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Cognition in the Wild

Edwin Hutchins

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for Dona

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Introduction

The seed from which this book grew was planted in November 1980, when I spent most of a day on the navigation bridge of a U.S. Navy ship as it worked its way in from the open North Pacific, through the Straits of Juan de Fuca, and down Puget Sound to Seattle. I was aboard the ship to study what the operators of its steam propulsion plant knew and how they went about knowing it. I had spent most of the preceding week down in the bowels of the ship, observing engineering operations and talking to the boiler technicians and machinist's mates who inhabited that hot, wet, noisy tangle of boilers, pumps, and pipes called the engineering spaces. I'll admit to having felt a little claustrophobic after a that time spent below the water line, where there is no night or day and the only evidence of being at sea is the rhythmic tipping of the deck plates and sloshing of water in the bilge below one's feet as the ship rolls in the swell. A chief boiler technician confided to me that in 21 years on Navy ships he had never yet been on deck to experience either of those two most romantic seafaring events, a ship's arrival at or departure from a port.

I resolved, therefore, to take my last few hours aboard this ship on the navigation bridge, where I could see out the windows or even go out on the bridge wing to get a breath of cold fresh air. My professional rationalization for being on the bridge was that there I would be able to observe the process that generates the flurry of engine commands that always taxes the engineering crew when the ship nears the dock. And I did make a detailed record of all engine and helm commands given in the 75 minutes from the time the engines were first slowed until they were secured-there were 61 in all. But what really captured my attention was the work of the navigation team.

Three and a half years later, the project that became this book began in earnest. In the summer of 1984, I was still working for the Navy Personnel Research and Development Center in San Diego as a civilian scientist with the title Personnel Research Psychologist. By then I had participated in two successful and well-known

projects. With these successes came the freedom to conduct an independent research project. I was given *carte blanche* to study whatever I thought was of most interest. I chose to study what I was then calling *naturally situated cognition*. Having a research position in a Navy laboratory made it possible for me to gain access to naval vessels, and my longtime love of navigation and experience as a racing yacht navigator made it easy for me to choose navigation as an activity to study afloat. I talked my way aboard a ship and set up shop on the navigation bridge. At the time, I really had no notion what an ideal subject navigation would turn out to be. When I began, I was thinking in terms of the naturally situated cognition of individuals. It was only after I completed my first study period at sea that I realized the importance of the fact that cognition was socially distributed.

A little earlier, I had been asked to write a book describing what is in cognitive anthropology for the rest of cognitive science. I began that project, but after I became disillusioned with my field I lost interest in it. The choice of naturally situated cognition as a topic came from my sense that it is what cognitive anthropology really should have been about but largely had not been. Clifford Geertz (1983) called for an "outdoor psychology," but cognitive anthropology was unable or unwilling to be that. The respondents may have been exotic, but the methods of investigation were largely borrowed from the indoor techniques of psychology and linguistics. When cognitive and symbolic anthropology split off from social anthropology, in the mid 1950s, they left society and practice behind.

As part of the cognitive revolution, cognitive anthropology made two crucial steps. First, it turned away from society by looking inward to the knowledge an individual had to have to function as a member of the culture. The question became "What does a *person* have to know?" The locus of knowledge was assumed to be inside the individual. The methods of research then available encouraged the analysis of language. But knowledge expressed or expressible in language tends to be declarative knowledge. It is what people can say about what they know. Skill went out the window of the "white room." The second turn was away from practice. In the quest to learn what people know, anthropologists lost track both of how people go about knowing what they know and of the contribution of the environments in which the knowing is accomplished. Perhaps these narrowing assumptions were necessary to

get the project of cognitive anthropology off the ground. I will argue that, now that we are underway as a discipline, we should revoke these assumptions. They have become a burden, and they prevent us from seeing the nature of human cognition.

In particular, the ideational definition of culture prevents us seeing that systems of socially distributed cognition may have interesting cognitive properties of their own. In the history of anthropology, there is scarcely a more important concept than the division of labor. In terms of the energy budget of a human group and the efficiency with which a group exploits its physical environment, social organizational factors often produce group properties that differ considerably from the properties of individuals. Clearly, the same sorts of phenomena occur in the cognitive domain. Depending on their organization, groups must have cognitive properties that are not predictable from a knowledge of the properties of the individuals in the group. The emphasis on finding and describing "knowledge structures" that are somewhere "inside" the individual encourages us to overlook the fact that human cognition is always situated in a complex sociocultural world and cannot be unaffected by it.

Similar developments in the other behavioral sciences during the cognitive revolution of the late 1950s and the 1960s left a troubled legacy in cognitive science. It is notoriously difficult to generalize laboratory findings to real-world situations. The relationship between cognition seen as a solitary mental activity and cognition seen as an activity undertaken in social settings using various kinds of tools is not at all clear.

This book is about softening some boundaries that have been made rigid by previous approaches. It is about locating cognitive activity in context, where context is not a fixed set of surrounding conditions but a wider dynamical process of which the cognition of an individual is only a part. The boundaries that have been softened or dissolved have been erected, primarily for analytic convenience, in social space, in physical space, and in time. Just as the construction of these boundaries was driven by a particular theoretical perspective, their dissolution or softening is driven by a different perspective one that arose out of necessity when cognition was confronted in the wild.

The phrase "cognition in the wild" refers to human cognition in its natural habitat that is, to naturally occurring culturally constituted human activity. I do not intend "cognition in the wild" to

be read as similar to Levi-Strauss's "pensée sauvage," nor do I intend it to contrast with Jack Goody's (1977) notion of domesticated mind. Instead, I have in mind the distinction between the laboratory, where cognition is studied in captivity, and the everyday world, where human cognition adapts to its natural surroundings. I hope to evoke with this metaphor a sense of an ecology of thinking in which human cognition interacts with an environment rich in organizing resources.

The attempt is cultural in nature, giving recognition to the fact that human cognition differs from the cognition of all other animals primarily because it is intrinsically a cultural phenomenon. My aim is to provide better answers to questions like these: What do people use their cognitive abilities for? What kinds of tasks do they confront in the everyday world? Where shall we look for explanations of human cognitive accomplishment?

There is a common misconception among cognitive scientists, especially those who do their work in laboratory settings, that research conducted outside the laboratory is necessarily "applied" work. I will argue in what follows that there are many excellent reasons to look at the "real world" that are not concerned with hoped-for applications of the research findings (although funding sponsors often like to think in those terms). Pure research on the nature of real cognitive practices is needed. In this book I emphasize practice not in order to support a utilitarian or functionalist perspective but because it is in real practice that culture is produced and reproduced. In practice we see the connection between history and the future and between cultural structure and social structure. One of my goals in writing this book is to make clear that the findings of pure research on cognition in the wild should change our ideas about the nature of human cognition in general. This is not news to anthropologists, who have been doing pure research in the form of ethnography for decades.

This book is an attempt to put cognition back into the social and cultural world. In doing this I hope to show that human cognition is not just influenced by culture and society, but that it is in a very fundamental sense a cultural and social process. To do this I will move the boundaries of the cognitive unit of analysis out beyond the skin of the individual person and treat the navigation team as a cognitive and computational system.

Chapter 1, "Welcome Aboard," attempts to locate the activity of ship navigation in the larger world of modern life. It weaves to-

gether three journeys: a movement through physical space from the "street" to the ship, a movement through social space from civilian to military life, and a movement through conceptual space from everyday notions of wayfinding to the technical domain of navigation. Both the researcher and the reader must make these journeys to arrive at the activity of navigation as practiced on the bridge of a Navy ship. Military ranks and the ways in which military identities are formed are presented here because these things affect individual's relationships to their work. An important aspect of the larger unit is that it contains computational elements (persons) who cannot be described entirely in computational terms. Who they talk to and how they talk to one another depend on these social organizational factors. This chapter also contains a discussion of the relationship of the researcher to the activity under study. (The name of the ship and the names of all the individuals mentioned in the book are pseudonyms. All the discourses reported, whether standing alone in transcript form or embedded in narrative passages were transcribed directly from audio recordings of actual events.)

Having taken navigation as it is performed by a team on the bridge of a ship as the unit of cognitive analysis, I attempt in chapter 2, "Navigation as Computation," to apply the principal metaphor of cognitive science cognition as computation to the operation of this system. I should note here that in doing so, I do not make any special commitment to the nature of the computations that are going on inside individuals except to say that whatever happens there is part of a larger computational system. This chapter describes the application of David Marr's notions of levels of analysis of cognitive systems to the navigation task and shows that, at the computational level, it is possible to give a single description of the computational constraints of all known technical forms of human navigation. A comparison of modern Western navigation with navigation as practiced in Micronesia shows that considerable differences between these traditions lie at the representational/algorithmic level and at the implementational level. A brief historical review of the development of modern navigation shows that the representational and implementational details of contemporary practice are contingent on complex historical processes and that the accumulation of structure in the tools of the trade is itself a cognitive process.

Chapters 3-5 explore the computational and cognitive properties of systems that are larger than an individual. The issues addressed

in these chapters concern how these larger systems operate and how their cognitive properties are produced by interactions among their parts.

Chapter 3, "The Implementation of Contemporary Pilotage," describes the physical structures in which the navigation computations are implemented. This chapter elaborates a conception of computation as the propagation of representational state across a variety of media. This view of computation permits the use of a single language of description to cover cognitive and computational processes that lie inside and outside the heads of the practitioners of navigation. The first section of this chapter describes the "fix cycle" as a cognitive process. The second section describes how navigation tools are used and how local functional systems composed of a person in interaction with a tool have cognitive properties that are radically different from the cognitive properties of the person alone. The third section discusses the ways in which the computational activity can be distributed through time by precomputing not only partial results but also the means of computation. I show here how the environments of human thinking are not "natural" environments. They are artificial through and through. Humans create their cognitive powers by creating the environments in which they exercise those powers. This chapter concludes with a discussion of the relationship between the cognitive properties of the individuals performing a task and the cognitive properties of the system in which they participate.

Chapter 4, "The Organization of Team Performances," moves the boundaries of the unit of analysis even further out to consider the cognitive properties of the team as a whole. Here I note some of the problems that are encountered when cognitive activities are distributed across the members of a group. It is not the case that two or more heads are always better than one. This chapter describes the structures and processes involved in the group performance of the navigation task. The first section follows through on the application of Marr's concepts of computation to the navigation activity and discusses the properties of the activity as an explicitly computational system. The second section presents a problem in work organization encountered by the navigation team and shows why it is often difficult to apply the concepts that organize individual action to the organization of group action. The final section shows how the members of the navigation team form a flexible connective tissue that maintains the propagation of representational state in the face of a range of potentially disruptive events.

Chapter 5, "Communication," continues the theme of chapter 4 but looks at communication in more detail. It asks: How is it that patterns of communication could produce particular cognitive properties in a group? The chapter begins with a discussion of features of communication observed in the navigation team and their effects on the Team's computational properties. These observations lead to some simple hypotheses about the ways in which patterns of communication might affect the computational properties of a group. These hypotheses are explored using a computer simulation of communities of connectionist networks. The simulations lead to the surprising conclusion that more communication is not always better.

Chapters 6-8 concern learning or change in the organization of cognitive systems at several scales.

Chapter 6, "The Context of Learning," is a bridge between the descriptions of ongoing operations provided by the previous chapters and the descriptions of changes in the nature of ongoing operations provided by the following chapters. It describes the context in which novice navigators become experts. This chapter is an attempt to examine both the work that the system does in order to scaffold learning by practitioners and the opportunities for the development of new knowledge in the context of practice.

Whereas in chapter 6 I deal with the observable contexts surrounding learning, in chapter 7, "Learning in Context," I try to dissolve the boundaries of the skin and present navigation work as a system of interactions among media both inside and outside the individual. I look at learning or conceptual change as a kind of adaptation in a larger dynamical system. This chapter presents a functional notation and a framework for thinking about learning as local adaptation in a dynamic system of coordinations of representational media.

Chapter 8, "Organizational Learning," returns the focus to the larger unit of analysis: the team as a whole. It presents a case study of an incident in which the navigation team was forced to adapt to changes in its information environment. The analysis presented here examines a particular incident in which the microstructure of the development of the navigation practice can be seen clearly. It is an attempt to show the details of the kinds of processes that must be the engines of cultural change.

Chapter 9, "Cultural Cognition," attempts to pull the preceding chapters together into a coherent argument about the relationships of culture and cognition as they occur in the wild. I attempt first

to illustrate the costs of ignoring the cultural nature of cognition. I argue that a new framework is needed to understand what is most characteristically human about human cognition. In order to construct a new framework, the old one must be deconstructed. I therefore provide two readings of the history of cognitive science: a history as seen by the proponents of the currently dominant paradigm and a rereading of the history of cognitive science from a sociocultural perspective. The differences between these two readings highlight a number of problems in contemporary cognitive science and give new meanings to some of the familiar events in its history.

Cognition in the Wild

1 Welcome Aboard

Narrative: A Crisis

After several days at sea, the U.S.S. *Palau* was returning to port, making approximately 10 knots in the narrow channel between Ballast Point and North Island at the entrance to San Diego Harbor. In the pilothouse or navigation bridge, two decks above the flight deck, a junior officer had the conn (i.e., was directing the steering of the ship), under the supervision of the navigator. The captain sat quietly in his chair on the port side of the pilothouse watching the work of the bridge team. Morale in the pilothouse had sagged during two frustrating hours of engineering drills conducted just outside the mouth of the harbor but was on the rise now that the ship was headed toward the pier. Some of the crew talked about where they should go for dinner ashore and joked about going all the way to the pier at 15 knots so they could get off the ship before nightfall.

The bearing recorder had just given the command "Stand by to mark time 3 8" and the fathometer operator was reporting the depth of the water under the ship when the intercom erupted with the voice of the engineer of the watch: "Bridge, Main Control. I am losing steam drum pressure. No apparent cause. I'm shutting my throttles." Moving quickly to the intercom, the conning officer acknowledged "Shutting throttles, aye." The navigator moved to the captain's chair, repeating: "Captain, the engineer is losing steam on the boiler for no apparent cause." Possibly because he realized that the loss of steam might affect the steering of the ship, the conning officer ordered the rudder amidships. As the helmsman spun the wheel to bring the rudder angle indicator to the centerline, he answered the conning officer: "Rudder amidships, aye sir." The captain began to speak, saying "Notify," but the engineer was back on the intercom, alarm in his voice this time, speaking rapidly, almost shouting: "Bridge, Main Control, I'm going to secure number two boiler at this time. Recommend you drop the anchor!" The captain had been stopped in mid-sentence by the blaring intercom, but before the engineer could finish speaking the captain said, in a loud but cool voice, "Notify the bosun." It is standard procedure on

large ships to have an anchor prepared to drop in case the ship loses its ability to maneuver while in restricted waters. With the propulsion plant out, the bosun, who was standing by with a crew forward ready to drop the anchor, was notified that he might be called into action. The falling intonation of the captain's command gave it a cast of resignation or perhaps boredom and made it sound entirely routine.

In fact, the situation was anything but routine. The occasional cracking voice, a muttered curse, or a perspiration-soaked shirt on this cool spring afternoon told the real story: the *Palau* was not fully under control, and careers and possibly lives were in jeopardy.

The immediate consequences of this event were potentially grave. Despite the crew's correct responses, the loss of main steam put the ship in danger. Without steam, it could not reverse its propeller—the only way to slow a large ship efficiently. The friction of the water on the ship's hull will eventually reduce its speed, but the *Palau* would coast for several miles before coming to a stop. The engineering officer's recommendation that the anchor be dropped was not appropriate. Since the ship was still traveling at a high rate of speed, the only viable option was to attempt to keep the ship in the deep water of the channel and coast until it had lost enough speed to safely drop anchor.

Within 40 seconds of the report of loss of steam pressure, the steam drum was exhausted. All steam-turbine-operated machinery came to a halt, including the turbine generators that produce the ship's electrical power. All electrical power was lost throughout the ship, and all electrical devices without emergency power backup ceased to operate. In the pilothouse a high-pitched alarm sounded for a few seconds, signaling an under-voltage condition for one piece of equipment. Then the pilothouse fell eerily silent as the electric motors in the radars and other devices spun down and stopped. Just outside the navigation bridge, the port wing pelorus operator watched the gyrocompass card in his pelorus swing wildly and then return to its original heading. He called in to the bearing recorder standing at the chart table: "John, this gyro just went nuts." The bearing recorder acknowledged the comment and told the pelorus operator that a breakdown was in progress: "Yeah, I know, I know, we're havin' a casualty."

Because the main steering gear is operated with electric motors, the ship now not only had no way to arrest its still-considerable

forward motion; it also had no way to quickly change the angle of its rudder. The helm does have a manual backup system, located in a compartment called aftersteering in the stern of the ship: a wormgear mechanism powered by two men on bicycle cranks. However, even strong men working hard with this mechanism can change the angle of the massive rudder only very slowly.

Shortly after the loss of power, the captain said to the navigator, who was the most experienced conning officer on board, "OK, Gator, I'd like you to take the conn." The navigator answered "Aye, sir" and, turning away from the captain, announced: "Attention in the pilothouse. This is the navigator. I have the conn." As required, the quartermaster of the watch acknowledged ("Quartermaster, aye") and the helmsman reported "Sir, my rudder is amidships." The navigator had been looking out over the bow of the ship, trying to detect any turning motion. He answered the helmsman: "Very well. Right 5 degrees rudder." Before the helmsman could reply, the navigator increased the ordered angle: "Increase your rudder right 10 degrees." (The rudder angle indicator on the helm station has two parts: one shows the rudder angle that is ordered and the other the actual angle of the rudder.) The helmsman spun the wheel, causing the indicator of the desired rudder angle to move to the right 10 degrees, but the indicator of the actual rudder angle seemed not to move at all. "Sir, I have no helm sir!" he reported.

Meanwhile, the men on the cranks in aftersteering were straining to move the rudder to the desired angle. Without direct helm control, the conning officer acknowledged the helmsman's report and sought to make contact with aftersteering by way of one of the phone talkers on the bridge: "Very well. Aftersteering, Bridge." The navigator then turned to the helmsman and said "Let me know if you get it back." Before he could finish his sentence, the helmsman responded, "I have it back, sir." When the navigator acknowledged the report, the ship was on the right side of the channel but heading far to the left of the desired course. "Very well, increase your rudder to right 15." "Aye sir. My rudder is right 15 degrees. No new course given." The navigator acknowledged "Very well" and then, looking out over the bow, whispered "Come on, damn it, swing!" Just then, the starboard wing pelorus operator spoke on the phone circuit: "John, it looks like we're gonna hit this buoy over here." The bearing recorder had been concentrating on the chart and hadn't quite heard. "Say again" he requested. The starboard wing pelorus operator leaned over the railing of his platform to

watch the buoy pass beneath him. It moved quickly down the side of the ship, staying just a few feet from the hull. When it appeared that the *Palau* would not hit the buoy, the starboard wing pelorus operator said "Nothin' "; that ended the conversation. The men inside never knew how close they had come. Several subsequent helm commands were answered with "Sir, I have no helm." When asked by the captain how he was doing, the navigator, referring to their common background as helicopter pilots, quipped "First time I ever dead-sticked a ship, captain." (To "dead-stick" an aircraft is to fly it after the engine has died.) Steering a ship requires fine judgements of the ship's angular velocity. Even if helm response was instantaneous, there would still be a considerable lag between the time a helm command was given and the time when the ship's response to the changed rudder angle was first detectable as the movement of the bow with respect to objects in the distance. Operating with this manual system, the navigator did not always know what the actual rudder angle was, and could not know how long to expect to wait to see if the ordered command was having the desired effect. Because of the slowed response time of the rudder, the navigator ordered more extreme rudder angles than usual, causing the *Palau* to weave erratically from one side of the channel to the other.

Within 3 minutes, the diesel-powered emergency generators were brought on line and electrical power was restored to vital systems throughout the ship. Control of the rudder was partially restored, but remained intermittent for an additional 4 minutes. Although the ship still could not control its speed, it could at least now keep itself in the dredged portion of the narrow channel. On the basis of the slowing over the first 15 minutes after the casualty, it became possible to estimate when and where the *Palau* would be moving slowly enough to drop anchor. The navigator conned the ship toward the chosen spot.

About 500 yards short of the intended anchorage, a sailboat took a course that would lead it to cross close in front of the *Palau*. Normally the *Palau* would have sounded five blasts with its enormous horn to indicate disagreement with the actions taken by the other vessel. However, the *Palau's* horn is a steam whistle, and without steam pressure it will not sound. The Navigation Department has among its equipment a small manual foghorn, basically a bicycle pump with a reed and a bell. The navigator remembered

this piece of gear and instructed the keeper of the deck log to leave his post, find the manual horn, descend two levels to the flight deck, take the horn out to the bow, and sound the five warning blasts. The keeper of the deck log ran from the pilothouse, carrying a walkie-talkie to maintain communication with the bridge. The captain grabbed the microphone for the flight deck's public address system and asked "Can you hear me on the flight deck?" Men below on the deck turned and waved up at the pilothouse. "Sailboat crossing *Palau's* bow be advised that I am not ... I have no power. You cross at your own risk. I have no power." By this time, the hull of the sailboat had disappeared under the bow of the ship and only its sails were visible from the pilothouse. In the foreground, the men on the flight deck were now running to the bow to watch the impending collision. Meanwhile, the keeper of the deck log had run down two flights of stairs, emerged from the base of the island, and begun sprinting across the nearly 100 yards that lay between the island and the bow. Before he was halfway to his goal, it was clear that by the time he would reach the bow the signal from the horn would be meaningless. The navigator turned to a junior officer who was holding a walkie-talkie and exclaimed "Just tell him to put the sucker down and hit it five times!" The message was passed, and the five feeble blasts were sounded from the middle of the flight deck. There is no way to know whether the signal was heard by the sailboat, which by then was directly ahead of the *Palau* and so close that only the tip of its mast was visible from the pilothouse. A few seconds later, the sailboat emerged, still sailing, from under the starboard bow. The keeper of the deck log continued to the bow to take up a position there in case other warnings were required.

Twenty-five minutes after the engineering casualty and more than 2 miles from where the wild ride had begun, the *Palau* was brought to anchor at the intended location in ample water just outside the bounds of the navigation channel.

The safe arrival of the *Palau* at anchor was due in large part to the exceptional seamanship of the bridge crew, especially the navigator. But no single individual on the bridge acting alone-neither the captain nor the navigator nor the quartermaster chief supervising the navigation team-could have kept control of the ship and brought it safely to anchor. Many kinds of thinking were required to perform this task. Some of them were happening in

parallel, some in coordination with others, some inside the heads of individuals, and some quite clearly both inside and outside the heads of the participants.

This book is about the above event and about the kind of system in which it took place. It is about human cognition especially human cognition in settings like this one, where the problems that individuals confront and the means of solving them are culturally structured and where no individual acting alone is entirely responsible for the outcomes that are meaningful to the society at large.

Gaining access to this field site required me, as an ethnographer, to make three journeys at once. In this first chapter I will try to weave them together, for the reader will also have to make these journeys mentally in order to understand the world of military ship navigation. The first is a journey through physical space from my home and my usual workplace to the navigation bridge of the *Palau*. This journey took me through many gates, as I moved from the street to the military base, to the ship, and within the ship to the navigation bridge. I will try to convey the spatial organization of the setting in which navigation is performed. The second journey is a trip through social space in which I moved from the civilian social world past the ship's official gatekeepers into the social organization of the Navy, and then to the ship's Navigation Department. This journey closely parallels the journey through physical space because space is so often used as an element of social organization. As the spatial journey took me to regions with narrower and narrower boundaries, so the social journey leads us through successively narrower levels of social organization. The third journey is a movement through conceptual space, from the world of everyday spatial cognition into the technical world of navigation. This third journey does not really begin until I near the end of the other two.

Through the Main Gate

A crisp salute from a young marine in dress uniform at the main gate's guard shack marked the transition from the "street" to the "base" from the civilian realm to the military. The base is a place of close-cropped haircuts and close-cropped lawns. Here nature and the human form are controlled, arranged, disciplined, ready to make a good impression. In boot camp inductee's credo is: "If it

moves, salute it. If it doesn't move, pick it up. If you can't pick it up, paint it white." The same mind imposes an orderliness and a predictability on both the physical space and the social world of the military base.

As a civilian employee of the Navy, I was encouraged to occasionally ride a ship in order to better understand the nature of the "operational" world. But being encouraged by my own organization to ride a ship and being welcomed by the crew are two different things. From the perspectives of the people running a ship, there may be little to gain from permitting a civilian on board. Civilians, who are often ignorant of shipboard conventions, may require some tending to keep them out of trouble. They take up living space, which on many ships is at a premium, and if they do not have appropriate security clearances they may have to be escorted at all times.

The Ship

The *Palau* is an amphibious helicopter transport. Its warfare mission is to transport marines across the seas and then deliver them to the battlefields in the 25 helicopters that are carried on board. The helicopters also bring troops back to the ship, which has a small hospital and a complete operating theater. Ships of this class are often mistaken for true aircraft carriers of the sort that carry jet planes. As is the case with true aircraft carriers, the hull is capped by a large flat flight deck which creates an overhang on all sides of the ship. But this flight deck is only 592 feet long, just over half the length of a carrier deck and much too small to handle fixed-wing jets. About halfway between the bow and the stern, jutting up out of the smooth expanse of the flight deck on the starboard rail, stands a four-story structure called the island. The island occupies the rightmost 20 feet of the flight deck, which is about 100 feet wide. The ship extends 28 feet below the surface of the water and weighs 17,000 tons empty. It is pushed through the water by a single propeller driven by a 22,000-horsepower steam turbine engine.

Originally, the ships of the *Palau's* class were planned to have been almost 200 feet longer and to have two propulsion plants and two propellers. However, budget cuts in the early 1960s led to a hasty redesign. In the original design, the off-center weight of the steel island was to be balanced by the second propulsion plant.

Unfortunately, the redesign failed to take into account the decrease in righting moment caused by the deletion of the second engine. When the hull that is now the *Palau* was launched, it capsized! It was refloated, and the steel island was replaced with an aluminum one. The ship was renamed and put into service. The aluminum island is attached to the steel deck with steel bolts. In a wet and salty environment, this forms an electrolyte that causes corrosion of the attachment points between the island and the deck. There is a standing joke among those who work in the island that someday, in a big beam swell, the ship will roll to starboard and the island will simply topple off the deck into the sea.

Two levels above the flight deck in the island is the navigation bridge. Also in the island are the air operations office, from which the helicopters are controlled, and a flag bridge where an admiral and his staff can work. The top of the island bristles with radar antennae.

The Gator Navy and the Other Navies

When I first went aboard the *Palau* it was tied up at pier 4 with several other amphibious ships. A frigate and a destroyer were tied up to an adjacent pier, but they are part of another navy within the Navy. Membership in these navies is an important component of naval identity.

Troop transport is not considered a glamorous job in the Navy. The *Palau* is part of what is called the *amphibious fleet*, the portion of the fleet that delivers marines to battlegrounds on land. The amphibious fleet is also known somewhat derogatorily as the "gator navy." The nickname is apparently derived from a reference to that amphibious reptile, the alligator. While the alligator is not a prototypical amphibian, its aggressiveness may be important in Navy culture; "salamander navy" or "frog navy" might be too disparaging.

The aviation community (the "airdales") claims to be the highest-status branch of the Navy. Most others would say that the submarine fleet (the "nukes") comes next, although the submariners consider themselves a breed apart. (They have a saying that there are only two kinds of ships in the navy: submarines and targets.) Then comes the surface fleet (the "black shoes"). Within each of these groups are subgroupings, which are also ranked. In the sur-

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