

Legacies of European ‘Belt and Road’? Visualizing transport accessibility and its impacts on population distribution

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ABSTRACT

The ‘Belt and Road Initiative’ was announced in 2013 to better connect China economically, socially and culturally with the world by new transport infrastructures. Before forecasting the long-term impacts of the initiative on economic activities and population, one could learn from history about how transport infrastructures and the corresponding accessibility of different locales they engendered or enhanced might have shaped and reshaped the distribution of the population and economic activities in Europe. Historic maps of transport infrastructures and population statistics were collected from such sources as the Stanford Geospatial Network Model of the Roman World, the Perry-Castañeda Library Map Collection, and the Gridded Population of the World Version 4. By digitizing and synthesizing the maps and statistics, transport accessibility in Europe and its nearby areas was mapped during both the Roman Empire (27 BC–476 AD) and the Middle Ages (1000–1500 AD), as well as the population distribution in Europe and its nearby areas in 2015. The mapping efforts indicated that the transport network changed greatly over time for various reasons, and that transport accessibility is a sufficient but not necessary condition for different locales’ population growth and economic prosperity over time.

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In 2013, Chinese President Xi Jinping announced an ambitious project called ‘the Silk Road Initiative’. Later, the project was also called the ‘Belt and Road Initiative’, where ‘belt’ indicates that historic surface routes that connected China and Europe and countries/regions in between, and ‘road’ refers to maritime routes connecting China, Southeast Asia, Near East, Africa and Europe (National Development and Reform Commission (NDRC), 2015). Regardless of the name of the initiative, it was forecasted that it would better connect China with 70 countries and billions of people by new and enhanced transport infrastructures (including maritime ports and routes) (Ma, 2018). It is too early (and also too challenging) to forecast the long-term impacts of the initiative on the (re)distribution of economic activities and populations across

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the affected countries. We can, however, probably learn from history about how transport infrastructures and the corresponding accessibility of different locales they engendered or enhanced might have shaped population configuration and economic activities in Europe. By collecting, digitizing and synthesizing historic maps of transport infrastructures and population statistics, we were able to map transport accessibility in Europe during two important periods of history: the Roman Empire (27 BC–476 AD) and the Middle Age (1000–1500 AD), and to connect these to the latest population distribution in Europe as of 2015 that we could access. Our maps and statistics are from such sources as the Stanford Geospatial Network Model of the Roman World, the Europe Mediaeval Commerce Map from the Perry-Castañeda Library Map Collection, and the 2015 Population Density of 1-km Resolution from the Gridded Population of the World Version 4. In our maps, transport accessibility was measured by network quantity penalized by distance (NQPD), which is an indicator calculated based on sDNA, one of the leading spatial network analysis packages jointly developed by scholars from Cardiff University, the University of Hong Kong and Tongji University (Cooper, Chiaradia, & Webster, 2019). Simply put, the NQPD measures how many links there are from a given node (city) and how difficult it is to travel from this node through those links to other nodes. Where there are more turns between links, the NQPD becomes smaller. In other words, a larger NQPD reflects better connections between a node and other nodes (Cooper, 2019).

Figures 1 and 2 indicate that extensive ‘belts and roads’ network existed in historic Europe and North Africa and Near East. If we tentatively ignore the actual carrying capacity and quality of those belts and roads, their scope and scale are vast. Figure 1, for instance, shows that roads in the Roman Empire connected many locations in the Eurasian and African continents. In

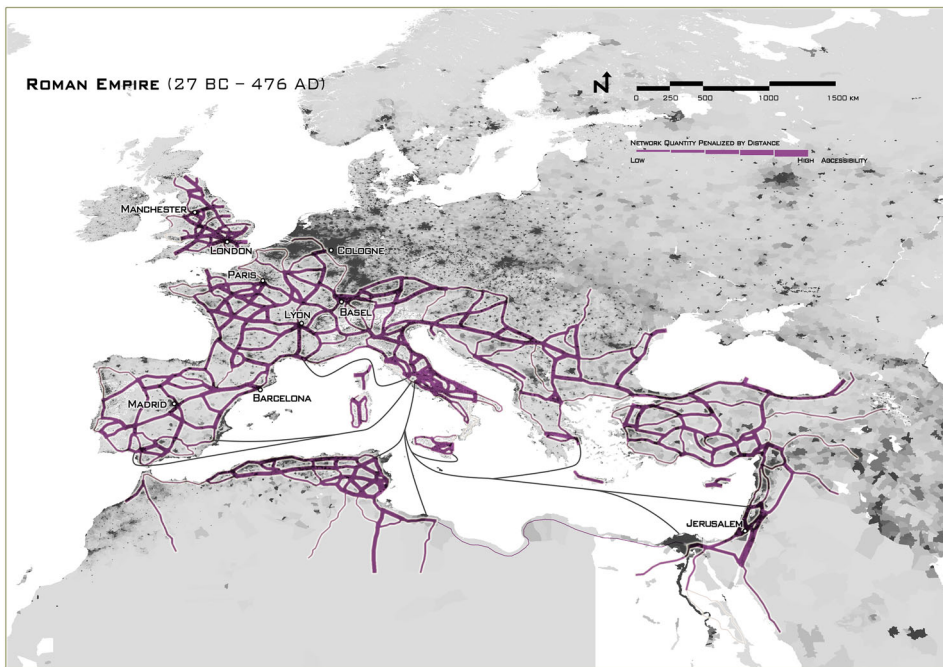


Figure 1. Transport accessibility in the Roman Empire (27 BC–476 AD) and the population distribution of Europe in 2015.

Sources for base maps: 2015 Population Density of 1 km Resolution, <http://ciesin.columbia.edu/data/set/gpw-v4-population-density-rev10/>; The Routes of Rome, <http://orbis.stanford.edu/>.

Software: ArcGIS 10.5.1, Spatial Design Network Analysis, Photoshop CC.

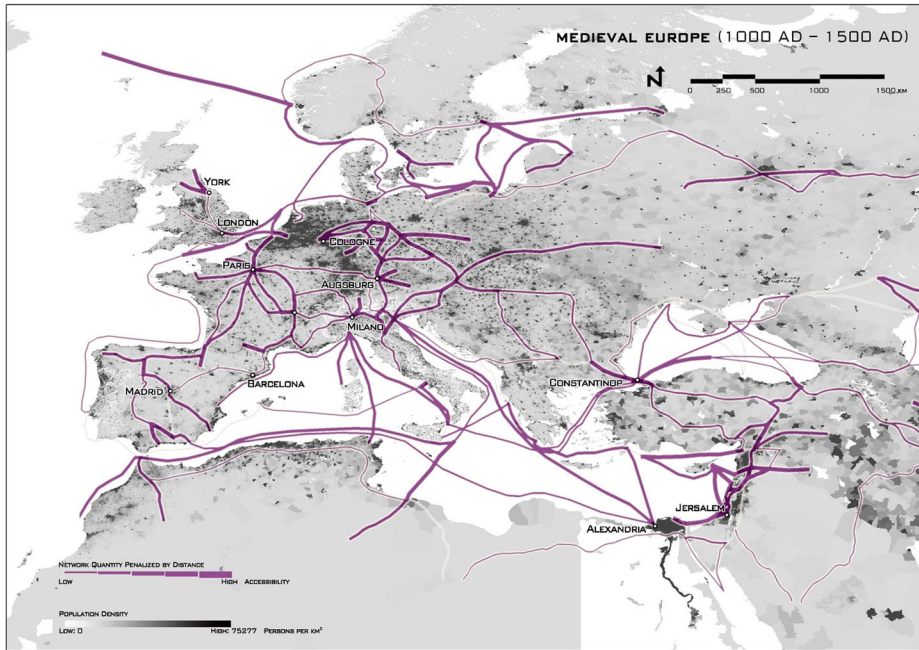


Figure 2. Transport accessibility in Medieval Europe (1000–1500 AD) and the population distribution of Europe in 2015.

Sources for base maps: 2015 Population Density of 1 km Resolution, <http://ciesin.columbia.edu/data/set/gpw-v4-population-density-rev10>; Europe Mediaeval Commerce Map, https://legacy.lib.utexas.edu/maps/historical/shepherd/europe_mediaeval_commerce.jpg.

Software: ArcGIS 10.5.1, Spatial Design Network Analysis, Photoshop CC.

relatively remote places in the empire such as Britain, the West Bank and Spain there were also extensive road networks. Not surprisingly, the Apennine Peninsula, the core of the empire, enjoyed some of the highest NQPDs. As the Roman Empire existed between 27 BC and 476 AD, many of its belts and roads emerged and thrived even before the silk roads between China and Europe came into being *c.*110 AD (Tilburg, 2007). In Figure 2, the surface roads decreased but maritime routes increased as compared with Figure 1. The average NQPD for different cities decreased, too. This might be caused by a lack of a strong and widespread empire such as the Roman Empire. Across Figures 1 and 2, such cities as London, Paris and Madrid consistently enjoy a high NQPD in the network of belts and roads over time. They also still serve as leading centres for population and economic activity in their respective regions and countries. However, many other cities (e.g., in Turkey, southern Italy and North Africa) tended to suffer from vicissitudes in transport accessibility, population and economy, suggesting that for those cities we captured, based on the maps mentioned above, good transport accessibility does not guarantee long-standing economic attractiveness, competitiveness and prosperity.

In summary, we can tentatively conclude that (1) China's Belt and Road Initiative is not the first of its kind in history – historic European empires and their neighbours actually developed extensive networks of belts and roads; (2) the overall network changed significantly over time for a variety of reasons; and (3) the long-term impacts of the network are mixed, meaning that transport accessibility is a sufficient but not necessary condition for population growth and economic prosperity. Other critical factors such as institutions, path dependence, climate, the built environment and building density might influence the status and fate of a city, a region

and even a country more (e.g., Glaeser, 2012; North, 1990). Nevertheless, history, as described above and shown in Figures 1 and 2, can still enlighten what might or might not make modern belt and road initiatives work. It seems that to make modern ‘belts and roads’ across the world a success, in addition to transport infrastructures and corresponding accessibility they engender or enhance across locales, we should not overlook other important factors such as institutions and the built environment. Only then can we best harness the joint positive impacts of all these factors to fulfil the promise of those modern ‘belts and roads’ – to create the largest possible social welfare for different participating countries and regions, which would help maintain the longest possible peace across these countries and regions.

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