WARD H. GOODENOUGH

8. Navigation in the Western Carolines

A Traditional Science

THE ATOLL DWELLERS OF MICRONESIA are ocean voyagers, unlike the inhabitants of Micronesia's few high islands. In the atolls, knowledge of how to build seaworthy sailing canoes and how to navigate from tiny place to tiny place over fairly long distances of open sea has been actively maintained for centuries as vital to successful life. Somewhat different systems of navigation are used in each of Micronesia's three atoll regions: Kiribati (formerly Gilbert Islands), the Marshall Islands, and the Western Caroline Islands (map 1).

Best known to students of Micronesia's cultures is the system used by navigators in the Western Caroline Islands—the great chain of atolls that lies between Pohnpei (formerly Ponape) in the east and Yap and Belau (formerly Palau) in the west, a distance of over a thousand miles. Throughout this region the same basic system has been in use, with local schools differing only in ways that are not crucial to successful voyaging. Navigators, moreover, all of whom are men, have to observe food taboos that result in their eating separately prepared food in their boathouses. Visiting navigators from other atolls dine with them there, so there is opportunity for exchanges of information and displays of knowledge. Such exchange is facilitated by there being a chain of closely related dialects, neighboring ones being mutually intelligible (or very nearly so) over the entire area. Navigation has been developed here, even in the absence of writing, to a high degree. Like any practical science, its application is an art, requiring both knowledge and skill.[1]

The Star Structure

Fundamental to the system of navigation is the "star structure" (*paafúú*), as it is called. Seen near the equator, stars appear to rotate across the heavens from east to west on a north-south axis. Some rise and set farther to the north and others farther to the south, and they do so in succession at different times. The "star structure" divides the great circle of the horizon into thirty-two points. Polaris, just visible, marks north, and the Southern-Cross in upright position marks south. Other points, while conceptually equidistant, are named for the rising and setting of stars, whose actual azimuths of rising and setting are not equally spaced. Frake

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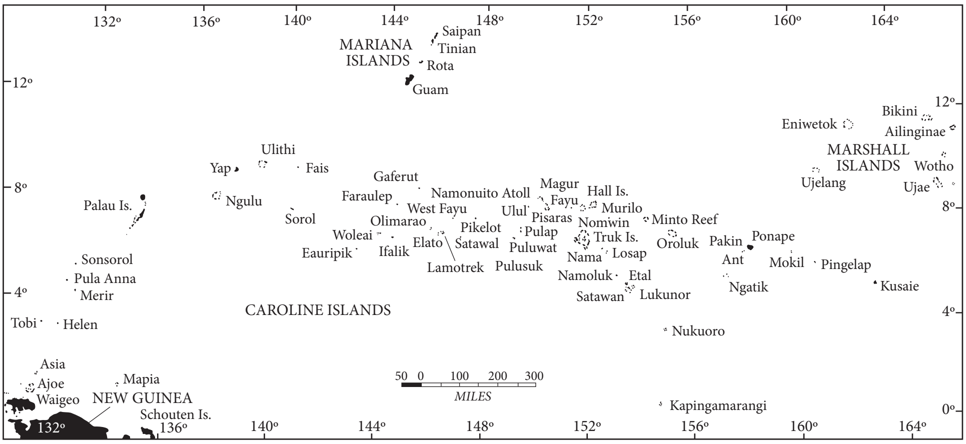

MAP 1 Carolinian navigator's world.

(1994) has observed, therefore, that the stars do not physically mark the points in the "star structure"; rather, they name them.

These thirty-two points, like the points on the European wind rose, form a conceptual compass and serve as the directional points of reference for organizing all directional information about winds, currents, ocean swells, and the relative positions of islands, shoals, reefs, and other seamarks. Every point has another that is conceptually diametrically opposite to it. These diametrical opposites are seen as passing through a point at the center of the compass, and a navigator thinks of himself or any place from which he is determining directions as at this central point, just as western navigators do when using a magnetic compass. Thus whatever point a navigator faces, there is a reciprocal point at his back.

Although navigators represent the thirty-two points of the sidereal compass as equidistant for instructional purposes, there seems to be recognition that the stars that name them are not evenly spaced at their points of rising and setting. Beta and Gamma Aquilae, which are very close to Altair, are omitted from some exercises, the compass being reduced in them to twenty-eight points. To use the stars effectively as directional guides requires either that sailing directions reflect empirical observation or that navigators take account of the difference between the observed position of a star and the position of the point on the compass to which it gives its name. On the basis of the evidence so far available, it seems that the former alternative is more probable. In the absence of writing and accurate maps, the discrepancies between the system as ideally represented and the sailing directions as empirically established are

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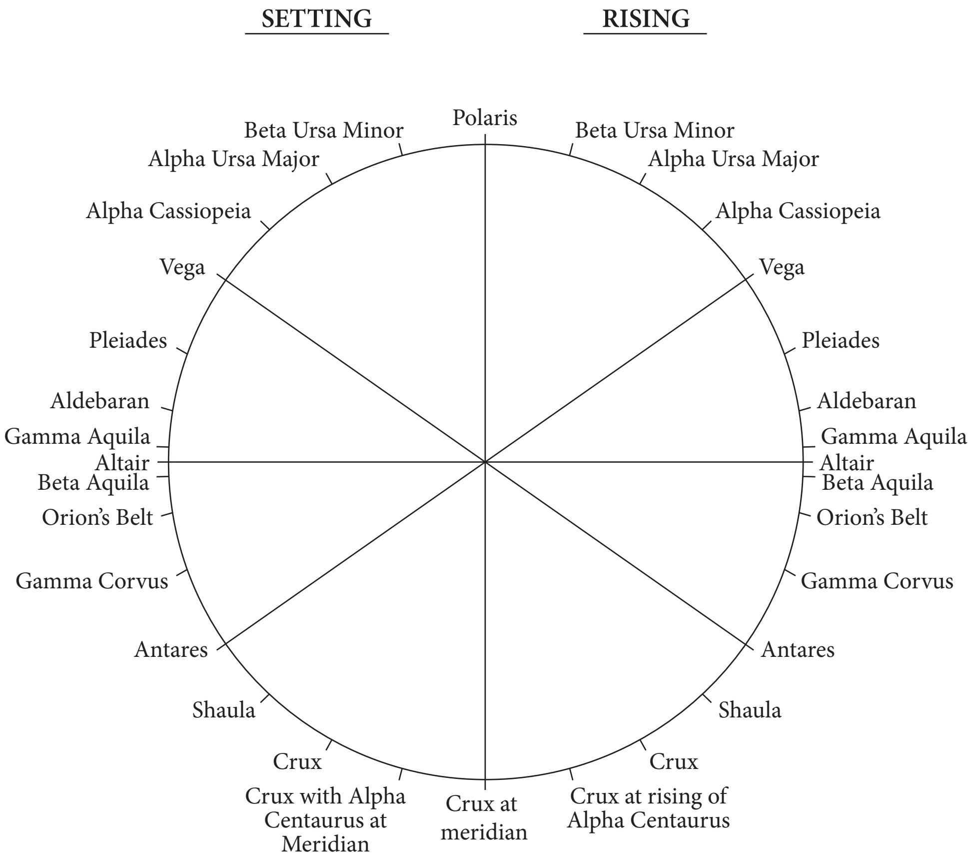

FIGURE 1 The "star structure" (sidereal compass).

not likely to be a matter of concern. The "star structure" is represented in Figure 1 as a compromise between the ideal and the real, showing points as diametrical opposites but bringing them as close as allowed to their actual degrees of azimuth at rising and setting.

A student first learns the compass points. Then he learns their reciprocals. For every pair of reciprocals he learns what other reciprocal pair lies at right angle to it. A compass star on one's beam can thus serve as a guide when the star on which one's course is set is not visible. Navigators develop a feel for the angular distances from one to another of all the points on the compass, just as we develop a feel for the angular distance of numbers on a clock face in describing directions. This feel enables them to maintain a course at the appropriate angle to any visible compass star or other star that "follows the same path" as a compass star. They can

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do the same thing with reference to any other phenomenon, such as an ocean swell or seasonally prevailing wind, whose compass direction is known.

Sailing Direction Exercises

All sailing directions are memorized in relation to the sidereal compass or "star structure." So are the relative locations of all places of interest, including such seamarks as reefs, shoals, and regions with distinctive marine life. After learning the "star structure," including its pattern of diametrical opposites, students begin to learn all this information regarding the relative locations of islands and sea marks. Navigators have developed a variety of exercises as aids in memorizing and remembering this large body of information.

The most important set of exercises (figure 2), called "Island Looking" (*woofanú*), takes all the known islands as points of reference and for each one the student goes around the compass naming the nearest places that lie along each radius (or very close to it). Navigators say that "Island Looking" is fundamental in their repertoire of knowledge.

Another exercise requires giving the names of all the "sea roads" (*yelán metaw*) or "sea directions" (*yitimetaw*) between various islands and reefs along with the reciprocal star directions on which they lie; and yet another requires naming the "sea brothers" (*pwiipwiimetaw*), the roads that lie on the same reciprocal star directions. An exercise called "Breadfruit Picker Lashing" (*fééyiyah*) uses as metaphor the breadfruit-picking pole (*yiyah*). In this exercise, one imagines reaching out with the pole along a given star course and picking off in succession all the islands and reefs that lie along it to the end of what is known, then turning and doing the same from that point along another course to its end, and so on until one has picked off all the places, real or imagined, in one's repertoire. Two other exercises, "Reef Hole Probing" (*yaaruwóów*) and "Sea-bass Groping" (*rééyaliy*), involve chasing a fish from island to island, each one cryptically identified by the name of a hole in one of its reefs to which the fish goes. These reef hole names provide a set of esoteric names, known only to navigators, with which they can discuss sailing among themselves without others present knowing what they are talking about.

In all such exercises the navigator follows a course from his home island to the one from which the exercise begins and then proceeds according to a set pattern from one place to another. The pattern may be to box the compass, as in "Island Looking"; to go in a series of zigzags, as in "Reef Hole Probing"; or to follow a main course northward, go east or

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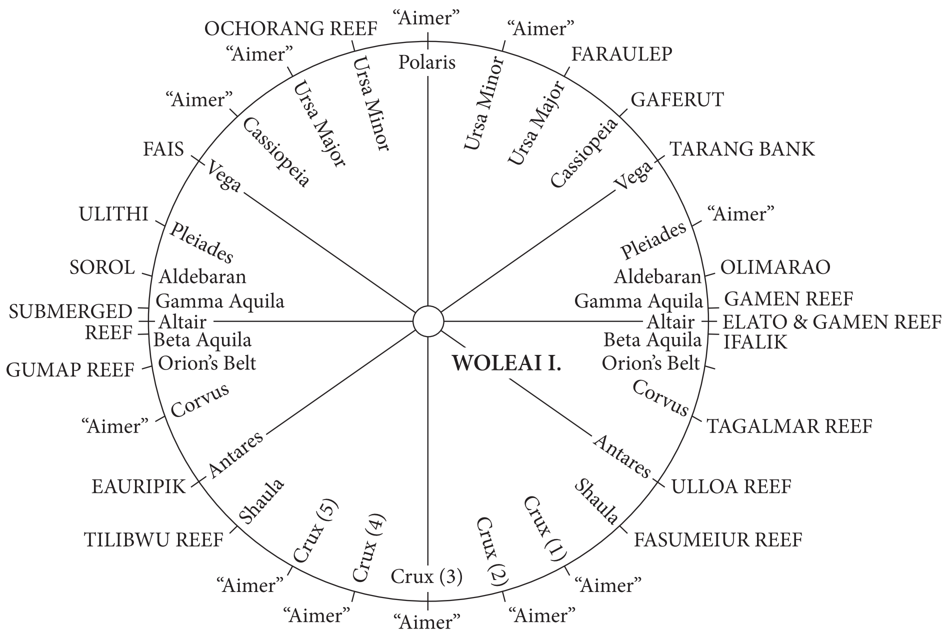

FIGURE 2 "Island looking" exercise, naming places and "aimers" (living sea marks) as one looks out from Woleai Island.

west from it, and then back at a series of points along it, as in an exercise called "Sailing of the Red Snapper" (*herákinimahacca*).

Living Seamarks

"Aimers" or "aligners" (*yepar*), as the Carolinians call them, are living seamarks (*pwukof*) associated with particular areas in the vicinity of islands or midway between them. They consist of such things as a tan shark making lazy movements, a ray with a red spot behind the eyes, a lone noisy bird, a swimming swordfish, and so on. Each has its own name and is to be found in a particular drag on a particular star course from its associated island, often on a course along which no island lies. No one sails to find them; rather, one hopes to encounter one of them when one is lost. They serve as a last hope for the navigator who has missed his landfall or lost his bearing, enabling him, if he is lucky enough to encounter one, to align himself once more in the island world. When doing "Island Looking" exercises, advanced students include these "aimers" among the locations to be named in boxing the compass from a given island.

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Keeping Track

A major problem for dead reckoning sailors is to estimate distance traveled and keep track of where they are in regard to their course. To do this, Carolinian navigators use what they call "dragging" or "drags" (*yeták*). It involves using a place other than one's destination as a point of reference. If you are traveling from Boston to New York, for example, Albany as point of reference lies to the west of Boston at the beginning of the journey and north of New York at the end of it. As you travel from Boston to New York, Albany moves in relation to where you are through several compass directions from west, to west northwest, to northwest, to north northwest, to north. The intervals between these changing compass directions divide the journey into four legs, as we would call them. In just this way, the Carolinians see the place of reference as being "dragged" through the intervening directions of their sidereal compass as a voyage progresses. The number of direction intervals through which the place of reference is "dragged" comprises the number of "drags" (legs) in the voyage.

Thus the course from Puluwat to Tol in western Truk, 160 miles away, is almost directly east on the "rising of Altair" (map 2). Pisaras lies 120 miles northeast of Puluwat on the rising of Vega and a like distance from Tol on the setting of Vega. During the voyage from Puluwat to Tol, Pisaras is "dragged" from the rising of Vega through the rising of Cassopeia, the rising of the main star in Ursa Major, the rising of Kochab in Ursa Minor, Polaris, and on through the settings of Kochap, Alpha Ursa Major, and Cassopeia to the setting of Vega, dividing the journey into eight "drags" of roughly twenty miles each. Estimating the headway he is making, a navigator keeps track of his progress from drag to drag. As sailing conditions change, he adjusts his reckoning of progress from one drag to the next. Such reckoning greatly facilitates keeping track of overall progress and expectation of landfall.

Every course between two islands has an island or seamark of reference that serves to divide the journey into "drags." Ideally, the end of the first "drag," called the "drag of visibility" (*etákinikanna*), should come when the island of departure is no longer visible, and the next drag, the "drag of birds" (*etákini maan*), should end at the most distant point at which land-based birds feed at sea. Similarly the next to last begins where birds again appear and the last when the island of destination becomes visible. These correlations are understood to be rough, but are useful in that a navigator knows from his estimation of the number of "drags" traveled when he should soon be sighting land-based birds and when he should be able to see his destination. If these signs fail to appear when he has reason thus to expect them, a navigator knows that he is off course.

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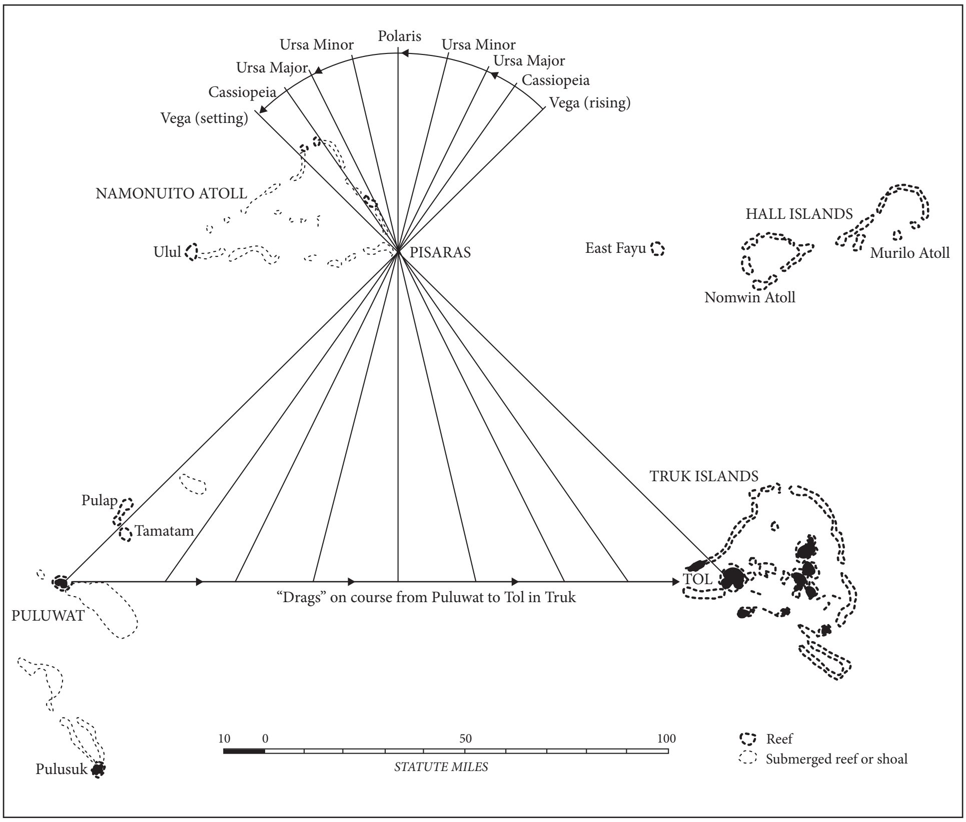

MAP 2 "Drags" on course from Puluwat to Truk.

Imaginary places can serve as points of reference for "dragging" as readily as real ones. All that is required is a convenient set of assumed compass directions to it from islands of departure and destination. For the voyage north from the Carolines to Guam and Saipan, there are no conveniently located islands. Here "ghost islands" and "aimers" are used as reference.

Schematic Mapping

Without maps or charts, navigators must devise ways of constructing mental equivalents. "Trigger Fish" (*pwuupw*) is the name for one such way of conceiving the geography of the navigator's world. It envisions the locations of five places. Four of them form a diamond to represent the head, tail, and dorsal and ventral fins of the trigger fish. The head is always the eastern point and the tail the western one. The dorsal and ventral

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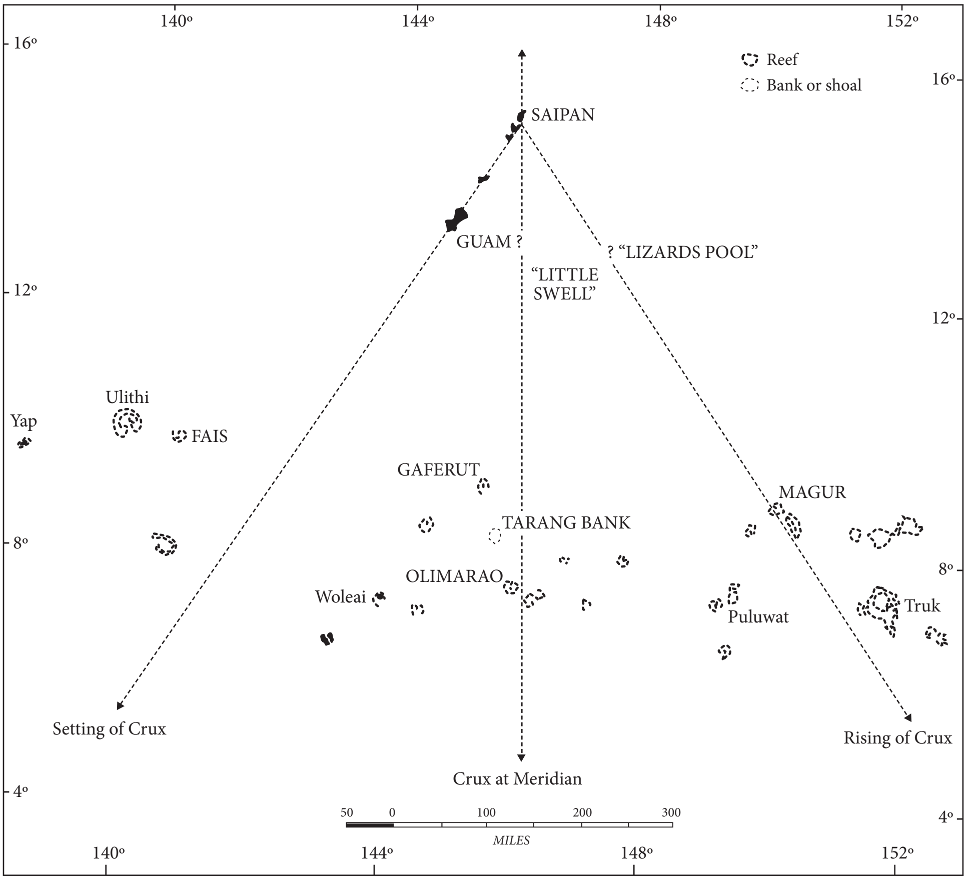

MAP 3 The "great trigger fish" (Fais and Magur tail and head, Gaferut and Olimarao dorsal and ventral fins) with its northern flip (places in capital letters) as located on the map (see fig. 3).

fins can serve either as northern and southern or southern and northern points respectively. The fifth place, at the diamond's center, is the fish's backbone. Any islands (real or imaginary), reefs, shoals, or living sea-marks whose relative locations are suitable can be construed as a trigger fish. On a course between the dorsal and ventral fins, the head can serve as the reference island and the backbone marks midcourse. Trigger fish may be arranged so that the northern point of one is the southern point of another, or the backbone of one is the southern point of another.

"Great Trigger Fish" (*pwuupw lapalap*) are large-scale schematic maps. Of special importance is the one that has Magur and Fais (650 miles

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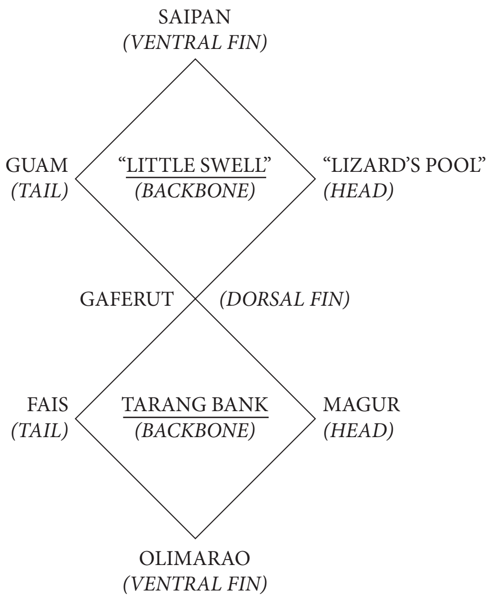

FIGURE 3 Carolinian's schematic representation of linked "trigger fish" (in this case the "great trigger fish" and its northern flip; see map 3).

apart) as head and tail, and Gaferut and Olimarao as dorsal and ventral fins (map 3). As one looks south from Saipan, the rising of the Southern Cross, named "Trigger Fish," lies almost directly over Magur, the head, and sets a bit east of Fais, the tail. Sailing south from Saipan or Guam, if a navigator keeps his course within the rising and setting of the Southern Cross, he will end up in the heart of the Caroline Island chain, with its many reefs, shoals, and other seamarks of which he has knowledge.

In one scheme, the northern flip of this great trigger fish has Gaferut as dorsal fin, Saipan as ventral fin, Guam as tail, and the imaginary place "Lizard's Pool" as head (figure 3). A set of lesser overlapping trigger fish involving a series of "ghost" places lying east and west of this north-south course between Saipan and Gaferut provide a series of reference points for dividing it into a convenient number of "drags."

Predicting the Weather

Prevailing weather conditions are equated with the "months" of a sidereal calendar. Although called "moons" (*maram*), they are not lunar months. In most calendars there are twelve or thirteen months of unequal length, each named for a star. A month begins when its star stands about 45 degrees above the eastern horizon just before dawn, when to look at it one

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must tilt one's head back to where one feels a roll of skin forming at the back of the neck. The month continues until the next month star reaches the same position.

A weather predicting system, called "storming of stars" (*mworenifúú*), involves the rising of storm stars and the first and last five days of the lunar cycle. Within the span of each month, one or two storm stars make their appearance in the east just before dawn. If there is one such star in the month, there will be stormy weather during the first five days of the next new moon in the west. If there are two such stars in the month, stormy weather will come during the last five days in the lunar cycle after the heliacal rising of the star.

More immediate weather conditions are forecast from the color of the sky at sunrise and sunset and from the shapes of clouds. Large cumulonimbus clouds, "house of wind" (*yimwániyang*), are believed to store up wind. If they are visible at dawn or dusk, a navigator expects the wind to come from their direction.

Putting the System to Work

It is one thing to learn the "star structure," sailing directions, sea-lane directions, and "aimers" and to become adept in the exercises and drills involving them. It is another thing to put it all to work in actual practice. The stars are not visible by day, the sky may be overcast at night, and the sailing directions in the exercises are, at best, only to the nearest compass point. Conditions vary with the seasons. To use the system, a navigator must rely on what he can actually see. He must also learn how to adjust the sailing directions in the light of his and his fellows' experience.

Ocean swells are a crucial guide in sailing. Navigators recognize up to eight different swells, one from each octant of the compass. Most dependable are those from the north, northeast, and east, associated with the tradewind season (our winter). During our summer, swells come from the southeast and south. The different swells have characteristic intervals. Navigators use opportunities to check the direction of swells against the stars. They then maintain course at the appropriate angle to the swells. When swell systems move across each other, they produce an effect somewhat like that of converging wakes of motorboats, forming an alignment of peaks or "wave nodes" (*pwukonó*) by which to steer. "Wave Nodes" is, indeed, the name used in reference to the whole body of knowledge relating to the interaction of currents, swells, and winds.

Currents reveal themselves by the shape of waves and ripple patterns. These patterns vary according to whether the current is going with the wind, across it, or against it, and according to their set in relation to the

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direction of swells. They make a significant difference in how one selects a course on the star compass. When setting out from an island, one uses an alignment of landmarks astern (*fótonomwir*) to set one's star course. A navigator should know the configuration of his home island as seen from every compass direction. On reaching the point, called "one tooth," where the island is just visible as a point on the horizon, one sights back along the bow-stern axis of one's vessel. If the island of departure lies directly astern on the axis, no compensation for drift from current is needed. The degree to which it is off, as measured by compass point intervals or their fractions, indicates to a navigator the degree of course adjustment he should make. He can measure the difference by holding out his hand at arm's length. The width of his hand corresponds rather well with the amount of arc on the horizon between adjacent points of a compass of thirty-two points.

In practice a navigator may begin with one star course and change to another at some "drag" point along the way. He adjusts for currents and changing wind conditions. Sailing against the wind may require planning a series of tacks from "drag" to "drag." In doing this, course settings from island of departure and island of destination to reference islands may help to structure the sequence of tacks. Using "drags" as a way to keep mental track of distances covered is crucial in such tacking, as when one plans to cross and recross the line of the direct course (*yallap*) from home to destination at the point where each new drag begins. Again, the set of current is critical in how far one tacks to right or left of one's true course.

Navigators must learn to make all these adjustments of course for the voyages they actually make. Years of sailing experience are necessary to develop skill as a practicing navigator. As with any other skill, not everyone is good at it.

Navigators as Ritual Specialists

Protective ritual is something else a navigator must learn. He is said to be the "father" of his crew, who depend on him for their safety and welfare. He must know how properly to invoke the patron spirits of navigation; he must carefully observe the associated taboos in regard to sex and food; he must know the spells that will prevent storms and repel sharks; and he must be able to provide his vessel with protective amulets. He and his crew must know the art of righting an overturned sailing canoe. Indeed, they may deliberately overturn it in order to ride out a bad storm without being blown far off course. In addition to all of this, it is useful for a navigator to know enough of the special rhetoric and spells associated with politics and diplomacy (*yitang*) to ensure hospitality and safe conduct for

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himself and his crew when visiting other islands. Where voyagers have kin or fellow members of their matrilineal clans, they can be relatively sure of hospitality, but otherwise they are liable to be treated with suspicion and hostility. Knowing how to interact properly with a community's official greeter of visiting canoes establishes a navigator as someone to be reckoned with and treated with respect.

Their ritual knowledge and their observance of food and sex taboos set navigators apart. They are perceived to be among the most learned and magically powerful members of Carolinian society. Having demonstrated ability on a test voyage, such as successfully making a 130-mile, direct trip from Puluwat to Satawal, a newly certified navigator is initiated (*pwpwo*) into the ranks of recognized senior colleagues (*palú*) . Thereafter, he eats in the canoe house with fellow navigators, whose food must be prepared separately for them. He has achieved the equivalent of a Ph.D. degree or a professional license to practice medicine or law in Euroamerican society.

Keeping the Knowledge Alive

As should now be clear, sustaining the total body of knowledge in the absence of writing is accomplished by organizing it, making it systematic and schematic. It is taught and learned in this organized form. Indeed, it is overlearned with the use of drills and exercises that build in redundancy and are continually rehearsed.

For memory storage, some of the lore is embedded in chants, whose metric and tonal structures provide aids to recall. These chants are often cryptic in content, requiring commentary in order to understand them. A trainee will learn the words first. Only later will his teacher supply the necessary interpretation. If a teacher should die before passing the commentary on, his pupil must make the best sense he can of the chant. In time, he will develop his own interpretation in the light of his other knowledge and experience.

It is interesting to observe that the new interpretation may be quite different from the earlier one and still be workably consistent with reality. Interesting, too, is the evident elaboration of navigational lore beyond practical requirements, involving sailing directions to many named places that no one ever visits, that lie outside the known world or in the sky world. The living seamarks represent an elaboration beyond what is empirically known, also. Navigators seem to enjoy playing with the possibilities within their system, elaborating on them both for the fun of it and in order to show off superior knowledge to one another. Thus, the practical core of the system that is empirically tested in continual application

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remains much the same among the competing "schools" of navigation.[2] They differ in their living seamarks, in their chants, in the interpretation of specific chants, in their mythology, and in their magical rituals—in those respects, in short, where difference has little or no effect on successful voyaging and is in regard to what lies beyond the means of ready empirical testing. The navigators' separate mess in the boathouse, where visiting navigators also eat, appears to have played an important role in keeping the common system of navigation shared, at its practical level, over such a wide area.

We should note, finally, that the theoretical assumptions on which the system rests are that the sun and stars revolve around the earth, which remains stationary, and that the star Altair rises due east and sets due west. That these assumptions are false within the framework of modern Western scientific understanding does not deprive the system of practical utility for their purposes nor, indeed, for the purposes of any sailor without instruments and having to navigate by dead reckoning in Carolinian waters.

Carolinian Navigation as a Practical Science

Several things stand out about Carolinian navigational knowledge. It has all the features of a practical science.[3] It contains a massive amount of discrete information, which, in the absence of writing and reference books, has to be committed to memory. The information is highly organized in a systematic way; the different ways of organizing it provide much redundancy as an aid to recall. It involves highly abstract thinking: the compass as a set of imaginary points at equal intervals around the horizon, named for the stars and abstracted from their perceived motions, but not identical with them; the use of "drags" as imaginary divisions of one's course of travel; the use of imaginary places as points of reference to calculate "drags"; and schematic mapping in the form of "trigger fish." Gladwin (1970) has called attention to the fact that navigators tested low for abstract thinking, and used this discrepancy to question whether the psychological tests in fact were testing for concrete as against abstract thinking at all.

It is also clear that Carolinian lore is based on empirical observation in its practical aspects and becomes fanciful only beyond the bounds of readily verifiable experience or practical application. We should note, moreover, that navigators are ever ready to add to their knowledge. In these respects Carolinian navigational lore is quite similar to Western practical science. Indeed, demonstration of its fundamental soundness was made by Piailug of Satawal, who successfully navigated the Hokule'a, a replica of an ancient Hawai'ian double-hulled voyaging canoe, from

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Hawai'i to Tahiti by dead reckoning alone, using only his own knowledge of seamanship and navigation as a Carolinian *palú* (Finney 1979).

There are things about this body of knowledge that have mystified some observers. Gladwin found it strange to base the system of "drags" and its use in tacking on the "concept of a moving island" (1970, 181), seeing the traveller as remaining at the center and the island world moving around him through the sidereal compass as he travels. He saw in this an example of a difference in the way human thinking may be culturally programmed; but I know of no other way to use a compass. If we speak of the direction of places changing in relation to us as we travel while Micronesians speak of places being "dragged" through different points of the compass, the figures of speech may be different, but the underlying understanding of a compass is not.

Lacking other instruments of observation, moreover, Micronesians train themselves to use their own bodies and senses far more than do Euroamericans. Piailug's ability accurately to gauge the direction and force of currents by observing faint patterns in surface ripples amazed Thomas (1987, 32). It takes a lot of practice to be able to assess distance and time of travel accurately enough to use "drags" as reference in tacking upwind. It also requires training to learn to pick up such seamarks as the surface manifestations of the presence of a submerged reef. Yet, obviously, none of these skills are beyond human perceptual abilities.

Bodies of Knowledge and Cultural Anthropology

Describing the content and organization of the many diverse bodies of knowledge that comprise human understandings is one of the workaday tasks of cultural anthropology. These bodies of knowledge range from how to make fire and catch fish to how to build airplanes and computers, from how to conduct oneself acceptably in one's family relations to how to do so in negotiating a business deal or prosecuting a legal case. Ethnography, as it is called, aims, among other things, to describe what one needs to know in order to engage with a society's members in all their activities in a manner that meets their standards of acceptable performance. Such knowledge is what is technically meant by a people's "culture." Like a language or a game, a culture is something one has to learn in order to describe it. Ethnography is, therefore, an exercise in the systematic learning and presentation of what people are expected to know. Ethnography also tries to describe how people apply and use such knowledge in the affairs of life as that knowledge constructs those affairs, including the skills that application requires and the preferred performance styles. Ethnography is as applicable to what farmers have to know, aeronautical engineers

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have to know, elementary school educators have to know, or religious specialists have to know to perform acceptably by their respective standards, as it is to what Micronesian navigators have to know to perform acceptably by theirs.

Having said this, I must add that there are relatively few ethnographic accounts of bodies of knowledge that tell us what we need to know to be acceptable practitioners of that knowledge. As I have just said, the only way to record it is for ethnographers to learn it themselves, to pass the test of acceptability, and then, having made a record of what was being learned as it was being learned (the "field notes"), to use that record to describe what they think they now know. In this way they can produce an account whose accuracy can be checked by those already knowledgeable and evaluated by those who try to use it as a guide to becoming knowledgeable themselves. Unfortunately, the customs governing dissertation research proposals in cultural anthropology are such as to steer students away from undertaking to learn and describe other systems of knowledge as a worthy end in itself. Ethnographies rarely describe activities in relation to all that one must know to perform them and all the decision points and criteria for making those decisions in the course of their conduct. But only by doing such things can we acquire good descriptions of the content of human cultures. Only by trying to do this can we confront and solve the methodological challenges it entails. Without such descriptions, however, we lack the information and the understanding that we need in order critically to examine propositions about the relation of culture to human cognition. With this last observation in mind, I ask the reader to consider if Micronesian navigation rests on mental operations of a kind with which we are largely unfamiliar or if, with better understanding of how it works, we find it represents ingenuities of much the same kind that are exemplified in the products of Western thought.

Notes

1. This chapter is adapted from a paper by Goodenough and Thomas (1987). Here, as in that paper, I try to integrate and summarize material from a number of sources. I have drawn heavily on the work of Gladwin (1970), who provides excellent information on the design of sailing canoes and on the use of "drags"; on that of Riesenberg (1972), who provides details on a number of star lore exercises and the workings of the "Great Trigger Fish"; and on that of Thomas (1987), who has greatly enriched earlier reports with information on exercises, "drags," weather prediction, reading the sea's surface, and the practical application of the formal system of actual sailing. For an earlier account see Damm and Sarfert (1935). See also Lewis (1973) and Turnbull (1991). By and large the same

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technical terms are used through all of the Western Carolines, but dialects differ. I have chosen to render them here in the dialect spoken on Puluwat Atoll, where Riesenberg worked. It is very close to that of Satawal, where Thomas studied navigation.

2. Two schools are present in Puluwat; *Wáriyeng*, "Wind Seeing," and *Fáánuur*, "Under the Banana Plant" (Gladwin 1970, 132).

3. In calling this a practical science, I have in mind the kind of knowledge we have traditionally associated with engineering, knowledge that involves empirically tested principles and rules of thumb, organized into a coherent system of ideas, that works well in the achievement of practical objectives. Whether it is science, or craft, or art, or a mix of all three is a matter of how one chooses to fit it into Western intellectual categories about which we Western intellectuals are ourselves in some disagreement.

References

Damm, H., and E. Sarfert. 1935. *Inseln um Truk: Puluwat, Hok, und Satawal.* Ergebnisse der Sudsee-Expedition 1908–1910, Series 2. B, vol. 6, pt. 2. Hamburg, Germany: Friedrichsen, De Gruyter.

Finney, Ben R. 1979. *Hokule'a: The Way to Tahiti*. New York: Dodd, Mead.

Frake, Charles O. 1994. "Dials: A Study in Physical Representations of Cognitive Systems." In *The Ancient Minds: Elements of Cognitive Archaeology*, edited by Colin Renfrew and Ezra Zubrow. Cambridge, U.K.: Cambridge University Press.

Gladwin, Thomas. 1970. *East Is a Big Bird: Navigation and Logic on Puluwat Atoll.* Cambridge, Massachusetts: Harvard University Press.

Goodenough, Ward H., and Stephen D. Thomas. 1987. "Traditional Navigation in the Western Pacific." *Expedition* 29 (3):3–14.

Lewis, David. 1973. *We, the Navigators*. Honolulu: University Press of Hawaii.

Riesenberg, Saul H. 1972. "The Organization of Navigational Knowledge on Puluwat." *The Journal of the Polynesian Society* 81:19–56.

Thomas, Stephen D. 1987. *The Last Navigator*. New York: Henry Holt.

Turnbull, David. 1991. *Mapping the World in the Mind: An Investigation of the Unwritten Knowledge of the Micronesian Navigators.* Geelong, Victoria: Deakin University Press.

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