

# Fractals and the Mind

Science's biggest mystery is the nature of consciousness. It is not that we possess bad or imperfect theories of human awareness; we simply have no such theories at all. About all we know about consciousness is that it has something to do with the head, rather than the foot.<sup>1</sup>

—Nick Herbert, *Quantum Reality*

**W**hen Jason Padgett was 31, a decade ago, he was brutally attacked outside a karaoke club in Tacoma, Washington. His assailants apparently wanted his expensive leather jacket. Padgett recalls, "All I saw was a bright flash of light and the next thing I knew I was on my knees and I thought, 'I'm gonna get killed.'" He was repeatedly kicked in the head, but survived.

## THE ACCIDENTAL GENIUS

Two days into his recovery in the hospital, Padgett began to notice something strange. His mind apparently had been rearranged. Everywhere he looked, things seemed to be made up of complex mathematical patterns. As he puts it, "Every single little curve, every single spiral, every tree [seemed] part of [the Pythagorean] equation."

Padgett was an unlikely candidate for this ability. He was a college dropout with no background or interest in mathematics. Before his head injury, he could not draw. Before being attacked, he was mainly interested in two things: body building and partying.

He became obsessed with drawing his perceptions as complex, elegant diagrams. Although he did not understand what he was seeing and drawing at first, he learned that these patterns are called fractals. "Fractals," he explains, "are shape(s) that, when you take the shape apart into pieces, the pieces are the same or similar to the whole."<sup>3</sup>

Padgett considers his fractal perspective as both a gift and a burden. "I'm obsessed with numbers," he states. "I literally dream about it. There's not a moment that I can't see it, and it just doesn't turn off. Sometimes I would really like to turn it off, and it won't. But the good far outweighs the bad. I would not give it up for anything."<sup>2</sup>

His goal is to leave the futon store where he works for the classroom. He wants to teach others that math is beautiful and natural and is embedded in the world around us.

Padgett attracted the attention of neuroscientists, including Berit Brogaard, a neuroscientist and philosophy professor at the Center for Neurodynamics at the University of Missouri-St Louis. She and her team performed a series of brain scans on Padgett. The scans showed damage that was apparently forcing other areas concerned with math and mental imagery to overcompensate, areas to which most people don't have full access. The neuroscientists say this transformed Padgett into an "acquired savant." Savant syndrome is the hyperdevelopment of a specific, narrow skill, such as prodigious musical, mathematical, or other ability.<sup>4</sup> Padgett is the

only person in the world who is known to have his particular skill.

You can view Padgett's stunning compositions at [http://www.huffingtonpost.com/2012/04/30/college-dropout-jason-pad\\_n\\_1464835.html#s919741](http://www.huffingtonpost.com/2012/04/30/college-dropout-jason-pad_n_1464835.html#s919741) and at <http://abcnews.go.com/blogs/health/2012/04/27/real-beautiful-mind-accidental-genius-draws-complex-math-formulas-photos/>.

## THE "SANDY BEACH" MODEL OF THE MIND

The more alternatives there are, the more uncertain the outcome.

The more uncertainty, the greater the potential for information transmission.<sup>5</sup>

—Roy Lachman et al

When head trauma results in normal or supernormal mental function, what might be going on? A clue may lie in fractals, which Jason Padgett saw everywhere he looked after his brain injury. In 1975, the mathematician Benoit Mandelbrot coined the term "fractal" from a Latin term for "broken," from which "fracture" is derived. In a fractal structure, similar patterns recur at progressively smaller scales. If you break apart or fracture the larger structure, you see the same or similar pattern in all the smaller pieces. Fractals have been used to describe partially random or chaotic phenomena such as crystal growth, fluid turbulence, and galaxy formation. Fractal patterns have been found at all levels of nature, such as in clouds, coastlines, snowflakes, crystals, blood vessel

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networks, ocean waves, DNA, heart rhythms, various vegetables such as cauliflower and broccoli, mountain ranges, river networks, and fault lines. Fractal art is now commonplace, as extraordinarily beautiful patterns are generated on computers by mathematicians and fractal artists.

Mathematician Ralph Abraham, of the University of California-Santa Cruz, is an expert in chaos theory, which deals with dynamical systems that are extremely sensitive to initial conditions. This means that long-term predictions in how these systems will behave is generally impossible. The best-known example is weather and the “butterfly effect,” according to which the flutter of a butterfly’s wing in China could conceivably trigger a tornado somewhere in the United States.

Abraham describes fractals as “a wide, frothy zone” where unlike things come together.<sup>6</sup> He uses the example of a sandy beach to illustrate how fractals show up in nature. On a map, a coastline appears sharply distinct. But when we view the boundary of land and water up close, the crisp distinctions disappear. On the beach there is water in the sand and sand in the water. “The transition from land to sea is a fractal,” Abraham says. “It is spatially chaotic. It is Natural [sic]. The Milky Way is a sandy beach in the sky. It is Natural also [sic]. Nature teaches us fractal geometry and chaos theory.”

Abraham asserts there are “fractals in [the] mind.” Fractals and chaos are in cahoots with each other, because chaos makes possible and encourages the formation of fractals. He suggests that in a normal psyche, the boundaries between the components of the mind, such as waking awareness and the subconscious, are “thick fractals, which permit a kind of porosity between these components of the psyche, and thus, integration”—what he calls the “sandy beach model” of healthy psychological function. In an unhealthy mind, the “boundaries may be like concrete walls or iron curtains.” When this happens, isolated components of the mind cannot communicate with one another. The result may be multiple personality disorder, in which mental domains are split off and isolated. Abraham’s term for this situation is “multiple personality dischaos,” a chaos deficiency syndrome.

Chaos deficiency – what Abraham calls “dischaos” – can also take place at a soci-

etal and global level, he suggests. It can cause disorders at “the collective conscious and unconscious of our society. . . . Thus, boundaries which are too firm (iron curtains) may be involved in world problems.” Therefore, “thick, frothy” fractal boundaries are a “prerequisite for the stability and longevity of a culture, or the health of an individual.” They are required for interconnectivity, communication, and integration both *within* the minds of individuals, as well as *between* the seven billion individual minds on the earth. The alternative is rigid boundaries that forbid fluid communication, tolerance, and understanding, with the resulting disintegration and break up of both individual personalities and global society.

Abraham believes we are in the dangerous process of defractalizing our society by establishing boundaries that are increasingly impermeable. As he puts it, “[O]ur culture has devoted excess attention to the walled fortress. . . concrete walls around the town, locks on the doors and houses, electronic motion detectors, video cameras at the bank card machine, and so on.” Gated communities separate us from one another in the name of security. Guns – a word derived from a Scandinavian term for war – are almost as numerous in America as Americans. The Occupiers and the 99 Percenters feel increasingly estranged from the One Percenters. Comity has virtually disappeared from the halls of Congress, where compromise has come to be equated with cowardice. Impermeable, nonporous boundaries have never seemed so prevalent. We are collectively suffering from a fractal-poor, chaos deficiency syndrome that is bent on eliminating the very qualities we used to prize—respect for difference, a celebration of variety, a melting pot of people and ideas.

### STUNNING THE MIND

Frederick Turner, professor of arts and humanities at the University of Texas at Dallas, resonates with Abraham’s language of chaos theory and fractals. Turner sees in fractal science a path through which individual minds may unite in a transcendent domain he calls “the divine mind.” Any experience, Turner says, that fills us with a sense of awe—a powerful artwork, majestic music, or a jaw-dropping sunset, eg—“stuns the mind into a blur.” At such a moment, he says, a “delicate attunement

or calibration” can take place in the brain, in which the “strange attractor of the divine mind” influences the individual mind to become “a fractal miniature of the universal mind itself.”<sup>7</sup>

Of course, we don’t have to get kicked in the cranium like Jason Padgett to stun our mind into receptivity. There are endless ways to set the stage for transcendent, transformative, creative moments. These experiences are always hammering on the door of awareness, just waiting for an opportunity to burst into the living room of our conscious life. They intrude in a dazzling variety of ways—most often in mundane situations such as sitting quietly, listening to music, viewing art, meditating, worshiping, praying, washing dishes, gardening, or doing nothing; or they may occur in dramatic, desperate moments such as near-death or life-threatening situations.

### MORE THAN METAPHOR?

But does the fractal language that Abraham and Turner employ represent actual processes in the brain, or is it metaphor? Just because we can see a tree does not mean there is a tree module or a tree image in the brain that has been tweaked. Just so, Padgett’s ability to see fractals in the outer world does not necessarily mean that fractals actually exist in his brain. How *any* sense perception is actually translated into a conscious thought remains a mystery, as the epigraph by physicist Nick Herbert emphasizes.

Chaos and uncertainty set the stage for the formation of fractal patterns in nature. Even if this chaos-fractal pathway is considered metaphorical for how our brain functions, it nonetheless contains fruitful implications for the way we live our lives. It encourages us to avoid the deadening effects of thoughtless ideologies and engrained behaviors, ruts, and routines. It is a way of imagining more effective communication between the compartments of our own minds and with other persons in the real world. It mitigates intolerance and prejudice toward “the other” and respects difference and ambiguity.

Many highly creative individuals seem to know this intuitively. Creativity involves seeing connections that have gone unnoticed, as when Einstein glimpsed the connections between energy, matter, and the speed of light, leading to the most fa-

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mous equation in history,  $E = mc^2$ . These relationships had eluded humans for all of human history.

Perhaps it was no accident that Einstein often appeared chaotic in his personal appearance—frowzy, scruffy, disheveled, the stereotype of the absent-minded professor. We might say that Einstein had a highly fractalized mind, a mind that was cordial to chaos, which spilled over into issues of dress, grooming, and so on.

Disordered behavioral traits and thought patterns that irritate buttoned-up individuals may actually be cultivated and embraced by highly creative persons. This is so common that psychologist Frank Barron, an expert on creativity, wrote in *Scientific American* nearly six decades ago:

[C]reative individuals are more at home with complexity and apparent disorder than other people are. . . . The creative individual, in his generalized preference for apparent disorder, turns to the dimly realized life of the unconscious, and is likely to have more than the usual amount of respect for the forces of the irrational in himself and in others. . . . [T]he creative individual not only respects the irrational in himself, but courts it as the most promising source of novelty

in his own thought. . . . The truly creative individual stands ready to abandon old classifications and to acknowledge that life, particularly his own unique life, is rich in new possibilities. To him, disorder offers the potentiality of order.<sup>8</sup>

Jason Padgett—former college dropout, body builder, partygoer, and head trauma survivor—has invigorated the discussion of the role of fractals in cognition. He does not philosophize about fractals, but he *sees* them. For him, the entire world is fractalized—a visible fact, not an invisible theory; not armchair reflection, but the way the world *is*.

If Jason Padgett is a living reminder of the mysteries of our mind, he also reminds us of our infinite possibilities. He is a one-man affirmation of Shakespeare's vision in *Hamlet*:

What a piece of work is man, how noble in reason, how infinite in faculties, in form and moving how express and admirable, in action how like an angel, in apprehension how like a god.<sup>9</sup>

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