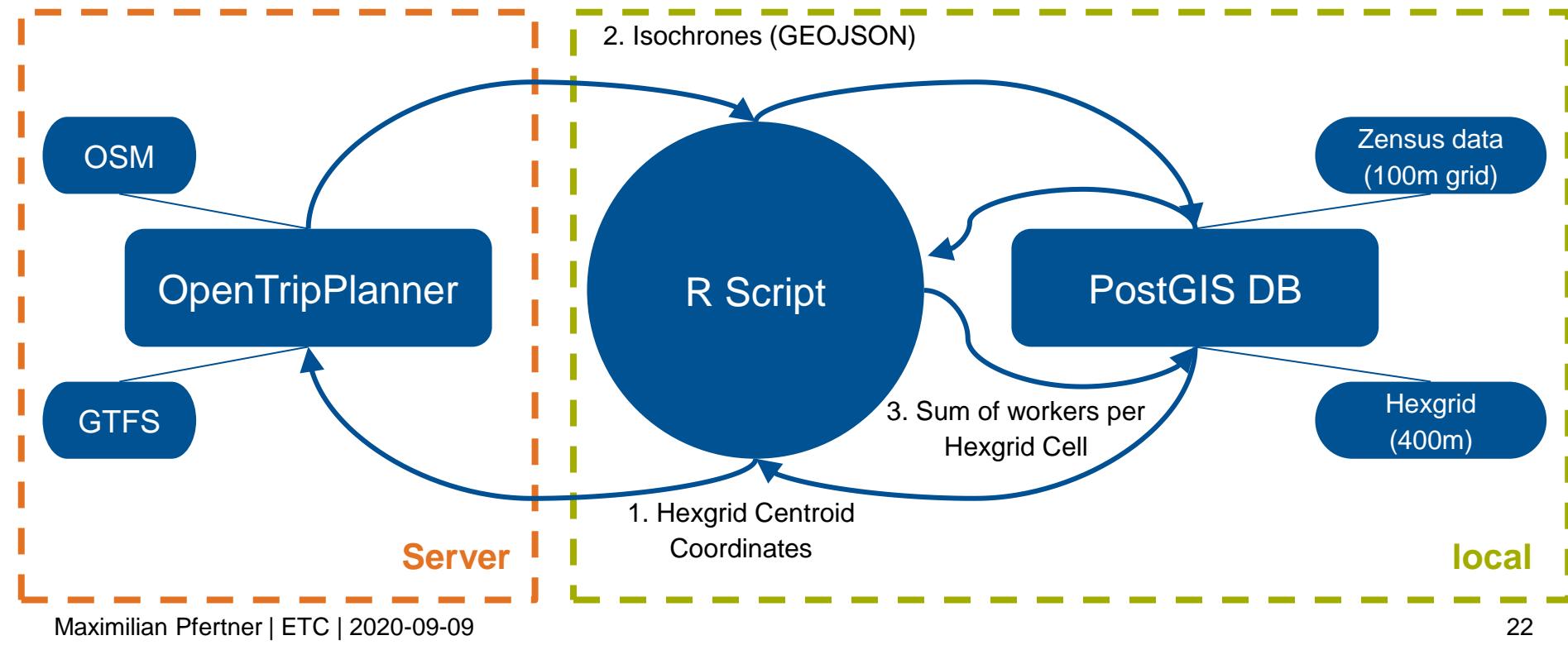
- Analyze the combined **potential of location** and **transport supply**
- Provide recommendations for land use and transport supply
- Compute a comparable figure to analyze both entire regions and specific locations
- Uncover locations with a mismatch of demand and supply

But...

- Analyses have been monomodal in the past
- Tools were expensive and complicated to use
- Data was scarce, especially on public transport supply
- The workplace from the firm's point of view has not been a focus of research

→ EMMA is multimodal, intermodal, open source, web-based (at least the output for now) and made for workplace locations

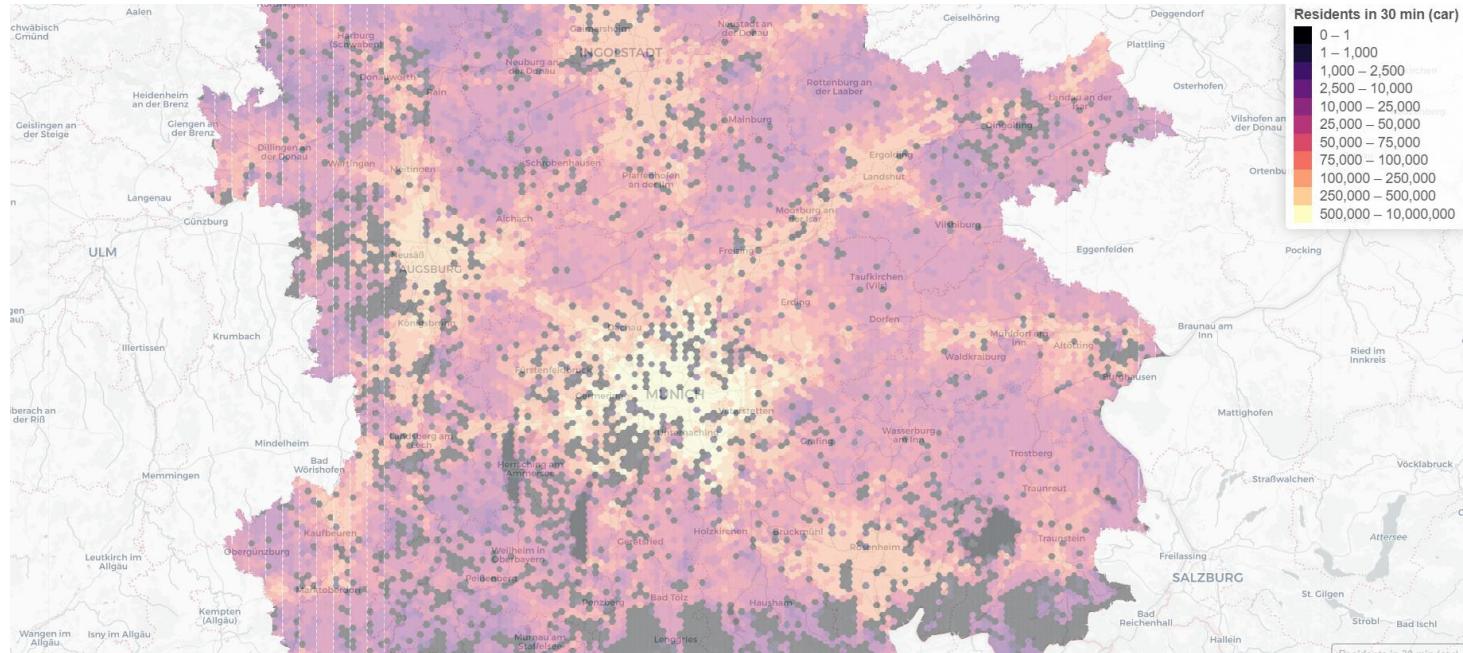
Model Architecture



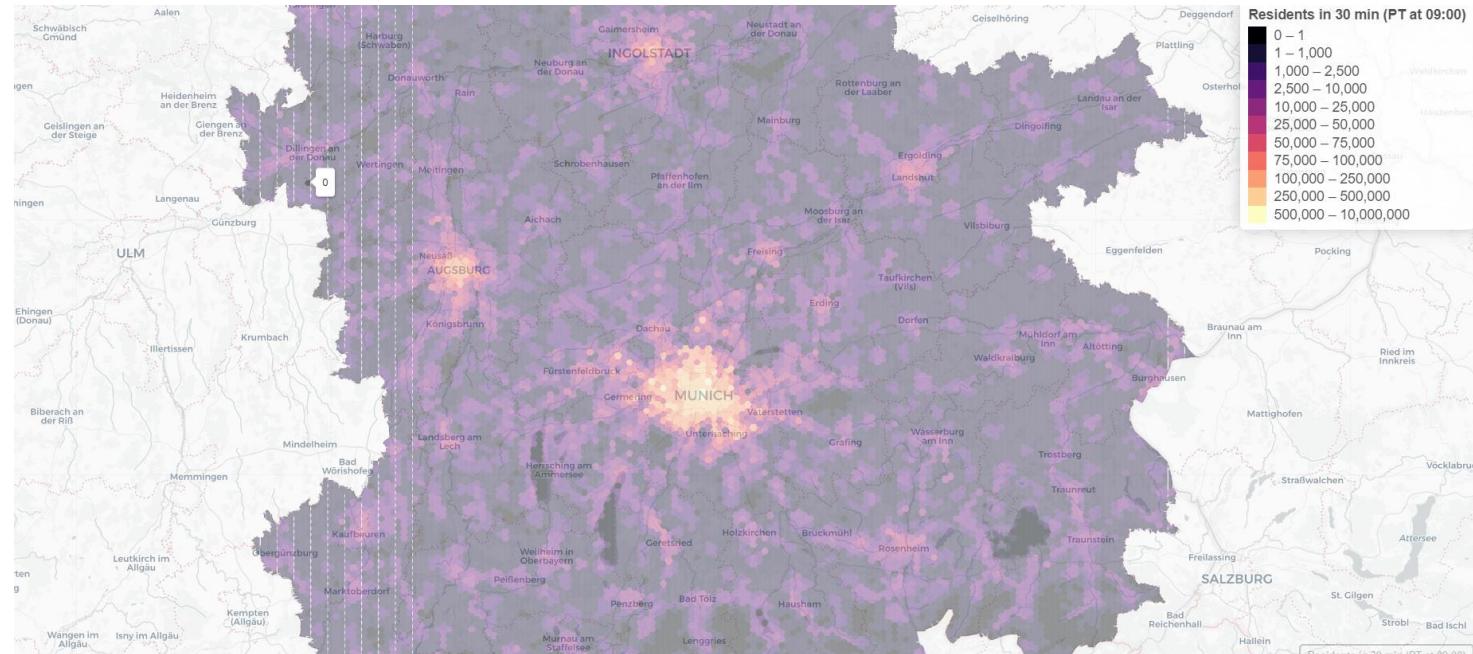
4. EMMA in action – first results

1. Regional overview of multimodal accessibility
2. Intermodality in practice – the example of KIM
3. Scenario Analysis in Public Transport

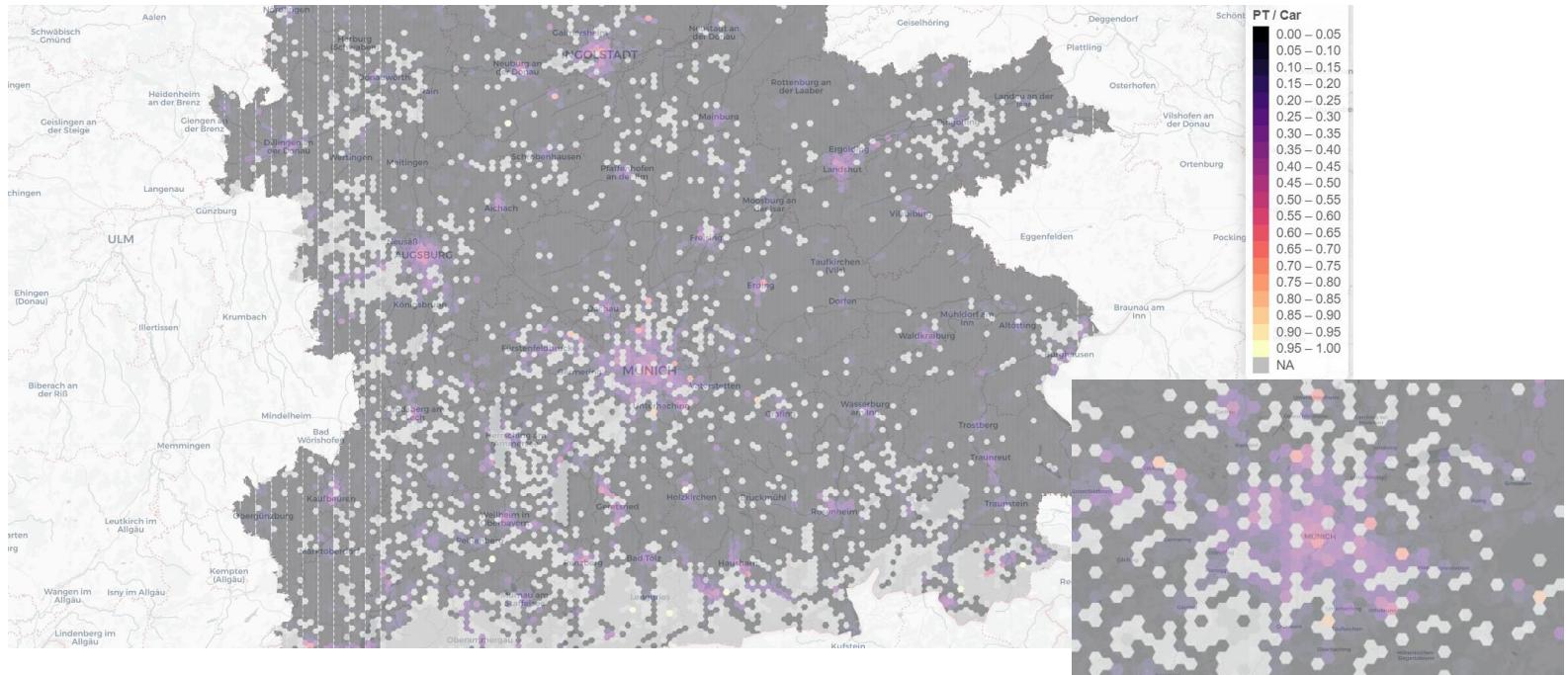
Regional overview of multimodal accessibility: Car



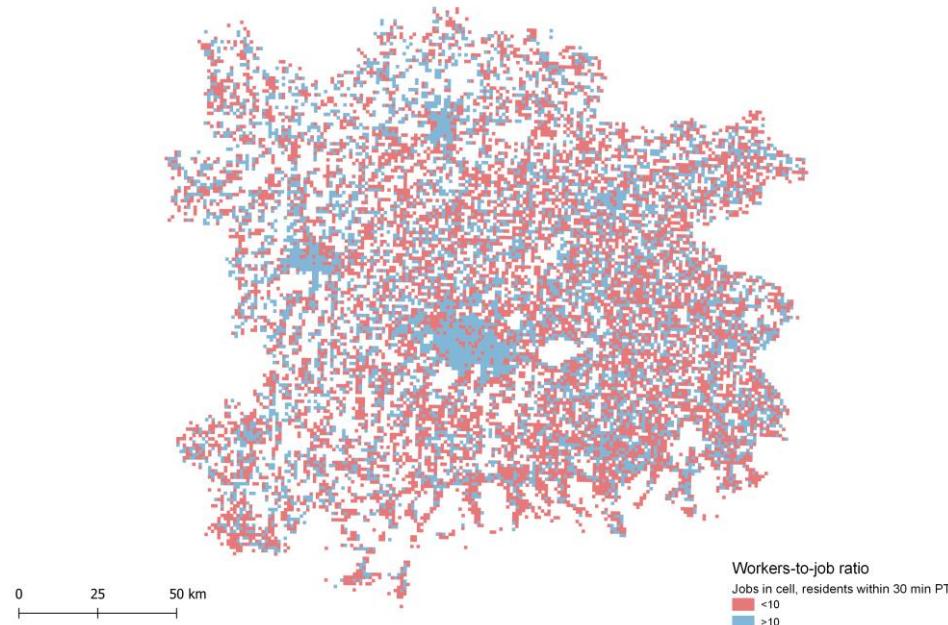
Regional overview of multimodal accessibility: PT



Regional overview of multimodal accessibility: PT / Car



Accessible population (PT) vs. Jobs in Cell



Intermodality in practice – the example of KIM

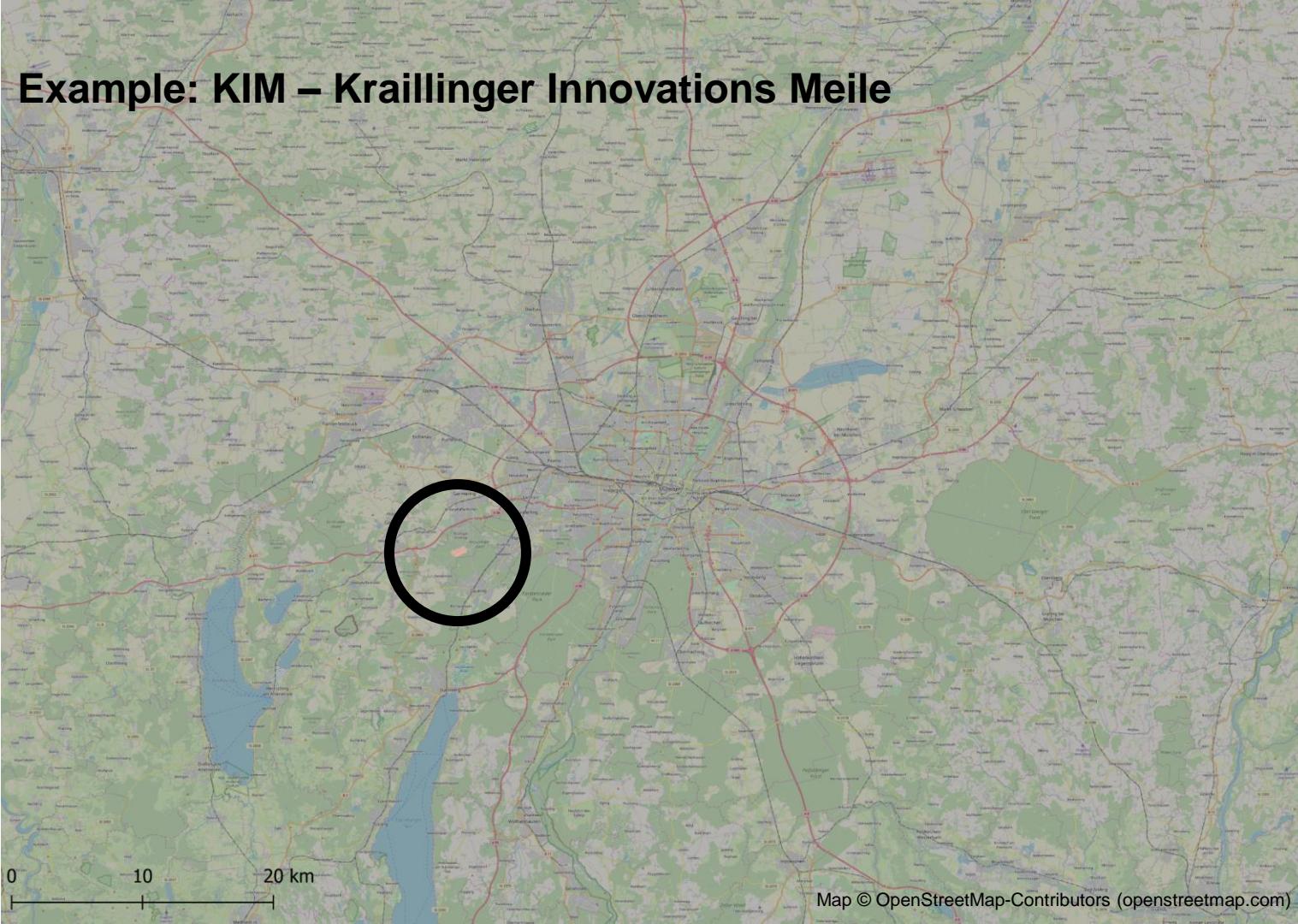
Kraillinger Innovations Meile:

- Industrial/Commercial area with 1,600 workers
- Located "in the forest" between two commute rail axis
- Car is predominant mode to get there

Question:

- How can intermodality (Bikesharing / Bike&Ride) improve the accessibility of the location?

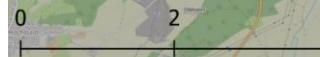
Example: KIM – Kraillinger Innovations Meile



0 10 20 km

Map © OpenStreetMap-Contributors (openstreetmap.com)

Example: KIM – Kraillinger Innovations Meile



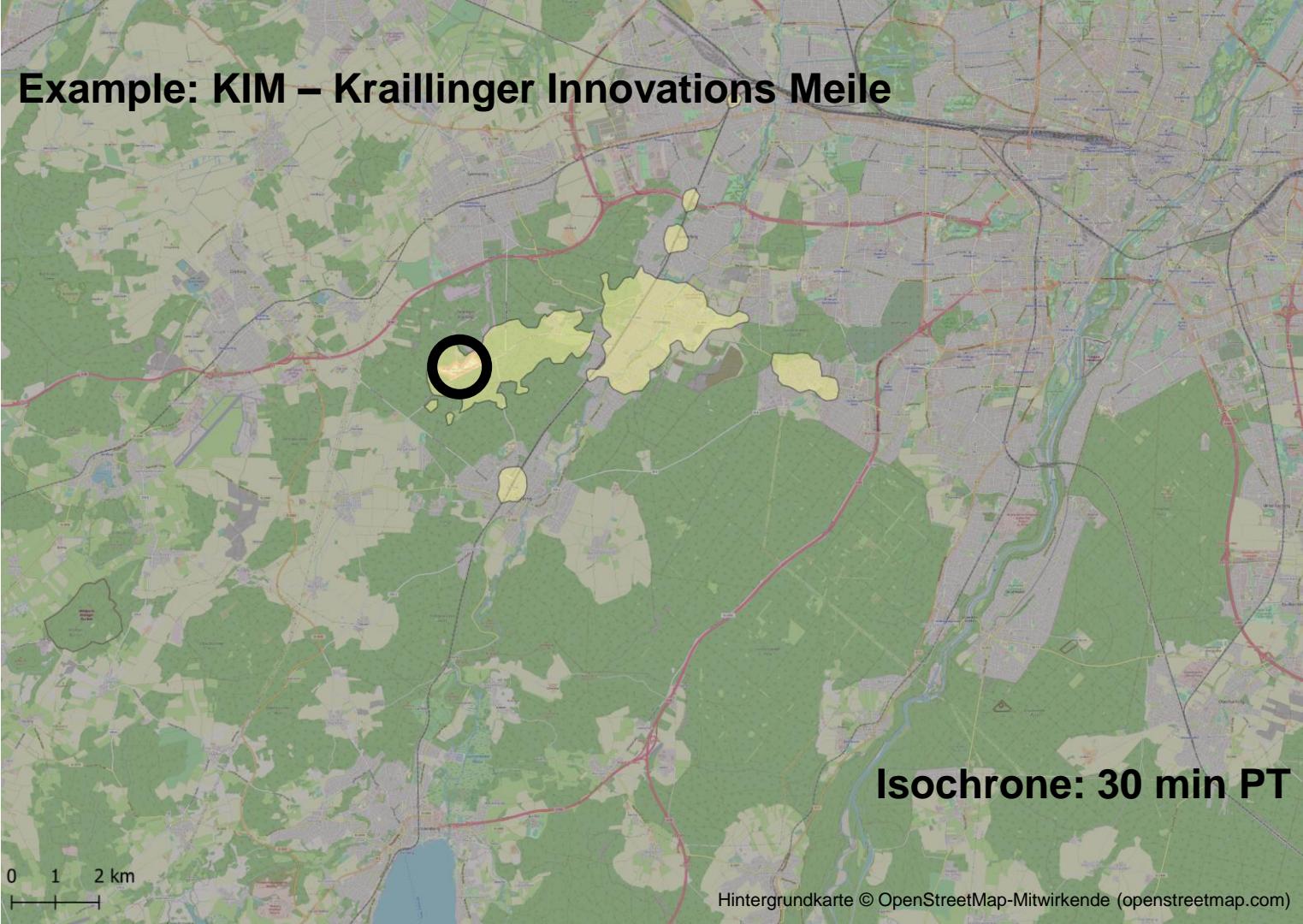
Example: KIM – Kraillinger Innovations Meile



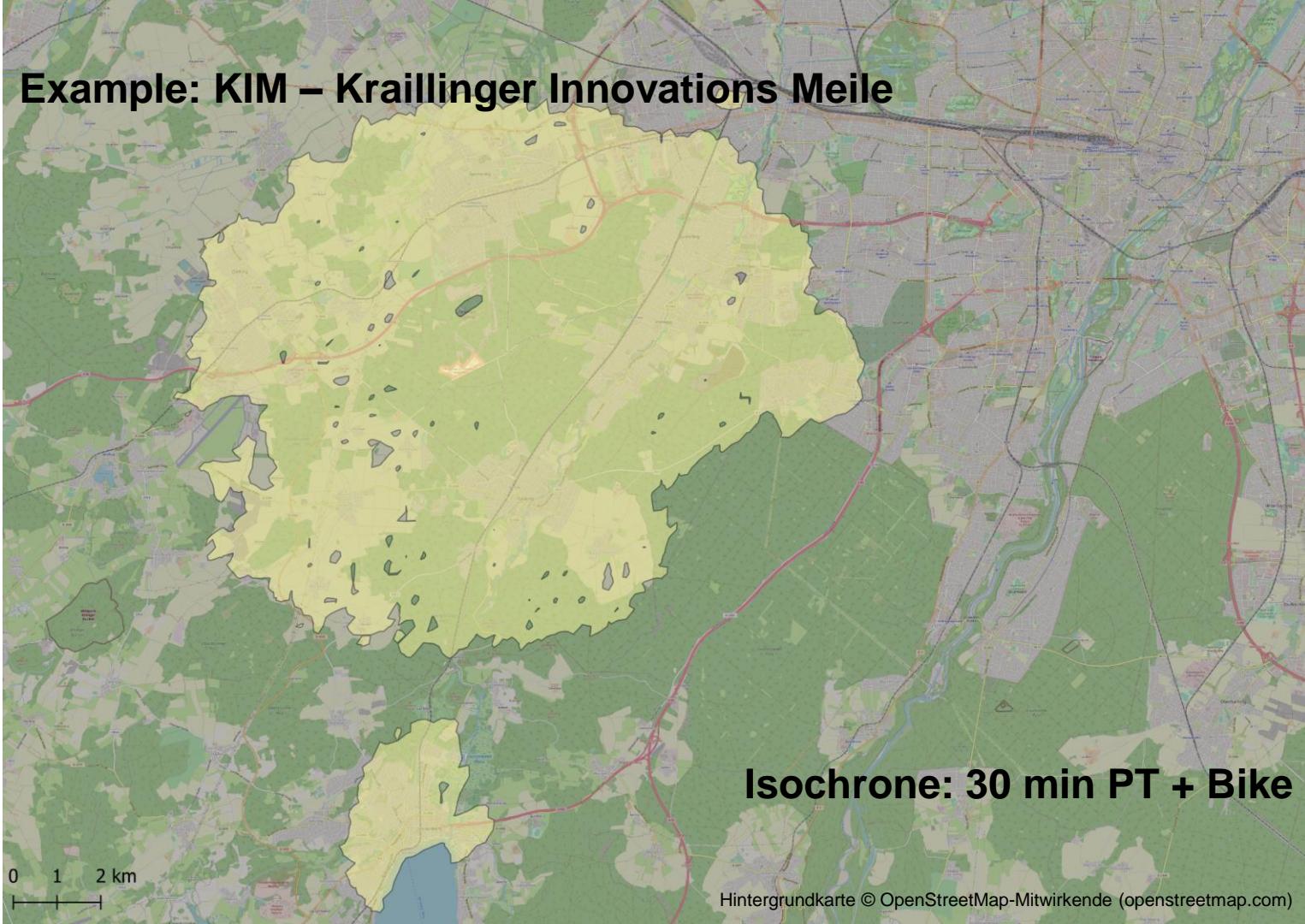
0 0.5 1 km

Map © OpenStreetMap-Contributors (openstreetmap.com)

Example: KIM – Kraillinger Innovations Meile



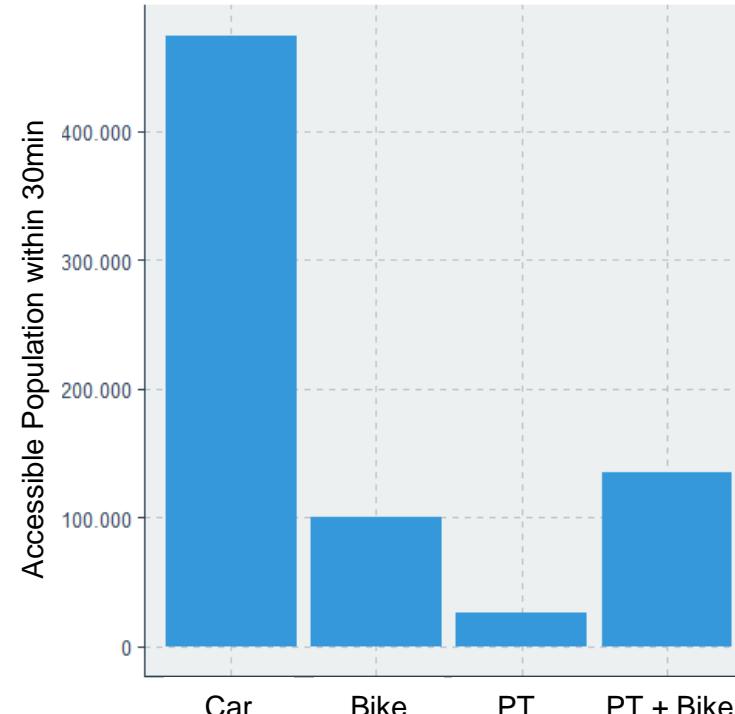
Example: KIM – Kraillinger Innovations Meile



0 1 2 km
A horizontal scale bar with markings for 0, 1, and 2 kilometers.

Hintergrundkarte © OpenStreetMap-Mitwirkende (openstreetmap.com)

Effect of intermodality (*PT + bike*) at KIM



Scenario Analysis in Public Transport

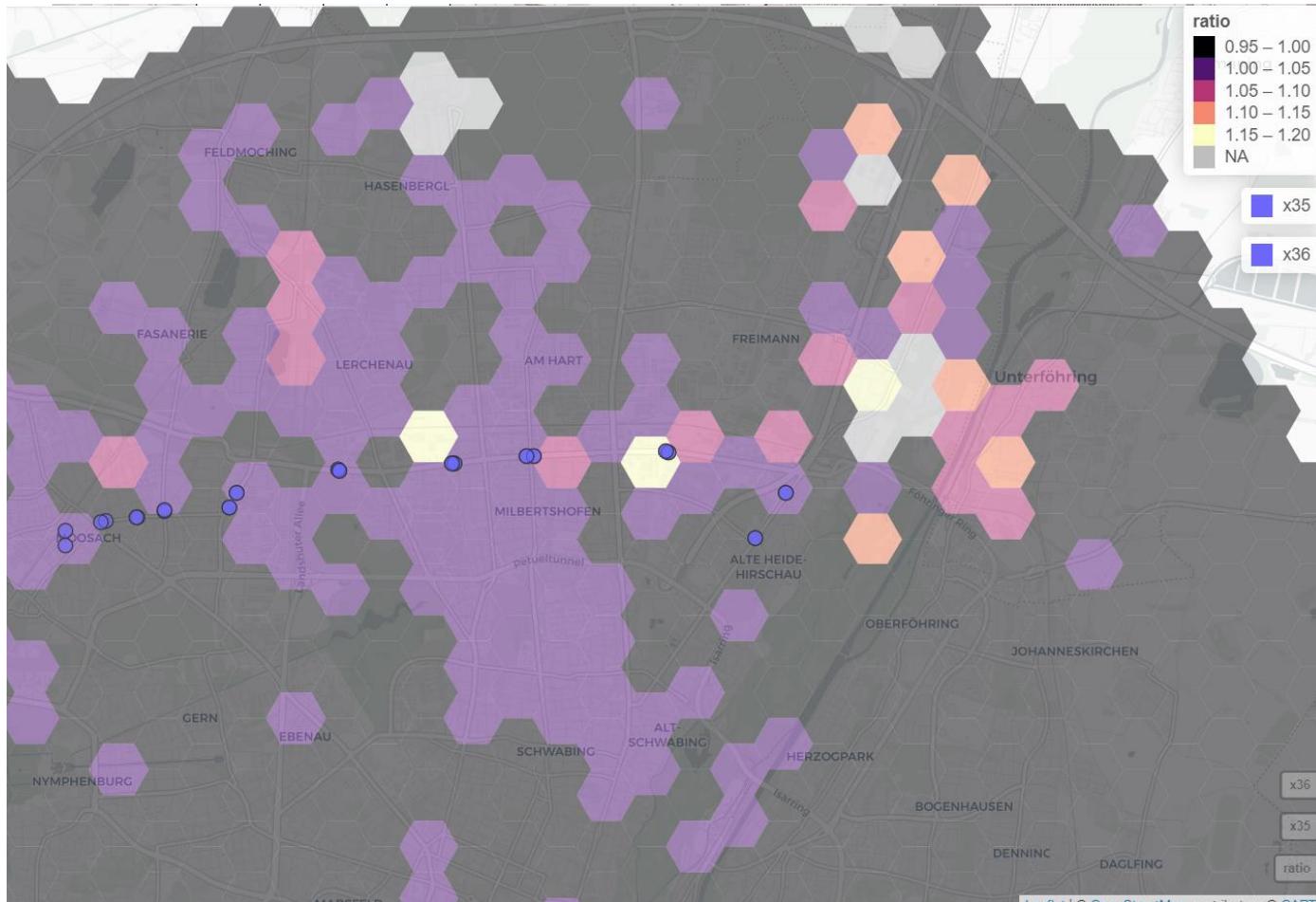
Express bus X35/36 – "faster trips to your workplace"

- Introduced in recent years to enable faster tangential connections in the north of Munich

Question:

- How do the new express bus lines affect the accessibility in the north of Munich and beyond?





EMMA's policy implications

- Location matters! The workplace location has a significant impact on mode choice and car ownership
 - All other sustainable mobility measures are struggling if the location is not good
- The reality does not consist of just drivers and transit users – don't forget intermodal and multimodal behavior
- With intermodal first-/last mile solutions, we can improve the attractiveness of transit a lot – beyond the obvious
- Accessibility analysis can help to plan for new services (e-Scooters, urban cable car, ...)
- Accessibility analysis is becoming easier thanks to open data and open source tools – we just need to puzzle the parts together

Thank you for your attention! Let's discuss...

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Let's stay in touch!

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