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ACKNOWLEDGEMENTS

I would like to thank Hendrickson International for employing my husband in Ohio, derailing plans I had to attend graduate school elsewhere, and affording my academic pursuits to be completed without financial hardship. I am grateful to Kent State University for providing a program which has given me close access to faculty and allowed me to create a meaningful and fulfilling experience. I am indebted to Dr. Richard Feinberg for his inspiring wisdom and expertise, his unwavering patience and guidance, and his accessibility and good humor. My gratitude to my husband, Patrick Pyrek, for making all this possible and enjoyable, is immense.
CHAPTER I

Introduction

Statement of Purpose

Distant travel to unfamiliar or undifferentiated landscapes (or seascapes) invokes the need for orientation. Magnetic compasses and so-called star compasses have been well described in navigational and anthropological literature. While “wind compasses” have been important navigational tools in some geographic regions, there are only vague hints of wind compasses in Oceania, an area renowned for voyaging and navigational acumen. One notable exception involves the island of Taumako, whose wind compass has been the subject of study by Marianne George for close to two decades. George’s findings and interpretations are presented on the website of the Vaka Taumako Project (http://www.pacifictraditions.org/vaka/). Here I offer an alternative interpretation, based on notes compiled by Richard Feinberg through nine months of ethnographic field study in 2007 and 2008. In the end, I will demonstrate that “wind compass” is a misnomer. What has been characterized as a wind compass on Taumako, and perhaps elsewhere, is part of a complex navigational toolkit that also draws on stars, wave patterns, and other natural phenomena for purposes of Oceanic way-finding.
George developed her model to educate future generations of Taumako navigators. This effort was at the request of Chief Crusoe Kaveia, a master navigator of Taumako, who spent the last two decades of his life trying to ensure that his people’s voyaging heritage did not slip away. George contends that the Taumako system is very precise and wind-based, an interpretation that appears conspicuously Western in its construction. However, this model is at odds with other research, and as an educational tool, it falls short. The model that I propose aims to better convey the Taumako navigational system and offer a more useful paradigm for educating future navigators.

The people of the Polynesian outlier island of Taumako are part of a larger cultural group that also includes the Polynesian Outer Reef Islands, (called Vaeakau in the local language) of the eastern Solomons. People of the Vaeakau-Taumako region maintain a long-standing navigational heritage, but that heritage is at risk of being lost. Recent efforts to document the navigational knowledge of these seafarers have resulted in a substantial accumulation of information on traditional non-instrument navigational techniques for the Vaeakau-Taumako. There has been a particular interest in understanding how these navigators make use of the wind as a navigational (as opposed to simply a propulsion) device. Other examinations of this phenomenon for various cultural groups have dubbed the navigational use of the wind as a ‘wind compass.’

A review of the data reveals that Vaeakau-Taumako navigational methods are not particularly wind-based. Their system is multifaceted. Nor are Westerners likely to consider their methods precise. George’s wind compass fails to allow for all the variation that is inherent in Taumako perceptions of wind. Additionally, despite having eight
diagrams which acknowledge other natural phenomena, her model is lacking in its ability to convey the information necessary to assist navigators in making safe passage. If George’s objective is to provide a visual construct for communicating Vaeakau-Taumako navigational methods to future generations of navigators, I predict this model will not succeed in its mission.

In this thesis, I will explore how the Vaeakau-Taumako wind compass fits into the broader system of Vaeakau-Taumako navigation. In doing so, I will deconstruct the notion of the wind compass as it has been depicted. Ultimately, I will construct a more comprehensive navigational toolkit which accurately represents the system utilized by the Vaeakau-Taumako. It is my hope that this cognitive construct will succeed in communicating to the people of Vaeakau-Taumako the rudimentary elements of navigation and complete the mission that Chief Kaveia sought to accomplish.

**Cognitive Constructs**

D’Andrade (1995) describes the role of the cognitive anthropologist as one that examines how people conceive of and think about objects and events in their world. Cognitive anthropology as a discipline has sought to develop its own ways of conceiving and thinking about how people do this. There is a whole vocabulary of concepts and tools available to the cognitive anthropologist to try to explain the unique characteristics of any particular domain for any particular culture.
Human beings have a need to organize our experiences with the external environment into a usable format. Shore (1996:3) reminds us that since we are born with brains that are only 25% of their eventual adult weight, “three-quarters of the human brain develops… in direct relationship with an external environment.” He refers to the human brain as an “ecological brain.”

Cognitive anthropologists identify the ways we organize information using many different terms, among them, schemas and models (D’Andrade 1995). Mandler (1984) views schemas as “organizing experience.” He identifies these as cumulative stores that result from interaction with the environment. Schemas are, as D’Andrade (1995:150) points out, “abstract organization[s] of experience.”

Related to schemas are models. In the 1940s, Craik (1943) introduced the notion of cognitive models and their importance in thinking. He posits that people carry “small-scale models” of external reality in their heads and are able to mentally manipulate them in order to make decisions which allow them to interact competently with the world. D’Andrade (1995:152) relates schemas to models by saying that schemas serve as simple models. “A model consists of an interrelated set of elements which fit together to represent something,” and these elements are often schemas.

Among the tools that Pacific Islanders use to navigate long distances are what can be described as mental models, or cognitive constructs. Such things as stick charts, star compasses, and wind compasses are developed to serve as mental representations of the physical world. People everywhere use such constructs to help them to make sense of the world around them and to assist them in successfully planning their activities and
behaviors so that they can meet their goals. These tools may seem exotic and difficult to access intellectually. However, such a mental toolbox is not an unfamiliar concept to the landlubber. In fact, the use of the word “compass” should invoke the image of a familiar construct, that of a magnetic compass. A magnetic compass is a representation of the earth’s circular horizon, on which there are four cardinal directions (NSEW) and an arrow that will orient itself toward the N.

A notable example of a cognitive construct used by Pacific navigators, but not examined in this thesis is the stick chart used by the navigators of the Marshall Islands. The location of these islands in relation to the prevailing winds and currents has led to the development of a sophisticated piloting system. This system is nicely translated into a visual construct which is used to teach the principles of swell refraction and intersection.

Fig. 1 Marshallese Stick Chart (Lewis 1994 [1972]:245)
[Fig. 1]. The Marshallese archipelago runs in two parallel chains of islands which are primarily in the doldrums zone. This natural phenomenon allows navigators to “easily discern the pattern of the underlying swells generated from afar, and the way the islands disrupt them” (Finney 2007:174).

A cognitive construct is not an exotic device utilized by specialists in the performance of highly skilled functions. For a more familiar example of a cognitive construct, consider the model represented by a daily planner for time management. A page-a-day calendar allows one to plan out the activities and behaviors for the day that are necessary to accomplish one’s goals. The page itself is not a day; it is a graphic representation of a 24-hour period, typically broken up into manageable blocks of time. The words one jots down on the page are not the activities themselves, but symbolic representations of what those activities are intended to be. Just like the navigator, this cognitive construct for the world allows us to plan our activities and behaviors in order to meet our goals. Our lives are filled with numerous cognitive constructs, many of which are transcribed into a graphic format.

Until recently, the cognitive constructs of the Pacific Island navigators had not been documented. Navigators maintained mental models of wayfinding, and conveyed those mental models to their apprentices without benefit of any written records. It was not until the twentieth century that we have been able to “see” the cognitive constructs of these experts. Since then, researchers have attempted to compare these constructs across cultures so that there might be better understanding of the cultural underpinnings of the people who utilize them.
Non-Instrument Navigation

Non-instrument navigation is a style of wayfinding used for centuries by indigenous peoples of the Pacific and elsewhere. It is a means of sailing to an intended destination across the open sea without the benefit of instruments (sextant, compass, or chronometer). Though there are variations in the specific methods utilized throughout Oceania, the general concepts are widely thought to be “variations of a common Pacific island system of navigation” (Finney 1994:52). Lewis (1994 [1972]:47), in his effort to “rediscover the vanishing art” of non-instrument navigation found that important navigational techniques and concepts were shared in Micronesia and Polynesia with differences stemming from local geographical features rather than cultural-linguistic divisions. Navigators must be proficient in the following areas of expertise in order to be considered master navigators: orientation of the vessel and accurate course-setting toward a specific destination; monitoring of progress along the route and making corrections as needed; and arriving at the specified destination (Lewis 1994 [1972]).

How do they do it? It is not effortless. Instruction in the art of navigation typically begins at an early age and can take many years to master (Gladwin 1970). And once a navigator has the necessary skills to journey long distances successfully, the journey itself is very demanding, requiring him to keep track of a great deal of information while en route (Gladwin 1970). Following is a brief overview of some of the methods navigators utilize.
The stars are an important navigational tool (Lewis 1994 [1972]; Feinberg 2008a). Stars follow a predictable trajectory, rising and setting in the same place without exception (Lewis 1994 [1972]). If a navigator knows of a star that aligns with his intended destination, he sails toward that star (Gladwin 1970). Conversely, he can look behind himself and see what stars align in the opposite direction (Gladwin 1970). However, stars come and go; they are in perpetual motion throughout the night, and once they fall below or rise too high above the horizon, their usefulness diminishes or disappears. So a navigator needs more than one star; he needs a sequence of stars to follow throughout the night (Lewis 1994 [1972]). Lewis (1994 [1972]:84) refers to this succession of rising or setting guiding stars as a “star path.”

Some navigational traditions rely heavily on the stars and have developed a mental construct known as a star compass (Ammarell 1999; Dodd 1972; Frake 1995; Gladwin 1970; Goodenough 1953; Lewis 1994 [1972]). A star compass is a representation of the surrounding horizon over which is juxtaposed a map of the stars. Prominent stars are identified at the point of their rising or setting around the circular horizon (Gladwin 1970).

There are also some groups which utilize a wind compass (Ammarell 1999; Burrows 1923; Dodd 1972; Feinberg 1988; Finney 1994, 2007; Lewis 1978, 1994 [1972]). Like a star compass, a wind compass is a mental representation of the surrounding horizon with corresponding known wind patterns. The wind compass is typically less complex and identifies the direction of regular and stable wind patterns around the circular horizon (Lewis 1994 [1972]). Though winds can vary from the
predominant pattern, usually it is not for long; but the impermanence of wind requires regular checking against other indicators such as ocean swells, land sightings, and the sun and stars (Lewis 1994 [1972]).

Both the predictability and the impermanence of tradewinds can be used to the sailor’s advantage (Finney 1994). The shift in direction is a benefit to a voyaging party wishing to make a round trip going east-west (Finney 1994).

Zenith stars are helpful in positioning a vessel along a particular latitude (Dodd 1972). A zenith star is one that aligns with a particular latitude, and passes directly overhead (Irwin 1992:48). Irwin (2007:80) indicates that precise sighting of the star at its zenith is accomplished by hanging a fishing line from above, plumbed with a sinker. If the destination island is at the same latitude as the sailing vessel, the zenith star can assist a navigator in aligning along that latitude (Dodd 1972). This is typically utilized when a navigator knows in advance what the specific zenith star is for a particular destination island (Finney 1994). He can maneuver the vessel directly below this star and then sail east or west straight toward the destination island (Finney 1994).

Waves are useful because they are similarly reliable and predictable (Ammarell 1999; Dodd 1972; Feinberg 1988; Gladwin 1970; Lewis 1994 [1972]). Swells are caused by prevailing winds that blow constantly over hundreds or thousands of miles of open sea (Feinberg 1988). These waves maintain a constant direction and are unaffected by local winds which may run counter to the prevailing winds (Feinberg 1988). Local winds can create “chop” or “seas” and the ability to distinguish between swells and seas is important
(Feinberg 1988). Swells can serve as a compass because there are only a small number of swell patterns that are predictable at different times of year (Lewis 1994 [1972]).

Because celestial features appear to traverse the sky from east to west, maintaining a constant latitude, but not longitude, it is difficult to determine longitude on the open sea. Further, it is a challenge to discern the passage of time without a reliable timepiece. Before existing timekeepers, people relied solely on dead reckoning, as do many traditional navigators still today (Lewis 1994 [1972]). Dead reckoning is estimating a current position by mentally keeping track of speed, heading, and time at sea, while also accounting for leeway and current (Lewis 1994 [1972]). Though this system may appear unreliable, practiced navigators can and do successfully determine their positions, or approximate positions, in this way (Lewis 1994 [1972]).

Once a vessel has sailed to the point where land should be nearby, but is not yet in sight (especially likely if the land is low-lying), different techniques are used to home in on the objective. These techniques include use of reflected waves, birds, clouds, and “underwater lightning.”

Reflected waves are waves reflected by some landforms (Feinberg 1988). They have a different shape than those generated directly by wind, and they indicate the direction of the land from which they are emanating (Feinberg 1988).

Certain birds are an indicator that land cannot be far away. Flight patterns of birds that roost on land at night and fly out to sea to fish during the day can be a giveaway if seen early or late in the day (Gladwin 1970). Different species of birds that are useful for finding land forage at different ranges, up to about 25 miles from land
(Gladwin 1970). It is important to be able to distinguish flying in and out from flying around, which birds may do when looking for fish (Gladwin 1970).

Clouds can also be a telltale sign of nearby land. Clouds tend to move more slowly over land than over the water, and they will often “sit” above an island (Lewis 1994 [1972]). Clouds may also take on colors when they are over land; these colors are read differently depending on whether the weather is fair or foul (Lewis 1994 [1972]).

Finally, there is the puzzling phenomenon of “underwater lightning” or deep phosphorescence. For obvious reasons, this is most detectable on dark nights (Lewis 1994 [1972]). It reportedly occurs below the surface of the water—from a foot to twelve feet below—in streaks which show the direction from the destination to the boat. Underwater lightning is said to be most useful about 80-100 miles from land.

Lewis (1994 [1972]) documented two cases where this phenomenon is reportedly used: the Santa Cruz Islands of the eastern Solomons and Tonga. Feinberg (n.d.b.) notes that there is no obvious scientific explanation for it, very few researchers have published accounts of it, and except for Lewis’s informants, there are few voyagers who have reported its use. Yet, as will be discussed later, it is a phenomenon which Vaeakau-Taumako navigators regularly report using. While the topic of underwater lightning is inconclusive and does not appear to play a major role in navigation outside of the Santa Cruz area, it does figure into Vaeakau-Taumako navigation.

Voyaging Communities
Voyaging communities are found throughout Oceania. A look at a map of the culture areas of the Pacific [Fig.2] offers insight into the setting which fosters this voyaging culture. Kirch and Green (1987:443) note that Polynesians exhibit a “historical legacy of shared, ancestral traits.” There is linguistic evidence that many of these people are descendants of Austronesian speakers who spread out from Southeast Asia several thousand years ago (Strathern et al 2002). Austronesian is one of the world’s most widely dispersed language bases, ranging from Easter Island to Madagascar. Clearly, Austronesian speakers have dispersed over a wide expanse of the earth, and they certainly had more than language in common. Their dispersal was made possible by their voyaging skills. And clearly those skills were retained for some.

Fig. 2 Culture Areas of the Pacific
Micronesia, the area of the West-Central Pacific, is well known for its voyaging and navigational traditions. The Caroline Islands, Marshall Islands, Marianas, and Kiribati all show varying degrees of voyaging expertise (Lewis 1994 [1972]). Currently, the Caroline Islands host what are widely considered to be the most expert non-instrument navigators. Gladwin (1970:158-159) depicts a voyaging range for Puluwat (now usually spelled Polowat) navigators of the Central Carolines of 400 miles or more.

Polynesia has recently experienced a renaissance in traditional long distance voyaging after a period of dormancy in which the skills of the ancients were all but lost. However, historical records attest to the fact that Polynesians were once adept at long distance voyaging. Irwin (1992) has written about the role of voyaging in the prehistoric colonization of Polynesia. This is not surprising considering the vast distance between Polynesian islands (the triangle formed by Hawaiʻi, New Zealand, and Easter Island) and the remarkable level of cultural cohesion of this vast area. The famed Hōkūleʻa project is responsible for catapulting the resurgence in the traditional arts of navigation.

For most Polynesians, voyaging is no longer a way of life. There are pockets of voyaging activity, predominantly geared toward retention of tradition rather than toward economic need. Interestingly, while much of Polynesia has seen its voyaging traditions fade away, a few Polynesian outlier communities have retained their navigational knowledge and still practice the maritime arts. For instance, Anutans regularly put out to sea for fishing voyages and occasionally still sail to neighboring Tikopia, more than 70 miles distant (Feinberg 1988; Feinberg and George 2008).
Melanesia is not known for long-distance voyaging. Malinowski’s (1932 [1922]) well-known *Argonauts of the Western Pacific* addresses the importance of canoe building and sailing among the Trobriand Islanders of Melanesia. However, their famous Kula ring (a ceremonial exchange system between islanders) did not require sailing significant distances.

Some, like the people of Marovo in the Western Solomon Islands (Hviding 1995) were once “strongly sea-oriented,” and in a number of cases, still maintain a strong maritime culture. However, their most notable seafaring skills do not fall into the category of long-distance voyaging.

The bulk of Melanesia’s population lives on the large island of New Guinea, and many New Guineans (technically not Melanesians) live their entire lives inland, never so much as seeing the ocean in which their island sits. The islands that surround New Guinea are clustered closely enough together that long-distance voyaging is not common.

West of the island of New Guinea, throughout Island Southeast Asia, we find people who make use of traditional navigational techniques for purposes of fishing and trading along coastlines as well as across the open sea. Despite falling into a geographic region which might suggest a separate category of people, this area is likely very much related to many of the people of Oceania. The Bugis of Sulawesi in Indonesia are frequent voyagers for purposes of modern trade and traverse distances of 500 miles or more (Ammarell 1999). One significant difference between these mariners and others is that, because of the purpose of their voyaging, their craft fall into the category of ships rather than canoes. These vessels are designed to carry a cargo capacity of as much as 70
tons or more, and combine Indonesian construction and European design (Ammarell 1999).

**Taumako**

Taumako is an island in the western Pacific. The placement of the island within its context involves a complex layering of geographic and political naming conventions. Taumako is part of the Santa Cruz Islands, which is politically tied to the Solomon Islands group. The Solomon Islands is composed of nine provinces, with Taumako in Temotu province. Within Temotu province is an island group known as the Duff Islands, and Taumako is the largest of the Duff Islands. Taumako is also the indigenous name for the whole group.

Taumako is culturally tied to the Vaeakau Islands such that it is appropriate to speak of a Vaeakau-Taumako tradition. The islands of Vaeakau include Matema, Nifiloli, Nupani, Nukapu, and Pileni. Geographically, these islands lie just south of west of Taumako. Because of this cultural association, the navigational techniques discussed in this paper are identified as belonging to a Vaeakau-Taumako tradition.

Though the Solomon Islands are in a part of the Pacific known commonly as Melanesia, there are several islands which are inhabited by Polynesians. These islands, which include Vaeakau-Taumako, are customarily referred to as Polynesian outliers, because they lie geographically outside the Polynesian Triangle. The people of these
Polynesian outliers demonstrate cultural and linguistic commonalities with distant Polynesians, though some of them have also come to resemble their Melanesian neighbors in many regards (Strathern et al 2002; Davenport 1962).

A look at a map of the Pacific culture areas [Fig. 2] gives an indication of Polynesia’s vastness; yet its people are remarkably similar in language and custom. Because of the great distances between the islands of Polynesia and the similarities between the peoples of these islands, one might surmise that Polynesians must be excellent long-distance voyagers. Unfortunately, modern influences have taken a toll on ancient voyaging knowledge (Finney 1979:13; Lewis 1994:17; Strathern et al 2002:233; Thomas 1987:5). However, there are pockets of active seafaring which draw on an unbroken chain of knowledge from the ancients (Davenport 1964; Feinberg 1988, 1995; Finney 1976; Lewis 1978, 1994[1972]).

It is not unusual for people who live on a small parcel of land in the middle of the ocean to be very comfortable in the water. However, people’s ability to navigate vessels to desired destinations varies greatly throughout the Pacific. Until recently, it was thought that the ancient wayfinding techniques of the Polynesians had been lost entirely. In recent decades, the only known active long-distance voyaging communities were in Micronesia, a region which is not known for its cultural cohesiveness, but rather for its ecological diversity and ability to support communities with a wide array of exploitive options (Strathern et al 2002).

In the 1970s, researchers such as Gladwin (1970) and Lewis (1994 [1972]) published accounts of how indigenous peoples sailed the oceans without the use of
instruments. Though there was evidence of such a sailing tradition in Polynesia, active practitioners of the art of long-distance navigation were scarce. Lewis (1994 [1972]) located a renowned navigator named Tavake (Lewis spells his name “Tevake”) from the Polynesian outlier of Pileni, also in the Solomon Islands. Tavake had been taught to navigate and had many years of experience as a navigator, but his opportunities for long-distance voyaging had dried up as his community gradually lost interest in maintaining this traditional lifeway. Consequently, more attention has been focused on the wayfinding techniques of the still active navigators of Micronesia.

Polynesian wayfinding may have been dying, but it was not dead. In the early 1990s, Chief Crusoe Kaveia of Taumako, himself a master navigator, set a course to reclaim his people’s voyaging heritage before it was too late. Since that time, the Vaka Taumako Project has sought to reincorporate the ancient voyaging ways into the daily lives of the people of Taumako by building traditional sailing vessels, documenting the voyaging techniques of their ancestors, and teaching voyaging skills to a new generation (Vaka Taumako Project website).

**Environmental Factors**

The methods listed earlier for determining one’s course, as well as progress along that course, make use of universal phenomena common to all the islands of the Pacific. However, not each of the methods is equally useful everywhere. For example, in the
Marshall Islands, because of the particular geography of the islands, reflected wave patterns are especially useful for wayfinding, and to an extent not seen elsewhere. These wave patterns are elegantly translated into “stick charts,” representations of wave patterns that offer navigators a reliable tool for visualizing and reading the waves [Fig. 1]. In the Carolines, because of the prevailing direction of sail and the proximity to the equator, the stars are the most useful and present fewer problems than in many other locations. The stars in this location are aptly transformed into an array of constructs that navigators use to find their way. But for most, including the Polynesian outlier of Taumako, there do not exist similar natural phenomena that can be converted to such superbly reliable tools, but rather, all natural phenomena are taken to be useful depending on the circumstances.

No navigator relies solely on one natural phenomenon such as the waves or the stars. All make use of the many resources available to them in order to maximize their chances of a successful voyage. What is significant about the fact that different locales have different phenomena which navigators find to be particularly useful is that these phenomena are typically exploited more fully by way of cognitive constructs.

**Structure of Material**

Vaeakau-Taumako navigational techniques are under-represented in the literature. However, other navigational techniques utilized by other culture groups have received more attention. This thesis will explicitly explore the use of star compasses in several
contexts. By way of comparison, there will then be a discussion of wind compasses to the extent they have been documented. Conceptually, wind compasses are less obvious in their construction and use, which is why an exploration of star compasses is helpful as an anchor.

Chapter IV is devoted to the navigational practices of the Vaeakau-Taumako. It is important to keep in mind that even though navigators may make extensive use of either a star compass, a wind compass, or some other construct, no skilled navigator uses only one device for wayfinding. All rely on a suite of tools based on existing natural phenomena in order to increase the odds of a safe journey. Vaeakau-Taumako navigators are no exception.

Following the Vaeakau-Taumako discussion is a comparison of the constructs from both a practical and cognitive point of view, keeping in mind that no construct is used in isolation. The final chapter concludes with some observations about the use of cognitive constructs in non-instrument navigation and offers some proposals for further investigation.
CHAPTER II

Star Compasses

Caroline Islands

The best known example of a star compass comes from the Caroline Islands. Several ethnographers have documented the use of the star compass, and many others have commented on the significance of this construct. The star compass is used throughout the many islands of the Carolines, and there are variations to be taken into account. But the standard star compass which is uniformly referred to is the one offered by Goodenough (1953) in his seminal piece, *Native Astronomy in the Central Carolines* [Fig. 3].

The star compass (or sidereal compass) is not an exhaustive mapping of the nighttime sky. It is, by necessity, a configuration of those stars and constellations (referred to collectively as asterisms) which provide practical applicability to the task of navigating. Goodenough (1953) noted that the Carolinians had only about 30 to 40 named asterisms. He also noted that it was their placement in the sky, rather than the intensity of their glow which determined their usefulness, further demonstrating the functional nature of these points of reference.
The pathbreaking examination of navigation in the Carolines is Gladwin (1970), which focuses on the people of Polowat Island, located in the Central Carolines. Gladwin expounds on Goodenough’s original work by offering further insight into how the star compass is used as a device for sailing the open sea with accuracy and reliability. As can be seen in Fig. 3, the Caroline star compass has thirty-two bearings which equate with stars on the horizon. This is the same number of bearings on a traditional mariner’s compass, but this apparent coincidence is likely due to the limits of human perceptual and cognitive capabilities rather than exchange of ideas (Frake 1995:156). The star compass has been in existence longer than the mariner’s compass, so it is not a derivation of it.
The thirty-two star points correspond to where the stars actually rise and set rather than being equally spaced as in a mariner’s compass. In fact, the eastern and western hemispheres of the compass are mirror images of each other: the stars that rise in the east are the same stars indicated in the western sky where they set. The result is that there are only sixteen named stars on the compass.

Though the cardinal direction for navigators on Polowat is east, the direction of Altair (the “Big Bird”), arguably the most useful star is the North Star (Polaris) because, though it is harder to see, it does not move and is found close to the horizon (Gladwin 1970). To the south, there is the Southern Cross, a constellation which many of us in the northern hemisphere have never seen because it can only be witnessed if one travels far enough south. The Southern Cross, rather than being stationary, creates a predictable arc across the southern sky, with the long axis always pointing to the celestial South Pole. This offers accurate readings because it is symmetrical and rotates around the base of the cross in a uniform fashion. Consequently, the star compass indicates it as five separate star points, each at a different time throughout the night.

Dividing north and south is Altair, which is the greatest navigation star to the navigators of Polowat (Gladwin 1970). Because the Carolines are mostly aligned parallel to the equator, Altair plays a significant role as a bearing, a backsighting (sighting to the rear of the canoe), and a zenith star (directly overhead). From Polowat, Altair is the bearing for such destinations as Satawal (to the west) as well as Chuuk (to the east), two distant non-stop passages that Polowat navigators regularly make. Referring again to Goodenough’s star compass [Fig. 3], one sees that Altair does not rise from due east (90°)

(Gladwin 1970).
on the equator, but in fact appears seven degrees north of that (83º). This is serendipitous because Polowat also sits seven degrees north of the equator, making the bearing of Altair from Polowat directly due east and west, and creating an arc which passes directly overhead on Polowat.

It is not necessary to describe each of the stars in order to gain an appreciation for how navigators utilize these natural phenomena in their construction of a mental model for planning and executing their long-distance journeys. While the star compass is itself a representation of natural phenomena and qualifies as a cognitive construct on its own, further elaboration of this device makes for an even richer and more useful tool.

In addition to the stars identified on the star compass, there are myriad stars which comprise star paths for a navigator sailing to a particular destination. This is necessary because once a star rises some distance above the horizon, its usefulness wanes. (And of course, when a star sinks below the horizon, its usefulness ceases until the following evening.) This is particularly true as one sails on a heading that is not directly east or west, because stars to the north and south will swing across the sky in an arc and will therefore become misleading as a bearing. So a constant succession of stars is necessary in order to assist in maintaining a correct heading.

Put another way, there is a prescribed succession of stars that a navigator pursues as he sails from one island to another. This succession of stars, or star path, is different for each pair of islands, and in order to be an accomplished navigator, one must recognize the sequence for any island pair in both directions. Navigators in the Carolines are
typically versed in the star paths for thirty or more islands, from any one of the thirty to any other.

This may seem a demanding task. It is. The casual observer, or even the diligent ethnographer is not likely to learn more than a small fraction of what the skilled navigator has committed to memory. In combination with these chains of stars which lead to particular destinations are also various geographical features. Riesenber (1976:91) describes these geographical features as very broad, and they include “both natural and mythical phenomena, and animate beings as well.” He explains how navigators develop a mnemonic device for arranging their knowledge into an organized pattern to create a metaphor which will guide them along their journey. Riesenberg offers examples of such metaphors as the use of a breadfruit picker to pull in an object, and fishing with a torch, going from place to place (both over the course of the journey). These are idioms used as tools for learning and remembering the many relationships between the various geographical and celestial phenomena along the route from one island to another.

Riesenber specifically uses the term “mnemonic devices” to describe these metaphors, yet Gladwin (1970:131) cautions that these tools for learning and remembering are “not a litany memorized by rote.” Gladwin notes that the information contained in the sequence is discretely available to the navigator, “as if it were floating on the surface of the navigator’s mind rather than embedded in a long mnemonic chain.” In other words, though the information is learned in a chain, any point in the chain can be accessed without having to progress through the entire sequence.
A review of the Caroline star compass would not be complete without a discussion of etak. Etak in its broadest sense is a mechanism for navigators to estimate distance traveled and includes three different phenomena for doing so. Two of these phenomena are straightforward and easy for anyone to grasp: the etak of birds and the etak of land. The more esoteric element of this system involves a reference island and its relationship to star bearings. With regard to the reference island, etak is a cognitive construct which makes use of the stars in order to aid the navigator in visualizing the progress of his journey. Many Western scholars have expressed consternation when presented with the etak system. The reasons for the puzzlement may stem from misconceptions about the purpose of etak, and preconceptions about how this abstract construct is visualized and made useful.

Briefly, etak is making use of an unseen reference island off to one or both sides of a course. This island and the star points along the horizon that the island will appear to “pass under” as the journey progresses, provide the navigator with an abstract conception of progress of the journey. He imagines the passage of the etak island in a straight line, moving through segments—the spaces between the various star points along the horizon. Superimposed over this line is his estimation of where he is at various times throughout the journey [Fig. 4]. The navigator knows in advance of his journey how long it should take for him to arrive at his destination under typical conditions. He is skilled at estimating the speed of his craft. In his mind’s eye, he envisions the passing of the etak island along the side of his canoe as he makes his way to his destination.
The purpose of etak has not been well understood. This is obvious from the contradiction between Sarfert’s (1911) assertion that etak islands are “emergency islands” where voyagers can take refuge if necessary, and Riesenberg’s (1976) subsequent discovery that some etak islands are entirely imaginary. Gladwin (1970) has assumed that etak islands are a construct for measuring distance, yet he clearly finds this notion troubling for two reasons. First, the etak system involves a combination of phenomena. There is the use of the reference island as described above, but there is also the use of “sightings.” On either end of a voyage, the navigator will be able to sight the island he is leaving and/or approaching from a maximum of about ten miles out (the Carolines are mostly low-lying atolls). Beyond that distance is the sighting of birds, which typically feed during the day at a maximum distance of about twenty miles from land. So at either
end of the voyage, there are two segments which are reliably about ten miles long. However, the segments that are created using the reference island and the stars under which it passes are not typically uniform in length, and may be quite different in length from the etak of sightings. This is the second reason for Gladwin’s confusion. He cannot understand why a system which measures distance is so inconsistent in its measurement of distance.

Feinberg (personal communication) also expresses unease with typical Western attempts to understand etak because of its circular logic: it appears to be a way of determining location which requires the navigator to know his location. He speculates that etak is simply an idiom that navigators use to talk about their location in relation to their point of embarkation, their destination, and various natural phenomena.

If one were to imagine a voyage in which a canoe is sailed directly from point A to point B by a skilled navigator who knows how long it should take and what direction to point toward, one might ask why bother having an etak system at all? But experienced sailors know that the wind is fickle and allows for direct sail from point A to point B with frustrating infrequency. In addition, how long it should take and how long it does take do not always coincide. According to Hutchins (1983), the purpose of the etak system is not to provide refuge or measure distances. Rather, it is twofold: first, it provides the navigator a mental representation of where he is in relation to his origin and destination. This is useful whenever conditions are less than ideal and he needs to keep a mental image of where he is on his journey. Second, it is a geometric toolbox for keeping rack of his progress should he find it necessary to tack toward his destination.
By starting out his voyage with a mental picture of the *etak* island and the corresponding stars under which the island will pass, the navigator is able to triangulate, quite literally, in the event of shifting winds which require him to tack his way toward his destination. (Tacking is sailing toward a destination in a zigzag fashion when the wind is blowing from the direction of one’s destination.) The system also permits the navigator to calculate the effects of changes in speed on the progress of the course.

The way this construct works is illustrated in Figs. 5 and 6. The navigator imagines the reference island and the corresponding star points for his voyage before he begins. Along the way, he keeps mental track (via dead reckoning) of the passage of the *etak* island as it “moves” from ahead of the canoe to behind it [Fig. 5]. If the wind should shift and make it necessary for him to begin tacking toward the destination before he wishes to change course, he notes the distance on the horizon that remains for the *etak* island.

![Fig. 5 Hutchins’ *Etak* (reference island) representation (Hutchins 1983:197)](image-url)
Fig. 6 Hutchins’ *Etak* as triangulation (Hutchins 1983:221)

island [Fig. 6a]. That distance can be visualized as two points on the horizon which
correspond to two points on the outrigger of his canoe. From where he sits, the point
where the current star bearing for the *etak* island “falls” onto the outrigger and the point
where the destination bearing “falls” onto the outrigger, create a distance which he can
use as a reference when he changes course [Fig 6b]. Once he changes course, this length
of space he has envisioned on his outrigger then becomes a measure of the distance he
must travel in order to arrive at the point where he should tack (change direction). That
distance is covered when the bearing for the goal island has traversed the imagined
distance along the outrigger. Before tacking again, he notes the distance between the
current heading and the bearing toward the destination, imagines that distance on his outrigger, and upon tacking notes the “movement” of his destination island as it traverses along his outrigger from start to end [Fig 6c]. This process is repeated as long as needed and reliably allows him to reach the etak of birds, where he has additional information to assist him in pinpointing his destination.

Hutchins’ (1983) interpretation of the etak system has not been confirmed by the navigators of the Caroline Islands. He notes that his theory conforms to the ethnographic record and resolves apparent anomalies perceived by other researchers. Nonetheless, it is speculative and remains to be confirmed (or refuted) by further work in the field.

There are many other devices that Caroline Island navigators put to use in order to arrive at their destination. But their use of the star compass and the etak system demonstrate the power of cognitive constructs to allow for a sort of mental charting without instruments.

**Polynesia**

Polynesians, like most voyagers of the world, have found the stars to be useful for navigating. But to say that the early Polynesians made use of a star compass may not be accurate and it is not supported by any evidence. Many of the Polynesian islands lie well to the north or south of the equator, making them quite different from the Caroline Islands. Traveling from one Polynesian island to another can result in significant changes
in latitude, making star mapping for a long distance voyage difficult. Further, as Lewis (1978:75) points out when quoting the Tongan navigator Ve‘etutu, “You must know the stars for each season, because in six months they will all be different from the ones you see now.” This problem is more pronounced the greater the latitude. For Polynesians traversing great distances north or south, a neat and tidy star compass is not available.

It is fair to say that Polynesians have made use of star paths. Lewis (1978:18) discovered in the late 1960s that despite having lost a great deal of their seafaring heritage, Polynesians were well aware of certain navigational arts such as the use of the star path. He discovered this when an interlocutor told him that a distant island was in the direction of a particular star, and that when that star rose above the horizon, another star would lead the way, and so on, creating a chain of stars from here to there. His source, Kaloni Kienga, told him that his people referred to this star path as kaveinga. Lewis noted that knowledge of kaveinga existed in Tonga and Tikopia (a Polynesian outlier in Melanesia proper), and a related concept of ‘avei‘a existed in Tahiti.

Elsewhere (such as Anuta and Tikopia), kaavenga means “carrier” and can refer to any guide star, rather than a star path (Feinberg 1988:100). Expert navigators on Anuta are well versed in the names, identities and trajectories of more than a dozen important constellations. Despite the limited number of sailing destinations in modern times, Anutans still remember star paths for islands to which they no longer sail (Feinberg 1988:113).

In addition to using star paths, Polynesians were, not surprisingly, likely to have made extensive use of zenith stars. Irwin (1992:48) explains that as stars pass their
zenith, they indicate latitude. Every star has a zenith, but only those that pass directly overhead and are on the observer’s latitude are called zenith stars. Other stars that pass due north or south of the observer do not appear to have a conventional name (Nainoa Thompson has dubbed them “meridians”) but can be used similarly. By knowing what star appears as the zenith for a particular island, a navigator would know when he is in the vicinity of that island’s latitude. If he has managed to knowingly sail to the east or west of his destination island, he can then maintain that latitude and sail toward the island (as long as that island is more or less downwind). Lewis (1978) noted that knowledge of zenith stars existed in Tikopia, Samoa, Tupuai, and Nukufero (he spells Nukufera). According to Lewis (1978:34), “Zenith star estimation had once been one of the cornerstones of the more sophisticated branches of Polynesian navigation.”

A review of the literature on the use of navigational aids by Polynesians suggests a level of disappointment on the part of researchers that there is no record of a star compass. Whether there ever was one and whether it disappeared long ago because of the distances Polynesians often found themselves from the equator, or disappeared more recently when long-distance voyaging was suppressed following Western settlement is anyone’s guess. But one thing is certain: the Micronesians were not the only early navigators to make use of a star compass.
Ammarell (1999:3–8) described the Bugis of South Sulawesi, Indonesia as the “modern heirs to an ancient maritime tradition that for millennia supported the spread of the Austronesian-speaking peoples throughout virtually all of Island Southeast Asia, Oceania, and even as far as Madagascar.” Several commentators (Goodenough 1953; Goodenough and Feinberg 1995; Dodd 1972; Lewis 1978, 1994 [1972]) have noted the apparent relationship between the navigational methods used in the Indo-Pacific region and across the Indian Ocean and those found in Oceania, a fact that is unsurprising in light of the Austronesian language connections. But in the context of this thesis, discussion of navigational techniques in Island Southeast Asia is complicated by several factors: instruments, landmarks, and religion.

Indonesia has undergone significant cultural changes as a result of centuries of trading with Middle Eastern Muslim trading partners. Over time, great swaths of the region have converted to Islam. Along with their religious influences, these traders have also brought technology, including the magnetic compass. Today, while it is common for navigators in Indonesia to know of and make use of the stars, they do not rely on them for wayfinding in the way that many of their cousins in Oceania still do. Their adoption of the magnetic compass has lessened the dependence on celestial navigation. Furthermore, because of the region’s geography, sailing within sight of land is quite common, making landmarks and their often-accompanying signs (i.e., clouds, birds, reefs, etc.) a more handy and utilized reference.

Another interesting element of navigation among Indonesians is that their religious observations sometimes inform their perceptions of the heavens and the weather
and influence their interpretation of events. For instance, Ammarell (1999:55) explains that “if the waxing crescent occurs on a Friday such that the tide rises just after noon prayer, and the wind picks up from the west, it is a sign of the arrival of the west monsoon.” Further, the moon is a celestial body both used for navigation and tracking time in the Islamic religious calendar. Awareness of lunar cycles can be attributed in part to religious observations (Ammarell 1999:101).

Ammarell describes several aspects of Bugis navigation, including the use of stars. He explains that older navigators are more familiar with star patterns than younger, though we get a picture of mariners who are not entirely dependent on any one mechanism for wayfinding. Despite the widespread use of the magnetic compass, most are capable of navigating without it, as is often done during the night when it is too dark to read the compass, as well as when a compass is discovered to be broken. Ammarell again demonstrates the influence of Islam on the mental constructs of navigation when he describes an elderly former navigator who told him that Alpha and Beta Centauri would set in a particular direction at *subu*, which is the early Morning Prayer between 4:00 and 5:00 am.

The existence of a star compass in Indonesia is documented by Ammarell [Fig. 7] and Lewis [Fig. 8]. Lewis (1978:142) explains that while the magnetic compass has long been in use in the Indian Ocean, it was definitely preceded by the star compass and that the star compass reveals some notable Indo-Pacific parallels. Lewis (1994{1972}:292) points out that one particular compass card shows the names for the cardinal directions of east and west are similar to those used in the Carolines. Both systems make use of
prefixes for “rising” on the eastern side of the compass and “setting” on the western side. Both have asterisms which are irregularly spaced and not consistent with the magnetic compass. Both view Altair as being centered between north and south rather than sitting seven degrees north of the equator. Finally, it appears that eighteen of the thirty-two asterisms are identical in the Indian Ocean and Pacific systems, according to Lewis (1994[1972]:292).

Fig. 7 Bugis Star Compass (Ammarell 1999:125)
According to Ammarell, older expert navigators know about twelve asterisms. Of these asterisms, there are many more navigators who know their names but cannot identify them in the night sky. Navigators are versed (to varying degrees depending on their level of experience) in the many star patterns that are necessary for them to make safe passage. These star patterns include both named and unnamed stars, and are the individual “roadmaps” that each navigator uses. Ammarell (1999:124) describes the knowledge of more skilled navigators by saying that they have not only memorized the positions of certain asterisms relative to specific courses; they have also gained a thorough Gestalt-like familiarity with the sky that allows them mentally to adjust to the westward drift of the stars through the night. When the given asterism has not yet arrived or is no longer at its marked position, the navigator mentally traces its path across the sky to reestablish that position. When it is no longer visible, the navigator uses other associated but unnamed stars to aim his ship.
It is typical that navigators use a combination of star headings and magnetic compass headings throughout a voyage, often preferring to follow the stars at night because it is too dark to read a compass. But Ammarell also notes that even those who make extensive use of the stars, because stars are not visible during the day, choose not to depend on them entirely, but also on the magnetic compass.

The co-mingling of the magnetic compass and the stars can be problematic. Ammarell notes that there is often a discrepancy between where navigators describe the rise and set points of stars and where they actually rise and set on the compass. He first thought it odd that these expert navigators did not know the true rise and set points of the stars. He later realized that the confusion was due to his failing to recognize the way that they conceptualize and apply the tools at their disposal. For these navigators, directions are context specific. Asterisms tend to be associated with the nearest cardinal (or semi-cardinal) direction. The heading for a particular asterism on a particular journey might be referred to as a specific direction on a compass, but it may in fact be to the left or right of that heading, depending on the destination. Similarly, in Micronesian navigation, Frake (1995:155) also argues that “stars provide the names, not the positions, for abstract conceptual segmentations of the horizon circle into 32 equally spaced points.”

Newly-Invented: Nainoa Thompson
The story of the *Hōkūle‘a* project is rich and complex and beyond the scope of this thesis. Briefly, in 1976, *Hōkūle‘a*, a double-hulled canoe built in the tradition of Polynesian voyaging canoes, sailed from Hawai‘i to Tahiti, using traditional (non-instrument) sailing techniques. This was a significant event for Polynesians because it helped to settle a long debate about whether early Polynesian seafarers were capable of such an intentional voyage. But a Micronesian, Mau Piailug, actually navigated *Hōkūle‘a* on its maiden voyage. Later, Hawaiian native Nainoa Thompson would learn the ancient wayfinding techniques.

Prior to the *Hōkūle‘a* project, Thompson had had no exposure to traditional Polynesian wayfinding methods (Finney 1994). In fact, no Hawaiian had any knowledge of these methods because such methods had been lost to the ages (Lewis 1976). In order for the *Hōkūle‘a* project to demonstrate the capacity to sail, utilizing traditional methods, from Hawai‘i to Tahiti, it was necessary to borrow the skills of Mau Piailug (Finney 1994).

On Piailug’s home island of Satawal in the Caroline Islands, ocean voyaging using traditional navigational methods is still practiced and taught to younger generations (Lewis 1976). Piailug had been sailing since he was a young boy and was recognized as a qualified navigator by the time he was a young man (Lewis 1976). His skill had allowed him to navigate distances of 500 miles without instruments or charts (Lewis 1976). Remarkably, though the navigational systems that are employed by various navigators throughout the Pacific are somewhat location-specific, Piailug was able to transfer his knowledge to the *Hōkūle‘a* expedition (Finney 1994). Using the Caroline star
compass, Piailug was able to not only transfer his skill to a distant place on the ocean, he was also able to convey his knowledge to his apprentice, Nainoa Thompson.

Along with his studies under Mau Piailug, Thompson also studied at length with Will Kyselka, a geologist turned astronomer at Hawaii’s Bishop Museum Planetarium (Kyselka 1987). With the benefit of the planetarium, Thompson was able to cram years of star study into several months of dedicated discipleship, thus rounding out his understanding of his own region (Kyselka 1987).

In 1980, the Hōkūle‘a voyage from Hawai‘i to Tahiti was repeated, this time, navigated by a Hawaiian: Nainoa Thompson (Finney 1994). And between 1985 and 1987, Hōkūle‘a was sailed again, this time on a more extensive journey, from Hawai‘i to Aotearoa (New Zealand) and back, through seven archipelagos (Finney 1994).

According to the Polynesian Voyaging Society website, since Thompson’s first voyage, he has logged tens of thousands of miles sailing and navigating the Pacific. But his more lasting contribution to the eminence of Hawaiian navigation is his ongoing effort to teach young people about sailing the way the ancients did. His approach to teaching students about seamanship draws upon his own learning experience, and encourages them to plan their own courses and take full responsibility for their voyages.

Kyselka (1987) describes Thompson’s use of stars in terms that are easy for a Westerner to understand. After all, Kyselka is a Western-trained astronomer. He tells us that Thompson made use of the great circles of the celestial sphere, which include the equator, the meridian, and the ecliptic. These correspond to the earth’s equator, lines of longitude, and the sun’s annual path. He reminds us that the earth is tilted at 23.5°, and
that for the most part, the moon and planets adhere to this alignment of the earth and sun. Distributed along this plane are twelve constellations (the zodiac), all save one described as an animal. The months of the year correspond to the period which the sun spends in that star group.

Using this information as his guide, Thompson was able to create a mental construct for establishing both direction and latitude. This construct included a star compass that he created, using thirty-six stars (seventy-two points) [Fig. 9]. By knowing the position of just one solitary star, a skilled navigator can orient the entire compass, even on the cloudiest night. Thompson apparently overlaid this star compass with another compass of his own creation [Fig. 10]. Kyselka informs us that Thompson’s compass used Hawaiian names for cardinal points of direction: Hikina (east), Komohana, (west), ʻĀkau (north), and Hema (south). This divided the compass into four quadrants.

Fig. 9 Nainoa’s Star Compass (Kyselka 1987:39)
He split the quadrants again to identify northeast, northwest, southeast, and southwest. He got this idea from Mau Piailug, who felt this was an intuitive way to divide the horizon since prevailing winds come from the northeast and southeast. These four directions he named *Manu*, the Hawaiian word for bird, which was also how Thompson visualized *Hōkūle‘a* as he sailed southeast toward Tahiti—"as a bird flying southeast, its head and neck outstretched and wings outspread" (Kyselka 1987:98). He continued to split the compass sections in half until he had thirty-two equal sectors, each of which he called a house. Within the four quadrants, the houses had the same names, but were identified by quadrant also. In this way, as Thompson imagined *Hōkūle‘a* flying toward Tahiti, he saw the islands pass through the sectors of his star compass. For instance he visualized the Marquesas traversing from SE *Na Leo* through SE *Nalani* and into NE *ʻĀina* during the voyage.
For finding direction, Thompson used several techniques. He saw the sun as a special star, aware that its place on the horizon shifted with the seasons. Accordingly, planets, also following a similar path were useful to him on short voyages. Thompson observed what he called meridians, the paths of the stars arcing across the sky (but not directly overhead), and when they reached their highest points, he could determine true north or south. To do so, Thompson preferred to use stars in pairs rather than singly. Two stars with the same longitude line up to point to true north or south unequivocally. Thompson also discovered a cumbersome mechanism for determining direction using the moon.

For establishing latitude, the well-known zenith star method was not one that Thompson found useful: it is simply very difficult to determine when a star is directly overhead. The way it is supposed to work is that certain stars pass directly over certain islands. If such a star passes directly over the canoe, then one would know that he is at the same latitude as that island. Kyselka speculates that this technique is more apocryphal than practical, especially for someone bobbing about at sea. However, Thompson was also able to make use of stars’ zenith points to help him determine latitude by memorizing the actual declination of 110 stars. Knowing how far north or south a star is from the equator, the observer who is able to determine the zenith point of a star can mathematically calculate his position. Again, Thompson found it even better to pair stars together to create a more reliable reading. Keep in mind also that he would identify particular stars that signaled directions and destinations which he found useful.
For example, he identified the star pair of Alioth-Cor Caroli to indicate the correct latitude for Tahiti.

Polaris, though imperfect as a latitudinal indicator, is useful when one is north of the equator (south of the equator, it is not visible). Also known as the North Star, Polaris is very nearly directly over the North Pole. That means that while other stars arc across the sky, Polaris appears still. At the equator, Polaris is barely visible at the horizon. At 10° north of the equator, Polaris is 10° above the horizon, so that there is a direct correspondence between the elevation of Polaris and the observer’s latitude.

One last way that Thompson utilized star pairs to identify latitude was to note pairs of stars that either rise or set synchronously. In practice, it is much easier to anticipate stars setting than rising. But if one knows which pairs pass the horizon synchronously at different latitudes, then one knows his latitude when it occurs.
CHAPTER III

Wind Compasses

Introduction

There is not a large body of information describing wind compasses. Most of those who may have used them in the past have lost much of their seafaring heritage. And those who have robust ongoing seafaring heritages seem not to have much use for them. There are some exceptions. But the relative inconspicuousness of wind compasses has left them largely ignored.

Lewis (1994 [1972]) offers a fair explanation of what wind compasses are all about. He reminds us that tropical Pacific winds are reasonably steady in their direction—an important feature on which to base a directional system. Further, he notes that variations of these winds are predictable for the most part—again important. So indigenous people of the tropical Pacific have in the past taken note of the reliable nature of the wind, and the predictability of its variation, and have fashioned a mental construct with which to find their way. Furthermore, as we will see from the accounts of Lewis (1978, 1994 [1972]) and Finney (1994), not only are these winds steady, they also have
distinct characteristics: moisture content, temperature, accompanying cloud formations, etc., which navigators can use to confirm their source of origin.

However, as Lewis (1994 [1972]) also points out, when compared to other phenomena such as the stars, the sun, or ocean swells, the wind is clearly less permanent and therefore is typically used as a secondary indicator of approximate direction. Those who navigate by the wind need to validate their wind readings by checking against other, more permanent phenomena such as landmarks, the sun, or the stars. One might wonder why the wind is regularly put to use if it is so problematic. Lewis would say that it is because the wind is simple to use. Sailors of all stripes are keenly aware of the direction of the wind and any shifts in direction. Those who use a magnetic compass are able to compare these shifts to the points on their compass, while those without instruments use the swells, the sun, or the stars to distinguish their altered courses. Lewis (1994 [1972]:133) quotes a Tikopian navigator who says “If the wind changes, I feel it by my boat on the waves.” Lewis goes on to say that “The methods of estimating the direction of the apparent wind by pennants, or merely the feel of the breeze on neck or cheek, are too well known to need elaboration.”

**Indo-Pacific**

*Bugis*

Ammarell (1999) has described the Malay wind compass [Fig. 12] used by the Bugis of Indonesia: a sixteen-point directional compass, which he says is rooted in the
opposing monsoon winds. The prevailing direction for these winds in the northern hemisphere is northwest to southeast during the winter and the reverse direction during the summer. Locally, however, there may be differences caused by geographic features. Linguistically, there is an association between the monsoons and the directions from which their winds originate. Ammarell notes that it is common for the names of winds to be synonymous with their direction of origin.

The sixteen points of the wind compass coincidentally correspond to the sixteen points of a magnetic compass, but one is not derived from the other. Instead, the wind
compass is perceived by its users as an encircling horizon with eight evenly-spaced sets of opposing directions. They also perceive the cardinal directions as primary, the points equally spaced between the cardinal directions as secondary, and the points between the primary and secondary to be tertiary, much like the magnetic compass.

According to Ammarell (1999:98), the functions of the wind compass are two-fold: “to identify the direction of the wind at sea and to describe the course and heading of a ship.” There is an interesting distinction that navigators make between a ship’s heading and the direction of the wind when these are just off one of the main directional points. To describe a heading, for example, that is just west of north, the Bugis navigator is likely to say “just left of north.” But if the wind is coming from that same direction, he is likely to say “just west of north.”

This distinction illustrates the contextual differentiation which Ammarell identifies as contingent and absolute direction. Simply put, absolute directions are always where they are regardless of where the person is. North is always north regardless of whether one is facing it. Contingent directions vary depending on the relationship of the person to the object. If two people are facing each other, both point the same direction toward north, but in opposite directions when pointing to the left.

Frake (1995) has discussed absolute and contingent directions in much the same way—Ammarell acknowledges borrowing Frake’s verbiage. Bennardo (2000), who has explored linguistic representations of space, particularly in Tonga, in exploring contingent directions, distinguishes frames of references of the three types: relative, intrinsic, and absolute. Relative frames of reference are focused on the speaker, and
intrinsic frames of reference are focused on an object. Both of these are not fixed and remain centered on the speaker or object as either moves about. Absolute frames of reference are fixed in terms of some external axis and do not change.

However, Ammarell’s descriptions differ from Bennardo’s in the context of the situation being described. According to Ammarell (1999:88), for many Austronesian speakers, there is such a distinction made so that absolute directions apply to the immediate space of the person, and contingent directions apply to the broader situation. This runs counter to the Tongan model as rendered by Bennardo (2009), where absolute frames of reference tend to apply to the broader space while contingent (relative and intrinsic) frames of reference apply to the immediate space.

In the above example of the navigator who says “just west of north,” versus “just left of north,” Ammarell contends that the absolute wording (west) is used when describing the heading of the ship (the immediate space of the person); the contingent wording (left) is used when describing the direction of the wind (the broader situation). This switching may seem peculiar to the English speaker, who is able to use the terms interchangeably, but is not sensitive to the contextual references that the Bugis and others are.

In fact, Bugis sailors refer not to just two ways (contingent and absolute) of naming directions for the wind, but four different systems. Two are contingent and two are absolute. Both of the contingent directions are used when naming winds at sea. One is described above, in the case of a sailor saying “just left of north” to describe the direction of the wind while on board the ship. The other is used to describe the wind in
relation to the individual on the ship, such as “a wind from behind.” The two absolute directions include the other example from above in which the sailor says “just west of north” to indicate the heading of the ship, as well as absolute directions used while on land to describe the direction of the wind. This last example is not useful to navigators at sea, though one may hear the terminology used. As Ammarell points out, in order to understand wind direction, it is necessary to keep in mind that all four of these examples overlap. A navigator may refer to a single source of wind in several different ways, each of which is contextually specific. For example, “an offshore wind” could also be coming from the “south-southeast” by way of the compass, as well as from the “south” if using the land-based verbiage, while being described as a “headwind” in terms of the ship. To the untrained listener, these may seem a collection of terms that can be used interchangeably. But according to Ammarell, though the Bugis may recognize that these terms may all be simultaneously accurate, the choice of term is situationally specific.

For the Bugis, the wind has great significance for propelling ships and providing access to fish, upon which the Bugis depend. Navigators understandably have developed what Ammarell (1999:106) has described as an “intimate knowledge of the wind and its relationship to other phenomena in the marine environment.” They are keenly aware that the wind brings atmospheric and marine phenomena. They understand that waves, swells, and currents follow the wind. They know that the weather changes with the prevailing winds and that wind can be predictive of the weather. But more significantly, they are able to use weather to predict the intensity and direction of the winds.
It is not uncommon to find a magnetic compass aboard a Bugis ship, though the importance of that compass will vary greatly from navigator to navigator. These items are often prized more for their perceived value as status symbols than their practical value. As time passes, more and more navigators become familiar with their use. But experienced navigators claim that these instruments are not necessary for safe passage because they know how to make use of the wind, waves, and stars. As described earlier, the compass is typically not used at night when it is too dark to see it, and when the compass is broken, there is little concern.

A typical magnetic compass is marked with the Standard English symbols of N-E-S-W, etc., though the Bugis refer to the directions that correspond to their own wind compass. The course to any destination is memorized as a series of destinations and requisite compass headings under various winds. These courses vary depending on the wind so that there are multiple courses memorized for each destination depending on the time of year the ship is sailing and from where the winds are emanating. These courses also take into account leeway due to wind and current.

**Melanesia**

*Fiji*

Lewis (1994 [1972]) notes that there is a Tongan influence on navigational methods for the practices found in Fiji, notably of the Lau group. He reproduces a wind compass [Fig. 14] drawn by another missionary, Fr. Neyret. This wind compass differs
visually from others. In addition to the erratically spaced six points on the compass, there are also three evenly spaced “sectors.” According to Lewis’s (1994 [1972]:114) translation of Neyret, the terms on the wind compass “refer to the names of winds originating in the sectors and have been secondarily applied to the sectors themselves.”

![Fig. 14 Fijian Wind Compass (Lewis 1994[1972]:115)](image)

**Micronesia**

Although much has been written about Micronesian navigators, little has been said of their use of a wind compass. Lewis (1994 [1972]) informs us that there are historical reports of a wind compass in Micronesia, albeit in the culturally distinct Marianas. Documents from the 1700s indicate that a ship containing a Jesuit priest went
adrift in the Marianas. This priest, Fr. Cantova wrote about the indigenous people’s use of a twelve-point wind compass. His account was brief and offered little detail. Not much else is known of this wind compass.

**Polynesia**

*Cook Islands*

Lewis’s (1994 [1972]) research on navigational methods of Polynesians was necessarily historical in its focus. Most, if not all of the Polynesian Triangle had lost its navigational heritage as a result of colonialism, up until revitalization efforts began taking place in the 1960s. There is scant documentation of navigational techniques prior to their disappearance. But there is evidence that navigators from several Polynesian archipelagos may have used a sort of wind compass. Lewis (1994 [1972]) presents a thirty-two point wind-rose [Fig. 13] from the Cook Islands, drawn in the nineteenth-century by a missionary, William Wyatt Gill. This wind compass is like others in that the points are named for the winds that blow from each point. According to Gill’s account, the Cook Islanders fashioned a wind device using a gourd into which they drilled small holes. This device was a physical representation of the winds which the chief priest would use to solicit the god of winds (Raka) when the winds were unfavorable and an expedition was planned. The gourd would be a gentle suggestion to Raka of the direction from which the priest wished the wind to emanate.
Unfortunately, there is no documentation which affords us an opportunity to envision how the Cook Islanders may have utilized the wind compass in a navigating scenario. Lewis speculates that they may have been used in much the same way as Mediterranean seafarers used eight-point wind-roses. Lewis (1994 [1972]:58) suggests

...given the shifting nature of the winds in the Mediterranean, it has been said that early mariners there must have been “able to recognize these winds either by their characteristics of temperature, moisture content, etc., or else by association with the sun, moon, stars, otherwise it would be hardly possible to use a wind-rose for purposes of navigation with any degree of certainty.” Similarly, it seems likely that Polynesian navigators used their wind-roses primarily for conceptualizing directions but ultimately relied on celestial referents to set their course for steering. Of course, we can only speculate on this point.
Pukapuka

Pukapuka is technically part of the Cook Islands (which is in free association with New Zealand), but it is isolated; it is only administratively linked in the modern nation-state sense. In the 1930s, Beaglehole and Beaglehole (1971[1938]:21-22) conducted ethnographic research in Pukapuka and were able to draw a wind compass [Fig. 15]. The winds on the compass are associated with the villages so that each village is perceived to “control” certain winds. Wind names are reportedly used in village chants, but one village does not use the names of other village’s winds. Further, there is an apparent association of the winds to specific gods, and appealing to those gods could control the winds.

![Fig. 15 Pukapukan Wind Compass (Lewis 1994[1972]:114)](image-url)
Beaglehole and Beaglehole also describe canoe and sail construction, but there is no discussion of navigation and how the wind compass may have informed navigators.

_Tahiti_

Finney (2007) notes that historical accounts of Tahitian navigators by explorers such as Captain Cook and Joseph Banks indicate that they too were well acquainted with the stars. But their only compass-like construct was based on the wind [Fig. 16]. Handy (1932) is responsible for bringing the drawing of this wind compass to the Western world; unfortunately, there is no accompanying commentary from him regarding how his

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Fig. 16 Tahitian Wind Compass (Finney 2007:162)
informants might have used it. Finney (2007) recounts Andía y Varela’s late sixteenth century remarks regarding Tahitian navigation, about which he learned from the navigator Puhoro from the Tuamotu island of Makatea (not Tahiti). According to Puhoro, the Tahitians divided the horizon into sixteen points, with the cardinal points to the east (sunrise) and west (sunset). The names of all the points are wind names, and according to Finney, many of these names are still remembered by Tahitians today.

Puhoro’s account differs from Handy’s graphic depiction: Puhoro claimed that there were sixteen points while Handy’s wind compass shows twenty-three points. However, Puhoro was not from Tahiti, so his ability to speak knowledgeably about Tahitian systems may have been limited. Also, there is a significant time span between Puhoro’s description to Andía y Varela in 1775 and Handy’s 1932 recording, which could account for some change to the system. Dodd (1972) speculates that the difference between the two accounts can be attributed to Handy’s superior ethnographic skills, which may have elicited more detail.

Tokelau

Burrows (1923) reported on what appears to be the existence of a wind compass in Tokelau, a New Zealand territory in the South Pacific which comprises a group of coral atolls. He indicated that back in the 1920s, the natives had a compass with twelve points, each point named for the wind.

Tonga
In discussing the sailor’s use of the wind for navigating, Lewis (1978:76) reminds us that “the wind being so changeable, its direction must be checked occasionally by stars or sun and it is advisable that the characteristics of different winds be known.” He goes on to give an example of such characteristics of known winds in Tonga. He says that the northwestern wind is warm and full of moisture, the southwestern wind is clear and cold, and southeast trades contain an unmistakable series of ranked cloud formations. It is from this sort of intimate understanding of the characteristics of the wind that Tongans and their Polynesian neighbors were able to successfully construct and utilize wind compasses.

**Polynesian Outliers**

*Anuta*

As stated earlier, Anutans rely primarily on the stars for navigation, but they also utilize what Feinberg (1988:92) refers to as a “rudimentary wind compass.” With nine points, it is not complex [Fig. 11]. Like others, it indicates the prevailing winds that occur during different times of the year and uses the same names for the winds as the geographical bearing from which they blow. Feinberg found its directions in some ways to be at odds with other Polynesian wind compasses. For example, the direction of *te tonga* lies just south of east for Anutans, whereas many Polynesians give it a southerly bearing. This makes sense when observing that the direction of Tonga is to the south from Samoa, for example, while it lies southeast from Anuta.
Feinberg’s (1988) research also led him to discover that there is much variation in the perception of the wind compass among individuals on Anuta. Several of his consultants identified the same winds in roughly the same sequence around the horizon, but the spacing and direction of those winds varied widely. Prior to this discovery, Feinberg noted that the Anutan wind compass is a near-perfect 40º rotation of the Tikopian wind compass recorded by Firth (1970). This type of apparent lack of precision has been noted by other ethnographers such as Lewis and Gladwin, who Feinberg notes...
have been inclined to observe that such as system “must only be good enough to enable [the navigator] to get where he wants to go, with some margin for error” (Feinberg 1988:95). Feinberg (1988:98) also concludes that, at least for Anuta, “directions are conceptualized as being, in a certain sense, relative to one another rather than absolute.”

*Outer Reef Islands*

In Lewis’s (1978) *The Voyaging Stars*, the focus is obviously on the use of stars as navigational aids, but he does note briefly that the Outer Reef Islanders in the eastern Solomons use a wind compass with eight points in addition to the stars in order to find their way. These people share the same seafaring tradition as Taumako. Davenport (1964:137-138) does not specifically write of a wind compass, though he does describe the navigators of this region as being especially cognizant of the winds and their patterns of behavior.

*Tikopia*

Firth (1970) wrote about religion on Tikopia, and much like Pukapuka, the winds on Tikopia are associated with the gods. In contrast to the Pukapukan view where some winds belong to one group and other winds to others, the Tikopians see the winds as available to all and the gods that control them can be solicited by any, despite different gods being specifically connected with particular ‘clans’. Firth (1970) also offers a wind compass for consideration [Fig. 17], but again, much like the Pukapukan wind compass, nothing is said of its use as a navigational tool.
Fig. 17 Tikopian Wind Compass (Firth 1970:156)
CHAPTER IV

Taumako Navigation

Introduction

Once active seafarers, most Polynesians experienced a loss of navigational skills in the wake of colonization, evolving economic pressures, and technological innovation. In the mid 1990s, people of Taumako, a Polynesian island in the eastern Solomon Islands, began an effort to revive their old seafaring heritage. Sailor-anthropologist Marianne George became involved with this voyaging revival in 1993, and a decade later invited anthropologists Richard Feinberg and Ben Finney to undertake research, publish their findings, and make the results available for local use. That research occurred in 2007-2008. The purpose of these efforts can be found in the mission statement of the Vaka Taumako Project on its website (http://www.pacifictraditions.org/vaka/):

The Vaka Taumako Project (VTP) preserves and perpetuates authentic Polynesian seafaring by assisting Paramount Chief K. Kaveia in getting support for building and sailing traditional voyaging canoes on traditional routes using traditional navigation methods, and for educating and informing Taumako youth, and others, about the traditional knowledge and activities of Taumako.
The data used for the following analysis of Vaeakau-Taumako navigation are taken from two sources: George’s interpretations as published on the Vaka Taumako Project website, and Feinberg’s published and unpublished works which include newsletters, field notes and papers presented at conferences, (Feinberg n.d.a., n.d.b., n.d.c., n.d.d.) George’s information on the website has not been peer-reviewed and appears to be in draft form, perhaps so that others can provide input in advance of publication. Feinberg’s data cover a range: published (but not peer-reviewed), currently under review, working toward submission, and raw field notes; they form the basis for development of an alternative interpretation of Vaeakau-Taumako navigation.

**George’s Account of Taumako Navigation**

According to the website, the Taumako wind compass can be described as “a navigational system correlating a horizontal array of wind positions with other observable phenomena—e.g. swells, sunrise and sunset paths, celestial bodies, seasons, dynamic behavior of winds, solstices and equinoxes, voyaging routes, star paths, etc.—and built upon an awareness and perception of phenomena that are not taught in western navigation or seamanship.” George states that data she had previously collected were confirmed during the 2007-2008 NSF-sponsored research effort. According to George, her primary source, Chief Crusoe Kaveia (whom she refers to as Te Aliki Kaveia—*te aliki* meaning ‘chief’ in Taumako), verified the accuracy of the diagrams that she
constructed (at his encouragement). The diagrams show the *Nohoanga te Matangi* navigation system, which translates literally as ‘seat of the wind’, but is more commonly referred to in English as ‘wind compass’. These diagrams are misleading in the sense that the information contained in them is orally and experientially transmitted. The idea of depicting them visually is a very recent phenomenon. George presents the diagrams in the order in which they were taught to her by Chief Kaveia.

The data are currently organized on the website into eleven separate constructs. However, not all of these have been fully fleshed out. Eight constructs are more or less complete. Each is elaborated as follows.

![Diagram of Eight Primary Positions](Vaka Taumako Project website)
#1 – Eight Primary Positions [Fig. 18]

The Taumako wind compass has eight major points evenly distributed around a circular horizon. The eight points are conceived as four pairs of opposing positions (180 degrees apart) around the horizon, resulting in the following pairs:

- *Te Alunga* and *Te Haka Hiu*
- *Te Tonga* and *Te Tokelau*
- *Te Ulu* and *Te Palapu*
- *Te Laki* and *Te Tokelau-Tū*

![Fig. 19 Sixteen Secondary Positions (Vaka Taumako Project website)](image)

#2 – Sixteen Secondary Positions [Fig. 19]

Although the website indicates that there are sixteen secondary positions, these are the intermediate positions between the primary points, resulting in only eight. The
secondary points can be thought of as both specific points midway between the two primary points and as a range between the two primary points. For example, *Te Alunga Tonga* refers to the specific point dissecting *Te Alunga* and *Te Tonga* as well as the full spectrum between *Te Alunga* and *Te Tonga*.

Lehman and Herdrich (2002:181, also see Feinberg n.d.a.) have written about the conceptualization of point fields in Samoa, noting that boundaries such as those delineated by the eight primary points are not axiomatic. Rather, each of the eight secondary points indicates a point field comprising the space that surrounds the specific point in each case. The actual boundaries are inferred from the adjacent point fields. These point fields would be infinite, if not for the abutting adjacent point fields creating the boundaries.

#3 – Thirty-two Named Wind Positions [Fig. 20]

Examining the figure, there appear to be sixteen tertiary points which fall between the eight primary and eight secondary positions. These points follow a naming convention similar to the secondary points in that they are a combination of the names of the two adjacent points. For example, the position between the primary point *Te Alunga* and the secondary point *Te Alunga Tonga* combines the two into *Te Alunga Alunga Tonga*. Whether these positions include both the specific points and the ranges between primary and secondary points as in the previous example, is not specifically addressed.

The resemblance of the wind compass to the magnetic compass begins to emerge as they both have thirty-two distinct points (eight primary, eight secondary, and sixteen tertiary), and they have similar patterns of naming convention, with compound terms
used to describe points between primary points and between secondary points and primary points.

Fig. 20 Thirty-two Named Wind Positions (Vaka Taumako Project website)

#4 – Sunrise & Sunset Positions [Fig. 21]

This diagram is the first of a series which overlays other natural phenomena onto the wind compass. This shows the positions of the rising and setting sun on the island of Taumako throughout the year. It is from this diagram that we get our first hint that unlike the magnetic compass, the Taumako wind compass is not oriented toward north (at the top), but rather toward east. It is common for the direction of the rising sun to be a prime indicator of direction throughout the Pacific voyaging communities. And linguistically, the Taumako refer to the east as “up,” and the west as “down.” With that in mind, we see
that this diagram is coded to show that when the sun rises in the direction indicated by the number 1, it will later that day set in the direction indicated by the number 1, and so on. However, this represents a model which is inconsistent with the movements of the sun. For example, the diagram shows that when the sun rises in the east, it sets in the northwest (1), and when it rises in the south-southwest, it sets in the west-northwest (4). This is not astronomically accurate.

#5 – Seasons & Calendrics [Fig. 22]

This diagram demonstrates the dominant wind direction for two specific seasons of the year. (Note: it does not evenly divide time using the circle.) There are four
time periods shown (unequally represented), but the wind is more reliable when it blows from the shaded areas than the intervening ones. The website indicates the tradewind season is from June 21 (solstice) to September 21 (equinox). During this time, the winds blow predominantly from between the northeast and the south. The cyclone season, when the westerly winds blow, is from December 21 (solstice) to March 21 (equinox). During this time, winds blow from between the southwest and the north.

#6 – Strong & Mild Winds and Special Winds [Fig. 23]

This diagram elaborates the winds more fully. Within both the tradewind and cyclone seasons, there are both strong and mild winds which blow from the directions indicated. There is a small discrepancy between the diagram and George’s description,
Fig. 23 Strong & Mild Winds and Special Winds (Vaka Taumako Project website)

with the diagram showing the cyclones blowing from Te Hakahiu through Te Tokelau Palapu and the verbiage saying that those winds blow from Te Hakahiu Laki through Te Tokelau Palapu. The descriptive material does not explain the timing any more than can be seen on the diagram.

In addition to the yearly pattern of tradewinds and westerlies, there are two “special” winds which appear and are recognized by the particular ways they behave. The first is known locally as Te Vaka Vei. The words on the diagram [Fig. 23] read “Special strong wind that slowly decreases as it shifts from Te Palapu to Te Tokelau during December.” This wind initially blows hard—about 35 knots or more—from the
north. Over a span of about two weeks, this wind shifts slowly counterclockwise to the northwest, decreasing its strength as it passes from *Te Palapu* to *Te Tokelau*.

The second of the special winds is *Te Vaka Haipula*. The words on the diagram [Fig. 23] read “Special strong wind that slowly decreases as it shifts from *Te Palapu* to *Te Hakahiu* during December.” Its pattern is similar to *Te Vaka Vei* in that it begins with a hard wind—about 30 knots or more—but this time from the northwest. It also diminishes as it traverses the horizon in counterclockwise fashion over a period of about two weeks, from *Te Tokelau* to *Te Hakahiu*. When the wind reaches *Te Hakahiu*, it has diminished to approximately 20 knots and it is safe for canoes to sail.

George asserts that these special winds are common to the Reef Islands and that there are other special winds to be found in the Reefs as well as other areas, depending on their geography. While some special winds may be common throughout islands of Temotu Province, not all the islands may experience them simultaneously, as it takes a while for wind to traverse from one island to another.

#7 – *The Man Pushing the Wind* [Fig. 24]

This diagram offers a metaphoric picture of how the winds shift around the horizon throughout the seasons and between seasons, showing the arms of a man literally pushing the wind. George describes it on the website, but its meaning is obscure. It says that the man pushes the wind counter-clockwise in an effort to resist the wind’s tendency to rotate clockwise. In the previous description of special winds, both *Te Vaka Vei*, and *Te Vaka Haipula* are said to begin strong and then diminish as they traverse
Fig. 24 The Man Pushing the Wind (Vaka Taumako Project website)

clockwise. So it is not clear whether the wind is moving clockwise or
clockwise, if it moves clockwise except in the case of “special winds,” or what the
impact is of the Man Pushing the Wind on the general wind pattern.

#8 – Celestial Bodies [Fig. 25]

This diagram shows the asterisms that are useful for navigating and their
correlation to the winds. It is perhaps the richest diagram in terms of the complex
information it stores. Once the elements are understood, it reads as a sort of text, or
almanac for reading the weather patterns. The point here is that certain asterisms are
useful during certain times of the year, when the wind tends to blow from the places
shown on the compass.
George offers a lengthy description of how to use this diagram. However, its use can be understood in several ways.

A. *It associates asterisms that are useful during certain typical wind patterns.*

For example, on this diagram, the second ring from the center, He Tum Davo (known to English speakers as Pleiades) is useful during the times of year when the wind tends to blow from the direction indicated.

B. *It shows asterisms that are not useful during certain typical wind patterns.*

The complement to the previous scenario is that of The Return of He Tum Davo, which covers a range of 90 degrees. During the time of year when the wind tends to blow from this direction, He Tum Davo is not visible—it is below the horizon.
C. *It suggests further information.*

There is an overlap between A and B. He Tum Davo is used for navigation during the period when it is not visible above the horizon in this way: both He Tum Davo and the asterism on the inner circle, Hakangi, are both searched for when the wind blows from between *Te Tokelau-Tū* and *Te Alunga*. According to George, when the two asterisms become visible over the horizon (which occurs annually) the pair of asterisms, referred to as Hetu e Lua (the star couple) usher in the westerly winds. Oddly, she refers to the westerly winds as the “winds of rising” and says that the season when they occur is called *Te Ngatae*. However, *Te Ngatae* is the season when winds blow primarily from the east. Her meaning is not clear.

D. *It suggests additional constructs.*

Like constellations everywhere, these asterisms are visualized as figures in the sky, such as a bird, a crab, or people. These visual constructs are often developed into mnemonics to remember various predictable aspects of natural phenomena. For instance, the sixth ring from the center, Takelo, is the asterism which Westerners know as Orion’s belt, but Taumako know it as three people paddling in a canoe. Taumako know that when Takelo is visible, there is an extra dry reef during the daytime. However, because Takelo is visible most of the year from Taumako, it is not clear how this information is distinguishable.

The diagram on Celestial Bodies indicates a complex interplay of asterisms and winds and their implied seasons. George notes that more features will be added to the
Taumako wind compass in the future; at the time of this composition, this is the extent of its development.

**An Alternative Interpretation of Vaeakau-Taumako Navigation**

Over nine months in 2007 and 2008, Richard Feinberg collected ethnographic data from people of Taumako and the surrounding area. Among his primary sources was Chief Kaveia, widely considered to be the most able navigator on Taumako until the time of his death in 2009.

When Kaveia was a young boy, his father died and he left Taumako for Pileni, a Vaeakau island west of Taumako. He reported that during his early years, he spent a lot of time sailing around the Santa Cruz region and eventually returned to Taumako. He learned navigational skills from his brother-in-law and others on Pileni and elsewhere in Vaeakau. He professed a love of the sea from the time that he was very young.

During most of WWII, he remained on Taumako, though he did some voyaging during those years. Around 1950, he signed on as a deck hand on a motor-sail ship and spent three years sailing around the eastern Solomons and Vanuatu. The ship’s owner and captain was Fred Jones. At the time he signed on, Kaveia did not speak any Pijin or Pislama (languages combining a largely English vocabulary with an Oceanic grammar and phonology); but Jones spoke Taumako. Eventually, Kaveia learned his second language. During his three years on the ship, he got to several ports in Vanuatu but
apparently did not venture much farther; he says he did not get to Australia, Fiji, New Caledonia, Polynesia, or even the central and western Solomons.

Kaveia reported that shortly after he got back to Taumako, he was appointed paramount chief by a priest from the Reefs who visited Taumako and was troubled by the fact that the Duffs had no paramount chief.

Other navigators, while not as skilled as Kaveia, are also experienced and have their own perceptions of navigational techniques. Some are of Kaveia’s generation or a little younger, while some are much younger and less experienced. Among the most skilled navigators in the region (as identified by Kaveia) are George Tavake, Shadrack Tuinamo, Clement Teniau, and Joseph Laki. George Tavake, originally from Pileni, now lives on Ndeni and learned from his father, the renowned Basil Tavake. Shadrack Tuinamo, also from Ndeni claims to have learned from many different instructors. Clement Teniau is originally from Nukapu and also now lives on Ndeni. He is a contemporary of Kaveia, and the two of them learned much of their navigational skills simultaneously and (according to Teniau) learned from each other as well. Joseph Laki is from Nupani and now lives in the village of Minevi, on the island of Temotu Neo, a small island next to Ndeni. He is about the same age as Kaveia and says he learned maritime arts from Basil Tavake.

The next tier of Vaeakau-Taumako sailor-navigators includes Jonas Holani, Nathaniel Leiau, Abraham Maone, Moses Mēmuana, Walter Latao Poniei, Peter Taea, and Roy Voia. Others with less experience sailing traditional canoes but declaring a keen interest include Fox Boda, Allen Ioki, William Keizy, Ini Taupea, Luke Vaikawi, and
Mostyn Vane. Much of what these voyagers understand about the Vaeakau-Taumako navigational techniques is information passed on to them by Kaveia. Since these individuals are now the ones who will pass on this knowledge to the next generation, their knowledge is also important.

Based on the accounts of these indigenous navigators, an image of Vaeakau-Taumako navigational techniques emerges which differs from George’s in a number of respects. It does, however, have one important element in common. George’s depiction is contextually rich, showing winds, seasons, and stars in order to paint a picture of what she calls “a navigational system.” The Taumako utilize a number of natural phenomena in order to maximize their effectiveness at sea. For this reason, it is inappropriate to describe the Taumako methods as simply a ‘wind compass’. It is clear from the numerous reports of Feinberg’s consultants that they use the wind, the waves (swells and reflected waves), the stars (including the sun), the seasons, the birds, and te lapa to inform their journeys. I characterize this array of tools as a navigational toolkit, which I represent in an inclusive diagram [Fig. 26].

I caution the reader against assuming too much precision and order upon encountering the word ‘system’ in this context. Such a word may give the impression that the Taumako envision their navigational task with a typical Western frame of mind. This confounds an understanding of their techniques. It is not that they are haphazard in their approach; on the contrary, their method is practiced consistency. But neither are they ‘scientific’ in the conventional Western sense. When a journey fails to go as planned, they deal with obstacles by intuition, relying on memories of past experiences,
Veaekaunau Navigational Toolkit

- 1a: Kau Aiona (Southern Cross) at sunset
- 1b: Kau Aiona (Southern Cross) between sunset and midnight
- 1c: Kau Aiona (Southern Cross) at midnight
- 1d: Kau Aiona (Southern Cross) between midnight and sunrise
- 1e: Kau Aiona (Southern Cross) at sunrise
- 2a: Talo (Antares) at sunset
- 2b: Talo (Antares) at sunrise
- 3a: Tio (Sirius) at sunset
- 3b: Tio (Sirius) at sunrise
- 4a: Takelo (Orion) at sunset
- 4b: Takelo (Orion) at sunrise
- 5a: Taawava at sunset
- 5b: Taawava at sunrise
- 6a: Hotumadvo at sunset
- 6b: Hotumadvo at sunrise

Fig. 28 - Veaekaunau Navigational Toolkit
tales told by other navigators, and a general sense of how various local phenomena can be trusted to guide the way to safe harbor. This can be compared to observations of navigating and fishing techniques used by various Pacific Islanders: they utilize a complex process that combines cognitive, visual, auditory, and kinesthetic ways of knowing about numerous elements of the environment into an integrated and holistic assemblage (Genz n.d.; Lauer and Aswani 2009; Feinberg and Genz n.d.). Westerners tend to rely on formulaic approaches to learning such methods. But much like the sea captain who has many years of experience behind him, the Taumako have an intuitive feel for the sea.

I contend that the way the Taumako navigate is not systematic in the Western sense of the word. If it were, one might expect a high level of consistency in the explanations of the phenomena and how they are utilized. This is not typically the case, as will be shown. There can be a high degree of variability in the responses given by different people and even by the same person from one day to the next. For example, reports of the direction for various winds were highly inconsistent (see Appendix A). Their methods are dependent on the situation, can vary significantly from person to person and event to event, and do not always fit into neatly organized compartments, the way we might expect of a system.

Moreover, the means by which navigators have traditionally been taught to navigate and the means by which ethnographers seek to understand that body of knowledge are vastly different. The two ways of knowing are at odds. Interestingly, the Taumako find themselves currently at a critical moment in their history when navigation
is not a lost art, but soon could be. They are hopeful that they can save it from extinction, but time is not on their side. Western scholarship is. Documenting their navigational methods for posterity as well as for the benefit of future generations in the hope that they will maintain this ancient lifeway is promising. Both the scholars and the Taumako would like for this to happen.

It is in the attempt to document these techniques that we discover how different a learning process it is to learn-by-doing, as opposed to learn-by-studying. It is a different thing to know from experience versus to know from an intellectual exercise. In other words, what may appear to be very unsystematic may in fact be a system that Western scholarship cannot easily grasp.

The Vaeakau-Taumako navigational toolkit consists of seven elements: the wind, the seasons, the stars, ocean swells, te lapa, reflected waves, and birds. Each of these is represented in the diagram [Fig. 26], and will be discussed in turn. The use of this graphic representation is intended to be stylistic only and is not related to any concepts of radiality or concentric models of space (c.f. Bennardo 2002; Bennardo 2009; Feinberg 2008b, n.d.a.). The importance of each of these elements varies from person to person and from situation to situation. They are therefore not presented in any order of importance. They are, however, presented in order of relatedness and proximity. The diagram shows Taumako at its center. The various navigational tools are depicted as emanating from the center in concentric circles.

*The wind*
The wind is an important feature of this toolkit. This representation of it [Fig. 26] differs from George’s. Whereas she explains it in precise terms, it becomes obvious from interviews that the Taumako perceive it more loosely. The conceptualization of directions taking up a range or field rather than a specific point has been described by Lehman and Herdrich (2002:184). They discuss a “point field” model which represents...

...a point with a series of vectors (possibly infinitely many) radiating outward... The field extends out indefinitely and ‘boundaries’ within such a system are not axiomatic but are derived as relationships between points. *The ‘space between’ points is always in contention and is therefore a focus of attention* (Lehman and Herdrich 2002:184, emphasis in original).

This description is apt because it illustrates the fluidity of the point-fields. This is the case with the Vaeakau-Taumako perception of wind directions.

Though Vaeakau-Taumako conceptions of space generally conform to a “container” model, Feinberg (n.d.a.) finds that the point field model is particularly relevant to wind as it applies to navigation. Specifically, he notes that the Vaeakau-Taumako wind compass has eight different wind points with both the points and the spaces between them referenced by name. But the boundaries which separate these amorphous spaces are a “judgment call.” Feinberg (n.d.a.:46) goes on to say that “one finds inconsistencies from one person to another, or even in the same person from occasion to the next, depending on his/her location, destination, prevailing and current winds, and perhaps other factors.”

The use of the term ‘wind compass’ is somewhat misleading: it is not reasonable to expect that people can identify precise points on the horizon (four, eight, sixteen, or thirty-two of them) without benefit of any reference point. Star and magnetic compasses...
both have stable reference points. But unless one is able to establish a fixed point on land or in the sky, one cannot be so exact in determining wind directions. Since the objective of the wind compass would be to navigate at sea under various conditions, such a reference would be problematic.

Based on their descriptions, ‘wind circle’ is a better term. The Taumako expression is *te nohoanga te matangi*, which translates roughly (metaphorically) to ‘the seat (or dwelling place) of the wind’. The term wind circle does not match theirs, but to my earlier point, any graphic representation of their perception of the wind is also not an exact match. Wind circle is more suitable than wind compass because while it corresponds to the drawing, it does not imply precision. Therefore, in the context of the toolkit, I refer to the wind construct as a wind circle.

Many navigators imagine that particular winds blow from precise points and not from broad ranges as is depicted in the diagram. The wind circle in the diagram allows for a range from which particular winds may blow because of the ranges given by Feinberg’s consultants. For instance, the wind *te tonga* is identified (usually by pointing) in the following ways:

- Magnetic east is about midway between *te alunga* and *te tonga* (Kaveia).
- *Te tonga* is 120 degrees, east-southeast (Joseph Laki).
- *Te tonga* is southeast (Teniau, as described on several occasions).
- *Te tonga* is south-southeast (Shadrack Tuinamo and Roy Voia).
- *Te tonga* is 140 degrees, just south of southeast (Peter Taea).
- *Te tonga* is southeast, about 150 or 160 degrees (Walter Latao Poniei).
Sailing from Taumako to Nifiloli (approximately a west-southwest heading), if the wind is *i te tonga*, it is directly off the port beam, placing it at about south-southeast (Kaveia).

Feinberg (personal communication) notes that the Taumako generally speak of the wind in such a way as to identify the place from which it blows, rather than calling the wind by name. For example, they might say that “*E noho i te tonga,*” meaning that “it dwells in the *tonga.*” They would not likely say that “the wind is *te tonga.*” The inclusion of a preposition places the wind in a spatial context. The difference is that the first example identifies the place from where the wind blows, as opposed to the second example, which names a particular wind.

*Te tonga* is perhaps the most important wind, allowing for smooth passage from Taumako to Vaeakau, a common journey for the Taumako. It is the wind which takes up the largest range on the wind circle, about seventy degrees. *Te tonga* is mentioned more frequently than any of the others because it is the predominant wind during the tradewind season (*te ngatae*), and the winds during this season are considerably more stable than during the cyclone season.

Though the above list describing the direction for *te tonga* covers a range, of the eight wind directions, *te tonga* is perhaps the most consistent. In fact, throughout Temotu Province, the direction for *te tonga* is remarkably consistent. Boerger’s (n.d.) review of wind direction vocabulary for seven languages of Temotu Province (apparently borrowed from Polynesian languages) and the corresponding directions from which those winds
blow, shows remarkable agreement among the seven with regard to *te tonga*. The other
directions show variability, but there is consensus that *te tonga* is generally southeast.

Other winds are similarly described, though none as extensively as *te tonga*. It is
from these oral accounts which I have pieced together the wind circle (see Appendix A).
It is important to understand that this wind circle is not a 100% accurate representation of
how any one Vaeakau-Taumako navigator envisions the wind. It is by necessity an
amalgamation of the many descriptions by various sources. It is unlikely that anyone on
Taumako or Vaeakau would agree 100% with this view, though it is likely that most
would agree that it is close. The value of such a diagram is its usefulness in describing
phenomena and supplying a construct for envisioning navigational tools available to a
navigator. Precision is not the goal of these navigators; arriving at their intended goal is.
This is accomplished by way of practice and experience, not a flawless tool.

The degree to which navigators of Vaeakau-Taumako rely on the wind for
navigation varies as much as any other element of the navigational toolkit. Yet for all,
there is recognition that while at sea, the wind must be checked against other phenomena,
such as the stars.

It is difficult for the Taumako to consider the wind in isolation from the seasons.
Winds tend to blow from particular ranges along the horizon during particular seasons, so
that the two concepts are inseparable. (Though winds do blow from non-seasonal
positions occasionally.) Feinberg’s consultants repeatedly refer to the best and worst
times to sail to and from particular destinations with emphasis on the season, the winds
associated with that season, and their usefulness to a sailing vessel. For instance, Kaveia
told Feinberg that during the tradewind season, the wind comes mainly from te tonga and that this is when most sailing is done from Taumako to Vaeakau.

In order to better understand the relationship of winds and seasons and how they impact sailing, it is beneficial to briefly discuss Taumako boat design. An understanding of the physical limitations of the sailing vessels used by the Taumako is important to the overall understanding of the navigational toolkit.

Taumako’s traditional sailing vessels are outrigger canoes constructed from local trees, dugout and fitted with various elements to facilitate their seaworthiness, comfort, stowage, etc. The Taumako speak often of sailing te puke, and somewhat less of sailing te alo, though Feinberg (personal communication) is inclined to believe that both have been used about equally. Te puke is larger than te alo. Because it is big, it can take a lot of sail, making it fast and able to carry a larger load. It is better able to handle adverse weather conditions and it sits high out of the water, keeping crew and cargo relatively dry. For these reasons, te puke is the preferred vessel, but sometimes there are not big enough trees available to make them. A smaller boat is better than no boat at all.

These vessels typically utilize a sail woven from pandanus leaves which have a crab-claw shape. There is some disagreement about the performance of vessels that use these sails. Some feel that this shape performs best with the wind astern because the mast comes in between the two points of the sail, distributing the wind’s force more symmetrically. Others say it performs best on a reach. These vessels sail best with a tail wind, to a point. However, if the wind is very strong, the bow will tend to plow the water. When the wind is strong, the crew is able to reduce the amount of sail, thereby
reducing the tendency to plow. These vessels also do well on a reach and can sail with the wind as close as about 30 degrees off the bow. But tacking into a direct headwind, or even sailing very close-hauled, is hard work and takes a long time. So people rarely if ever do it.

Therefore, passage in *te puke* or *te alo* is restricted by the direction of the wind. This is why being attuned to the seasons and the prevailing winds during those seasons, and knowing where destination islands are in relation to those winds is key to managing a safe voyage. In a motor boat, wind direction is not as restrictive, though even these vessels have their limitations. It pays to know the winds whenever one is at sea.

George has also outlined compound terms to identify ranges between specific points on her wind compass, such as *te alunga-tonga*. Data from Feinberg’s sources support this. However, because the eight main points are placed differently on the toolkit, those compound terms would cover ranges that are not exactly the same. While the Taumako may perceive the eight primary points to be more precisely indicated around the horizon, because this is a point-field system (Lehman and Herdrich 2002; Feinberg n.d.a.), these compound terms do indicate a range between those points. They are used the way a Westerner might use the term “north-northeast.” Technically, that would be 22.5° on the magnetic compass, though we are not likely to demand such precision. After all, the Vaeakau-Taumako wind circle has eight primary points as compared to the Western four, so it is more finely tuned at the primary point level than the Western compass. The Taumako use these compound terms infrequently and imprecisely. For example, Kaveia told Feinberg that to sail from Vaeakau to Taumako,
one sails during the cyclone season, and the best wind is *te tokelau-hakahiu*, but anything from *te tokelau* to *te laki* is acceptable.

George oriented her wind compass with *Alunga* at the top. There are reasons for this that make sense. As mentioned earlier, it is common for the direction of the rising sun to be a prime indicator of direction among Pacific voyaging communities. However, when Kaveia was asked about whether or not there was a primary point for calculating the wind compass, he indicated that there was not. All eight directions are of the same value in terms of orientation. I have drawn the diagram with north at the top since it seems to not be of consequence to the Taumako and it is significantly more readable to a Western audience.

George discussed the movement of the winds on her wind compass by using the analogy of the man pushing the wind. She suggested that there was regular and predictable movement of the wind around the horizon. Kaveia reported to George that during the cyclone season, the wind starts in *te palapu* and moves to *te hakahiu*, which would be a counterclockwise progression. Interestingly, he did not say that the wind goes to *te laki*, which would be the full span of the cyclone season winds. As for tradewind season winds, he said that there is no regular progression from *te tokelau* to *te ulu* and that the wind can come from anywhere in that range during that season. He noted that it comes mostly from *te tonga* and *te ulu*, but not much from *te tokelau-tū* or *te alunga*.

Feinberg asked Kaveia whether the Taumako perceive their wind circle as an abstract system of orientation or if the wind directions are concrete points. Kaveia’s response indicated that the Vaeakau-Taumako wind circle is conceptually similar to the
Western NSEW compass. The directions for the wind remain constant regardless of one’s position, though the directions to various places change as one moves about the Pacific [Fig. 27]. If one is on Taumako, Tikopia is more or less in the direction of *te tonga*, while if one is on Anuta, Tikopia is more in line with *te laki*.

![Fig. 27 Map of Taumako and Surrounding Area (source unknown)](image)

*The seasons*

The seasons are the only element in the toolkit that are not a distinct phenomenon perceived with the senses, but rather, a composite of other phenomena that are classified in the mind. People who live in the Pacific are well attuned to the rhythm of the annual seasons. These seasons correspond to weather patterns which are important regardless of voyaging proclivities. It is useful to be aware of the timing of the seasons in order to be informed of the accompanying weather phenomena while at sea.
Two separate elements of the navigational toolkit are closely tied to the seasons: the wind and the ocean swells. This is because, unlike the seasons which come to mind in Ohio, the seasons in the Pacific are based on two predominant wind patterns. The timing of these wind patterns varies from one interlocutor to another. For instance, Kaveia told Feinberg that the two seasons are the same duration: *te ngatae* from late June to late December; *te angeho* from December to June. (George’s description of the seasons indicates that Kaveia told her differently.) But another source, Clement Teniau, a respected navigator from Nukapu (a Vaeakau island), told Feinberg that from approximately April to late December (right around or a little after Christmas), is when the tradewinds blow. This is the season that the Taumako refer to as *te ngatae*. The rest of the year is the cyclone season, or *te angeho*. Both of these consultants agree that the best voyaging times are from March through December (except July and August when the tradewinds blow too hard), roughly equating to *te ngatae*, the tradewind season.

The diagram shows that the seasons, *te ngatae* and *te angeho*, each correspond to one hemisphere of the circle, and four associated wind directions. Throughout the year, it is possible that the wind could blow from anywhere around the circumference of the horizon. However, during *te ngatae*, the winds blow predominantly from the east, and during *te angeho*, they blow predominantly from the northwest. This is informative for two main reasons. First, it is a good indicator of the difficulty of sailing in a contrary direction at a given time of year. Knowledge of the prevailing wind patterns allows people to plan their journeys to take advantage of the changing wind when it comes time for them to return home. A round trip can take several months. There are plenty of good
times to sail throughout the year, but the relative ease of arriving at one’s destination has much to do with the direction of travel. Second, the constancy of winds blowing from a particular direction over thousands of miles for days on end has an effect on ocean waves. The wind persistently blows the water in the same direction, causing the water to “pile up,” and these piled up waves are what Vaeakau-Taumako navigators know as swells, or\textit{ hokohua loa}. Feeling or seeing the swells while at sea is only useful if one knows what season it is and where the wind is likely to have been blowing from for some time. \textit{Te hokohua loa te ngatae} and \textit{te hokohua loa te angeho} are both detectable at any time, but their relative strength varies with the season.

The names \textit{te ngatae} and \textit{te angeho} identify several phenomena and correspond to the direction of the prevailing winds. They name the two seasons as they occur during the year, so that during September, it is the season of \textit{te ngatae}, and in February, it is \textit{te angeho}. They identify the directions from which the prevailing winds emanate during those seasons, meaning that a wind from \textit{te tonga} is also a \textit{ngatae} wind, and a wind from \textit{te laki} is also an \textit{angeho} wind. Finally, the names correspond to the ocean swells which are caused by those prevailing winds. The ocean swells are called \textit{te hokohua loa}, and there are two kinds: \textit{te hokohua loa te ngatae} and \textit{te hokohua loa te angeho}.

When Kaveia was asked about the regularity of the movement of the wind during the seasons, his answers were incongruent. He told Feinberg that movement of the wind during \textit{te angeho} is regular and predictable, starting strong in January and becoming very strong in February. Hurricanes are most likely to occur in January, or even more so in February. The season begins with the wind blowing from \textit{te palapu} and swings around to
te hakahiu. He then said that te tokelau winds are strong and te palapu winds are very strong, but if the winds are progressing counterclockwise (as George indicates), that contradicts his statement that the winds get stronger between January and February. Te palapu winds should be strong and te tokelau winds stronger if progressing counterclockwise. He said that the wind is weaker through March, April, and May (for him, te angeho runs till late June), with March through May being a good time to sail. Conversely, te ngatae winds are less regular and there is no progression from te tokelau-tū to te ulu (which would be clockwise). He said that the wind can come from any place along the horizon at any time during te ngatae and that the wind blows quite a bit from te tonga and te ulu, but not much from te tokelau-tū or te alunga. (However, this is somewhat contradicted later in a description of swells, also heavily influenced by the seasons.) July and August present tradewinds that are strong enough to be potentially dangerous. This observation of the irregularity of the wind has been supported by anthropological research which asserts that periodic westerly wind reversals during the tradewind (te ngatae) season are responsible for west to east migration of Polynesians from the Asian coast across the Pacific (Finney 1985). Kaveia reported that the wind is not strong from mid to late September through December, during te ngatae season.

The stars

Stars are a favorite navigational aid of nearly all sailors. Of all the observable natural phenomena that a navigator might take advantage of while at sea, the stars are the
most stable and reliable. They may not always be visible. But when they are, if the
navigator knows the celestial patterns, he can be assured of his heading.

The Taumako are not known for using stars extensively. This may give the
incorrect impression that they do not consider the stars important. They find the stars
very important for the reason just cited. Yet there is tremendous variability in the degree
to which individual navigators make use of the stars, just as there is tremendous
variability in the degree to which they rely on each of the elements of the toolkit. Kaveia
believed it was necessary to have extensive knowledge of the nighttime sky. On the other
extreme, Jonas Holani is happy knowing only one star for navigating, though he is
perhaps more a sailor than a navigator. Most are comfortable somewhere between the
two.

Kaveia is known to have taught his disciples that knowledge of star paths was
very important. However, his knowledge of star paths was not apparent in his
conversations with Feinberg. In George’s diagram [Fig. 25], Kaveia noted the relevance
of nine asterisms, most of which were mentioned to Feinberg as well. Yet Feinberg
(n.d.d.:46) noted that when he spoke to Kaveia about the use of stars, he “tended to
emphasize two or three primary stars and seemed to suggest that other secondary stars
coming before or after were unimportant; that they were only relevant for a small part of
the night, or that they were so obvious as not to require special commentary.” It is not
clear whether this represents a deficiency in his knowledge of star paths (and whether his
knowledge was once extensive and was later lost, or whether his star path knowledge was
always limited) or if he simply had a change of heart regarding the significance of star
paths. Conversely, he may have conceptualized the movements of many stars in terms of the movements of just a few.

The Taumako use the stars for two purposes. First, they serve as orientation. If a navigator finds himself turned around and disoriented at sea, the absence of landmarks can present a hazard. Other phenomena, such as wind and swells are also used for reorientation. Some navigators, such as Clement Teniau, are more comfortable using swells than stars because they perceive swells as highly stable and reliable, whereas the stars move around all night. Yet most navigators find stars to be at least a comfort, knowing that the sky’s patterns are eminently trustworthy. Some less experienced sailors, such as Mostyn Vane and Fox Boda consider the stars to be the primary navigational tool. However, even those who prefer the stars for orientation are sometimes forced to use other means when the weather is uncooperative.

The second purpose of stars is to guide navigators to their specific destinations. Stars are guides to islands, but there can be variation to these guide stars depending on season and winds. For example, when sailing with a wind directly astern, one would aim toward a star that sets directly over an island, but if sailing with a wind to port, one would sail toward a star that sets to the left of the island, or aim to the left of the guide star to account for inevitable leeway. Should the winds change, as winds are prone to do, adjustments may be needed in the use of stars as guides.

Additionally, one might reasonably expect that a guide star has to rise or set over a particular island in order to be useful. But this is not necessarily the case. If one habitually sails to a destination at the same time of year and under similar conditions, it
can be expected that stars will appear in relation to destination islands in familiar patterns. In other words, if one habitually sails toward an island, one becomes accustomed to sighting stars as they rise and fall along the horizon at predictable distances from the destination island. One can aim toward the island knowing that a star should align on a point on the canoe that is not the bow. In this way, many stars are useful as guides without aligning with a particular island.

The diagram shows stars as the outer-most ring, because they are the most distant phenomenon. The stars shown are examples of commonly named stars and their approximate rising or setting points. These rising and setting points vary slightly throughout the year and the times at which they rise and set vary significantly throughout the year. Many stars are not even visible for much of the year. Because particular destinations are consistently sailed to at approximately the same time of year, these variations are not a hindrance.

Roy Voia of Pileni noted that stars do not have to be low in the sky to be navigationally useful. For a navigator who knows the sky well, the identification of one star makes it possible to identify the placement of others. And it is not necessary to know the names of stars in order to make use of them. Again, if a navigator knows the sky well, he can make use of many stars which he may not be able to identify by name.

While there is flexibility in the system, the Taumako are accustomed to making use of well worn patterns of navigation. They are capable of dealing with adversity at sea, but the universe of destinations, conditions, and distances traveled is confined to a small enough lot that they do not find themselves extensively tested. So, for example,
they consider the guide star to Nifiloli to be Talo, which does not set directly over Nifiloli, but rather to the left (i.e., south) of it. This is consistently effective because they regularly travel there at a time of year when the winds are blowing from *te tonga* and push the vessel to the right of the guide star, right on track for Nifiloli.

Both Shadrack Tuinamo and Jonas Holani proposed to Feinberg that Vaeakau-Taumako navigators of the past had much more extensive knowledge of navigating in general, and the stars in particular. Much of this knowledge has been lost as a result of modern influences. And the hold on this knowledge was always tenuous: while many people in island communities are skilled sailors, skilled navigators are typically few.

*Swells*

Vaeakau-Taumako sailors recognize three kinds of waves, or *hokohua*. One of these, chop, or seas, is caused by localized winds and is not useful for navigational purposes. Another is ocean swells, which the Taumako call *hokohua loa* ‘long waves’. These are waves that traverse great distances and are caused by prevailing winds. The third is reflected waves, waves that “bounce off” an island.

All of these waves can be seen as well as felt. One must become adept at differentiating one type of wave from another, but this seems to come quickly to those who spend time at sea. What does not seem to come as quickly is the ability to “feel” the waves. All seem to start out by seeing the waves, which works well during the day. But to be a skilled navigator, one must be able to feel those waves for night sailing. This takes more experience.
Swells, or *hokohua loa*, are caused by seasonal winds. As previously mentioned, the constancy of winds blowing from a particular direction over thousands of miles for long periods causes the water to “pile up.” The winds tend to blow from the east during the season known as *te ngatae*, the tradewind season, and from the northwest during the season known as *te angeho*, the cyclone season. While it is possible for the winds to blow from anywhere around the circular horizon, they tend to blow most consistently from *te tonga* and *te alunga*, respectively, during *te ngatae*, and from *te tokelau* and *te palapu* during *te angeho*. (This differs from what Kaveia reported about wind directions during *te ngatae* earlier, though it is consistent with Feinberg’s (personal communication) observation.) Therefore, *te hokohua loa* is known to come in two varieties: *te hokohua loa te ngatae* and *te hokohua loa te angeho*. In figure 26, the swells are shown in the circle beyond the seasons because they are so closely associated with the seasons.

The result of this regularity is that while at sea, one can make use of the pattern of swells to recognize changes in localized winds. If the local wind does change, that change will be apparent when compared to the more stable swells. This is especially useful when there are no other visible cues, such as the stars. Clement Teniau prefers to use *te hokohua loa* as a guide rather than the stars because, “The stars move around; the waves are always there” (Feinberg and Genz n.d.:14).

The swells do change direction, but the shift cannot be abrupt. Even if the Taumako were to sail longer distances (which they seldom do) and experience a change in the swell direction, there would likely be an opportunity to verify the change based on the movement of the sun, moon, or stars.
Te lapa

Te lapa is a challenge to describe. It would be tempting to ignore it as a navigational aid because it does not conform to any scientifically documented phenomenon. However, it is most definitely part of the Vaeakau-Taumako navigational toolkit, and many navigators swear by it. Genz et al (2009) encountered a similarly vexing phenomenon in Micronesia. A particular reflected wave pattern identified by Marshallese navigators could not be detected with instruments or explained by researchers. Such failure to verify these wave patterns had no impact on consultants who were able to use these seemingly non-existent patterns to find their way. The authors were left to conclude that the Marshallese navigators have “alternative ways of conceptualizing the ocean that do not easily fit within a scientific framework” (Genz et al. 2009:220). This explanation fits te lapa.

Te lapa has been described as “like underwater lightning,” and many of Feinberg’s consultants told him that it looks just like lightning. The comparison to lightning is probably due to it appearing as a streak of light in the darkness of the ocean. Some (Kaveia, Abraham Maone, and Jonas Holani) have noted that the streak is a straight line, more like a flashlight beam, and not a zigzag. Te lapa points to an island. It is used by navigators to identify the location of islands while at sea. Lewis (1994 [1972]), the only Western scholar who has documented the use of te lapa, used the term “deep phosphorescence” to describe it and said that it appeared from one to twelve feet below the surface. This account differs from those who spoke to Feinberg. All agree that it appears at or near the surface of the water.
Feinberg (n.d.b.) himself was unable to witness te lapa. In his many conversations with his sources, he indicated his frustration and told them that he had never been able to see it when on a ship. It was a common refrain from these consultants that the deck of a ship is probably too high above the water for good observation of te lapa. Also, the speed of travel and the turbulence caused by a ship were thought possibly to interfere with te lapa viewing. If these observations are accurate, they may go a long way toward explaining why Westerners have had so little luck experiencing te lapa. However, Feinberg (personal communication) notes that people have also had trouble sighting it from a motor canoe, a vantage point which would hamper the “too high” conjecture, but not the “speed” or “turbulence” explanations.

There is variation among the islanders as to the distance at which one can expect to see te lapa. However, there are some consistent patterns to their perceptions. Te lapa is primarily a homing device. It is shown in figure 26 as the first of three homing tools used by the Taumako. There is a range where it is most useful, typically about sixty to eighty miles away from one’s destination, perhaps less than that. If one is sailing to an island that is approximately sixty to eighty miles from the origin island, there will be difficulty seeing te lapa until one has sailed far enough away from the origin island to eliminate the interference from that island. Once one gets within about twenty miles of the destination, te lapa is no longer helpful.

Shadrack Tuinamo, from one of the Vaeakau islands, commented that te lapa starts small, gets big, then gets small again as one traverses toward the destination island. In other words, the intensity of te lapa is at its peak at a certain distance out from the
island, and farther and closer from that distance, the intensity diminishes. Kaveia suggested that the intensity of *te lapa* corresponds to both distance and the size of the island to which it points.

One might expect that while out at night, it is possible to be within ideal *lapa* range for more than one island simultaneously, and therefore, to see *te lapa* for more than one island. Kaveia reported that this is common. If there are multiple islands, one must know in advance the relative positions of the destination islands in order to distinguish *te lapa* for one island from *te lapa* for another. There are no distinguishing features differentiating *te lapa* for the various islands.

Despite the fairly general agreement that *te lapa* is best observed a few dozen miles from its island of origin, there are a few outliers. Kaveia reported instances when he had used *te lapa* to sail much greater distances. For example, he reported using it to find his way from Santa Cruz to Santa Ana, approximately 300 miles away. This apparent discrepancy can be accounted for when considering that many sources note that the usability of *te lapa* varies with sea conditions. Some indicate that dark and stormy seas produce the best conditions for seeing *te lapa*, while others say dark calm seas are best.

With all the discussion among Feinberg’s sources about *te lapa*, one could get the impression that it is a very important navigational tool. To be sure, there are some who would say so. However, on one particular nighttime voyage made specifically for the purpose of studying *te lapa*, Feinberg (n.d.b., n.d.c., n.d.d.) discovered that no one other than the captain, Teniau, had ever seen *te lapa*. Feinberg and four others spent a fruitless
night in search of the elusive *lapa*. Feinberg (n.d.b.:16) notes that although he is not quite ready to give up on *te lapa*’s existence, “it is hard to see how a phenomenon so rare and hard to find could be a dependable navigational tool, particularly in an emergency situation—precisely when it would be most necessary.” It is a topic which, without any scientific understanding of the phenomenon, can take on the character of folklore. *Te lapa* remains a mystery.

*Reflected waves*

Reflected waves are another important tool for navigation. They differ from swells in the way they are seen or felt. Reflected waves are useful because they indicate the presence of landforms which the ocean swells are hitting and reflecting back out to sea. They are shown in figure 26 as the second homing tool, just beyond *te lapa*.

Two things are important with regard to waves in general. First, one must be able to distinguish the various types of waves. For example, even though chop is not telling, it is important to recognize that it is chop and not reflected waves. Second, it is important to have a mental picture of what landforms make up the “reflectors” along the way. Certainly, the reflected waves can be an excellent homing indicator if one can detect them, guiding the vessel to landfall. However, other landforms to either side of the path of a vessel can inform the navigator as he makes his way to his destination. One has to know the relative position of the destination to avoid confusion caused by reflected waves from a different island.
Reflected waves are used in much the same way as *te lapa*: for homing in on an island. The range is similar, or maybe a little less than *te lapa*, with a maximum range of twenty to thirty miles out from an island. These waves are smaller, weaker, and harder to detect than swells. Clement Teniau suggested that the closer one gets to an island, the bigger and stronger will be the reflected waves, though they are never very strong out at sea.

There are many names used to describe reflected waves. People in the Duff Islands tend to call them *te hokohua ttuki* (sometimes pronounced *te hokohua ssuki*). Some Taumako say the expression refers to the way the waves ‘bang’ into the hull of a vessel, *ttuki* being one term for a banging motion. Others identified the “proper” Taumako term is *te hokohua te kaenga*. People from the Vaeakau islands call reflected waves *te hokohua potopoto* (sometimes pronounced *te hokohua poroporo*), literally ‘short waves’.

*Birds*

Awareness of seabirds and their feeding patterns is such common knowledge among Pacific Islanders that it is unremarkable. Such knowledge is also indispensable at sea—it can mean the difference between wandering aimlessly and making landfall. Nearly all sea voyagers make use of birds even when they are not “lost.” Birds provide an accurate homing mechanism for the navigator who has sailed within the feeding range of certain seabirds, but is still beyond sight of the island. When a vessel is adrift,
knowledge of birds can be a lifesaver. Birds are shown on the diagram [Fig. 26] as the last circle of homing tools, just beyond reflected waves.

It is not enough simply to be aware that birds are helpful. One must be adept at recognizing what particular birds look like, how they sound, and what their feeding patterns are. Feeding patterns include the time of day when they are likely to feed, so that one knows whether the birds are flying out to feed, flying back to the island to nest, or simply flying around looking for food. It is also useful to know what the typical feeding range is for various birds. When a navigator sails to a point where he should expect birds and there are none, he should suspect that something is amiss.

According to Kaveia, there are many different birds that can be used to indicate land at different times of day because of the various feeding patterns that each displays, with the most useful times generally being at dawn and sunset. This is why it is important to be able to distinguish the different species. Whether one is closing in on the destination before dawn, mid-day, or at sunset, there is information in the sky for those who can read it.

The types of birds typically used by navigators include te mounga, te ngongo, te kovaa, te kotaha, and everyone’s apparent favorite, te tavake, ‘the tropic bird’. Shadrack Tuinamo, while commenting on the usefulness of birds, noted that te tavake comes in two varieties: te tavake toto (red), and te tavake tea (white). The two make very different calls, and those calls beckon to the approaching vessel, telling the navigator which way to go.
Kaveia recalled a particular journey when he was a young man traveling from Taumako to Pileni. He remembered the winds, the waves, *te lapa*, and the birds. He remembered that before dawn, they could hear the calls of *te tavake* and could follow the sound. The birds, *te mounga* and *te ngongo*, were seen at dawn and led to way to Pileni. When he later returned to Taumako, the same birds were used to show the way home.

*Composite*

I have teased apart the various tools found in the Vaeakau-Taumako Navigational Toolkit in order to detail how each is used by navigators. Of course, none is used in isolation. The degree to which individuals utilize these tools varies from one person to the next and from one day to the next. It is a very fluid framework which offers multiple options for multiple situations.

In order to convey how the pieces of the toolkit are combined into a comprehensive navigational tool, I will offer a few examples of how these elements are holistically perceived.

These examples are taken from Kaveia’s lengthy description of how to use the toolkit, addressing when to sail from where to where, what winds blow then, and what stars to follow. A few excerpts from his discussion follow.

- During *te ngatae* season, the wind generally comes from *te tonga*, and the most important navigational constellations are Talo, Tino, and Takelo (Feinberg n.d.c.:180).
• If sailing from Taumako to either Utupua or Vanikoro, go *i te angeho* and follow Te Kau Akona (the Southern Cross). The wind should be from *te palapu* or *te tokelau-palapu*. The Southern Cross sets between Utupua and Vanikoro—somewhat west of south. The outrigger is kept to the side of the canoe the wind strikes. If the wind is coming from *te tokelau* or *tokelau-palapu*, the outrigger is to starboard. When going to Utupua, point the bow to the west of the Cross. If the wind is coming from *te palapu*, the outrigger is to port and the bow is again pointed to the right (west) of the Cross. But when going to Vanikoro, point the bow to the east of the Cross (Feinberg n.d.c.:180).

• To sail from Vaeakau to Taumako, travel during *te angeho* season. Follow the stars Takelo and Tino. The best wind is *te tokelau-hakahiu*, but anything from *te tokelau* to *te laki* is acceptable. With any of those winds, one follows the same stars (Feinberg n.d.c.:181).

Abraham Maone feels that he is a capable navigator, able to reorient himself at sea after becoming disoriented for whatever reason. He does this by using a range of tools which include stars, winds, swells, reflected waves, and *te lapa*. He does not see any one of these as more important than another; instead, he sees them as “all same-same.” When one is not available, he looks for others. For example, if he cannot see the stars, he attends to the wind. If the wind changes, he knows it because he keeps track of the direction of swells (*hokohua*). Upon approaching an island, he becomes aware of its presence by the reflected waves (*hokohua ssuki*). *Te lapa* is also important when approaching an island, but of course, only at night.
Shadrack Tuinamo describes what navigating a typical voyage was like for him. He says that if he is sailing and the wind changes, he is aware of the change because he is also looking at the stars or the wave patterns. If he is close to an island and the wind is coming from the direction of that island, he may opt to paddle to the island if it is near. However, if it is too far away, he opts to turn around and go back because it is too difficult to paddle a large voyaging canoe into a headwind. This demonstrates why it is so important to know the wind circle and its relation to swell patterns and stars. A navigator must know where the wind is coming from and which islands can be reached given the existing wind. He must know which stars come up in te palapu or te tokelau-tū or te alunga. Without knowledge of all the directions and associated waves and stars, a navigator is not safe at sea.

These are just a few examples of navigators describing the integrated use of the tools in the toolkit. These examples were chosen because they were clearly described, but the sentiment is common among navigators in the region. Each of the tools has its strengths, but the true strength of the Vaeakau-Taumako Navigational Toolkit is found in the array of tools available to inform the navigator during myriad circumstances.

*How to use the Vaeakau-Taumako Navigational Toolkit*

Here are a few examples of how a navigator might use the toolkit, based on actual descriptions given by Feinberg’s consultants.

Sailing from Taumako to Vaeakau, the toolkit diagram [Fig. 26] indicates that the heading would be west-southwest. September to October (during te ngatae season) is the
best time according to Kaveia (and Feinberg notes that May and June also offer prime winds for this trip). This is because the wind is relatively stable, but not too strong; and it comes from *te tonga*, which means running before a tail wind to the port side of the stern. The most important navigational constellations are Talo, Tino, and Takelo, with Talo being the guide star to Nifiloli, for example, though it sets to the left (south) of Nifiloli. With the wind in *te tonga*, the heading is toward Talo and the wind will push the canoe toward Nifiloli.

According to Teniau, a return voyage to Taumako normally takes place during a three-month period between December and March. Any time during that period is acceptable, as long as one is careful about the weather. (Kaveia disagreed and said that February is not a good month for sailing anywhere; Teniau acknowledges that February is problematic, but sails with caution. This discrepancy can be accounted for by noting that Kaveia’s sailing range is typically significantly greater than Teniau’s, causing him to be at sea much longer and allowing more time for the weather to change.) In any case, this voyage takes place during *te angeho*. Kaveia identified the best winds as *te hakahiutokelau*, putting the wind just port of astern, but he also said that any wind from *te tokelau to te laki* is acceptable. The guide stars, regardless of wind, are Takelo and Tino.

Kaveia described sailing to Tikopia and Anuta, though he also indicated that these were not places to which people normally voyaged from Taumako. His description is hypothetical, which helps to illustrate how the toolkit can be utilized to make passage even to a place where a navigator has no experience sailing. He said that sailing to either Anuta or Tikopia, one would travel during *te angeho* season. For Tikopia, the best winds
are *te palapu, tokelau-palapu, or tokelau*. The guide star is Tino, which Kaveia said has its zenith directly over Tikopia. For Anuta, the season and winds are the same, but the stars are different, with Hetumdavō or Hakangi as guide stars.

In all instances, as one closes in on the destination, *te lapa*, reflected waves, and finally birds, will assist the navigator in locating the island. In this way the diagram of the Vaeakau-Taumako navigational toolkit, though not a precise instrument, can assist in conceptualizing the many methods available to a navigator for making safe passage.
CHAPTER V

Comparison

Practical Similarities & Differences of Compasses

All three types of compass discussed in this thesis are based on naturally occurring phenomena: the magnetic force at the North Pole, the recurring star patterns, and the regular wind patterns of the Pacific. But there is a significant difference between the magnetic compass and the star and wind compasses. A magnetic compass is a physical device which responds to the earth’s magnetic pull. The other two devices need not be physically represented at all in order to be useful and neither responds to corresponding phenomena the way that a magnetic compass responds to magnetic north. Whether humans are able to sense magnetic north without benefit of such a device is in dispute (Finney 1995). Regardless of whether it is possible to do so, Finney (1995:500) notes that “standard analyses of noninstrument navigation by such expert wayfinders as Pacific island seafarers allow no role for magnetoreception.” Without a magnetic compass, one who depends on magnetic north for wayfinding is at a loss.

This is not the case with star and wind compasses. The stars are readily seen by the eye and the wind is readily felt by the skin, as well as “seen” via streamers, seas, and
spray. Therefore, the star compass and wind compass are not physical devises. They can be physically represented on paper (or as devices), as has been done in this thesis in order to communicate their structure. But for the people who use these constructs, that structure lives in their heads. These are classic examples of mental constructs designed to provide an understanding of a particular domain of knowledge: navigation. A discussion of mental constructs follows later in this chapter.

These three types of compass are all well-suited to the purpose for which they were designed. Mariners who depend on any one of them are generally known to be successful navigators. That is the ultimate test of whether a construct has value. It would be tempting to compare each of the three types of compass and rate them according to their effectiveness. However, each type is used in a particular environment, each with its distinctive resources and limitations. If each type is eminently effective in the environment in which it was developed, such a comparison is specious.

There are obvious ways in which these constructs differ from one another. This is perhaps where we find ourselves tempted to make judgmental comparisons. With the exception of the occasional shift in the position of the earth’s magnetic pole (unlikely to occur in any particular navigator’s navigating life) the magnetic compass is not susceptible to change. North is consistently in the same place. This is very helpful when at sea without any differentiation in the sky or on the water. Additionally, a magnetic compass can be used in any weather, day or night, though it does require a light source on a dark night. The ready availability of this information source can be a significant convenience factor.
The star compass is likewise not susceptible to change, if one stays close to the equator. Even away from the equator, the shift in position of the stars is regular and predictable. However, the stars become less useful to a navigator as they move away from the horizon and out of line of sight. This is especially true as one moves away from the equator because the stars make an arcing motion across the sky toward the nearest pole. Should a navigator fix his heading on an arcing star, he will steadily drift off his intended heading.

There is also the inconvenience of having the stars be visible only at night. The sun is a star visible in the day, but for the reason just mentioned, it is only useful near sunrise and sunset. The moon poses similar constraints, and is occasionally not visible at all.

Finally, clouds can be an obstacle to making any use of celestial bodies. For this reason, knowledge of weather patterns and the likelihood of clear skies is regularly employed so that there will be a safe journey.

A wind compass is obviously the least stable of the three in that winds shift, and at sea, there may not be a reference point to be certain from where, along the circular horizon, the new wind is coming. However, that particular view of the “weakness” of the wind compass does not negate the wind as an important source of information. While there may indeed be no visual reference point for gauging a shifting wind, there are palpable reference points. Winds from particular directions have particular properties. To the untrained, these differentiations mostly go unnoticed. It is as if wind is bland and tasteless to those who do not “know” it. But for those who rely on the wind, a shift is
accompanied by a shift in the wind’s characteristics. When the wind shifts direction, its flavor alters as well. While these shifts are often detectable, their detection is not instantaneous and precise. For this reason, the wind’s relationship to other phenomena (swells, stars, sun) can be important. Most Pacific navigators are attuned to many different pieces of information and appear to sense changes in wind as if by osmosis.

In comparison with the other types of navigational indicator, wind has the advantage of not requiring a certain time of day to be useful; it requires no flashlight to see it at night; and it does not disappear below the horizon. It does, however, stop blowing from time to time. This poses a problem separate from wayfinding. Without wind, a sailing vessel cannot sail. This problem is not unique to those who utilize a wind compass. All sailors eventually deal with the frustration of being becalmed. Yet for the sailing vessel, the stagnancy of no wind presents an additional problem should the current carry the boat off course: it can be difficult to judge directions when the wind picks up again.

One last point about how these constructs compare: in the current era, it is common for individuals who have never seen the sea to be aware of modern navigational devices which offer extraordinary precision. Standard issue global positioning systems (GPS) are available to the buying public for both marine and land navigation. I have used a GPS device when sailing. These devices, though not perfect, are accurate enough that one could start from anywhere in the world and sail directly to a position the size of a basketball. That is extraordinarily precise. Can a magnetic compass direct a navigator with that degree of precision? No, not consistently. What about the star compass or wind
compass? Probably not. Is it necessary to have this level of precision when sailing toward a destination the size of a small island rather than the size of a basketball? Rarely, if ever. Plus, even though a GPS device is helpful and potentially lifesaving, it is not practical in remote areas where the ability to maintain such high-tech units and keep them supplied with batteries is extraordinarily difficult.

The point is that all of these systems get the job done nicely under most circumstances. If you need to find a storefront on a busy street, the wind compass may not be adequate. But that does not mean that under normal circumstances, it is less than adequate for navigating the Pacific.

The biggest disadvantage of star and wind compasses is the extensive training and practice required to make effective use of them. Magnetic compasses and GPS devices require comparatively little learning to get a navigator to his destination.

**Cognitive Similarities & Differences of Compasses**

“Undeniably, a great deal of order exists in the natural world we experience. However, much of the order we perceive in the world is there only because we put it there” (Holland and Quinn 1987:3). The cognitive constructs that have been developed to assist navigators in their wayfinding activities exist because someone sought to order natural phenomena in such a way as to be able to manipulate them mentally to facilitate the decision-making necessary for competent interaction with the world. These models
are all abstractions, different from each other, yet similar in critical ways, and with the same general purpose.

Cognitively, there is an obvious similarity between the three constructs of magnetic, star, and wind compass. The fact that we refer to each of them as a compass attests to that. Each is a circular depiction of the earth’s surface (in the context of this thesis, the ocean’s surface), with the observer in the center and the horizon around the circumference.

Each of the three types of compass indicates regular (though not necessarily equidistant) points along the horizon. It is common for there to be 32 points on a compass. Frake (1995) questions why it is common for 32 points to appear in the directional schemes of seafarers across the world. He argues against any historical connections that suggest borrowing. Instead, he offers a practical explanation. First, it is the natural outcome of simply dividing a circle in equal halves sixteen times that 32 points are produced. Dividing the circle in half once, twice, four, or eight times also gives an equally divided circle, but lacks the specificity that 32 points offers. To split the 32 points again and create 64 points would likely be overkill. Yet the more obvious reason for 32 points on a compass is that when an average sized man holds his fist out at arm’s length, the width of his fist is about eleven degrees. The math works out to 32 points on the horizon that are about a fist’s width apart from each other (Frake 1995:156). This makes a handy reference point.

Having 32 points is common, but not universal. Many exceptions have been presented. The number of reference points on a navigational compass corresponds to the
number of reference points that those who use it find necessary. That variation is attributable to a number of factors: distances typically traveled, number of destinations regularly visited, and navigational factors which may help or hinder the navigational process (such as visible landforms, the use of multiple devices, etc.).

In addition to the commonality of 32 points, many compasses recognize cardinal, secondary, and tertiary directions. The extent to which a compass utilizes compound terms to identify reference points is related to the extent to which those who use it find such differentiation necessary. As previously indicated, if fewer reference points are required, all three levels may not be considered.

One way in which the stars and the wind differ from each other as mechanisms for cognitive construction is that the wind only blows from one place at a time (though the wind can swirl). It is temporally singular. Conversely, the stars are numerous. And they are often grouped together in clusters in order to form recognizable patterns. In fact, there is a clear connection between the indistinctiveness of individual stars and what the untrained person might perceive of wind. One star looks more or less like any other. One wind feels like any other. It is only when a star is combined with other stars or other phenomena and made to paint a picture that any individual star becomes recognizable. Likewise a wind can be understood in the context of the seasons and the swells, informing a learned navigator and providing the orientation needed to set a course.

Additional Factors
It is easy to look at the use of compasses in isolation and assume that their effectiveness is limited because of the many factors which may inhibit their use. However, no competent navigator sets out on a sailing voyage with only one trick in his bag. As I have stated repeatedly in this thesis, there are many other sources of information which a successful navigator uses to make his way to his destination. Further, there are particular sources of information which are more or less useful depending on the environment. A navigator sailing on a dark night without a flashlight or a match is going to find his magnetic compass much less useful than the stars. If clouds obscure the sky, orientation by celestial bodies will be problematic. And when the wind fails to blow, it does not matter what device is used for wayfinding to a vessel with sail power alone. But when the wind begins to blow again, the navigator must know where he is and how to proceed to his destination.

It is not appropriate to consider any one wayfinding technique to be the only technique that a navigator would use, and therefore, to judge it on the basis of how likely it is to meet all his needs. All navigators use a variety of techniques. Some are better suited than others to certain geographical environments, times of day, weather conditions, and proximity to geographical features. Selection of an appropriate wayfinding technique does not depend on viability per se. They are all viable. The choice depends on the tool’s suitability for the task at hand.
CHAPTER VI

Summary & Conclusions

Overview

As we have seen, some non-instrument techniques are universal among voyagers across the Pacific, and perhaps around the world. For instance, proximity to land favors techniques that make use of the nearby land formation. These techniques include reading the waves reflecting off the land, assessing the flight patterns of birds which feed at sea during the day and nest on land at night, and studying cloud formations that tend to develop over land masses.

However, the diversity of conditions around the globe has given rise to a variety of wayfinding techniques. It is perhaps no coincidence that the magnetic compass took root among Europeans (who not coincidentally had access to metal), where, since the 1500s, sailors have tended to sail large swaths of the earth’s open oceans, often well off the equator. The utility of the skies or wind as mental constructs for wayfinding would be challenging under these circumstances. And prior to the invention of the magnetic compass, no doubt the skies and wind were more relied upon for bearings. For the needs
of a vessel spanning the globe, a magnetic compass offers better compatibility with the environment than the star or wind compass.

Wayfinding techniques can almost be plotted using a Venn diagram. Some constructs are probably common to all seafarers, some are common to most, and some are known to only a few. And the ones that are employed by only a few are employed to varying degrees depending on their particular circumstances. The more the construct conforms to those circumstances, the more it is employed.

The navigators of Vaeakau-Taumako make use of many non-instrument techniques. The wind compass is simply one of their tools, and their voyaging community is among a scattering of Polynesian communities who make use of it. Throughout Polynesia and the Polynesian Outlier communities, there are various examples of wind compasses. These constructs conform in that wind names are isomorphic to directional names. They differ in the amount of detail they contain, how reliable the winds are in the region, and the correlation of winds with other natural phenomena including the extent to which other phenomena are used to confirm the readings of wind direction.

Further Investigation

This thesis attempts to explain the Vaeakau-Taumako wind compass as a cognitive construct. It compares the Vaeakau-Taumako wind compass to other wind
compasses as well as star compasses and magnetic compasses. It seeks to explain how each is a cognitive framework for navigation. In addition, it explains that the people of Vaeakau-Taumako employ not just a wind compass, but an entire suite of navigational tools in order to maximize their effectiveness at sea.

George’s wind compass diagrams are very precise and wind-based. She has developed a suite of diagrams which does not fully coincide with Taumako descriptions of their navigational perceptions. As a representation of navigational concepts for communicating Vaeakau-Taumako navigational methods to future generations of navigators, George’s model is at best cumbersome, and at worst, incorrect.

The alternative model presented in this thesis fits into the broader system of Vaeakau-Taumako navigation. The wind compass is not a precise instrument, nor is it necessarily the primary tool used for navigation. It is part of a comprehensive navigational toolkit utilized by the Vaeakau-Taumako. As a cognitive construct for communicating Vaeakau-Taumako navigational methods to future generations of navigators, I propose this model with the expectation that it will successfully communicate the rudimentary elements of navigation and complete Chief Kaveia’s mission.

It would be advantageous to share this newly developed construct with the people of Vaeakau-Taumako in order to ascertain if it comports with their perceptions and if it effectively communicates the essential elements of navigation. The ultimate test of this toolkit’s efficacy is whether or not it is used and promotes seamanship and navigational acumen. A long-term monitoring of this would be beneficial.
In addition, there is the potential opportunity to explore this toolkit’s applicability to other voyaging traditions. For instance, it may have enough in common with Anutan navigational methods to warrant adaptation. As a construct, it may be useful in communicating concepts and promoting the retention of navigational knowledge among other Pacific islanders.

On the wish list of research that would be useful would be biological data which might indicate any neural processing differences between the groups of navigators. For instance, it would be interesting to know if there are developmental differences between communities, or between navigators and the rest of the population in any one community. It would be exciting to understand what is taking place in the brains of navigators as they are doing the work of reading the world around them and tracking their progress toward a destination. For instance, Feinberg and Genz (n.d.) have written of a particularly puzzling interaction with the navigator Teniau from Nukapu Island in the Outer Reefs. Despite Teniau’s apparent navigational expertise—he is a respected navigator in his community and consistently arrived at planned destinations—he nonetheless made many apparently contradictory statements to Feinberg. These reports were both inconsistent with information given by other sources and often inconsistent with Teniau’s own earlier statements. Feinberg has struggled to make sense of these discrepancies, but perhaps normal ethnographic techniques cannot uncover what is going on. It seems that Teniau himself was not able to describe what was occurring in his own mind (or body) though he is a very capable navigator.
Unfortunately, the opportunities for administering fMRI tests on navigators while at sea are non-existent. But further research into the neurological activities of people with exceptional wayfinding capacities would do well to explore the individuals who navigate the Pacific in order that we may better understand their specific realm of expertise.
APPENDIX A

Oral Accounts of Winds

Each of the points of the wind circle has been estimated based on statements made by Feinberg’s consultants.

**te alunga**
- Magnetic east is about midway between *te alunga* and *te tonga* (Kaveia).
- *Te alunga* is just north of east, at about 80 degrees. (Teniau).
- *Te alunga* is due east (90 degrees) (Teniau).
- *Te alunga* is just south of due east (Teniau).
- *Te alunga* is east (Teniau and others).
- *Te alunga* is due east (90 degrees) (Shadrack Tuinamo).
- The sun rises from *te alunga* (George Tavake).
- The sun rises in *te alunga* (Roy Voia).
- *Te alunga* is 80 degrees (Joseph Laki).
- *Te alunga* is northeast (40 degrees) (Peter Taea).
- *Senake* (equivalent of *te alunga*) is sunrise (just south of east) (Walter Latao Poniei).

**te tokelau-tū**
- The alignment of Utupua to Taumako is toward *te tokelau-tū* (Kaveia).
- *Te tokelau-tū* is just about due east (Teniau).
- The alignment of Taumako to Samoa is toward *te tokelau-tū* (Kaveia).
- *Te tokelau-tū* is east-northeast (approximately 60 degrees) (Teniau).
- *Te tokelau-tū* is just north of northeast (Shadrack Tuinamo).
- *Te tokelau-tū* is northeast, about 40 degrees. (Teniau and others).
- *Te tokelau-tū* is 45 degrees (Joseph Laki).
- *Te tokelau-tū* is northeast (Roy Voia).
- *Te tokelau-tū* is north-northwest, 340 degrees (Peter Taea).
- *Te tokelau-tū* is 40 degrees (Walter Latao Poniei).

**te palapu**
- *Te palapu* is east-northeast, about 60 degrees (Teniau).
• *Te palapu*: Northeast (approximately 45 degrees) (Teniau).
• *Te palapu* is southwest (Teniau and others).
• *Te palapu* is approximately 20 degrees (Teniau).
• *Te palapu* is just west of north (Shadrack Tuinamo).
• *Te palapu* is approximately 40 degrees (Teniau).
• *Te palapu* is north-northeast, about twenty degrees. (Teniau).
• *Te palapu* is about north (Roy Voia).
• *Te palapu* is 10 to 20 degrees (Joseph Laki).
• *Te palapu* is west-northwest, 300 degrees (Peter Taea).
• *Te palapu* is just about north (0 to 10 degrees) (Walter Latao Poniei).

*te tokelau*
• *Te tokelau* is just about due north (Teniau).
• *Te tokelau* is due North (0 degrees) (Teniau).
• *Te tokelau* is toward Tinakula (which would be south from Nukapu) (Teniau and others).
• *Te tokelau* is west-northwest (Shadrack Tuinamo).
• *Te tokelau* is directly toward Tinakula (north-north west at about 350 degrees) (Teniau).
• *Te tokelau* is about northwest (Roy Voia).
• *Te tokelau* is 320 degrees (Joseph Laki).
• *Te tokelau* is west, 260 degrees (Peter Taea).
• *Te tokelau* is about 340 degrees (Walter Latao Poniei).

*te hakahiu*
• *Te hakahiu* is about 330°; approximately west-northwest (Teniau).
• *Te hakahiu* is southwest (Teniau).
• *Te hakahiu* is toward Temotu Neo (south-southeast) (Teniau and others).
• *Te hakahiu* is toward the point at the north end of Temotu Neo (almost directly west at 270 degrees) (Teniau).
• *Te hakahiu* is west-southwest (Shadrack Tuinamo).
• *Te hakahiu* is about west (toward Tinakula) (Roy Voia).
• *Te hakahiu* is 270 degrees (Joseph Laki).
• *Te hakahiu* is southwest, 240 degrees (Peter Taea).
• *Te hakasiu*: (equivalent of hakahiu) is northwest, about 320 degrees (Walter Latao Poniei).

*te laki*
• *Te laki* is about 250 degrees (Teniau).
• If you are on Anuta, Tikopia is more or less toward *te laki* (just south of southwest) (Kaveia).
• *Te laki* is due west (270°) (Teniau).
- *Te laki* is southeast (Teniau and others).
- *Te laki* is just south of southwest (Shadrack Tuinamo).
- Tinakula is *i te laki* from Nukapu (just south of southwest) (George Tavake).
- Tinakula is *i te laki* from Nukapu (just south of southwest) (Teniau).
- *Te laki* is southwest or south-southwest, about 215 degrees, or possibly as far west as 225 degrees (Teniau).
- *Te laki* is about southwest (Roy Voia).
- *Te laki* is 220 degrees (Joseph Laki).
- *Te laki* is 200-220 degrees (Peter Taea).
- *Te laki* is west-northwest, about 280 degrees (Walter Latao Poniei).

**te ulu**
- *Te ulu* is about 170 degrees, just east of south (Teniau).
- *Te ulu* is south (180 degrees) (Teniau).
- *Te ulu* is east-southeast (Teniau and others).
- *Te ulu* is south (Shadrack Tuinamo).
- *Te ulu* is directly toward Lata Station, just east of south at about 170 degrees. (Teniau).
- *Te ulu* is 180 degrees (Joseph Laki).
- *Te ulu* is south (Peter Taea).
- *Te ulu* is straight south (Walter Latao Poniei).
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