

I. PROLEGOMENON ON THE NATURE OF SCIENCE

All physical theories are wrong. All mathematical theories are right. Mathematics and the physical world are clean separate things ... and, a priori, have *nothing* to do with each other. The ultimate criterion for physics is agreement with experiment. The ultimate criterion for mathematics is logical consistency.

There has been so much confusion about physics and mathematics that it is well worth asking ‘just what **is** the relationship between them’ ? Here in lies a key to understanding the modern world. Mathematics is *not* physical and exists entirely inside our heads. The physical world we study is *not* mathematics and lies entirely ‘outside’ us. The pivotal observation we now live with since the classical Greeks and since the Renaissance ... is that *approximate* mathematical modeling of the physical world *seems* to be a useful undertaking. Somehow ... ‘NATURE’ lets us get away with it. The fact that you can make mathematical models *at all* is amazing enough. But that you don’t have to get it *all* right to get part of it right is just plain astounding. This is the great discovery. We now understand that all models have limitations - both in what they claim to model and in the stated precision of what they do model. This no longer bothers us. We expect it. No model encompasses the entirety of the physical world or agrees perfectly with all experiments. Thus they are all wrong. The sole criterion for *being* mathematics at all is being logically consistent so that if it *is* math at all it is right. The criteria of right and wrong are, accordingly, utterly useless. Instead, we use the criteria of ‘good’ and ‘bad’. Learning just how to apply these words is, however, a matter of deep experience in either realm. No one yet knows just how far humans are going to be able to take the enterprise of applying mathematics to model nature. We haven’t been at it very long! ... and there is certainly no end in sight yet. This is *our* enterprise. It is with trembling hearts ... and the profoundest wonder and respect that we tread the path of Pythagoras, of Democritus, Ptolemy, Galileo, Newton, or Gauss.



***„Alles Vergängliche ist nur ein Gleichnis,
 Das Unzulängliche, hier wird’s Ereignis,
 Das Unbeschreibliche, hier ist es getan;
 Das Ewigweibliche zieht uns hinan.“***

FIG. 1: Goethe: Faust