

## ESSAY by Ralph E. Gomory

### The Known, the Unknown and the Unknowable

We are all taught what is known, but we rarely learn about what is not known, and we almost never learn about the unknowable. That bias can lead to misconceptions about the world around us.

The known is pressed on us from the first. In school we start each course at the beginning of a long book full of things that are known but that we do not yet know. We understand that beyond that book lies another book and that beyond that course lies another course. The frontier of knowledge, where it finally borders on the unknown, seems far away and irrelevant, separated from us by an apparently endless expanse of the known. We do not see that we may be proceeding down a narrow path of knowledge and that if we look slightly left or right we will be staring directly at the unknown.

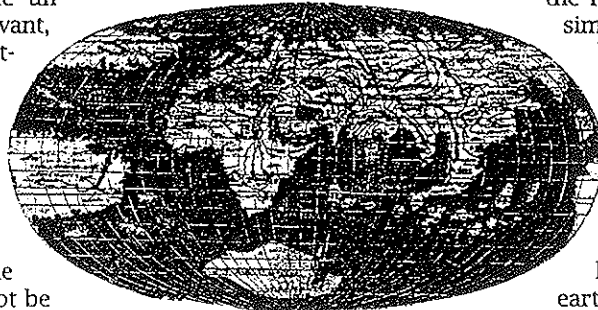
Even when we are right on the edge of the unknown, we may not be aware of it. Those of us who learned the history of the Persian Wars in school did not know that the events so vividly described are all based on the writings of the one source who survived—Herodotus. If you want to know almost anything that happened in the Greece of that time and it was not recorded by Herodotus, it is unknown and in all probability can never be known. But we did not think of his accounts as fragments of knowledge on the edge of the unknown; it was just more stuff from the huge pile of facts we had to learn about the history of Greece.

Because of such lessons, we grow up thinking more is known than actually is. If we had a better description of the limits of present knowledge, that description could be a part of what we are taught. Such insight would give us a better perspective on what is known and what is currently unknown.

In time, many things now unknown will become known. We will learn more about what lies below the surface of the earth, and we may learn how neurons interact to let us perceive and think. The accumulating pile of data can be

misleading, however. Beyond the currently unknown are the things that are inherently unknowable.

Few unknowables are consciously recognized as such. The outcome of a spinning roulette wheel and the local weather three months from now belong to that small class. Every day, however, we bump into phenomena that may well be unknowable but that we do not recognize as such. Some of these unknowables form the bases of respected professions. Brokers make a living anti-



16TH-CENTURY MAP reveals its unknowns only in hindsight.

ciating the fluctuations of stock prices. Presidents run for office based on claims of what they will do for a vast and poorly understood economy composed of many unpredictably interacting sectors. We do not even know if we are dealing here with the partly known, the mainly unknown or the unknowable.

Nevertheless, we unconsciously recognize that the unknowable surrounds us. Nobody thinks about or pretends to know who will run for president 20 years from now. Nor do people try to predict the automobile accidents they will be involved in. To know that we will be struck by a car next year, we would have to know, with impossible accuracy, the particulars of the life of the driver, his habits, his timing, his way of pressing the accelerator and so forth—all the facts that are needed to bring him with perfect precision to that unpleasant encounter. It is clear that all these details are unknown, and we do

not try very hard to learn about them because we instinctively realize they are also unknowable.

In distinguishing the known or the unknown from the unknowable, the level of detail can be decisive. The level of detail is what separates the delusion of the gambler from the wealth of the casino owner. The gambler attempts to predict the individual and unpredictable spins of the roulette wheel; the owner concerns himself with the quite predictable average outcome.

The prediction process is aided by the fact that the artificial is generally simpler than the natural. The roll of a bowling ball down an alley, for instance, is easier to predict than the motion of an irregular stone tumbling down a rough hillside. It is likely that the artificial will increasingly save us from the unpredictable. It may be easier to move gradually toward a completely enclosed earth whose climate could be artificially controlled than to learn to predict the natural weather.

It is in creating the artificial and controllable that science excels. Science and engineering have made it possible to construct the partially artificial surroundings we live in today, replete with huge bridges, trucks, airplanes, antibiotics and genetically altered species. We are likely to build an increasingly artificial, and hence increasingly knowable, world.

Two limitations may constrain the march of predictability. First, as the artifacts of science and engineering grow ever larger and more complex, they may themselves become unpredictable. Large pieces of software, as they are expanded and amended, can develop a degree of complexity reminiscent of natural objects, and they can and do behave in disturbing and unpredictable ways. And second, embedded within our increasingly artificial world will be large numbers of complex and thoroughly idiosyncratic humans.

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