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Spatially explicit reconstruction of historical transport infrastructure

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1 Overview

Spatially explicit reconstruction means that the spatially correct shape of the historical transport infrastructure is reconstructed rather than just the information on connections. The advantage of such historical data is that it allows to model travel time, speed and travelled distance of historical journeys. The method presented here draws on historical sources, such as transport and survey maps as well as travel literature, and also on current GIS data (OpenStreetMap shape files; OSM).
In this work flow, manual as well as automated steps are included. The result is the most likely shape of historical land transport infrastructure, differentiated into categories depending on the quality of the network element.
Currently, the database covers Switzerland, Germany, France, Austria and Italy for time steps ca. 1950, 1845 and *1720 (in parts*). The data is extended towards other areas, such as BeNeLux, and back in time up to 1510.

2 Path dependency

When reconstructing historical transport networks, path dependency is exploited to generate results. This holds for transport, map making (as maps are primary sources) and infrastructure.

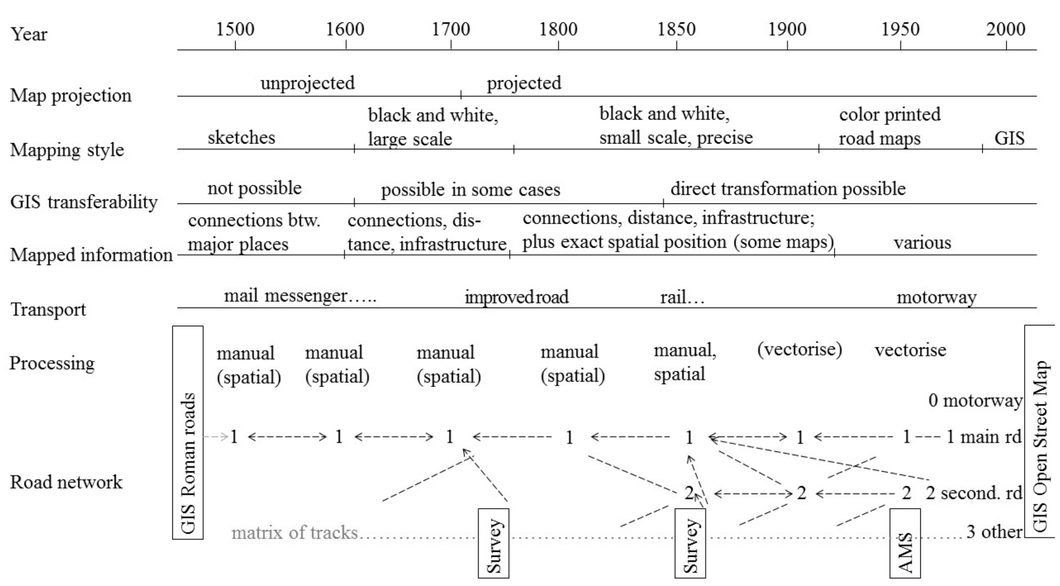

Fig. 1 Interdependencies between transport, map making and infrastructure, guided by path dependency.

This approach is shown at an illustrative example: the St. Gotthard pass in Switzerland 1845. On the left there is a travel map (information on connections), in the middle a survey map, and on the right the current OSM road shape. As there is only one road (shape), this is an easy example. In the lowlands, there are usually many potential roads that might correspond to a connection on the travel map. Based on additional information, mainly other maps or tables of lists of places along roads, the most likely road is chosen.

Fig. 2 Interdependencies between transport, map making and infrastructure, guided by path dependency.

3 Speed

Speed depends on four variables: the quality of infrastructure, the travel system (i.e. organisation of the transport supply), and the slope. The first three variables are modelled based on historical sources, such as travel maps and books as well as on literature as secondary sources. The speed is based on the maximum speed based on variables 1-3 and corrected by the influence of slope. As shown below, steeper slope means slower speed. In this equation, the characteristics of draft animals are considered. The information on slope comes from a current digital elevation model.

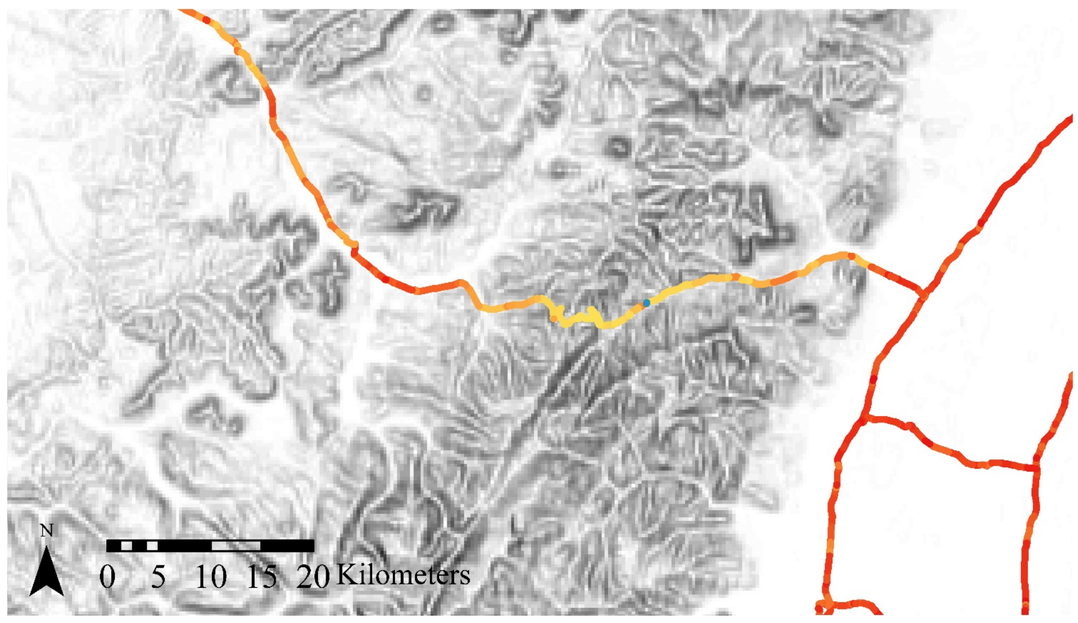

Fig. 3 Speed model depending on slope and quality of road

4 Potential use: Least cost path

When applying a travel time to all elements of the network as well as to the space in between, a surface of travel time is generated. The inverse is least costs.

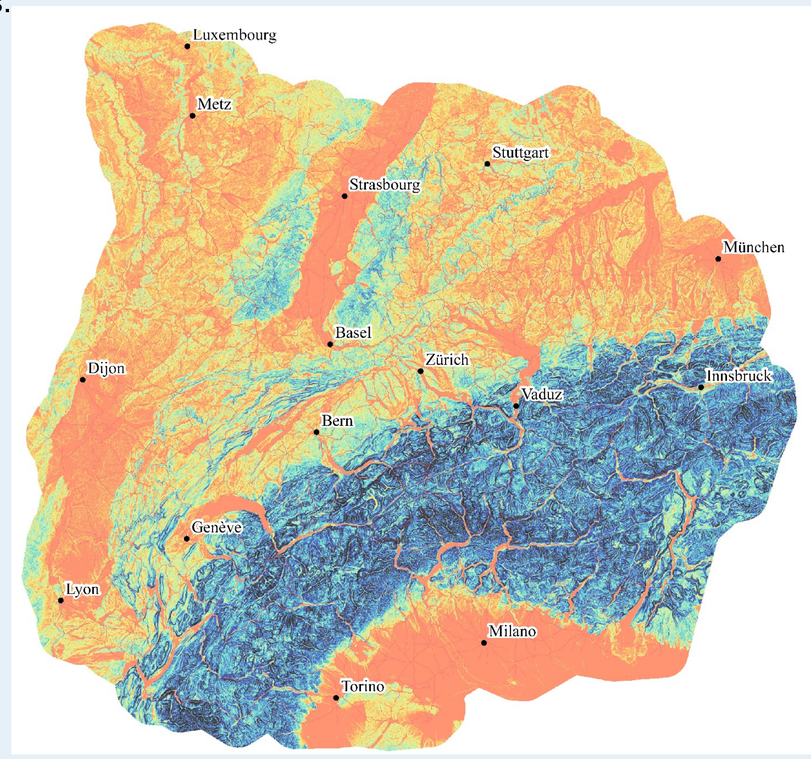

Fig 4 Least cost path within study perimeter

5 Literature

Fuhrer, R. (2019) Modelling Historical Accessibility and Its Effects in Space, *Doctoral Thesis*, ETH Zürich, Zürich.
Link to pdf

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