

# Chapter 1

## Introduction

### 1.1 Setting the Problem: the Historical Context of Symmetry

There are dramatic moments in the history of science when the making of a new concept determines a whole way of thinking with the result that it obliterates the old modes to such an extent that it is almost impossible to retrieve them. Indeed, it takes a great effort of imagination and a convincing display of evidence to isolate such moments and cast them into relief. And when one succeeds in imagining such times when the successful concept was not yet available, the old mode of thinking may seem quaint and inconsequential in light of the power of the modern concept. We submit that such a moment took place in 1794 when Adrien-Marie Legendre (1752–1833) put forward a new definition of symmetry in a textbook on the elements of geometry.

Our objectives in this book are twofold: (1) to describe in great detail the story leading to this moment in 1794, and (2) to clarify the nature of this revolutionary scientific concept which has so powerfully fixed our gaze that we cannot see otherwise. Specifically, we will demonstrate that the concept of symmetry, as it is currently applied in many scientific domains, is entirely different from what was meant by the term, *symmetry*, in ancient and medieval times up to the early modern period. At the core of our argument is the claim that the scientific concept of symmetry as we know it today is in fact modern—it is a 19th-century concept.

We regard it as an important task for the historian and philosopher of science to liberate scientific concepts from the fetters of necessity, that is, to warn against turning concepts from historical contingencies into philosophical necessities. Like any other scientific concept, symmetry has a history: it has had various applications and different usages through the ages; it evolved for a long period of time and some of its usages have had a distinct inception and a time when they fell out of use. In this study we limit the historical discussion to the period from the inception of the term, *symmetry*, in Greek antiquity till an entirely new meaning was assigned to it in the late 18th century. We then place the novel meaning in its original context, specifically, the Revolutionary and Napoleonic era in France. This is a self-contained study; we will see that the period under consideration works as a unit. That is, in this period the various usages are closely related and evolved from the original meanings of the term, *symmetry*, in antiquity. We will argue that Legendre's