Traditional Navigation in the Western Pacific

A Search for Pattern

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Do people learn and mentally organize their experience in similar ways in spite of differences in their cultures and in the content of what they have to learn? Or is there a primitive mentality essentially different from a civilized one? We know that all people, if raised in the appropriate environment, prove capable of learning to speak any language and to think and operate effectively in the context of any culture. But what about different peoples' traditional bodies of specialized lore? Are they organized in similar ways, or not? Cognitive psychologists are interested in understanding how specialists mentally process and store their knowledge so that they can retrieve it as needed. Traditional navigators of the Central Caroline Islands provide a case in point.

The Carolinian art of navigation includes a sizable body of knowledge developed to meet the needs of ocean voyaging for distances of up to several hundred miles among the tiny islands and atolls of Micronesia. Lacking writing, local navigators have had to commit to memory their knowledge of the stars, sailing directions, seamarks, and how to read the waves and clouds to determine currents and predict weather.

1
Outrigger sailing canoe and Satawal Island.

Before Europeans entered Micronesia, the known world of Carolinian navigators extended from Palau and Yap in the west to Ponape in the east and from Saipan and Guam in the north to Nukuoro and Kapingamarangi in the south (Fig. 10). Their sailing directions also included places beyond this region in the west, south, and east, but these lay outside the limits of intentional voyaging and were mostly mythical rather than real places. Knowledge of such distant places met no practical need but served to show off one's learning.

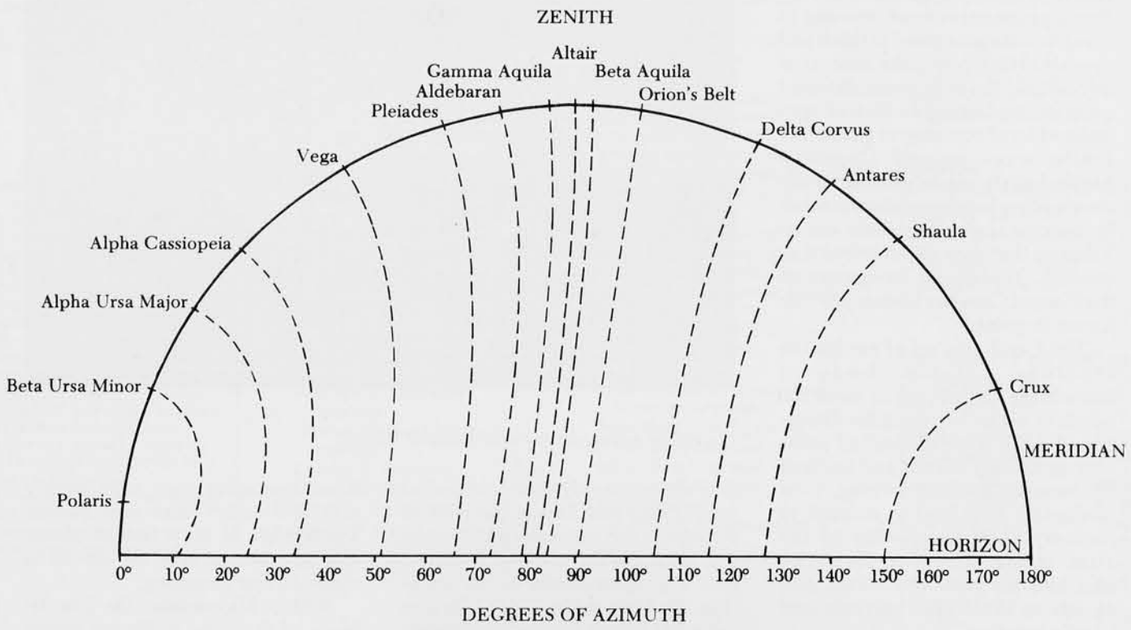
Within Micronesia, the low islands of the coral atolls are where navigation and seafaring have been known and practiced. People living

on the high islands of this region — Palau, Yap, Truk, Ponape, and Kosrae — did not maintain seafaring traditions and depended on the atoll dwellers for trade and ocean travel. Puluwat, Pulap, and Satawal, all west of Truk, were where Carolinian navigation was most highly developed, and where it continues to be in active use today.

The Sidereal Compass

Basic to the entire navigational system is the "star structure," as the navigators call it. Observed near the equator, the stars appear to rotate around the earth on a north-south axis. Some rise and set farther to the north and some farther to the south, and they do so in succession at different times. The "star structure" divides the great circle of the horizon into 32 points where the stars (other than Polaris) for which the points are named are observed to rise and set (Figs. 2,3). These 32 points form a sidereal (star) compass that provides the system of reference for organizing all directional information about winds, currents, ocean swells, and the

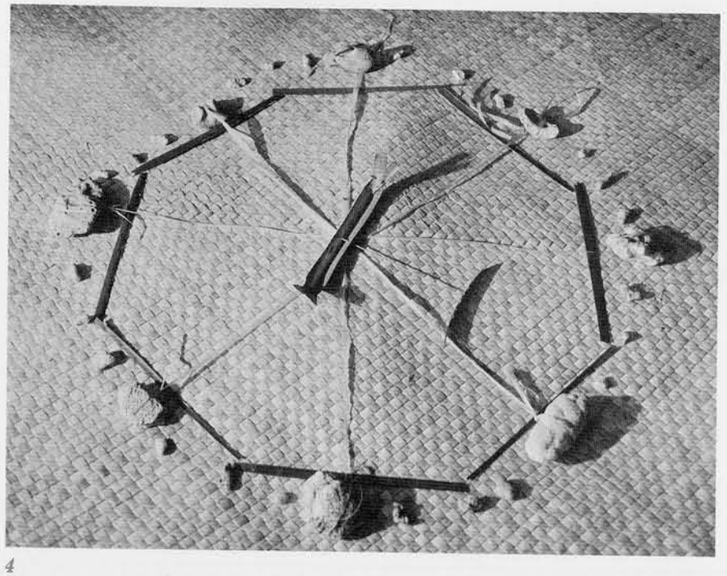
2
The "star structure" (sidereal compass).



3
Pathways of compass stars from their risings in the east (two-dimensional projection).

relative positions of islands, shoals, reefs, and other seamarks. The diametrically opposite points of this compass are seen as connecting in straight lines through a central point. A navigator thinks of himself or of any place from which he is determining directions as at this central point. Thus, whatever compass point he faces, there is a reciprocal point at his back.

After learning the compass points, a student of navigation is taught all their reciprocals. The reciprocal of the rising of Vega in the northeast, for example, is the setting of Antares in the southwest. For every reciprocal pair a student must then learn what other reciprocal pair lies at right angle to it. A compass star on the beam can thus serve as a guide when the star on which one's course is set is not visible. A feel for the angular distances from one to another of all the compass points enables a navigator to maintain his course at the appropriate angle to any visible compass star or any other visible star known to rise and set at about the same place as a compass star. To be able to use the stars this way is essential, the navigator shifting from one to another as they rise and set in the course of a night. When no stars are visible, as in daylight or in overcast at night, a navigator still orients himself with reference to the star compass. Knowing the compass direction of wind and ocean swell (see below), he can keep track of where he is headed.



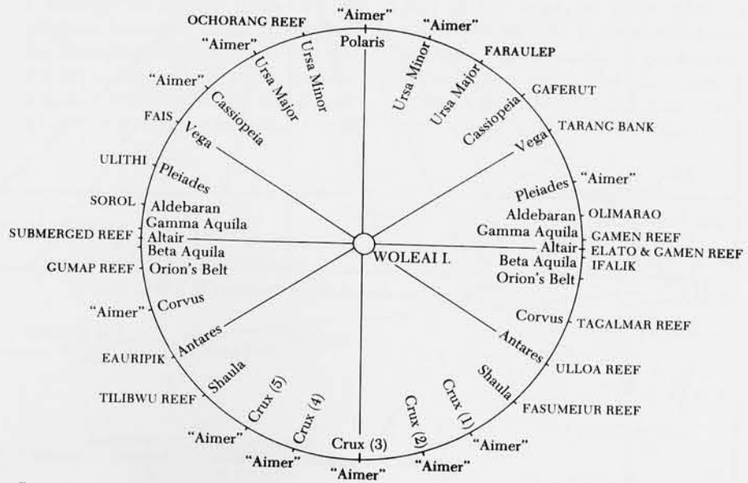
4
Representation of "star structure" (sidereal compass) and canoe for teaching purposes.

Sailing Direction Exercises

All sailing directions are kept in relation to the sidereal compass, as are the relative locations of all places of interest, including such numerous seamarks as reefs, shoals, and marine life. To memorize this large body of information the Carolinians have developed various exercises.

"Island Looking" is the name of the most important exercise. With it, navigators and their pupils endlessly rehearse their knowledge of where islands are located in relation to one another. One takes an island and then goes around the compass naming the places that lie in each direction from that island. Then one takes another island and does the same. As they sit around the boathouse in the evening, older men quiz the younger men and one another. In reciting "Island Looking," a beginner gives the name of the nearest island that lies in a given compass direction from the hub island. As he goes around the compass, if no island lies in a particular direction, he so indicates. Later, the student learns to include reefs and shoals and, finally, living seamarks (see below), thus filling most of the compass directions from each focal island. Figure 5 shows the places named on the compass directions as one looks out from Woleai Atoll.

Another exercise, "Sea Knowing," involves learning the names of all the sealanes, called "roads," between the various islands and reefs.



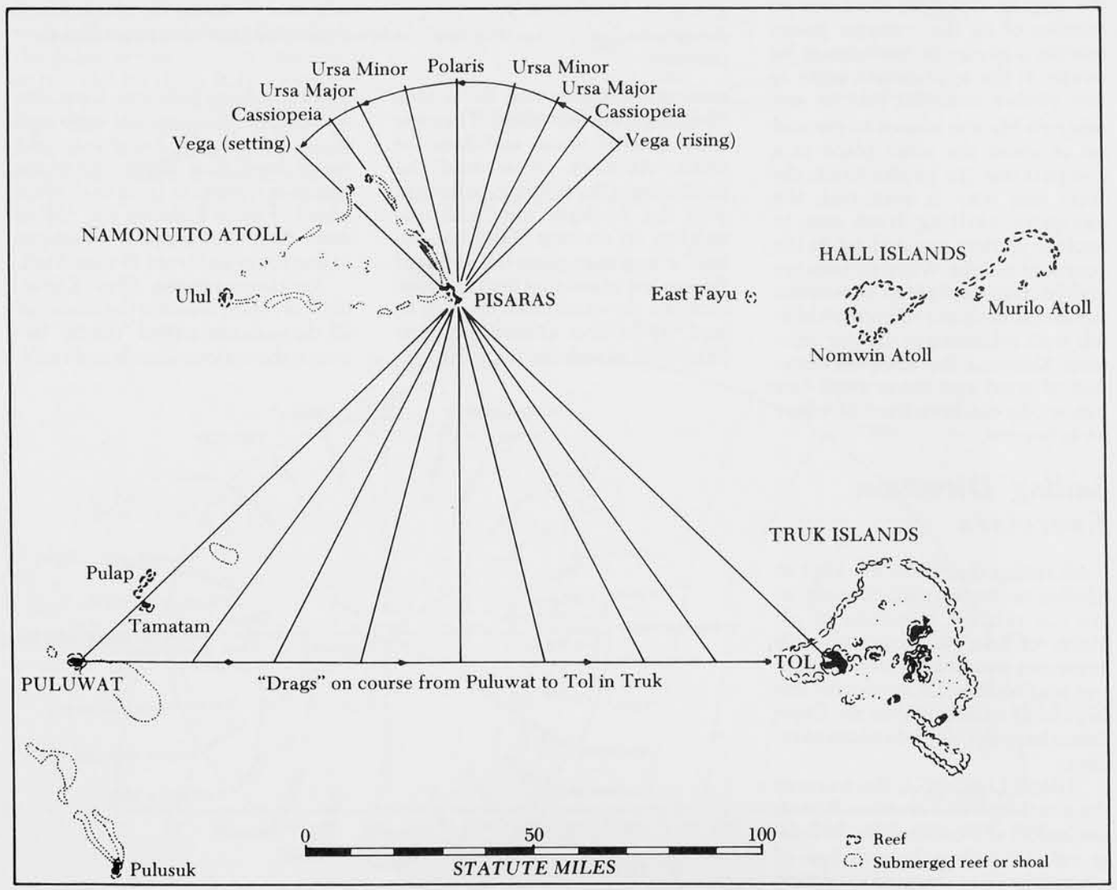
5
"Island looking" exercise, naming places and "aimers" (living seamarks) as one looks out from Woleai Island.

6
Breadfruit picker.

To speak of sailing on the "Sea of Beads" is to indicate travel between Woleai and Eauripik on the star course between "Rising of Fishtail" (in Cassiopeia) and "Setting of Two Eyes" (Shaula in Scorpio). Referring only to the names of sealanes, those in the know can tell one another where they have been traveling and leave the untutored in the dark.

The exercise called "Sea Brothers" groups sealanes that lie on the same star compass coordinates. Thus on the course from "Rising of Fishtail" to "Setting of Two Eyes" lie the several sealanes that connect the islands of Pisaras and Pulusuk, Pikelot and Satawal, West Fayu and Lamotrek, Gaferut and Woleai, and Woleai and Eauripik. A navigator may forget the sailing directions from Woleai to Eauripik but remember that the Woleai-Eauripik sealane is "brother" to the West Fayu-Lamotrek sealane. His remembering the star coordinates for the latter allows him to retrieve the forgotten coordinates for the former.

"Coral Hole Stirring" imagines a parrot fish hiding in its hole in the reef at a given island. A fisherman probes the hole with a stick to drive the fish out into a dipnet, and it darts off to a hole in the reef at a neighboring island. Again the fisherman tries to catch the fish, and again it darts away to another island, and so on through a series of islands back to the one from which the exercise began. Each such hole has a special name, known only to navigators, that serves as a synonym for the island name. In this exercise the star courses are from hole name to hole name. To learn all of these star courses is to learn a parallel and redundant set of sailing directions. "Coral Hole Stirring" provides another arena within which to rehearse these directions and, importantly, a way for navigators to discuss voyages within the hearing of others without being understood. Another exercise very similar to this one is called "Sea Bass Groping."



7
"Drags" on course from Puluwat to Tol in Truk.

"Breadfruit Picker Lashing" uses as metaphor the pole for picking breadfruit, which has a short stick lashed to its end at an angle that permits engaging the stem of a fruit and twisting it loose (Fig. 6). In the navigator's imagination a breadfruit picker reaches out in a straight line along a particular star course, from one place to the next, until it turns in a new direction on another course, and so on until it has picked off along these courses all the known places, real and imaginary, in the navigator's repertoire. There are a number of breadfruit picker exercises, beginning at different places and following different star courses.

Similar exercises have been devised under other names in different atolls. In each the navigator follows a course from his home island to the island from which the exercise begins. He then proceeds in accordance with a set pattern from one place to another. The pattern may be to box the compass, or it may be to go in a series of zig-zags, or it may be to follow a main course northward, going off to east and west and back at each of a series of points along the main course. Some exercises rehearse the details of reefs, shoals, and seamarks along specific courses frequently traveled by local navigators.

Keeping Track

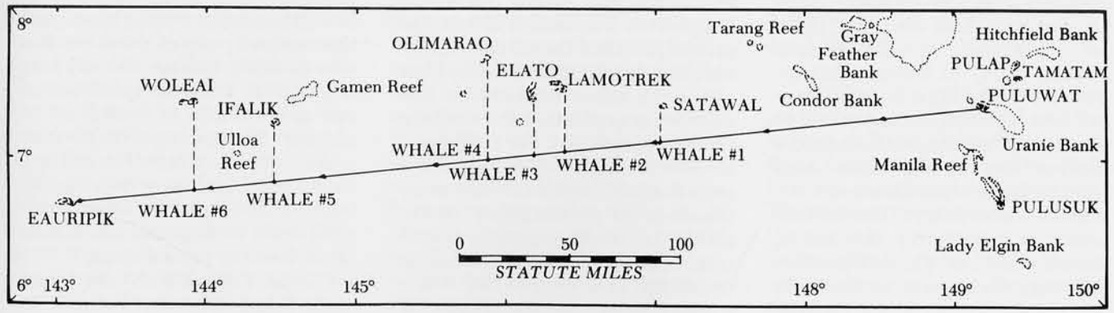
To estimate distance traveled and to keep track of his position during a voyage, a navigator uses what he calls "dragging" or "drags." It involves using an island other than his destination as a point of reference. On a voyage from Puluwat to Truk, for example, the island of Pisaras serves as reference (see Fig. 7). The course from Puluwat to Truk is almost directly east on the rising of Altair. Pisaras lies, out of sight, 120 miles (190 kilometers) northeast of Puluwat on the rising of Vega and a like distance northwest of Truk on the setting of Vega. As the voyager goes the 150 miles (245 kilometers) from Puluwat to Truk, Pisaras is "dragged" from the rising of Vega through the rising of Cassiopeia, the rising of the main star in Ursa Major, the rising of Kochab in Ursa Minor, Polaris, and on through their respective settings to the setting of Vega on arrival at Truk. Each next compass position to which Pisaras is "dragged" begins a new leg or "drag" of the journey. The whole journey in this case is thus divided into eight "drags." Estimating the headway he is making, a navigator keeps track of his progress from one "drag" to another. As changing conditions affect his progress, he need adjust his reckoning only from one "drag" to the next. This way it is easier to keep overall track of progress made and expectation of landfall.

Every course between islands has an island or seamark of reference that serves to divide the journey into "drags." Ideally, the end of the first "drag," the "drag of visibility," corresponds with the point at which the island of departure ceases to be visible; and the end of the second, the "drag of birds," corresponds with the most distant point at which land-based birds feed at sea. Similarly, the next to last is the one at which land-based birds again appear, and the last one begins when the island of destination becomes visible.

Imaginary places can serve as points of reference for "dragging" as well as real ones, since real places that serve as such points are always too far away to be visible. For the trip north from the Carolines to Guam and Saipan, there are no conveniently located islands. Here "ghost islands" are used as reference.

Living Seamarks

"Aimers" are living seamarks, said to be associated with particular locales in the vicinity of islands or midway between them. They comprise 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 of these phenomena has its own individual name and is located within a particular "drag" on a particular star course from its associated island. One does not sail to find them, rather one



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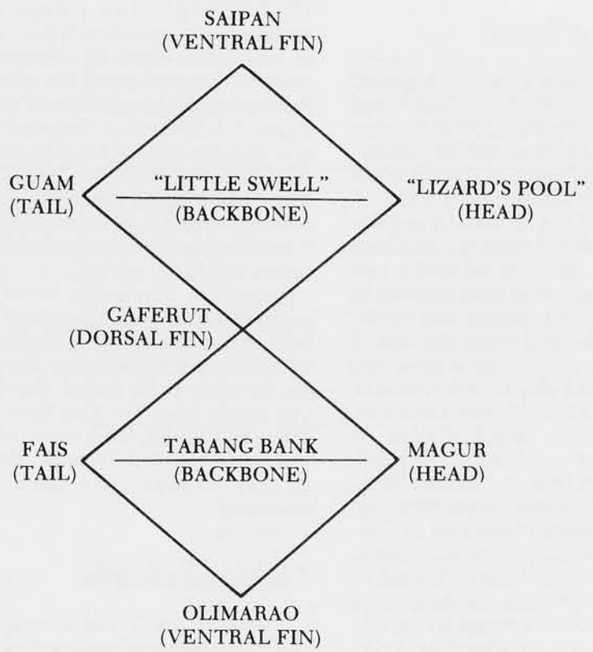
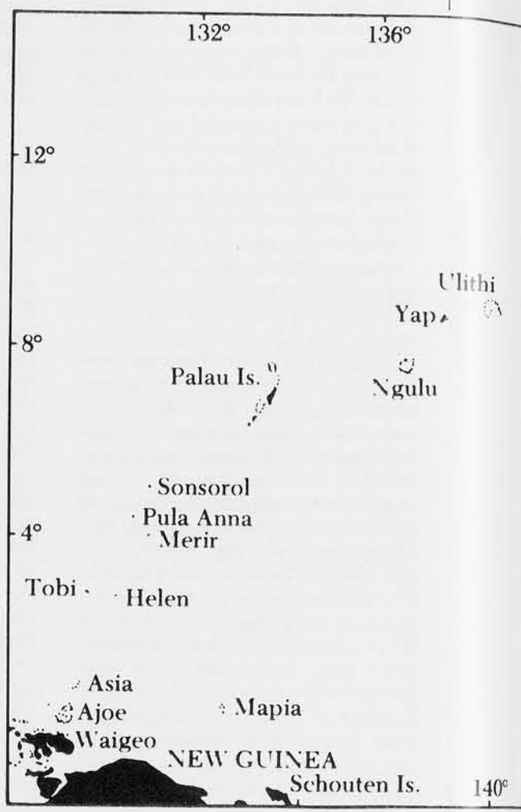
"Aimers" on course from Puluwat to Eauripik.



9
Schematic representation of linked "trigger fish" (in this case, the "great trigger fish" and its northern flip).



10
Carolinian navigator's world.

encounters them only when lost and not always then. They serve as a last recourse for the navigator who has missed his landfall or lost his bearings, enabling him to "align" himself once more in the island world.

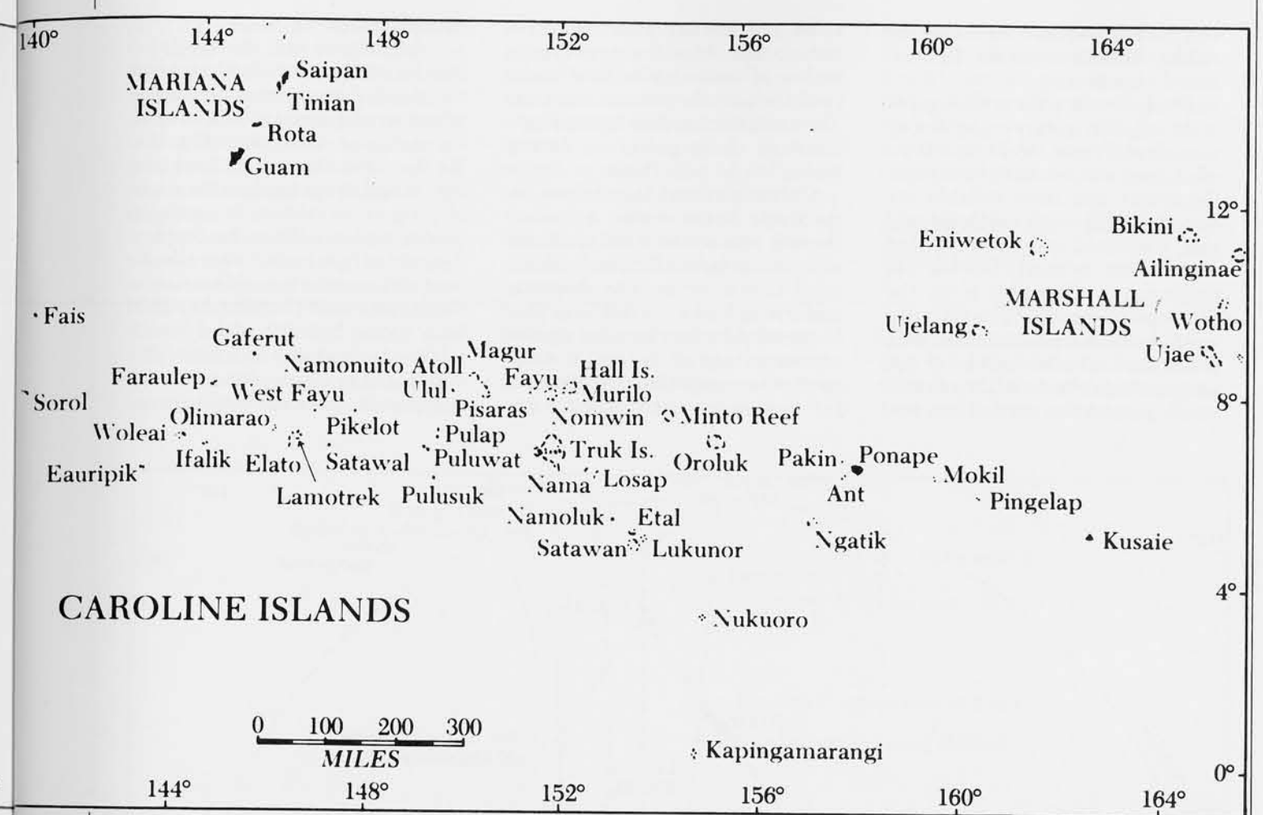
When doing the "Island Looking" exercise, an advanced student includes these "aimers" among the locations to be named in boxing the compass from a given island. They also figure in other exercises. There are, additionally, special exercises relating solely to living seamarks. Thus, on the long course from Puluwat to Eauripik there is said to be a row of whales, each situated a day's sail directly south of an island (Fig. 8). Each whale has its own distinctive characteristic. This scheme provides a basis for reorienting oneself when lost. The drill involves following the course to Eauripik, naming each whale along the way and the island that lies north of that whale.

Schematic Mapping

Having no maps or charts, navigators must devise ways of constructing mental equivalents. "Trigger Fish" is the name for one such way of conceiving of the geography of the navigator's world. It envisions 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; but the dorsal and ventral fins can serve either as northern and southern or as southern and northern points respectively. The fifth place, at the center of the diamond, represents the fish's backbone. Any set of islands, real or imaginary, reefs, shoals, or living seamarks whose relative locations are suitable can be construed as a trigger fish. On a course between the dorsal and ventral fins, the head or tail can serve as reference island and the backbone marks midcourse.

Where it is possible to see two trigger fish arrangements in which the northern point of one is the southern point of another, navigators engage in what they call "turning the trigger fish." The southern trigger fish is mentally flipped northward, its dorsal fin serving as a hinge. As a result, the same place serves as dorsal fin for both, being the northern point of one and the southern point of the other. It is also possible to have overlapping trigger fish, using the backbone of one as the dorsal or ventral fin of another. Navigators arrange their world into large trigger fish and into chains of contiguous or overlapping lesser ones (Fig. 9). These exercises serve to organize the islands into schematic mental maps.

"Great Trigger Fish" are large-scale maps. One has Pulusuk as head, Palau (1225 miles or 1585 kilometers west) as tail, places



called "fishing ground of *kumak* fish" and "reef of needlefish" as dorsal and ventral fins, and Eauripik as backbone. The great trigger fish of special importance is the one that has Magur and Fais (650 miles or 1050 kilometers apart) as head and tail, while Gaferut and Olimarao are dorsal and ventral fins (Fig. 11). As one stands on Saipan looking south, moreover, the rising of the constellation "Triggerfish" (Crux) lies almost directly over Magur, and its setting is fairly close to the bearing for Fais. On sailing south from Guam and Saipan, a navigator knows that, if he stays within the rising and setting of Crux, he will end up in the heart of the Caroline chain, with its many reefs, shoals, and other seamarks of which he has knowledge. The northern flip of this great trigger fish keeps Gaferut as the dorsal fin and has Saipan as ventral fin, Guam as tail, and the imaginary place "Lizard's Pool" as its head.

Predicting Weather

Weather conditions are equated with the months of a sidereal calendar. Though called "moons," these months are independent of the moon. 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 must tilt one's head back to the point where one feels a roll of skin forming at the back of the neck. It continues until the next month star reaches the same position. After each month begins, one or two "fighting stars" make their first appearance above the eastern horizon just before dawn (Fig. 12). If there is one such star in the month, it will "fight" (bring stormy weather) for five days after the next new moon first appears in the west at sunset. If there is another fighting star in the same month, it will make stormy weather in the last five days of the moon's cycle that began in that month. What is a fighting star in one month may be the star for which a subsequent month is named; but not all fighting stars designate months. More immediate weather conditions are forecast from the color of the sky at sunrise and sunset and the shapes of the clouds.

Putting the System to Work

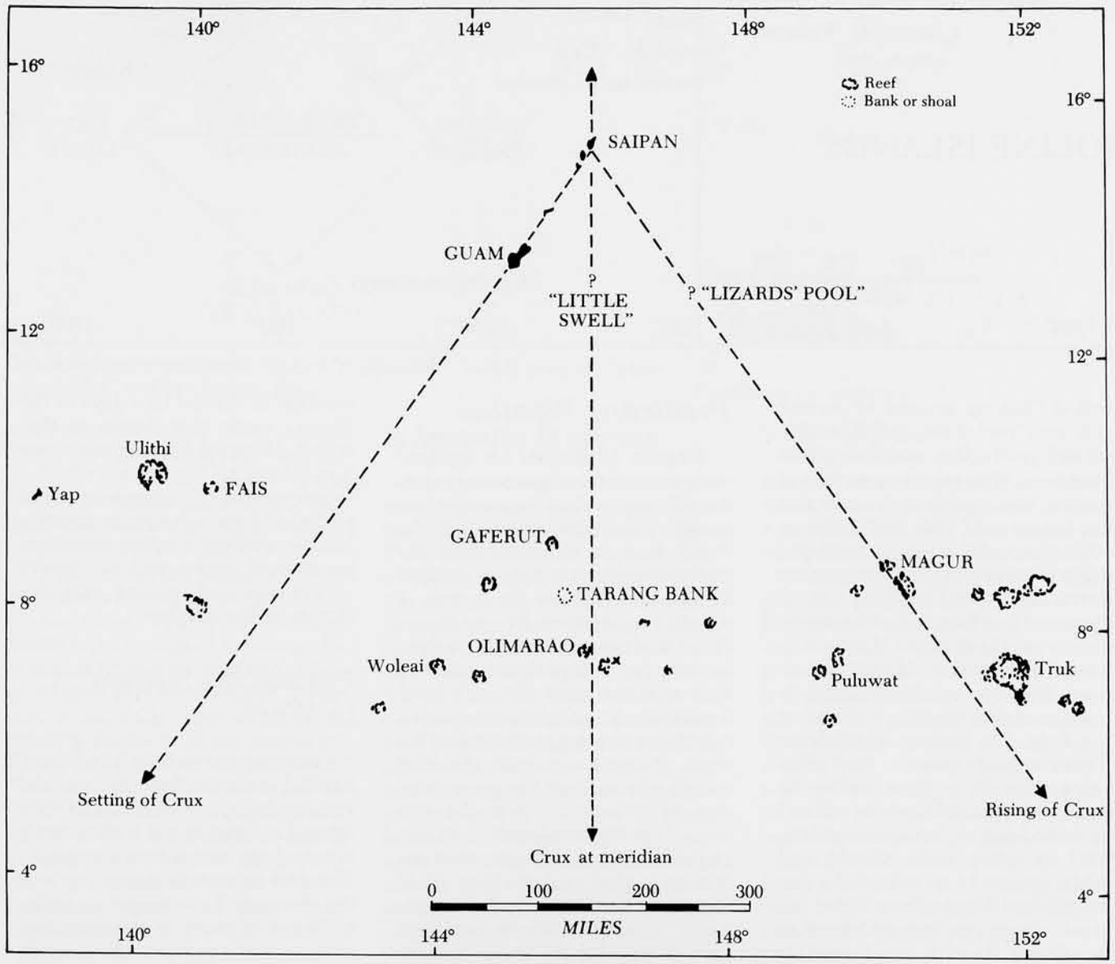
Learning the sailing directions, parallel sea lanes, "aimers," and the various drills involving them is one thing. Learning to put it all to work in actual practice is something else. The stars are not visible by day, and the sky may be overcast at night. Sailing directions in the exercises are, at best, only to the nearest compass point. Conditions vary with the seasons. Application requires using what one can actually

see, and it requires adjusting the sailing directions in the light of actual experience.

Ocean swells are a crucial guide in sailing. Navigators recognize up to eight different swells, one from each octant of the compass. Dominant and most reliable 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 take advantage of opportunities to check the direction of swells against the stars. When two swell systems are moving across each other, like the converging wakes of motorboats they make peaks where they come together. The navigator can steer by the alignment of these peaks or "wave nodes," as he calls them.

Currents reveal themselves by the shape of the waves. A current flowing against the wind produces steeper waves, one flowing with the wind flatter waves. The direction and strength of a current may also be revealed by the pattern of ripples on the surface of the water. Currents make a significant difference for how a navigator adjusts his course in actual voyaging.

When setting out, the navigator lines his canoe up with landmarks on the island of departure according to whatever alignment is indicative of his particular star course (Fig. 13). He then trims his sail to hold that course and keeps track of the angle of progress in relation to swells or "wave nodes." When he reaches the point of "one tooth," where the island of departure is visible as only a single point on the horizon, he sights back to see how the island lies in relation to the course he is maintaining. If it is in direct alignment, no compensation for current is necessary; if it is out of alignment, he uses the degree of shift to estimate the strength of the current. There are working rules for how to adjust one's course. For example, a navigator may adjust his course by half a compass position for each full compass position the island has shifted out of alignment.

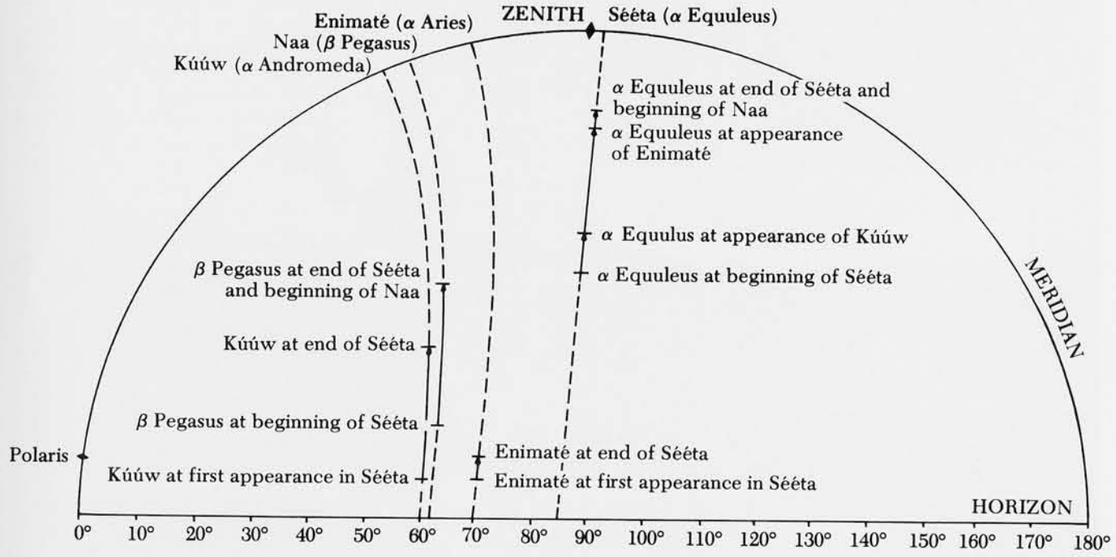


11
The "great trigger fish" (Fais and Magur as tail and head) with its northern flip (places in capital leters) as actually located on the map.

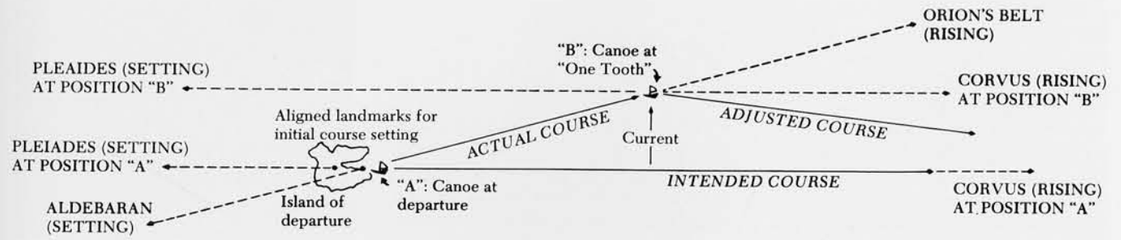
Application of navigational lore also requires fine tuning the systems of knowledge and adapting them to local conditions. The course directions given in "Island Looking" and other training exercises are not in fact the ones a navigator actually follows, unless he has never made the particular voyage before. They indicate where one island lies in relation to another but do not show how best to travel between them. In practice, a navigator may begin with one star course and change to another course at some "drag" point along the way. Adjustments must also be made for currents and changing conditions as they are met. Sailing against the wind is likely to require planning a series of tacks from drag to drag. The navigator must learn how to make all these adjustments of course for the voyages he actually expects to make. Years of sailing experience are necessary to develop skill as a navigator. Boys begin learning the names of stars at 5 or 6 years of age, and only when they are 18 or 20 at the earliest are they ready to take charge of a voyage on their own. As with any other skill, not everyone is good at it.

Navigator as Ritual Specialist

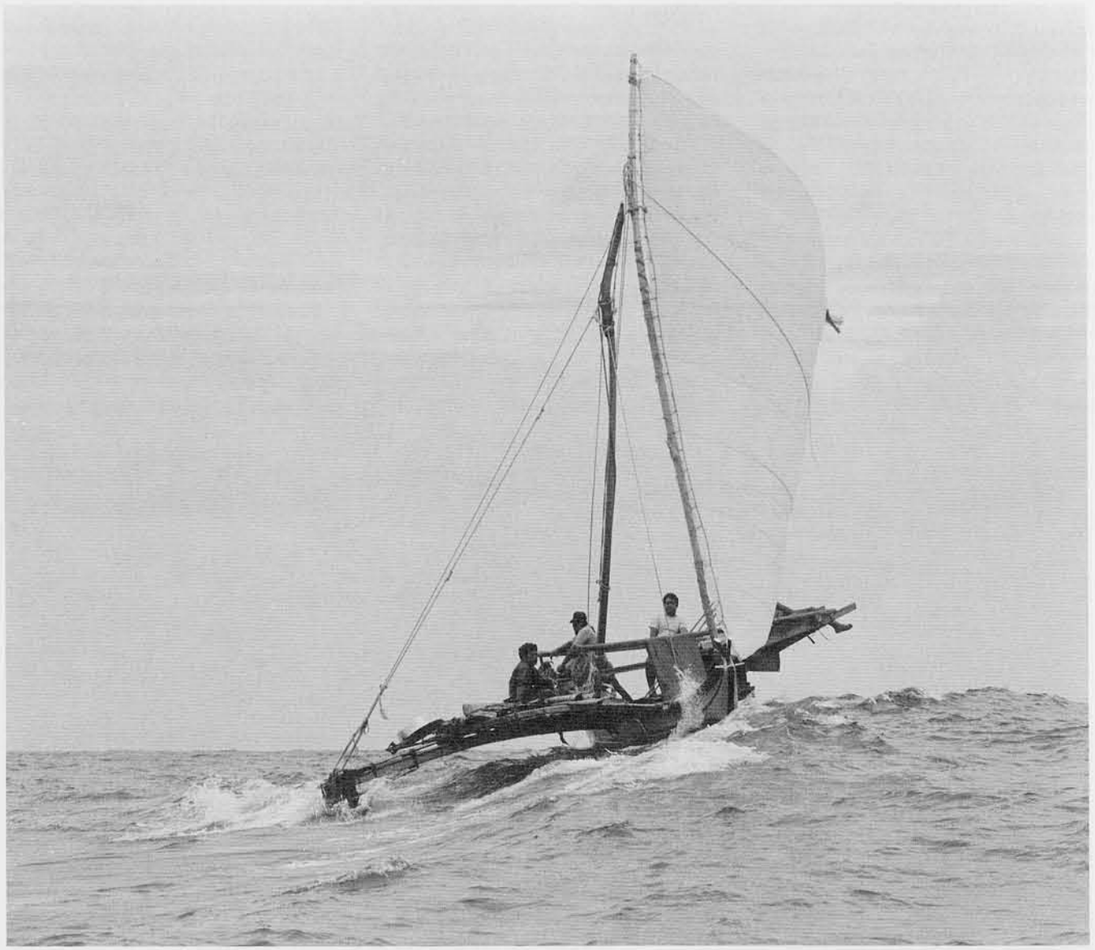
Protective ritual is another part of what a navigator must learn. He is said to be the "father" of his crew, who depend on him for their welfare. Properly invoking patron



12
The courses (looking east) of the month star Séeta *and its fighting stars* Kúúw *and* Enimaté *and the simultaneous course of the succeeding month star* Naa.



13
Course adjustment to allow for currents.



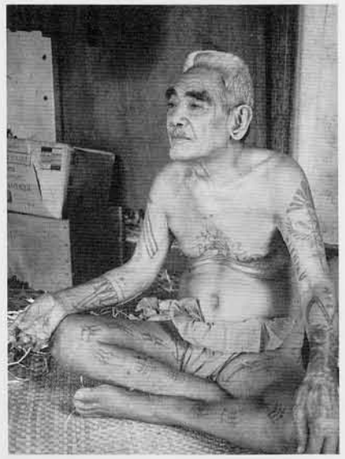
14
Canoe angling across swell.

spirits of navigation, carefully observing necessary taboos, employing spells to prevent storms and ward off sharks, providing protective amulets for the vessel are also among a navigator's responsibilities and among the things he must learn. He should also know enough of the special rhetoric and spells associated with politics and diplomacy to ensure hospitality and safe conduct for himself and his crew on arrival at other islands. Such knowledge is especially useful where voyagers do not have kin connections and where people are likely therefore to be suspicious and even overtly hostile.

Their ritual knowledge, particularly, sets navigators apart. To exercise their office, they must observe various taboos. They must avoid sexual intercourse before undertaking a voyage and until safe return home. They may eat only such food as has been separately prepared for them. The boathouse is their special preserve.

Keeping the Knowledge Alive

As should now be evident, sustaining the total body of navigational knowledge in the absence of writing is accomplished first 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 standardized drills and exercises that build in redundancy and that are continually rehearsed.

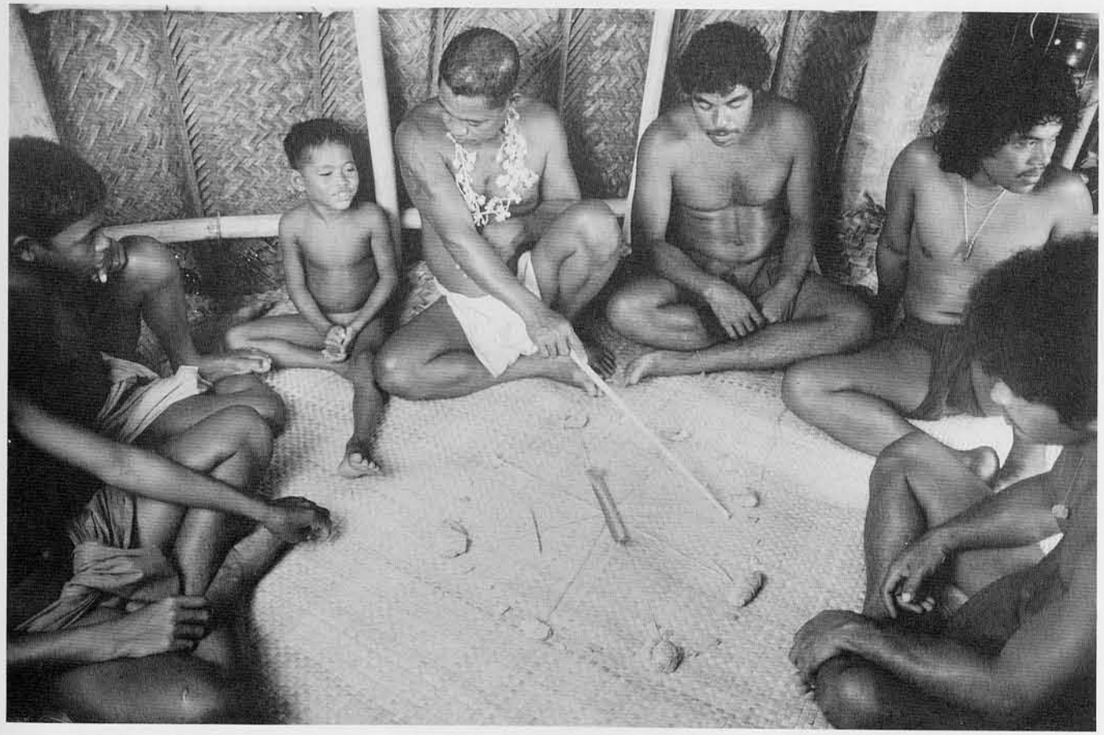


15
A venerable navigator at home on Satawal.

For memory storage much of the lore is also embedded in chants. The metric and tonal structures of Carolinian chant forms provide aids to recall. These chants are often cryptic in content, requiring commentary in order to understand them. A trainee will learn the words of a chant first. When he has the words down, his teacher will supply the necessary interpretive commentary. If a teacher should die without having passed on the commentary, his pupil must make the best sense of the chant he can. In time, he will develop his own interpretation and commentary in the light of his other knowledge and actual experience. It is interesting to note that this new interpretation may be quite different from the original and yet still be workably consistent with reality.

Interesting, too, is the evident elaboration of navigational lore beyond practical requirements. The record shows that navigators have

16
Steering with foot on steering oar; navigator is smoking.



17
Instruction on the "star structure."

enjoyed playing with the possibilities within their system, elaborating on them apparently for the fun of it and to show off virtuosity. Since European entry into Micronesia, navigators have added sailing directions to new places they had not known before; and they have equated newly encountered places with formerly mythical ones, thus validating them. By playing with their system and adding to it whenever possible, they keep it alive.

The Search for Pattern

As Micronesian navigation exemplifies, people can deal purposefully with their world only insofar as they can organize their experience of it. To do this, they abstract from their experience patterns of relationship among things. Some of these patterns are inherent in what they have experienced, but people also impose pattern on experience. Insofar as such impositions do not produce undesired consequences, they have practical utility. Science requires that we subject such abstractions and impositions of pattern to critical examination and evaluation through procedures that are likewise subject to critical examination. But the scientist's search for pattern as the key to understanding is only a selfconscious application of the process by which humans generally achieve effective understanding.

Bodies of Knowledge and Cultural Anthropology

Describing the content and organization of the many and diverse bodies of knowledge that comprise human understandings is a major concern of cultural anthropology. Ethnography, as it is called, aims 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 performance. Such knowledge is what is meant by a society's culture. Like a language or a game, a culture is something one has to learn before one can describe it. Ethnography is thus an exercise in the systematic learning and presentation of what people know, including the things they use as standards for perceiving and interpreting their world. It also tries to describe how people apply and use such knowledge in the affairs of life.

The products of ethnography provide necessary information for a number of scientific and practical interests. If American businessmen do not understand the Japanese culture for doing business and how Japanese actually use it, they are likely to have trouble negotiating business deals with their Japanese counterparts. We need adequate descriptions of the content of cultures to reveal reliably the range of difference among them. Without this, we cannot find the underlying similarities that unite us as humans. In their search for pattern, for example, do humans learn and organize experience in fundamentally similar ways, as we asked at the beginning of this presentation? To what extent do they use similar techniques for storing and retrieving information? Traditional navigation in Micronesia provides one example of how ethnography may contribute to answering such questions.

After college, **Stephen Thomas** spent several years as a professional yacht captain and navigator, logging over 30,000 miles in the Mediterranean, Atlantic, Caribbean, and Pacific. In 1983 and 1984, he made field trips to Satawal Island to study Carolinian navigation with the well-known navigator Mau Piailug (on the right in the photograph). His book, *The Last Navigator*, has recently been published by Holt and Co.

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