

Preface

The more we learn about the world, and the deeper our learning, the more conscious, specific, and articulate will be our knowledge of what we do not know; our knowledge of our ignorance.¹

Karl Popper

A man's got to know his limitations.

Harry Callahan

Magnum Force (1973)

Everything should be made as simple as possible, but not simpler.

Attributed to Albert Einstein

With understanding comes ambivalence. Once we know something, we often find it boring and trite. On the other hand, the mysterious and unknown fascinates us and holds our attention. That which we do not know or understand is what interests us, and what we *cannot* know intrigues us even more. This book explores those topics that reason tells us we cannot know because they are beyond reason.

There are many books that convey the amazing facts that science, mathematics, and reason have revealed to us. There are also books that cover topics that science, math, and reason have not yet fully explained. This text is a little different. Here we study what science, mathematics, and reason tell us *cannot* be revealed. What cannot be predicted or known? What will never be understood? What are the limitations of computers, physics, logic, and our thought processes? What is beyond the bounds of reason? This book aims to answer some of these questions and is full of ideas that challenge our deep-seated beliefs about the universe, our rationality, and ourselves.

Along the way we will study simple computer problems that would take trillions of centuries to solve; consider perfectly formed English sentences that have no meaning; learn about different levels of infinity; leap into the bizarre and wonderful world of the quantum; discuss specific problems that computers can never solve; befriend butterflies that bring about blizzards; ponder particles that simultaneously dance at different parties; hear about paradoxes and self-referential paradoxes; see what relativity theory tells us

¹ Page 38 of Popper (2002).

about our naïve notions of space, time, and causality; understand Gödel's famous theorems about the limitations of logic; discover certain problems in mathematics and physics that are impossible to solve; explore the very nature of reason, science, and mathematics; wonder why the universe seems to be perfect for human beings; and examine the complex relationship between our mind, reason, and the physical universe. We will also attempt to peek beyond the borders of reason and see what, if anything, is out there. These and many other fascinating topics will be presented in a way that is clear and comprehensible.

While exploring these various limitations in diverse areas, we will see that many of these limitations have a similar pattern. These patterns will be investigated in order to better understand the structure of reason and its limits.

This book will not be a comprehensive list of all the diverse examples in which limitations of reason are to be found. Rather, our goal will be to understand why these boundaries arise and why reason cannot extend beyond its boundaries. Several representative limitations in each area are selected and discussed in depth.

Rather than just list the limitations, we aim to explain them or at least provide the intuition of why a particular area is beyond reason. It is important to realize that this book is not wishy-washy or New Age. Nor is this a history book in which we gloss over the meaning of ideas in order to give a chronological development of how these ideas arose. This is a popular science book that will gradually and clearly explain the ideas presented.

Since we accept Stephen Hawking's dictum that every equation halves the number of readers, very few equations will be found in this text. However, we do believe in the power of diagrams, charts, and graphs to simplify complex ideas. Our goal is clarity.

Each chapter deals with a different area: science, mathematics, language, philosophy, etc. These chapters are arranged from the concrete to the most abstract. We start with simple problems of everyday language and move on to straightforward philosophical questions, ending with the abstract world of mathematics. For the most part, the chapters are independent of each other and can be read in any order. The reader is encouraged to first read the topic that interests her. (The unifying theme of self-referential paradoxes is found in Chapters 2, 4, 6, and 9.)

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