Metropolitan Network: A strong European railway for an ever closer union

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Key Facts

21,000 km
of high-speed lines to be added between 2030 and 2050

60%
of **EU citizens connected** by HSR network

Frequent connections
between metropolitan regions

Increase to
317%
in HSR traffic
by 2050 relative to 2015

Total Rail market share expected to increase from 11% in 2015 to
19%
by 2050

HSR market share 2050 for distances between 500 – 1,000 km
27%
compared to 13% in 2019

Rail connects people to build an ever closer union

Rail connects people. For an ever closer union, we need more rail. It is of vital importance for the mobility of millions of European citizens that high performing international rail passenger transport be further developed and expanded. And beyond that, this expansion directly supports the most overarching objectives of the European Union.

Rail transport is climate protection

The development of a powerful high-speed rail (HSR) network to connect European cities and citizens is first and foremost crucial to fighting climate change. After all, rail passenger transport emits 80 per cent less carbon dioxide than air travel and 75 per cent less than car travel. The clear and ambitious climate targets set out in the European Green Deal and the Commission's Sustainable and Smart Mobility Strategy therefore rightly include provisions regarding the expansion of rail.

Rail drives industrial development

Efficient European train connections also form the backbone of mobility in Europe. Economic and industrial development and the functioning of the internal market require the ability to move quickly and reliably between European metropolitan regions. According to the Commission's Industrial Strategy for Europe, a particular focus should be placed on sustainable and smart mobility industries, including rail, as it is only these industries that have the potential to drive the twin transitions, support Europe's industrial competitiveness, and improve connectivity.

Rail ties Europe together

Connecting people, regions, and countries in Europe through efficient international rail services also makes a significant contribution to reaching the objectives of European Regional Policy – an investment policy that promotes job creation, competitiveness, economic growth, improved quality of life, and sustainable development. One of the priorities of this policy is to ensure a more connected Europe by enhancing mobility. Consequently, many of the major projects supported by the EU's cohesion policy funding concern rail.

Rail supports international aid and solidarity

The current war in Ukraine has very clearly shown that high-performance rail connections, especially connecting central and eastern European countries, are vital for crisis intervention. Trains played a pivotal role in ensuring the prompt and secure arrival of numerous Ukrainian refugees seeking safety in European countries at the onset of the crisis. Rail continues to play a key role in enabling those seeking refuge from war to flee. Even more and better connections make Europe better equipped for crisis situations.

Rail strengthens European identity

Finally, a well-functioning network of high-speed rail connections in Europe enables people to get to know each other's countries, to engage in fruitful exchanges, and to further unite Europe. This is particularly important for young people – for example using the Interrail pass – to lay a solid foundation for European unity for the future.

The Commission has set the right course to foster European high-speed rail connections. The Action Plan to boost passenger rail comprises tailored measures to unleash the potential of cross-border rail transport. The proposed revision of the TEN-T Regulation sets the framework for a further development of the core, extended core, and comprehensive network in Europe, taking intermodality and the connection of urban nodes into account.

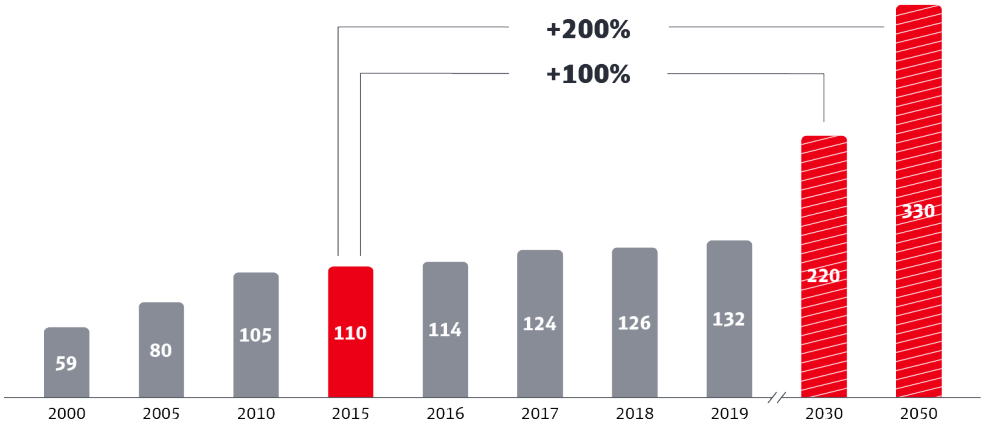
Against this background and fully in line with the framework set by the Commission, we present this analysis to show the need for a long-term development of a European high-speed network based on market considerations.

Reducing carbon emissions

With the Green Deal and its Sustainable and Smart Mobility Strategy, the EU has set itself the target of reducing transport-related carbon emissions by 90 per cent by 2050 and making the transport system sustainable.[1] To achieve the objectives of sustainable, smart, and resilient mobility, two milestones, among various other things, were set out:

- double the volume of European high-speed rail traffic by 2030, and
- triple the volume by 2050

compared to the base year 2015.[2]



HSR transport volume in Europe
[in billion pkm per year]

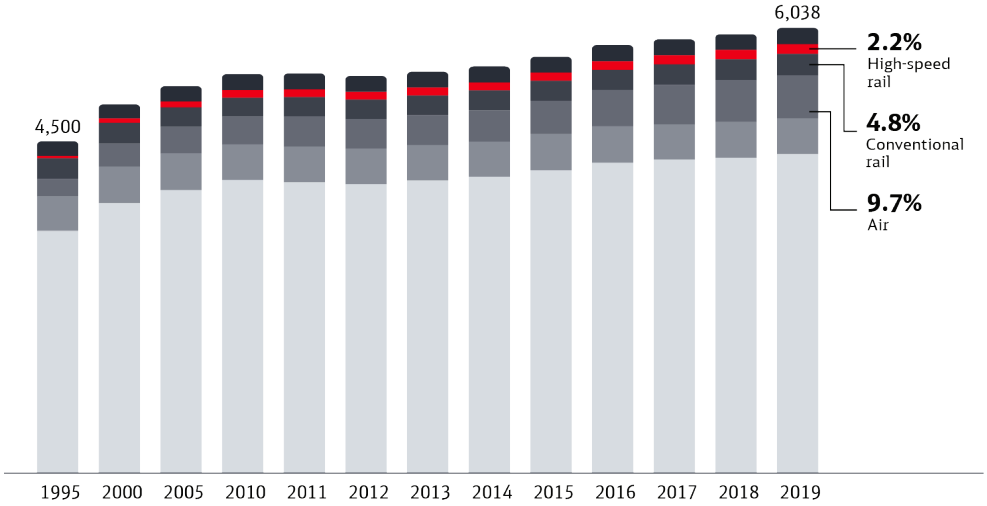
Statistical EU data
Derived EU target

(1) Definition: HSR transport covers all traffic with high-speed rolling stock (incl. tilting trains able to run 200 km/h). This does not necessarily require high-speed infrastructure.

European Commission, Directorate-General for Mobility and Transport, EU Transport in figures: Statistical Pocketbook 2022, Publications Office, 2022

Ambitious EU target

Despite the rising demand for mobility, rail transport's market share in Europe was merely 7.0 per cent in 2019 and has grown only slightly since 2000, while the market share of air transport increased from 6.1 per cent to 9.7 per cent.[3]



Traffic volume by mode of transport 1995–2019
[in billion pkm per year]

Other
HSR
Conventional rail
Air
Coach
Car

European Commission, Directorate-General for Mobility and Transport, EU Transport in figures: Statistical Pocketbook 2022, Publications Office, 2022

In a discussion paper published in May 2022, Deutsche Bahn AG (DB) estimated that only around 75 per cent of the necessary traffic growth by 2030 can be achieved on the high-speed rail infrastructure that is currently in place or planned for construction.

[1] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 2020. *Sustainable and Smart Mobility Strategy – putting European transport on track for the future* {SWD (2020) 331 final}, EUR-Lex - 52020DC0789 - EN - EUR-Lex (europa.eu)
[2] European Commission, Directorate-General for Mobility and Transport, EU Transport in figures: Statistical Pocketbook 2022, Publications Office, 2022, https://data.europa.eu/doi/10.2832/216553
[3] European Commission, Directorate-General for Mobility and Transport, EU Transport in figures: Statistical Pocketbook 2022, Publications Office, 2022, https://data.europa.eu/doi/10.2832/216553

A substantial expansion of HSR infrastructure is necessary to achieve the ambitious EU growth targets. However, investment in the expansion of existing infrastructure or the construction of new cross-border infrastructure has been very slow-moving. Current efforts to expand existing high-speed rail infrastructure leave many metropolitan regions unconnected to European high-speed rail and thereby much potential for HSR traffic growth untapped.

Background and approach of the study

The Green Deal and the Sustainable and Smart Mobility Strategy set out an ambitious target to reduce transport-related carbon emissions by 90 per cent by 2050. This will require unconditional commitment and willingness to adapt by governments, institutions, transport companies, and European citizens along with a sustained search for smart solutions.

As rail operators, we want to actively contribute to achieve the doubling and tripling in high-speed rail transport by 2030 and 2050, respectively. Based on their experience with high-speed lines already in service, we expect that the infrastructure that is planned or currently under construction will not be sufficient to meet the targets that have been set out. For instance, several countries, especially in the eastern regions of Europe, are inadequately connected or not connected at all by high-speed lines, which leaves much of the potential for traffic growth untapped. From a demand-driven perspective, it appears that a broader network is required to effectively connect all the metropolitan regions in the European Union. [4] These regions are home to more than 250 million citizens or approximately 60 per cent of the European Union's population and thus presumably experience the highest transportation demand. A significantly larger HSR network could enable modal shift to HSR and additionally would set a coherent standard in transport quality all over Europe.

To obtain a well-founded and independent view on this vision, DB commissioned PTV Planung Transport Verkehr GmbH to carry out a study to simulate the effect on the achievability of the EU's targets for 2030 and 2050. In a joint effort with a significant number of railway operators in Europe, a travel demand model was developed which is able to predict natural growth of transport demand caused by changes in population and prosperity and the impact of reduced travel times within a better connected HSR network. To determine the multi-modal effects within the entire transport market, the model includes high-speed and conventional rail as well as private car, coach, and air transport. Travel demand and socio-economic data in the model use the NUTS 3 zonal system. Traffic flow simulation uses transportation networks of all modes in a high resolution. The level of service of high-speed rail in 2030 and 2050 is computed assuming hourly service between metropolitan regions and an average commercial speed of 210 km/h on the new HSR lines in 2050. Price, travel time, and service quality of the competing modes (car, coach, air) are assumed to remain unchanged. No additional shocks or disruptive changes are assumed.

To include the most recent statistics, the study is based on data from 2019, as the last year before long distance travel demand was disrupted by the COVID pandemic. The baseline and comparison year for the study results is therefore 2019. In the base year, the study uses empirical demand data for air and rail and synthetic demand for the other two transport modes (coach and car).

A validation of the model to the base year of the EU targets, 2015, was made. As the definition of HSR demand used by Eurostat covers all traffic with dedicated HSR rolling

[4] The metropolitan typology is applied at the level of NUTS level 3 regions and identifies metropolitan regions in the European Union (EU). These regions are defined as urban agglomerations (NUTS level 3 regions or groups of NUTS level 3 regions) where at least 50% of the population lives inside a functional urban area (FUA) that is composed of at least 250,000 inhabitants.
Eurostat. *Methodological manual on territorial typologies | 2018 edition,* https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/ks-gq-18-008

stock, the model includes services on conventional lines, where such trains are in use. According to Eurostat data, the baseline number of passenger kilometres (pkm) in 2015 was 110 billion pkm.[5] As part of this study, PTV validated and completed its model with support from DB, ČD, NS, ÖBB, PKP Intercity, Renfe, SBB, SNCB, SNCF, and Trenitalia. This resulted in a slightly higher value of 113 billion pkm for the total HSR demand within the EU in 2015 and in a more complete and consistent origin-destination matrix of rail demand in Europe. For consistency reasons, in the following the EU base value of 110 billion pkm for 2015 is shown.

Current network and plans up to 2030

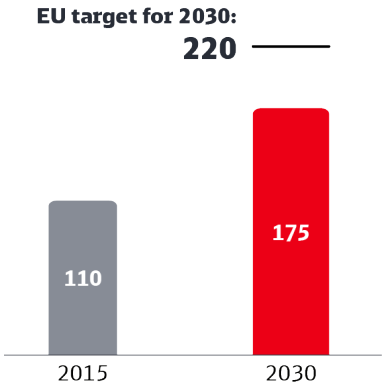
Currently, European high-speed lines still form a patchwork of separated networks focused on national traffic and characterised by different technical standards and operational models. High-speed traffic has traditionally been strong between specific major cities, especially in western European countries where dedicated high-speed lines exist. Many other metropolitan regions, especially but not exclusively in the eastern part of Europe, remain unconnected by high-speed lines. Although a limited number of high-speed lines cross borders and additional ones are planned within the revised TEN-T program, the national networks do not merge into a cohesive European high-speed rail network.
Overall, European rail infrastructure is characterised by a concentration on national lines and lacks cross-border interconnectivity, leaving much potential for growth unexploited.

Planned European HSR network until 2030

- Fast connections in 2019 > 190 km/h (commercial speed)
- Fast connections in 2019 ≤ 190 km/h (commercial speed)
- New HSR lines to be ready between 2020 and 2030 (design speed as planned, 250 km/h if unknown)

[5] European Commission, Directorate-General for Mobility and Transport, EU Transport in figures: Statistical Pocketbook 2022, Publications Office, 2022, https://data.europa.eu/doi/10.2832/216553

To assess the EU's first milestone of doubling traffic volumes by 2030, the analysis examined the existing network together with the infrastructure expected to be built by 2030 (based on publicly available sources). The analysis shows that the planned infrastructure measures are not sufficient to achieve a doubling of HSR traffic by 2030. High-speed rail traffic in Europe will only grow by about 60 per cent of the envisaged growth (resulting in 175 billion pkm of the 220 billion pkm set out in the target).



HSR passenger kilometres – target and simulation 2030
[in billion pkm per year]

HSR

Building an ever closer union with a European Metropolitan Network: connecting all European metropolitan regions with high-speed lines to achieve the 2050 target

The current and planned infrastructure leaves many metropolitan regions in Europe unconnected, and the 2030 targets will likely not be achieved. Therefore, this initiative is to build on and go far beyond the current plans of the TEN-T network or the infrastructure to be opened by 2030.

A new network linking all metropolitan regions by high-speed rail – the Metropolitan Network – would be sufficient to achieve the necessary traffic growth by 2050. It would be necessary to build new lines and expand existing ones to cover around 21,000 additional kilometres. Along with the new lines expected to be in service by 2030, the entire network would more than triple the length of the 2019 HSR infrastructure in the EU27 (which, according to Eurostat 2019, amounts to 11,336 km).[6]

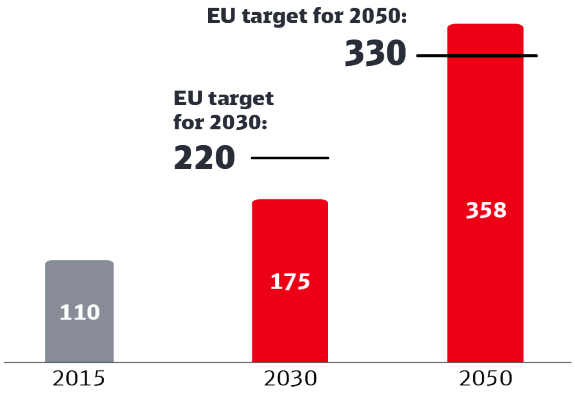
The geographical scope of the proposed Metropolitan Network covers EU countries and connects some relevant nodes in the EU candidate countries as well as other EU neighbouring countries (e.g. Chișinău, Lviv, Belgrade, Oslo, Skopje). However, further domestic traffic of such countries has not been included in the Metropolitan Network and the model at this stage. In view of the ongoing accession negotiations, these countries should be included in potential subsequent studies for long-term infrastructure plans.

Approximately a third of the new lines needed to link all European metropolitan regions by high-speed rail are already included in the 2022 negotiating mandate ("general approach") for a revised TEN-T network[7]. To complete a Europewide network, an extensive number of additional lines would need to be added to the program.

While the passenger kilometres based on the current plans for 2030 are unlikely to meet the Green Deal targets, the implementation of the Metropolitan Network could enable a threefold increase in HSR traffic by 2050. Thus, the 2050 target cannot be achieved if the future HSR network in Europe was considerably smaller than the proposed Metropolitan Network.

[6] European Commission, Directorate-General for Mobility and Transport, EU Transport in figures: Statistical Pocketbook 2022, Publications Office, 2022, https://data.europa.eu/doi/10.2832/216553

[7] European Commission, Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Union guidelines for the development of the trans-European transport network, amending Regulation (EU) 2021/1153 and Regulation (EU) No 913/2010 and repealing Regulation (EU) 1315/2013, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0812



HSR passenger kilometres – target and simulation of the Metropolitan Network 2050
[in billion pkm per year]

HSR

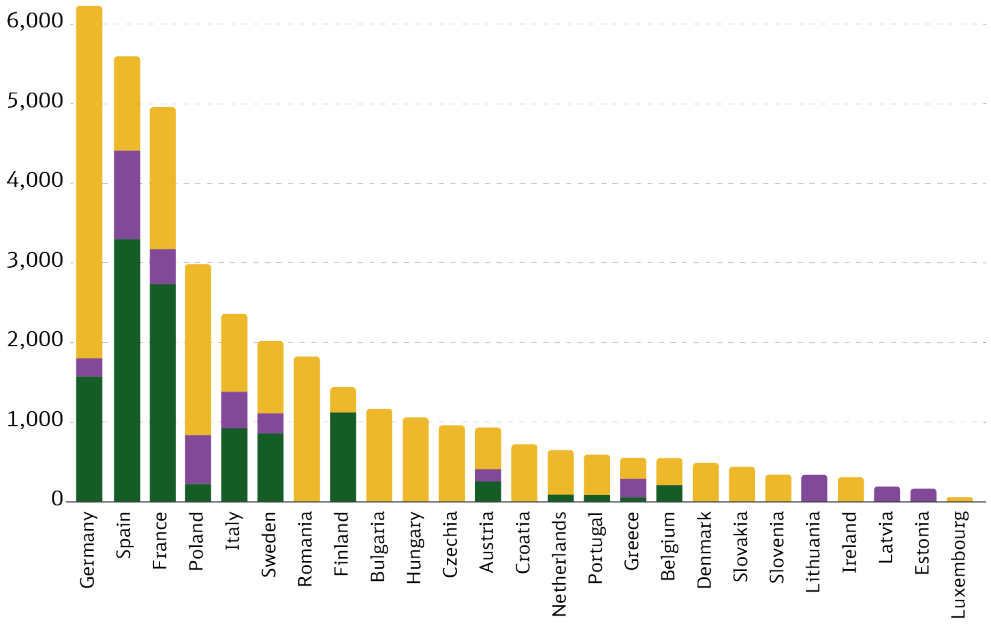
Building an additional 21,000 km of rail infrastructure over the next 27 years is an ambitious target. However, considering that approximately 20,000 km of motorway was built in the EU27 between 2000 and 2020, it is clear that infrastructure of comparable size and complexity can be built in an even shorter time.[8] An extensive additional investment would be needed to build and further develop a HSR network in Europe. Furthermore, an emphasis on capacity enhancement in the nodes has to be considered, as this could enable frequent (e.g., hourly) connections between the metropolitan regions which are vital to generate additional traffic in Europe.

Vision 2050: European Metropolitan Network

- Fast connections in 2019 > 190 km/h (commercial speed)
- Fast connections in 2019 ≤ 190 km/h (commercial speed)
- New HSR lines to be ready between 2020 and 2030 (design speed as planned, 250 km/h if unknown)
- Metropolitan Network (design speed 300 km/h)

[8] Eurostat, Data Browser, *Length of motorways and e-roads*, accessed on 17.04.2023, https://ec.europa.eu/eurostat/databrowser/view/ROAD_IF_MOTORWA_custom_5808423/default/table

Based on this European Metropolitan Network, Germany, Poland, Romania, France, and Spain would have the highest absolute growth in terms of HSR network length compared to 2019. Germany would have the highest absolute expansion potential, as there is currently (base year 2019) less dedicated HSR infrastructure[9] in Germany (1,571 km) than for example in Spain (3,297 km) or France (2,734 km) and the number of metropolitan regions to be connected is relatively high due to the spatial structure.



Current and necessary development of HSR infrastructure
[in km, per country]

HSR line km (2019, Eurostat)*

New HSR lines to be ready between 2020 and 2030 (design speed as planned, 250 km/h if unknown)**

Metropolitan Network (design speed 300 km/h)

European Commission, Directorate-General for Mobility and Transport, EU transport in figures: Statistical Pocketbook 2021, Publications Office, 2021

***Some values estimated*

By expanding the infrastructure in the proposed Metropolitan Network (including the lines under construction or planned, shown in purple), Germany would almost quadruple its HSR infrastructure (+296%/+4,649 km), while Poland would increase its HSR network (currently 224 km) more than tenfold (+1,233%/+2,762 km) compared to 2019.

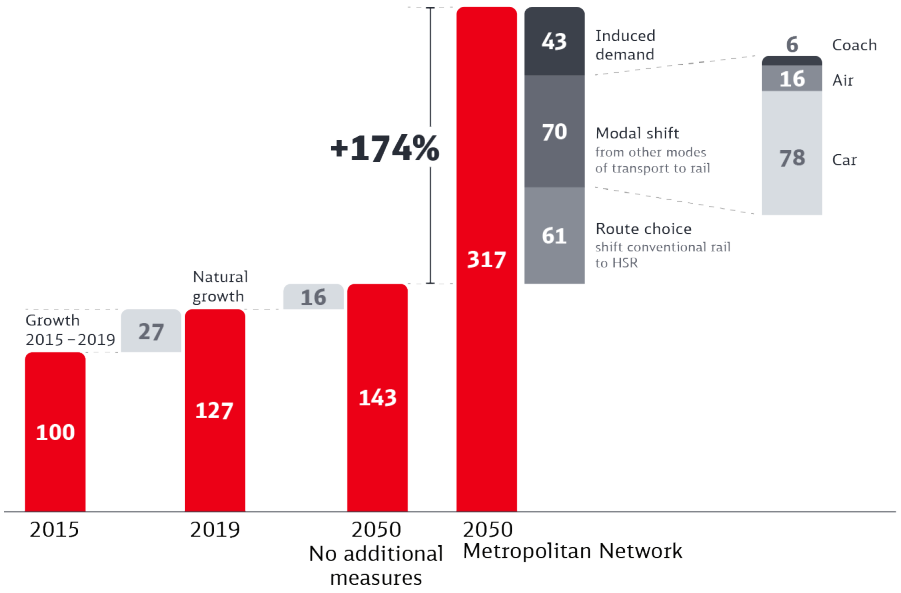
Results

This study clearly shows the need for a European Metropolitan Network to achieve the ambitious goals of the Green Deal and the Sustainable and Smart Mobility Strategy as well as the benefits thereof.

a) A European Network unlocks the potential needed to achieve the climate target by tripling HSR demand

The results of the demand simulation show that the proposed Metropolitan Network would achieve the tripling of HSR traffic by 2050 by connecting metropolitan regions across Europe.
From 2015 to 2019, a growth of 27 percentage points was achieved through important infrastructure and service extensions in the core HSR markets. Through 2050, natural growth (population and economy) is estimated to be only a minor driver of rail demand (+16 percentage points) and would not lead to achieving the targets without additional measures. In contrast, a substantial expansion of HSR infrastructure and services, and the resulting travel time reductions would have a major impact on travel demand. The European Metropolitan Network would be able to bring an additional growth of 174 percentage points to achieve the tripling of HSR demand by 2050.

[9] Definition according to European Commission, Directorate-General for Mobility and Transport, EU Transport in figures: Statistical Pocketbook 2021, Publications Office, 2021, https://data.europa.eu/doi/10.2832/27610: High speed lines include principal railway lines allowing traffic at speeds on the main segments equal to or greater than 200 km/h on upgraded lines and 250 km/h on especially built lines. Dedicated high-speed railway line is a line specially builtto allow traffic at speeds equal to or greater than 250 km/h for the main segments.



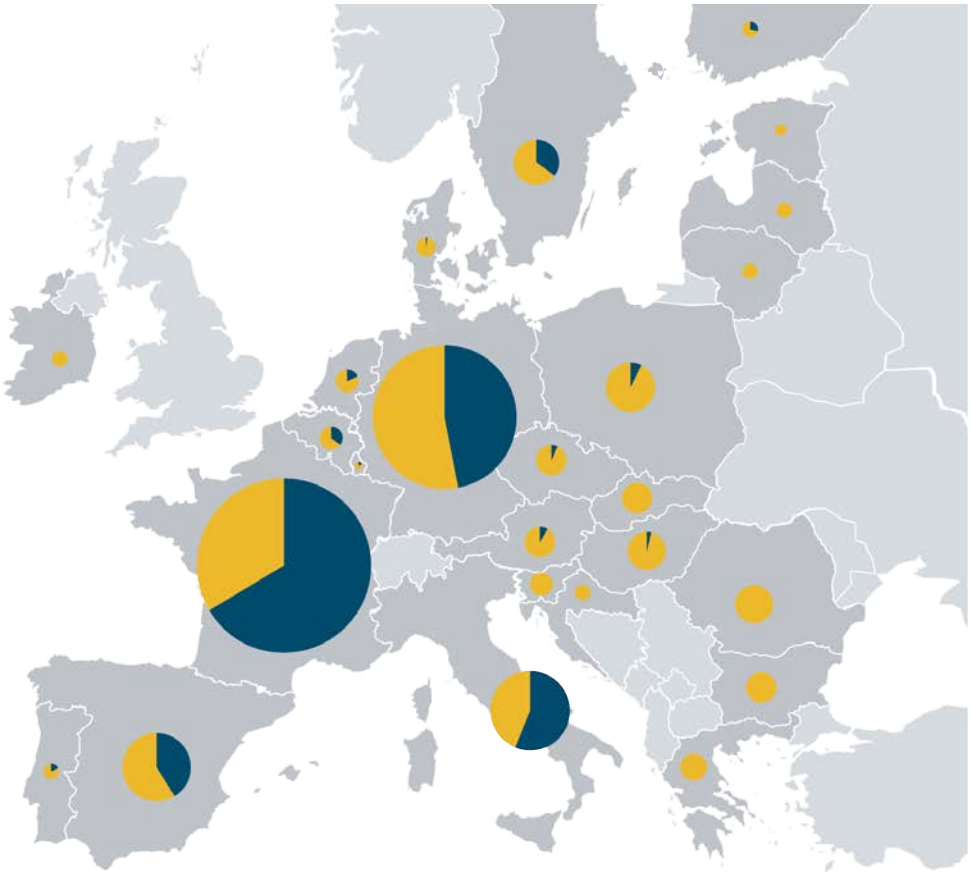
HSR growth 2015–2050
[in pkm normalised to 100% in 2015, in %]

HSR simulation

This growth is assumed to stem from the following three sources:

- Around 61 percentage points of the growth would be generated through a shift from conventional rail to HSR. At the same time, conventional rail would benefit as a feeder for HSR. Overall, conventional rail transport would remain stable. The railway system as a whole would benefit.
- As the largest contribution, modal shift would yield 70 percentage points of additional HSR traffic growth. Most of the volume shifted to rail would replace car trips. Only some would replace air trips as long distances cannot be served competitively even with a fast HSR network, and little would replace coach trips. Markets with currently well-developed conventional rail infrastructure would have particularly high shifts from conventional rail to HSR. Markets with currently less developed rail infrastructure, i.e., especially in eastern Europe, would have particularly high shifts from other modes to HSR.
- Finally, the European Metropolitan Network would create 43 percentage points of induced demand that would not have been realised without the network effects – a clear sign of connecting regions and people, which would not have been connected otherwise.

High-speed traffic in large existing HSR markets would increase significantly and markets would emerge that previously did not exist or existed to a very limited extent. These newly connected markets would provide around 12 per cent of the traffic needed to achieve the tripling of high-speed traffic, of which Romania would have the highest growth potential in terms of traffic volume. These markets would additionally provide important network effects for demand in the established HSR markets and would be important links for the future connection of EU candidate and neighbouring countries to the European Union.

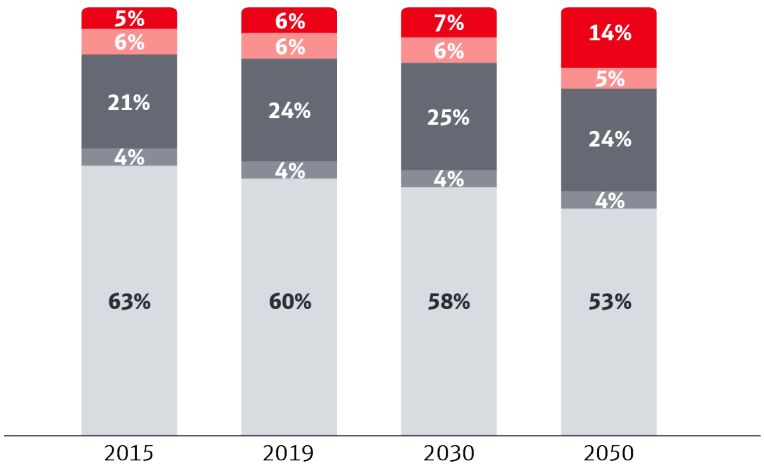


HSR growth in the Metropolitan Network
[in billion pkm, per country, 2019 vs. 2050]

Germany (approx. 78 bn pkm per year), Italy (approx. 39 bn pkm per year), and Spain (approx. 36 bn pkm per year) are already among the largest four HSR markets but are expected to continue to have high growth rates. While Spain (+142%) and Germany (+112%) would more than double their HSR traffic, Italy (+78%) and France (+50%) would also still grow substantially. France (approx. 92 bn pkm per year) would remain the largest HSR market in the EU27 but would have a lower growth rate as there already is a well-developed HSR network.

b) With the Metropolitan Network, the market share of rail increases

It becomes evident that HSR will not substantially gain market share by 2030. Air travel, on the other hand, gains three percentage points in market share from 2015 to 2019 and basically remains static in the following years. The slightly declining market share of motorised private transport thus seems to be in favour of air travel rather than HSR. Only a significant expansion of the infrastructure will enable substantial modal shift in favour of rail.

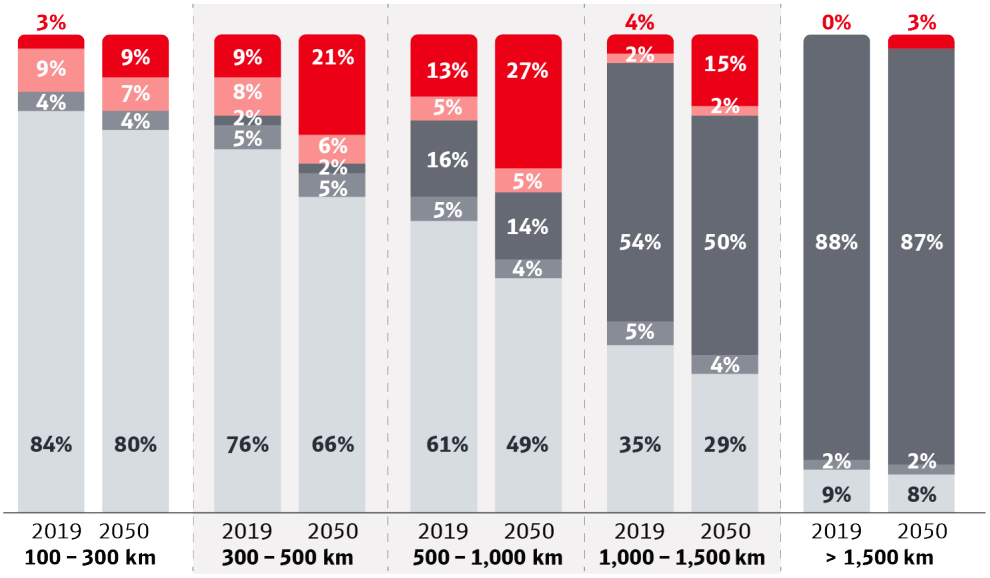


Market share of different modes of transport 2015–2050
[long-distance ≥ 100 km, in pkm, in %; percentages may not total 100 due to rounding]

HSR
Conventional rail
Air
Coach
Car

If the proposed Metropolitan Network is implemented, the market share of HSR would nearly triple and increase from 5 per cent in 2015 to over 14 per cent market share in 2050. The share of conventional rail would approximately remain stable, as, among other things, feeder and shuttle services to and from the HSR network would benefit from this. The proposed HSR network would make capacity available for conventional passenger rail services and freight services so that previously unmet demand could be served. The entire railway sector benefits from the increased infrastructure capacity. Private motorised transport would lose market share, going from 63 per cent in 2015 to 53 per cent in 2050, while the market share of air travel would reach its peak at 25 per cent by 2030 and experience a slight decline to 24 per cent by 2050. The main reason for the stable air traffic demand is structural: a large share of volume in European air traffic is due to distances that cannot be served competitively even with a fast HSR network.

If implemented, the Metropolitan Network would significantly increase rail demand for distances between 300 and 1,500 km with market share growth of over 10 percentage points by 2050, while private motorised transport would lose significant market share. Therefore, these distance classes would be a highly relevant market for high-speed transport. Air travel remains the preferred mode of transport for journeys over 1,500 km. Car travel remains the second most important alternative in long range distance classes.



Market share of different modes of transport 2019 vs 2050
[by travel distances, in pkm, in %; percentages may not total 100 due to rounding]

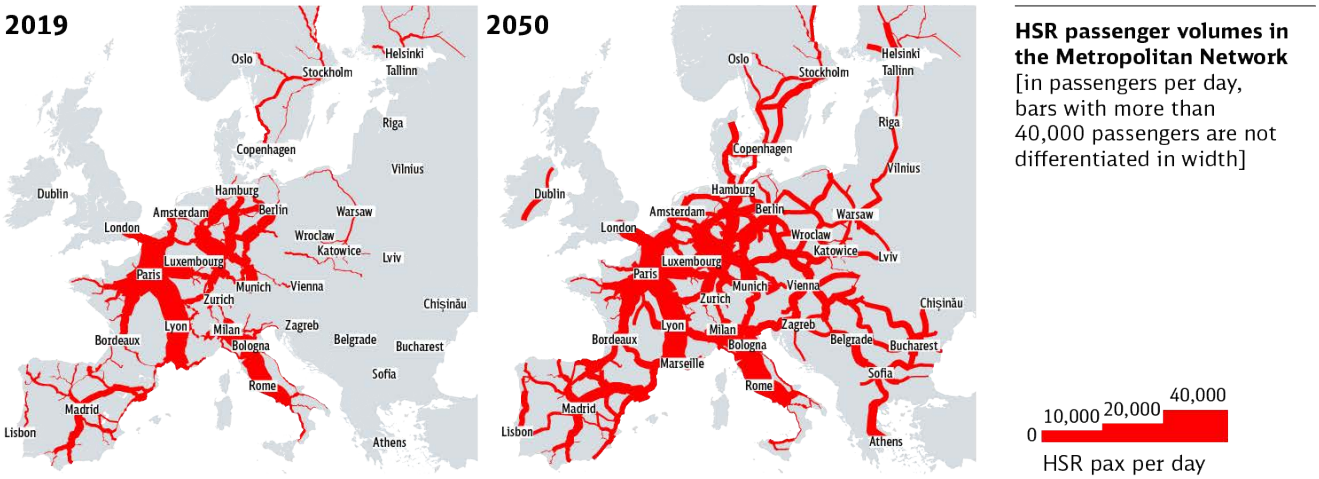
HSR
Conventional rail
Air
Coach
Car

A further increase in the market share of HSR until 2050 could be promoted by additional regulatory measures, if these are designed to make the use of rail even more attractive, e.g., financially through lower taxation. The present study does not take such additional shocks into account.

c) With growing national and international demand, the Metropolitan Network would ensure an economic basis for operating trains with high frequencies

Almost the entire proposed Metropolitan HSR-network in the EU27 shows sufficient demand to ensure a solid economic basis for HSR operation with high frequencies (exceptions to this are mostly branch lines).

From a market perspective, it is evident that significant demand exists outside the existing HSR network which is currently not being met. The expansion of HSR infrastructure makes it possible to tap into this potential, especially in eastern European countries. Better connectivity significantly increases cross-border demand which in turn also increases the volume of traffic on the existing HSR corridors.



The highest passenger volumes in the whole network are currently observed on successful HSR infrastructure such as Paris-Lyon or Rome-Bologna and this will continue if the Metropolitan Network is implemented. New HSR corridors with particularly high demand would be e.g., Thessaloniki-Athens as well as connections between France and Spain or between Vienna, Prague, and Berlin.

d) The European Metropolitan Network fosters convergence and the integration of European countries and brings EU citizens closer together

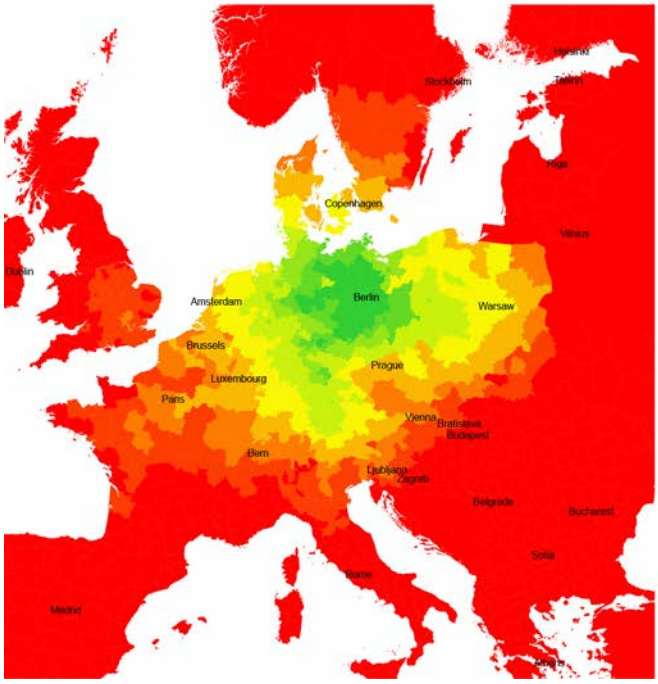
All metropolitan regions would benefit substantially from the 2050 European Metropolitan Network. Shorter travel times enable much better connectivity and accessibility, and thereby increase the appeal of rail travel between European regions.

This will be especially evident in areas that currently have little or no HSR infrastructure. The proposed HSR network thus aligns the accessibility of European metropolitan regions irrespective of their size or function and fosters convergence and the integration of countries, particularly in eastern Europe.

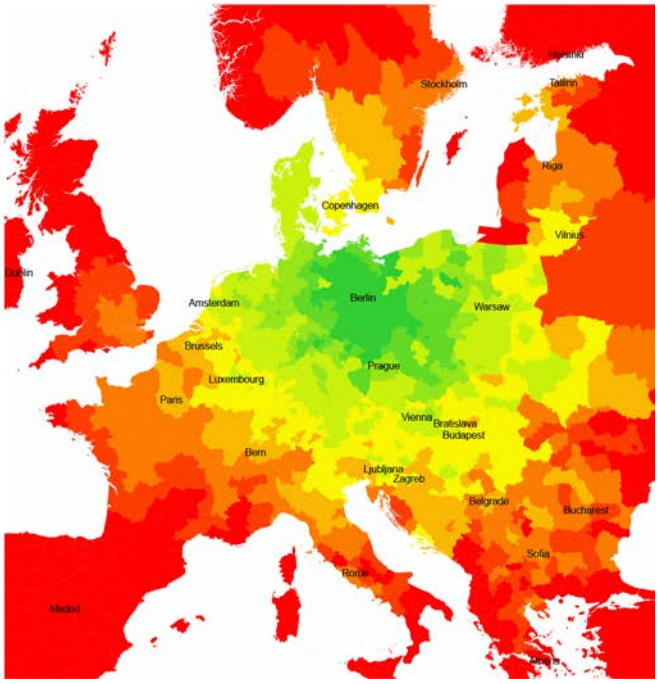
The diagrams below impressively illustrate how the Metropolitan Network could lead to greater integration in Europe. The substantial expansion of the network would make more destinations accessible to European citizens at a reasonable travel time. The Metropolitan Network has the potential to bring Europeans across the Union closer together.

Perceived travel time of Berlin

2019

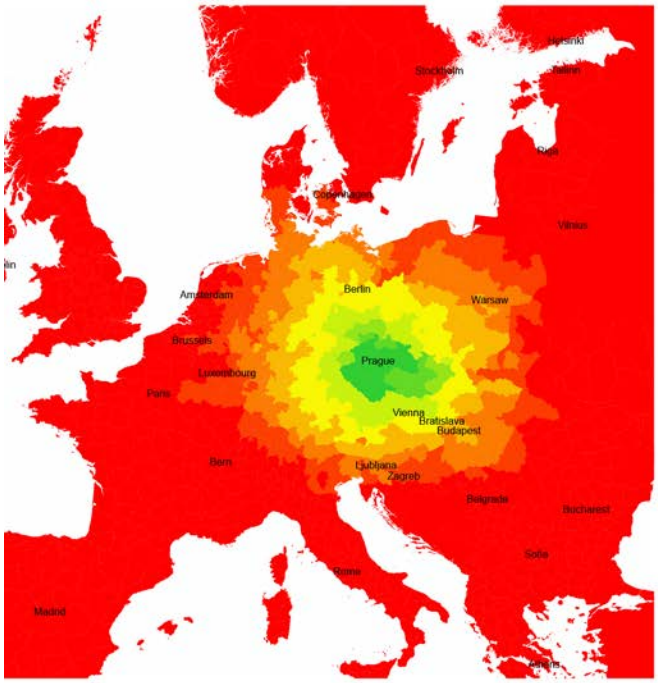


2050

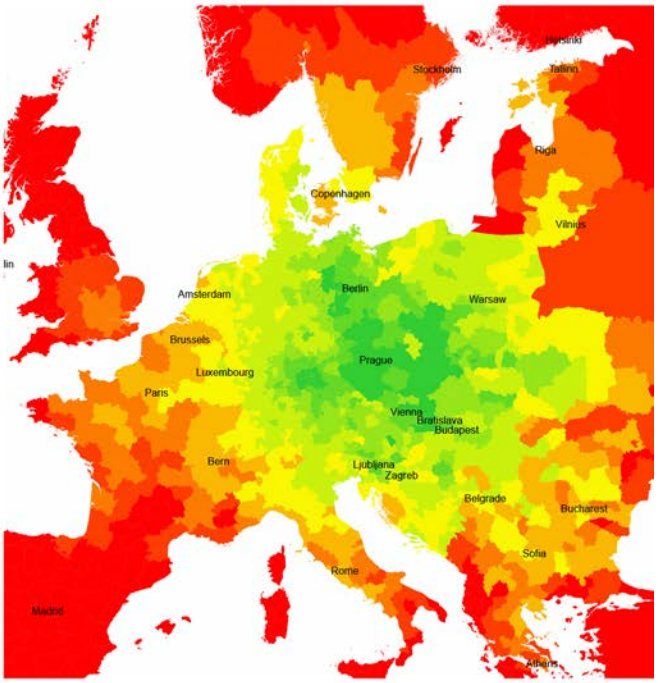


Perceived travel time of Prague

2019



2050



Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

The way forward

- **Connect all metropolitan regions with high-speed rail**
  Key success factors for the modal shift in passenger services are travel time and frequency. If all of Europe's metropolitan regions (agglomerations of over 250,000 inhabitants) were linked by a high-speed rail network at intervals with high frequency, the volume of high-speed rail traffic could be tripled.
- **Implement a Europe-wide effort**
  Considerable action and financial investments in infrastructure needs to be taken in nearly all European countries, which will probably exceed the scope of the current funding mechanisms. To unlock the needed budgets, new tailor-made financing procedures should be implemented Europe-wide.
- **Go further than the TEN-T network**
  TEN-T plans are the foundation to enable the modal shift towards green mobility. However, the current plans do not go far enough. It is clear that a network should be developed that goes far beyond the current plans for the TEN-T network. To complete a Europe-wide network, a significant extension of current infrastructure should be discussed and added to the program.
- **Create capacities both for freight and conventional rail**
  Expanding high-speed infrastructure will create new capacity on existing lines for conventional passenger services and freight services in Europe. Using this new infrastructure efficiently would maximise the capacity gain. This would enhance connectivity and reduce congestion.
- **Bring Europeans closer together**
  Implementation of the Metropolitan Network is based on high-speed lines, within countries and especially across borders. It would not only reach the Green Deal targets of the European Commission but furthermore also connect people regardless of borders and of which country they live in. It fosters convergence and integration of the European countries and will allow every European citizen to experience the free movement of people, goods, and services – the foundation on which Europe is built.

List of Abbreviations

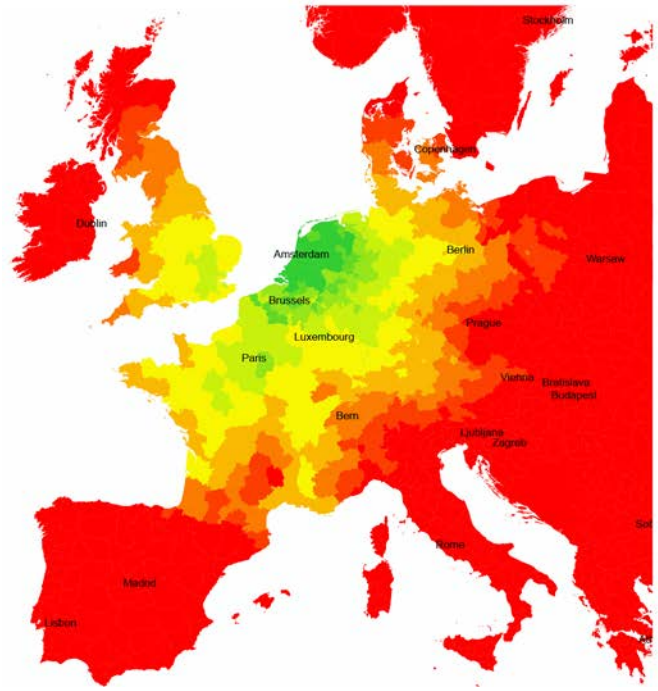
HSR	high-speed rail
pkm	passenger kilometre
TEN-T	Trans-European Transport Network

List of Figures

Appendix

Perceived travel time of Amsterdam

2019



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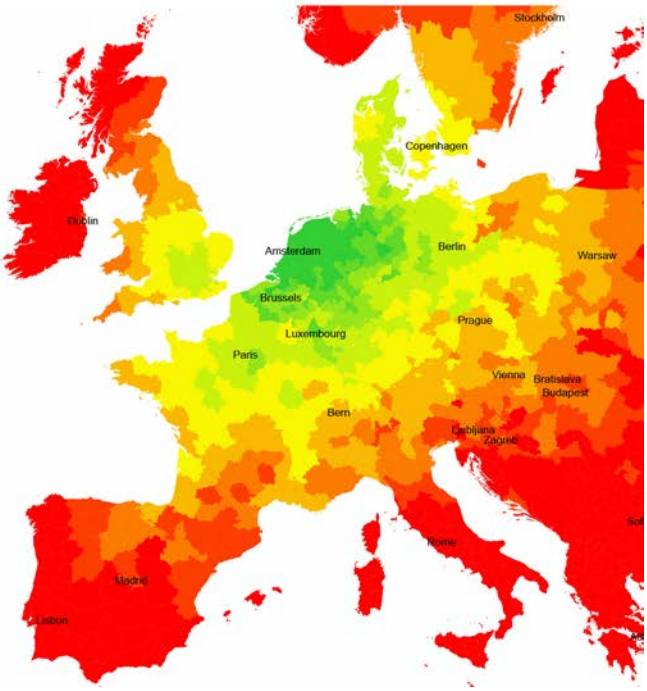

Perceived travel time of Athens

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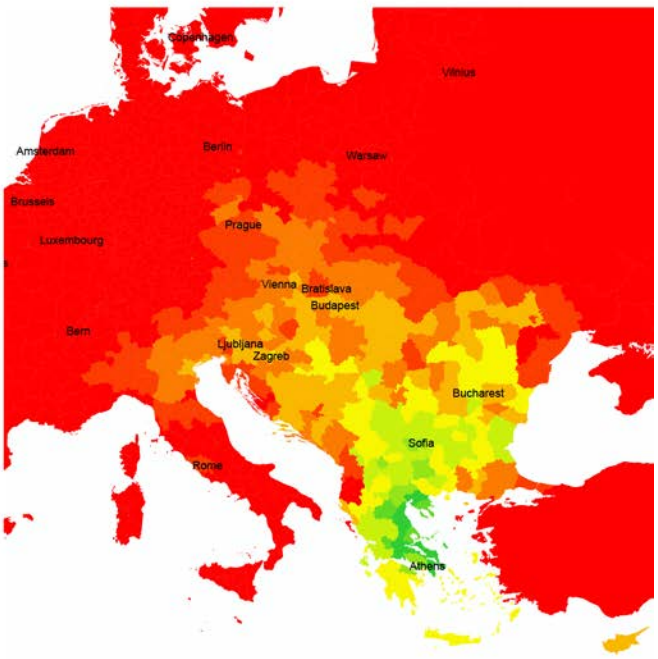


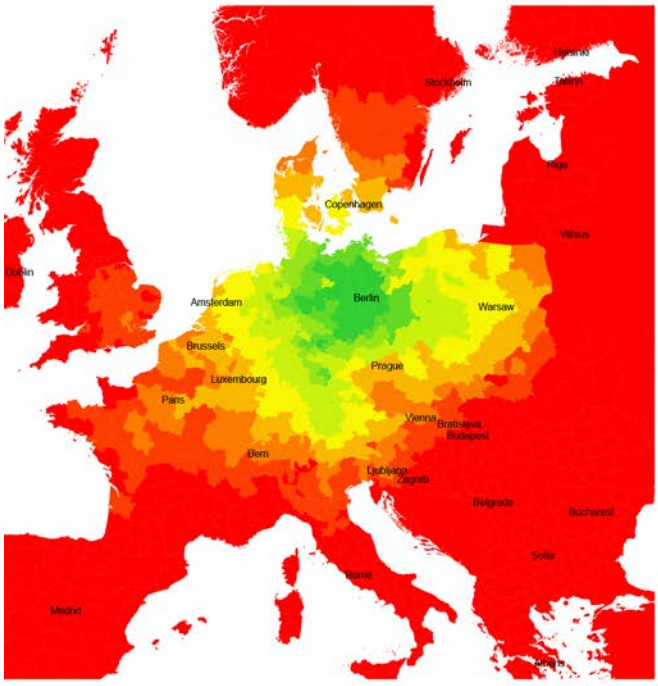
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Berlin

2019



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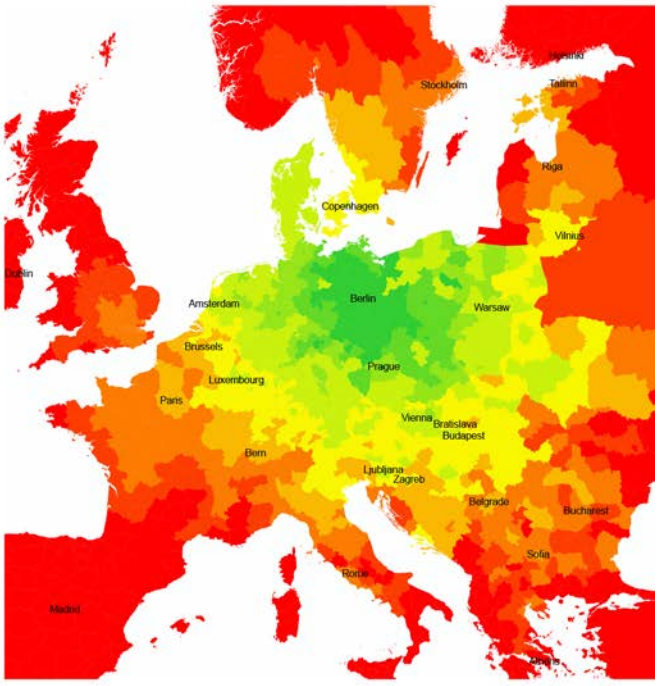

Perceived travel time of Bern

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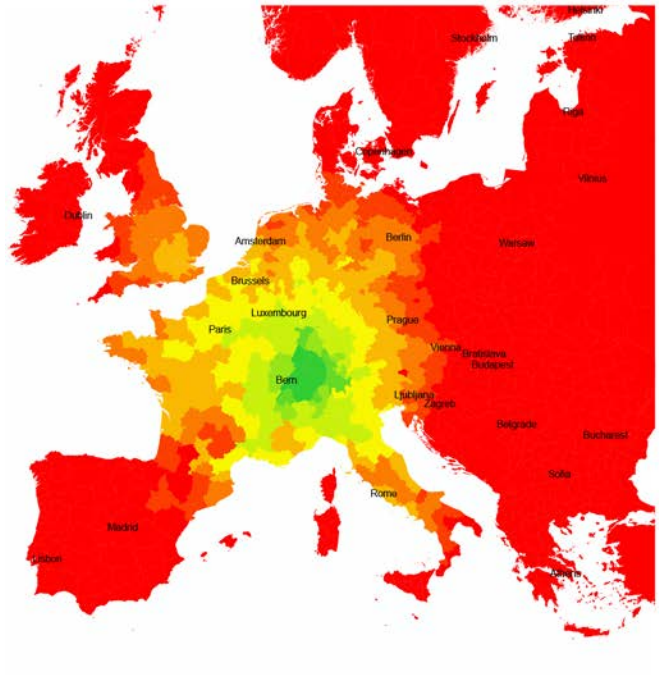

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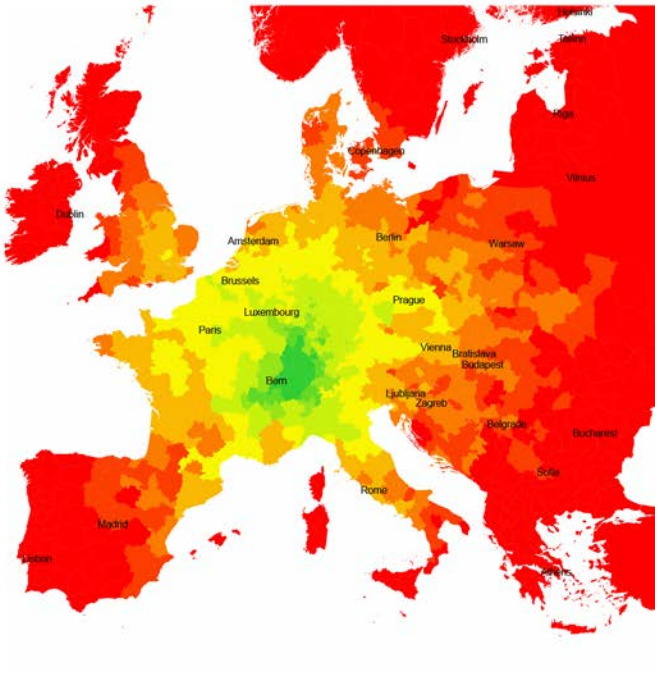


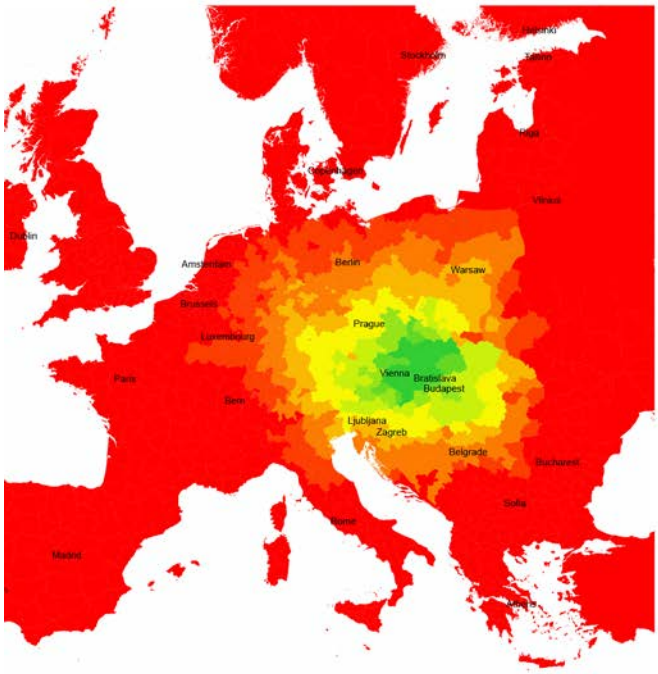
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Bratislava

2019



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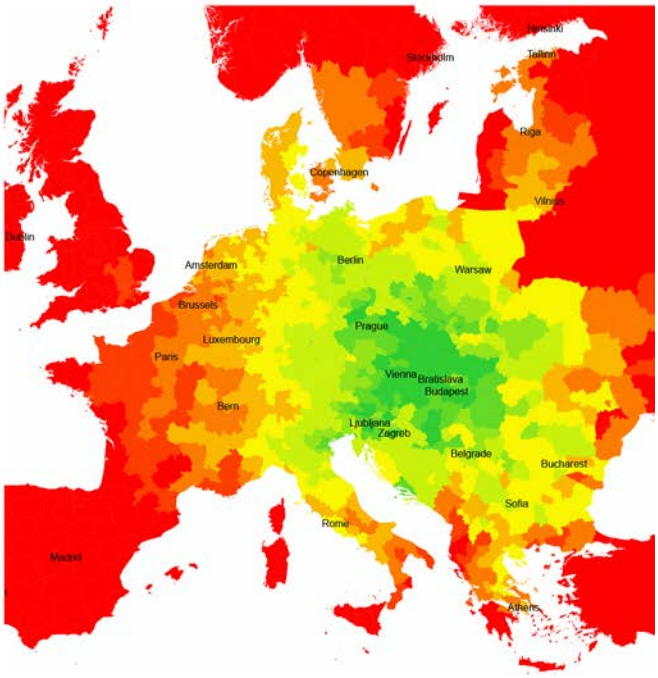

Perceived travel time of Brussels

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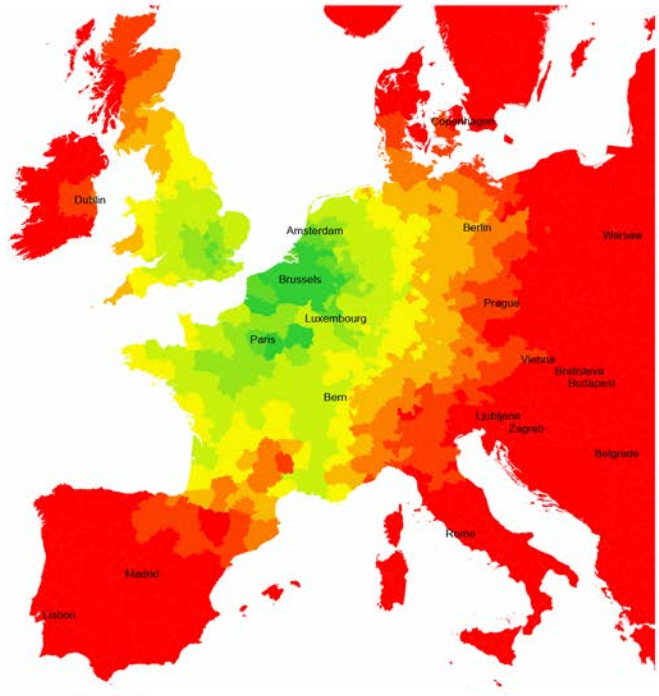

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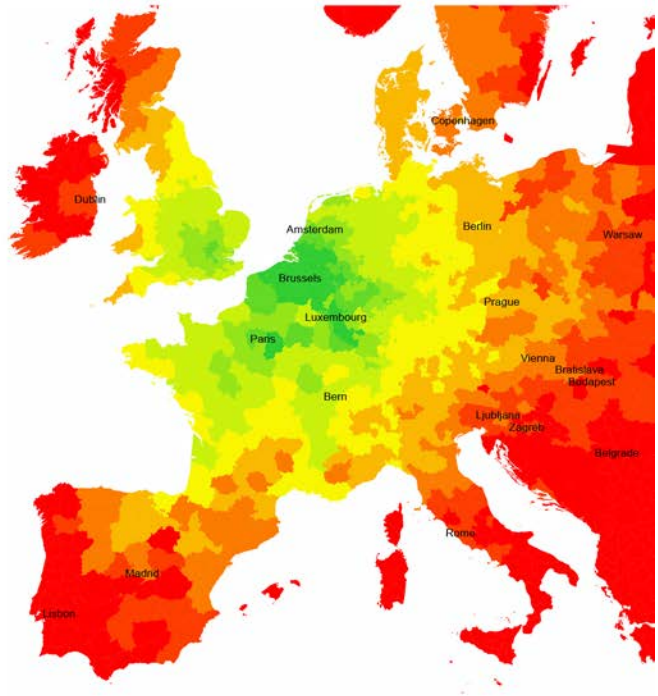

Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Bucharest

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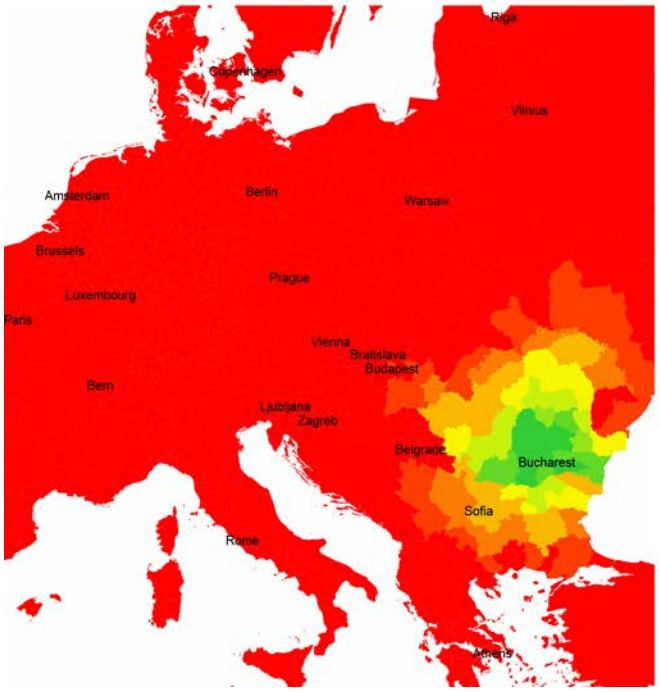

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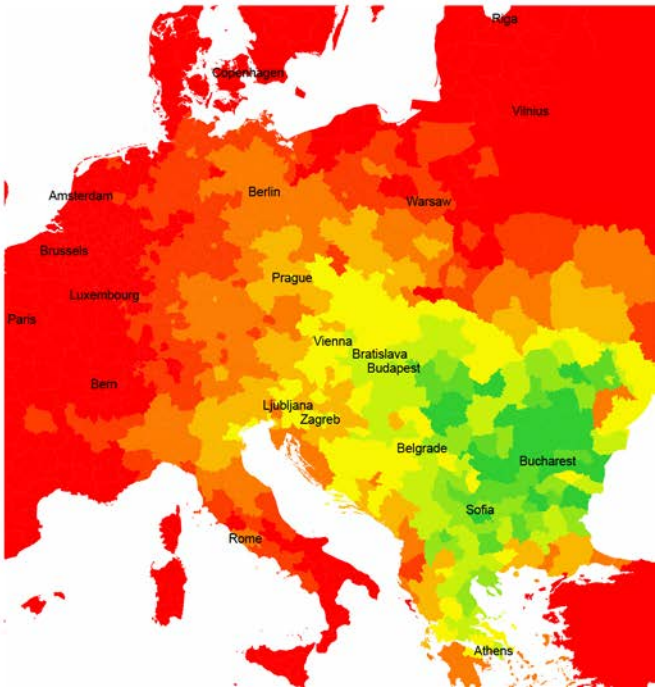

Perceived travel time of Budapest

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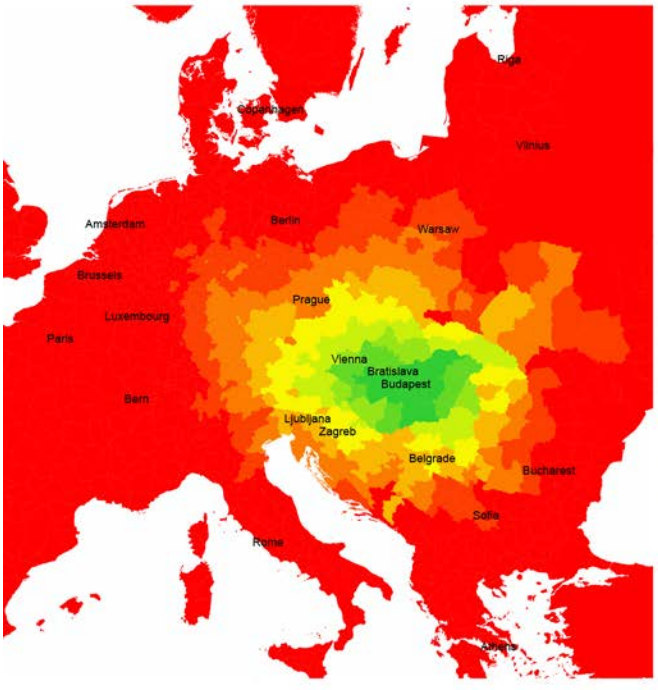

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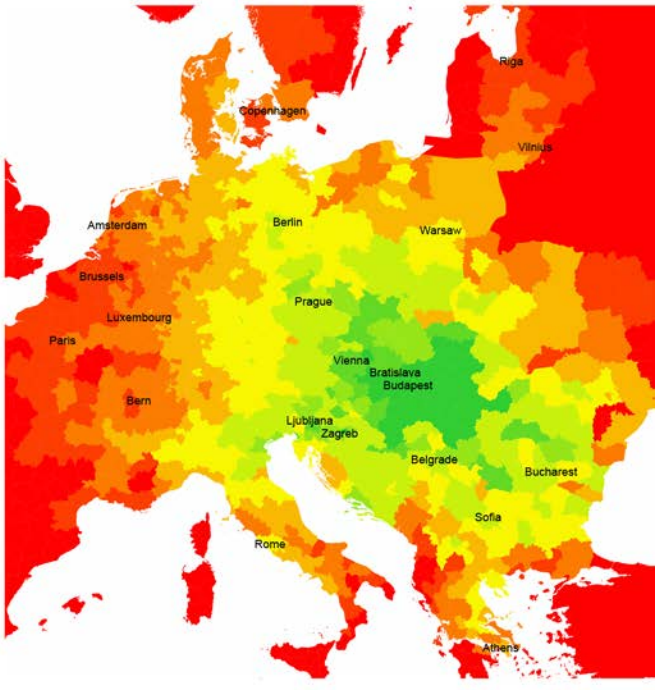

Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Copenhagen

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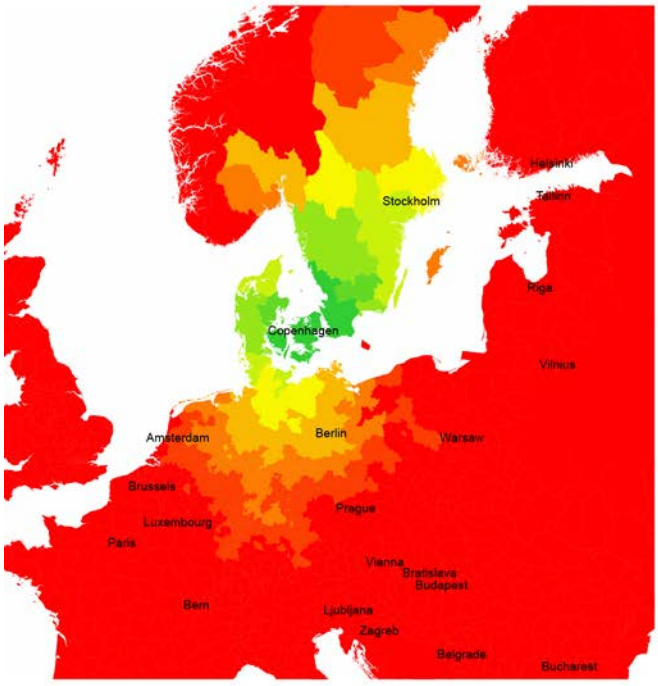

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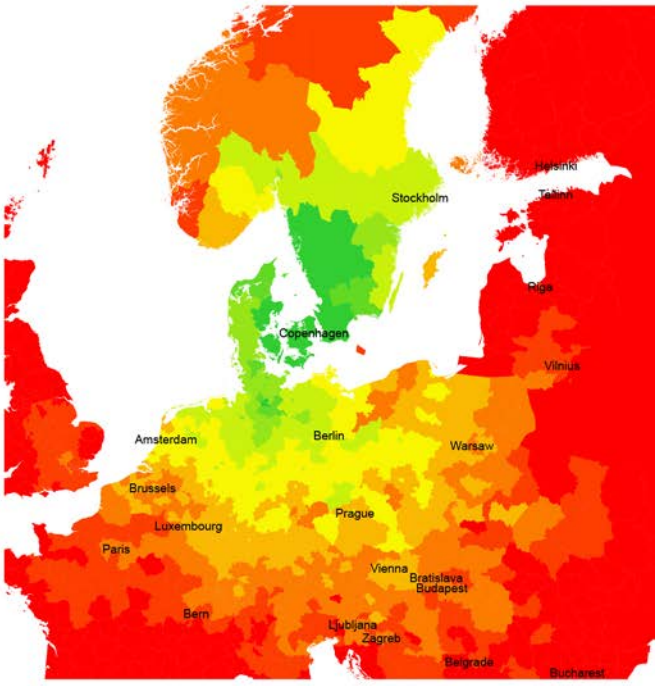

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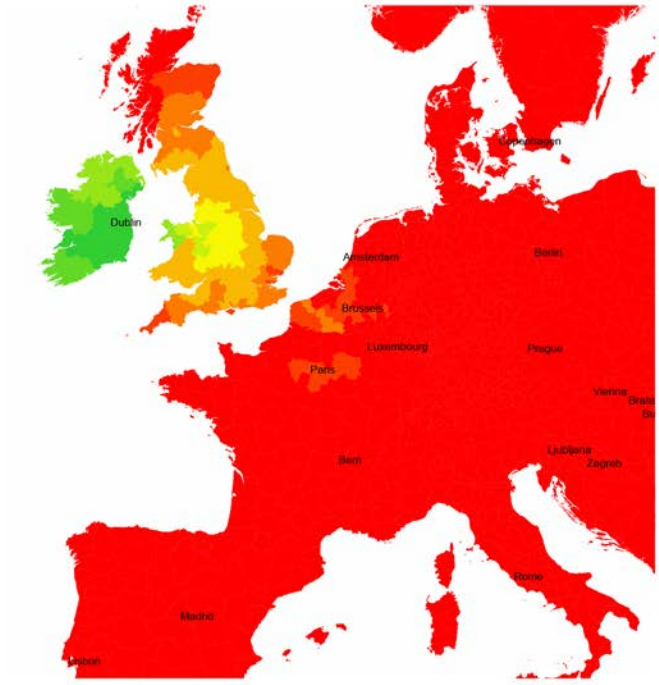

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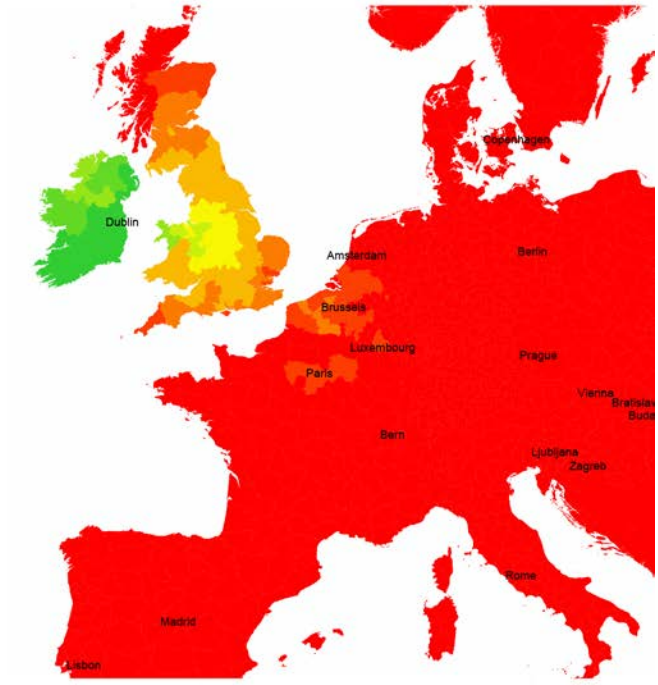

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low... medium... high travel time

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Perceived travel time of Helsinki

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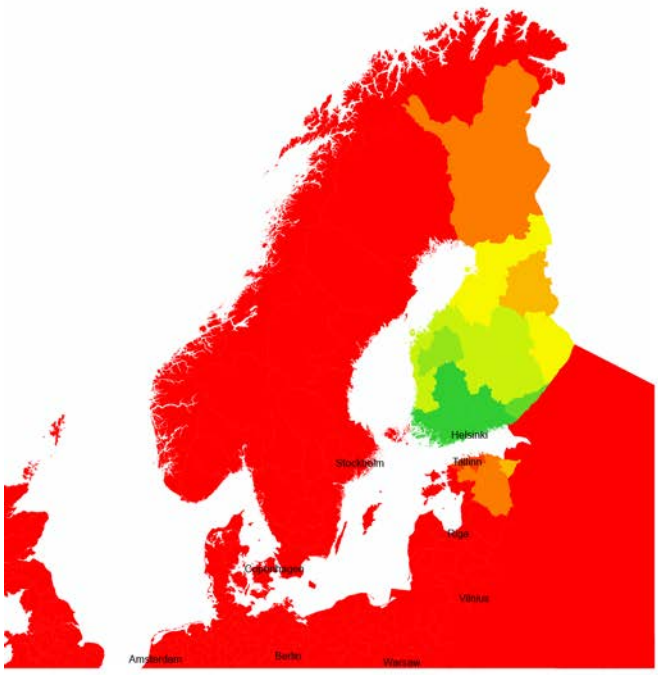

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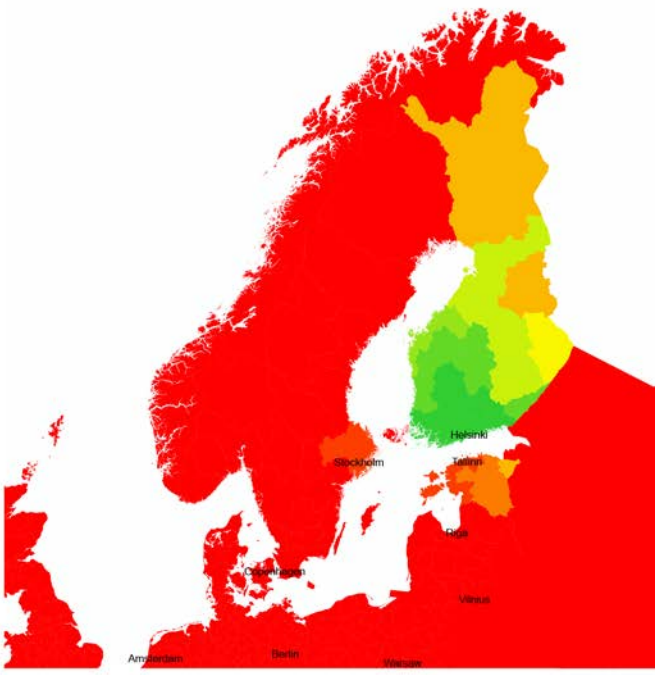

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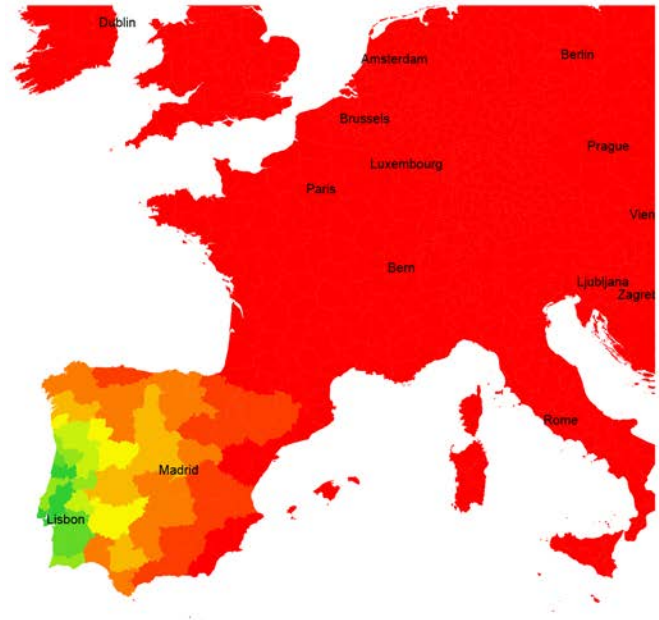

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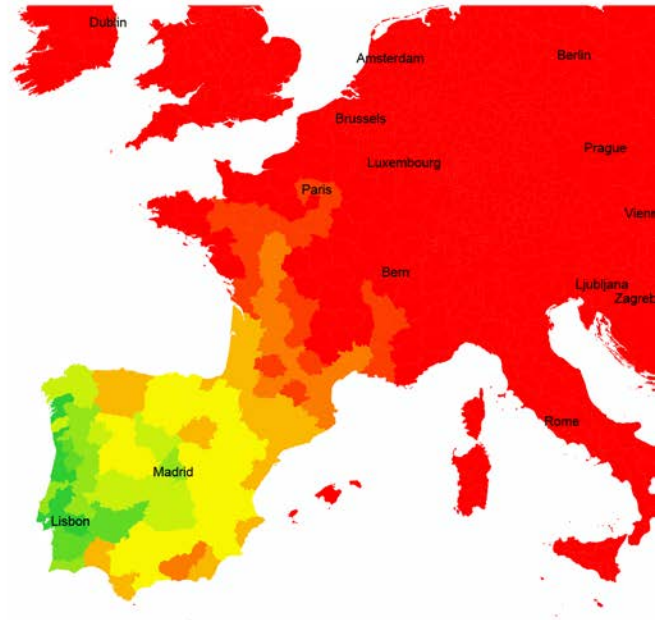

Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Ljubljana

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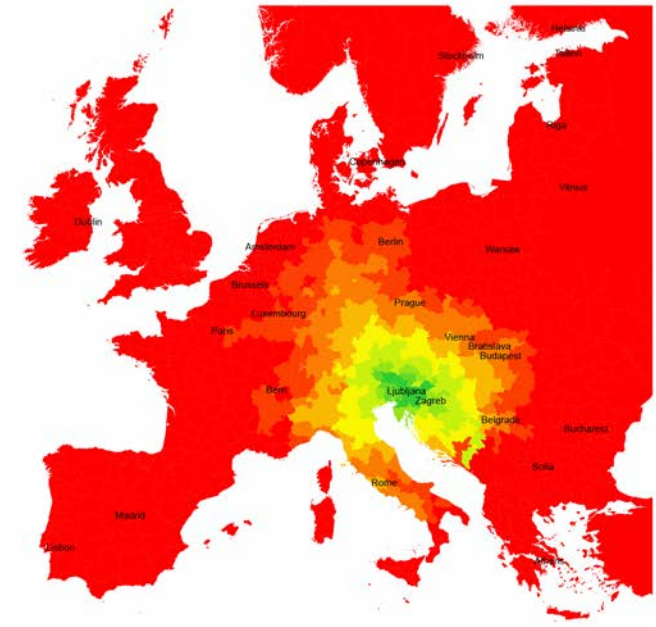

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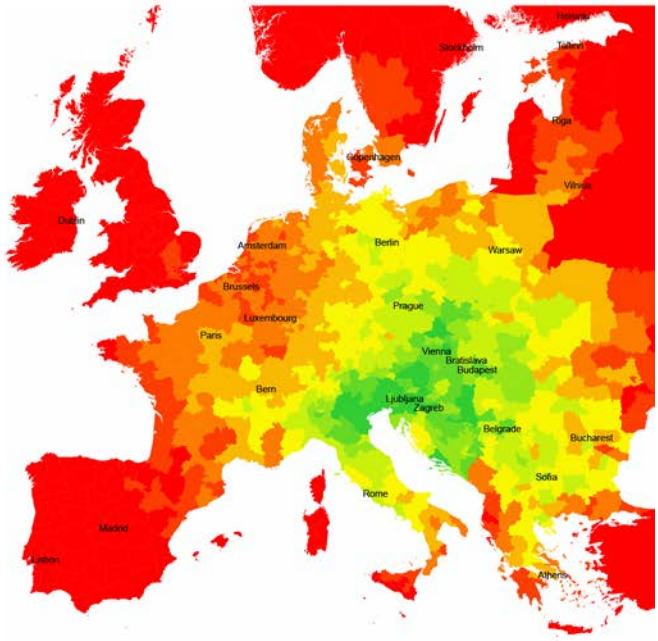

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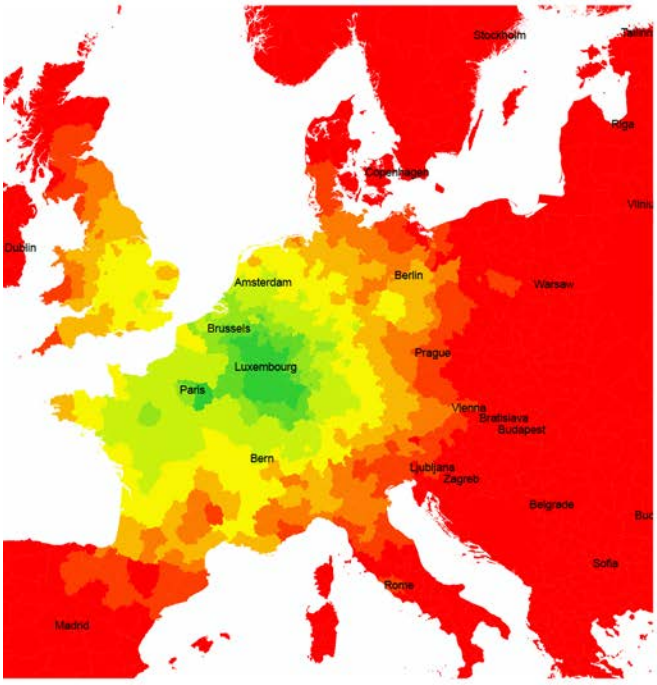

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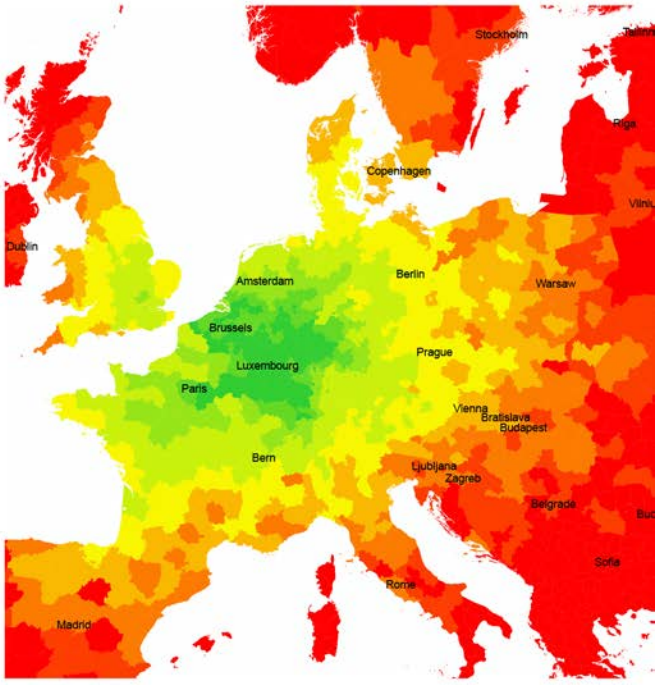

Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Madrid

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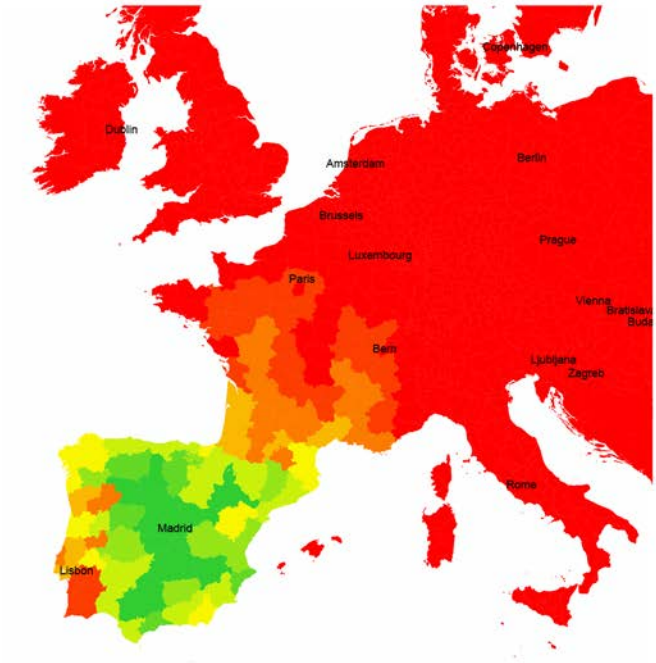

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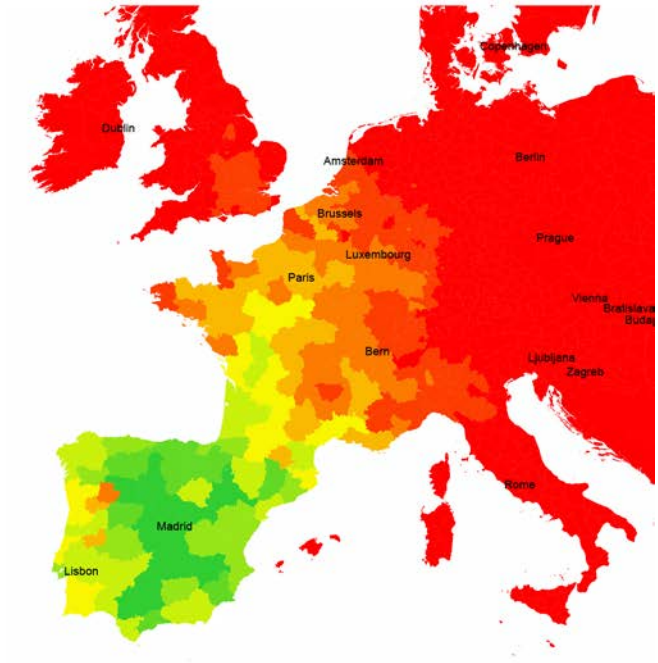

Perceived travel time of Paris

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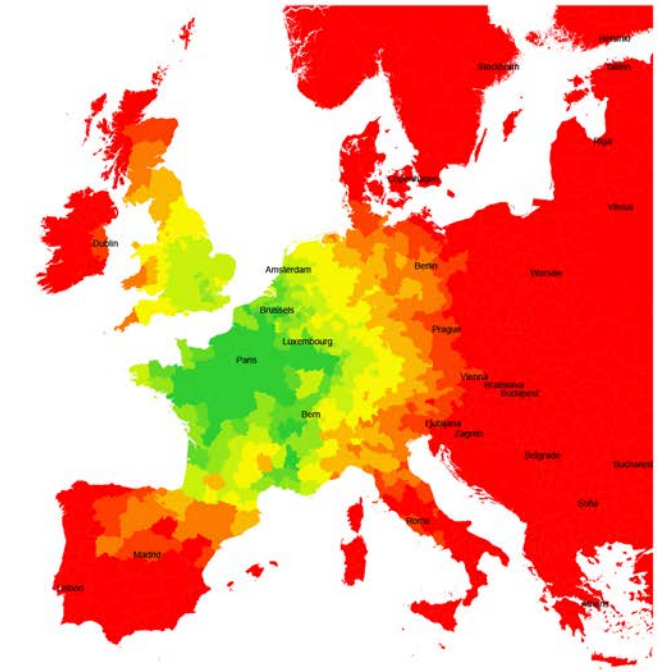

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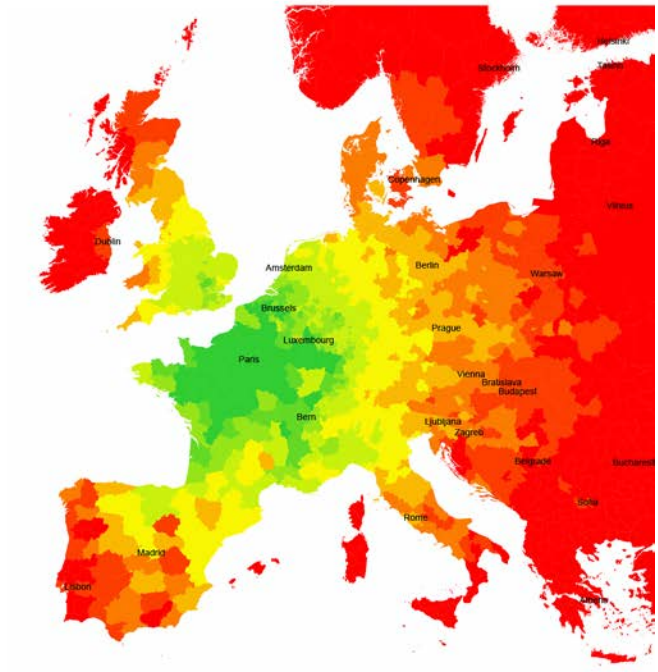

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low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Prague

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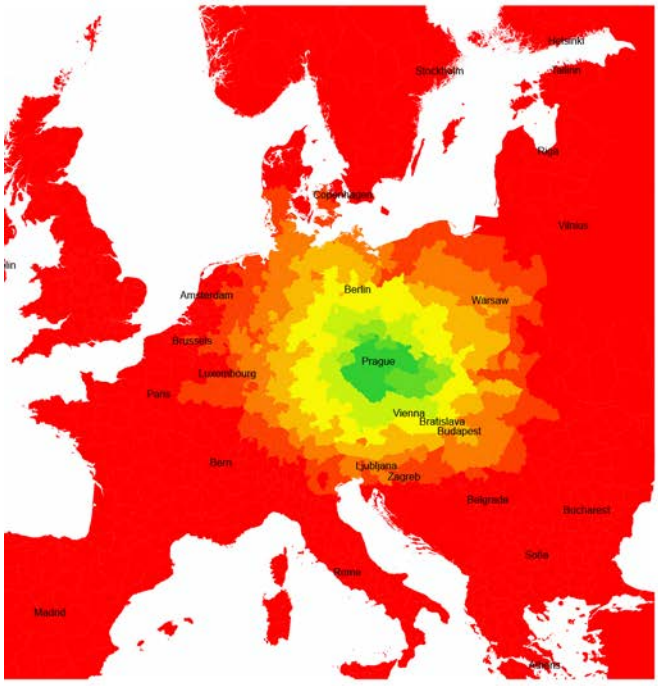

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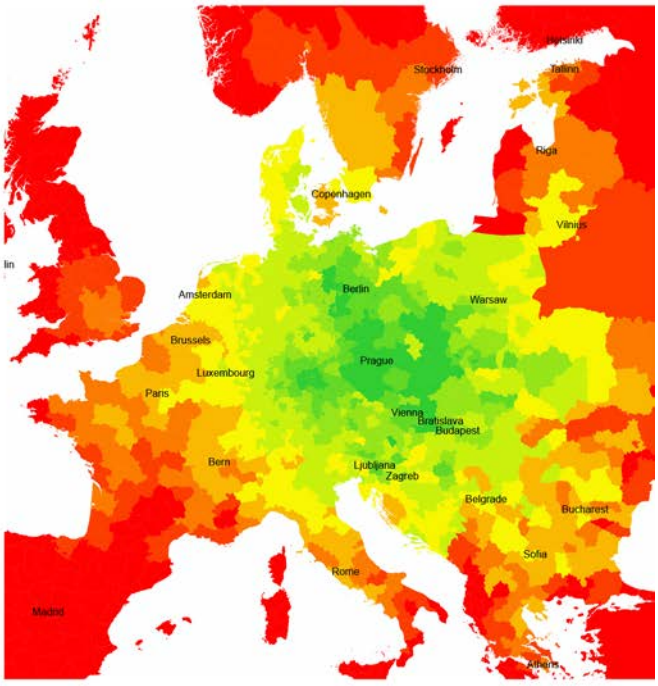

Perceived travel time of Riga

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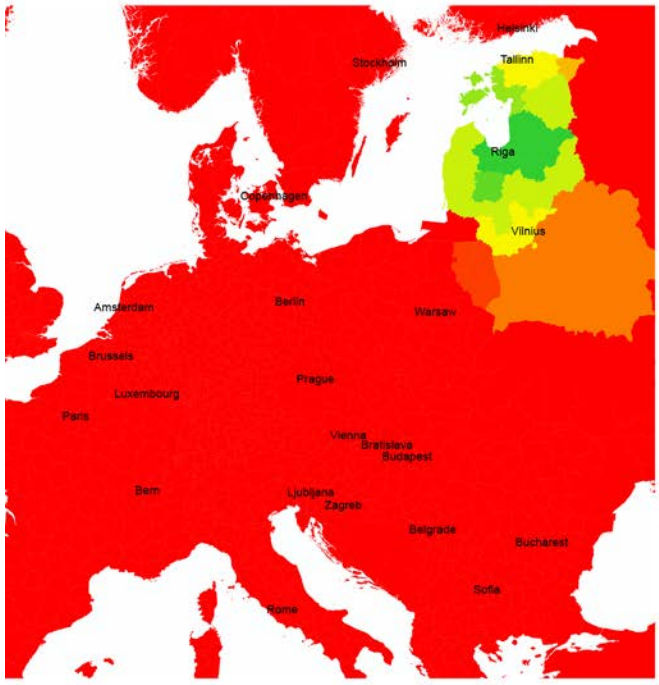

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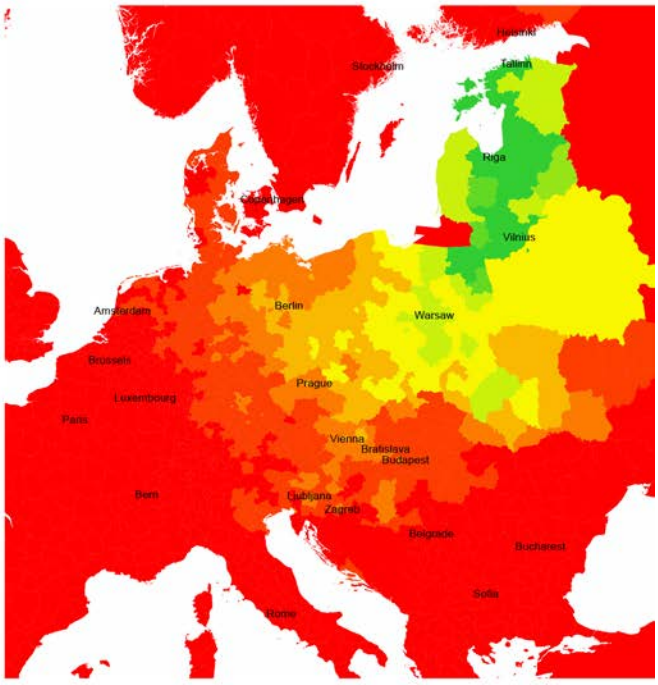

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Perceived travel time of Rome

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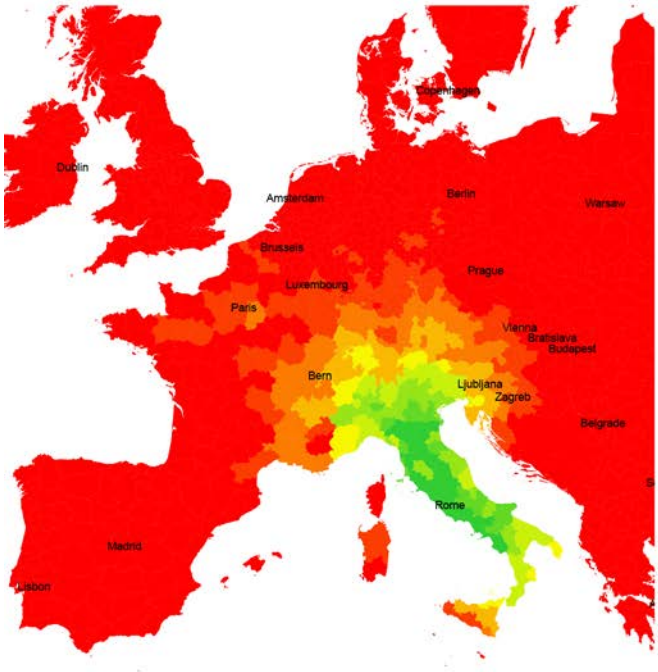

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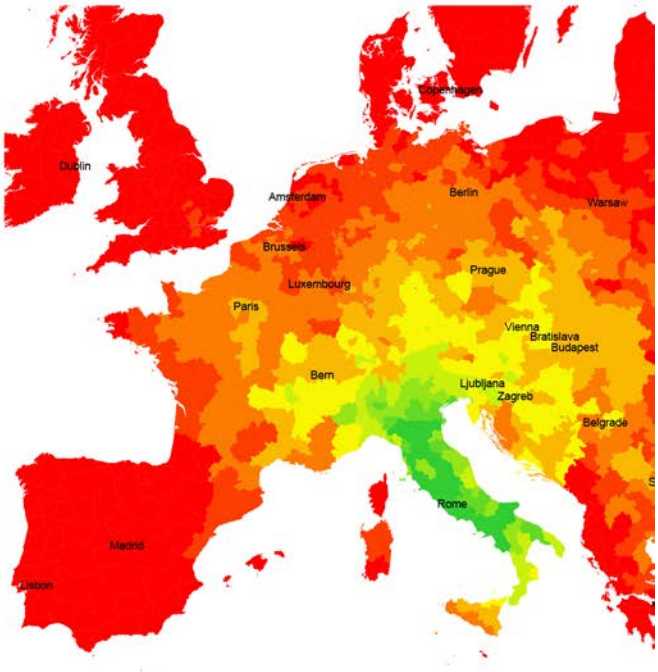

Perceived travel time of Sofia

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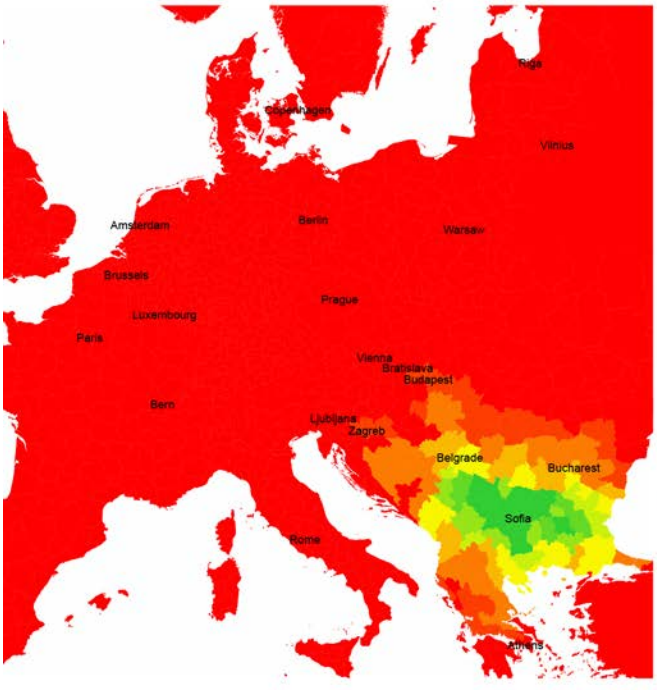

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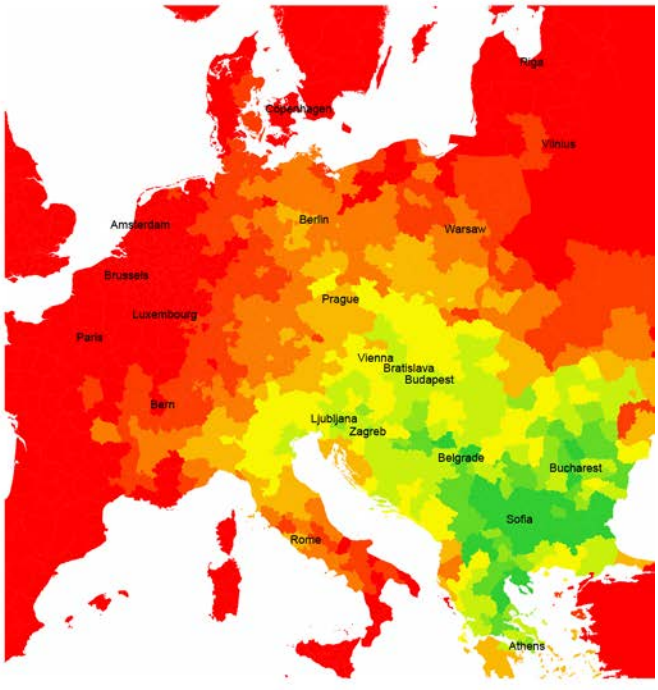

Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Stockholm

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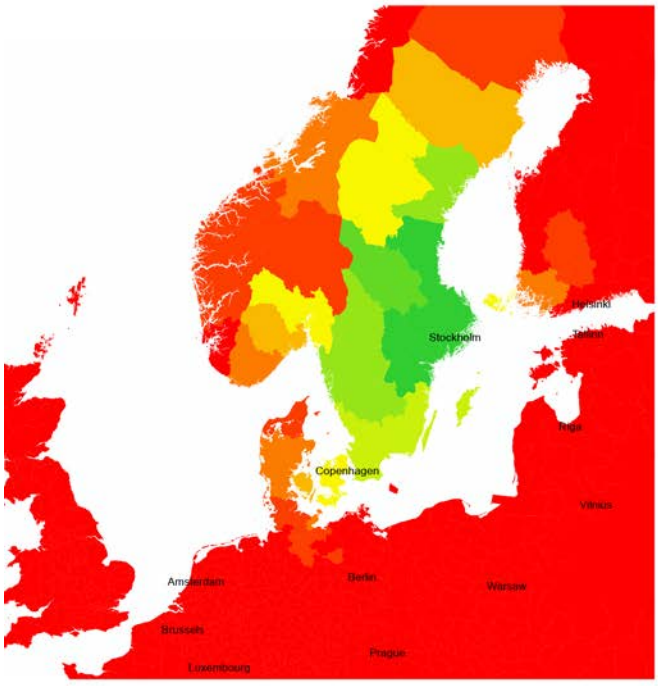

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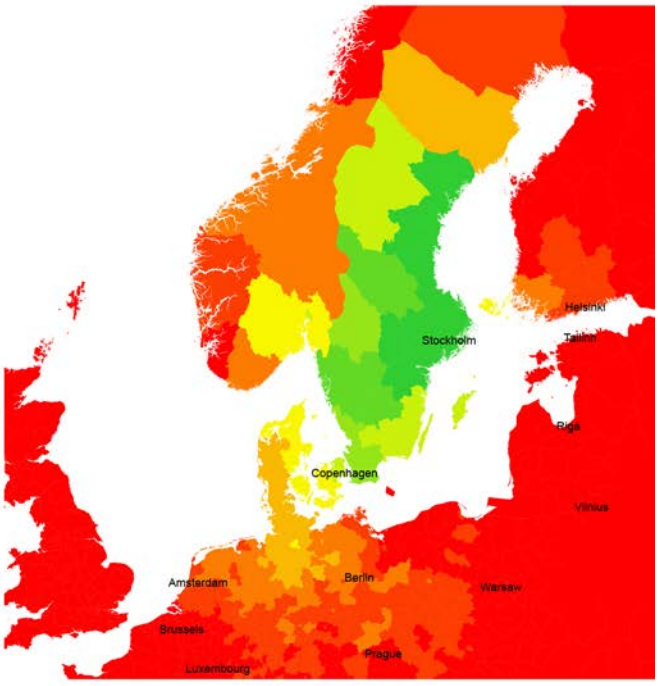

Perceived travel time of Tallinn

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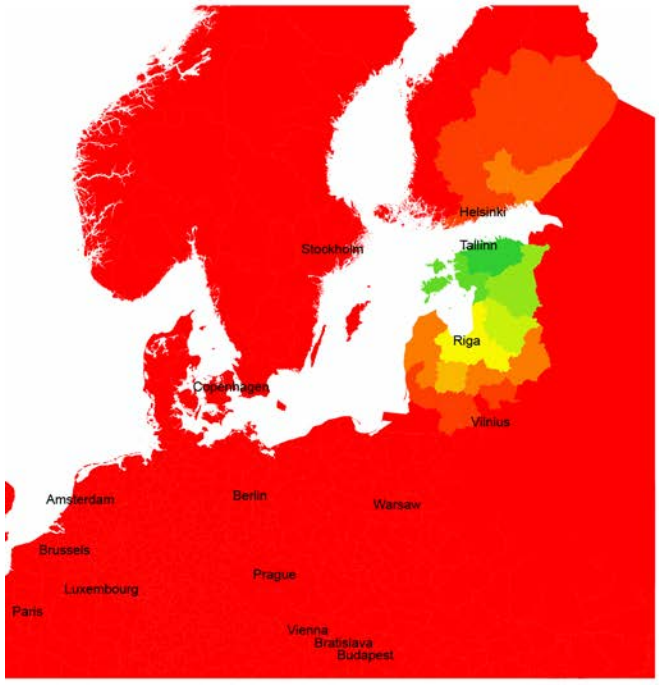

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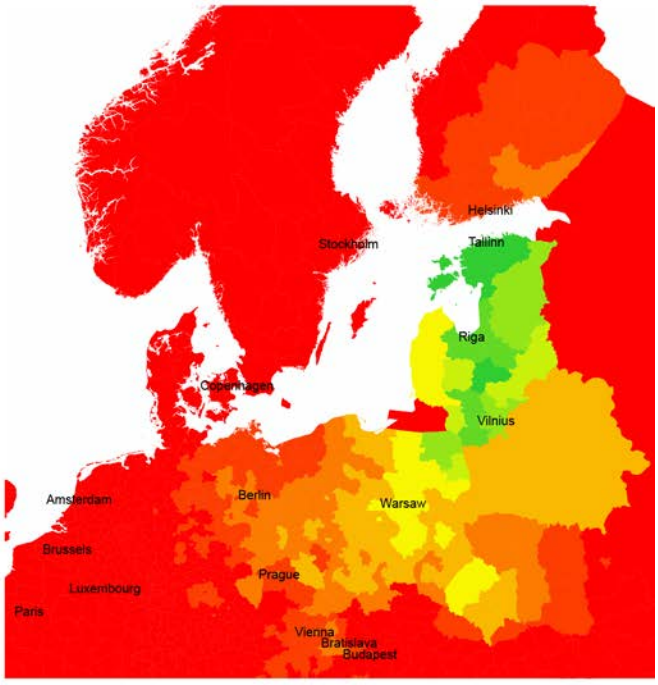


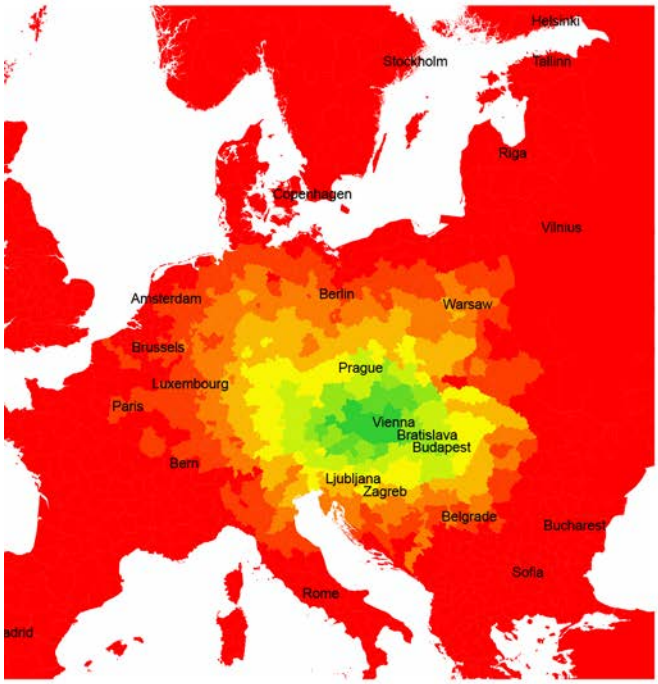
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Vienna

2019



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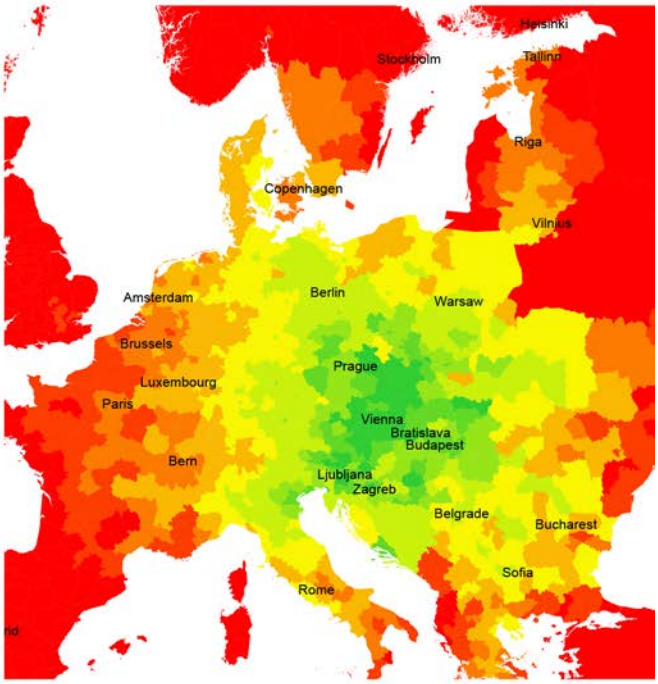
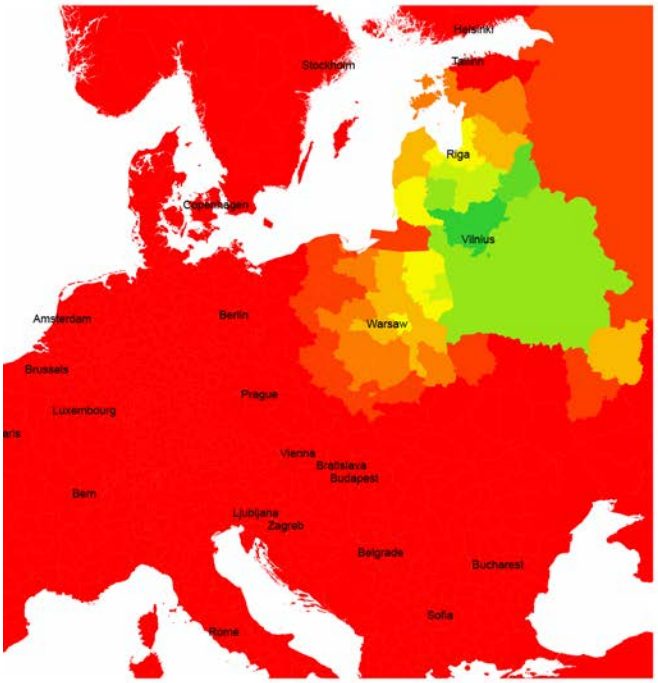


Perceived travel time of Vilnius

2019



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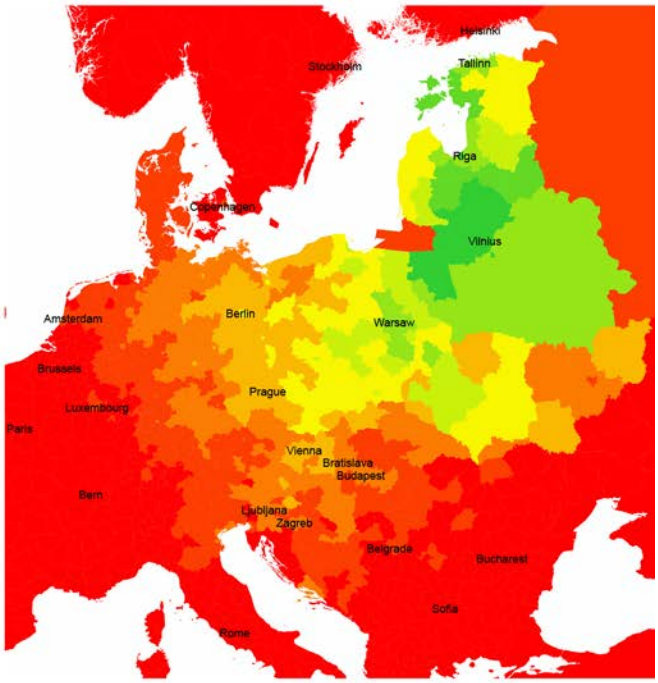


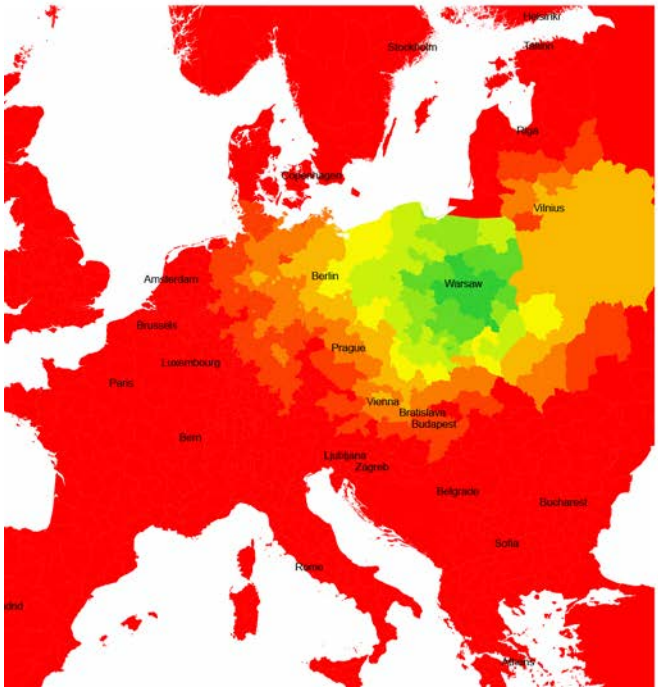
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Warsaw

2019



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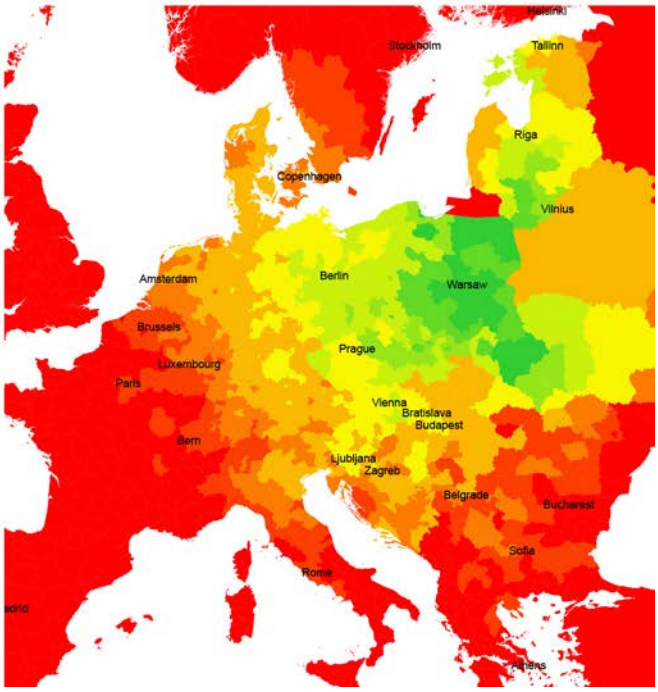
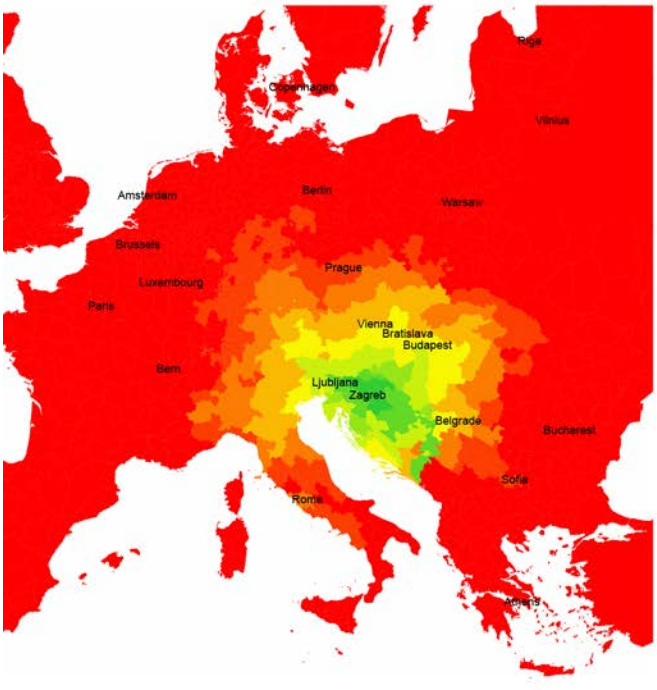


Perceived travel time of Zagreb

2019



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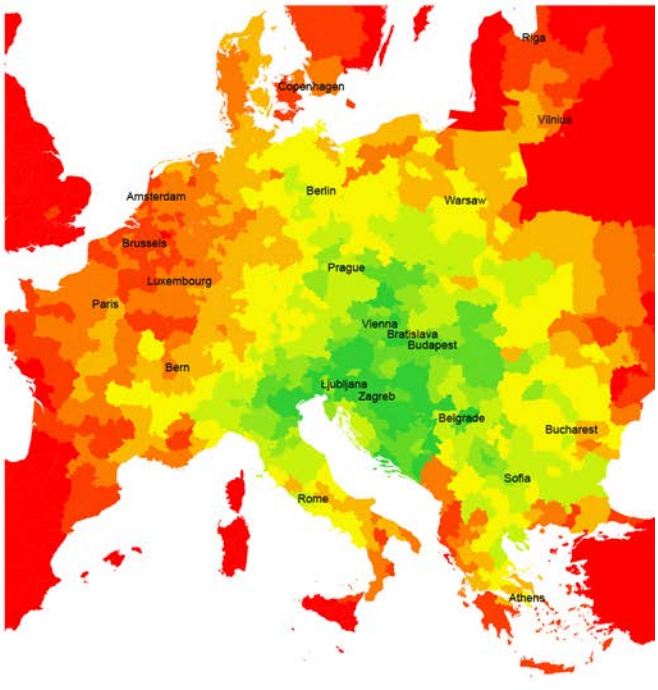


Perceived travel time

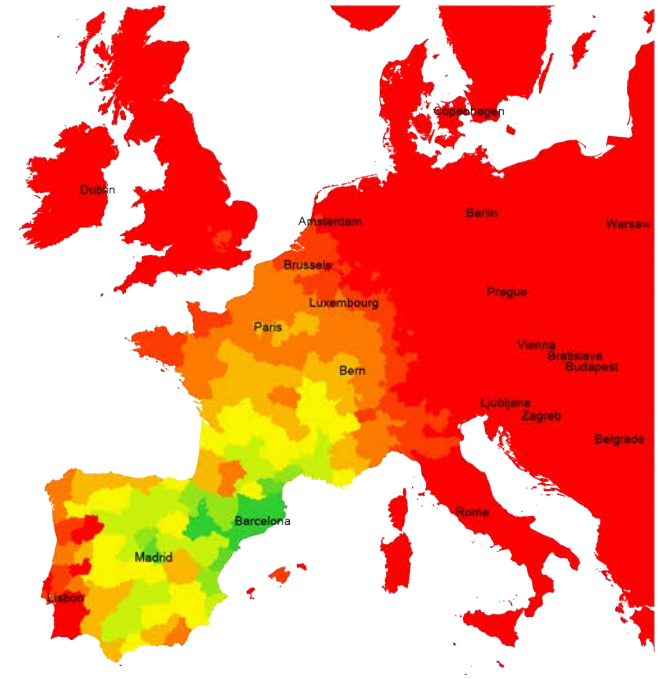
low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Additional European cities

Perceived travel time of Barcelona

2019



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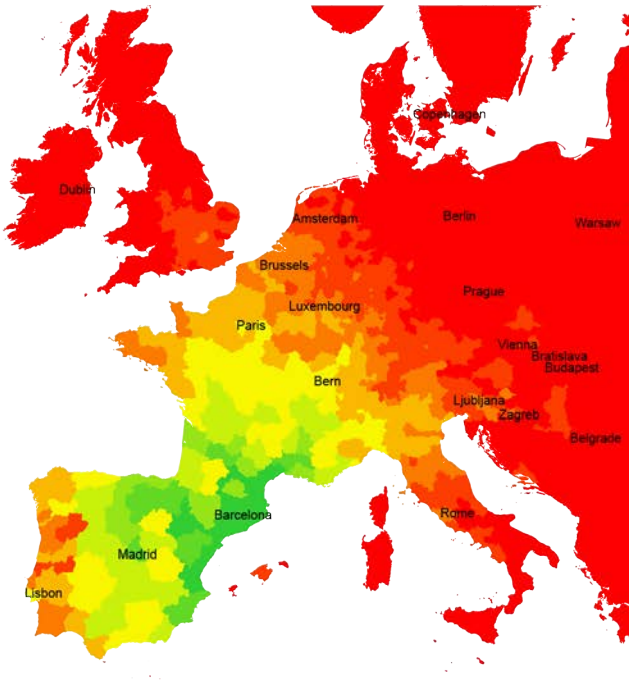


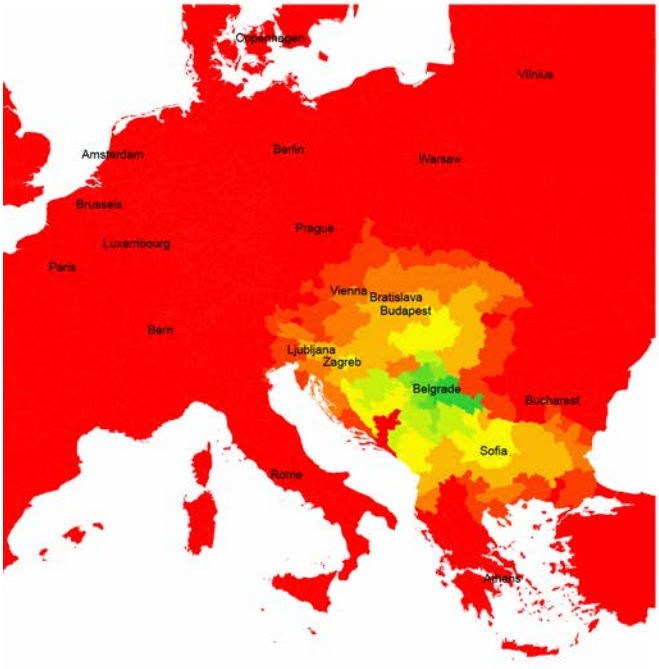
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Belgrade

2019



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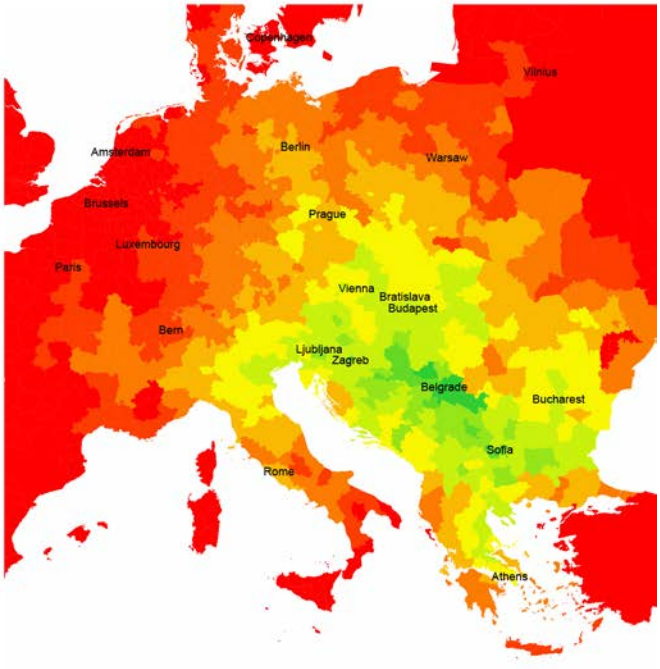


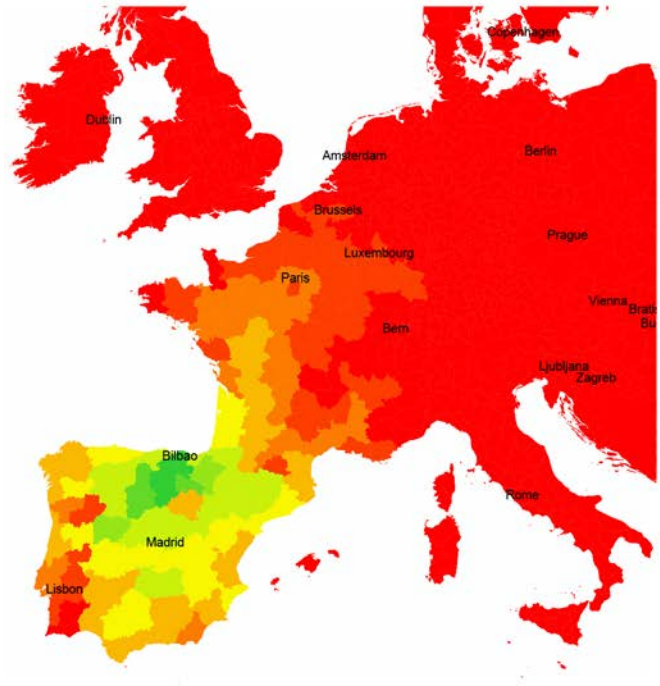
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Bilbao

2019



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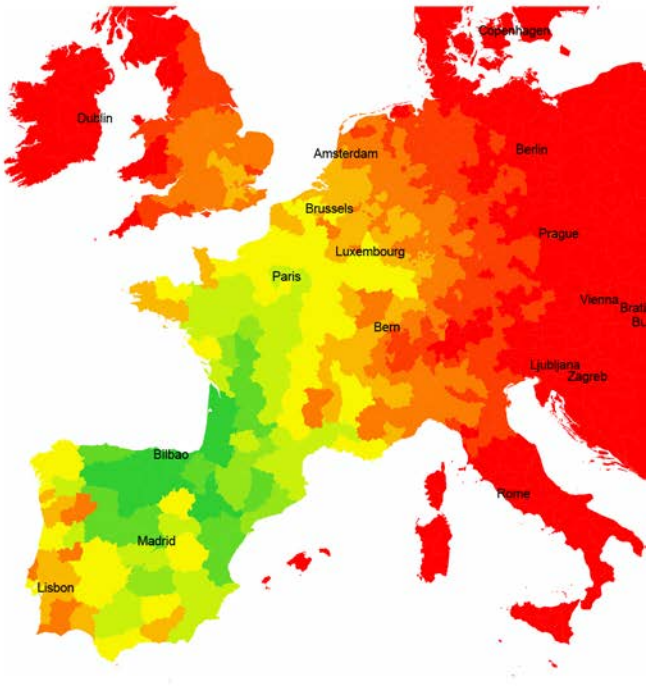


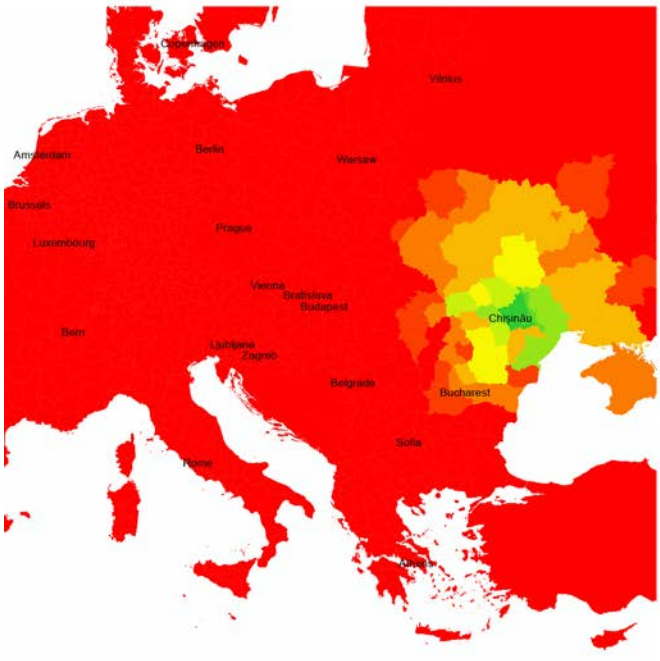
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Chișinău

2019



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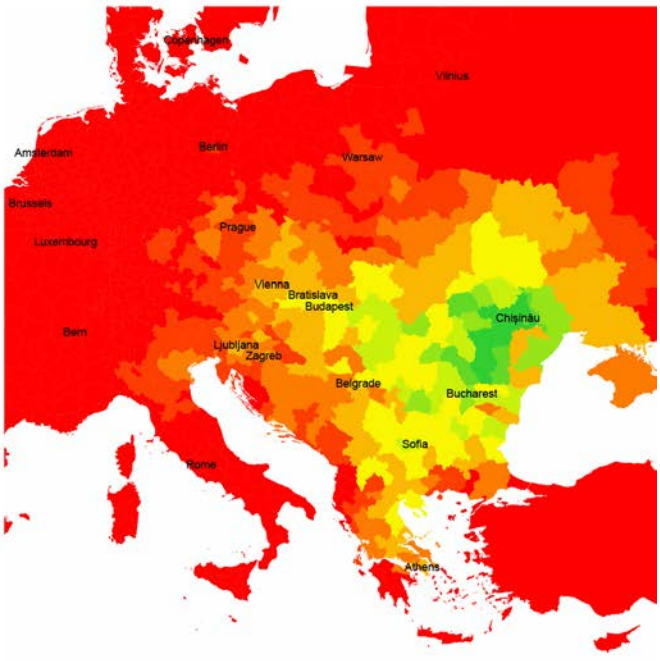


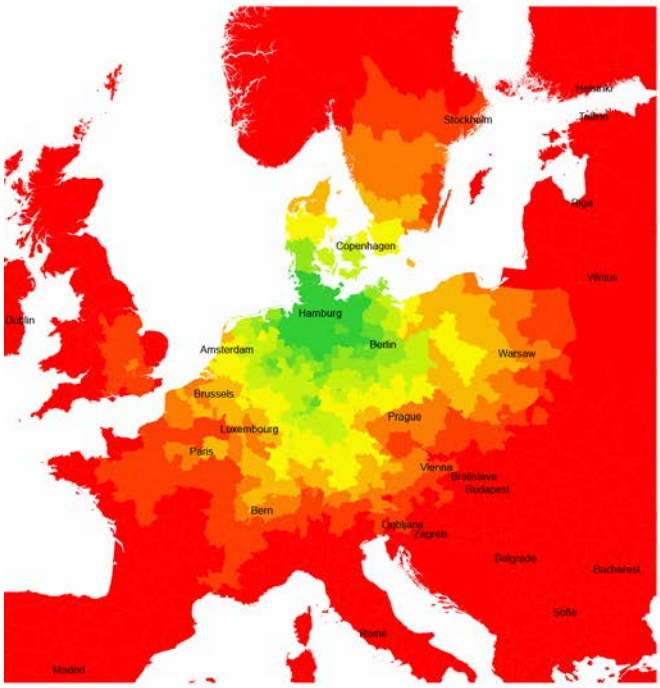
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Hamburg

2019



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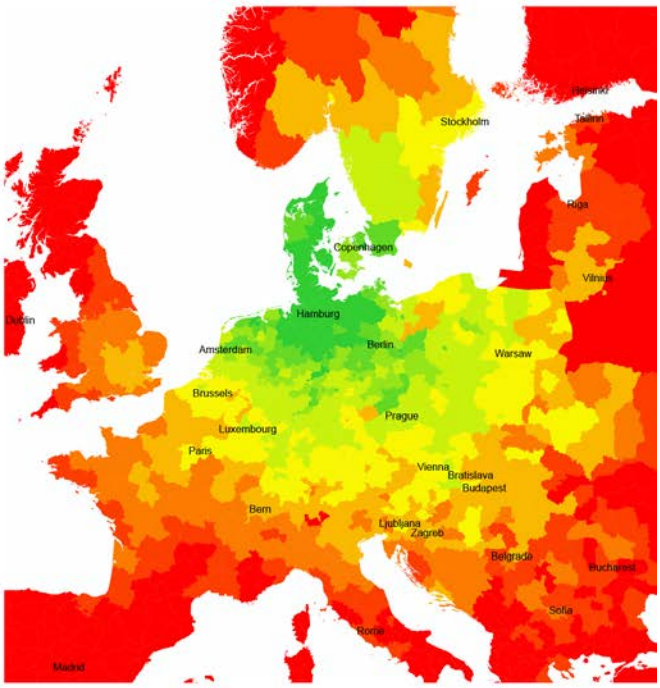


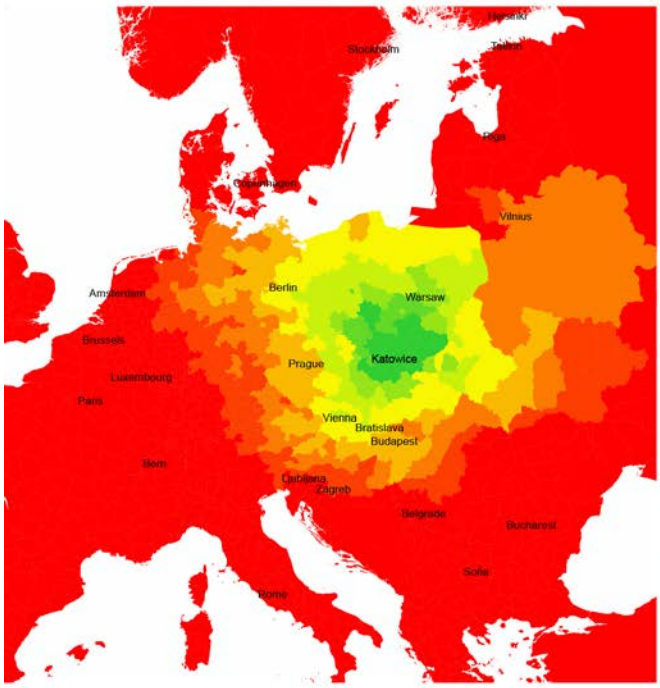
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Katowice

2019



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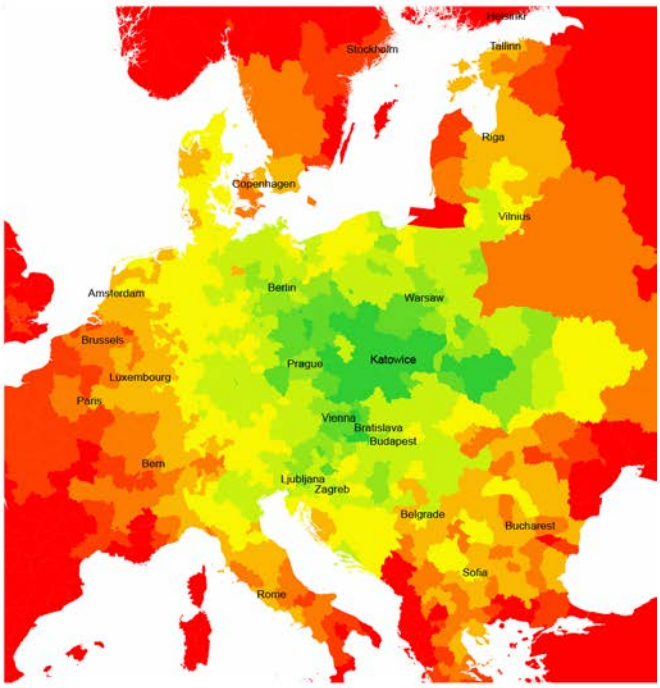


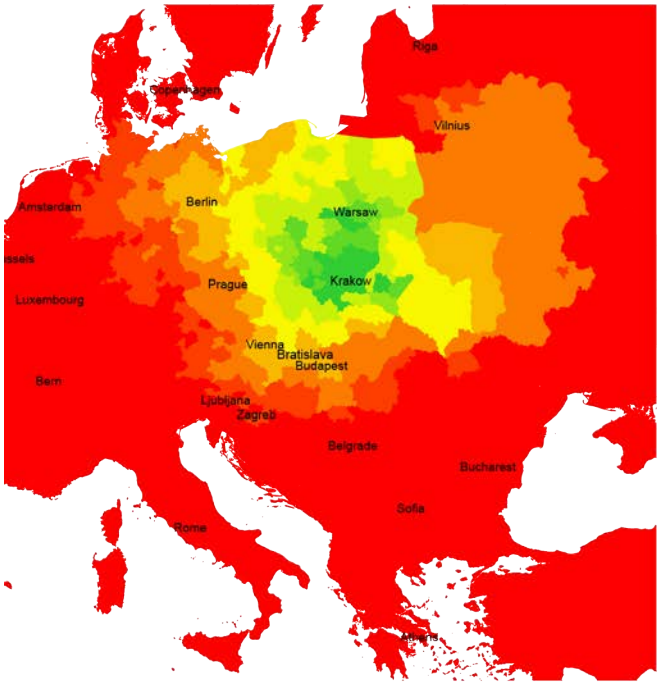
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Krakow

2019



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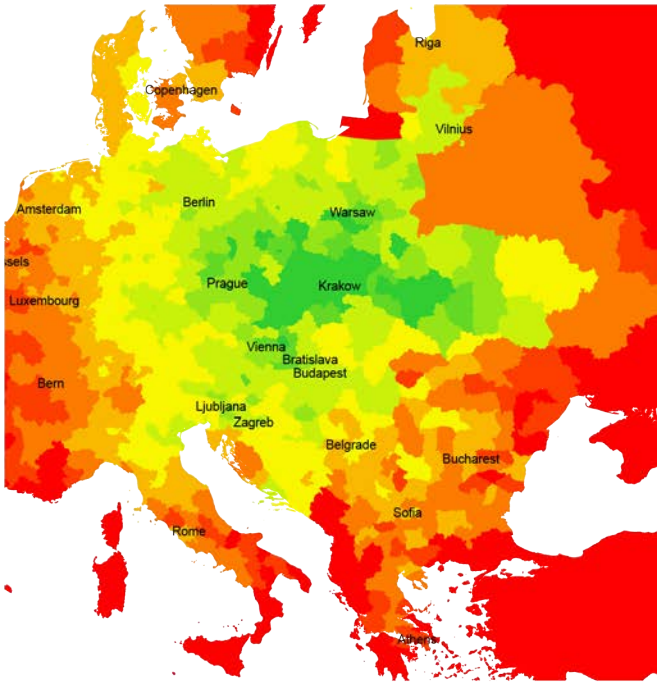


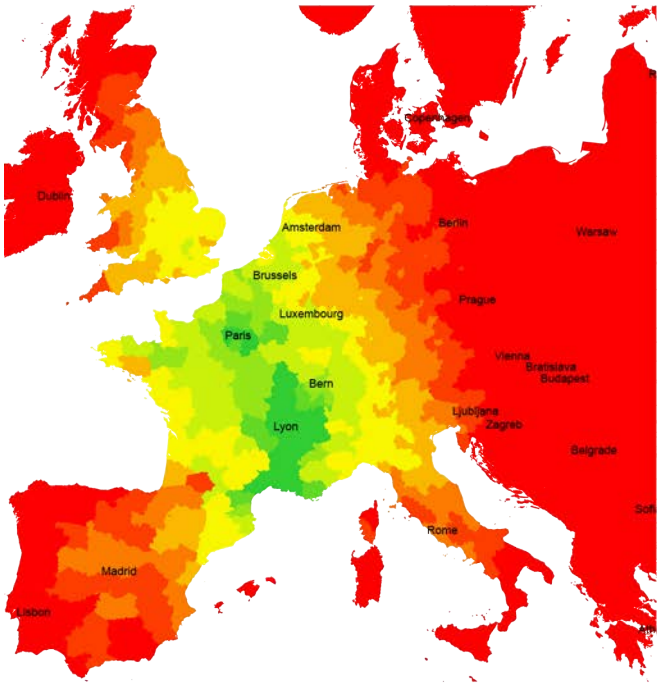
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Lyon

2019



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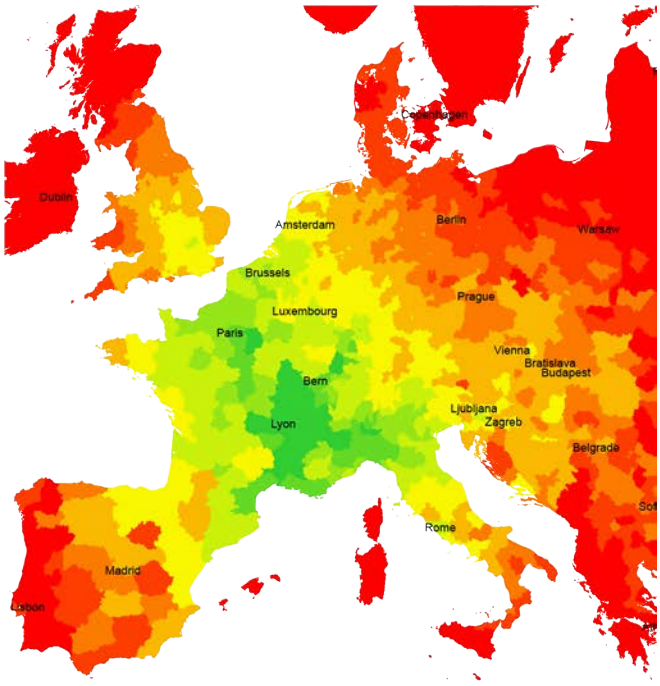


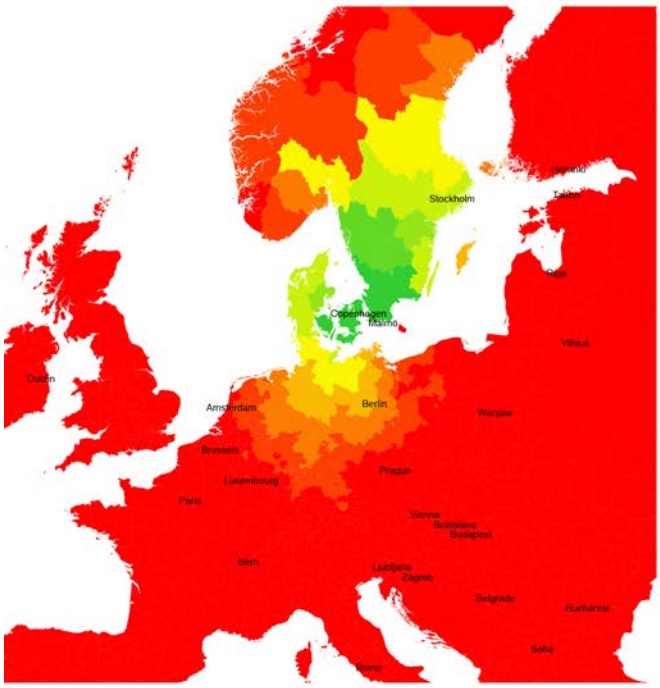
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Malmö

2019



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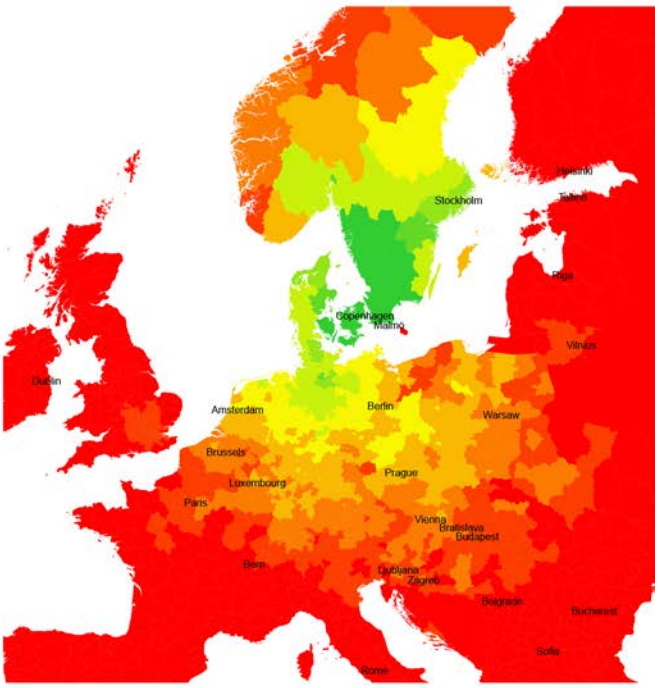


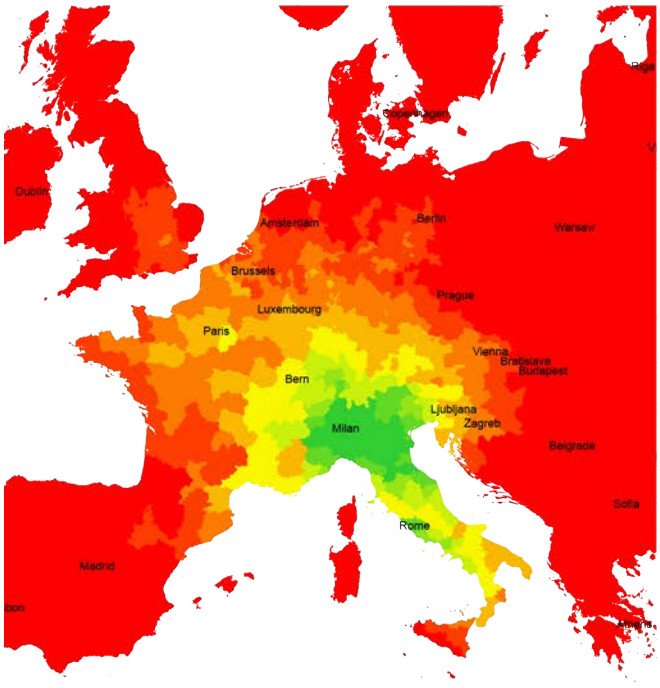
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Milan

2019



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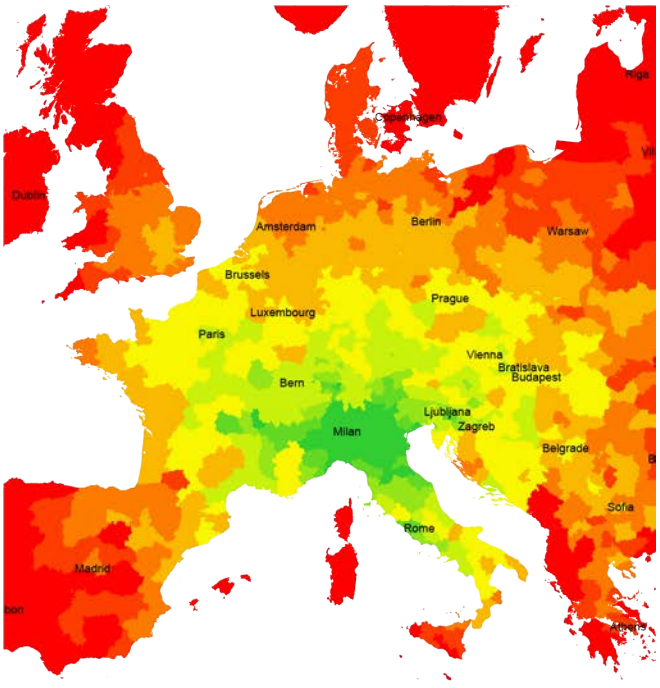


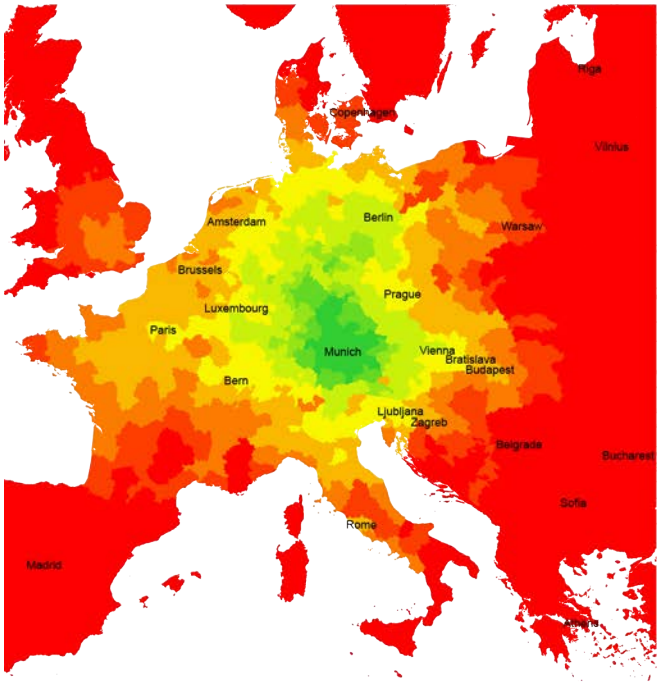
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Munich

2019



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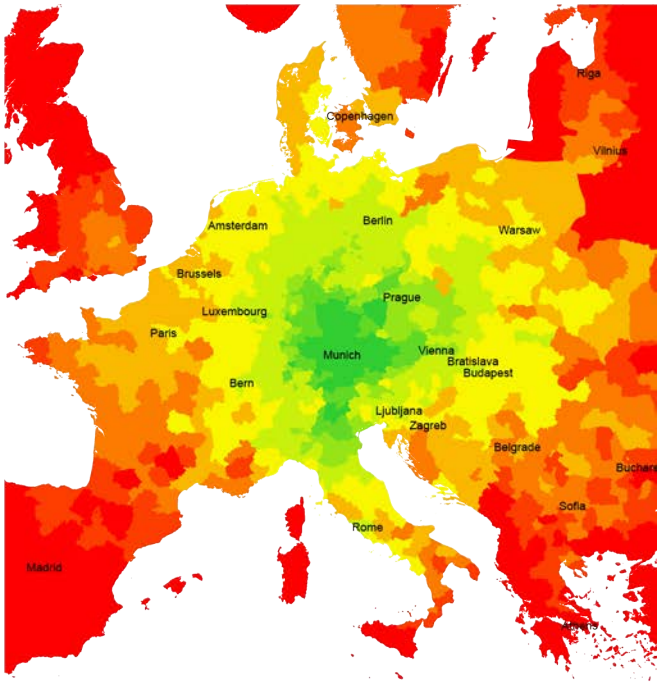


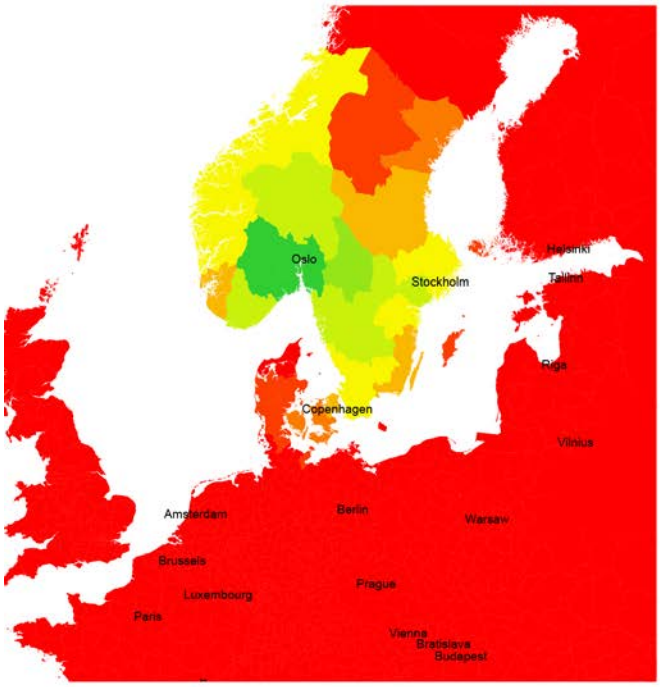
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Oslo

2019



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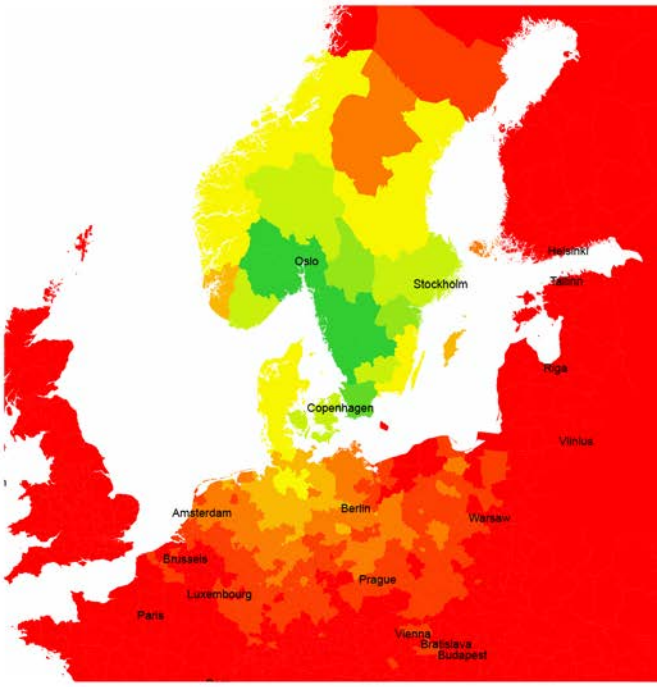


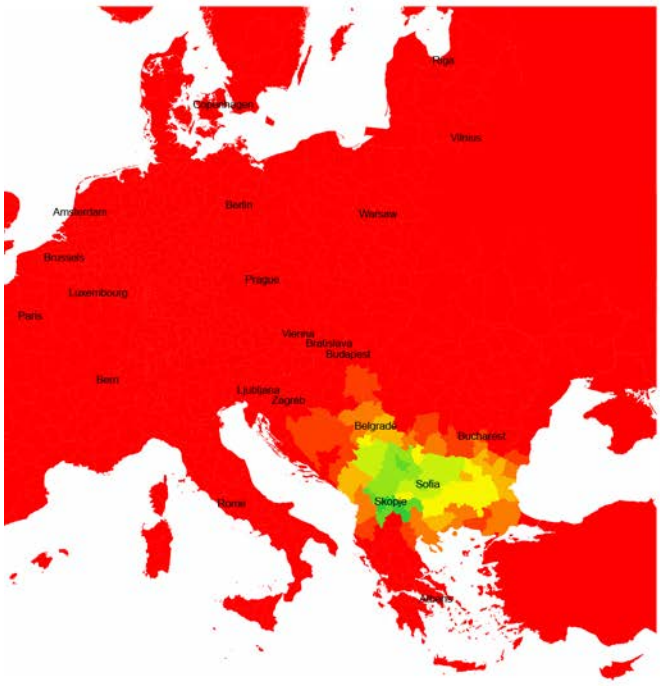
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Skopje

2019



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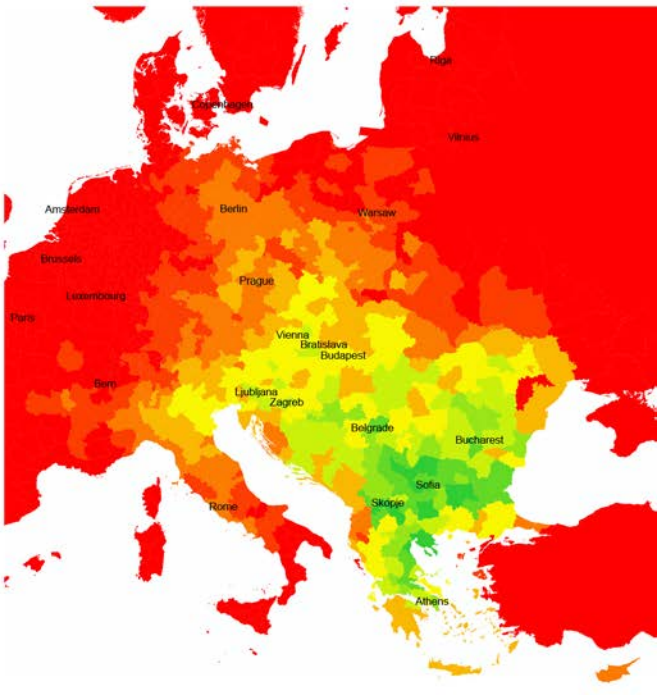


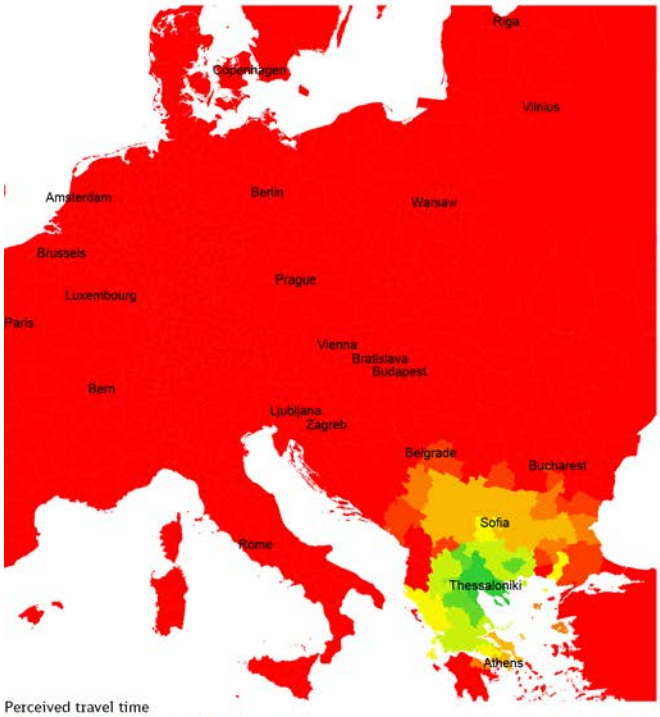
Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).

Perceived travel time of Thessaloniki

2019



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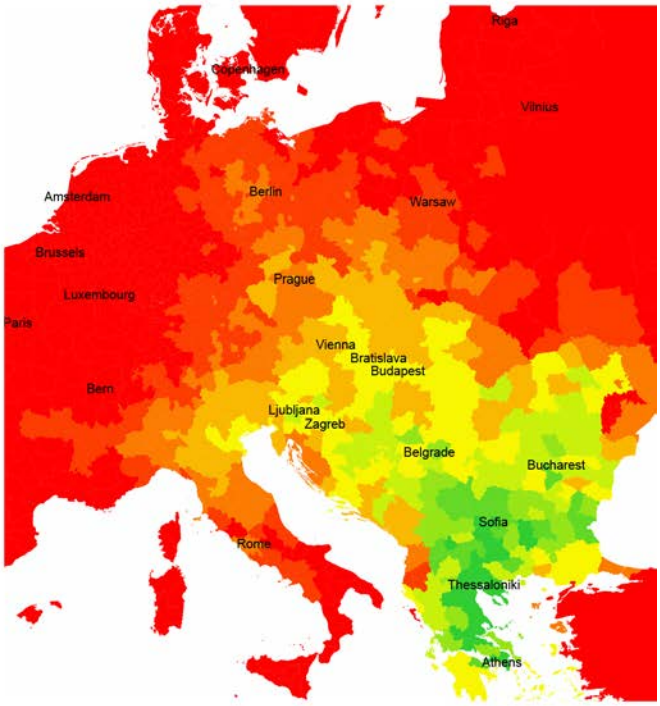

Perceived travel time

low... medium... high travel time

Includes access time per NUTS-3 zone, waiting time at start, and travel and interchange times (with higher values for new HSR hubs).