

## The Epi Phenomenon

By Douglas R. Hofstadter

... for your consideration ...

### As Real as it Gets

Thanks to the funneling-down processes of perception, which lead eventually — that is, in a matter of milliseconds — to the activation of certain discrete symbols in its brain, an animal (and let's not forget robot vehicles!) can relate intimately and reliably to its physical environment. A mature human animal not only does a fine job of not slipping on banana peels and not banging into thorn-bristling rosebushes, it also reacts in a flash to strong odors, strange accents, cute babies, loud crashes, titillating headlines, terrific skiers, garish clothes, and on and on. It even occasionally hits curve balls coming at it at 80 miles an hour. Because an animal's internal mirroring of the world must be highly reliable (the symbol elephant should not get triggered by the whine of a mosquito, nor should the symbol mosquito get triggered if an elephant ambles into view), its mirroring of the world via its private cache of symbols becomes an unquestioned pillar of stability. The things and patterns it perceives are what define its reality — but not all perceived things and patterns are equally real to it.

Of course, in nonverbal animals, a question such as “Which things that I perceive are the most real of all to me?” is never raised, explicitly or implicitly. But in human lives, questions about what is and what is not real inevitable bubble up sooner or later, sometimes getting uttered consciously and carefully, other times remaining unexpressed and inchoate, just quietly simmering in the background. As children and teen-agers, we see directly, or we see on television, or we read about, or we are told about many things that supposedly exist, things that vie intensely with each other for our attention and for acceptance by our reality evaluators — for instance, God, Godzilla, Godiva, Godot, Gödel, gods, goddesses, ghost, ghouls, goblins, gremlins, golems, golliwogs, griffins, gryphons, gluons, and grinchies. It takes a child a few years to sort out the reality of some of these; indeed, it takes many people a full lifetime to do so (and occasionally a bit longer).

By “sorting out the reality of X”, I mean coming to a stable conclusion about how much you believe in X and whether you would feel comfortable relying on the notion of X in explaining things to yourself and others. If you are willing to use griffins in your explanations and don't flinch at other people's doing so in theirs, then it would seem that griffins are a seriously real concept to you. If you had already pretty much sorted out for yourself the reality of griffins and then heard there was going to be a TV special on griffins, you wouldn't feel a need to catch the show in order to help you decide whether or not griffins exist. Perhaps you believe strongly in griffins, perhaps you think of them as a childish fantasy or a joke — but your mind is made up one way or the other. Or perhaps you haven't

yet sorted out the reality of griffins; if it were to come up in a dinner-party conversation, you would feel unsure, confused, ignorant, skeptical, or on the fence.

Another way of thinking about “how real X is to you” is how much you would trust a newspaper article that took for granted the existences of X (for example, a living dinosaur, a sighting of Hitler, insects discovered on Mars, a perpetual-motion machine, UFO abductions, God’s omniscience, out-of-body experiences, alternate universes, superstrings, quarks, Bigfoot, Big Brother, the Big Bang, Atlantis, the gold in Fort Knox, The South Pole, cold fusion, Einstein’s tongue, Holden Caulfield’s brain, Bill Gates’ checkbook, or the proverbial twenty-mile “wall” for marathon runners). If you stop reading an article the moment you see X’s existence being taken for granted, then it would seem that you consider X’s “reality” highly dubious.

Pick any of the concepts mentioned above. Almost surely, there are plenty of people who believe fervently in it, others who believe in it just a little, others not at all (whether out of ignorance, cynicism, poor education, or excellent education). Some of these concepts, we are repeatedly told by authorities, are not real, and yet we hear about them over and over again in television shows, books, and newspapers, and so we are left with a curious blurry sense as to whether they do exist, or could exist, or might exist. Others, we are told by authorities, are absolutely real, but somehow we never see them. Others we are told were real but are real no longer, and that places them in a kind of limbo as far as reality is concerned. Yet others we are told are real but are utterly beyond our capacity to imagine. Others are said to be real, but only metaphorically or only approximately so — and so on. Sorting all this out is not in the least easy.

## **Concrete Walls and Abstract Ceiling**

To be more concrete about all this, how real is the marathoners’ twenty-mile wall, mentioned above? If you’re a marathoner, you almost surely have a well-worked-out set of thoughts about it. Perhaps you have experienced it personally, or know people who have. Or perhaps you think the notion is greatly exaggerated. I’ve never hit the wall myself, but then my longest run ever was only fifteen miles. What I know is that “they say” that most runners, if they haven’t trained properly, will bang up against a brutal wall at around twenty miles, in which their body, having used up all of its glycogen, starts burning fat instead (I’ve heard it described as “your body eating its own muscles”). It comes out of the blue and is extremely painful (“like an elephant falling out of a tree onto my shoulders”, said marathoner Dick Beardsley), and many runners simply cannot go any further at that point, and drop out. But is this a universal phenomenon? Is it the same for all people? Do some marathoners never experience it at all? And even if it is scientifically explicable, is it as real and as palpable a phenomenon as a concrete wall into which one bangs?

When I entered math graduate school at Berkeley in 1966, I had the self-image of being quite a math whiz. After all, as an undergraduate math major at Stanford, not only had I coasted through most of my courses without too much work, but I had done lots of original

research, and on graduating I was awarded the citation “with Distinction” by the Math Department. I was expecting to become a mathematician and to do great things. Well, at Berkeley two courses were required of all first-year students — abstract algebra and topology — and so I took them. To my shock, both were very hard for me — like nothing I’d ever encountered before. I got good grades in them but only by memorizing and then regurgitating ideas on the finals. For the entire year, my head kept on hurting from a severe lack of imagery such as I had never before experienced. It was like climbing a very high peak and getting piercing headaches as the air grows ever thinner. Abstraction piled on abstraction and the further I plowed, the slower my pace, and the less I grasped. Finally, after a year and a half, I recognized the situation’s hopelessness, and with a flood of bitter tears and a crushing loss of self-confidence, I jettisoned my dream of myself as a mathematician and bailed out of the field forever. This hated, rigid “abstraction ceiling” against which I had metaphorically banged my head without any advance warning was a searingly painful, life-changing trauma. And so . . . how concrete, how genuine, how real a thing was this abstract “abstraction ceiling”? As real as a marathoner’s wall? As real as a wooden joist against which my skull could audibly crash? What is really real?

Although nobody planned it that way, most of us wind up emerging from adolescence with a deeply nuanced sense of what is real, with shades of gray all over the place. (However, I have known, and probably you have too, reader, a few adults for whom every issue that strikes me as subtle seems to them to be totally black-and-white — no messy shades of gray at all to deal with. That must make life easy!) Actually, to suggest that for most of us life is filled with “shades of gray” is far too simple, because that phrase conjures up the image of a straightforward one-dimensional continuum with many degrees of grayness running between white and black, while in fact the story is much more multidimensional than that.

All of this is disturbing, because the word “real”, like so many words, seems to imply a sharp, clear-cut dichotomy. Surely it ought to be the case that some things simply are real while other things simply are not real. Surely there should be nothing that is partly real — that wouldn’t make sense! And yet, though we try very hard to force the world to match this ideal black-and-white dichotomy, things unfortunately get terribly blurry.

### **The Many-faceted Intellectual Grounding of Reality**

That marble over there in that little cardboard box on my desk is certainly real because I see the cardboard box sitting there and because I can go over and open it and can squeeze the marble, hefting it and feeling its solidity. I hope that makes sense to you.

The upper edge of that 75-foot-tall Shell sign near the freeway exit is real, I am convinced, because every road sign is a solid object and every solid object has a top; also because I can see the sign’s bottom edge and its sides and so, by analogy, I can imagine seeing its top; also because, even though I’ll certainly never touch it, I could at least theoretically climb up to it or be lowered down onto it from a helicopter. Then again, the sign could topple in

an earthquake and I could rush over to it and touch what had once been its upper edge, and so forth.

Antarctica, too, is real because, although I've never been there and almost surely will never go there, I've seen hundreds of photos of it, I've seen photos of the whole earth from space including all of Antarctica, and also I once met someone who told me he went there, and on and on.

Why do I believe what certain people tell me more than I believe what others tell me? Why do I believe in (some) photos as evidence of reality? Why do I trust certain photos in certain books? Why do I trust certain newspapers, and why only up to a certain point? Why do I not trust all newspapers equally? Why do I not trust all book publishers equally? Why do I not trust all authors equally?

Through many types of abstraction and analogy-making and inductive reasoning, and through many long and tortuous chains of citations of all sorts of authorities (which constitute an indispensable pillar supporting every adult's belief system, despite the insistence of high-school teachers who year after year teach that "arguments by authority" are spurious and are convinced that they ought to be believed because they are, after all, authority figures), we build up an intricate, interlocked set of beliefs as to what exists "out there" — and then, once again, that set of beliefs folds back, inevitably and seamlessly, to apply to our own selves.

Just as we believe in other peoples' kidneys and brains (thanks almost entirely to arguments from analogy and authority), so we come to believe in our own kidneys and brains. Just as we believe in everyone else's mortality (again, thanks primarily to arguments from analogy and authority), so we come, eventually, to believe in our own mortality, as well as in the reality of the obituary notices about us that will appear in local papers even though we know we will never be able to flip those pages and read those notices.

What makes for our sense of utter sureness about such abstract things? It comes firstly from the reliability of our internal symbols to directly mirror the concrete environment (e.g., we purchase a cup of coffee and instantly, somewhere inside our cranium, God only knows where, there springs into existence a physical record reflecting this coffee, tracking where it is on the table or in our hand, constantly updating its color, bitterness level, warmth, and how much there is left of it). It comes secondly from the reliability of our thinking mechanisms to tell us about more abstract entities that we cannot directly perceive (e.g., the role of Napoleon in French history, the impact of Wagner on late-romantic French composers, or the unsolvability by radicals, such as Évariste Galois, of the quintic equation). All of this more abstract stuff is rooted in the constant reinforcement, moment by moment, of the symbols that are haphazardly triggered out of dormancy by events in the world that we perceive first-hand. These immediate mental events constitute the bedrock underlying our broader sense of reality.

Inevitably, what seems realest to us is what gets activated most often. Our hangnails are

incredibly real to us (by coincidence, I found myself idly picking at a hangnail while I was reworking this paragraph), whereas to most of us, the English village of Nether Wallop and the high Himalayan country of Bhutan, not to mention the slowly swirling spiral galaxy in Andromeda, are considerably less real, even though our intellectual selves might wish to insist that since the latter are much bigger and longer-lasting than our hangnails, they ought therefore to be far realer to us than our hangnails are. We can say this to ourselves till we're blue in the face, but few of us act as if we really believed it. A slight slippage of subterranean stone that obliterates 20,000 people in some far-off land, the ceaseless plundering of virgin jungles in the Amazon basin, a swarm of helpless stars being swallowed up one after another by a ravenous black hole, even an ongoing collision between two huge galaxies each of which contains a hundred billion stars — such colossal events are so abstract to someone like me that they can't even touch the sense of urgency and importance, and thus the reality, of some measly little hangnail on my left hand's pinky.

We are all egocentric, and what is realest to each of us, in the end, is ourself. The realest things of all are my knee, my nose, my anger, my hunger, my toothache, my sideache, my sadness, my joy, my love for math, my abstraction ceiling, and so forth. What all these things have in common, what binds them together, is the concept of “my”, which comes out of the concept of “I” or “me”, and therefore, although it is less concrete than a nose or even a toothache, this “I” thing is what ultimately seems to each of us to constitute the most solid rock of undeniability of all. Could it possibly be an illusion? Or if not a total illusion, could it possibly be less real and less solid than we think it is? Could an “I” be more like an elusive, receding, shimmering rainbow than like a tangible, heftable, transportable pot of gold?