Introduction

As we move into the twenty-first century, we are ever more aware that we are connected to people in other cultures throughout the world. Through expanding communication networks and spreading markets, more experiences of ours and theirs are becoming similar. But, at the same time as we move toward greater likeness, we realize that there is much that we do not and did not share. In particular, we have come to understand that different cultures have different traditions and different histories. Even the same or similar happenings had different effects and different meanings when integrated into different cultural settings and interpreted through different cultural lenses.

This is just as true for mathematical ideas as it is for other aspects of human endeavors. Different cultures emphasized different ideas or expressed similar ideas in different ways. What is more, because cultures assort or categorize things differently, the context of the ideas within the cultures frequently differ.

Among those who study and write about the history of mathematics, there has been growing understanding that what is generally referred to as modern mathematics (that is, the mathematics transmitted through Western-style education) is, itself, built upon contributions from people in many cultures. There is now greater acknowledgment of, in particular, mathematical developments in China, India, and the Arabic world. In addition, there is increased recognition of the work of individuals from an expanding diversity of backgrounds.

There are, however, still other instances of ideas that did not feed into or effect this main mathematical stream. This is especially true of occurrences in traditional or small-scale cultures. In most cases, these cultures and their ideas were unknown beyond their own boundaries, or misunderstood when first encountered by outsiders. During the past 80 years, there have been vast changes in theories, knowledge, and understanding about culture, about language, and about cognitive processes. Yet, only recently have these newer understandings started to impinge upon histories of mathematics to modify the earlier, long-held and widespread, but, nonetheless, erroneous depictions of traditional peoples.

First and foremost, we now know that there is no single, universal path—following set stages—that cultures or mathematical ideas follow. With the exception of specifically demonstrated transmissions of ideas from one culture to another, it is assumed that each culture developed in its own way. When we introduce the varied and often quite substantial mathematical ideas of traditional peoples, we are *not* discussing some early phase in humankind's past. We are, instead, adding pieces to a global mosaic. In terms of our picture of *global* history, we are supplying complexity and texture by incorporating expressions from different peoples, at different times, and in different places. We are, in short, enlarging our understanding of the variety of human expressions and human usages associated with the same basic ideas.

Our focus, then, is elaborating the mathematical ideas of people in these lesser known cultures, that is, the ideas of peoples in traditional or small-scale cultures. In an earlier work, some of the peoples whose mathematical ideas I introduced were the Inuit, Iroquois, and Navajo of North America; the Incas of South America; the Caroline Islanders, Malekula, Maori, and Warlpiri of Oceania; and the Bushoong, Kpelle, and Tshokwe of Africa. Here we continue to enlarge our global vision by discussing, among others, ideas of the Maya of South America; the Marshall Islanders, Tongans, and Trobriand Islanders of Oceania; the Borano and Malagasy of Africa; the Basque of Europe; the Tamil of southern India; and the Balinese and Kodi of Indonesia. Each of these instances adds to our knowledge, but at the same time, makes us all the more aware that it is only a beginning: It is estimated that about 5000–6000 different cultures have existed during just the past 500 years. We will never know about the ideas of those that no longer exist, but there are several hundred that we can know more about.

There is no single, simple way to define a culture. In an attempt to capture all of its nuances, there are many different definitions. By and large, however, the definitions have in common that a culture is a group that continues through time, sharing and being held together by language, traditions, and mores, as well as ways of conceptualizing, organizing, and giving meaning to their physical and social worlds. Often it is associated with a particular place. To say that a culture continues through time is not to say that it is static. All cultures are ever-changing. What varies, however, is the pace of change. In general, traditional or small-scale cultures, as contrasted with, say, post-industrial societies, are more homogeneous and slower to change. Today, throughout the world, there is an overlay of a few dominant cultures, and no culture has remained unmodified by its contacts with others. Nevertheless, traditional cultures still exist, even if sometimes alongside of, or even within a dominant culture.

Where traditions changed slowly or persisted for a long time, we speak about them using the conventional idiom of "the ethnographic present," that is, we describe them at some unspecified time when the traditional culture held sway. However, we will, where we can, note the time depth of the tradition described, and cite some of the ways it has been modified or adapted, while, nevertheless, persisting to varying degrees in its underlying coherence. We will even discuss how a tradition that has been ongoing for hundreds of years both continues in its familiar form and yet becomes involved with a newly developed technology that has been introduced.

Although most of us have a notion of what *mathematics* is, the term has no clear and agreed upon definition. Expansion of the term generally relies on citing examples from one's own experience. To incorporate the ideas of others, it is necessary to clarify our definition and to move beyond the contents of the familiar settings of mathematics, that is, to look beyond the classroom and beyond the work of professional mathematicians. We will, therefore, speak instead of the more inclusive *mathematical ideas*. And, we will, first of all, specify what we take these to encompass: Among mathematical ideas, we include those ideas involving *number, logic, spatial configuration, and, more significant, the combination or organization of these into systems and structures.*

Most cultures do not set mathematics apart as a distinct, explicit category. But with or without that category, mathematical ideas, nonetheless, do exist. The ideas, however, are more often to be found elsewhere in the culture, namely, integrated into the contexts in which they arise, as part of the complex of ideas that surround them. The contexts for the ideas might be, for example, what we categorize as navigation, calendrics, divination, religion, social relations, or decoration. These, in fact, are some of the contexts for mathematical ideas that we will elaborate here. As we discuss the ideas, we also discuss their cultural embedding. Were we to present the ideas divorced from their contexts, they might look more like our own modern mathematics. This approach, however, would distort a major difference—most practitioners of modern mathematics value their ideas because they believe them to be context-free; others value their ideas as inseparable from the cultural milieu that gives them meaning.

Just as most cultures do not have a category called mathematics, they do not group mathematical ideas together as we do—that is, their ideas are not neatly partitionable into, say, algebra, geometry, model building, or logic. The extended examples that we discuss will determine which ideas are presented and the way they are grouped together.

In the chapters that follow, although we discuss the mathematical ideas of others, we do, nevertheless, view them from within our own cultural and mathematical frameworks. For understanding, we call upon similar ideas and concepts we have learned, and we use the vocabulary we share with the reader to convey our understanding. As outsiders to these cultures, we cannot do otherwise. It may well be that other cultures have some ideas too dissimilar from our own for us to detect, just as we have some ideas they do not have. What is crucial, however, is that we not impute to others ideas and concerns that are our own, and that we not be constrained by prejudgments. The process of viewing the ideas of others may lead us to think in more detail about some of our own ideas. In particular, it may lead us to identify some of our unstated assumptions. We may, perhaps, find that some ideas we have taken to be universal are not, while other ideas we believed to be exclusively our own, are, in fact, shared by others.