

atheoretical diagnostic language — is thus given further support.

While denying that they are ‘anti-psychiatry’, Kutchins and Kirk do deplore the proliferation of psychiatric labelling, facilitated by *DSM*’s ever-lengthening diagnostic list. Nowadays many groups, and not just psychiatrists, patently have an interest in translating everyday behaviours into psychiatric diseases — worry for example becomes “generalized anxiety disorder”.

In this medicalization process, the wretched and the powerless are all too easily further victimized by labels that carry a lasting stigma. One solution, of course, would be for the public acceptance, without shame, of mental disorder. But that would be crying for the moon.

This is a serious and well-documented study, which casts serious doubt on the touted scientific status of *DSM* categories. It is also readable, although Kutchins and Kirk’s preoccupation with the day-to-day minutiae of the politics of naming may dispose some psychiatrists to see in this a case of ancient obsessional disorder. It is certainly sobering to discover just how the terms we take for truth have come into currency. □

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Where has the billion trillion gone?

The Conscious Universe: The Scientific Truth of Psychic Phenomena
by Dean I. Radin

HarperEdge: 1997. Pp. 320. \$25.

I. J. Good

My friend Christopher R. Evans worked for a time with the well-known parapsychologist J. B. Rhine, but became a sceptic. In 1974 I invited Evans to Blacksburg, Virginia, to give a lecture on extra-sensory perception (ESP), and picked him up at Roanoke airport. He had travelled from London in a Boeing 727. The licence number of my car happened to be CRE 727. The probability of that coincidence was about $1/26^3 \times 1,000,000,000$.

I have experienced three even more remarkable coincidences, one of which changed the course of my life. But I doubt whether these coincidences were paranormal because there are more than 5 million minutes a decade. Some people must have experienced chance coincidences with probabilities of about 10^{-14} . So controlled, not anecdotal, observations are needed.

In England, for about 20 years starting in 1939, S. G. Soal was by far the most promi-



Body language

Facial features of the sanguine, phlegmatic, melancholic and choleric personality types (clockwise from top left), taken from Johann Lavater’s *Essays on Physiognomy* (1789). They are reproduced in *Believing in Magic: The Psychology of Superstition* by Stuart A. Vyse

(Oxford University Press, £18.99, \$25). Vyse argues that scientific analysis of differences in personality traits — such as sensitivity to coincidence, fear of failure, a need for control — can help us to understand why superstition and belief in the paranormal are so prevalent today.

nent parapsychologist. He did controlled card-guessing experiments resembling those of Rhine. At the suggestion of Whately Carington, Soal examined his records, looking for ‘hits’ one ahead and one behind the guess of the ‘current’ card. In one series of experiments, the tail probability, or *P* value (the probability that, by chance, the outcome would be at least as ‘extreme’ as the observed outcome), was 10^{-35} for the ‘one-aheads’, thus seeming to prove the existence of pre-cognitive telepathy.

But evidence accumulated, culminating in the ingenious detective work of Betty Markwick in 1978, showing that Soal’s studies were very probably fraudulent. Dean Radin, author of *The Conscious Universe*, avoids mentioning Soal.

Radin is firmly convinced that paranormal events happen. His conviction is based mainly on evidence from controlled experiments but is influenced also by the ‘non-local’ phenomena of quantum mechanics.

Quantum mechanics has affected many people’s metaphysical speculations about consciousness and ESP. For example, some 50 years ago, in a conversation with the prominent physicist Léon Rosenfeld about subjective experiences, I said: “A [quantum]

field theory does seem to be natural in order to understand how the activities of numerous neurons in a brain somehow summate. Perhaps psi depends on ψ [the Schrödinger wave function].”

Leaving psi aside, there are much more serious and technical speculations about the relationship between consciousness and quantum fields by Stuart Hameroff and Roger Penrose, related to microtubules — extremely small skeletal elements in neurons. One could say that microtubules update Descartes’ pineal gland. Penrose does not, however, mention ESP in his work on consciousness.

Taken at its face value, some of the evidence from controlled experiments is conclusive. But we have to allow for fraud and the ‘file-drawer’ effect. Take the first of these. Even many ‘normal’ scientists have cheated, as recorded by Alexander Kohn in *False Prophets: Fraud and Error in Science and Medicine* (Barnes and Noble, 1986). To that collection may be added the psychologists who lie to their subjects and call the lying ‘experimental dissimulation’.

Parapsychologists and psychics have more incentive to cheat because, if their research results are uninteresting, they have

less opportunity to turn to teaching. Unconscious cheating, wishful thinking (which is universal), unsound experimental design and analysis, and seeing what we expect are further pitfalls. The statistician M. G. Kendall once described the phenomenon of seeing what one expects as “one of the deadliest forms of bias in psychology”. He was referring to an experiment in which an observer of a reliable random-number generator had a tendency to write down too many even numbers.

Potentially the most important evidence in Radin’s book is in the chapter on meta-analysis, which is also emphasized in the introduction — and it is here that the ‘file-drawer’ effect comes into play.

Meta-analysis is the combination of results from many experiments. A problem in meta-analysis, and in statistics generally, is how to allow for the researches that remain unpublished and unknown because their *P* values did not reach a conventional significance level such as 0.05. I do not know who coined the name ‘file-drawer’ effect for this problem. This effect drags down the statistical significance of published work. Radin claims that “parapsychologists were among the first to become sensitive to this problem” — although he does not say when — and he mentions that “in 1975 the Parapsychological Association’s officers adopted a policy opposing the selective reporting of positive outcomes”. The problem was known to statisticians by 1958.

Consider the following typical example. Radin points out that there were 186 publications on ESP card tests worldwide from 1882 to 1939. “The combined results of this four-million trial database [taken at face value],” he says, “translate into tremendous odds against chance — more than a billion trillion to one.” (A ‘trial’ is the guess of one card.) He means that the *P* value is about 10^{-21} — he is not writing only for the scientific establishment. This *P* value corresponds to a bulge above ‘chance’ expectation of 9.5σ , where σ is the standard deviation. (I call that a ‘sigmage’ of 9.5.)

Apart from the possibility of conscious and unconscious fraud and wishful thinking in some fraction of the publications, Radin claims, with no explanation, that, in order to “nullify” the statistical significance, the file drawer would have to contain “more than 3,300 unpublished, unsuccessful reports for each published report”. That number 3,300 is a gross overestimate. It should be reduced at least to about 15 (or even to 8).

The expected sigmage in the file drawer, under the null hypothesis, would be slightly negative but I will call it zero. If these results were combined with the published work, the total sample size would be multiplied by 16, thus becoming 64 million individual guesses. Given the null hypothesis (‘chance’), the bulge would be unaffected so

the sigmage would be divided by $16 = 4$ and would become $9.5/4 = 2.4$, with a *P* value of about 1/100.

Because the number of individual guesses is so large, this *P* value appreciably supports the null hypothesis (no ESP). This is because a Bayes factor (the factor by which the odds of a hypothesis are multiplied in the light of the observations), corresponding to a fixed *P* value, is roughly proportional to $1/N$, where *N* is the sample size. So Radin’s method for evaluating the file-drawer effect, whatever that method may be, must be misguided. This conclusion largely undermines Radin’s meta-analysis which is central to his case for ESP.

Nevertheless, Radin’s book is well written and provides a good summary of the arguments supporting the existence of ESP, with about 600 references. It is less good on the counter-arguments. Readers should also consult *ESP and Parapsychology: A Critical Evaluation* by C. E. M. Hansel (Buffalo, 1980), where much fraudulent work is exposed. Radin quotes Hansel as saying that three *P* values, each of 0.01, amount to one of 10^{-6} , and that he (Radin) would find that convincing. But the product of independent *P* values is not a *P* value. The product has to be transformed by a method due to R. A. Fisher. Both Hansel and Radin have overlooked this. In the present example, the composite *P* value is 1/9,000, not 1/1,000,000.

I am not a sceptic by definition. There is one type of experiment that could convince me if it were successful. Guesses, by psychics, of the parities (even or odd) of future cricket scores could be published on the World Wide Web. The actual scores and parities could be published (later) in large print to help the

precognizing of the psychics and to help their evaluation. This procedure would rule out the possibility of undetectable fraud. □

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Dangerous liaisons

Menachem’s Seed
by Carl Djerassi
University of Georgia Press: 1997. Pp. 196.
\$21.95

Jack Cohen

This is the third novel in a series of what the chemist Carl Djerassi calls “science-in-fiction” in which everything mentioned could or does exist. “Most of my characters, fictional as well as real, are scientists,” he says. “By exposing their lives, I try to make comprehensible the culture and behaviour of scientists.”

There is a similar, specialized genre on the fringes of modern science fiction — stories about fictional scientists like fictional detectives or even fictional cowboys. Carl Sagan’s *Contact* is a well known example, but Gregory Benford’s *Timescape* or *Artefact*, Greg Bear’s *Blood Music*, as well as Nigel Kneale’s older *Quatermass* series or even E. E. ‘Doc’ Smith’s archaic *Lensman* all come to mind as fiction about scientists. Science-in-fiction, however, seems to be less exciting and to have fewer possibilities.

I reviewed elsewhere the first of Djerassi’s novels, *Cantor’s Dilemma*, and recommended it, mainstream

Toy review Smaller, cheaper, more plasticky

With Christmas still months away, and the latest Mars landing already fading in the memory, it is a good time to draw your attention to this scientific stocking-filler. In collaboration with the US Jet Propulsion Laboratory, Mattel has brought out the “Mattel Hot Wheels JPL Sojourner Mars Rover Action Pack Set”.

This is a set of three small plastic models: the Pathfinder spacecraft in transit, with removable heat shield and tiny lander; a larger-scale version of the lander, with foldable panels and removable rover; and a larger-scale-still Sojourner rover. The rover is undoubtedly the star, with sprung ‘rocker-bogey’ suspension that allows it to take up all sorts of cute rock-sniffing postures.

The *Nature* review copy of the Mattel Hot Wheels JPL Sojourner Mars Rover Action Pack Set has now completed its primary mission objectives, successfully demonstrating the technology involved in operating for several weeks on top of a computer screen in a harsh environment of editorial curiosity, without suffering any appreciable reduction in its

operational parameters. And at \$5 initial outlay (only available in the United States, at present it is certainly in keeping with NASA’s new economical philosophy.



Toy robot: the Sojourner rover model (slightly smaller than actual size).

But for those who hark back longingly to the old days of expensive, ‘gold-plated’ missions, an expensive, literally gold-plated model of Sojourner is available (for \$49.99). It “is mounted on a silver base plate molded to resemble the martian surface and has a handsome brass identification plate”. Surely a must for every mantelpiece.

Stephen Battersby is an assistant editor of *Nature*.