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

Slayton, E.R.

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## Modeling Canoe Voyaging in Theory

This chapter explores the socialization of seascapes and the mental construction of navigation, or the existence of mental maps, which made sea-based travel corridors accessible. Seascapes can be defined as places imbued with cultural connections that are on the sea, in view of the sea, or in coastal areas bordering the sea (Cooney 2003; see also Crouch 2008). Seascapes are a cross between the conceptual and corporeal realities of everyday life. They represent an arena of interaction with the sea environment or between different cultural groups (*sensu* Cooney 2003: 326; Crouch 2008: 132-136), sea-centred material culture (*e.g.*, McNiven 2008: 154), and, in some cases, people and the 'spirit' world (*sensu* Cooney 2003: 324; Lewis 1994; McNiven 2003, 2008; for a broader discussion of water as spiritual metaphor, see Strang 2008b: 124). Seascapes can also be significant culturally (*e.g.*, McNiven 2003, 2008: 154) and for expressing group identity (*e.g.*, Cooney 2003: 323). Exploring these seascapes' physicality, or the physical space people use and move through, can assist in uncovering the relationship between the social, psychological, and physical use of the sea.

Because life at sea held a critical role within coastal mainland and island communities (Crouch 2008), canoeing technology in the Caribbean fostered robust inter-island exchange networks that are evident within the archaeological record (Bérard 2002). Yet, as noted by Callaghan (2013: 254), until recently the capabilities of past Caribbean seafarers have been underrepresented in archaeological research. The archaeological, ethnohistoric, and ethnographic records of canoe use in the Caribbean are essential to understanding the possibilities that seafaring offered. In addition to the different views of Caribbean seafarers as either expert navigators with effective technology or as simple canoers, there is also debate as to how they constructed their vessels and what technologies they used (see Frederick 2014; Honeychurch 1997a; Lewis 1994).

The technological limitations of canoe use revealed through ethnography, experimental, and experimental archaeology function as the basis for discussing constraints on voyages (for ethnographic, see Dodd 1972; Frederick 2014; Taylor 1938; for experimental and experiential, see Bérard *et al.* 2016; Billard *et al.* 2009; Horvath and Finney 1969). Experimental studies of canoe building and voyaging provide additional information on the possible use and utility of canoes to supplement these records (Billard *et al.* 2009, 2016). Ethnographic examples and comparisons can help to explain how people contextualized being on the sea (Crouch 2008: 134; Lewis 1994; Tingley 2016; see

also examples in Ingold 2009). For example, the ways in which people ‘read the waves’ to understand current flow likely influenced their movement through and understanding of the sea (Lewis 1994; Tingley 2016). A canoer’s view and feel of the surrounding environment provided clues on where the best direction for seafaring would be. These clues could be followed and linked to form optimal routes. We can also gain insight into how vessels may have been used by evaluating the capabilities, seaworthiness, or capacity for crew and cargo of the canoes themselves (*e.g.*, Billard *et al.* 2009; Taylor 1938). For example, planked vessels, or dugout canoes with additional siding added to extend the height of the vessel, would capsize less than those that had not had the canoe sides built up (Bérard personal communication 2014; Taylor 1938). Canoes that capsized less frequently had a greater chance of delivering their crew and cargo to their destination, supporting the continuation of existing systems of mobility in the islands.

In addition to these technological limitations, inter-island and intra-island settlement patterns, as well as the ability of canoers to reach certain destinations, may have been influenced by environmental factors. These factors include the outline of seascapes, the spaces where sea and land meet, the placement of coral reefs and sandbanks, tides, and the location of channels (Crouch 2008: 132). Other environmental factors such as current and wind also influenced the ability of canoers to reach certain destinations, as has been discussed in connection with modeling movement on seascapes (*e.g.*, Altes 2011; Callaghan 2001, 2003; Davies and Bickler 2015; Irwin *et al.* 1990; Slayton 2013). The likelihood of canoers having a successful voyage can be modeled by considering these environmental factors, as well as a crew’s ability and paddling capacity (*e.g.*, Callaghan 2001, 2003). These limiting factors can be used as defining variables to create computer models of pre-Columbian sea routes. The application of these constraints will be discussed more extensively in the following chapter.

## 2.1 Seascapes as Spaces

Even though the sea makes up over 70 percent of the earth’s surface, traditionally much of the discussion of lived spaces in archaeology has only concerned activities that would have taken place on land (McNiven 2008: 149). There has also been some discussion over the degree to which islands were isolated cultural entities (*sensu* Erlandson and Fitzpatrick 2006: 14-16; Evans 1977: 20,23; Fitzpatrick and Anderson 2008: 6-8; Vayda and Rappaport 1963). In the past, many archaeologists have considered islands to be isolated laboratories (for discussions of islands as laboratories as initially developed for island biographies, see MacArthur and Wilson 1967; for further discussion of islands as laboratories, see Boomert and Bright 2007; Broodbank 1999; Crouch 2008: 133; Evans 1973; Fitzpatrick and Anderson 2008: 5-8; Gosden and Pavlides, 1994; Terrell 2008), their cultural evolution linked to their relatively small size and surrounding water. In this view, island communities were not connected by the sea, but were rather bounded and constrained by it. Neglecting to acknowledge seascapes to the same degree as landscapes ignores the crucial role water played as a facilitator of social connection in past societies, globally and in the Caribbean (*sensu* for Caribbean examples, see Hofman *et al.* 2010; Torres and Rodríguez Ramos 2008; for non-Caribbean examples, see Crouch 2008; Broodbank 2000; Gosden and Pavlides 1994). As Gosden and Pavlides (1994: 170) put it “The sea is not necessarily either a bridge or a barrier: it is what people make it.”

Only by considering the human understanding and use of the environment, not just the environment's effect on humanity, can we gain a more complete picture of these societies. The important role of the sea as a connector is one reason why explaining and analyzing seascapes is essential to understanding networks and connections between Amerindian islanders. Caribbean islands and their communities have increasingly been seen as highly connected, or engaged in complicated inter-island mobility systems (*e.g.*, Hofman *et al.* 2010; Torres and Rodríguez Ramos 2008). There is no question that many islands were linked through sea travel (*e.g.*, for the Caribbean, see Curet 2005; Hofman *et al.* 2006, 2010; Torres and Rodríguez Ramos 2008; for the Mediterranean, see Broodbank 2000; for the Pacific, see Terrell *et al.* 1997). Seafarers determined destinations for their canoe trips based on various factors that have been modeled, including site location, weather patterns, and the technological capabilities of the canoe (*e.g.*, Broodbank 2000; Callaghan 2001; Davies and Bickler 2015; Hofman *et al.* 2016; Montenegro *et al.* 2016; Slayton 2013). Canoers may also have had to plan voyages depending on shifts in the current or the weather, possibly stopping at an island for several days before they could launch again (*e.g.*, Broodbank 2000: 94). Voyages that were tied to specific environmental conditions may have altered relationships between seafarers and where they made port.

In landscape theory, corridors of movement are often connected to or around areas associated with specific "taskscape." Ingold defines taskscape as "a pattern of activities collapsed into an array of features" (Ingold 1993: 162, 2000; see also Nyland 2017; Rajala and Mills 2017; Tilley 1994). Taskscapes can include areas of production, such as lithic collection or manufacture (*e.g.*, Nyland 2017; Rajala and Mills 2017), or a space in which ideas are transferred (Ingold 1993). Similarly, sea pathways (or corridors of movement) often link a series of sea-based activity areas, for example those associated with fishing grounds (Agouridis 1997: 13; Crouch 2008: 135; Lewis 1994; McNiven 2008: 152-154) or safe places to harbor (Agouridis 1997: 14). Lewis (1994) mentions Pacific seafarers mentally tying fishing grounds to the flight paths of birds and certain points within the seascape. Agouridis (1997) and Broodbank (2013) mention the physical placement of markers that can denote harbors, which also constitutes a social connection to a sea-based activity. Trowbridge (1913: 890) makes the argument that people's memory of distance places is not geographically exact. In this vein, the connection between known harbors on distant islands and the friendly communities that live there may provide deeper meaning to the seascape as you traverse it (Terrell and Welsh 1998). Places associated with navigation markers or activities may have been given names or positions within a cultural narrative (Broodbank 2013; McNiven 2008: 152-154). These pathways and connected activity areas form the broader continuous seascape. Selected and associated cultural areas within landscapes, and by extension seascapes, can provide information on a community's relationships with its environment and with other peoples, as humans spatially order their social world (*sensu* Casey 1996).

Casey (1996) also discussed the importance of movement through an area for constructing social space. For example, in ritual spaces individuals tend to move in set patterns established through learned tradition and bodily repetition (Casey 1996: 23). This is similar to theories explored by Ingold (1993, 2000, 2009, 2011) and Tilley (1994), who theorize the construction of social space as being tied to the body's movement through and interaction with a landscape. Here, either in the general world

(Ingold 2011) or through the Welsh mountains (Tilley 1994), the progression of an individual informs on how people established mental and physical relationships between physical landmarks. In this way, the continuation of cultural areas, or even the remembrance of certain social spaces, are key aspects of a community ordering its world and establishing set pathways of moving through it. Connecting social spaces with activities or navigation markers to create a spatially-ordered sphere can also be seen in works discussing seascapes (*e.g.*, Broodbank, 2013; Crouch 2008; Frake 1985; Terrell and Welsch 1998). For example, Crouch (2008: 133) discussed the position of the Tudu sandbank as a central point within the mental map of Torres Straight islanders, despite its small size and low prominence in the water.

The seascape theory used here is drawn from archaeological landscape theory (*sensu* Casey 1996; Ingold 1993, 2000, 2011; Tilley 1994) and previously developed seascape theory (*sensu* Boomert and Bright 2007; Cooney 2003; Crouch 2008; Gosden and Pavlides 1994; McNiven 2008; Terrell and Welsch 1998; Torres and Rodríguez Ramos 2008; Waldren 2002). However, the social rules applied to seascapes can be very different from those assigned to landscapes due to the somewhat static nature of the latter and the fluid nature of the former. As Cooney (2003: 325) put it, “Seeing and thinking of the sea as a seascape – countered, alive, rich in ecological diversity and in cosmological and religious significance, and ambiguity – provides a new perspective on how people in coastal regions actively create their identities, sense of place, and histories.”

Sea voyages either around a specific island or between neighboring islands were likely a daily part of life for island communities. The use of seascapes must have helped shape these communities. Additionally, people living on small islands might need more interaction with off-island communities to supplement limited subsistence or material resources found around their habitation sites within their own landscapes (*e.g.*, Broodbank 2000; Crouch 2008; Gamble 2008). This could have led to the development of interconnection, focused on resource procurement or exchange relationships, between the various islands and communities within the Lesser Antilles (*e.g.*, Hofman *et al.* 2007, 2010). For example, Broodbank (2000: 91) describes the necessity for “ceaseless movement between individuals, communities and islands, simply in order to keep life going and information flowing in the Cyclades.” It is likely that a similar situation existed amongst the small and neighboring islands of the Lesser Antilles.

In some cases, communities were connected more directly through seascapes than landscapes (Bérard 2002; Bright 2011; Cooper 2010; Rouse 1992). The preference for sea-based mobility can be seen in the high level of interaction between two islands on opposite sides of a channel (Bérard 2002; Bright 2011; Broodbank 2000; Rouse 1992). Sometimes Caribbean communities that inhabited the same island had equal opportunities to contact each other by sea or land, yet were often connected more directly through seascapes and settlement location was based on the efficiency and speed of water travel from that location (Cooper 2010). Cooper (2010) discussed movement around Cuba, both over its interior hills and exterior seascape. He puts forward the idea that many sites found within the archaeological record may have been closer, in terms of time cost, when traveling across seascapes rather than landscapes. In part, this was due to the superior speed of vessels in the water and the difficulty in covering Cuba’s slopes by foot (Cooper 2010). Preference for movement by sea can also be considered valid for other Caribbean Islands that are also mountainous with small coastlines easy to traverse by canoe, such as Saba.

Reliance on a sea-based mental map of significant spaces would likely have been important amongst island-based communities (*sensu* Ingold 2000, 2009; McNiven 2008; Terrell and Welsch 1998). Mental maps can provide specific associations to the wide range of resources (Ingold 2009, 2011). This includes resources that can be found within the seascape, both above and below the sea's surface (McNiven 2008). The knowledge of landing locations and the logistics of sea travel contained in a mental map is related to a community's dependence on sea travel for survival (*e.g.*, Crouch 2008; Gosden and Pavlides 1994; Samson and Cooper 2015; for practical navigation, see Lewis 1994; as applied in wayfinding, see Ingold 2009, 2011). Seasonal availability of a place contained in a mental map could have further affected the social meanings people gave to it and could have created a schedule on which to visit it (*e.g.*, Callaghan 2003; Fitzpatrick 2014; Hofman *et al.* 2006, 2010). Because seasonally accessible resources can sometimes be the focus of site assemblages, for example mountain dwelling crabs and Audubon's Shearwater birds at the site of Plum Piece on Saba (Hofman and Hoogland 2003), these sites can demonstrate the importance of the seascape to the creation of a mental map.

## 2.2 Movement through Sea Spaces

Just as a landscape “exists by virtue of it being perceived, experienced, and contextualized” (Ashmore and Knapp 1999: 1), so too does a seascape. Landscapes and seascapes are three-dimensional spaces in which a human cognitive or ‘experienced landscape’ overlays topography (*sensu* for physiology, see Gibson 1979; Lynch 1960; Richards 1974, for mental map theory, see Ingold 2011; Richards 1974, for theory of movement, see Kirby 2009; Tilley 1994). Moreover, it has been argued that perception, or human experience, is irrevocably linked to movement (Gibson 1979; Ingold 2011: 11; Kirby 2009). Lynch (1960) address how an individual's perception of their environment can be influenced both by the landscape that surrounds them and information provided to them by the community on how to process these stimuli. In reference to the perception of reality through the context of maps, he states “As long as he can fit reality to the diagram, he has a clue to the relatedness of things” (Lynch 1960: 11). Repetition of movement may also allow for the establishment of context within a landscape or cityscape, and lead to the creation of localities that can provide context for travelers on how to move through a space (Lynch 1960). This may also have held true for Amerindian canoers who received instruction or input from more experienced navigators. As long as canoers could contextualize what they saw around them to what they knew of navigation, they could deal with paddling through different kinds of currents or landing on infrequently visited or unfamiliar shores. Richards (1974: 10) also refers to the ability of the individual to place themselves within a broader context without being able to physically see the entire trajectory of their path. This would have been key for Amerindian navigators to plan visits to other islands and the harbors on them that were out of their view.

Meaning is attached to pathways or environments through an individual's use of specific travel corridors (Gibson 1979; Ingold 2011; Kirby 2009). As Kirby (2009: 15) puts it, “memory is always influenced by spatial practice and spatial cues, and engagement in surroundings from embodied mnemonic interplay with characteristics of place

in a community.” This memory of places would have impacted the process of canoers through an environment and the construction of remembered places within landscapes or seascapes. Lowenthal makes the point that “What people perceive always pertains to the shared ‘real’ world” (Lowenthal 1961: 249); even in our remembering or dreams we source what we have seen to fill the spaces in our imagination. This shared real world would have informed the contextualization of individual and communal mental maps, as people could perceive and interpret the environment on a personal level and also have shared these thoughts with the community. In some respects, it is possible that navigation is one area where cognitive psychologists can study human thinking on movement and attachment to the environment.

Movement through landscape transforms topography from a surface on which culture occurs to a series of connected places where humans physically and mentally interact with their environment (*sensu* for cognitive physiology theory, see Gibson 1979; Lynch 1960; for mental map theory, see Ashmore and Knapp 1999; Ingold 2000, 2011; Richards 1974; for archaeological phenomenology theory, see Tilley 1994). Space is often seen as the container of movement (Shanks 1992) and provides a method for ‘thinking’ directionally and about mobility (Ingold 2000, 2009, 2011; Tilley 1994). More specifically, it allows for people to process their environment by moving through it. To some, movement exists in space while cultural affiliation dominates the places within spaces (Shanks 1992; Tilley 1994:36). Furthermore, instead of viewing islands as bounded by water it is possible to conceive of water as bounded by land. The blank space representing the sea on most maps hides a complex arrangement of both the physical realities of canoeing and the mental maps constructed around this activity. The straight lines used to draw connections on maps suggest simple relationships, which belie more complicated interactions dependent on social connections and environmental factors (*e.g.*, Broodbank 2000, 2013).

It is also possible to consider that mobility through space cannot be dissociated from place (Ingold 2009). All spaces, in fact, can be considered places with meaning assigned by those who pass through them (*sensu* Golledge 1992; Ingold 1993, 2009; McNiven 2008; Thomas 2006; Tilley 1994). Ingold (2011: 146) has also argued that there are no spaces within places, merely places experienced by wayfinders as they move through their environment. In this construction of reality, the primary container of being is a path rather than a fixed place (Ingold 2011: 12). In essence, space evolved in relationship to the community that moved through it. Landscapes, and the places that exist within them, can be considered as manmade areas (Jackson 1986). In this sense, where movement creates meaning, no space or landscape is devoid of cultural association (*sensu* Casey 2008; Ingold 2011).

Some researchers have applied the theory of phenomenology, or the understanding of the meaning of landscape through an individual’s point of view (Tilley 1994, 2016: 25), to movement studies in order to fill in the gaps that exist in the ethno-historic or ethnographic record and to better understand the construction of mental maps (*sensu* Husserl 1970, 2013; Llobera 1996). Husserl (1970), for example, studied how humans experience consciousness and interpret the world (see also Husserl 2013; Llobera 1996). Visual, physical, or mental comparisons with the past, when weighted against environmental change and cultural bias, can inform how we understand movement through a landscape (Tilley 1994) or seascape. Tilley (1994) famously applied



this approach to the views from megalithic chamber tombs in the Black Mountains in Wales, connecting views of the mountains surrounding the tombs and the process of walking in the area to the construction of cultural perceptions. However, one should be careful not to rely completely on these methods, as there are many detractors to the phenomenological archaeological approach (see Fleming 1999). Still, phenomenological archaeological theory can help to align our perception of physical locations of archaeological evidence with progression along a path and to conceptualize how we think about traveling through an area.

Looking towards the past, it is possible to engage in a ‘moving’ dialogue with the landscape, which is known as pedestrian speech act (Tilley 1994: 30). In a pedestrian speech act, the individual walker reacts to the environment around them, interpreting pieces of the landscape as they come to pass in real time while holding onto preconceived views of what is passing. Walking through a landscape becomes a conversation between the observer and the environment (*sensu* Golledge 1992, 1999; Gibson 1979; Ingold 2011; Tilley 1994). Environmental conversations similar to pedestrian speech acts are possible on seascapes, if more complicated due to the fluidity of the surface. A path in a landscape can be followed directly, while a path through a seascape always requires some level of approximation of the necessary route because of the movable terrain (*e.g.*, Frake 1985; Gladwin 2009; Lewis 1994; Tingley 2016). As discussed by those who model routes through seascapes, the sea can be altered by several factors, such as tide and changing wave height, that can change on a daily or even hourly basis (Altes 2011; Callaghan 2001; Davies and Bickler 2015; Hofman *et al.* 2016; Slayton 2013). Traveling through seascapes provides a greater challenge, as the seas are ever-changing and may not allow for consistency in retracing one’s path due to seasonal variation in the currents.

Evaluating the development of a site by how it is viewed through time is intrinsic to the study of archaeology. A route’s meaning and/or use influences and is influenced by the course of a path, as well as its beginning and end (*e.g.*, Surface-Evans and White 2012: 4). The location of sites or pathways can be the result of the presence or locations of older sites. This can lead to a sense of cultural continuity or persistent places (*e.g.*, Samson and Cooper 2015; Schlanger 1992; Terrell and Welsch 1998). While some parts of a landscape become observed through the progression of the observer down a path (Tilley 1994), other prominent points within the space may not yet have been revealed as the observer is not yet at a space from which they can be seen (Wheatley and Gillings 2000). For a person to progress successfully to a target along a preferred route, possessing a mental map is essential.

When approaching movement through space, one should look for how people would have approached seafaring on the sea, or evaluated the conditions for cognitive maps of the environment in which they were used (*sensu* Neisser 1976). This is due to the defined tasks and skill sets required by seafaring (*sensu* for cognitive maps, see Neisser 1976: 119-22; for cognitive seafaring maps, see Frake 1985: 255; Oatley 1977). In particular, challenges of being out of sight of land may have altered the processes of constructing cognitive maps (Oatley 1977: 583). In fact, Oatley (1977: 542) refers to the process by which sailors in Oceania think of themselves as moving through two frames of reference, past islands they cannot see and celestial bodies that are visible. The change in frame of reference may have sparked different traditions or techniques for marking places within the minds of seafarers.

The ability to create a mental construct of a place, and in turn associate other places with it, is a critically important aspect of navigation (*sensu* Golledge 1992, 1999; Ingold 2009, 2011; Tilley 1994). It is not necessary to be at or even in sight of a place to have that place in mind (*e.g.*, Frake 1985: 260; Gosden and Pavlides 1994; Samson and Cooper 2015; Tilley 1994). A mental order or progression of associated places can influence our cognitive view of traveling between two points (Golledge 1992, 1999; Ingold 2009, 2011; Tilley 1994). Navigation and mental ordering also include a process of separating out important areas or central places from the broader encompassing seascape within the total area existing in the mind of a person (*sensu* Ingold 1993, 2000, 2011; McNiven 2008; Tilley 1994). These associations or navigation markers can include places that one would pass when traveling to, from, or between sites (Tilley 1994). Navigation points can also include areas of the sea with shifting water color associated with changes in bathymetry, rocks protruding from the sea, or even known fishing grounds (Agouridis 1997; Lewis 1994).

Celestial bodies, such as the sun, moon, and stars, were also likely used by pre-Columbian navigators to mark the routes between islands or convenient landing points (*sensu* Lamarche 1993; Torres and Rodríguez Ramos 2008; for global examples, see Agouridis 1997; Bilić 2009; Dodd 1972; Lewis 1994; Oatley 1977). The stars and moon would have been especially valuable markers for those crews paddling at night, when other navigation points may have been obscured. As many routes through the Caribbean region required crews to travel for over 24 hours, celestial navigation techniques were probably in common use.

Less permanent phenomena are used by seafarers as well. Movable weather features, like clouds hovering over islands, can also act as navigation markers (Lewis 1994; Minnis *et al.* 1992). The presence of birds may also be considered a navigation tool, as the movement of birds could have been used by crews to identify fishing grounds or the location of islands (Lewis 1994).

When traveling between two points, social regulations, preferences, and associations enable the viewer to travel along the correct path safely if they have been introduced to the pathway by older navigators (*sensu* in reference to sea-based movement, see Broodbank 2000; Frake 1985; Golledge 1999; Gosden and Pavlides 1994; Tilley 1994). The process of traveling from one point to the next is central to landscape archaeology as “in the process of movement a landscape unfolds before the observer” (Tilley 1994: 31). This shared understanding connects the viewer to a material object and the position of that object within space. Allowances may be made for individual beliefs and associations within this construct because areas may bring up different connotations to different people (Fleming 1999, 2006; Johnston 1998). As Fleming (2005: 929) points out, one person’s view of a prominent hill from a megalithic tomb is another’s view of a prominent valley (see also Cummings and Whittle 2004: 61). Thus, there is a move beyond simple, objective recognition of space. Each space can have a different meaning or association for different individuals (Tilley 1994: 26). Just as modern-day sailors have differing opinions on the best points to anchor (*e.g.*, Bowditch 1995, 2002; Lewis 1994), Caribbean Amerindians likely had differing views on what were important places to which to navigate.

There are areas where movement occurs but little to no trace of human action or interaction remains. These transitional or border spaces, or “non-places” (*sensu* Agué 1995; Mans 2011; Nakamura 2013), are areas through which people regularly pass but which lack settlements (*e.g.*, Crouch 2008; Ingold 2009, 2011). The cultural sig-

nificance of these transitional spaces can be difficult to discern from the archaeological record and are often obscured (Ingold 1993). The identification of these spaces is difficult, especially on the sea (McNiven 2008a; Terrell 1997). The placement of geographic features, which can be used to guide travellers through the sea, affects the boundaries of social spaces (*sensu* Darvill 2008; Zedeño 2008). These boundaries occur alongside areas whose existence is largely based in a perception of a wider encompassing landscape (David and Thomas 2008), effectively creating social and environmental barriers. The use of computer modeling may help us locate these boundaries, as will be demonstrated later in this work.

Additionally, the vessels that peoples used to move between places may also have affected the seafarers' perception of the environment. It has been argued that canoes themselves should be considered mobile sites (Crouch 2008). Within these vessels people engaged in social interaction, reprising their roles as social actors in land-based communities. Paddlers also ate and slept within canoes, allowing for the canoe to hold more meaning than just its economic or mobile functions (Crouch 2008). Peoples lived within the confines of these canoes, likely engaging in teaching navigation techniques. In some ways, this makes the mobile canoe a moving taskscape for educating canoers in seafaring knowledge. Though canoes as sites were limited in size, they can be considered of equal value to any campsite on a landscape in that they contained similar activities. The canoe also held individuals with possibly different skill sets, places within the community, and varying levels of seafaring knowledge (Crouch 2008). In association with the concept of wayfinding mentioned by Ingold (2000, 2011), canoes can also be a space in which these cultural activities are taught to younger generations, thus sustaining cultural ties and beliefs (*sensu* Terrell and Welsch 1998). Determining the shape of these in-canoe relationships is difficult because sea-based sites were mobile and are not generally present within the archaeological record. In this way, route modeling is one way to estimate the base needs of those in canoes. The time cost behind optimal voyaging routes generated by computer models can indicate what supplies, such as food or water, would have been necessary to sustain a crew for voyages of a specific length. These qualifiers are the first steps to identifying who and what could interact within the mobile site of a canoe.

### 2.3 Sea-based Mental Maps

Pathways offer a unique opportunity for archeological study. As discussed above, they represent the continuation of communal knowledge in the form of mental maps (*sensu* Golledge 1999; Ingold 1993, 2011; Tilley 1994, *e.g.*, Samson and Cooper 2015; Terrell and Welsch 1998). The way the body moved through a landscape can cause a link to form between memory and future actions, as expressed by Tolman's (Tolman 1948; Tolman *et al.* 1946) work with rats running through mazes. However, the way we remember places may change when they are not in view (Tilley 1994) or alter entirely through linguistic or cultural changes in society (Kirby 2009). Even how we adapt and view changing urban environments is tied to our previous experiences with city landscapes (Lynch 1960). Still, as long as we impose structures onto the physical world, our processes of moving through places we have learned in our private experience or public education can support the existence of mental maps (Lowenthal 1961).

These maps need not be physical manifestations of directions. Richards (1974: 9) states “that objective procedures for representing space, such as maps and charts, are valueless unless they are referred back to the individual and notions of direction.” While the individual determines the context in which to interpret environmental stimuli, it is always through a frame of reference built from previous experience and the knowledge that has been communicated to them by others. In this case, information from others would not be physical paper maps or charts but communication from more experienced navigators.

Though focused on different regions, work by those referenced above could be applied to the development and maintenance of wayfinding maps in the Caribbean. Research by Frake (1985), Ingold (2000, 2009, 2011), Terrell and Welsch (1998), and Tilley (1994) suggests that humans almost assuredly constructed mental maps to order their world based on lived experiences of the individual that could be communicated to the group. Geography can play a role as an anchor for communal memories and shared associations (*e.g.*, Basso 1996; Schlanger 1992). If a place is returned to repeatedly over several decades, either by individuals or groups, the location can become rooted in the minds of a society (Golledge 1999; Ingold 1993; Terrell and Welsch 1998). This of course also applies to movement within seascapes, where many individuals within coastal groups likely had shared knowledge of cultural spaces (McNiven 2008; Strang 2008). Knowledge could then be passed down generationally from one navigator to the next (*sensu* Ingold 1993; Terrell 1997; Terrell and Welsch 1998; for a discussion of community practices, see also Wenger 1998). It is also possible that navigation mental maps could have been formed through community efforts at sea, resulting in something like a “joint enterprise” (Wenger 1998: 77), in which navigation processes are created by groups navigating together and making decisions as a team. The evolution of a seafaring mental map also reflects the generational and community-wide changes in inter-island mobility and exchange networks over time.

It can be challenging to understand how people constructed links between themselves and the fluidity of the sea’s surface. Ashmore and Knapp (1999) argue that it is not only the construction of monuments that can define human alteration of topography but also the creation of trails and the views that are generated from them. Pathways, be they over land or through the sea, represent places meaningful in themselves or places from which meaningful features can be viewed (Gibson 1979; Golledge 1992; Ingold 2009, 2011). Gibson (1979: 174) refers to thinking of mental maps and the signposts that allow for navigators to follow them into two questions: “how could signals yield an experience of self-movement and an experience of the external world at the same time” and “how could signals have two meanings at once, a subjective meaning and an objective one.” These questions should be considered in the progression along travel corridors established by individuals and maintained by generations. How would the meanings and uses of these routes change, and what connotations might be held within navigation markers altered over time (*e.g.*, Lewis 1994; McNiven 2008; Terrell 1997, for broader theory, see also Bradley 1993: 26; Ingold 1993; Knapp and Ashmore 1999). It is even possible in some cases that landmarks existed not only as cultural reminders but also as a reference to how these areas were used (Tilley 1994). These viewpoints can be linked with cultural ideologies that mark them as places that intersect with a group’s mobile identity (Ingold 2000). This is especially significant for

geographic navigation points woven into common mythology. This phenomenon is termed wayfinding and is related to concepts of cultural mobility and communal or social memory (Ingold 2000, 2011).

In using the term wayfinding, I also make connections with Ingold's (2011: 150) term "transport," or destination-oriented, movement. Although Ingold separates transport and wayfinding routes, I would argue that people moving between sites in canoes had to engage in basic concepts of wayfinding, such as learning from and interacting with others and the environment, despite being oriented towards a destination point. Navigation at sea may have involved active dialogues with the surrounding seascape, initiating connections with rest areas as they became necessary and following a set route when required. The constant demands of sea travel possibly remained in the minds of navigators, even when at their destinations, suggesting that, even when on directed routes, canoers were engaging in acts of wayfinding.

Individuals developing a personal mental wayfinding map would have learned places of import from experience at sea as well as from the stories, both real and mythic, from older navigators (Broodbank 2000: 23). As Ingold (2011: 161) puts it, "making their way from place to place in the company of others more knowledgeable than themselves, and hearing their stories, novices learn to connect the events and experiences of their own lives to the lives of their predecessors, recursively picking up the strands of these past lives in the process of spinning out their own." Like learning a language, acquiring navigational skills likely happened over time through associations with objects, environmental trends, and people, rather than solely through instruction (Ingold 2011: 162; Vološinov 1973: 81). These activities may not have been passed down explicitly, but through shared inter-generational activities and practices (Ingold 2011: 161; Vološinov 1973).

As referred to previously, one can posit that alongside these individual mental maps there existed a community or collective map (*sensu* Bradley 1993; Broodbank 2000: 22, 2013; Knapp and Ashmore 1999; Kuchler 1993; Oosten 1997: 152), maintained over generations (*sensu* Frake 1985: 268; Knapp and Ashmore 1999: 14; Schlanger 1992; Sherratt 1996: 146; Terrell and Welsch 1998) or shared across regions (*e.g.*, Samson and Cooper 2015). Each new mariner learned from his predecessors their stories of what worked and what did not, or which currents to follow and which waves to cut across (*e.g.*, Lewis 1994; for theory of navigation, see also Ingold 2011). This mental map could not survive in one individual. Instead, communal wayfinding maps perpetuated things learned in each successive generation, building in a knowledge of safe practices and social goals (*i.e.* resource collection).

There are many ways to uncover these mental maps. For example, identifying features or points are significant for marking navigational cues and physical boundaries (Bradley 1993; Broodbank 2013; Cooney 2003; Ingold 2009; Knapp and Ashmore 1999; McNiven 2008). Similarly, cultural associations or group connections, including the continued knowledge of the locations of far-off friendly sites, can be incorporated into the map as connections between communities on varying islands have "intergenerationally inherited friendships" (Terrell 1997; Terrell and Welsch 1998: 59). These sustained connections can be supported by ethnographic and historical accounts and can also be reflected in the archaeological record (Hofman *et al.* 2008b).

The bundling of modeled routes between island communities can suggest the location of canoe travel corridors and connected mental wayfinding points. If travel corridors evident from the modeled pathways were perhaps used by canoers, these routes may have been a part of the mental map of pre-Columbian navigators traveling through the Lesser Antilles. If these routes were used consistently, it is likely that nearby landscapes were linked to cultural memory to guide canoers along the route. The islands passed by these generated routes can suggest where researchers can look for deeper connections between seafarers and the coastlines they pass. Coastlines near these routes, and the areas visible from the suggested pathways, could have been areas used as wayfinding points within the Amerindian mental map.

Visibility is a large component of constructing a mental map. Although marked places are tied to specific topographical features or broader spaces, they can “move” with an individual through the space. While geographical features are physically static, they also become a portable entity within the viewer’s mind (*sensu* Golledge 1999; Gibson 1979; Ingold 1993; Tilley 1994). Thus, landscape archaeologists must try to examine changes in topography alongside a space’s cultural associations (Fleming 2006: 271). In addition to topographical changes over decades, annual alterations, such as the seasonally-dependent presence or absence of a river, need to be included in the mental map. Visibility is often examined in terms of lines of sight (*e.g.*, Llobera 1996; Wheatley and Gillings 2000). Lines of sight can also dictate and control how canoers related to their environment when out at sea. For example, canoers who could see patches of sea with birds swooping down to collect fish may have felt ownership over those fishing rights (*e.g.*, Lewis 1994). Canoers who were able to see landmarks from their vessels may also have felt a sense of ownership or social connection to those points. This has been hinted at in works like those done by Smith (2016), who generated least-cost seafaring routes modeled off the coast of Pembrokeshire in visual range of Iron Age promontory forts. He suggested that differences in the visual prominence of various types of promontory forts, as viewed from the sea, reflect a past coastal communities’ engagement with wider Iron Age maritime trade networks.

In the past, visibility studies have focused on what could be seen from land, such as visible points on the same landmass, visible sections of another islands, or viewable areas of the sea. However, even when in view, the sea was typically discussed in terms of how it affected people on land (*e.g.*, de Ruyter forthcoming; Fisher *et al.* 1997; Fraser 1988). This focus on the sea from the land limits the full understanding of past human experiences, as people who intensively used seascapes likely tended to view them and landscapes from the perspective of the sea (Friedman *et al.* 2010; Torres and Rodríguez Ramos 2008). When looking at seascape viewsheds, it is important not only to consider the visual approach to the island but also “sea, horizon and sky” (Broodbank 2000: 23; Helms 1998: 24-28). Caribbean studies are beginning to focus on views from the sea to the land and including in the discussion how canoers could visual relate to their surroundings and travel to sites (*e.g.*, Brughmans *et al.* 2017; Friedman *et al.* 2010).

For seascapes, visibility is based in part on being able to see aspects of changing weather patterns, shifting currents, wave height, and the passing appearance and disappearance of islands with visible markers such as island peaks, beaches, harbors, as well as other visually prominent points (Crouch 2008; Friedman *et al.* 2009). Other movable markers, such as birds, clouds, and mangroves can also help to orient canoers at sea

to the location of islands or specific ports (*sensu* Gladwin 2009; Lewis 1994). Canoers may also have been able to identify other vessels while paddling between islands. Thus, what is or can be viewed during the progression along a path becomes significant in constructing and maintaining mental maps.

As discussed above, following the movement of the viewer through these spaces is essential to understanding the progression of a mental wayfinding map along a route (Llobera 2000; for cognitive theory on visual perception, see also Gibson 1979). Not only the topography of a landscape but also the spot from which the landscape is viewed are susceptible to change (Fleming 2005, 2006; see also Friedman *et al.* 2010; for viewshed modeling from seascapes theory, see Torres and Rodríguez Ramos 2008). For example, a person sitting in a canoe will have a different view of the sea than someone standing, as can also be said of the cox and the paddlers (Friedman *et al.* 2010). While the physical capabilities of any one person may not necessarily have wide effect on the perception of the landscape for the whole group, it can influence individuals' access to specific pieces of the mental map and provide clues as to how that map was seen.

The concept of shared generational beliefs should therefore be approached carefully. For example, people reuse or replace monuments of past cultures or construct roads on top of existing trails (Gosden and Lock 2013), such as the Roman Appian Way (Povoledo 2008; Witcher 1998). Though such routes continue to be used, they are largely disassociated from their past cultural, if not physical, context. A clearer way to study pathways is to examine the movements passing through them as they can be a tie between peoples and several places. By investigating not only the chronological but also the spatial order of navigation points, changes in the use and perception of the landscape and its cultural associations can be judged (Schlanger 1992; Tilley 1994). For seascapes, these points can be extended to coastal sites or possible markers visible from the sea (Friedman *et al.* 2010; Torres and Rodríguez Ramos 2008). Changes in site locations can help to define changes in pathway structures and the mental map. As a result, the evolution of a seafaring mental map reflects the changes in inter-island mobility and exchange networks.

The theory of how people traversed through their environment is complicated by the possibility of several mental maps and navigation markers existing within one community (*sensu* Frake 1985; Ingold 2011). One constraint on accessing knowledge of a past landscape is a result of the temporal distance between modern communities and the cultural norms of past peoples. Individuals looking to canoe may have had their access to seascapes restricted (*e.g.*, Arnold 1997; Broodbank 2000, 2013; Gamble 2008), as one must possess a vessel like a canoe to travel over the sea. In some societies, ownership of the canoe was restricted to wealthy high-status individuals or those who had the technical knowledge to build a vessel (Arnold 1997; Broodbank 2000; Gamble 2008). Thus, ownership or knowledge of these mental maps could set one apart from the larger community (*sensu* wayfinding mobility theory, see Golledge 1999; Gould and White 1974; Ingold 1993; *e.g.*, for social hierarchy and canoe ownership, see Broodbank 2000, 2013; Cherry and Leppard 2015; Gamble 2008; Lewis 1994).

While discussing contemporary mental maps from the United States, Gould and White (1974) suggested that the mental maps of decision-makers, or those who have influence over the mobility of others, is a key aspect in the structuring community mental maps. Though they express this in regard to the freedom of mobility accessible to those in

charge of large corporations and their ability to encourage the movement of their goods and the location of headquarters on a national or global scale, there are elements of this thinking that can be applied to the hierarchical structures of canoe use. Those who had control of the canoe would have felt the benefits of mobility in ways those denied access would not. Who had access to these canoes, and thus the sea and other islands, would have influenced both an individual's and the community's mental maps.

Navigators may have also held esteemed positions within seafaring societies. The dangers of seafaring likely elevated the reputations of individuals, which may have encouraged people to take up these skills to earn positions of importance within their communities (Broodbank 2001: 94). However, by conducting ethnographic research, the memorization of place ordering can be discussed on a regional basis (*e.g.*, for continuing work in the Pacific, see Gladwin 2009; Lewis 1994; for the Caribbean, see Lamarche 1993). By visiting research areas and speaking with local communities, archaeologists can access information stored in the social or geographic memory of the landscape. However, ethnographic efforts cannot cover all aspects of traveling practices, due to the broad subjects of research, the time depth of the records, the effects of colonization, and the change in cultural practices between 1492 and today.

## 2.4 Conclusion

The ways in which people move through seascapes affect not only the locations and associations of places, but the process of individuals interacting with one another and their environment. Peoples on paths categorized and memorized their environment when moving through it. The theory of movement and navigation helps to validate the use of least-cost sea-based pathways to connect archaeological materials, as without the knowledge of optimal routes there would be no assurance that peoples would have consistently used modeled travel corridors. Without the knowledge that people were remembering current flow and the location of past sites, modeling canoe routes between islands would be superfluous. Canoers would have communicated what they were seeing and how they were feeling moving through the sea as part of an organized social interaction. These interactions were contained in mobile sites (*i.e.* canoes) that encourage the exchange of seafaring knowledge between paddlers (Crouch 2008). By establishing a communal mental map, seafaring peoples populated the environment with places that could be remembered when not in sight and visited again and again. As such, the routes modeled for this work represent an additional way to discuss pre-Columbian Amerindian mental maps and travel corridors that helped to define the inter-personal and inter-island relationships in the Lesser Antilles.