

The joy of science

A review of *Unweaving the Rainbow* by Richard Dawkins

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Unweaving the Rainbow by Richard Dawkins, published by Allen Lane, The Penguin Press, £20, ISBN 0-713-99214-X

In *Unweaving the Rainbow*, Richard Dawkins sets out to show that science is not a cold dispassionate process but can appeal to the aesthetic senses as much as poetry or art. He takes his title from a poem by Keats, written in 1820. The theme of the poem was that, in seeking to explain natural phenomena, scientists rob the world of wonder. Keats wrote the poem against Newton, whom he accused of destroying the wonderment in a rainbow.

Newton had, by using a prism to split sunlight into the spectral colours, explained the wave-like nature of light. Dawkins replies that although the universe is indifferent to human preoccupations, its beauty can be better appreciated with the advantage of knowledge and understanding. He begins by explaining the ephemeral nature and improbability of an individual's existence. For any person alive at this moment, his or her life contains, by chance, the one out of millions of sperm that could have achieved existence and is just part of one generation against the countless generations that have gone before and will come in the future.

To provide a grasp of the enormous time scale that represents the earth's existence, he compares it to a library of books. If each year were represented by one volume, we would have to go back through a 1000 feet of volumes to read about our Australopithecine ancestors. To read about the trilobites, we would have to back through 35 miles of books. The whole shelf of the history of the earth would be 200 miles long.

Dawkins opposes postmodernism, taking up the American anthropologist Matt Cartmill who says, "There are no objective facts--all supposed 'facts' are contaminated with theories." He opposes the dumbing down of science to make it appear "relevant", but is not against fun in science, and cites the Royal Institution Christmas lectures for children as a good example of how science can be accessible, yet challenging. He attacks the dominance of such programmes as the *X-Files* for helping to create a non-rationalist climate of opinion, but is not opposed to science fiction per se.

Chapters two through five all have "Barcodes" in their headings. In *Barcodes in the Stars*, Dawkins shows that, following from Newton's work on splitting light using a prism, Maxwell developed the theory of electromagnetism and the concept of the wave nature of light. Quantum theory has since shown the dual nature of light, in that it can also be considered to consist of discrete particles of energy. Maxwell's experiment in splitting light

into its constituent colours resulted in spectra interspersed with black lines. The German physicist von Fraunhofer was able to show that these lines were a signature of the chemical makeup of the media through which the light had passed. This meant it was possible to study the chemical makeup of stars at enormous distances from the earth. The American astronomer Hubble was able to show that the red shift of the light from stars, i.e., the lengthening of the wavelength, meant that stars were moving away from each other at enormous speeds. This led to the concept of the expanding universe, which is fundamental in our understanding of its history and nature.

In *Barcodes on the Air* Dawkins explains the phenomenon of sound. Different wavelengths of sound produce a different pitch, as heard by the ear. But the ear can detect more than just pitch. Musical instruments produce different harmonics. Harmonics are made up of multiples of the fundamental frequency. It is possible, using the Fourier technique, to break down complex patterns into their basic sine wave patterns. He goes on to explain how other cycles in nature can be analysed and explained using such techniques.

Barcodes at the Bar examines the use of "genetic fingerprinting" in "proving" identity in court. The technique relies on the fact that large sections of DNA in a human chromosome are made up of "junk" multiple copies, and that these multiples form patterns which, in theory, are unique to a particular individual and can be used to prove or disprove an identity from body tissue. Dawkins explains that certain subgroups of people could share common patterns and that this must be taken into account when interpreting evidence based on DNA patterns.

The book then moves on to oppose religious and non-rational thought. Dawkins writes that people's sense of wonder is being hijacked by superstition, rather than science. In the West, although religion is in decline, the interest in the paranormal is taking its place. He takes up astrology, explaining that the constellations used by them are based on arbitrary arrangements of stars. These stars in no way form coherent collections; they just appear to be closely associated because of the particular line of view seen from earth. Also these arrangements are not eternal. The constellations had a very different appearance 1 million years ago and will take on a different appearance over the next 1 million years.

Against the growing cult surrounding so-called alien encounters, Dawkins brings out the enormity of the universe. Even if intelligent life evolved elsewhere, he says, the chances of us being

in contact are very remote. To point out the emptiness and vastness of space, he uses Isaac Asimov's analogy. If a grain of sand represented all the matter in the universe, the grain would be in the middle of a 20-mile cubic box.

Dawkins takes apart the predictions of astrologers. He points out that astrologers' predictions have no consistency. A reliability coefficient is a measure of agreement of predictions. A coefficient of 1 would be complete agreement; a coefficient of -1 would be complete disagreement. A figure around 0 would mean no association, i.e., complete randomness. When the predictions of astrologers are judged on this basis they have a reliability coefficient of 0.1, and those of palmists 0.11. In other words, their "predictions" are about as valid as someone making a random guess.

Dawkins warns against being dogmatic, but goes on to expose such "paranormal" events as those recently shown on Carlton television's *Beyond Belief* series. In one programme, a man claimed to be able to see through his father's eyes. The man was blindfolded and a number wheel spun. The man claimed to be able to see through his father. What the father was doing, explains Dawkins, was using a clever code to indicate the numbers. For example "now son what am I seeing" could be 30, "what is this" could be 55, etc. Clever but hardly paranormal.

He analyses uncanny events that seem to be beyond explanation, but when examined statistically lose their mystery. He gives as an example a TV mystic claiming to be able to stop watches. People are invited to ring in if a watch they have stops ticking. Dawkins then examines the probability of such events. If a watch battery lasts a year, then the chance of it stopping in a particular five-minute period, i.e., during the programme, is about 1 in 100,000. This is low, but if 10 million are watching it means that about 100 watches will stop in that period. If you add on people ringing because their clock stopped that day, then the mystic soon gains credibility.

Dawkins tackles coincidence. He cites a lecture by Richard Feynman, a science writer, in 1963. Feynman explained how the clock in his wife's bedroom stopped at 9:22 p.m., the exact moment of her death. It appears an amazing, almost supernatural coincidence. But on examination it is not. The clock was subject to stopping when it was tilted. The nurse had picked up the clock to check the time when his wife died, thus tilting and stopping it. He also attacks those who try to use quasi-scientific language to cover their charlatanism, such as one author who speaks about "quantum morality", "quantum psychology", etc.

In the later chapters Dawkins takes up his own field, that of evolutionary biology. He brings in his concept of the "selfish gene", explaining that any gene has to operate within a suite of other genes that must "cooperate" to produce the desired effect, i.e., the survival of the individual and the species. Genes must adapt along similar lines to have a beneficial effect. A cheetah, as well as developing the genes to produce a fast agile body attuned to hunting, must also develop the short gut associated with the carnivorous way of life. This "cooperation" can also take place at a higher level. Dawkins is careful to point out the need to maintain a scientifically detached view. For example, in forests there are bacteria that break down the soil and so produce nutrients for the

trees. But this is a purely incidental consequence of the property of the bacteria. He takes to task those who invoke the "Gaia" concept of considering the earth and the organisms within it as one living, whole organism. One senior ecologist dismissed the idea of the dinosaurs being wiped out by a comet by stating, "Gaia would not have permitted it."

Dawkins brings in the concept of the "Genetic Book of the Dead" to show how any one particular organism, at any one time, embodies the experiences that species has gone through and evolved to suit its particular lifestyle. As an example, he takes whales that over millions of years have evolved from some form of land dwelling animal to one able to exploit the marine environment. The built-up experience of the species, in adapting to a marine environment, is expressed in the genetic makeup of the whale.

In the final two chapters, Dawkins examines how we interpret the world. He explains that the brain and its senses are attuned to detect changes. Faces play an important part for both monkeys and man. Face recognition would play an important part in any intelligent social animals. He brings out the essential role of brain capacity in human evolution. In the 3 million years that have elapsed between *Australopithecus* (an early ancestor of man) and present-day *Homo sapiens*, brain size has increased four-fold. He speculates on how this process may have taken place. He uses critical mass concept, i.e., that once it reached a certain size, positive feedback ensured even further growth. As for the mechanisms that brought this about, he cites the evolution of language as a prime candidate.

Dawkins's book is certainly eclectic, but is a stimulating read. As part of the promotion of the book, the publisher arranged public readings by Dawkins and his wife. At Leeds and Manchester University there were audiences of about 500 to hear the readings and ask questions. That his readings were so well attended shows there exists a growing audience for a scientific outlook and a rejection of the debased intellectual level of most public discussion and media trivia. In his book, Dawkins refers to the late Carl Sagan several times. I think that Dawkins shares the pure joy and wonderment that Sagan expressed in his writings and lectures. He also shares the intellectual rigour and defence of rationality. The book deserves to be read for these values alone.



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