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Integrating Dynamic Ride-Sharing into an Agent-Based Traffic Simulation: A Sensitivity Analysis

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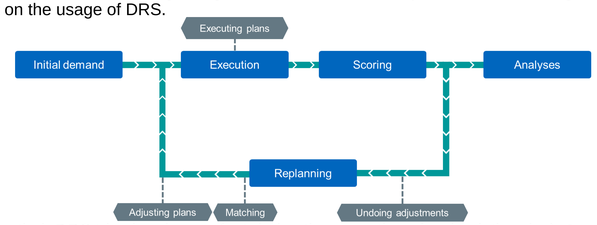
OBJECTIVES

Objective 1: Identifying **potential of dynamic ridesharing (DRS)** as a mobility solution.

Objective 2: Assessing **potential positive impacts** on possible mileage and environmental effects.

OVERVIEW

We use the **agent-based simulation framework MATSim** to simulate dynamic ridesharing (DRS) and extend it with a module that **simulates pick-ups and drop-offs** of other agents. In this study, we conduct a **sensitity analysis** of several simulation parameters to find significant influences on the usage of DRS.



Agents plan their DRS trips in advance (not during the execution of a simulation day). Agents that are willing to use DRS can become a DRS rider or a DRS driver (if car and driver's license available). If one of their trips is assigned as DRS rider or DRS driver, an algorithm is applied to find suitable trip matchings.

The willingness to use DRS is based on a classification of pro:motion types

- *Spontaneous - on the Go* (12 %)
- *Highly Informed Sustainability* (22 %)
- *Efficiency-oriented information Pickers* (12 %)
- *Interested Conservatives* (22 %)

as potentially interested in DRS, whereas on the other side, the *Low Demand* (19 %) and *Digital Illiterates* (13 %) are not assigned to DRS pe se.

KEY FINDINGS

The share of DRS significantly increases if

- the departure time of the DRS rider can be adapted by up to 1h
- also short trips are included to be used for DRS
- there are incentives for the DRS driver
- a higher share of the population is willing to use DRS

In the **maximum scenario**, we identified a **1.8% share of DRS riders**, representing a realistic potential for DRS under favorable conditions.

METHODS

Matchmaking of agents

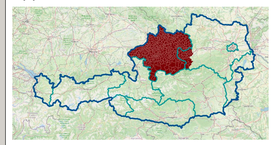
DRS rider and DRS driver have the same origin and destination zone (**cell size** of square)

DRS rider and DRS driver need to depart within the same time bin: **time segment duration**

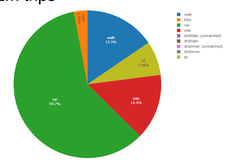
DRS rider can **adjust** their **departure time** to a configurable amount of time

Case study

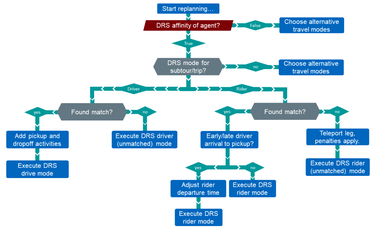
Upper Austria



Population: 25% sample
1.295m people – 323k agents
Network: 418k links, 186k nodes
~ 1m trips



Assignment of DRS modes



Additional **configurable parameters:**

- **Agent's affinity to DRS**
- **Minimum DRS driver leg**
- **Minimum DRS rider leg**
- **Penalty for not being picked up**
- **Maximum waiting time for the DRS rider**

The evaluation of DRS rider trips and DRS driver trips can be changed in the way that DRS riders have to pay a fix amount of money per kilometer (**DRS rider cost**) whereas DRS drivers will earn a configurable amount of money per kilometer (**DRS driver profit**).

The value of travel time savings (VTTS) is set to **80% of the VTTS of car drivers**.

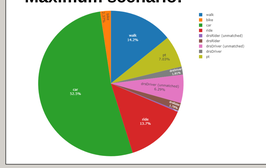
The *default scenario* and **maximum scenario** are set as following:

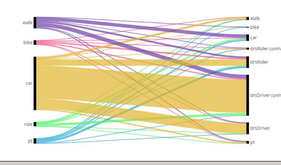
Cell size	Time segment duration	Adjust departure time	Agent's affinity to DRS	Minimum DRS driver leg	Minimum DRS driver leg	Penalty for not being picked up	Maximum waiting time for DRS rider	DRS rider cost	DRS driver cost
4000 m	*3600 s*	*900 s*	*50%*	*20 m*	*20 m*	*10 EUR*	*180 s*	*0.05 EUR*	*0.05 EUR*
4000 m	**7200 s**	**7200 s**	**100%**	**20 m**	**20 m**	**10 EUR**	**60 s**	**0.05 EUR**	**0.50 EUR**

RESULTS

Modal shifts

Maximum scenario:





DRS drivers and DRS rider **mostly** come from **previous car trips**. There is just some minor substitution from walk or public transport trips.

Mileage

Our study revealed an **increase in Vehicle Kilometers Traveled** (VKT) after introducing DRS in the scenarios. However, a notable share of these VKT results from unmatched DRS drivers for which no statement can be made if they would genuinely opt for this mode.

Default scenario: up to 400,000 km (+1.3%) more VKT

Maximum scenario: up to 560,000km (+1.7%) more VKT

Contact & Download

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