So here, in dealing with the reckonings and evaluations of users about which numeral systems to prefer, we must be careful not to assume a universal logic that requires a particular outcome. Because people are not rational choice machines, we need to understand their cultural rationality in order to understand how they made sense of their decisions. This is particularly important when looking at people far removed, chronologically or culturally, from contexts with which we are familiar. Nonetheless, this is an evolutionary book, in a historical sense, seeking to understand the long-term processes by which the reckonings of individuals at discrete periods come together to shape the histories of numerical systems, until they too, inevitably, meet their day of reckoning. Not only are we not at the "end of history" of numeration—surely new systems will be developed and used in the coming centuries—but there can be no such end, as long as humans are still judging and evaluating their numerical tools.

Numerals, cognition, and history: these three reckonings are the three central themes of the following seven chapters. Each element of this triad is essential for understanding human numbering practices and the social context of written numbers. Or so I reckon.

Note: On "Western numerals"

Throughout this book, I use the term "Western numerals" to refer to the set of signs 0123456789, organized in a base-10 system using place value, as I have done in my earlier research. In the English-speaking world, we mostly learn these signs under the name "Arabic numerals," which reflects the fact that they were borrowed by Western Europeans from Arabs living in Spain, Sicily, and North Africa in the tenth century CE. In the scholarly literature on numerals, these are most often called "Hindu-Arabic numerals," which reflects a little more of the history of the system, because the Arabic script got its numerals from an antecedent system used in northern India as early as the fifth or sixth century CE. Other terms like "Indian" and "Indo-Arabic" are also found. The historian of mathematics Carl Boyer, whose early work on numeral systems played an important role in my development as a "numbers guy," argued somewhat facetiously that we might more properly call it the "Babylonian-Egyptian-Greek-Hindu-Arabic" system (1944: 168)—although in this case I think he was wrong, and that "Egyptian-Mauryan-Indo-Arabic" would get the history straight.

The most basic problem with the formulations "Arabic" and "Hindu-Arabic" is that they do not adequately distinguish the set of signs 0123456789 from the set of signs ٠١٢٣٤٥٦٧٨٩ used in Arabic script or the set of signs ०१२३४५६७८९ used in the modern Devanagari script, or any number of other decimal, place value systems. All of these descend ultimately from that same fifth–sixth century CE Indian ancestor. To make matters more confusing, in Arabic the numerals used alongside Arabic script are called *arqam hindiyyah* (Indian numerals). The problem of ambiguity is thus a serious one. Because several such systems are in active use (particularly the Western European 0–9 and the "Arabic" set), it becomes a nightmare to try to distinguish these systems from one another. We need different terms for each set of numerals.

Structurally they are very similar to one another—although not completely; for instance, many Indian writers customarily write 100,000 as 1,00,000 and 1,000,000 as 10,00,000. So I talk about Western, Arabic, and Indian numerals to refer to the decimal, place value systems used in three different script traditions. Paleographically—in terms of the history of the signs themselves—they are quite distinct, and are likely to remain so. One could argue that just as we talk about the "Latin alphabet," we could call 0123456789 the "Latin numerals" instead of "Western." But this would only create confusion with the "Roman numerals." "Western numerals" reflects the fact that the particular graphemes (the specific signs) were developed in a Western European context and were first and most prominently used in Western Europe.

One might argue that by calling them "Western numerals" I am denying them their history, obscuring the fact that they derived from Indian and Arabic notations, which I certainly do not wish to do. But I think that Boyer has a point—why stop at "Hindu," since the "Hindu" place value numerals derive from a nonpositional system used in Brahmi inscriptions in India as early as the fourth century BCE, which in turn probably derives from Egyptian hieratic writing going back as early as the twenty-sixth century BCE! And if we later decide that this history is wrong, do we then change the name? I am far more concerned that by using terms like "Arabic" or "Hindu-Arabic" for 0123456789, we render invisible the continued existence and active use of actual Arabic and Indian numerals in the modern Middle East and South Asia. Using an umbrella term—which, in reality, obscures all but a single variant of a rich family of numerical forms—unfairly collapses

this complex genealogy with several extant modern branches into a single unilinear history. The history of place value becomes merely *our* history of place value. And, in the same way that the fallacious evolutionary error that humans are descended from chimpanzees renders chimps as our ancestors when they are actually our cousins, we must avoid rhetoric that suggests that Devanagari, Arabic, Persian, Telugu, Gujarati, and many other decimal positional systems are historical relics. No one seriously disputes the facts of the history and evolution of these systems, but our labeling practices run the risk of making it appear as if we stand alone at the end point of the history of numerals. "Western numerals" highlights that specific paleographic and structural innovations happened in the West (principally in Spain and Italy), but maintains a suitable conceptual distance from the related but still vital systems of the Middle East and South Asia.