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PREFACE

The brain poses an exceedingly difficult problem for modern science. Science is wedded to the notion that every system, no matter how complex, can eventually be fully understood in terms of its component parts. This idea, called reductionism, is an intellectual strategy that enables the scientist to study complex systems in an experimental fashion. Reductionism has been hugely successful in advancing science over the past 400 years. There is real cause for hope that the reductionist approach will enable us to conquer human disease, to solve the problem of poverty, to extend human capacity, to build efficient engines that use alternative fuel sources, and so on. Virtually every scientist is committed to the idea that reductionism is the pathway to a brighter future. Yet whether such an approach can enable us to understand the human brain fully is another question entirely. While scientists hope that by studying individual nerve cells it will eventually become possible to understand the function of the brain, it is not certain that this is feasible.

Can the brain ever truly understand itself? Is there a distinction between understanding the brain and knowing the mind? Are those traits that we perceive to be uniquely human, traits such as creativity or altruism

or spirituality, dependent upon attributes unique to the human brain? Is it consciousness that makes us fully human, or do we share consciousness with many other creatures? How is it possible that the human brain, probably the most complex and sophisticated object in the universe, could have arisen in a world so often characterized by chaos? Has the human brain changed over time and will it continue to change? Did the brain evolve or was it necessarily created in its final form? Are the mechanisms of mutation and natural selection adequate to explain the human brain, or do they fall woefully short? How can we explain what we are?

Clearly, we cannot claim to know the world if we do not even know our own minds. Yet it has been very challenging to understand even relatively simple things: how can a nerve cell stimulate a muscle to contract or a heart to beat? An enormous gap remains between comprehending how an individual nerve cell works and how the brain as a whole works: how can a mass of neurons enable us to learn and remember? And this gap in our knowledge is trivial compared to our current inability to understand how the brain gives rise to behavior and culture: how can a mass of brain tissue produce art or science or theology? Our lack of insight into how the brain works is nowhere more apparent than in our fundamental incomprehension of the creative act itself.

Creativity may be the single greatest challenge to modern reductionist science, yet science has already yielded fresh insights into innovation and imagination. It is our view that evolution can now explain the human brain in broad strokes, and will eventually explain human behavior in detail. Our understanding of mutation and natural selection provides useful insights into the evolution of the human brain. We contend that, because of the selective advantage of having a highly complex brain, the emergence of sophisticated behavior is inevitable; creativity is simply the fruit of emergent complexity, an unintended consequence of the evolved mind. Nevertheless, the fact that Handel could conceive *The Messiah* seems no less remarkable than if ants in rural Pennsylvania resolved to outdo Frank Lloyd Wright, to build another, better Fallingwater.