DyMoN
Dynamic Mobility Nudge

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Dynamic Mobility Nudge: Insights into digital, data-based nudging for sustainable urban mobility from a transdisciplinary project

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with support of OASC

European Commission | URBAN EUROPE

Claudia Luger-Bazinger

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Psychology

Behavioural Insights

DyMoN
Dynamic Mobility Nudge

Geoinformatics

Information technology

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Dana Kaziyeva

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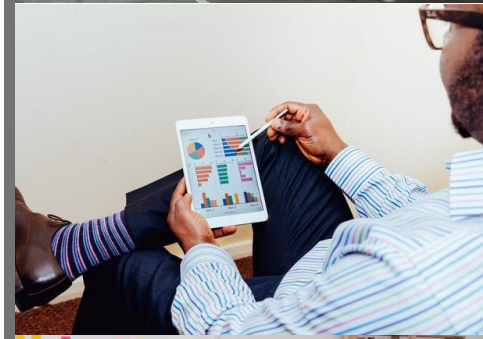
Sustainable mobility in cities

- Less individual car use but walking, bicycling or public transport instead (**active mobility**)
- **Individual mobility choices are significant**: Transport accounts for a quarter of Europe's GHG emissions (European Environment Agency, 2018), plus more quality of life in cities without cars
- **‚Hard' interventions** (e.g. laws) only go so far
- **Effective ‚soft' interventions are needed** that target motivation, social norms, etc. to motivate more sustainable mobility habits
- Within our **European research project DyMoN**, we want to offer **digital, data-based interventions** (‚nudges') to foster sustainable mobility

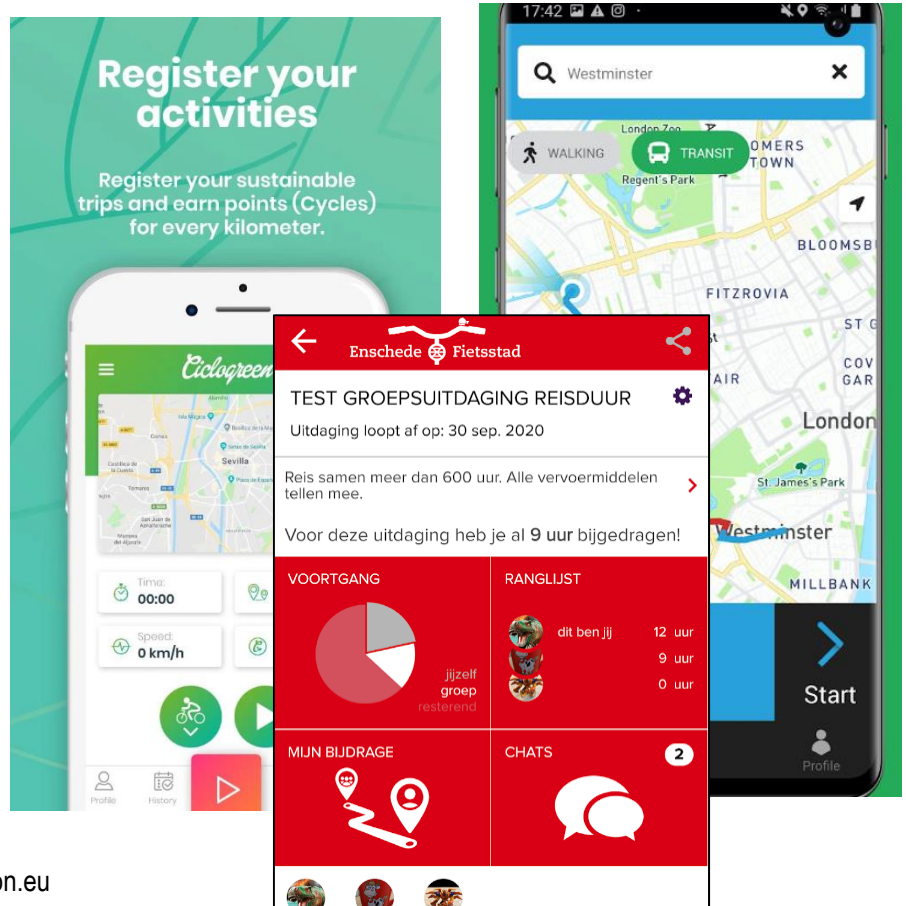


Nudging and behaviour change

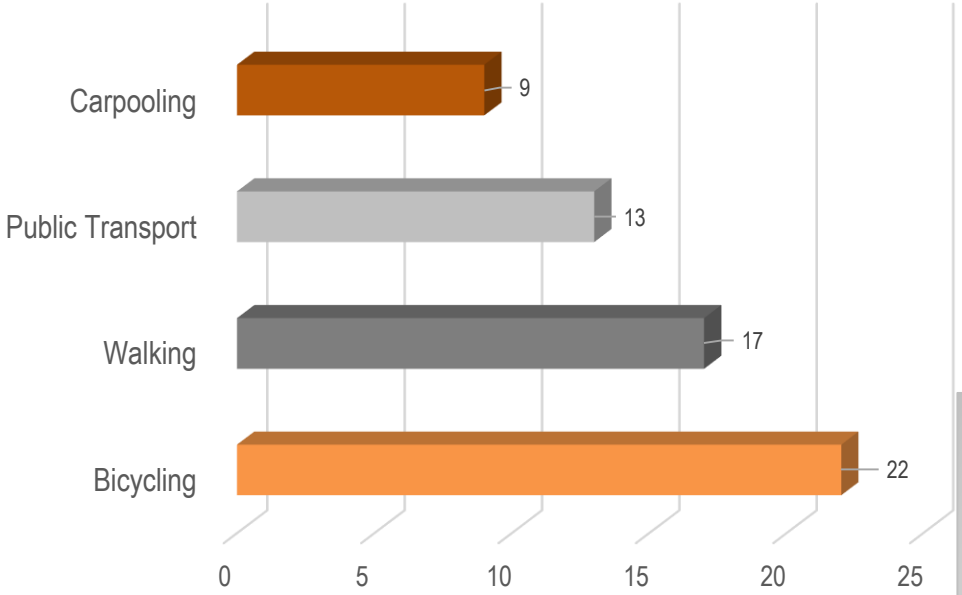
- **Nudging:** A way to steer **people's behaviour** into a **desired direction**
  - a collection of methods from psychology & behavioural economics, without restrictions or banning options.
- Nudging changes the environment in which decisions take place (e.g. by providing information in a new way), one of many **behaviour change techniques**
- Used also on **mobility behaviour to motivate more sustainable choices**
- Can be used in **digital environment** (via smartphones)
- *Example*: Apps that want to contribute to better mobility choices

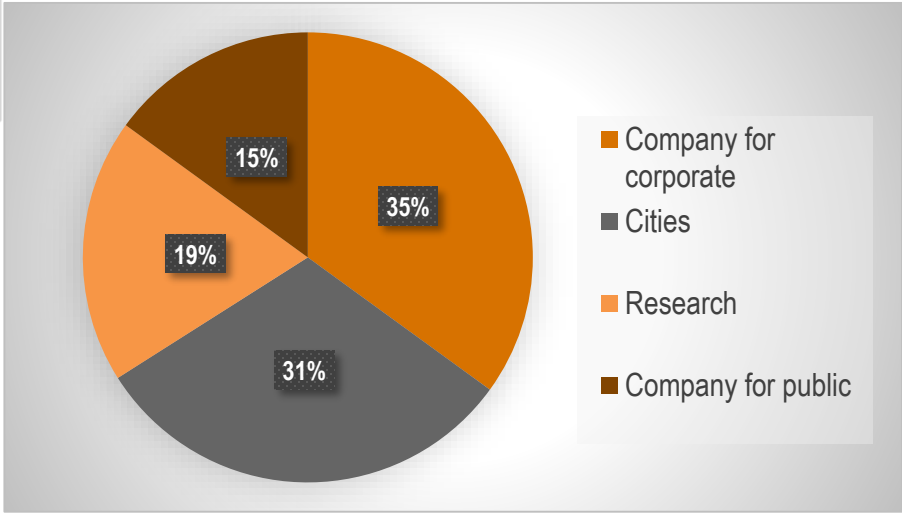
Analysis of urban mobility apps

- **Mobile applications** that seek to encourage **more sustainable mobility choices**, so **not just routing or schedules,** but
  - promotion of sustainable urban mobility (such as CO2 emission data), green routing as key element, any other form of nudge
- **Goal:** Overview of **commonly used digital interventions for sustainable mobility**
- **Search** in Google Play Store and Apple App Store **(July – September 2022)**
- **26 apps** fit search criteria (228 cities and 18 different countries)



Luger-Bazinger et al. (forthcoming). Digital behavioural interventions for sustainable mobility. Behavioural Economics Guide 2023.





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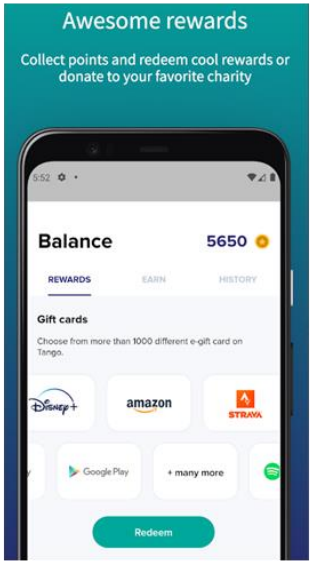
Top nudges used in urban mobility apps

1 2 3 4 5

Review of user journey

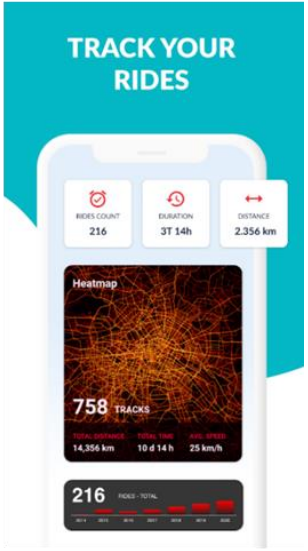
Gamification with monetary incentives



Sustainability Tracker

Route options

Mobility tracker



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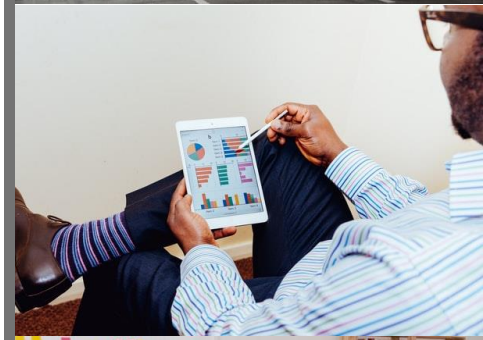
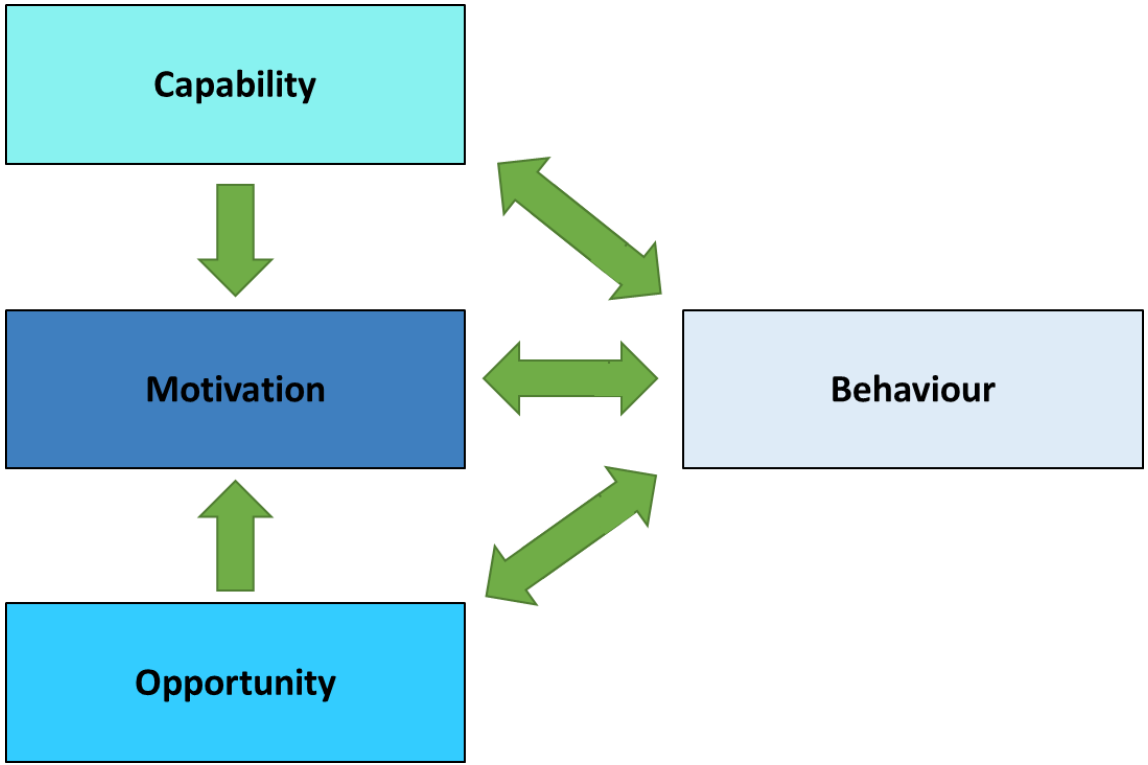
Effective behaviour change for mobility?

- **Typical pattern**: Same set of digital nudges are used
- **Little reference to models of human behaviour** in the mobility field (Andersson et al., 2018; Möser & Bamberg, 2008; Sunio & Schmöcker, 2017)
- This **could limit the effectiveness of interventions** and inhibits their design (Chng & Sanchez, 2021; Webb et al., 2010)
- **Public health as a field where there is a much closer connection** to human behaviour and psychology
  - **Transferring the COM-B model** (Michie, van Straten, & West, 2011) into the **field of mobility** for the DyMoN project

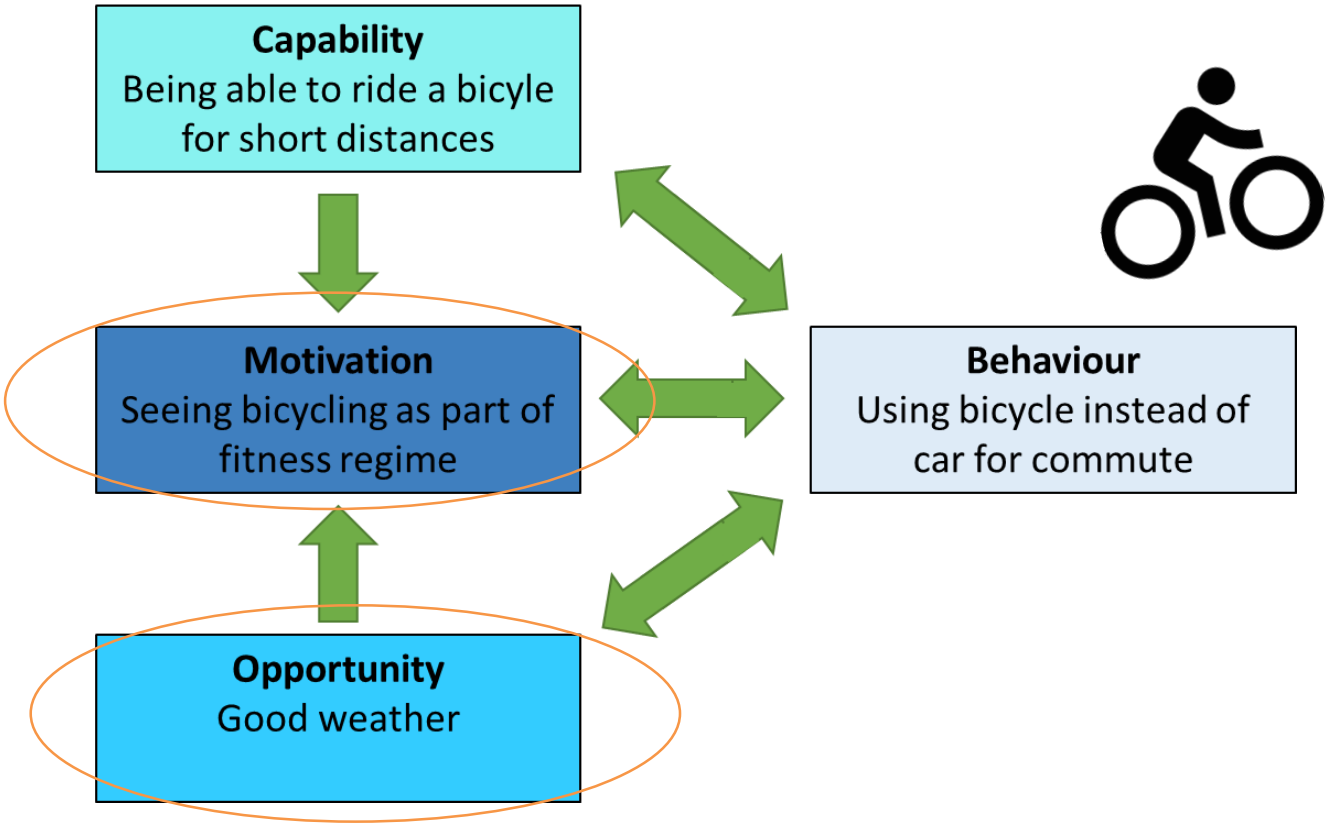




Michie, van Straten, & West, 2011

Behaviour
Using bicycle instead of car for commute

Adapted from Michie, van Straten, & West, 2011



Adapted from Michie, van Straten, & West, 2011

Nudging Repository in DyMoN

- Set of **digital nudges** for sustainable mobility (for motivating bicycling, walking, public transport)
- **Text to be used for notifications** in urban mobility apps, for e-mails…
- **No app, but content that can enhance existing apps!**
- **Situational components** can be taken into account that determine **timing and content of nudges** (data such as weather, traffic…) – **situation awareness**

- Example: **"A bicycle ride home from work helps to clear your head and refresh your thoughts! Today is the perfect day!"**

(nudge: information about emotional consequences; situation: bikeability, no rain or strong wind)

Situation-Awareness

- **Situational factors (timing + location)** as additional, crucial context elements for digital nudges
  - Weather / weather forecast, infrastructure, traffic situation, bikeability, walkability, …
- If we can determine the **perfect when + where**, we can increase the effectiveness of our digital interventions!
  - Motivation + Opportunity + Capability!
- **Unique to the mobility field so far**
- Situation-awareness is implemented by **our project partner, University of Salzburg** (Geoinformatics)


Situational context
every 10 min
20 % occupancy
100 m proximity
0.7 bikeability
0.5 walkability
+10 C
2 m/s
0 mm
200 m

Nudges are behavioural interventions to steer citizens' choices toward "desirable" options.

Reasonable options: where and when?

In which situations decisions to take sustainable mode of transport would be in people's "**best interest**"?

Nudge at a **suitable time and place** can increase its effectiveness.

What constitutes situational context?

User context

12 March 2023
12:00

12.2345, 47.2343

every 10 min
20 % occupancy
100 m proximity

0.2 bikeability

0.7 walkability

+20 C
2 m/s
0 mm

200 m

Nudging repository

Nudge 1: situational conditions
Nudge 2: situational conditions
...

What situational factors and thresholds define suitability of a nudge?

Spatial characteristics according to mode and **Weather** and **Special factors**

Walk:
- walkability
- walking distance

Bicycle:
- bikeability
- bicycling distance

Public transport:
- PT stop in proximity
- PT departure frequency

- temperature
- precipitation
- glaze
- wind speed
- sunshine

- PT occupancy
- bicycle infrastructure
- traffic state
- congestions
- car parking availability
- green walk/bicycle ways
- beautiful walkway
- safe bicycle way

A bicycle ride home from work helps to clear your head and refresh your thoughts! Today is the perfect day!

high bikeability
reasonable bicycling distance

moderate temperature,
no precipitation,
no glaze,
no strong winds

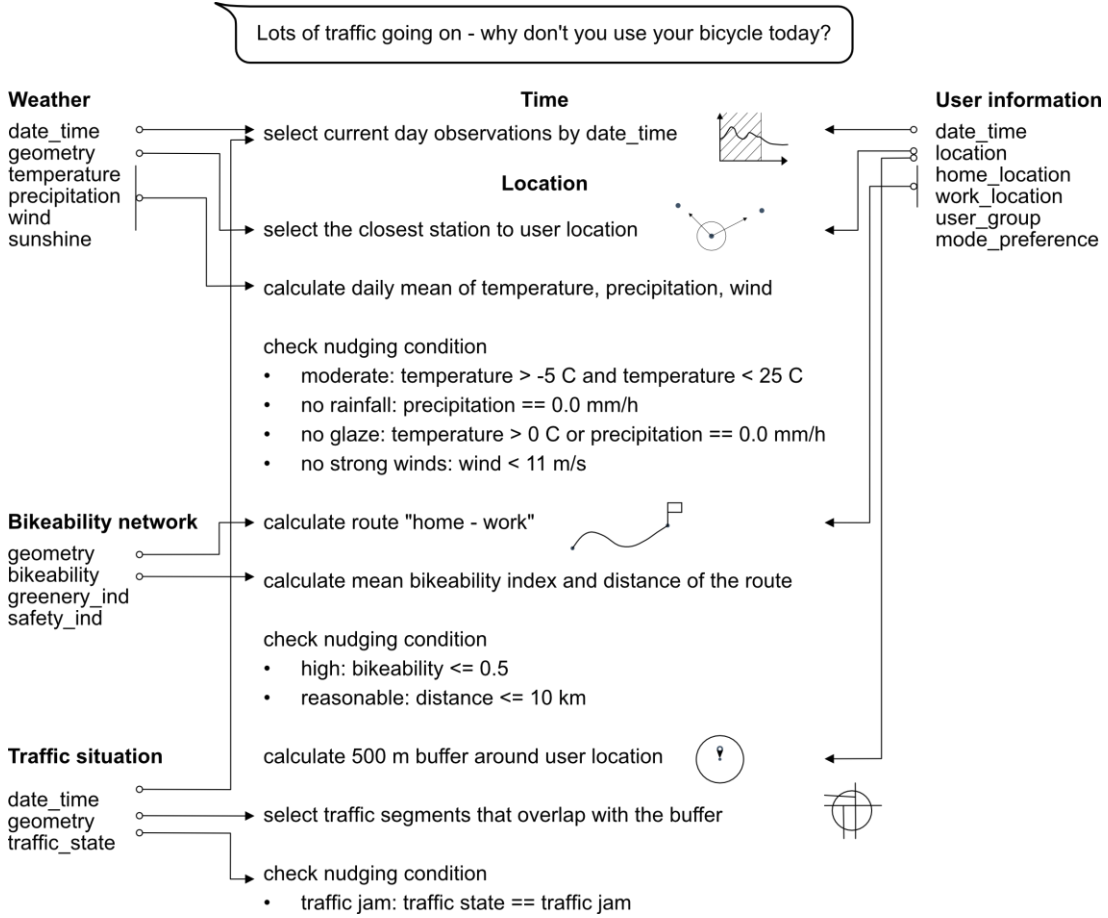
What do we need to design a framework for situation-aware nudging?

- Definition of situational factors
- Ontology development: semantic -> syntactic representation of a situation
- Data
- Technical implementation

Ontology development

Nudges in text representation →

Nudge rulesets ←



Data

Acquisition

- Open
- Accepted formats: DATEX II, xml, json, etc.

→ Transferability

Storage and internal sharing

- Secure: DyMoN API
- No personal data: nudging logic does not learn about user behaviour
- Documentation: Data Management Plan

Data

Data assessment matrix identifies data demand and ensures efficiency in the data acquisition, a maximum of transparency and the opportunity to trace everything back.

- Availability
- Importance to the project aims
- Suitability
- Acquisition effort

38 datasets for nudging logic, dashboard, and simulation model

Weather					
Information	Av	I	S	Ac	Ind
Rainfall forecast	1	5	5	4	29
Temperature real-time/forecast	1	5	5	4	29
Glaze real-time/forecast	1	5	5	4	29
Wind real-time/forecast	1	5	5	4	29
Sunshine real-time/forecast	1	5	5	4	29

Environmental information					
Information	Av	I	S	Ac	Ind
Temperature real-time at test area	1	5	5	4	29
Noise real-time at test area	1	4	5	4	26
Air quality forecast	1	3	5	4	23
Noise historical	1	3	4	5	22

Trip planning					
Information	Av	I	S	Ac	Ind
Public transport scheduling and routing	1	5	5	4	29
Individual routing advice	0	3	0	0	0

Infrastructure					
Information	Av	I	S	Ac	Ind
Public transport stops and departure frequency	1	5	5	5	30
Bicycle infrastructure with temporal construction sites	1	5	5	5	30
Bikeability network	1	5	5	5	30
Walkability network	1	5	5	5	30
Beautiful walkways	1	5	5	5	30
Safe bicycle lanes	1	5	5	5	30
Green spaces	1	5	5	5	30
Parking slots/spaces for bicycles	1	4	5	5	27
Charging stations for e-bikes	1	3	5	5	24
Occupation of car parking facilities	1	3	5	4	23
Bike sharing stations	1	2	5	5	21
Occupation of bicycle parking facilities	0	1	0	0	0

Mobility					
Information	Av	I	S	Ac	Ind
Trip distances	1	5	5	5	30
Travel survey	1	2	5	5	21

Traffic					
Information	Av	I	S	Ac	Ind
Congestion, troubles, construction sites, and events	1	5	5	4	29
Passenger occupancy in public transport	1	5	5	3	28
Floating car data	1	4	5	3	25
Bicycle traffic volume at stations	1	3	5	5	24
Motorized traffic forecast	1	2	5	3	19
Motorized traffic at stations	1	2	5	3	19
Origin-Destination-data	1	1	4	5	16
Floating bicycle data	1	2	3	4	16

User information					
Information	Av	I	S	Ac	Ind
Socio-demographic	1	5	5	1	26
Trip purpose	0	5	0	0	0
Mode of transport	0	4	0	0	0
GPS	0	1	0	0	0
GSM	0	1	0	0	0

Data

Open, available, and accessible:

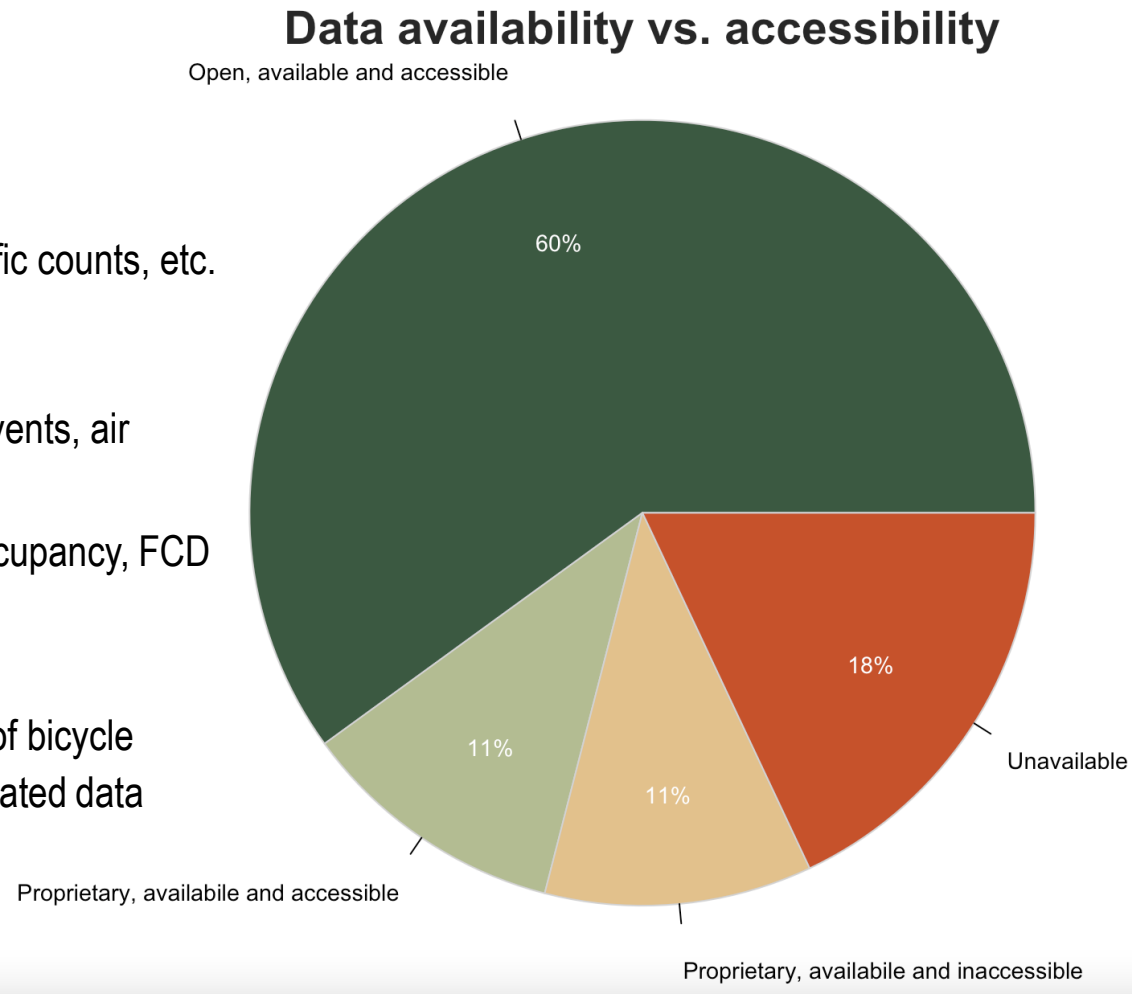
- Weather, urban infrastructure, traffic counts, etc.

Proprietary:

- Available and accessible: traffic events, air quality sensor data
- Available and inaccessible: PT occupancy, FCD

Unavailable:

- Floating bicycle data, occupation of bicycle parking facilities, other user-generated data



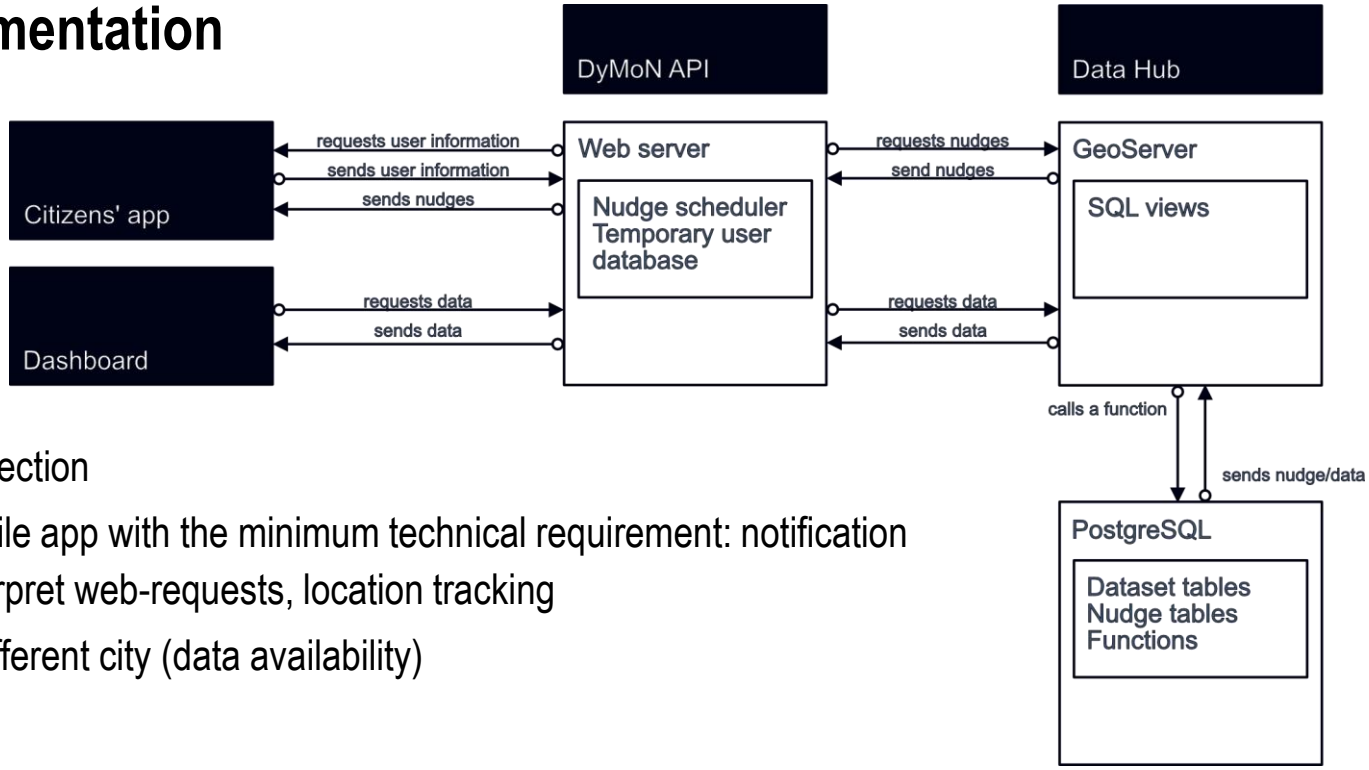
Data

Data Management Plan

Identifier	Description or use in projects
Unique identifier	Specify a unique identification number for the record
Date of metadata	Date on which the metadata was created or updated; format YYYY-MM-DD
Title	Title of the described record
Description	Content description of the data
Category	Selection of a predefined category according to the OGD Metadata 2.4 Annex 9c
Keywords	Freely definable keywords, depending on a project
Attribute description	Indication of the available attribute description: • Standardised metadata set (e.g. OGC-compliant service description) • Machine-readable data description (e.g. XSD scheme) • Structured data description (e.g. JSON file + column description, header description of a CSV file) • Textual data description (e.g. document)
Further metadata (link, document)	Further information on the metadata, reference to a website or a document (document can also be inserted directly into Confluence). Alternatively, a textual attribute description can also be inserted here (e.g. useful if no further document exists or a uniform attribute description is desired in the project).
Data controller + contact page + e-mail contact	Indication of the data controller, if possible also indication of a contact person (email, contact page)
License	Indication whether the data are made available under a "closed license" (trial) or under an "open license" (free/open).
Link to the terms of use	A short textual documentation on the terms of use should be given for a quick overview. In principle, a distinction can be made between the following types of use: • "Use allowed only within a specific project" + short textual documentation of the terms of use + documentation of other specific conditions (closed license) • "Use allowed for several research projects" + short textual documentation of the terms of use (closed license) • "Open license" + short textual documentation of the terms of use according to the open license + additional link to a descriptive website As further information, the user contract can also be inserted (especially relevant for concluded licenses). In case of derived data consisting of several different data sources, the corresponding terms of use must then be taken over from the data set with the most restrictive license.
License quote	If a license or a user contract is specified, then indicate here how to refer to it when using the data
Data quality/origin	If known, provide the information on the origin of the data and data quality/quality assurance
Temporal extent (beginning)	YYYY-MM-DD
Temporal extent (end)	YYYY-MM-DD; If the end record is not known, it is set to the end of a project by default;
Record, service or document link	Specify a location; does not necessarily have to be a link, can also be a local repository or the location in database
Record, service or document format	Data format, e.g. gpx, csv, WMS - PNG, WFS - JSON, etc.

(Leitinger, S., et al., 2020)

Technical implementation



- No personal data collection
- Adoption by any mobile app with the minimum technical requirement: notification system, ability to interpret web-requests, location tracking
- Transferability to a different city (data availability)

Limitations:

- Restricting regulations on location tracking in the background, battery consumption

Be involved with DyMoN!

Sustainable Mobility Hackathon in Uppsala (March 16 – 18th 2023)

- Online + in-person in Uppsala (Green Innovation Park)
- Do you have a *challenge* in your city that could relate to this project?

DyMoN „Digital Nudging for Sustainable Mobility“ Webinar Series

- Starting in fall 2023 in cooperation with OASC
- Sign-up at the list and we keep you informed

DyMoN Summer School, June 2023

- „GIS and psychology meet for behavioural change in mobility: Innovative digital interventions for sustainable mobility”
- Summer School in Salzburg from 27.06. – 06.07.2023
- www.dymon.eu

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More information, results, news and events on our website:
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DyMoN

Dynamic Mobility Nudge

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Uppsala University, Department of Civil and Industrial Engineering, Sweden

Sustainability InnoCenter

Sustainability InnoCenter, Sweden

Ecollective, Sweden

Project website: https://dymon.eu

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