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Seascape corridors : modeling routes to connect communities across the Caribbean Sea

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Summary

The goal of this study was to determine the feasibility of modeling past maritime connections between indigenous island communities in the Caribbean and to evaluate how computer generated routes connecting islands in the Caribbean can inform on the structure of past inter-island relationships.

The research is part of the inter-disciplinary Island Networks Project supported by the Netherlands Organization for Scientific Research (project number 360-62-060). This project examines the transformations of inter-island social relationships across the historical divide in the Lesser Antilles. Uncovering possible canoe routes between Amerindian communities can help to explain the structure, capabilities, and limitations of the physical links in social and material networks that existed prior to and just after 1492. To evaluate links between pre-Columbian island communities in the Lesser Antilles, I modeled optimal routes between indigenous archaeological sites to examine how routes in various seasons and through different regions influenced possible lines of connection. Canoe routes were generated in three different areas in the Caribbean, stretching from the island of Hispaniola to the Leeward Islands and from the Windward Islands to Guyana. This allowed for a basic test of the method's viability over different distances and environmental changes. Sea-based pathways created for this work provided new insights into the movement of peoples and material culture between islands and past Amerindians communities in this region.

Least-cost pathway analysis is a popular approach for analyzing the physical connection between sites in archaeology. Over the past three decades researchers have explored several methods to analyze least-cost pathways on landscapes (e.g., White and Surface-Evans 2012). Land-based least-cost efforts have outpaced the number of works creating optimal travel routes across the sea's surface. Perhaps as a result, no community standard for using computer- and GIS-based methods to model canoe or sailing routes exists. Though methods used in previous research often focus on determining the time-cost and success of specific routes, these measures have been calculated or judged in different ways. Colleagues from the University of Konstanz and I proposed a new tool to model past canoe routes. The tool used in this work modeled directed canoe voyages, or where the start and end points of pathways are pre-determined, a technique not yet used in the Caribbean region where work has focused on understanding undirected, or drift, voyages.

The tool used here differs from previous works as it follows an isochrone method. Based on Hagiwara's (1989) work, isochrone modeling evaluates optimal routes by having a seafaring vessel move towards a termination point over several time-intervals. By reevaluating paddling direction and underlying current at several steps, these intervals allow for the model to mimic real world canoeing techniques. The isochrone method is a convincing way to construct routes over the shifting surface of the sea.

By applying this method to three case studies spread around the Caribbean region I evaluated how crews adapted to paddling through different island layouts. This approach covers close connections, as found in the tight cluster of the Leeward Islands, and distant connections, like those between the northeastern South American coastline and the Windward Islands. I also explored how canoe pathways could be structured around a chain of islands by evaluating movement between the eastern edge of Hispaniola and the Leeward Islands. Routes generated through these three regions demonstrated the model's effectiveness for analyzing possible connections between known archaeological materials and possible canoe travel corridors.

Sites used within this study were selected based on objects within their assemblages. I focused only on a few materials or stylistic elements that were imported into the islands. Archaeological evidence to support these connections was drawn from pre-Columbian Archaic Age (2000 to 400 BC), Late Ceramic Age (1200 to 1500 AD) and early colonial period (AD 1492 to 1600) assemblages. These include both physical materials sourced for export, such as Long Island flint from the Leeward Islands, and stylistic elements, such as motifs originating in the Greater Antilles that spread into the Lesser Antilles. Where appropriate, I evaluated historic and ethnographic accounts alongside archaeological evidence. I also assessed modern experiential and experimental canoe studies to better understand what limitations should be placed on routes. When woven together, these lines of evidence provided a solid platform to realistically determine what sites were likely connected in the past. The modeled routes give shape the layout of possible connections suggested by other members of the Island Networks project (e.g., Hofman *et al.* forthcoming; Laffoon 2018).

Linking Amerindian sites shows that reconstructing canoe routes complements studies of exchange and mobility networks in the Caribbean. The generated pathways point to likely avenues of connection that cannot be seen through the presence of the archaeology alone. The material record can demonstrate the connection, computer modeling can hypothesize the travel corridors. Routes were shown to pass by other islands in the region when moving from the origin to termination points. These in-between islands may indicate places crews rested during voyages. Islands that are passed on the way to other islands could also represent points where exchange occurred. The islands suggested as in-between connectors by routes modeled in this work can point to new areas for archaeological comparison. It is possible that future works, both modeling and survey-based, will expand the capability of generated pathways to indicate the placement of past communities. The relationship between sites and the location of routes also supports the use of a mental map, or wayfinding toolkit, among Amerindian navigators.

These modeled canoe routes also allow for an evaluation of movement in different seasons. This is currently difficult to achieve through a comparison of seasonally available materials in the region. It is likely that these considerations were vital to canoe navigators as a change in environmental conditions, such as currents, affected the difficulty and trajectory of routes in different seasons. New insights into seasonal constraints on regional canoe networks can expose those communities predisposed to be in contact throughout the year and optimal (or least-cost) canoeing periods. Comparing the layouts of routes over various seasons may be one of the best ways to retrace the location of canoe travel corridors that existed in the Amerindian mental map.

