Comparing community mobility reduction between first and second COVID-19 waves

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Transport Policy

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Paper in a Nutshell [1]

- Using Google CMR, mobility reduction rate comparison between the first and second COVID-19 waves in
  - Lombardia, Italy
  - Île de France
  - Birmingham, UK
  - Manaus, Brazil
  - Berlin, Germany
  - Toronto, Canada
- Multi-dimensional visualization considering multiple place categories for each selected locality $\Rightarrow$ Pareto-compliant conclusions
- For each temporal granularity (56-day and 14-day consecutive windows), data is aggregated using the area under the curve (AUC) approach

[1] G. Cavalcante da Silva, F. M. de Almeida, S. Oliveira, E. F. Wanner, L.C.T. Bezerra, R. H.C. Takahashi, L. Lima, Comparing community mobility reduction between first and second COVID-19 waves, Transport Policy, V. 112, 2021, pp 114-124,

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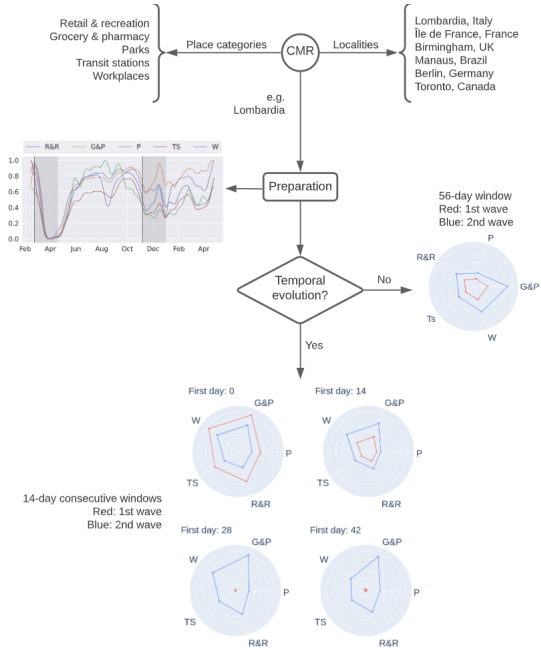

Retail & recreation
Grocery & pharmacy
Parks
Transit stations
Workplaces
Place categories
CMR
Localities
Lombardia, Italy
Île de France, France
Birmingham, UK
Manaus, Brazil
Berlin, Germany
Toronto, Canada
e.g.
Lombardia
R&R
G&P
P
TS
W
1.0
0.8
0.6
0.4
0.2
0.0
Feb
Apr
Jun
Aug
Oct
Dec
Feb
Apr
Preparation
56-day window
Red: 1st wave
Blue: 2nd wave
Temporal evolution?
No
Yes
First day: 0
First day: 14
First day: 28
First day: 42
14-day consecutive windows
Red: 1st wave
Blue: 2nd wave

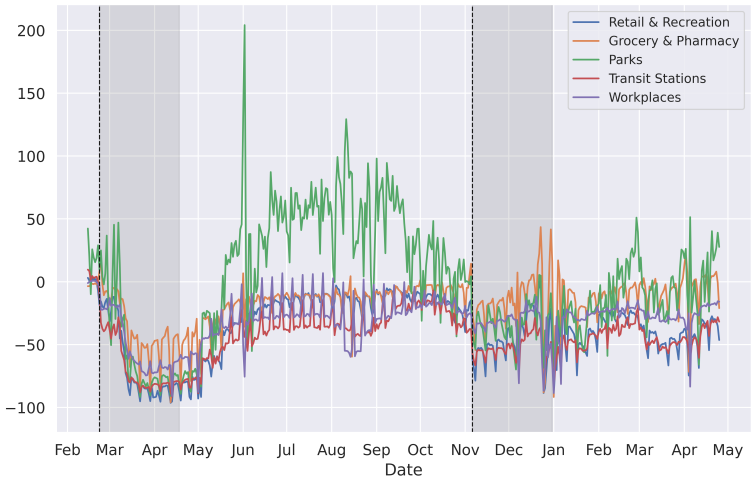
Google CMR Place categories

Category	Places
Grocery & pharmacy	Grocery markets, food warehouses, farmers markets, specialty shops, drug stores, and pharmacies
Parks	Parks, public beaches, marinas, dog parks, plazas, and public gardens
Transit stations	Public transport hubs, e.g. subway and bus stations
Retail & recreation	Restaurants, cafes, shopping centers, theme parks, museums, libraries, and movie theaters
Residential	Places of residence
Workplaces	Places of work

Initial restriction dates for first and second waves in 2020

Wave	Lombardia	Île-de-France	Toronto Division	Berlin	Birmingham District	Manaus
1st	Feb 23rd	Mar 12nd	Mar 12nd	Mar 13nd	Mar 13nd	Mar 16th
2nd	Nov 6th	Oct 30th	Nov 21st	Nov 2nd	Nov 5th	Dec 26th

Original CMR data for Lombardia



Data preparation

Google recommends:

1. calibrating data in a locality-wise basis;
2. handling noise incurred by holidays or other exceptional circumstances;
3. balancing the difference in magnitude between categories.

What we have done:

1. processing the whole time series for each locality and place category to ensure that the data previous to the 1st wave present zero mean;
2. isolating data trend from weekday seasonality effects and noise using seasonal-trend decomposition by loess (**STL**);
3. balancing the contribution of individual place categories (data for each category is scaled to a common range per locality.)

Social distance restriction measures

Locality	Wave	*Parks*	*Retail & recreation*	*Transit stations*	*Workplaces*	*Schools*
Lombardia	1st	✓	✓	✓	✓	✓
	2nd	*In part*	*In part*	✓	✓	—
Île-de-France	1st	✓	✓	✓	✓	✓
	2nd	*In part*	✓	*In part*	*In part*	—
Birmingham District	1st	—	✓	—	*In part*	✓
	2nd	—	✓	—	*In part*	—
Manaus	1st	✓	✓	✓	✓	✓
	2nd	*In part*	*In part*	✓	✓	*In part*
Berlin	1st	✓	✓	✓	*In part*	✓
	2nd	✓	*In part*	—	*In part*	—
Toronto Division	1st	✓	✓	*In part*	*In part*	✓
	2nd	✓	✓	*In part*	*In part*	✓

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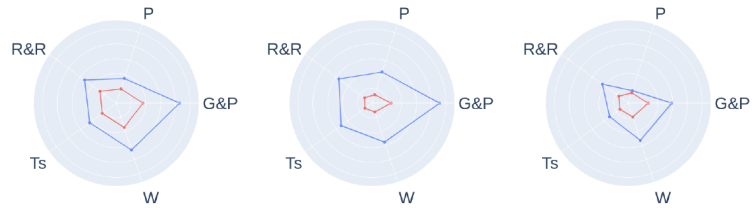
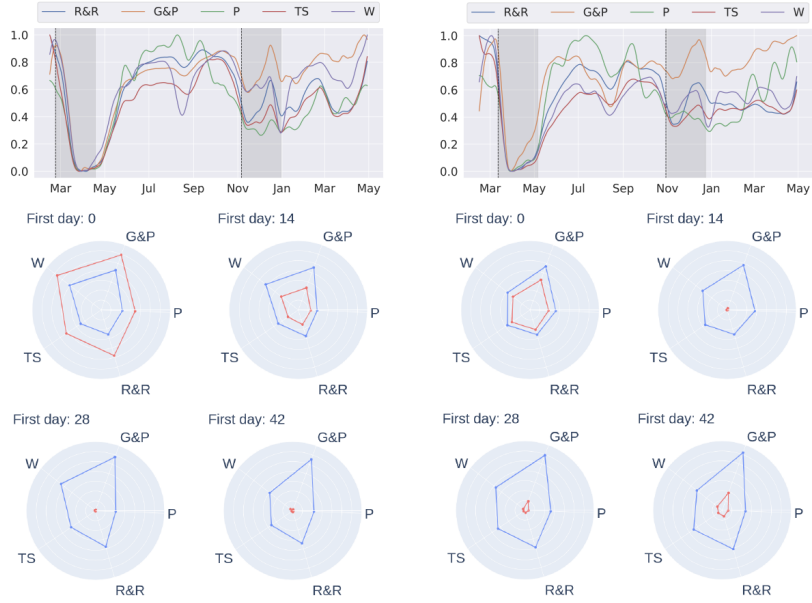
56-day window

Mobility reduction rates in the first (red) and second (blue) waves



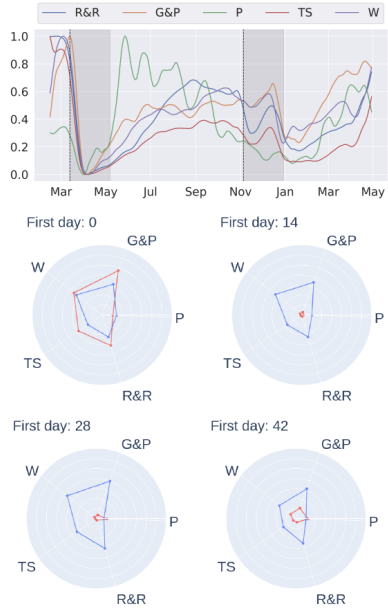
(a) Lombardia (b) Île-de-France (c) Birmingham District

(d) Manaus (e) Berlin (f) Toronto Division

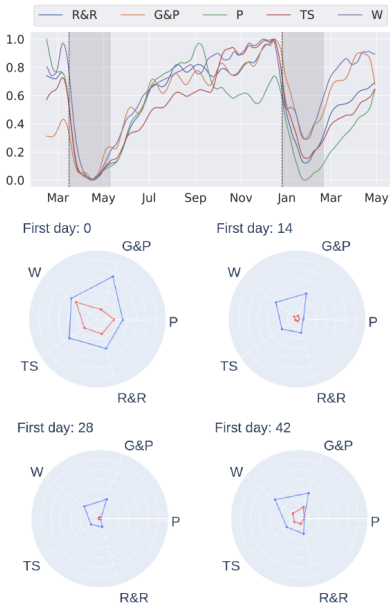


(a) Lombardia

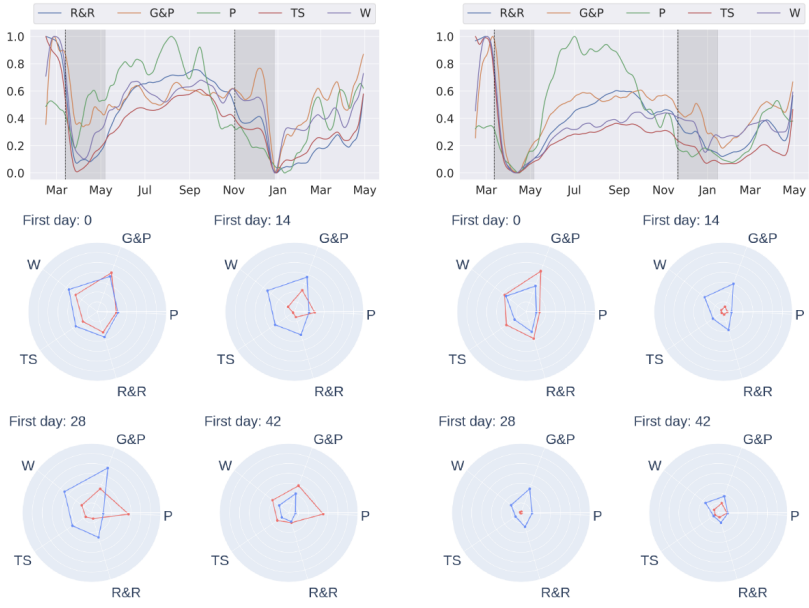
(b) Île-de-France



(a) Birmingham District



(b) Manaus



(a) Berlin

(b) Toronto Division

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Conclusions

- Reduction rates observed during the 1st wave were much higher than during the 2nd.
- December holiday season mobility in some of the localities reached pre-pandemic levels.
- Manaus was the only locality where 2nd wave mobility was nearly as reduced as during the 1st wave, likely due to the P1 variant outbreak and oxygen supply crisis.

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Thank You!

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