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Introduction

This book is written for the mariner who wants to learn the concepts of piloting and navigation and do more than merely follow a closely prescribed set of rules. The reader is expected to be an active participant, and many exercises have been designed to help along the way.

This is not the *only* book you will need when you go to sea, so we provide references to other books that are more specialized or more compendious. But we have tried to deal with all the topics usually considered essential for coastal and blue-water boating.

OUR APPROACH

Henry David Thoreau was a Harvard student during the nineteenth century. In his chapter titled "Economy" in *Walden,* he wrote, "To my astonishment I was informed on leaving college that I had studied navigation!—why, if I had taken one turn down the harbor I should have known more about it." We cannot offer a boat ride in Boston Harbor, but our book is a response to Thoreau's plea for a *practical* approach. Its methods were initiated by Frances Wright and Professor Bart Bok at Harvard during the Second World War, and they were developed and refined during four decades of teaching by Dr. Wright and her assistants, and then by Professor Whitney, Philip Sadler, and many course assistants.

Three of our methods are common to many books: (1) hands-on involvement, (2) practical applications and the use of concise forms, and (3) emphasis on the need for constant vigilance. This book provides problems and answers for each chapter, and it includes practical lists of resources for the navigator who is preparing to set out. A set of reduction forms is provided at the rear of the book. These forms will help you with all the common types of sextant sight reduction. They are intended to be self-guided, and they may be photocopied and put into a ring binder for use at sea.

What makes our book different from most others is its focus on the three further methods: (4) *confrontation with misconceptions,* (5) the use of *definitions based on procedures,* and (6) the use of *imaginary scenarios* or "thought experiments." We feel these methods are keys to learning, and we owe thanks to our colleague, Philip Sadler, and his cohorts in the education department of the Harvard-Smithsonian Center for Astrophysics for helping us understand their value.

What do they mean? How do they affect this book?

Confrontation with misconceptions

Our minds are not empty buildings into which we merely bring furniture and tools. We all have ideas about almost any topic, whether we have studied it or not, so the process of learning is somewhat like constructing a new wing on an existing building. If a new idea is presented to us, we will add it to the existing superstructure—which often consists of naive ideas that we have invented for ourselves—and the result is often a bizarre floor plan. The old house will remain, and the naive ideas will still be available to mislead us into dead ends or through doorways that have no balconies.

So, it is not enough merely to give you the correct explanation, expecting you to grasp its full implications and throw out the naive ideas. Learning can only occur when you are able to confront your preconceptions and see that they do not work. You must, in many cases, be convinced of the need to restructure the old house. This confrontation can be achieved by having you make a prediction based on your preconceptions. If the prediction fails and you can admit that something is wrong with the old

idea, you are then ready to work toward a new conception.

Many sections of this book have questions to help you explore your preconceptions. These are the "pretests" and they will enable you to confront your ideas. Write your predictions in a notebook before looking at the answers found in the Appendix. Exercises are included to help make some of the ideas more obvious. Posttests (with answers in the Appendix) have been supplied to give you a chance to try out the new ideas.

Procedural definitions

By themselves, concepts and data are meaningless. Only when they are seen as part of a procedure are they useful to the navigator, just as a window frame is not much use until it is set into the framework of a house. The confident navigator is one who has a grasp of the procedures by which the navigational concepts are defined.

For example, when we introduce the concept of angular size we outline a series of steps starting with simple distance measurements and gradually coming to the idea of *apparent angular size.* Each section of the book starts with a statement of the concept to be treated and then focuses on a step-by-step procedure that will lead you to the concept.

Using imaginary scenarios

Our approach in this book is to help you visualize each concept by way of a *scenario,* which is our word for an imaginary experiment. Scenarios don't have to be real to be useful, as they can simplify and clarify our thinking. For example, in coping with time zones we imagine a flight around the world in a super-fast jet plane. We imagine starting at a point just west of the international dateline, wherever that may be—for the moment, we don't need to know. We take off at dawn and fly westward at 24,000 miles per hour, away from the sun. In our mind's eye the sun sinks below the eastern horizon again. This tells us that the local time has become earlier, so we must set our clock earlier. By imagining that we fly all the way around the globe in one hour, we can decide what to do when we cross the date line again. (We will complete this discussion in Chapter 13.)

The type of understanding that comes from imaginary scenarios is much more powerful than memorized rules. It will prepare you to handle situations that are not in any textbook. Scenarios not only *connect facts* and help you remember them, they can also *generate new insights.* One aspect of learning to navigate—or of learning any technical skill—is to build up a repertory of scenarios that can be used to solve new types of problems as they arise.

SPECIAL FEATURES

We have added three features to assist the navigator, whether beginner or expert:

1. A discussion of the Polynesian and other natural methods of determining positions and directions by noting the positions of the stars, as well as simple methods for determining latitude and longitude with an almanac and accurate timings of sunrise and sunset;
2. A set of self-guided concise forms for carrying out the reduction of a variety of sextant sights;
3. A mini-almanac giving the sun's declination and time of local noon for 1992-2001, and numerous other tables and lists.

Remember to pay constant vigilance, not only to the sea and your vessel, but to your misconceptions as well.

Happy and safe voyaging!