Is the universe around us a figment of our imagination? Or are our minds figments of reality?

In this refreshing new look at the evolution of mind and culture, bestselling authors Ian Stewart and Jack Cohen eloquently argue that our minds necessarily evolved in an inextricable link with culture and language. They go beyond conventional reductionist ideas to look at how the mind is the response of an evolving brain trying to grapple with a complex environment. Along the way they develop new and intriguing insights into the nature of evolution, science and humanity.

FIGMENTS OF REALITY

Ian Stewart and Jack Cohen

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The evolution of the curious mind

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ZARATHUSTRAN THEORY OF EVERYTHING:

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Preface

Isn't it strange that the animal we used to be developed into the creature that we now are? How – and why – did human intelligence and culture evolve? How did we evolve minds, philosophies and technologies? And now that we have them, where are they taking us?

The orthodox answer to these questions looks inside our brains to see what they are made of and how the various components operate. This leads to a story based upon DNA biochemistry, the evolution of nerve cells as pathways for sensory information, and their organisation into complex networks – brains – that can manipulate neural models of natural objects and processes. Mind is seen as a property of an unusual brain – complex enough to develop culture – but here the 'reductionist' story starts to lose its thread. Many people see mind as something that transcends ordinary matter altogether. Philosophers worry that the universe around us may be a figment of our own imagination.

In *Figments of Reality* we explore a very different, but complementary, theory: that minds and culture co-evolved within a wider context. Every step of our development is affected by our surroundings. Our minds are rooted in ordinary matter; they are complex processes – or complexes of processes – that happen in material brains. Our brains are linked to reality by their molecules; but they are also linked to reality on another level, their ability to model reality within themselves.

Those links have had important effects on the evolution of the brain and the mind. For example, even our sense organs are not totally pre-programmed: far from it. Instead, as we grow, our senses are 'tuned' to detect particular features of our surroundings. Mind is not immaterial transcendence: it is the response of an evolving brain to the need to survive in a complex environment. And with the evolution of culture, that environment has become self-modifying and self-referential, and human minds have done the same.

Evolution and tuneable senses have produced minds that can grapple with reality by operating upon *features* – high-level structures/processes in the brain that correspond to large-scale regularities in the surrounding world. For example, a goat eats leaves because they *look* like leaves, not because its nerve cells have a chemical affinity for chlorophyll. If plants had evolved differently,

using a purple chemical for photosynthesis, then goats would be looking for purple leaves instead; but otherwise they would be much the same as present-day goats. We shall investigate how the mind explores its own mental landscape and works with the features that it finds there. This leads to a new theory of the relation of individual minds to the human culture in which they reside.

This is a different view from that of current physics, which, for instance, sees a table as 'mostly empty space' because of atomic theory, and thereby directs our attention *away* from important human-scale features such as 'wooden', 'solid', 'brown'. Such 'commonsense' features were important for evolution, and remain important for understanding many areas of science. For example, the evolution of the goat as a successful herbivore depended upon its ability to perceive leaves, not upon its understanding of biochemistry.

How can a conscious, intelligent mind evolve? Instead of giving a reductionist answer based upon internal fine structure we take an external, contextual view. We see the accumulating knowledge of generations of intelligent beings as a thing or process with its own characteristic structure and behaviour: *extelligence*. Extelligence constantly modifies and organises itself through continuing interactions with innumerable individuals. As a result, extelligence has become greater, more permanent, and far more capable than any individual intelligence. However, extelligence makes no sense without intelligences to interact with it: the two are 'complicit'. The developing mind of each child interacts with extelligence by way of language, and the two-way flow between individuals and their surrounding culture changes both. Intelligence is fostered in the child, and extelligence is fostered in the culture. Thus the evolution and structure of the brain cannot be divorced from the evolution and structure of human society and its environment, the universe.

Our minds co-evolve with everything that influences them. Minds *are* figments of reality, processes going on inside structures made from ordinary matter whose behaviour evolved *in order to* mimic, model, and manipulate natural processes. This explains why they are 'unreasonably effective' ♪[1] at perceiving and reorganising their environment. The human condition is a complicit interaction between culture and individual minds, each shaping the other.

Culture depends upon communication, which we achieve with language. Language, the first step towards extelligence, co-evolved with brains and made minds, complicit with hands and technology, and the discovery of patterns

1 The symbol ♪ ('note') indicates that there is a note at the back of the book which takes the appropriate topic further, or provides a reference. Various technicalities are relegated to the Notes, as are discussions of interesting distractions.

and laws. Mind can only think about mind once language equips it with a recursive (that is, self-referential) feature-detection system. Once it has this, *self*-awareness is an immediate, essentially trivial property, because 'self' is a feature too. The existence of features makes it possible to employ a mental map instead of the real territory.

The greatest single step in organic evolution was the aggregation of different bacteria to make the nucleated cell. Similarly, the greatest step so far in our cultural evolution has been the aggregation of different cultures to make multicultures. There are many kinds of multiculture, ranging from multinational corporations to major cities like New York. But the self-complication of human culture will not stop there, because it is a self-propelled process. Today's multicultures are like the creatures of a colony, coexisting as more or less isolated 'ghettos'. Tomorrow's multicultures will be more like genuine multicellular organisms, in which extelligence is specialised like the different tissues of a complex animal. Our new communication technologies are beginning to knit all of the different multicultures into a new entity, a superculture: Humanity.

This will be our story.

And here is the place to thank everybody who has contributed to it. JC is grateful for the hospitality of the University of Warwick, which provided him with a room and a phone. IS had a room and a phone too, but then, he works there. The manuscript of *Figments of Reality* was subjected to critical reading by a variety of people. We are grateful to them for their sterling efforts, which improved the book considerably. Naturally we take full responsibility for any remaining errors or infelicities (unless they were the other author's fault). Our editors at Cambridge University Press, Tim Benton and Barnaby Willitts, deserve special mention since they were exposed to more than one version of the manuscript. In alphabetical order, the other readers were: Daniel Goldenberg, Steve Gould, Mac Hanson, Rabbi Dr Margaret Jacobi, Mike Leci, Mal Leicester, Christine McNulty, Alan Moore, Alan Newell, David Poyser, Terry Pratchett, Helen and Gareth Rees, Lena Sarah, Paulo Sousa, Heather Spears, Colin Touchin, and Elizabeth Viau.

A word about the brief stories that head each chapter. They are there because they illuminate, perhaps indirectly, the main themes of the chapter concerned. All of them are, to the best of our knowledge, true. (Except one, which we invented, for very good reasons – only to find that it contained more truth than we had thought. We confess the falsehood early in the appropriate chapter, and explain the unexpected germ of truth shortly afterwards.) Some of our readers complained that one or two of these stories were not 'politically correct'.

However, we left them unchanged, because we feel that political correctness should be secondary to truth. We emphasise that the stories are not intended to be derogatory or offensive, and if you think any of them is, then you're reading things into it that we didn't intend. For example, we mention a woman scientist who becomes emotional. We cast her as a woman because, as it happened, she was. The emotion, to us, is a positive and necessary feature of the story, and if the same thing had happened to a male scientist, he'd have been just as emotional, and we would have told it that way. Several stories rest upon human frailties or idiosyncracies, but we are not holding anyone up to ridicule. The aim of those stories is to illustrate what a strange but wonderful animal we humans are.

Figments was written in a variety of places – lots of trains between Coventry and London Euston, benches in St. James's Park in London, benches on the Thames Embankment – even sometimes at a desk. Many of the places were aeroplanes – Ryanair from Birmingham to Dublin, American Airlines from Chicago to San Francisco, Delta Airlines from Salt Lake City to Cincinnati ... One of the ironies of the complex world of the late twentieth century is that one of the best places to find the solitude to write is at 35,000 feet travelling at 550 mph.

Not for long, we fear: already telephones are proliferating across the backs of aircraft seats.

A tropical island would be more comfortable, but comfort is not conducive to wordage. Stuck on a tropical island, it is too easy to consume coconuts and rum punch all day long without ever having the stimulus to put pen to paper. Stuck in a Boeing 767 on an overnight flight, with eight hours to pass and about ten cubic feet of space to pass it in, one's only companion a heap of gin miniatures and a can of tonic water, the attraction of taking refuge in the world of the imagination is far stronger. All you need is a legal pad and a pen, or for technofreaks, a laptop.

We used both. We're not fussy and we type fast.

IS & JC
Coventry, September 28, 1996

Figure Acknowledgements

Figure 3
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Figure 21
Jack Cohen, *Reproduction*, Butterworths, London 1977, p.179, Figure 10.1.

Figure 22
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Figure 24
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