What is important is the real world, that is physics, but it can be explained only in mathematical terms.

Dennis Serre[1]

[...] mathematics as a precise language for expressing relationships among quantities in the real world [...].

Carver Mead[2]

real world
entity
language
communicate
information
investigate
relationship
plan
act

Chapter 1

Symbolic Systems

Contrary to what most people think, MATHEMATICS originates in, and deals with, the **real world**. However, dealing with real-world **entities** requires a **language** in order to:

- **Communicate** about the real-world, that is share **information** about real-world entities,
- **Investigate relationships** among real-world entities so as to understand the way the real world works,
- **Plan** how ro **act** on the real world because acting on the real world without thinking ahead usually has very unfortunate consequences.

There are all sorts of languages: anywhere between 3000 and 8000 spoken languages, hundreds of sign-languages, etc. There are written languages, pictorial languages, secret and non-secret codes, bar codes, computer languages, etc. And, as we will see, in order to do MATHEMATICS, we will need a special kind of written languages so as to know exactly what we are doing and so as to check matters with others.

1.1 What Languages Are Made Of

Very, very roughly, languages are constructed as follows:

[1] Bulletin of the AMS, Vol 47 Number 1 Pages 139-144
[2] Foreword to *Street-Fighting Mathematics* by Sanjoy Mahajan, The MIT Press.