

Using OpenStreetMap for Quantification and Visualization of Urban Mobility Space Inequality

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whatthestreet.moovellab.com



Article

Crowdsourced Quantification and Visualization of Urban Mobility Space Inequality

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Abstract

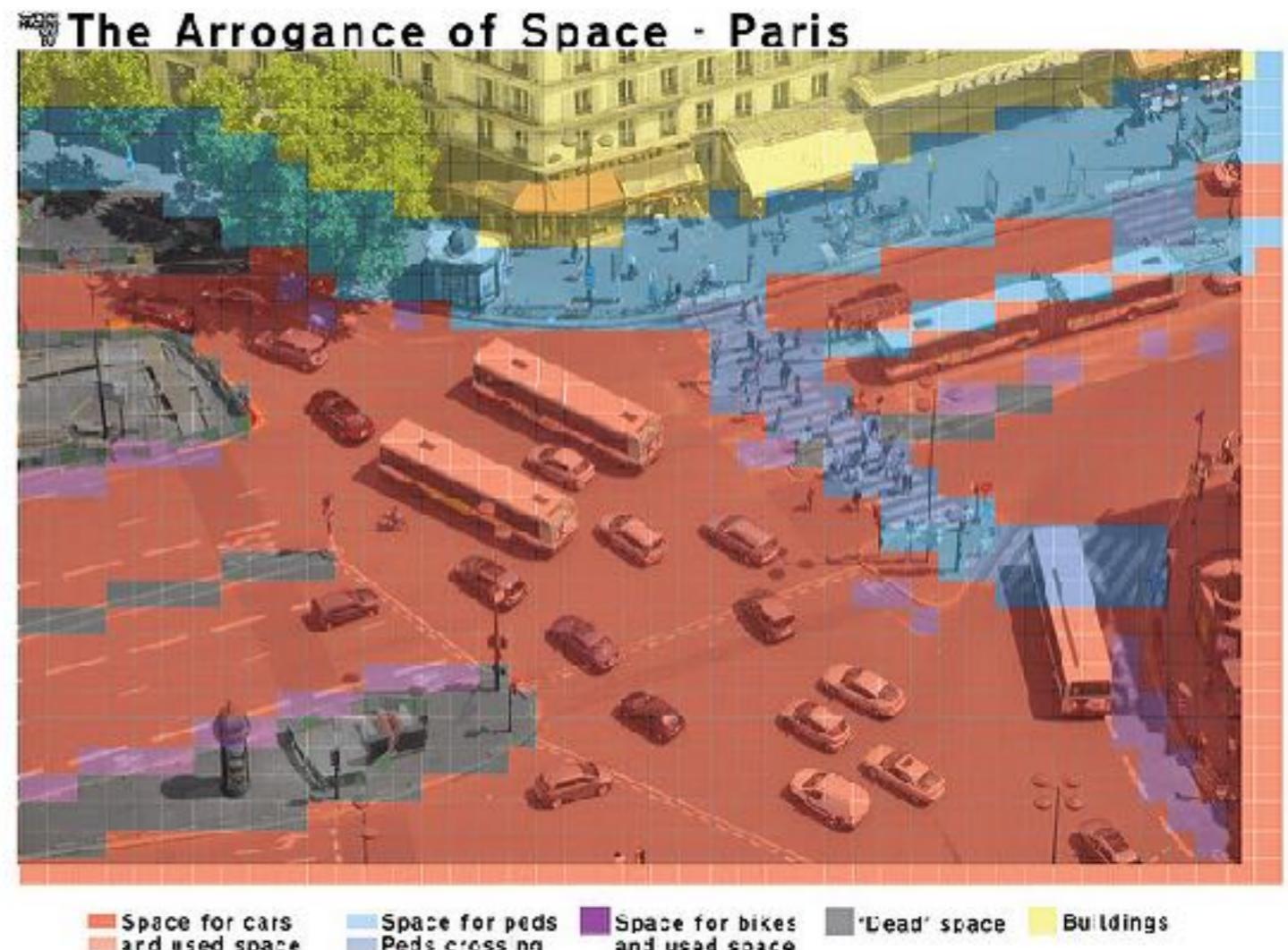
Most cities are car-centric, allocating a privileged amount of urban space to cars at the expense of sustainable mobility like cycling. Simultaneously, privately owned vehicles are vastly underused, wasting valuable opportunities for accommodating more people in a livable urban environment by occupying spacious parking areas. Since a data-driven quantification and visualization of such urban mobility space inequality is lacking, here we explore how crowdsourced data can help to advance its understanding. In particular, we describe how the open-source online platform What the Street! uses massive user-generated data from OpenStreetMap for the interactive exploration of city-wide mobility spaces. Using polygon packing and graph algorithms, the platform rearranges all parking and mobility spaces of cars, rails, and bicycles of a city to be directly comparable, making mobility space inequality accessible to a broad public. This crowdsourced method confirms a prevalent imbalance between modal share and space allocation in 23 cities worldwide, typically discriminating bicycles. Analyzing the guesses of the platform's visitors about mobility space distributions, we find that this discrimination is consistently underestimated in the public opinion. Finally, we discuss a visualized scenario in which extensive parking areas are regained through fleets of shared, autonomous vehicles. We outline how such accessible visualization platforms can facilitate urban planners and policy makers to reclaim road and parking space for pushing forward sustainable transport solutions.

Keywords

big data; bin packing; crowdsourcing; data visualization; mobility; OpenStreetMap; sustainable transport; transport justice; urban space inventory; volunteered geographical information

The arrogance of space

Space is not distributed fairly between modes of transportation



The arrogance of space

Case study:
Copenhagen



Arrogance of Space - Copenhagen. A Section of Hans Christian Andersen Boulevard

■ Motorized Vehicles ■ Bikes ■ Pedestrians ■ Shared Space ■ Bus ■ Non Transport Space ■ Zebra Crossing ■ Trains

And this is the
best place in the
world for bikes!

Modal Share for Copenhageners Commuting to Work/Education



Allocation of Transport Space in Copenhagen



COPENHAGEN
IZE
EU



Really!

Cars are used 36 min per day

Cars are not used 1404 min per day

Cars are used 36 min per day

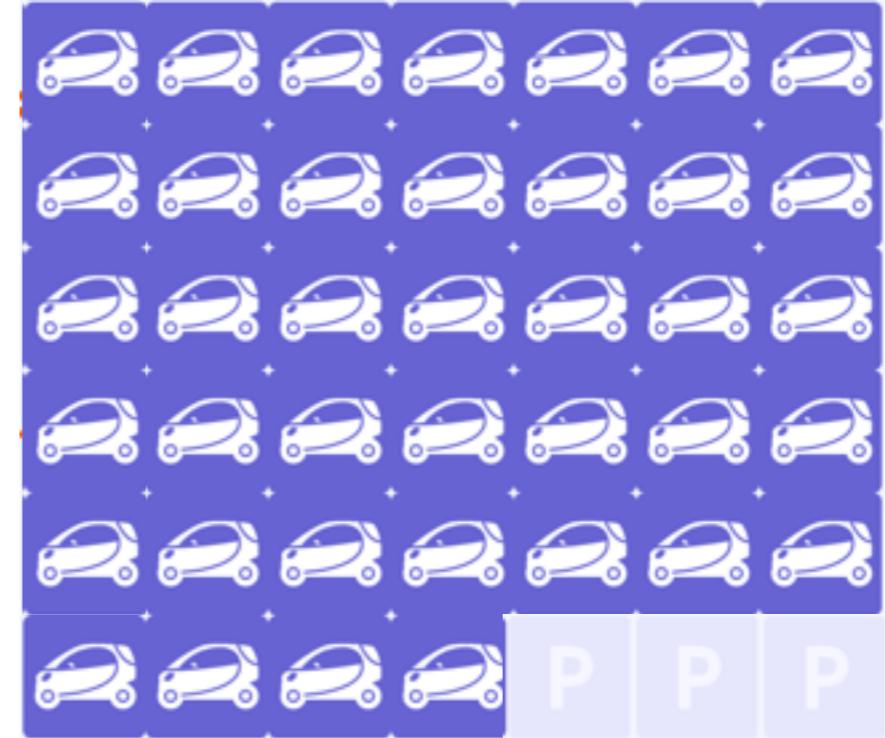
Cars are not used 1404 min per day

A typical snapshot of Budapest

15,000 cars moving



600,000 cars parked

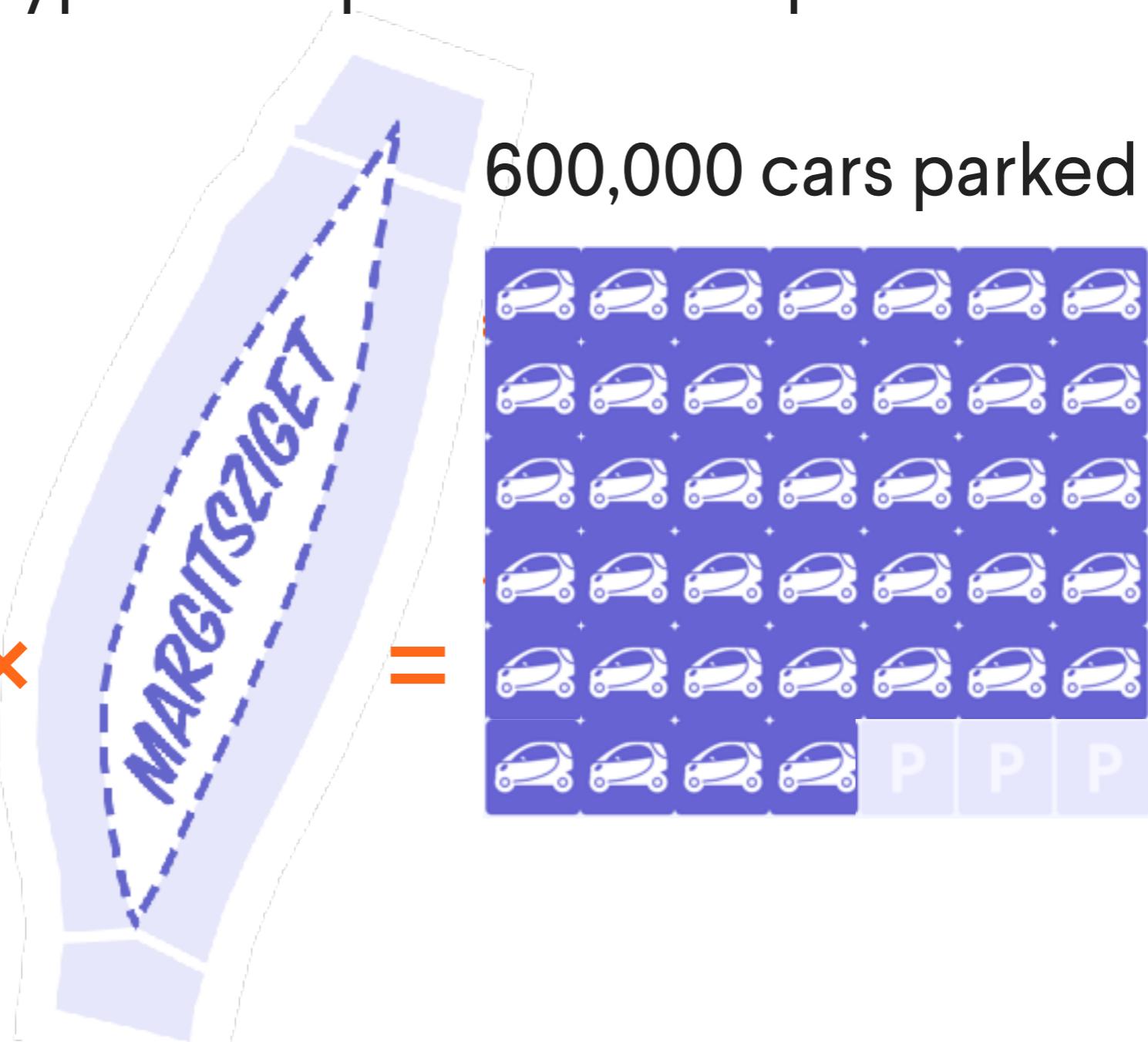


Cars are used 36 min per day

Cars are not used 1404 min per day

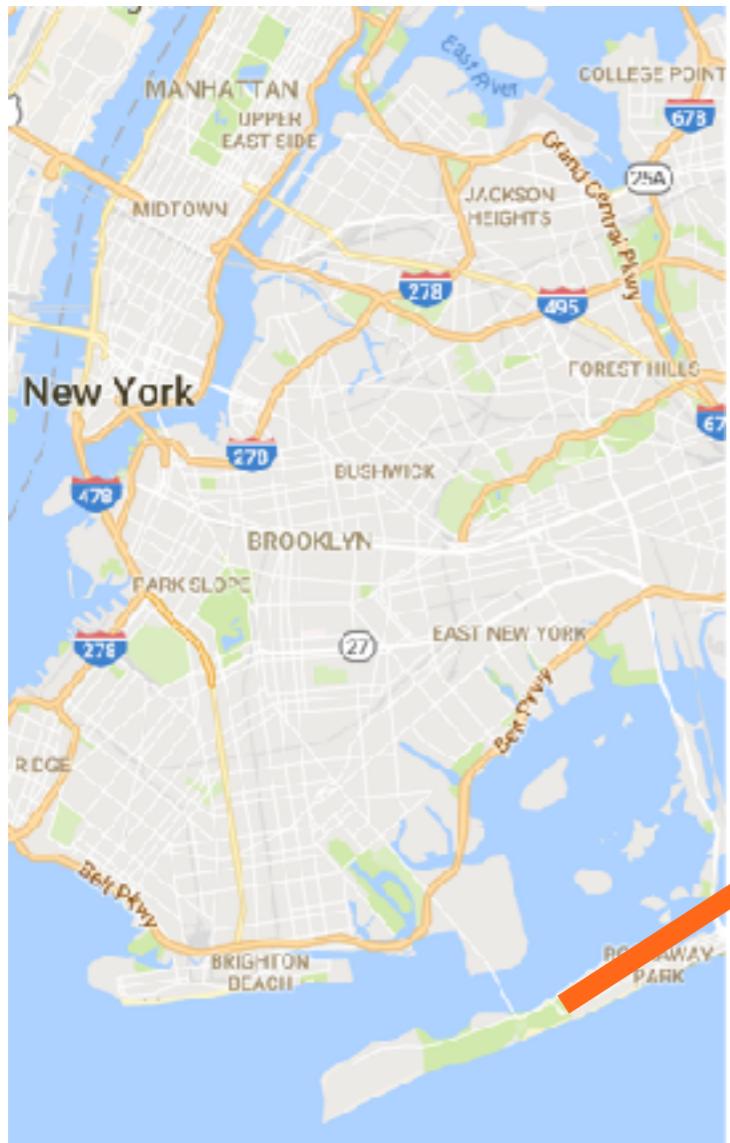
A typical snapshot of Budapest

18,500 = 4 ×
Playgrounds



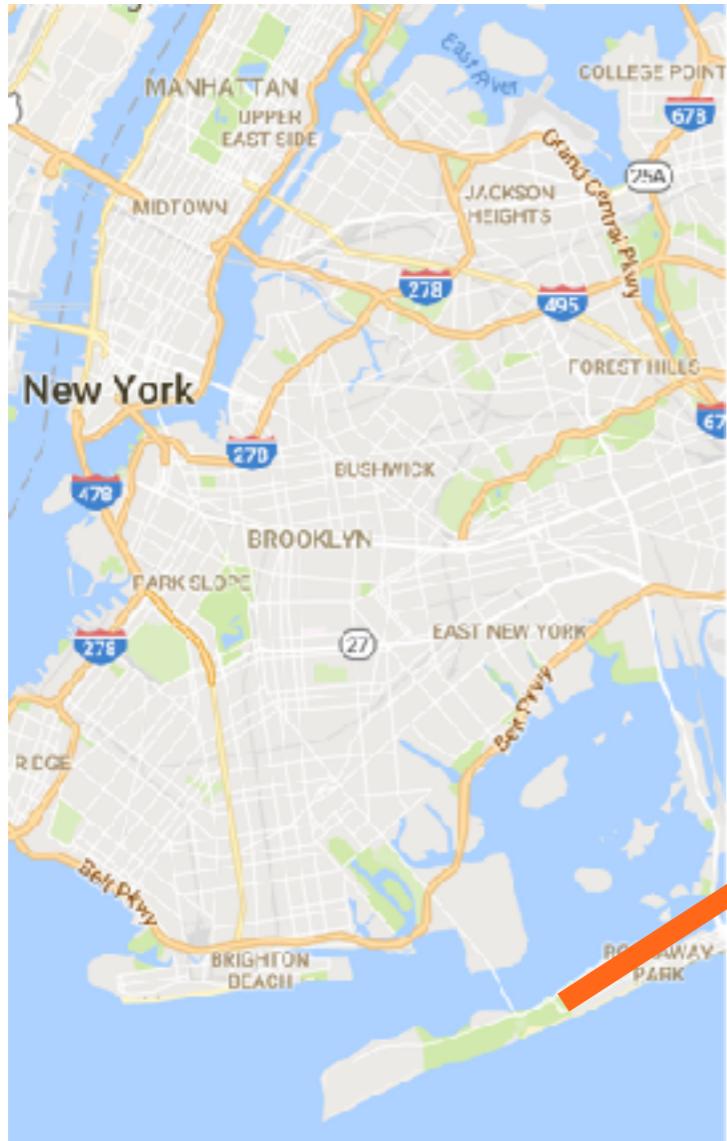
How does all of this space look like?

How can we get it back?



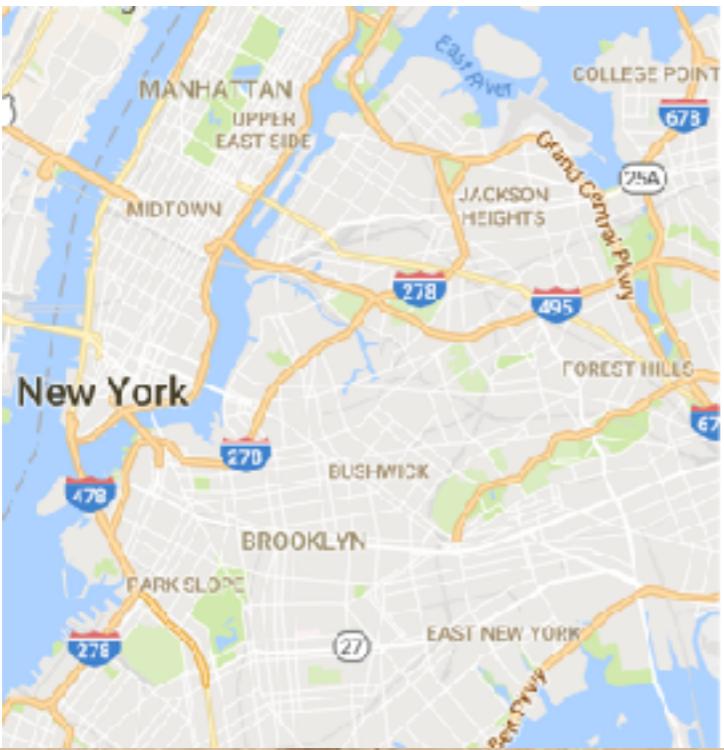
What a lovely green..



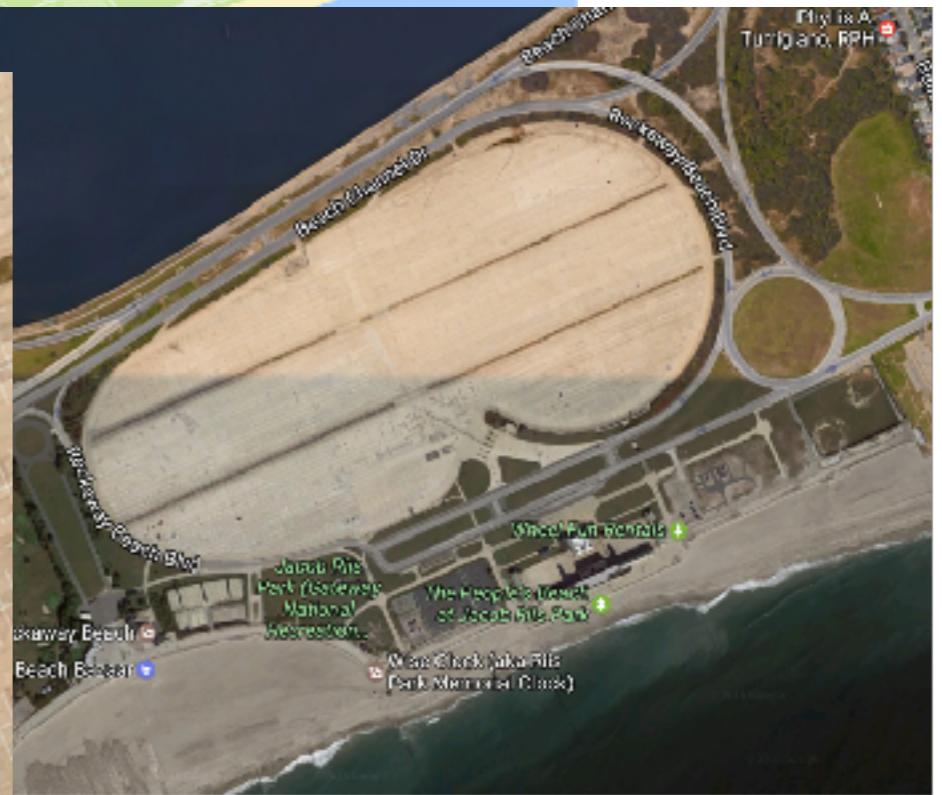
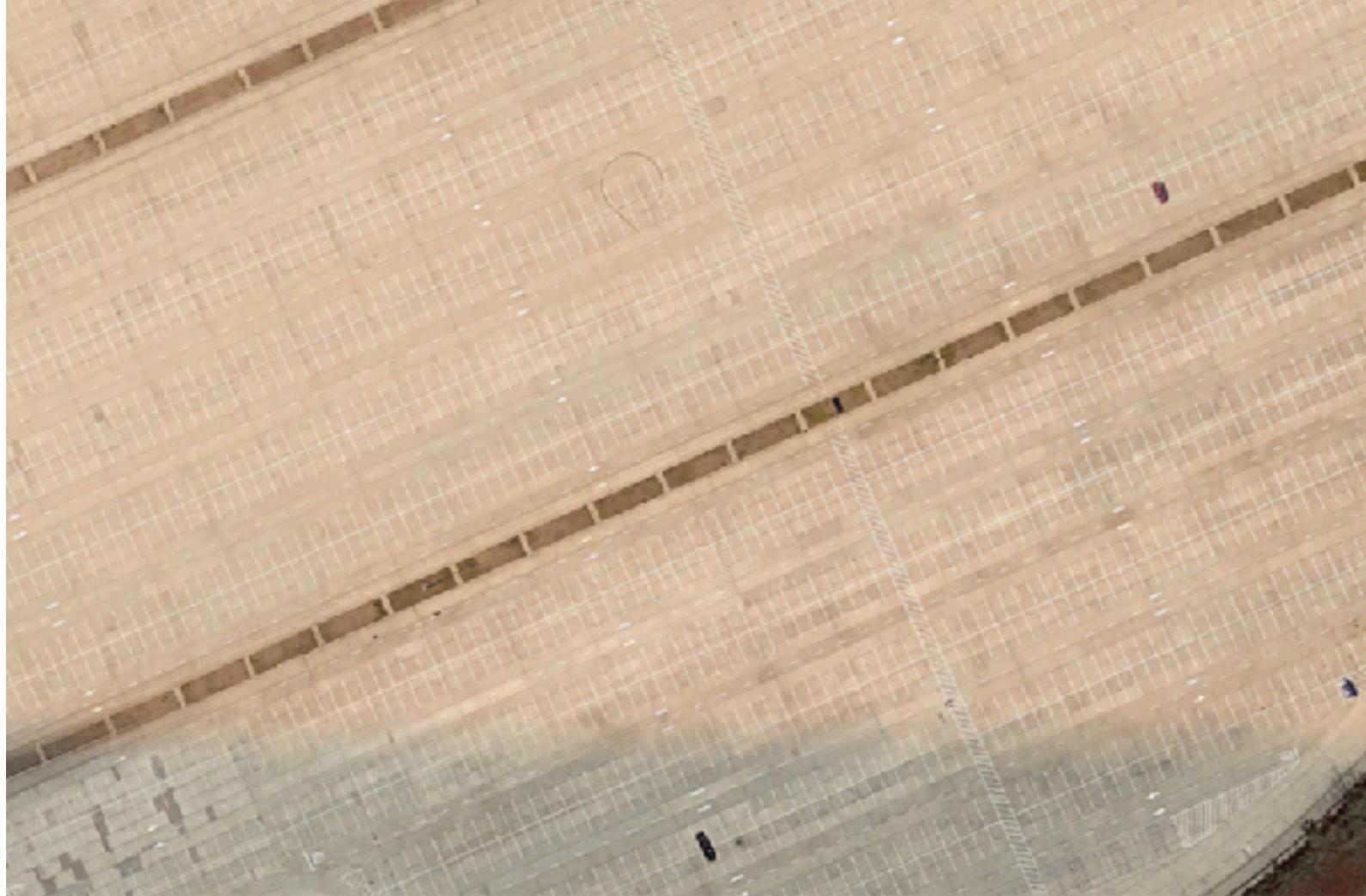
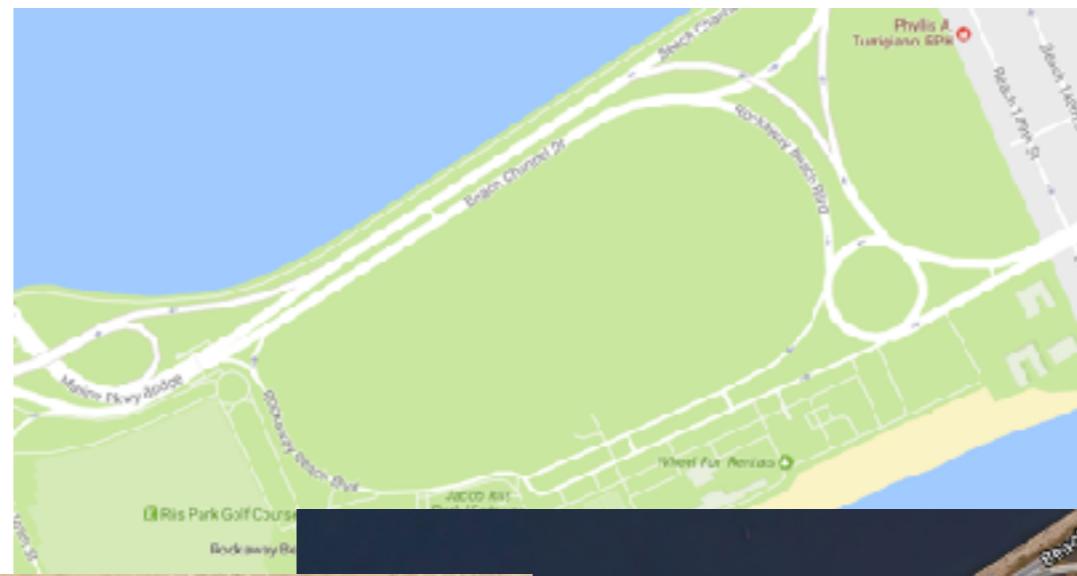


What a lovely ~~green..~~ green..

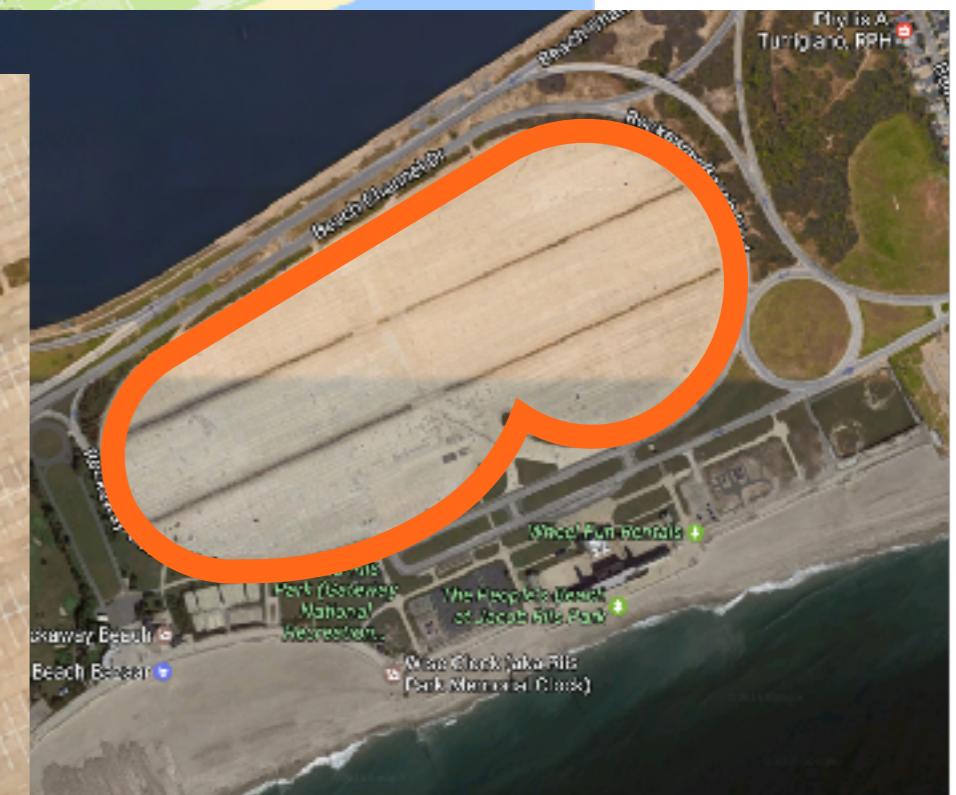
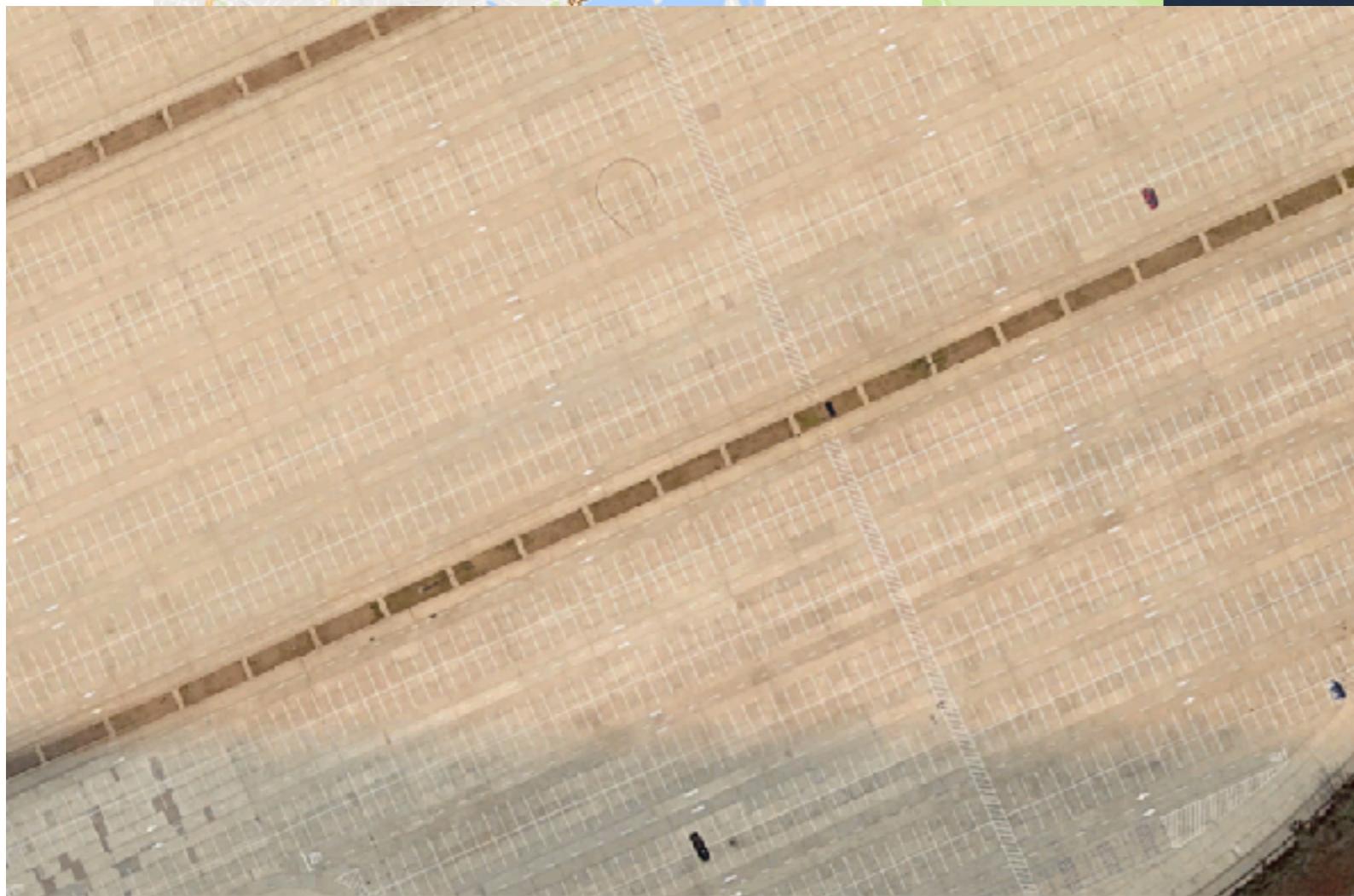
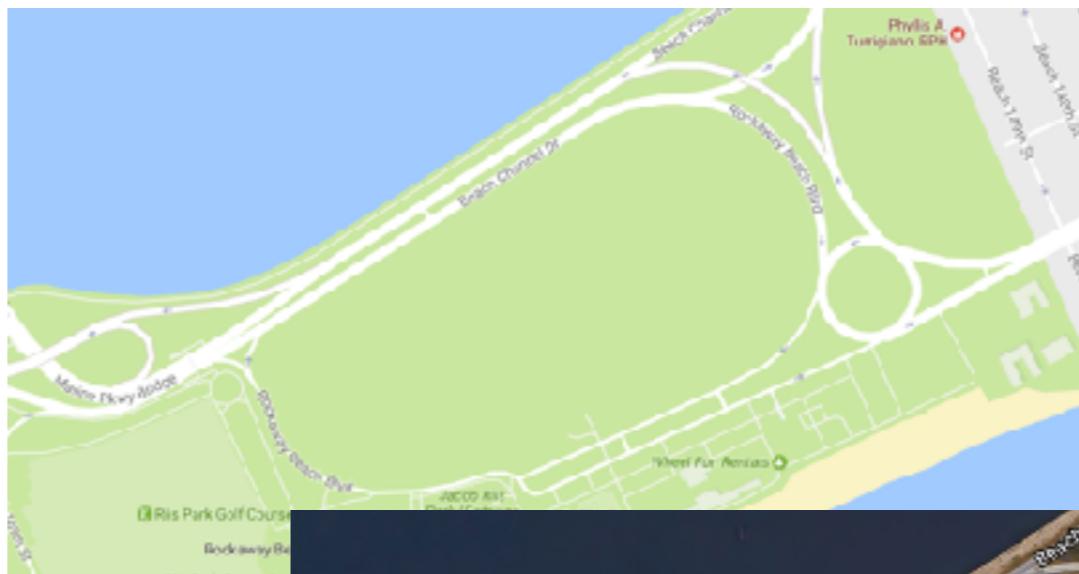
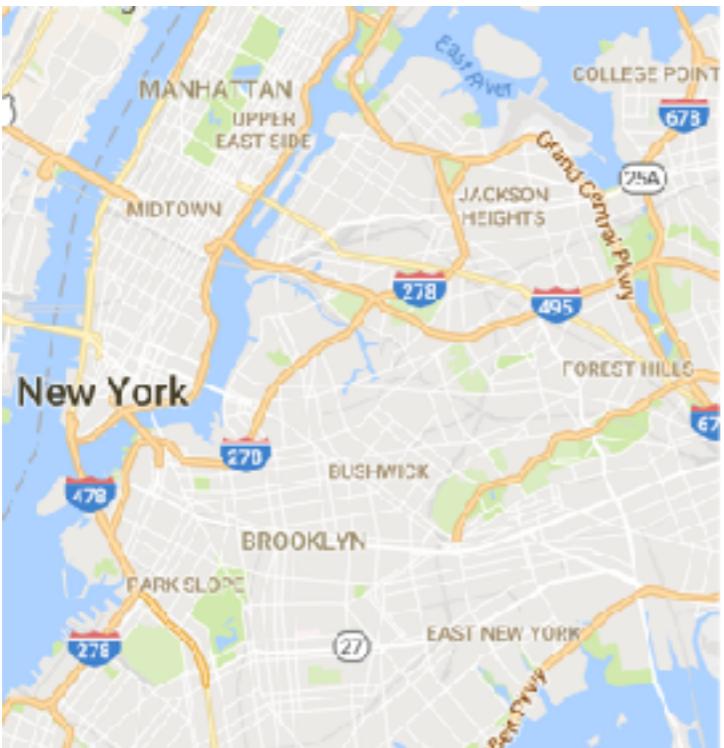




What a ~~lovely~~ green.. MONSTER

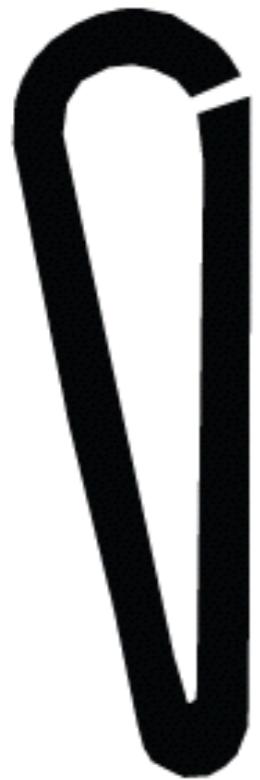


800m x 500m

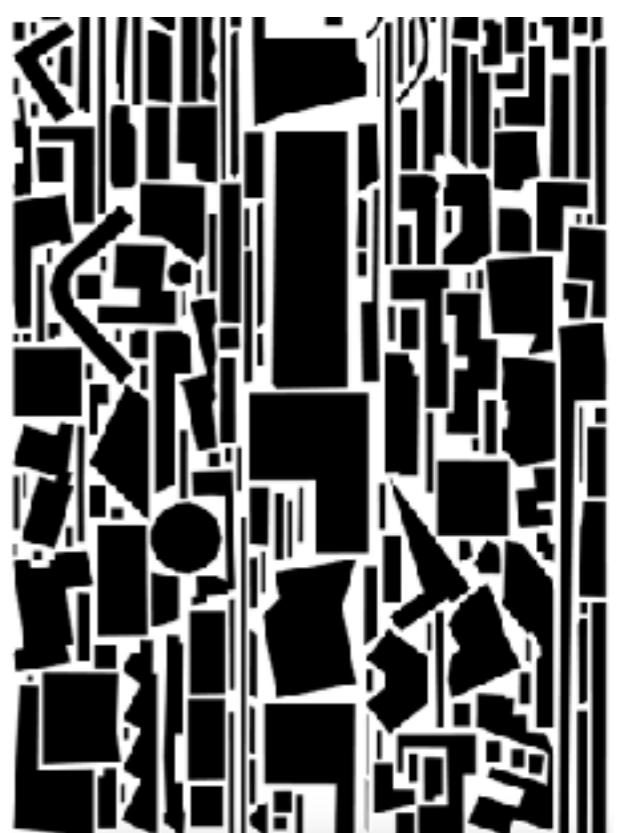
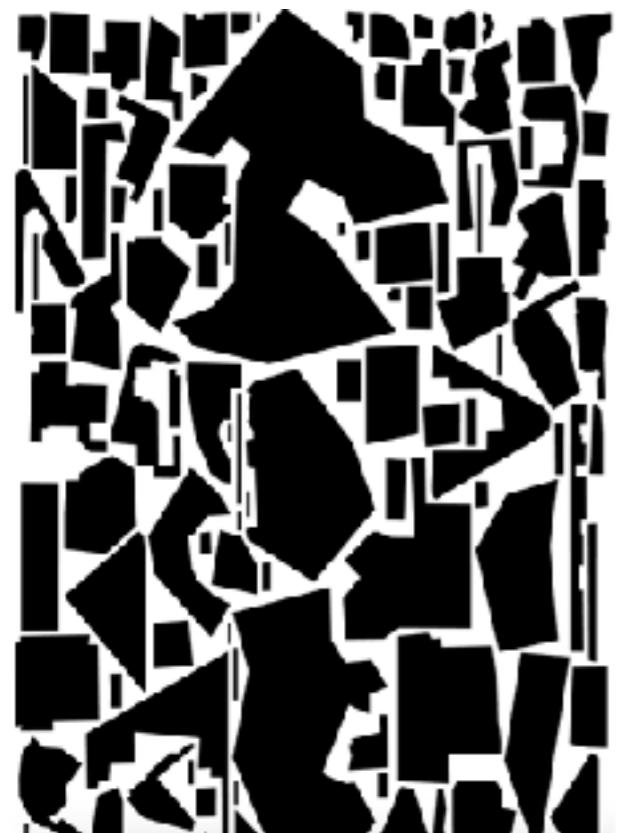


Use polygon packing to visualize ALL parking spaces SVGnest.com





Cities have unique patterns



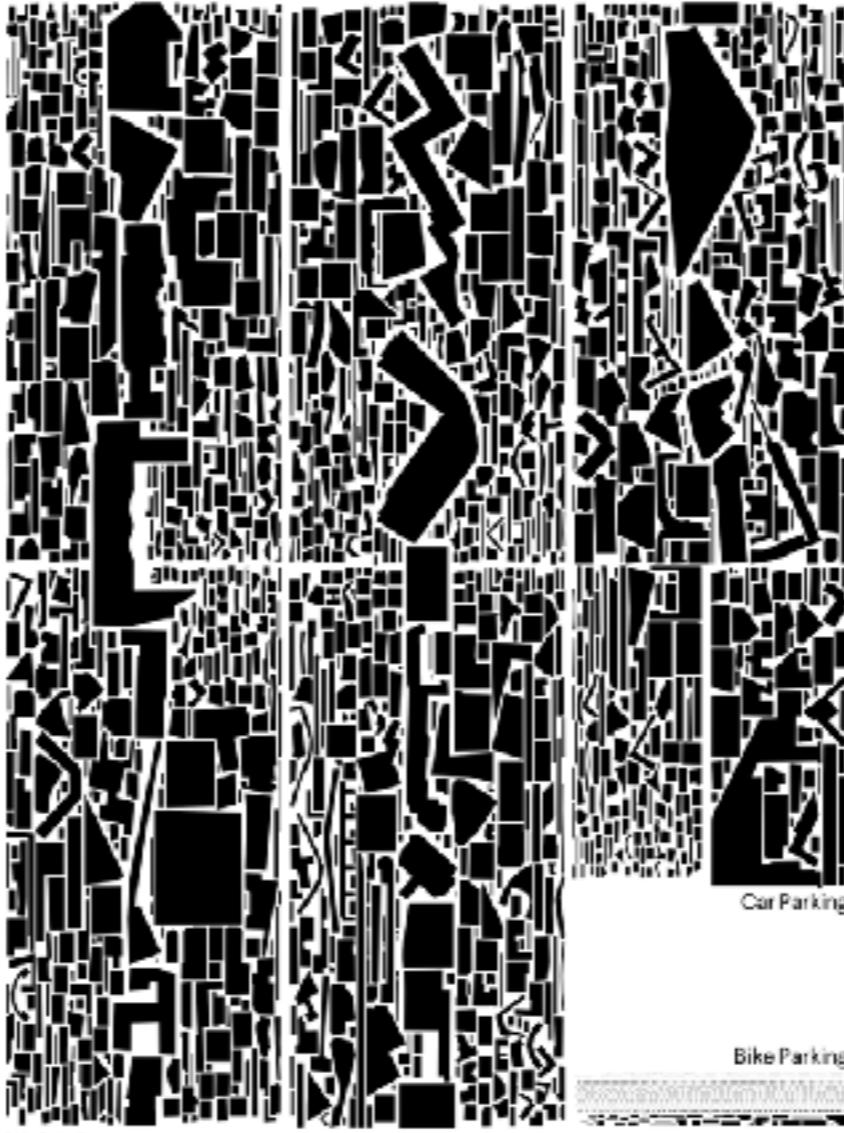
Porta, Crucitti, Latora, Physica A 369: 853-866 (2006)
Barthelemy, Flammini, PRL 100:138702 (2008)

Cities have unique distributions

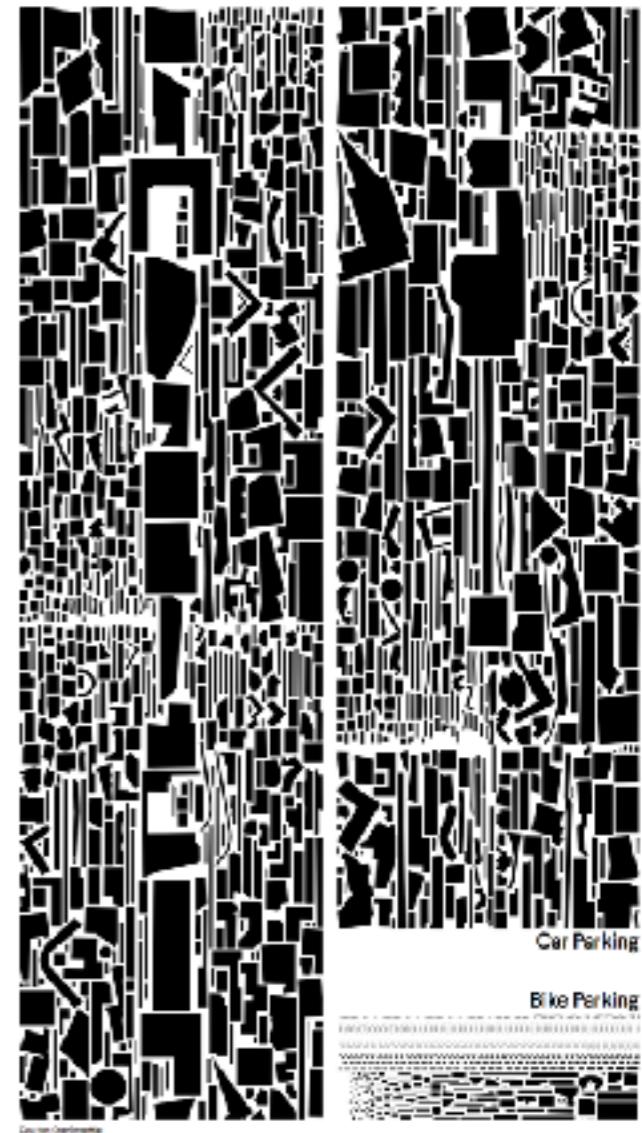
Chicago



Budapest



Copenhagen



Cities have unique distributions

Chicago



What the Street?
<http://whatthestreet.microlab.com>

Parking

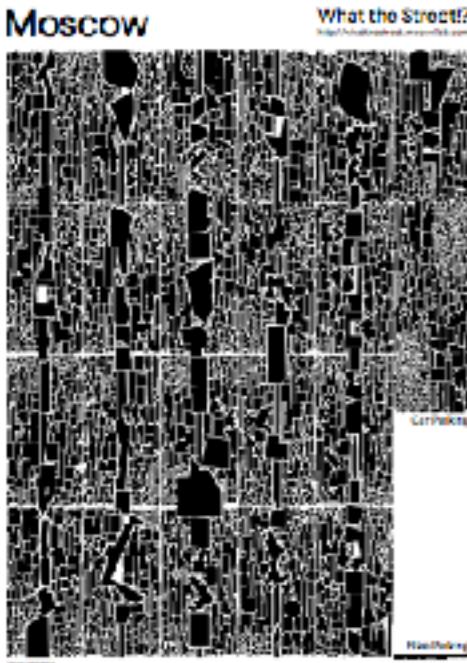
openhagen



What the Street?
<http://whatthestreet.microlab.com>

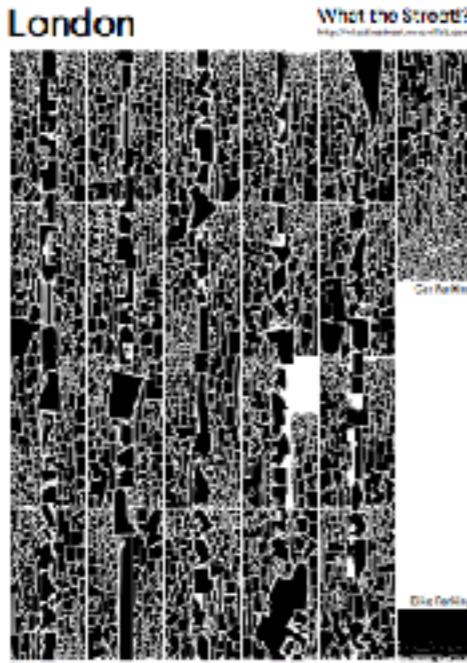
What the Street!? covers 23 world cities

Moscow



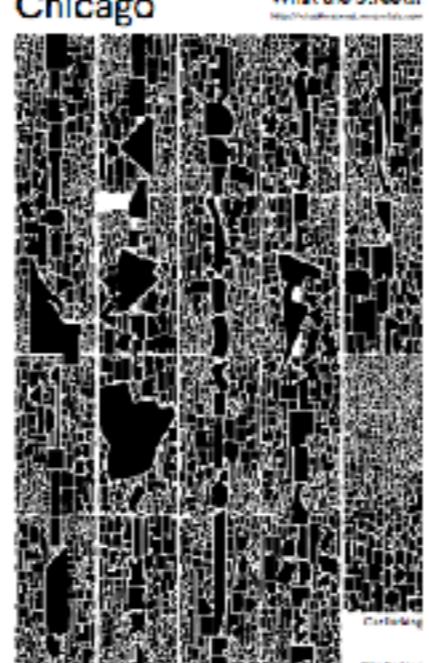
What the Street?
<https://github.com/moovel/lab-what-the-street>

London



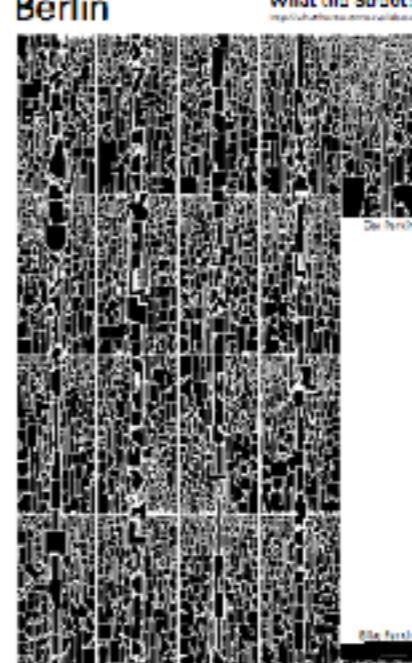
What the Street?
<https://github.com/moovel/lab-what-the-street>

Chicago



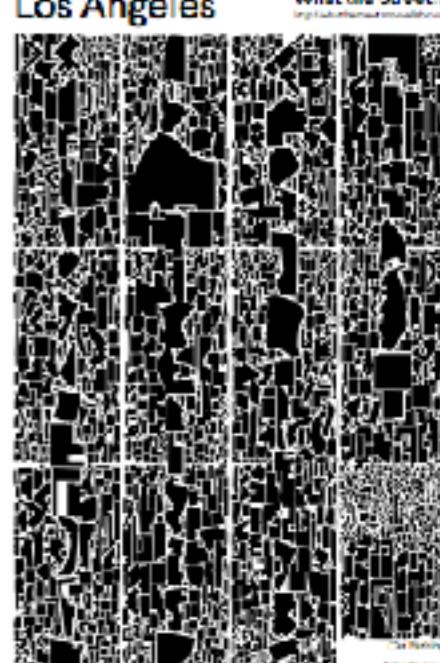
What the Street?
<https://github.com/moovel/lab-what-the-street>

Berlin



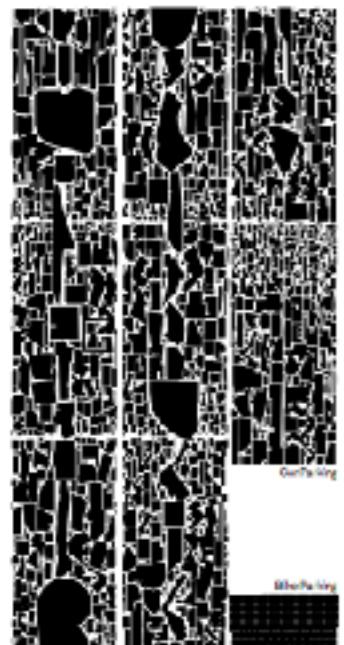
What the Street?
<https://github.com/moovel/lab-what-the-street>

Los Angeles



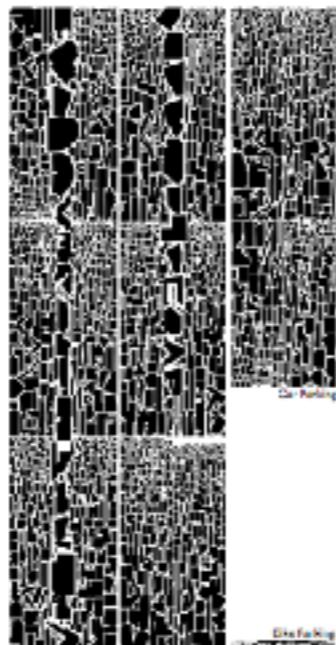
What the Street?
<https://github.com/moovel/lab-what-the-street>

New York



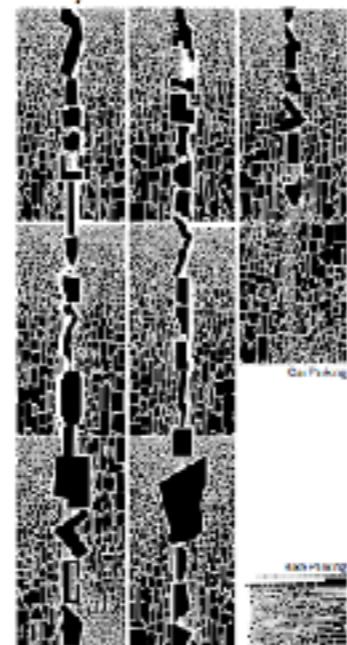
What the Street?
<https://github.com/moovel/lab-what-the-street>

Helsinki



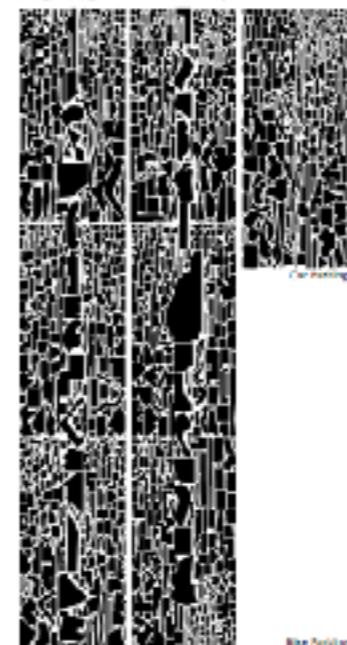
What the Street?
<https://github.com/moovel/lab-what-the-street>

Tokyo



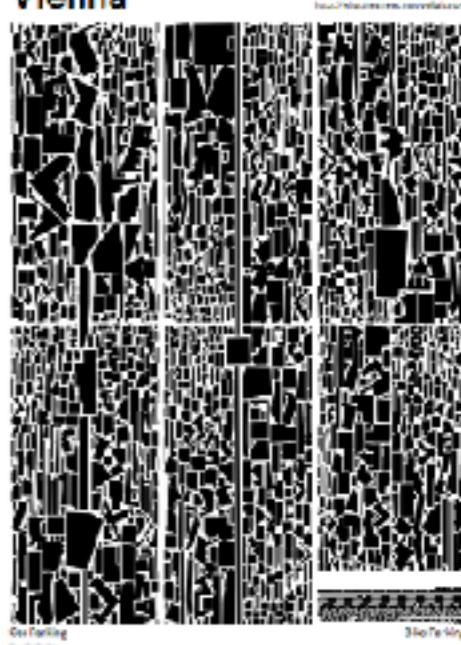
What the Street?
<https://github.com/moovel/lab-what-the-street>

Rome



What the Street?
<https://github.com/moovel/lab-what-the-street>

Vienna



What the Street?
<https://github.com/moovel/lab-what-the-street>

Open-sourced at <https://github.com/moovel/lab-what-the-street>
Add your favorite city!

Use graph algorithms to roll up
ALL streets, bike lanes, and rails

<https://github.com/gboeing/osmnx>

Home Search Streets

No Parking Selected



0 m²

0.0 m²

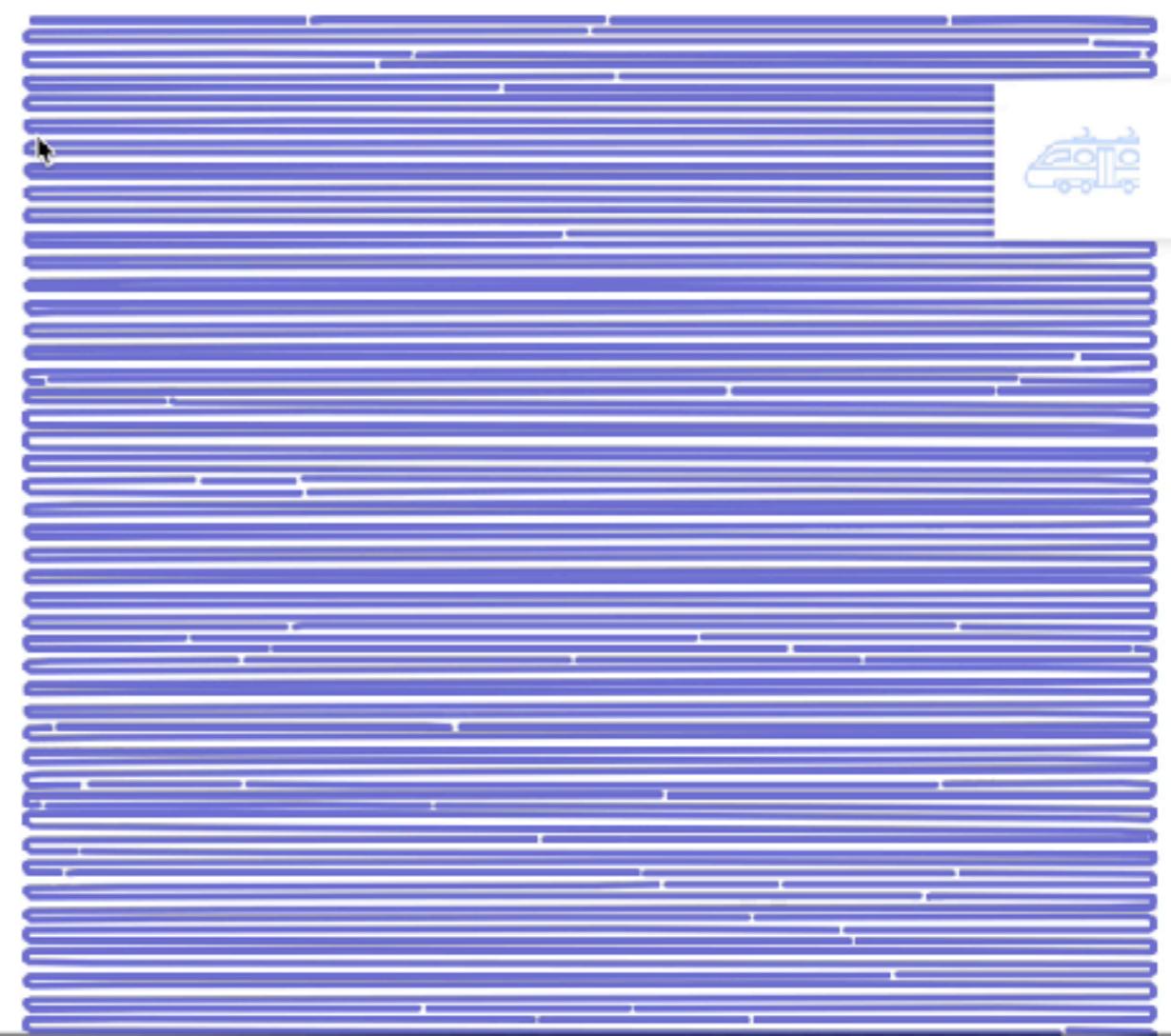


No Lane Selected

Car Parking



Car Lanes



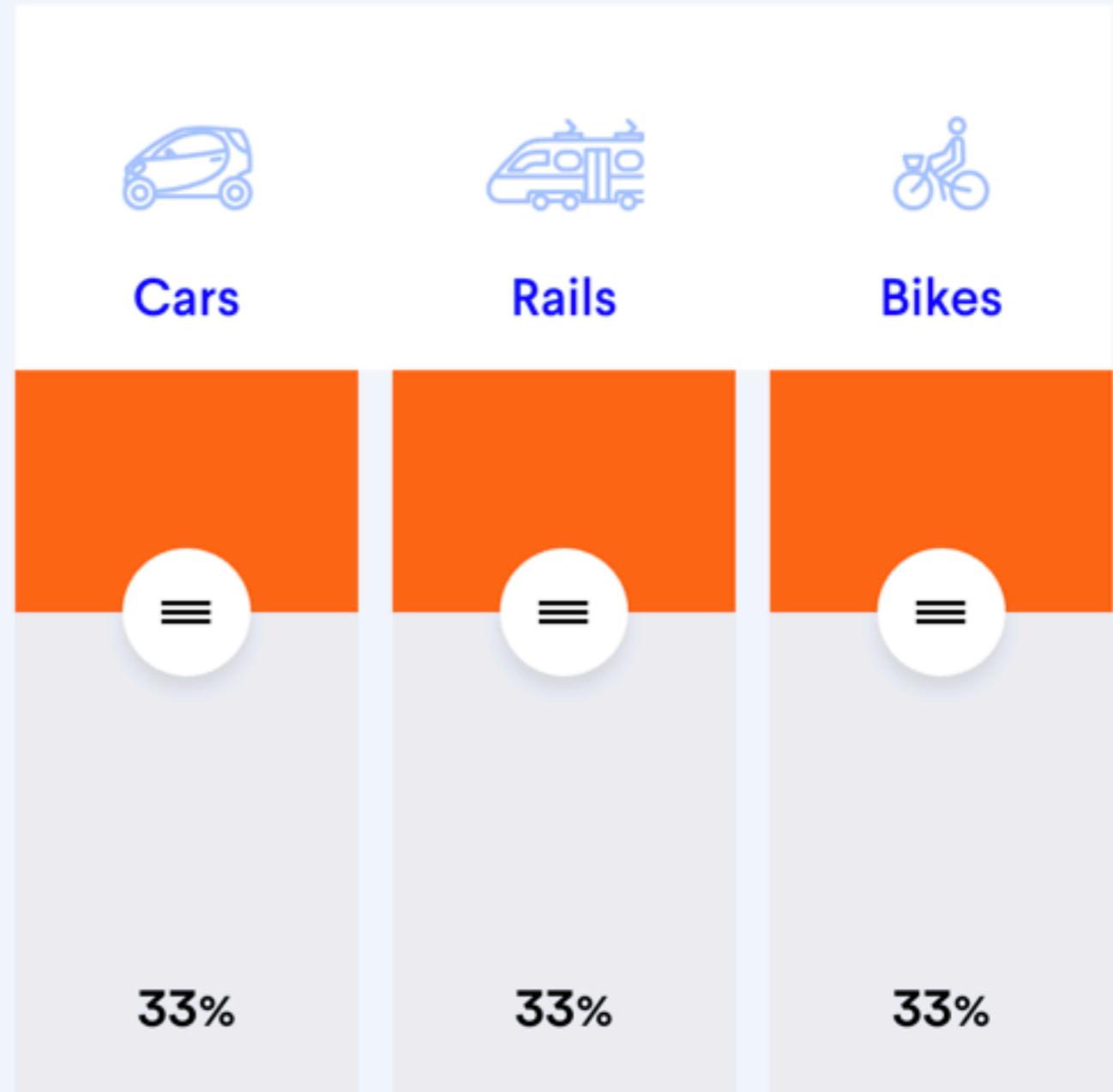
↑ Scroll to next →

Exploring "The arrogance of space" interactively

Who owns Budapest? ↓

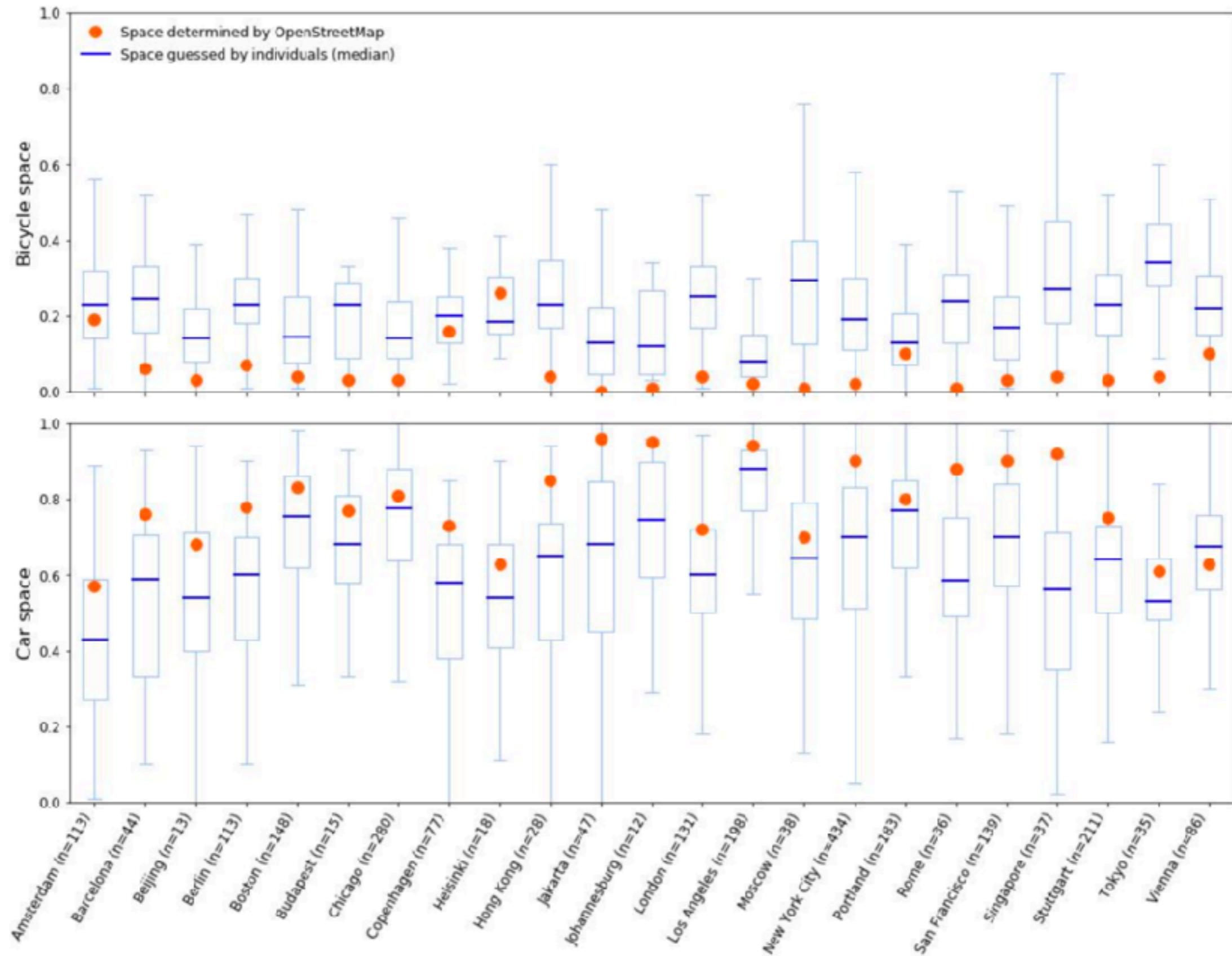
City space is limited! What do you think, how much space is allocated to the different ways of moving through the city?

TAKE YOUR
BEST GUESS
BY ADJUSTING THE
SLIDERS

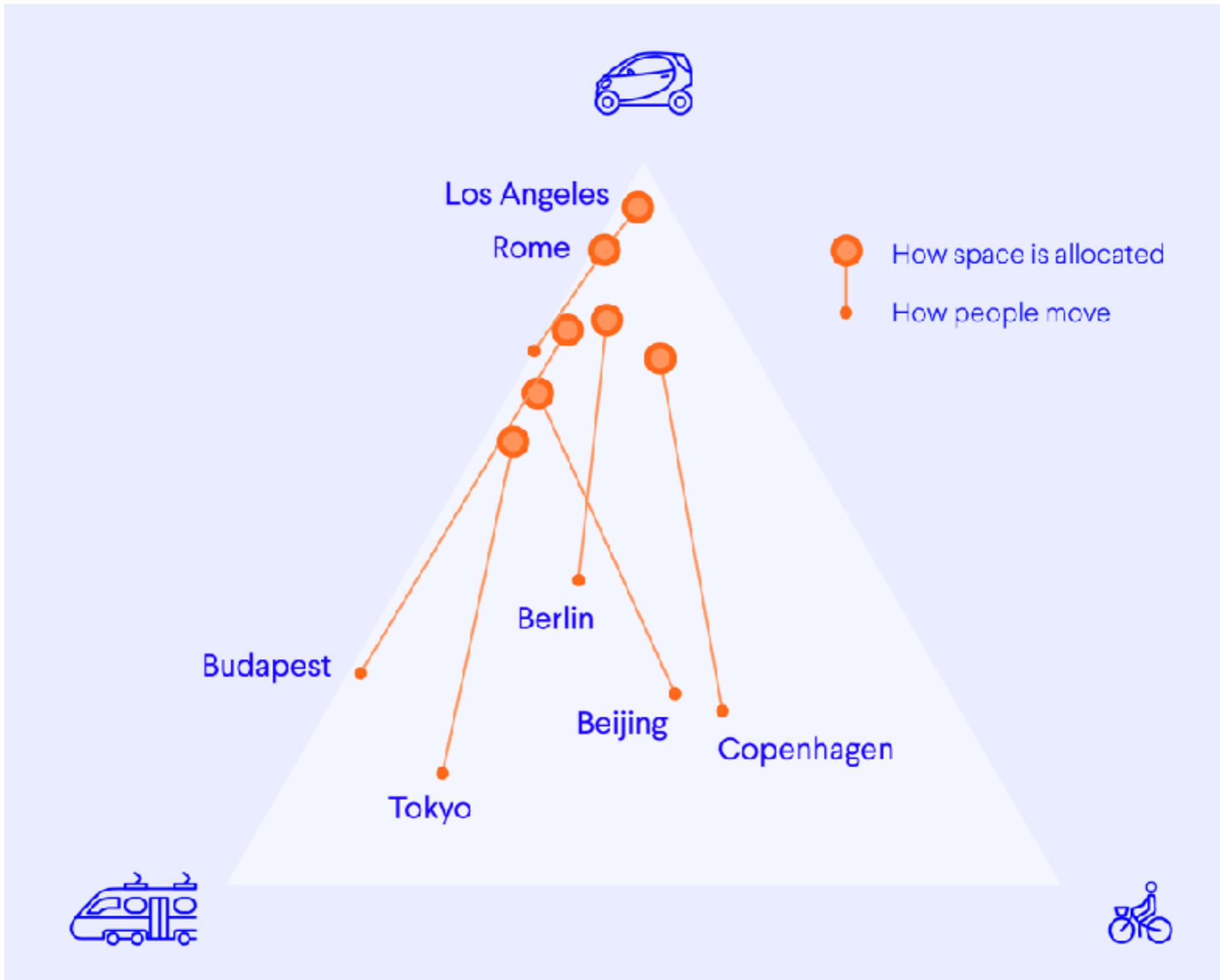


Get Started

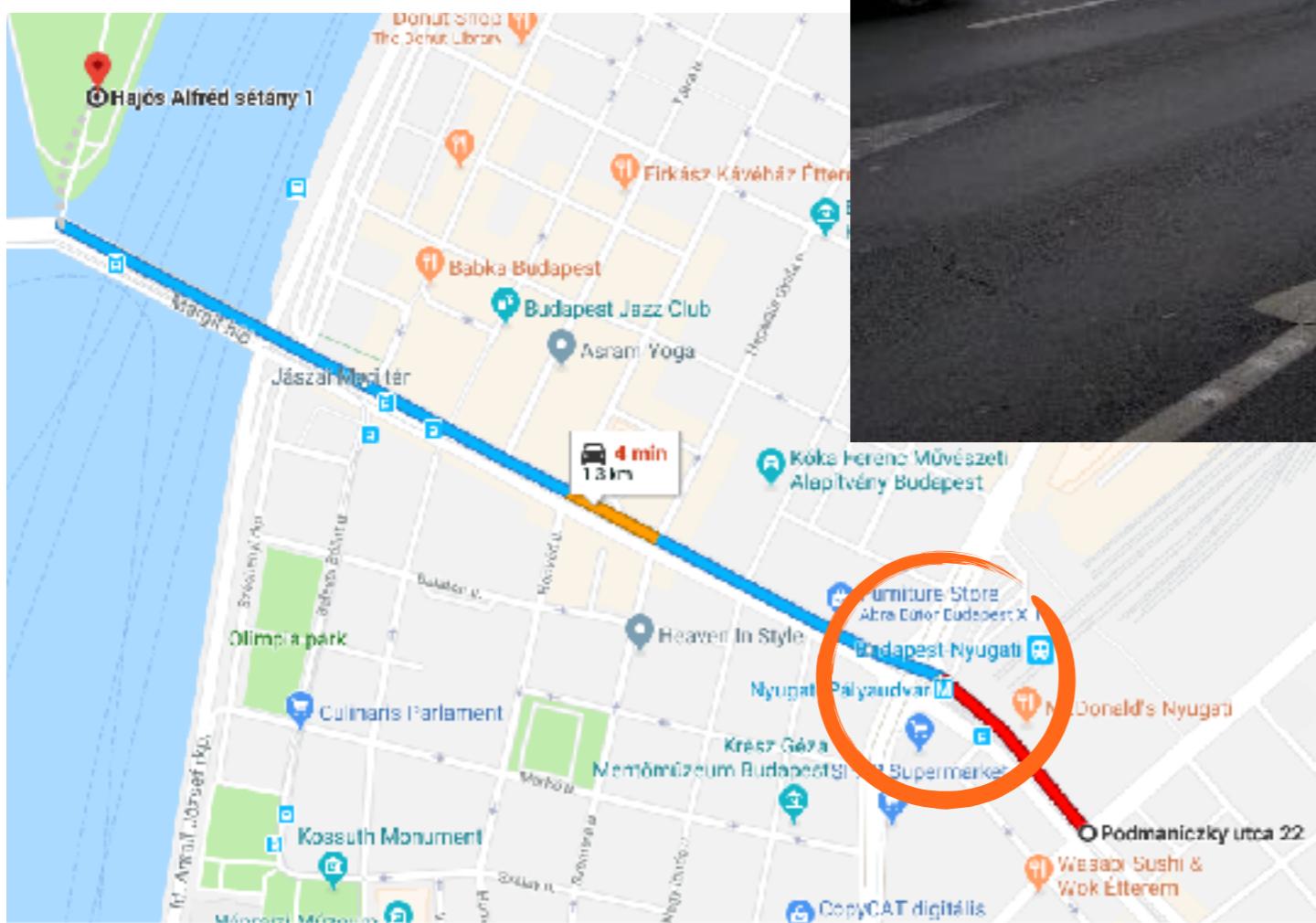
People underestimate car space, overestimate bike space



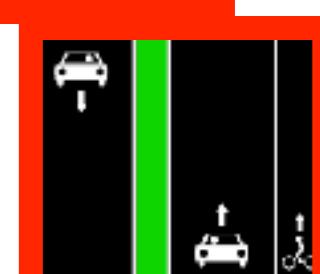
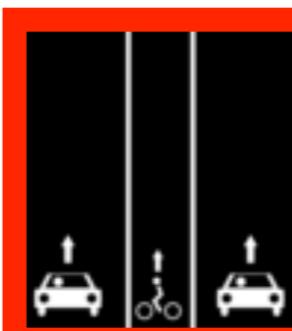
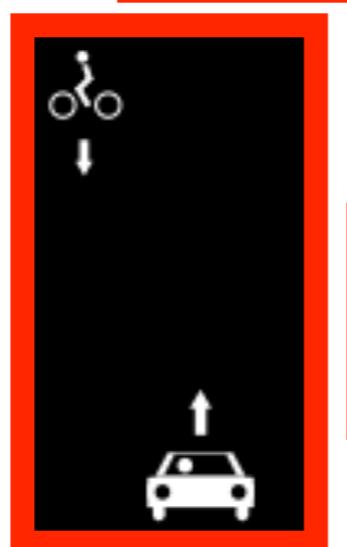
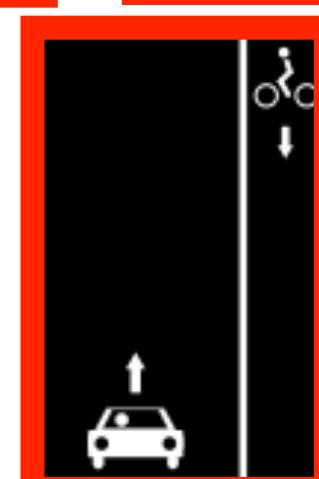
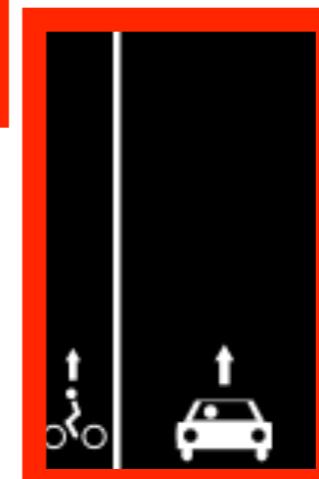
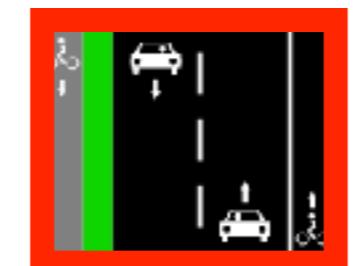
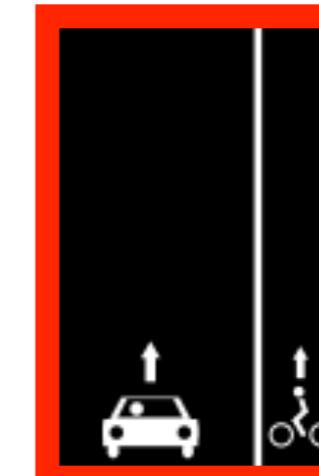
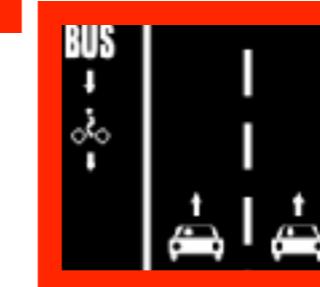
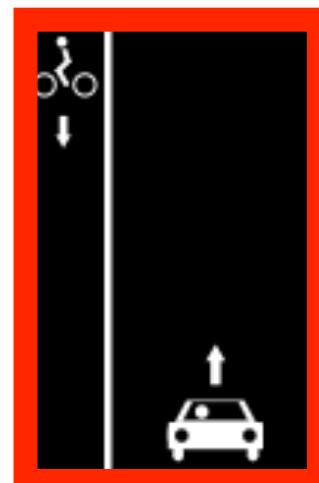
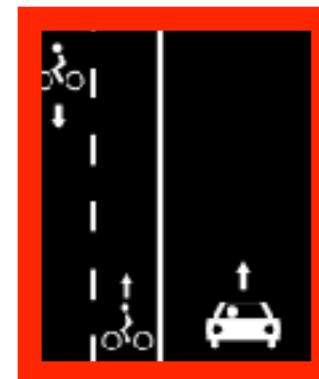
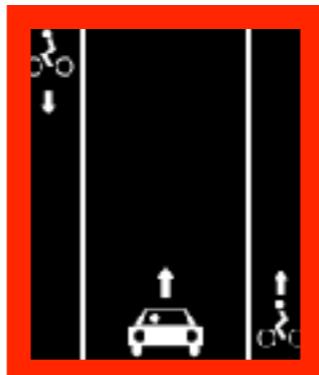
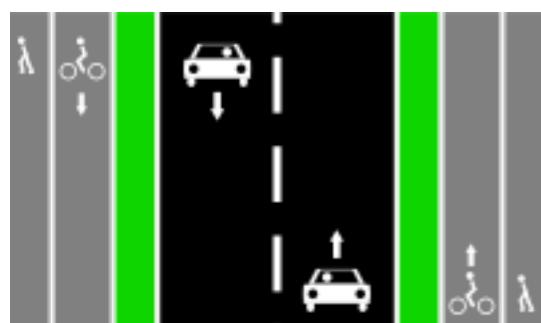
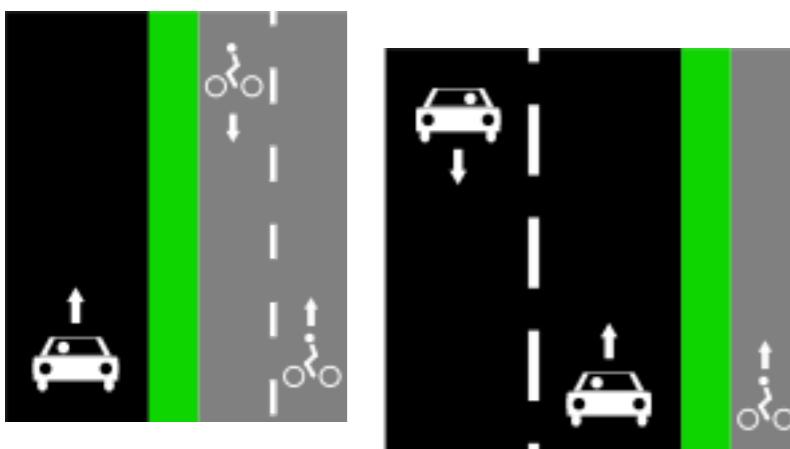
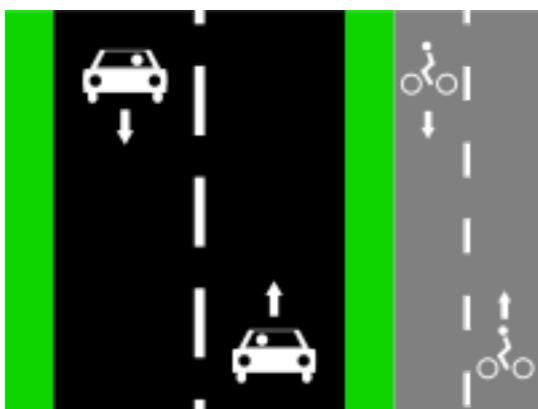
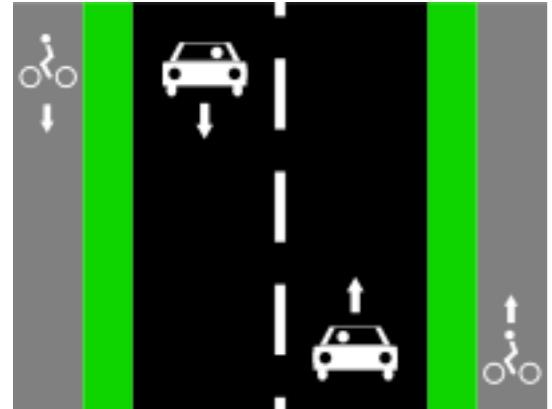
The mobility triangle shows the arrogance of space in two data points



Biking to Margit-sziget from Nyugati? Prepare to die.



Protected vs unprotected bike lanes

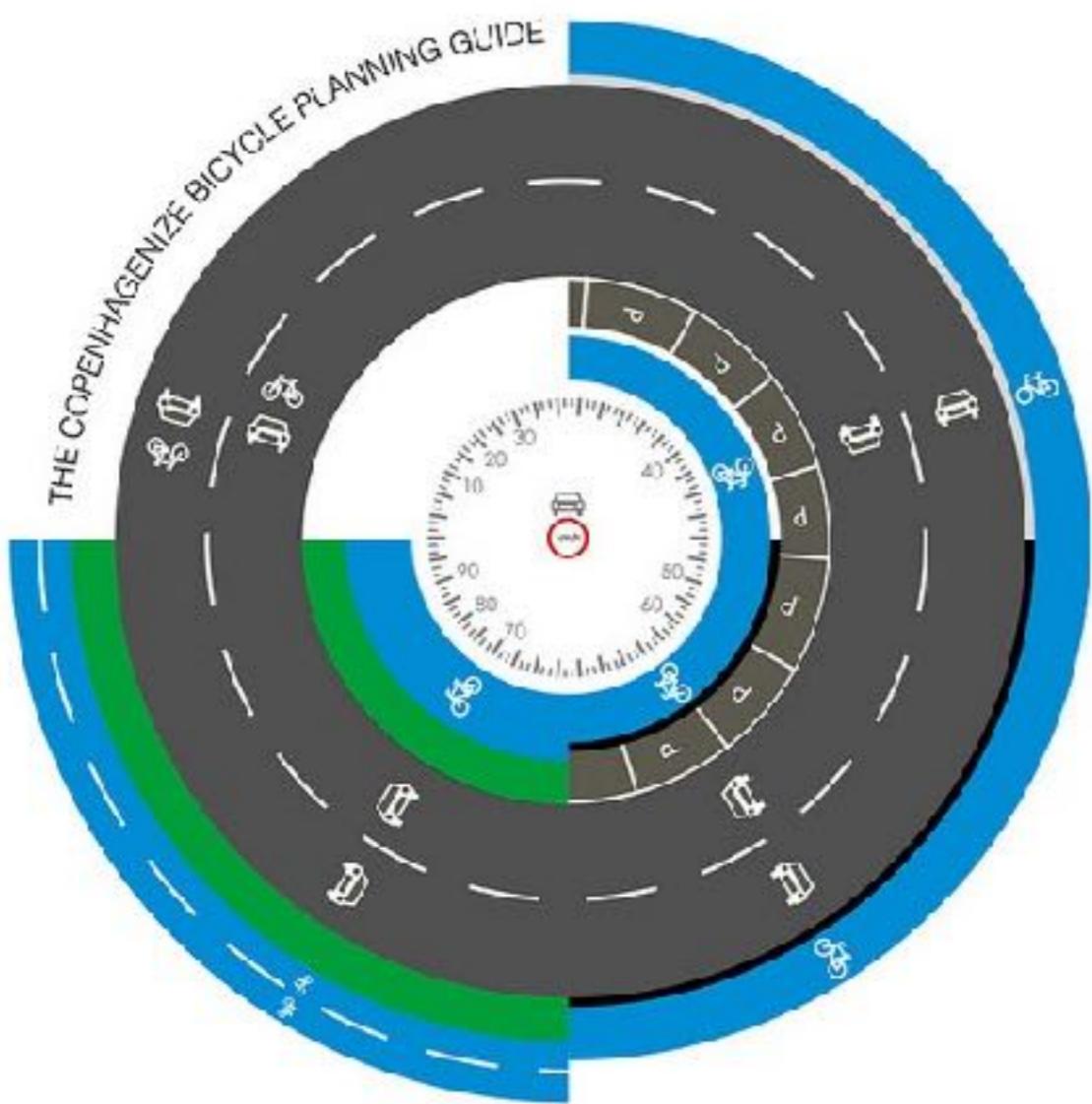


Protected vs unprotected bike lanes



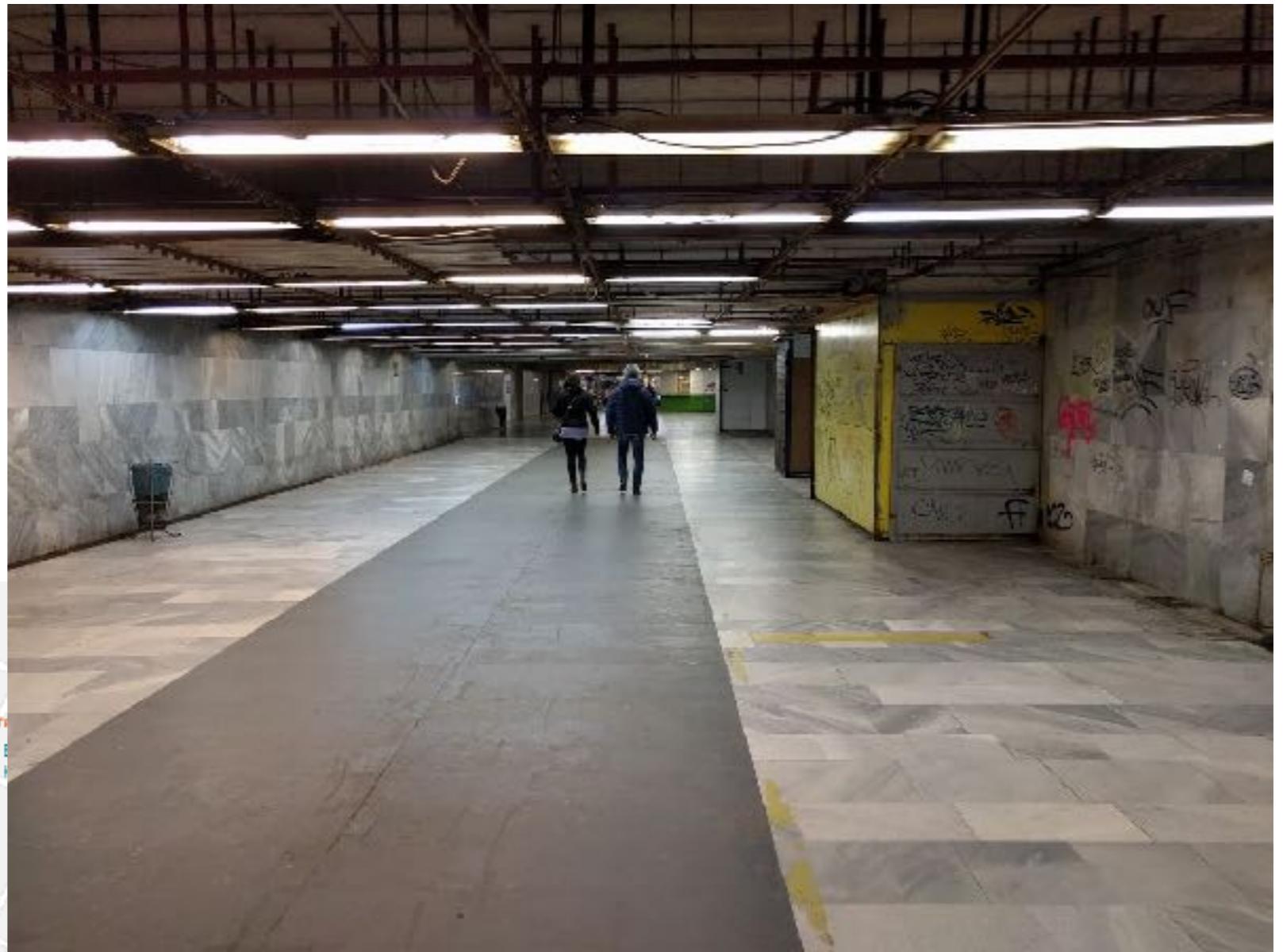
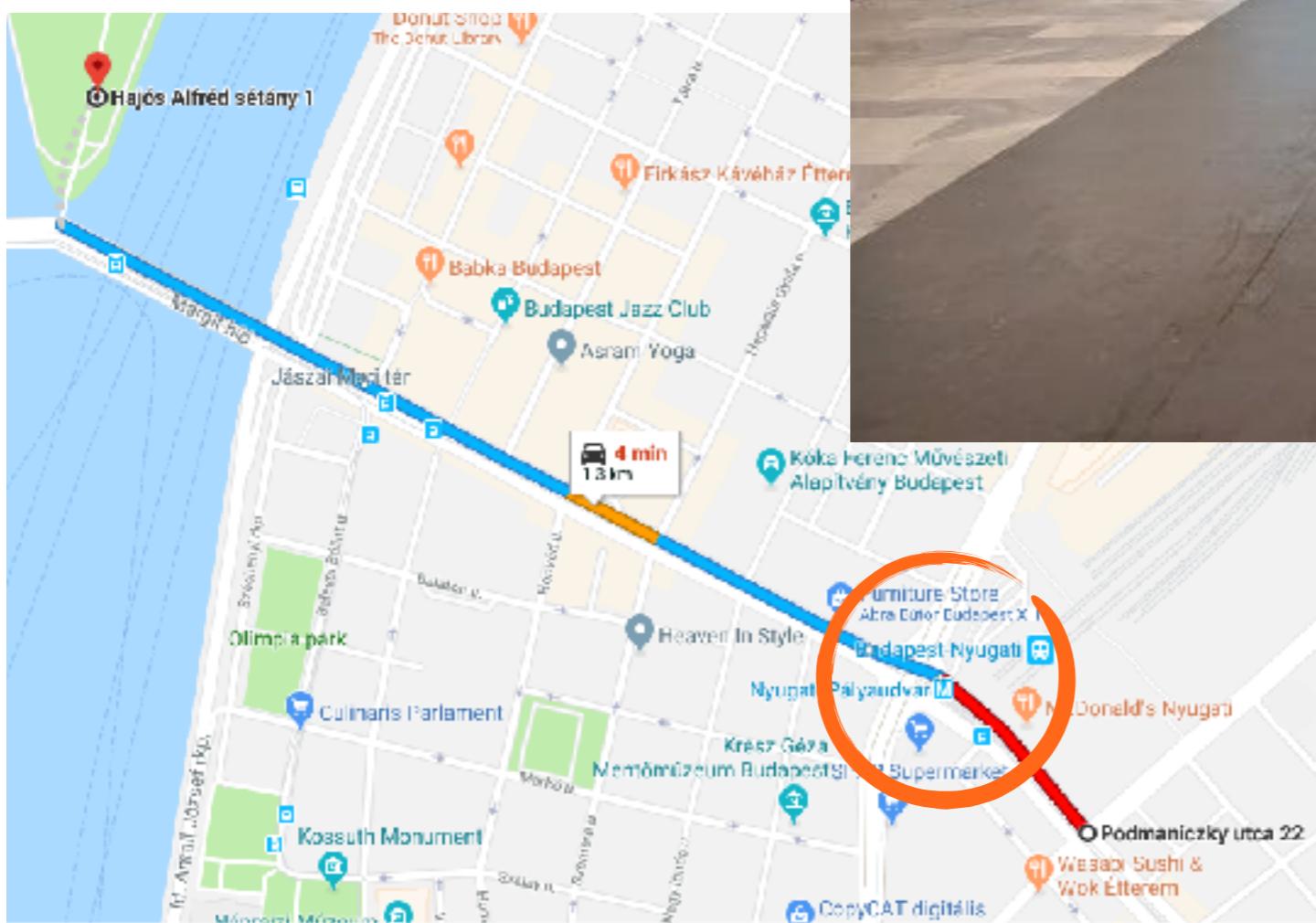
Protected vs unprotected bike lanes

The less bicycle infrastructure a city provides, the less protected it is



https://twitter.com/moore_oliver/status/994583493035417600

Walking to Margit-sziget from Nyugati? Leave your baby home.



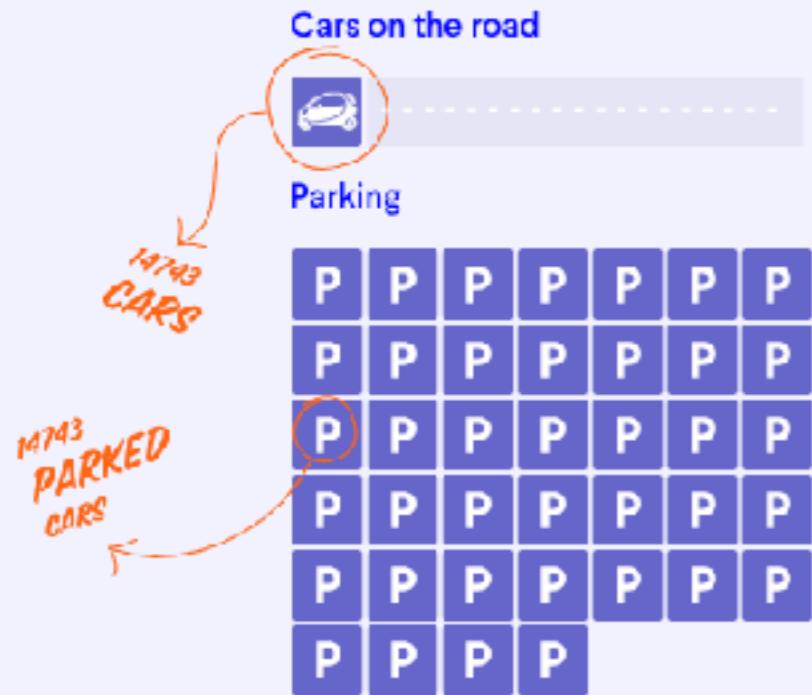
How can we get back the space?

10% of self-driving cars can deliver same mobility



93% of parking spaces can be saved by autonomous, shared vehicles

Today's Budapest



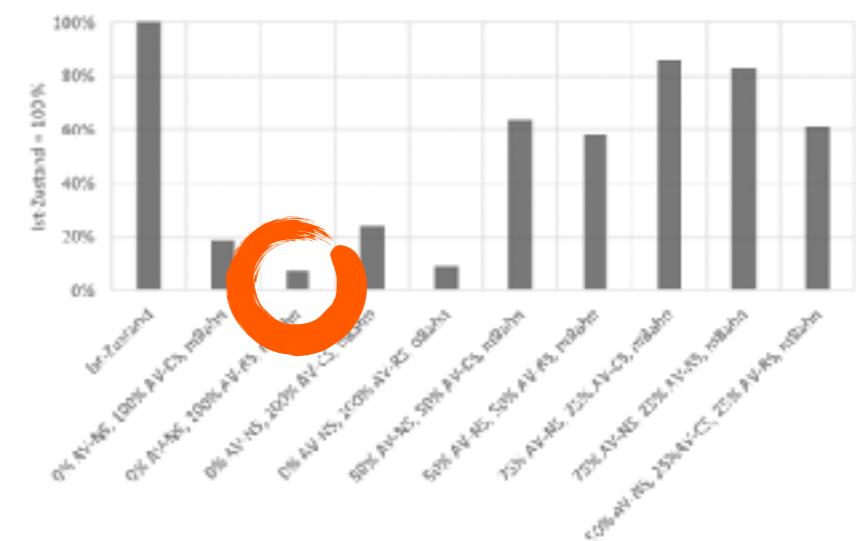
Based on the study MEGAHOUR of ISV,
University of Stuttgart, by Friedrich and Hartl

534,753

Parking spaces
could be freed up.

Future Budapest

Autonomous cars on the road



Friedrich & Hartl, Univ. Stuttgart (2016)

Autonomous, shared cars are nice, but NOT the ultimate solution

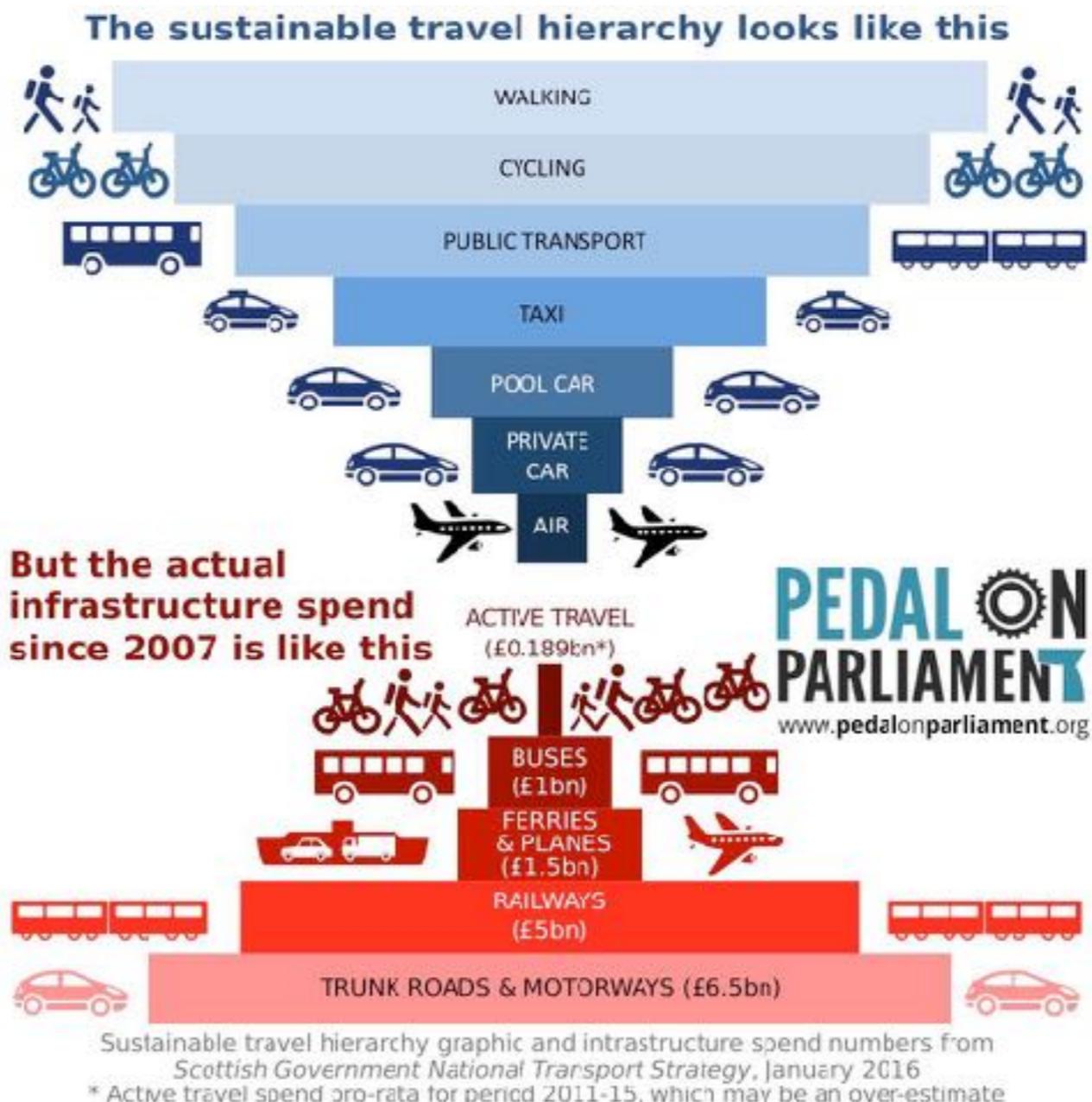


Autonomous, shared cars are nice, but NOT the ultimate solution



We know the solution. It is simple geometry.

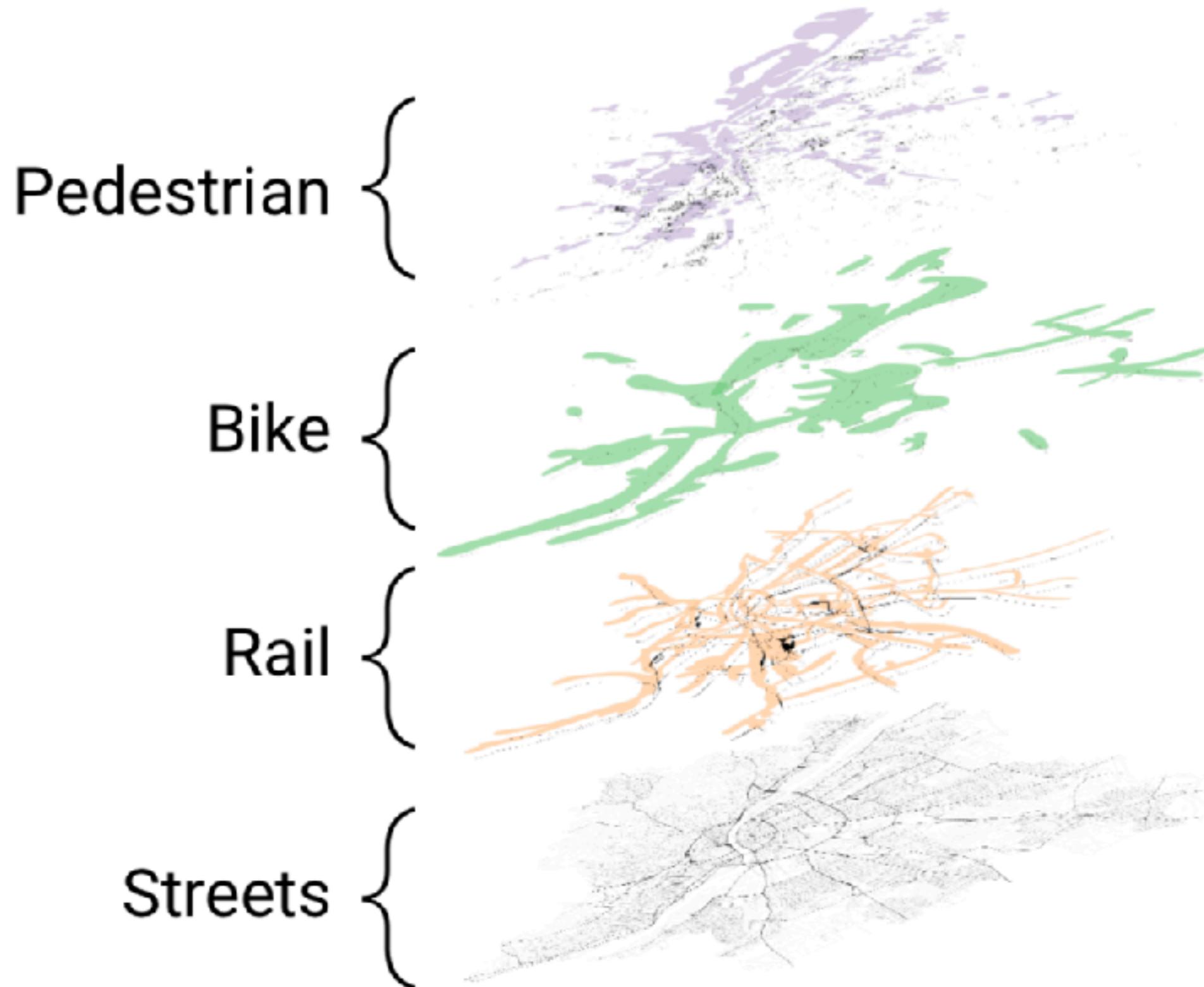
The arrogance of budgets



Good scaling+economic arguments why car-centric cities are not sustainable

Gossling and Choi, Ecol Econ 113 (2015)
Louf and Barthelemy, PRL 111.19 (2013)

Urban infrastructure is a multiplex network



More research needed on sustainable infrastructure networks

Completeness

Holes in coverage - forced car-ownership

Efficiency

Respect desire lines

Interplay

Multimodality

whatthestreet.moovellab.com



Thx to OpenStreetMap for all the data!