

# Mapping the uncertainty of past maritime routes

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## Abstract:

One of the aims of the ongoing Portic program (<https://anr.portic.fr/en/home/>) - ANR-18-CE38-0010 - is to visualize the content of Navigocorpus, a database collecting historical sources about maritime trade of XVIII<sup>th</sup> century, through interactive maps and charts underlining the uncertainty part about data. One of the intended visualizations retraces ships movements over time. Navigocorpus contains in fact, among others, the digitalized transcription of over 30,000 ship clearances of French ports in 1787. A clearance record typically includes the name of the ship and its captain, its tonnage, its homeport, its cargo and its intended destination. However, some registers of clearances are still missing for few admiralties (which were French Old Regime districts for collecting maritime taxes). Besides, this database contains two other sources, namely “Health Registry in Marseille” and “The small cabotage notebooks”. Some ship descriptions match between these sources and can confirm a declaration of the other source. This work presents concrete examples of uncertain destinations and the way we dealt with them at two levels: that of modeling and visualization through maps.

First, past ships' routes are inferred by cross-referencing historical sources. The focus is on the different kinds of uncertainty pertaining to the declarations of destination of ships identified as identic throughout the various sources. A new variable is computed for each waypoint, with six different levels: observed – declared – unverifiable - confirmed – controversial – invalidated. For instance, when the next chronological clearance in the database confirms the previous declaration (a ship clearing from Bordeaux to Nantes is found clearing from Nantes one month after), Nantes becomes a “confirmed” destination in the first clearance. If instead the next clearance is not coherent, like clearing from La Rochelle to Lorient, because it not in the same admiralty nor in the same equivalent region, then it is qualified as “invalidated”. However, some destinations can not be checked: those towards foreign countries, for which we do not have sources, or towards few admiralties where registers are missing. They are qualified as “declared”. Equally, the last waypoint of a ship is “unverifiable”. Yet, it happens that a ship declares a departure for a foreign and distant destination, whereas we find it just after clearing from France in a known lapse of time. This foreign destination will be qualified as “invalidated” or just “declared”, according the point of view about the duration that is required to make the return trip in France. Since this requires some historical knowledge about ancient navigation and routes, there is often a controversy about these cases, which are “controversial”. The algorithm makes the automatic assessment of waypoints by using a gazetteer (Plumejeaud-Perreau et al., 2021) that specifies the admiralty of each port, the belonging to other places (such as countries or islands), and whether sources are available for this location. After that, we deduce a synthesis variable qualifying the uncertainty level of any leg linking two successive waypoints.

At the visualization level, we have implemented a pathfinding algorithm per sea. Our approach is inspired by work of (Poncet-Montanges, 2013), that do not use a graph based approach because it involves a great number of a priori parameters (weather, kind of vessel, danger of capture at sea, etc.). Furthermore, these approaches are based on a predefined discretization of the search space, whereas the ocean is a continuous space and there is no straightforward way to mesh it. Our approach draw a trait line between the start and end, but the part of the segment intersecting the coast is extracted to build a buffer along the coast, for which a set of intermediate waypoints are put at regular space. It iterates thus recursively, and allows computing a set of maritime routes that never intersects coastal parts. Thus, the computed route can be mapped (Figure 1) like alternatives paths using appropriate semiotic rules to convey the level of certainty we have on the route in its various components. The color hue of a diverging palette is used to show the certainty level (from green for confirmed to red for invalidated) whereas dashed lines are used to show the steps that have been inferred by the algorithm. For this map, we added manually numbers related to the segment number within the trajectory to show the mess this could become without the interactivity of a Web app. Equally, here, colors of ports are related to the French Province they belong to (like Morlaix and Saint-Brieuc are in Brittany), but here, an appropriate tooltip would better describe the port and its belongings. This visualization tool, that will be available on the Web, offers a way to query

routes on various criteria (name of the captain, of the ship, flag of the ship or date of the clearance) very easily. It shows a map with the various scenarios concerning their itinerary, along with full metadata explaining the uncertainty level on each segment, and a schematic view using the same semiology.

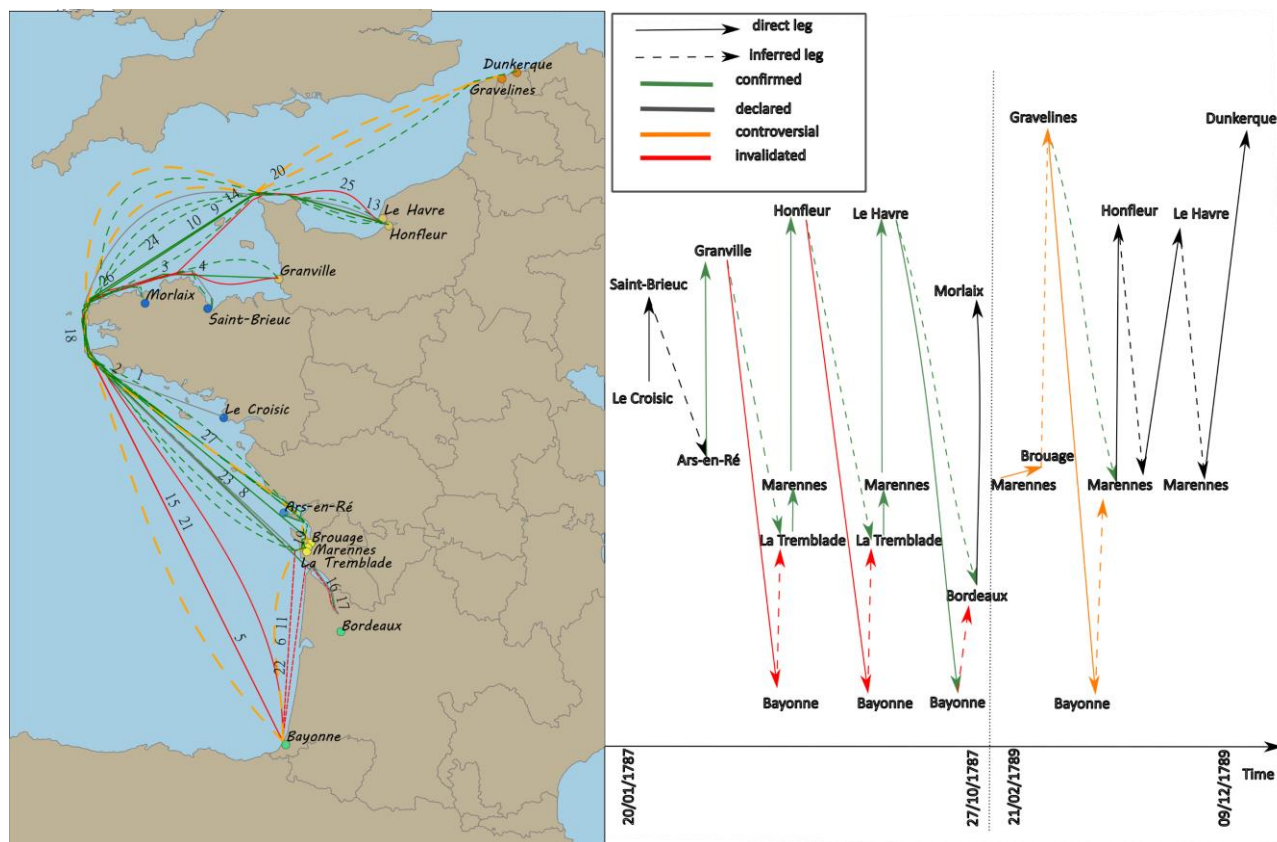


Figure 1. Map and schematic view of itineraries of one ship.

## References

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