

# THE PHYSICS OF OUR

*“Spooky” connections between subatomic particles may explain telepathy — and perhaps connections to ancestors. See all of life in a single line . . .*

BY DEAN RADIN

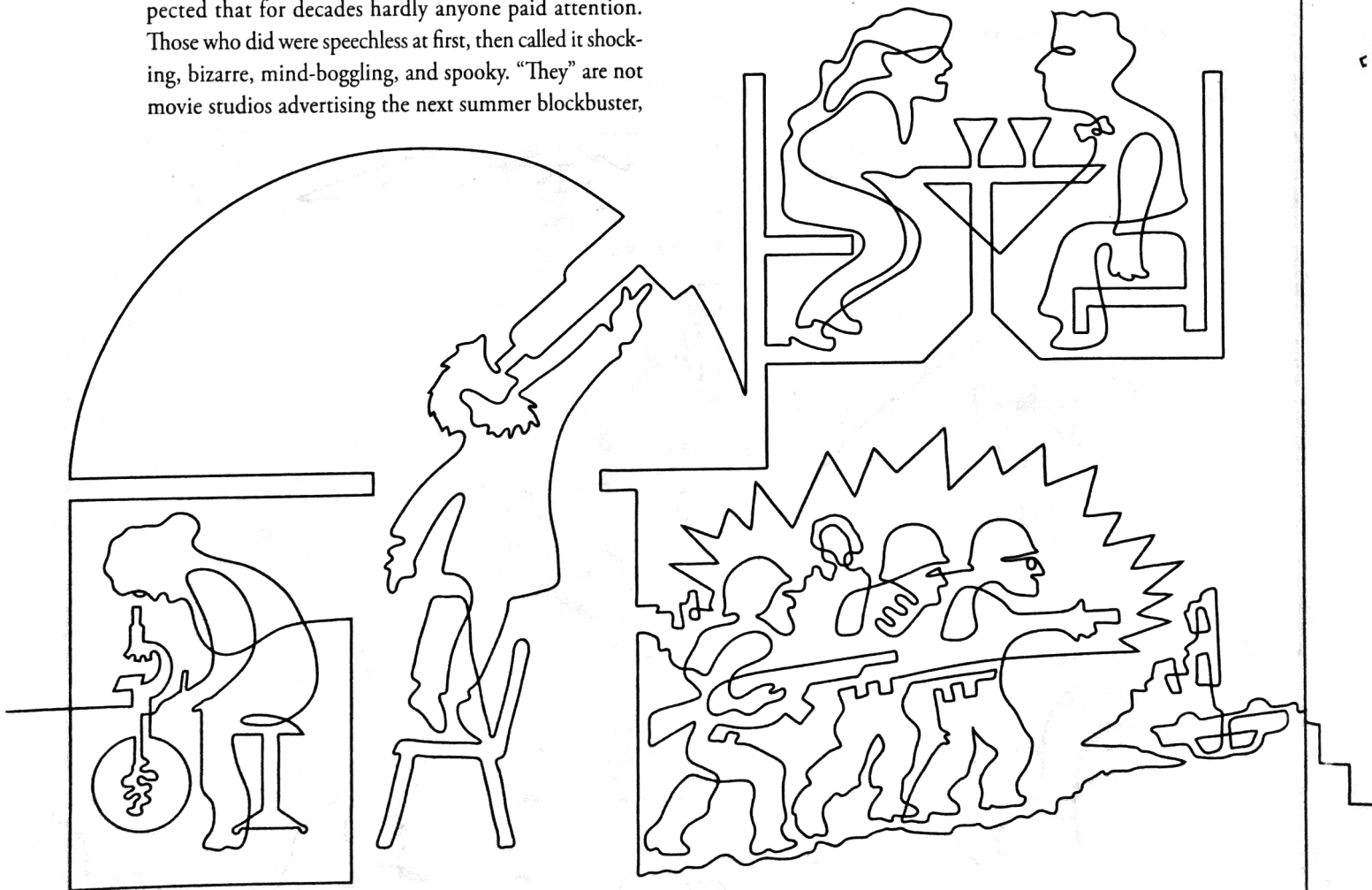
Historians disagree over precisely when reality changed. Some say 1905. Others point to key events in 1964 and 1982. I think of it as a glacial shift that took most of the twentieth century.

The new reality is not yet fully understood, but what we’ve grasped so far suggests a new perspective so unexpected that for decades hardly anyone paid attention. Those who did were speechless at first, then called it shocking, bizarre, mind-boggling, and spooky. “They” are not movie studios advertising the next summer blockbuster,

but physicists and philosophers struggling to understand the new reality.

This “new reality” is the modern understanding of the fabric of reality as revealed by modern physics. It began with a prediction of quantum theory that particles, even those traveling away from each other at the speed of light, could remain connected such that reversing the electric charge of one particle would also reverse the charge of the other. Einstein couldn’t accept the prediction, calling it “spooky action at a distance.” Erwin Schrödinger, one early proponent of quantum theory, used the word entanglement to mean connections between separated particles that persist regardless of distance. These connections are instantaneous, operating “outside” the flow of time.

The entanglement of particles was thought to be so fragile



# ENTANGLEMENTS

that, according to one prominent physicist, “Anything, even the passage of a cosmic ray in the next room, would disrupt the [quantum] correlations enough to destroy the effect.” The first demonstrations of entanglement in the 1970s relied on sensitive measurements in exotic conditions such as extreme cold or extremely short periods of time. Now, however, researchers report increasingly complex forms of entanglement of longer duration and at higher temperatures. Physicists have entangled ensembles of trillions of atoms in gaseous form, and entanglement has been demonstrated among the atoms of relatively large chunks. Entangled photons have been shot through sheets of metal and remained entangled. Photons remain entan-

gled after being sent through 50 kilometers of optical fiber, or while being transmitted through the atmosphere.

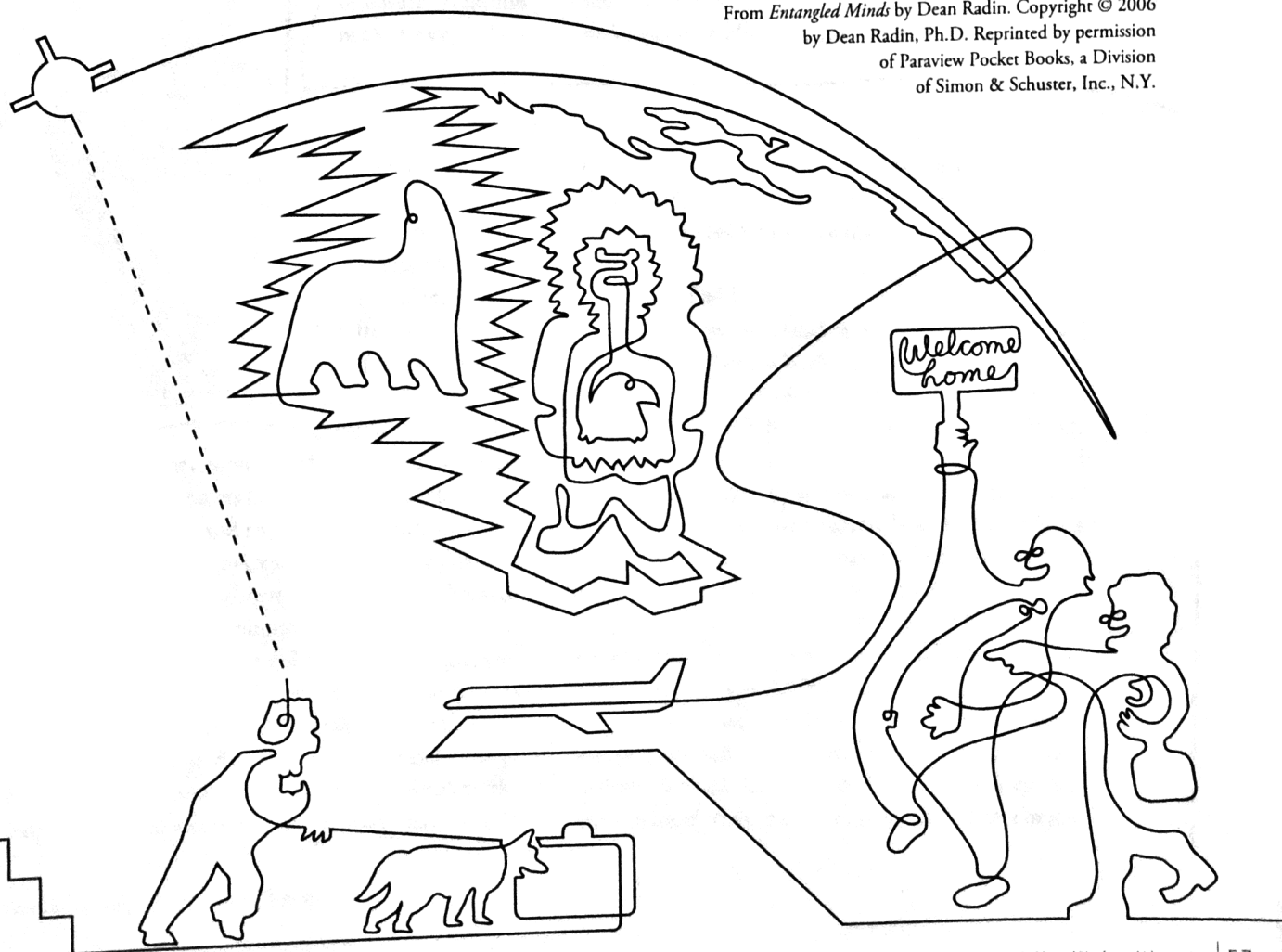
A review by Michael Brooks of developments in research on entanglement that appeared in the *New Scientist* (March 2004) concluded, “Physicists now believe that entanglement between particles exists everywhere, all the time, and have recently found shocking evidence that it affects the wider, ‘macroscopic,’ world that we inhabit.”

## The New Science of Bio-entanglement

Much of the research into entanglement concerns the possibility that it can be harnessed to create a quantum computer thousands if not millions of times faster than the fastest supercomputer of today. Already, clusters of

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ILLUSTRATION BY DON WRIGHT



four entangled photons have been demonstrated to make quantum computing significantly easier than was previously imagined. What fascinates me about entanglement, however, is not the creation of quantum computers but bio-entanglement — quantum connections within and among living systems — that some scientists believe will explain the holistic properties of life. Already, organic molecules such as tetraphenylporphyrin (C<sub>44</sub>H<sub>30</sub>N<sub>4</sub>) have been successfully entangled. While entanglement has not yet been observed in proteins, viruses, or larger living systems, there is theoretically no limit to the size of an entangled object.

Numerous scientists, including Nobel laureate physicist Brian Josephson, have proposed that biological systems might use entanglement in novel ways. In 2005, physicist

Johann Summhammer of the Vienna University of Technology proposed that because entanglement is everywhere in nature, evolution may have taken



advantage of it. In particular, he speculated, “Entanglement could coordinate biochemical reactions in different parts of a cell, or in different parts of an organ. It could allow correlat-

ed firings of distant neurons. And . . . it could coordinate the behavior of members of a species, because it is independent of distance and requires no physical link. It is also conceivable that entanglement correlates processes between members of different species, and even between living systems and the inanimate world.”

Physicists have even speculated that entanglement extends to everything in the universe, because as far as we know, all energy and all matter emerged from a single primordial Big Bang. And thus everything came out of the chute already entangled. Some further speculate that empty space, the quantum vacuum itself, may be filled

## It is also conceivable that entanglement correlates processes between members of different species, and even between living systems and the inanimate world.

with entangled particles. Such proposals suggest that despite appearances, we might be living within a holistic, deeply interconnected reality.

Why don't we feel entangled? Physicists point out that when prepared atom-sized objects interact with the environment, such as by colliding with molecules of the air or crossing electromagnetic fields, they become entangled with those objects, but such interactions tend to quickly disrupt the special state of quantum “coherence” in which simple forms of entanglement can most easily be observed. This loss of coherence, appropriately called decoherence, is one reason we perceive everyday objects as separate and not blurred together. But decoherence doesn't magically make quantum effects vanish. We're still permeated with

entangled particles. The question posed here is whether these deeply entangled states are meaningfully related to human experience. I propose that they are.

### The Entangled Life

In the future, when entanglement is better understood, I expect that someone will ask, “What would happen if two human beings became entangled? Perhaps they'd show correlated behavior at a distance too, just as entangled atomic matter does.” Case studies of identical twins will be used to justify this speculation. For example, consider a true case where twin boys raised separately were independently named Jim by their adoptive parents. Each Jim married a woman named Betty, divorced her, then married a woman named Linda. Both Jims were firemen, and each built a circular white bench around a tree in his backyard. Could such coincidences reflect “entangled” Jims?

An enterprising scientist will conduct an experiment isolating identical twins in dark, soundproof, electromagnetically shielded chambers. She'll ask them to keep each other in mind while at random times she'll flash a bright

light at one of them. Each flash will generate a predictable response in that twin's brain. After confirming the presence of those responses, she'll examine the brain activity of the twin not subjected to the flashes, to see whether there's a corresponding simultaneous response. This electroencephalograph, or EEG correlation, will demonstrate a positive correlation between the two brains.

How much time until this fanciful scenario unfolds? None. The "entangled brains" experiments have already been performed more than a dozen times over the past 40 years by independent researchers. And they work!

One of the first such experiments was published in 1965 in the journal *Science*. That study reported that the EEGs of pairs of separated identical twins (two such pairs out of 15 pairs tested) displayed unexpected correspondences. When one twin was asked to close his eyes, which increases the brain's alpha rhythms, the distant twin's alpha rhythms also increased. The same effect was not observed in unrelated pairs of people.

Today, positive results in these EEG correlation experiments continue to be reported. One notable advance was published in 2003 by Leanna Standish at Bastyr University in Seattle, Washington. Using brain scanning technol-

ogy known as functional magnetic resonance imaging, or fMRI, Standish found in one pair of participants that the "receiving" person's visual cortex was activated when her distant partner was exposed to a flashing light. This outcome was consistent with the results of the EEG correlation studies, and located the region of the brain where the effect occurs. In 2004, psychophysicologist J Wacker- mann published a review of such experiments in *Mind and Matter*. Wacker- mann concluded that there appears to be a real, repeatable effect. With increasingly sophisticated experimental designs, the effects continue to be observed by independent investigators.

**EEGs of identical twins showed that when one twin was asked to close his eyes, which increases the brain's alpha rhythms, the distant twin's alpha rhythms also increased.**

In my new book, *Entangled Minds*, I suggest that we consider the possibility that our minds are physically entangled with the universe, and that quantum theory is relevant to understanding common psychic, or psi, phenomena. Common psi experiences include mind-to-mind connections (telepathy), perceiving distant objects or events (clairvoyance), perceiving future events (precognition), and mind-matter interactions (psychokinesis). Psi may also be involved in intuition, gut feelings, distant healing, the power of intention, and the sense of being stared at. I think it significant that there is a word for psi experiences in every language, from Arabic to Zulu, Czech to Manx Gaelic. Indeed, psi experiences have been reported by people in all cultures, throughout history, and at all ages and educational levels. This suggests that the phenomena are basic not only to human nature, but also tell us something about the fabric of reality.

That said, we should avoid jumping to conclusions.

I don't claim that quantum entanglement explains all things spooky. Rather, I propose that the fabric of reality comprises "entangled threads" consistent with the core of psi

experience. Of course, human experience is more than a collection of threads. Our bodies are fabrics built from countless variations of reality. And our experiences, to stretch a metaphor, are quilts made from fabrics stitched together in myriad delightful ways. Understanding this quilt and its relationship to psi will take more than identifying these threads. But it's a first step. ❖

Dean Radin is senior scientist at the Institute of Noetic Sciences in Petaluma, California. He is the author of *The Conscious Universe* and *Entangled Minds: Extrasensory Experience in Quantum Reality* (Paraview Pocket Books, 2006), from which this article was adapted.

