Article title: Brain as Transducer: What if the brain is not a self-contained information processor? What if it is simply a transducer?
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Brain as Transducer

What if the brain is not a self-contained information processor? What if it is simply a transducer?

Robert Epstein, PhD

People are going back and forth
across the doorsill
where the two worlds touch.
--Rumi (1207-1273), "Don't Go Back to Sleep"

What do ghosts, prophecies, and reincarnation have in common? If you're a hard-headed science-type like me, the answer is easy: They're all fringy, evidence-poor concepts mainly espoused by people who can't think clearly – people who will believe, well, *anything*, no matter how flimsy the evidence.

While we're at it, let's throw in out-of-body experiences, demonic possession, and the power of prayer to work miracles.

But what if these and dozens of other fringy ideas – not to mention a respectable number of real human oddities, such as schizophrenia, dreams, and hallucinations – could all be accounted for by a relatively simple idea about how the brain works – an idea that might even be testable?

In other words, what if Occam's razor helped us, suddenly, to unite and make sense of a large number of apparently unrelated and sometimes weird ideas?

When you shave with Occam's razor, sometimes you get cut – I get that. The simplest explanation isn't necessarily the best; it might even be wrong, or at least completely useless. "God" explains everything, but it doesn't stand up well as an explanation, in part because God's very existence is questionable.

With that caveat in mind, let's explore the ramifications of a simple idea about the brain – namely, that it is a bidirectional transducer.

Transduction Is All Around Us

A few inches to the left of the laptop computer on which I am now typing stands an imposing Sennheiser microphone that I use mainly when someone is interviewing me for a radio or TV show. A thick black cable protrudes from the back of the microphone and snakes its way to a boxy analogue-to-digital converter, which links to my computer via a bright red USB cable.

My computer links wirelessly to a router in the next room, and the router connects to AT&T, my internet service provider, through a telephone cable that runs from the router to a wall socket. That cable leads to a sequence of dozens of other transition points through which crude representations of my voice pass before some semblance of it is finally heard by a talk-show host in, say, London. With enough research, I could probably figure out each and every step of the journey, but you get the idea.

If I'm speaking to a host of a BBC radio program, representations of his or her voice are also traveling in the other direction from his or her microphone through dozens of transition points until they finally activate a tiny speaker in my ear bud, through which I hear a semblance of his or her voice. If we're also using video to communicate, cameras are sending images to screens, again through many transition points, and again in both directions.

Representations of these images and sounds might be passing not only through multiple transition points but also through thousands of miles of copper or fiber optic cables, or are perhaps being transmitted to satellites hundreds of miles above the earth and then re-transmitted to receivers on the ground. Long ago, pathways like this could accommodate only one conversation at a time, with communications running in only one direction at a time, but now such pathways are bidirectional and are often shared simultaneously by thousands of different conversations.

Remarkably, when everything is working smoothly, my conversation with the London host is as seamless as it would be if we were in the same room. Even though I'm 5,500 miles away in San Diego, I can't detect any time gaps between my ramblings and the host's reply. Those gaps exist, but they're so short that neither I nor the host can perceive them.

Long-distance, computer-mediated communications don't always work smoothly, of course. Sometimes sounds or images are degraded or distorted, a word or two disappears, or a connection breaks. During one live interview, my voice apparently became so tinny, with stronger and stronger harmonics overlaying my voice as the minutes passed, that the host suddenly announced that I was really a robot. As technology continues to improve, such glitches will occur less frequently, and the quality of the sound and video will approach that of in-person reality.

What's happening here? Is my voice actually travelling 5,500 miles? Definitely not. If you were the lord of a 19th century mansion, you might have been able to shout into a "speaking tube" that snaked its way through your home and carried your voice all the way to the kitchen or servants' quarters. In that case, the sound of your voice was literally carried to its destination by the air in the tube.

But when I speak into my microphone, the pattern of sound waves produced by my voice – a distinctive, non-random pattern of air pressure waves – is being *converted* by the microphone into a similar pattern of electrical activity. The better the microphone, the more accurately it duplicates the original pattern, and the more I sound like me at the other end.

That conversion process – the shifting of a "signal" – a meaningful, non-random pattern of activity – from one medium (say, the air in front of the microphone) to another medium (say, the wire at the back of a microphone) is called *transduction*.

And transduction is all around us, even in organic processes. Our bodies are completely encased by transducers. Our sense organs – eyes, ears, nose, tongue, and skin – transduce distinctive properties of electromagnetic radiation, air pressure waves, airborne chemicals, liquid-borne chemicals, textures, pressure, and temperature into distinctive patterns of electrical and chemical activity in the brain. We even know how to use organic substances to create new kinds of transducers, such as OECTs: organic electrochemical transistors.

Evolution didn't just create millions of new species of organisms, it also created millions of new types of transducers, and engineers are now using both organic and inorganic materials to create thousands more.

To repeat (because this is important): Transduction is all around us – both forms of transduction that have evolved over eons and new forms of transduction that humans are inventing.

The Ultimate Transducer

What if evolution, at some point, produced a special kind of transducer that could shift signals from the physical world as we know it to, well, a very different kind of world?

Nearly all religions – even Buddhism, which has no god and rejects the idea of an immortal soul – teach that immaterial realms exist that transcend the reality we know. For Christians and Muslims, those realms are heaven and hell.

One of the simplest and clearest statements of such a concept comes from ancient Greek mythology. As long as the deceased had its toll in hand – well, actually in its mouth – it would be transported by Charon, an old and ugly ferryman, across the river Styx to Hades, the land of the dead. (In some tellings, the dead crossed the Acheron, which is sometimes described as a lake.)

In other words, the dead were transported to, quite literally, the *Other Side*, which I'll refer to henceforward, at least most of the time, as the OS. Unfortunately, not everyone was eligible to make the crossing. If no one thought to bury you or to put that coin in your mouth, you were doomed to roam *this* side of the river as a ghost.

The idea of a realm that somehow transcends the one we experience directly has taken on many forms over the centuries. George Griffith, England's most prominent and prolific science fiction writer of the late 1800s, published a prescient novel about this realm in 1906: *The Mummy and Miss Nitocris: A Phantasy of the Fourth Dimension*. The book's protagonist, Professor Franklin Marmion, is a distinguished mathematician and physicist who anticipates discoveries and concepts that real quantum physicists would eventually introduce in the mid and late 1900s. Over the course of the story, Marmion not only reluctantly accepts the fact that a higher dimension must exist, he also acquires the power to shift his body there, which allows him to become invisible. He also learns, among other counterintuitive things, that multiple objects can occupy the same space at the same time, and he adjusts his mathematical model of the world accordingly.

Griffith might have been aware of a contemporary of his, William James, a prominent Harvard philosopher and also arguably America's first psychologist. In 1898, James published a short book entitled *Human Immortality: Two Supposed Objections to the Doctrine*, in which he praised his contemporaries for boldly using scientific methods to investigate "providential leadings in answer to prayer, instantaneous healings, premonitions, apparitions at time of death, clairvoyant visions or impressions, and the whole range of mediumistic capacities."

Regarding human consciousness, James asserted that a universe-wide consciousness existed that beamed human consciousness into our brains "as so many finite rays," just as the sun beams rays of light onto our planet. Our brains, he said, being limited in their capabilities, generally suppress and filter real consciousness, while sometimes allowing "glows of feeling, glimpses of insight, and streams of knowledge" to shine through. He called this idea "transmission-theory."

Ideas like James's have been around for thousands of years. In his 2006 book, *Life After Death: The Burden of Proof*, alternative medicine guru Deepak Chopra says that ancient Hindu texts teach that the material world we know is nothing but a projection from the universal consciousness that fills all space. Death, he says, is not an end; it is a merging of a relatively pathetic human consciousness with that of the dazzling universal one. To add gravitas to this idea, he does what many recent authors have done:

he suggests that modern formulations of quantum physics are consistent with his belief in a universal consciousness.

The connection between physics and modern theories of mind and consciousness is tenuous at best, but modern physicists do take the idea of parallel universes seriously. They debate the details, but they can hardly ignore the fact that the mathematics of at least three of the grand theories at the core of modern physics – inflation theory, quantum theory, and string theory – predict the existence of alternate universes. Some physicists even believe that signals can leak between the universes and that the existence of parallel universes can be confirmed through measurements or experiments. In a recent essay, physicist A. A. Antonov argues that our inability to detect that vast amount of dark energy and dark matter that must exist in our own universe is evidence of the existence of parallel universes, six of which, he speculates, are directly adjacent to our own.

Again, setting the details aside, physicists agree that the three-dimensional space we experience is simply not the whole picture. As theoretical physicist Lee Smolin put it recently, "Space is dead."

Evidence for Transduction?

So is there evidence to support a theory of transduction? This is where, perhaps, you expect me to talk about ghosts, or maybe about the claims that best-selling authors have made in recent years about the "proof" that telepathy, out-of-body experiences, and communication with the dead are real.

Let's set all the spooky stuff aside for the moment and instead talk about my 95-year-old mom. Her memory is unreliable, but she is still quite lucid and plays a lightning-fast game of double solitaire; I can seldom beat her.

She also hears music continuously, and it's not the kind of music that drives us nuts when we can't get a tune out of our head. She hears *original* music, none of which she recognizes, and she will sometimes try to hum or sing what's she hearing. She says it's coming from "the neighbors downstairs," and it doesn't bother her, she says, because some of the music "isn't bad" and because it helps her fall asleep. The fact that other people can't hear what she's hearing doesn't bother her either. She simply smiles slyly and says, "Maybe you should get your hearing checked."

Am I concerned? Well, just a bit, but my main concern is not with the music my mom hears but with the music's *source*. I would be much more comfortable if the inconsiderate neighbors lived *upstairs*. I told her this the other day, and she laughed and said, "I see what you're getting at, but don't worry. I'm *not* going to hell." Very determined, my mom.

Where is all this original music coming from? My mother has never composed music, and she insists she would be incapable of doing so "no matter how much you paid me."

When I was a graduate student at Harvard, I noticed a stranger roaming around the hall near my office and offered to assist her. Doris, it turns out, had heard voices for years, and she was hoping she could find someone in the psychology building – William James Hall – to help her get rid of those voices because they often got her into trouble. Surely, she insisted, this building was the right place to find some help. I didn't have the heart to tell her that Harvard, at the time, had no clinical psychology program and that I was doing behavioral research with pigeons. If her voices had sent her there, they were mischievous indeed.

When internal perception really goes awry, people can be overwhelmed by hallucinations, visions (sometimes of a religious nature), or distortions of reality so extreme they have to be hospitalized.

Even the "normal" among us hallucinate several times each night – we call it dreaming – and we all have at least two highly disorienting experiences each day called "hypnogogic states" – those eerie and sometimes creative interludes between sleeping and waking.

I have sometimes dreamt intricate full-length movies that seemed as good as any Hollywood film. Alas, most of the time, no matter how hard I try, I can't seem to hold on to even a shred of a dream during the few seconds when I'm staggering from my bed to the bathroom.

Where does all this content come from, and why do we have so little control over it?

Hold that thought, and let's move on to what experts have, in recent years, clumsily labeled "paradoxical lucidity," or, even worse, "*terminal* lucidity." (The latter term suggests that clear thinking can be fatal, and I suppose it was for Bruno and others who offended the Church, but generally I think we need a lot more clear thinking than we have.) These labels refer to what might simply be called "the last hurrah" – the burst of mental clarity that sometimes occurs shortly before people die – even people for whom such clarity should be impossible.

For more than two centuries, medical journals have published credible reports of highly impaired, uncommunicative people who suddenly became lucid for a few minutes before they died. There are documented cases in which people with dementia, advanced Alzheimer's, schizophrenia, and even severe brain damage – people who have not been able to speak or to recognize their closest relatives for years – suddenly recognized their relatives and spoke normally.

A 2020 study summarizing the observations of 124 caregivers of dementia patients concluded that in "more than 80% of these cases, complete remission with return of memory, orientation, and responsive verbal ability was reported by observers of the lucid episode" and that "[the] majority of patients died within hours to days after the episode." The periods of lucidity typically lasted between 30 and 60 minutes.

Some of the historical reports of lucid episodes are truly extraordinary. Here are just two of the many cases reported by Michael Nahm and his colleagues in 2012:

> In a case published in 1822, a boy at the age of 6 had fallen on a nail that penetrated his forehead. He slowly developed increasing headaches and mental disturbances. At the age of 17, he was in constant pain, extremely melancholic, and starting to lose his memory. He fantasized, blinked continuously, and looked for hours at particular objects…. He remained in the hospital in this state for 18 days. On the morning of the 19th day, he suddenly left his bed and appeared very bright, claiming he was free of all pain and feelings of sickness…. A quarter of an hour after the attending physician left him, he fell unconscious and died within a few minutes. The front part of his brain contained two pus-filled tissue bags the size of a hen's egg (Pfeufer, 1822)….
>
> Haig (2007) reported the case of a young man dying of lung cancer that had spread to his brain. Toward the end of his life, a brain scan showed little brain tissue left, the metastasized tumors having not simply pushed aside normal brain tissue but actually destroyed and replaced it. In the days before his death, he lost all ability to speak or move. According to a nurse and his wife, however, an hour before he died, he woke up and said good-bye to his family, speaking with them for about five minutes before losing consciousness again and dying.

If the brain is a self-contained information processor, how can we explain the sudden return of lucidity when the brain is severely damaged? For that matter, think about the variability that occurs in your own lucidity over the course of 24 hours, during which you are, at various times, completely unconscious,

partially conscious, or fully conscious. If you add drugs and alcohol to the picture, the variability is even greater, and it can be quite bizarre.

The variability problem is addressed in an intriguing paper published by Jorge Palop and his colleagues in *Nature* in 2006, who note that patients suffering from a variety of neurodegenerative disorders often fluctuate over the course of a single day between states of extreme confusion and relatively normal mental states. Such radical changes, they note, "cannot be caused by sudden loss or gain of nerve cells." They speculate that this variability might be driven by changes in neural networks, but, overall, they present the variability problem as a complete mystery.

But what if the variability is not caused by changes in "processing" power in the brain but rather by transduction effects? By changes occurring not in our local universe but in the OS? Or by minor changes occurring at the point of connection? Or by changes occurring in brain structures that are essential to signal transfers?

I've also been intrigued by what appear to be credible reports about visual experiences that some congenitally-blind people have had when they were near death. Experiences of this sort were first summarized in a 1997 paper by Kenneth Ring and Sharon Cooper, later expanded into a book called *Mindsight* (1999). The paper and book describe the experiences of 14 people who were blind from birth and who had near-death experiences (NDEs), some of which included content that appeared to be visual in nature. Soon after Vicki U. was in a near-fatal car accident at age 22, she remembered "seeing" a male physician and a woman from above in the emergency room, and she "saw" them working on a body. Said Vicki:

> I knew it was me.... I was pretty thin then. I was quite tall and thin at that point. And I recognized at first that it was a body, but I didn't even know that it was mine initially. Then I perceived that I was up on the ceiling, and I thought, "Well, that's kind of weird. What am I doing up here?" I thought, "Well, this must be me. Am I dead?"

Born premature, Vicki had suffered severe damage to her optic nerves while still in an incubator. She had never had a visual experience before her NDE, and, according to the researchers, did not even "understand the nature of light." While near death, she also claimed to have been flooded with information about math and science. Said Vicki:

> I all of a sudden understood intuitively almost things about calculus, and about the way planets were made. And I don't know anything about that. ... I felt there was nothing I didn't know.

Several aspects of Vicki's recollections are intriguing, but the most interesting to me are the visual experiences. How can someone who has never had such an experience – "No light, no shadows, no nothing, ever," according to Vicki – suddenly have rich and detailed experiences of this sort? Ring and Cooper found others like Vicki – congenitally blind people who not only had visual experiences when near death but whose NDEs were remarkably similar to some common NDEs of sighted people.

And why can't we remember pain? We can remember facts and figures and images – quite poorly, most of the time – and we can even get choked up remembering strong emotions we've felt in the past – but *we can't remember pain*. Are sensations of pain getting filtered out by transduction pathways? Could that be why our dreams are pain free? That begs an obvious question: Is the OS a kind of pain-free Heaven?

And have you ever met a stranger who made you feel, almost immediately, that you had known him or her your entire life? And sometimes this stranger has the same feeling about *you*. It's a strong feeling,

almost overwhelming. We can try to explain such feelings with speculations about how a voice or physical characteristics might remind us of someone from our past, but there's another possibility – that in some sense *you had actually known this person your whole life*. If the brain is a bidirectional transducer, that is not a strange idea at all.

In fact, *none* of these phenomena looks mysterious – dreams, hallucinations, lucidity that comes and goes, lucidity that should be impossible, that strong sense of knowing someone, blind vision, our inability to remember pain, my mom's melodies – when viewed through the lens of transduction theory. And how about dissociative identity disorder, or schizophrenia, or that *déjà vu* feeling, or even demonic possession? *Easy peasy*.

And All That Jazz

This brings me, reluctantly, to the recent rise of "postmaterialist" science, or at least postmaterialist psychology. The latter is marked by – or perhaps blemished by – the founding of the journal *Spirituality in Clinical Practice* by the American Psychological Association (APA) in 2014 and the founding of the Association for the Advancement of Postmaterialistic Sciences in 2017. (Disclosure: I have been a full member of the APA since 1983.)

Postmaterialism is all about "controlled experiments" that have supposedly proved, or at least supported, claims that mediums can communicate with the dead, that ghosts will happily comply when we ask them to climb into little boxes in a laboratory, that children can remember their past lives, that people near death can communicate with dead relatives, that people can send their thoughts to people in another room telepathically, and that future events can somehow travel backward in time to impact people's current behavior.

I am *so*, *so* tempted here to start naming names and tearing down reputations, but my musical mom raised me better than that. I will say this: one of the early papers published in that new APA journal – a paper that was accepted without peer review – demonstrated thinking so shoddy that it scared me. If you are a highly trained scientist with a Ph.D. from a reputable institution, and you think that seeing the word "elephant" 15 times during a 24-hour period is evidence that a divine force is looking after you, it's time to retire, my friend.

Fortunately, I don't *need* to tear apart shoddy thinking or flawed experiments to advocate for transduction theory. In fact, if this theory proves to be valid – and, yes, I believe it is testable – every fantasy of the postmaterialists will be fulfilled – every fantasy except one, that is, and that is *the postmaterialist claim itself*. That's because parallel universes are not wispy, physics-free spiritual entities; they are just non-obvious companions of the material universe in which we happen to live. To put this another way, if the brain is a transducer, both dualism and the classic mind-body problem disappear.

A Better Brain Theory

Let's set aside both the mundane and the exotic reasons we should take transduction theory seriously and get to the heart of the matter: The main reason we should give serious thought to such a theory has nothing to do with ghosts. It has to do with the sorry state of brain science and its pathetic reliance on the computer metaphor.

Joseph Dorri, one of my research associates at AIBRT, recently calculated that Beethoven's thirty-two piano sonatas contain a total of 307,756 notes, and that doesn't take into account the hundreds of sections marked with "repeat" symbols. Beethoven's scores also include more than 100,000 symbols

that guide the pianist's hands and feet: time signatures, pedal notations, accent marks, slur and trill marks, key signatures, rests, clefs, dynamic notations, tempo marks, and so on.

Why am I telling you about Beethoven? Because piano virtuoso and conductor Daniel Barenboim memorized *all thirty-two of Beethoven's sonatas by the time he was 17*, and he has since memorized hundreds of other major piano works, as well as dozens of entire symphony scores – *tens of millions* of notes and symbols.

Do you honestly think that all this content is somehow *stored* in Barenboim's ever-changing, ever-shrinking, ever-decaying brain? Sorry, but if you study his brain for a hundred years, you will never find a single note, a single musical score, a single instruction for how to move his fingers – not even a "representation" of any of those things. The brain is simply *not* a storage device. It is an extraordinary entity for sure, but not because it stores or processes "information." (See my *Aeon* essay, "The Empty Brain," for more of my thinking on this issue, and for a truly great thrill, watch Barenboim play the third movement from Beethoven's 14th piano sonata here. His fingers are often a blur, and the notes come so quickly that it's often impossible to distinguish one from another.)

Over the centuries – completely baffled by where human intelligence comes from – people have used one metaphor after another to "explain" our extraordinary abilities, beginning, of course, with the divine metaphor millennia ago and progressing – and I use that word hesitatingly – to the current information-processing metaphor (again, see "The Empty Brain"). I am proposing now that we abandon the metaphors and begin to consider substantive ideas we can test.

To be clear: I am *not* offering transduction theory as yet another metaphor. I am suggesting that the brain is truly a bidirectional transducer and that, over time, we will find empirical support for this theory – one that has profound implications, as you may have already guessed.

In a way, we are already surrounded by evidence that supports transduction theory. My staff recently generated a list of 58 human experiences – or at least human *beliefs* about such experiences – that are consistent with such a theory. But I think we do can much better than assemble lists of human quirks.

Recall that Einstein's Special Theory of Relativity, published in 1905, and then his General Theory of Relativity, published in 1915, received no direct and convincing empirical support for several years – first regarding predictions his equations made about the perihelion precession of Mercury's orbit, then about the bending of light around the sun (observed by Arthur Eddington in 1919), and then about the gravitational redshift of light. It took a full century before his predictions about gravity waves were confirmed.

If we can cast some aspects of transduction theory into formal, predictive terms (I'm working on that now and am looking for collaborators), we might be able to make specific predictions about transduction in either direction – about subtle variations in reactions times, for example, or about duplex interference patterns. We might also be able to predict quantitative aspects of dreams, daydreams, hallucinations, autism, and schizophrenia.

And then there's the question of mechanism. If you transported a 17th century scientist to the present day and showed him or her how well you can converse with someone using a cell phone, he or she would almost certainly want to examine the contents of the phone. The remote voice must be *in* the phone, after all. To put this another way, a Renaissance scientist will naively view the phone as a self-contained processing unit, much as today's brain scientists naively view the brain.

But that scientist will never find the remote voice inside the phone, because it is not there to be found.

If we explain to the scientist that the phone is a transducer, however, he or she will now examine the phone in a very different way, searching for evidence of transduction, which he or she – aided by appropriate instruments and knowledge – will eventually find.

And here is the problem: If you *never* teach that scientist about transduction, he or she might *never* unravel the mysteries of that phone.

Which brings me to the claustrum, a small structure just below the cerebral cortex that is poorly understood, although recent research is beginning to shed some light. Many areas of the brain connect to the claustrum, but what does it do? If the claustrum turns out to be the place where signals are transferred between our universe and a parallel one, *you will probably never discover this remarkable fact if transduction is not on your list of possibilities.*

If modern brain scientists begin to look for evidence that the brain is a transducer, they are likely to find such evidence. They can find it directly, through a new understanding of pathways, structures, brain injuries, electro-chemical activity, or brain waves, or they can find it indirectly, by simulating aspects of brain function that appear to be capable of transducing signals. Neural networks, which have proved useful in computing, were inspired by relatively simplistic observations of brain anatomy and activity. Other aspects of brain function might inspire new devices or computer programs that allow transduction to be simulated.

In the extreme case, we might inadvertently create mechanisms that either send signals to a parallel universe, or, of greater interest, that *receive* signals from that universe.

Fortunately, as all successful inventors will confirm, you don't need to understand how something works – the flight of birds, for example – to build an invention that emulates its performance.

Could animal brains help us understand the transduction process – at least the brains of mammals and some birds? The theory of evolution teaches us how natural selection can differentiate traits and even species, but it also reminds us of continuities across species (especially in Darwin's *The Expression of the Emotions in Man and Animals* [1872]). It's possible that human brains have especially strong connections to the OS, with some humans having stronger connections than others, and with all connections subject to disruption. Efficient and clear transduction might be the key to understanding the emergence of human language and consciousness; here is a possible explanation for what might have been the relatively sudden appearance of such abilities (see Julian Jaynes's 1976 book, *The Origin of Consciousness in the Breakdown of the Bicameral Mind*). If animal brains have weaker or more limited connections to the OS, might comparative brain studies focused strictly on transduction shed further light on how this transduction is accomplished?

It might take decades for us to see such advances, but with vast resources already devoted to the brain sciences and with multiple Nobel prizes on the line, I'm guessing we'll move much faster.

And if you're worried that transduction theory is just another one of those inherently untestable theories – like string theory or theories about parallel universes – think again. With transduction theory, we have an enormous advantage: *The transduction device is available for immediate in-depth study*.

Implications

What will happen – how will things change – if we find evidence to support a transduction theory of the brain? This could mean, at the modest end of a continuum of discoveries, that we find what appear to be mechanisms of transduction in the brain, or perhaps that we are able to simulate some aspect of

brain anatomy or function in a way that allows us to create new types of software or hardware that transduce signals.

At the other extreme on that continuum, transduction research could produce evidence of pathways between our universe and one or more parallel universes, and that in turn might allow us to learn, over time, how to communicate in new ways along such pathways and, perhaps, how to open new pathways for travel.

It's reasonable to speculate that if transduction theory proves to be useful as a way of understanding the brain, our understanding of the universe and of our place in that universe will change profoundly. We might not only be able to make sense of dozens of odd aspects of human experience, we might also begin to unravel some of the greatest mysteries in the universe: how to reconcile relativity and quantum mechanics, where our universe came from, what else is out there – even whether there is, in some sense, a God.

Some Final Notes

Before I sum up, I need to come clean about consciousness. I doubt that transduction theory will solve the consciousness problem because I don't think there *is* a consciousness problem. Consciousness is just the experience we have when we're observing ourselves or the world. It seems grand simply because we're part of the system we're observing. It's a classic example of how difficult it can be to study a system of which one is an integral part; think of this problem as a kind of Gödel's theorem of the behavioral sciences. (For my whole spiel on this issue, see my 2017 essay, "Decapitating Consciousness.")

Consciousness aside, if the brain – the human brain, in particular – is truly a transducer that connects us to the Other Side – or to a Vast Intelligence – or to an Operating System of some sort (techies: you *knew* that was coming) – we are unlikely to confirm this if we continue to cling to the brainless idea that the brain is a self-contained information processor. We are *organisms*, and while there is no evidence that organisms process information, nature is *superb* at building transducers. We are literally encased in transducers from head to toe, and we might contain one too – one that is as unique as it is powerful.

If you are as skeptical about flimsy theories as I am, by now you might be thinking: Has Epstein lost his mind (and, if so, where did it go)? Does he now believe in ghosts and Ouija boards and reincarnation?

Let me assure you that I am as hard-headed as ever. I won't believe in ghosts until Casper himself materializes in front of an audience and pushes me off the stage. But I am also acutely conscious of how little we actually know, both about ourselves and our universe. If one simple idea – brain as transducer – might stimulate new kinds of research and might also bring order to what seem to be scores of unrelated, bizarre, and highly persistent human beliefs, I'm all for it.

Robert Epstein is Senior Research Psychologist at the American Institute for Behavioral Research and Technology (AIBRT) in California. A Ph.D. of Harvard University, he is the former editor-in-chief of *Psychology Today* magazine and the author of 15 books and more than 300 articles on various topics in the behavioral sciences. His mathematical model of the Carrier Separation Plan, a strategy for quickly eradicating SARS-CoV-2 and comparable pathogens, can be accessed at https://doi.org/10.3389/fpubh.2021.640009.