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ANNALS OF THE MIND

ADVENTURES IN
TRANSCRANIAL DIRECT-
CURRENT STIMULATION

ANNALS OF PSYCHOLOGY

SOCIAL ANIMAL

often only two people here, on the California coast just north of San Diego. Patricia Churchland is throwing a rubber ball into the ocean for her two dogs (Fergus and Maxwell, golden retrievers) to fetch. Her husband, Paul Churchland, is standing next to her. They are both wearing heavy sweaters. They are in their early sixties. They are tall—she is five feet eight, he is six feet five. They come here every Sunday at dawn.

Pat is constantly in motion, throwing the ball, stepping backward, rubbing her hands together, walking forward in a vigorous, twitchy way. She has pale eyes, a sharp chin, and the crisp, alert look of someone who likes being outside in the cold. (Even when it is sunny, she looks as though she were enjoying a bracing wind.) She seems younger than she is: she has the anxious vitality of a person driven to prove herself—the first to jump off a bridge into freezing water. Paul stands heavily, his hands in his pockets. He is still. He nudges at a stone with his foot. He looks up and smiles at his wife's back. He has a thick beard. He looks like the sort of person who finds it soothing to chop his own wood (and in fact he is that sort of person).

Paul and Pat met when she was nineteen and he was twenty, and they have been married for almost forty years. They are both Canadian; she grew up on a farm in

the Okanagan Valley, he, in Vancouver. They have two children and four grandchildren. They live in Solana Beach, in a nineteen-sixties house with a small pool and a hot tub and an herb garden. Each summer, they migrate north to a tiny island off the Vancouver coast. Both are professors of philosophy at the University of California at San Diego. They have been talking about philosophy together since they met, which is to say more or less since either of them encountered the subject. They test ideas on each other; they criticize each other's work. At this point, they have shaped each other so profoundly and their ideas are so intertwined that it is impossible, even for them, to say where one ends and the other begins. Their work is so similar that they are sometimes discussed, in journals and books, as one person. Some of their theories are quite radical, and at the start of their careers the Churchlands were not always taken seriously: sometimes their ideas were thought silly, sometimes repugnant, verging on immoral. In those days, they formed a habit of thinking of themselves as isolates aligned against a hostile world, and although they are now both well established in their field, the habit lingers.

"For the first twenty-five years of our career, Pat and I wrote only one paper together," Paul says, "partly because we wanted to avoid—"

"We wrote more than that," Pat says.

"Together? I thought 'Stalking the Wild Epistemic Engine' was the first."

"There was 'Functionalism, Intentionality, and Whatnot.'"

"O.K., so there's two. In the early stages, when Pat wrote her papers she said, 'Paul, you really had a lot of input into this, should we put your name on it?' I'd say, 'No, I don't want people saying Pat's sailing on Paul's coattails.'"

The guiding obsession of their professional lives is an ancient philosophical puzzle, the mind-body problem: the problem of how to understand the relationship between conscious experience and the brain. Are they different stuffs: the mind a kind of spirit, the brain, flesh? Or are they the same stuff, their seeming difference just a peculiarly intractable illusion? And if they are the same stuff, if the mind is the brain, how can we comprehend that fact? What can it possibly mean to say that my experience of seeing blue is *the same thing* as a clump of tissue and membrane and salty liquid?

Think of some evanescent emotion—apprehension mixed with conceit, say. Then think, That feeling and that mass of wet tissue—*same thing*. Or think of the way a door shutting sounds to you, which is private, inaccessible to anyone else, and couldn't exist without you conscious and listening; that and the firing of cells in your brain, which any neuroscientist can readily detect without your coöperation—*same thing*. The terms don't match, they don't make sense together, any more than it makes sense to ask how many words you can fit in a truck. That is the problem.

In the past, it seemed obvious that mind and matter were not the same stuff; the only question was whether they were connected. Everyone was a dualist. In the seventeenth century, Leibniz thought that mind and body only appeared to interact because God had established a perfectly synchronized harmony between them (an ingenious theory impossible to refute). Descartes believed that the mind was composed of a strange substance that was not physical but that interacted with the material of the brain by means of the pineal gland. Nowadays, few people doubt that the mind somehow is the brain, but although that might seem like the end of the matter, all that's necessary to be clear on the subject, it is not. It is not enough to imagine that the brain *houses* the mind (in some obscure cavity, perhaps tiny intracellular pockets), or *gives rise to* the mind (the way a television produces an image), or *generates* the mind (a generator producing current): to imagine any of those things is to retain the idea that the mind and the brain are distinct from each other. The problem is not one of knowledge; the problem is our obdurate, antediluvian minds that cannot grasp what we believe to be true.

Some philosophers think that we will never solve this problem—that our two thousand years of trying and failing indicate that it's likely we are no more capable of doing so than a goat can do algebra. Others believe that someday a conceptual revolution will take place, on a par with those of Copernicus and Darwin, and then all at once it will be clear how matter and mind, brain and consciousness, are one thing. Paul and Pat Churchland believe that the mind-body problem will be solved not by philosophers but by neuroscientists, and that our present knowledge is so paltry that we would not understand the solution even if it were suddenly to present itself. "Suppose you're a medieval physicist wondering about the burning of wood," Pat likes to say in her classes. "You're Albertus Magnus, let's say. One night, a Martian comes down and whispers, 'Hey, Albertus, the burning of wood is really rapid oxidation!' What could he do? He knows no structural chemistry, he doesn't

know what oxygen is, he doesn't know what an element is—he couldn't make any sense of it. And if some fine night that same omniscient Martian came down and said, 'Hey, Pat, consciousness is really blesjeakahgjfdl!' I would be similarly confused, because neuroscience is just not far enough along." Philosophers have always thought about what it means to be made of flesh, but the introduction into the discipline of a wet, messy, complex, and redundant collection of neuronal connections is relatively new. Nowadays, it seems obvious to many philosophers that if they are interested in the mind they should pay attention to neuroscience, but this was not at all obvious when Pat and Paul were starting out, and that it is so now is in some measure due to them.

VIDEO FROM THE NEW YORKER

The High Stakes of the Trump Midterms

The Churchlands like to try, as far as possible, not only to believe that they themselves are thoroughly physical creatures but also to *feel* it—to experience their thoughts as bodily sensations. They have never thought it a diminishment of humanness to think of their consciousness as flesh—quite the opposite. And they are monists in life as they are in philosophy: they wonder what sort of organism their marriage is, its body and its mental life, beginning when they were unformed and very young—all those years of sharing the same ideas and the same dinners. When they met, Paul and Pat were quite different, from each other and from what

they are now: he knew about astronomy and electromagnetic theory, she about biology and novels. But as time went on they taught each other what they knew, and the things they didn't share fell away. Their family unity was such that their two children—now in their thirties—grew up, professionally speaking, almost identical: both obtained Ph.D.s in neuroscience and now study monkeys. Paul sometimes thinks of Pat and himself as two hemispheres of the same brain—differentiated in certain functions but bound together by tissue and neuronal pathways worn in unique directions by shared incidents and habit. This is not a fantasy of transparency between them: even one's own mind is not transparent to oneself, Paul believes, so to imagine his wife's brain joined to his is merely to exaggerate what is actually the case—two organisms evolving into one in a shared shell.

"It's funny the way your life is your life and you don't know any other life," Pat says. "I don't know what it would have been like if I'd been married to—"

"A patent lawyer?"

"Something like that. It's hard for me to imagine."

"I think the two of us have been, jointly, several orders of magnitude more successful than at least I would have been on my own," Paul says. "I'd like to understand that better than I do; I presume it's got something to do with the brain. You could say, well, we exchanged a lot of oxytocin, but that's probably one per cent of the story." (Oxytocin is a peptide produced in the body during orgasm and breast-feeding; when it is sprayed into the noses of experimental subjects, they become more trusting and cooperative.) "To what extent has Pat shaped my conceptual framework and hence my perceptions of the world, and to what extent have I done that for her? I think the answer is, an enormous extent. But I don't know how to unwind it."

"We've been married thirty-six years, and I guess we've known each other for forty-two or something like that. That's a long time."

"Thirty-seven years. Weren't we married in '69? Almost thirty-eight."

"That is a long time."

The tide is coming in. A few more people have arrived at the beach—there are now a couple of cars parked next to the Churchlands' white Toyota Sequoia. Pat and Paul walk up toward the road. The dogs come running out of the sea, wet and barking.

Pat Churchland grew up in rural British Columbia. Her parents owned an orchard—in the summer the Okanagan Valley is hot enough for peaches. “We used to regale people with stories of life on the farm because they thought it was from the nineteenth century,” Pat says.

“You had chickens, you had a cow,” Paul says.

“We didn’t have an indoor toilet until I was seven. We had a two-holer, and people actually did sit in the loo together. I know it seems *hilarious* now.”

When Pat was a teen-ager, she worked in a fruit-packing plant. Neither of her parents was formally educated past the sixth grade. In her understanding of herself, this kind of childhood is very important. To her, growing up on a farm in the middle of nowhere means that you have no patience for verbiage, you are interested only in whether a thing works or not. And if it doesn’t work you had better figure out how to fix it yourself, because no one is going to do it for you.

When Pat went to college, she decided that she wanted to learn about the mind: what is intelligence, what it is to reason, what it is to have emotions. She found that these questions were not being addressed in the first place she looked, psychology—many psychologists then were behaviorists—but they were discussed somewhat in philosophy, so she started taking philosophy courses. She met Paul in a Plato class, her sophomore year. She soon discovered that the sort of philosophy she was being taught was not what she was looking for. At the time, in the nineteen-sixties, Anglo-American philosophy was preoccupied with language—many philosophers felt that their task was to untangle the confusions and incoherence in the way people spoke, in the belief that disagreements were often misunderstandings, and that if our concepts were better sorted out then our thinking would also be clearer. This held no great appeal for Pat, but one thing led to another, and she found herself in philosophy graduate school at the University of Pittsburgh. The department was strong in philosophy of science, and to her relief Pat found people there who agreed that ordinary language philosophy was a bit sterile. At Pittsburgh, she read W. V. O. Quine’s book “Word and Object,” which had been published a few years earlier, and she learned, to her delight, that it was possible to question the distinction between empirical and conceptual truth: not only could philosophy concern itself with science; it could even be a kind of science.

After a year, she moved to Oxford to do a B.Phil. Philosophy at Oxford at the time was very far from Pittsburgh—quite conservative, not at all empirically oriented. Nobody seemed to be interested in what she was interested in, and when she tried to do what she was supposed to she was bad at it. It was all very discouraging. She was beginning to feel that philosophy was just a lot of blather. “The idea seemed to be that, if you analyzed your concepts, somehow that led you to the truth of the nature of things,” she says. “It was just garbage.” She was about to move back to Canada and do something else entirely, maybe go into business, but meanwhile Paul Churchland had broken up with the girlfriend he’d had when they were undergraduates and had determined to pursue her. He came over to Oxford for the summer, and they rented a little house together on Iffley Road. Paul had started thinking about how you might use philosophy of science to think about the mind, and he wooed Pat with his theories.

At Pittsburgh, where he had also gone for graduate school, he had learned to be suspicious of the intuitively plausible idea that you could see the world directly and form theories about it afterward—that you could rely on your basic perceptions (seeing, hearing, touching) being as straightforwardly physical and free from bias as they appeared to be. He concluded that we cannot help perceiving the world through the medium of our ideas about it. It’s not just a matter of what we pay attention to—a farmer’s interest might be aroused by different things in a landscape than a poet’s—but of what we actually *see*. In the course of that summer, Pat came to look at philosophy quite differently. “I stayed in the field because of Paul,” she says. “Gradually, I could see all kinds of things to do, and I could see what counted as progress.” Philosophy could actually change your experience of the world, she realized. And if it could change your experience of the world then it had the potential to do important work, as important as that of science, because coming to see something in a wholly different way was like discovering a new thing.

Paul didn’t grow up on a farm, but he was raised in a family with a practical bent: his father started a boat-works company in Vancouver, then taught science in a local high school. His mother took in sewing.

“I guess I have long known that there was only the brain,” Pat says.

“When you were six years old?” Paul says.

“Well, no, of course not.”

“I remember deciding at about age eleven or twelve, after a discussion with my friends about the universe and did God exist and was there a soul and so forth,” Paul says. “I’d been skeptical about God. My parents weren’t religious. I would ask myself, What do you think thinking is? And I’d say, I guess it’s just electricity.”

Paul as a boy was obsessed with science fiction, particularly books by Robert Heinlein. He vividly remembers “Orphans of the Sky,” the story of a young man named Hugh Hoyland. Hugh lives in a world called the Ship, which is run by scientists—all except for the upper decks, where it is dangerous to venture because of the mutants, or “muties,” who live there. One day, Hugh is captured by an intelligent two-headed mutie named Joe-Jim, who takes him up to the control room of the Ship and shows him the sky and the stars. All at once, Hugh realizes that what he had been told were inscrutable religious metaphors were in fact true: the Ship is not the whole universe after all but merely a thing inside it, and it is actually making some sort of journey. He tries to explain this to the scientists, but they tell him he is talking nonsense. How could the Ship move when the Ship is all there is? “Orphans of the Sky” is a classic philosophical fable, a variant of Plato’s story about prisoners in a cave who mistake shadows cast on the wall for reality. Its moral is not very useful for day-to-day work, in philosophy or anything else—what are you supposed to do with it?—but it has retained a hold on Paul’s imagination: he always remembers that, however certain he may be about something, however airtight an argument appears or however fundamental an intuition, there is always a chance that both are completely wrong, and that reality lies in some other place that he hasn’t looked because he doesn’t know it’s there.

Paul’s father had a woodworking and metal shop in the basement, and Paul was always building things. He planned eventually to build flying saucers, and decided that he was going to be an aerodynamical engineer. He stuck with this plan when he got to college, taking courses in math and physics. But the summer after his first year he found himself hanging around with a group of friends who could make sophisticated arguments about the existence of God. Paul was at a disadvantage not knowing what the ontological argument was, and he determined to take some philosophy classes when he went back to school. Although he was trained, as Pat was, in ordinary language philosophy, by the time he graduated he also was beginning to feel that that sort of philosophy was not for him. When he got to Pittsburgh, Wilfrid Sellars became his dissertation adviser. In the mid-nineteen-fifties, a few years before Paul became his student, Sellars had proposed that the sort

of basic psychological understanding that we take for granted as virtually instinctive—if someone is hungry, he will try to find something to eat; if he believes a situation to be dangerous, he will try to get away—was not. Concepts like “beliefs” and “desires” do not come to us naturally; they have to be learned. Nor were they simply descriptive: we do not see beliefs, after all—we conjecture that they are there based on how a person is behaving. No, this kind of ordinary psychological understanding was something like a theory, a more or less coherent collection of assumptions and hypotheses, built up over time, that we used to explain and predict other people’s behavior.

In writing his dissertation, Paul started with Sellars’s idea that ordinary or “folk” psychology was a theory and took it a step further. If folk psychology was a theory, Paul reasoned, it could turn out to be wrong. It had happened many times, after all, that understandings that felt as fundamental and unshakable as instincts turned out to be wrong. Our folk geology—the evidence of our eyes and common sense—told us that the earth was flat, and while it still might look that way we accepted that it was an illusion. Our folk biology told us that if we slammed a hand in a door we would feel pain at the point of contact—and, while we still felt pain in the hand, we now knew that the pain signal had to travel away from the hand to the brain before we experienced it. Folk psychology, too, had suffered corrections; it was now widely agreed, for instance, that we might have repressed motives and memories that we did not, for the moment, perceive. Surely it was likely that, with progress in neuroscience, many more counterintuitive results would come to light. How probable was it, after all, that, in probing the brain, scientists would come across little clusters of “belief” neurons? It wasn’t that beliefs didn’t exist; it was just that it seemed highly improbable that the first speakers of the English language, many hundreds of years ago, should miraculously have chanced upon the categories that, as the saying goes, carved nature at its joints. It might turn out, for instance, that it would make more sense, brain-wise, to group “beliefs about cheese” with “fear of cheese” and “craving for dairy” rather than with “beliefs about life after death.”

Mental life was something we knew very little about, and when something was imperfectly understood it was quite likely that we would define its structure imperfectly, too. It was only rarely that, in science, you started with a perfectly delimited thing and set out to investigate it; more often, your definition of what it was that you were looking at would change as you discovered more about it. (“Consider the medieval physicists who wondered what fire could be,” Pat says.

“They identified a range of things that they thought were instances of fire: burning wood, the sun, comets, lightning, fireflies, northern lights. They couldn’t give a definition, but they could give examples that they agreed upon. Jump now to the twentieth century. The category of fire, as defined by what seemed to be intuitively obvious members of the category, has become completely unstuck. Turns out that burning wood is actually oxidation; what happens on the sun has nothing to do with that, it’s nuclear fusion; lightning is thermal emission; fireflies are biophosphorescence; northern lights are spectral emission.”)

Why, Paul reasoned, should we assume that our everyday psychological notions are any more accurate than our uninformed notions about the world? Why should we suppose introspection to be infallible when our perception is so clearly fallible in every other way? Paul speculated that it might, someday, turn out that a materialist science, mapping the structure and functions of the brain, would eliminate much of folk psychology altogether. Some folk categories would probably survive—visual perception was a likely candidate, he thought. Attention, perhaps. Representation. But not much more than that.

Pat and Paul married in 1969 and found jobs together at the University of Manitoba, in Winnipeg.

“Winnipeg was basically like Cleveland in the fifties,” Pat says. “Very innocent, very free. The kids look back on those years in Winnipeg as being . . .”

“A great bonus?”

“Yes. Despite the weather. You’d just go out on your front steps and holler when it was dinnertime. You’d have no idea where they were.”

“There wasn’t much traffic. The kids were like a flock of pigeons that flew back and forth from one lawn to another.”

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By Paul RudnickFiction: "A Tranquil
Star"**By Be****By Primo Levi**

The University of Manitoba was not the sort of place to keep close track of a person's publications, and, for the first time, Pat and Paul felt that they could pursue whatever they liked. Pat decided that if she was ever going to really get at the questions she was interested in she had to know more about the brain, so she presented herself to the medical school and asked permission to study neuroanatomy and neurophysiology with the medical students.

While she was at Oxford, she had started dipping into science magazines, and had read about some astonishing experiments that had been performed in California on patients whose corpus callosum—the nerve tissue connecting the two cerebral hemispheres—had been severed, producing a "split brain." This operation had been performed for some years, as a last-resort means of halting epileptic seizures, but, oddly, it had had no noticeable mental side effects. Then someone had come up with the idea of stimulating the hemispheres independently, and it had been discovered that the severing did indeed produce some rather strange results. If the word "hat," for instance, was shown only to the right side of the visual field (controlled by the verbally oriented left hemisphere), the patient had no trouble saying what it was, but if it was shown to the left (controlled by the almost nonverbal right hemisphere), he could not—indeed, he would claim not to have seen a word at all—but he could select a hat from a group of objects with his left hand.

"It was amazing that you could physically separate the hemispheres and in some sense or other you were also separating consciousness," Pat says. "In one way, it shouldn't be a surprise, I suppose, if you think that the mind is the brain. On the other hand, the fact that you can separate a sense of self—that was tremendously important. People had done split brains before, but they didn't notice anything. They thought, What's this bunch of tissue doing here—holding the hemispheres together? But you don't need that, because they're not going to go anywhere, so what is it? You had to really know the physiology and the anatomy in order to ask the questions in the right way."

“There were cases when a split-brain patient would be reading a newspaper, and, since it’s only the left brain that processes language, the right brain gets bored as hell, and since the right brain controls the left arm the person would find that his left hand would suddenly grab the newspaper and throw it to the ground!” Paul says.

“Well, it wasn’t quite like that. It wasn’t like he was surprised. It just kind of happened.”

Some of the experiments sounded uncannily like cases of spiritual possession. One patient had a pipe placed in his left hand that he could feel but not see; then he was asked to write with his left hand what it was that he had felt. His left hand began very slowly to form the letters “P” and “I”; but then, as though taken over by a ghost, the hand suddenly began writing quickly and fluently, crossed out the “I” and completed the word “PENCIL.” Then, as though the ghost had been pushed aside again, the hand crossed out “PENCIL” and drew a picture of a pipe. It seemed, the experimenters concluded, that the left hemisphere, impatient with the left hand’s slow writing, had seized control of the hand and had produced the word “PENCIL” as a guess, based on the letter “P,” but then the right hemisphere had taken over once again and corrected it. There appeared to be two distinct consciousnesses inside a person’s head that somehow became one when the brain was properly joined. Or one self torn in two.

At the medical school in Winnipeg, Pat was assigned a brain of her own, which she kept in the lab in a Tupperware pot filled with formaldehyde. Later, she observed neurosurgeries, asking the surgeon’s permission to peer in through the hole in the scalp to catch a glimpse of living tissue, a little patch of a brain as it was still doing its mysterious work. She attended neurology rounds. The first neurological patient she saw was himself a neurosurgeon who suffered from a strange condition, owing to a lesion in his brain stem, that caused him to burst into tears at the slightest provocation. He would sob and shake but at the same time insist that he was not feeling in the least bit sad. This made an impression on her, partly because she realized how it would have flummoxed a behaviorist to see this complete detachment of behavior and inward feeling and partly because none of the neurologists on the rounds were surprised. The condition, it appeared, was not all that uncommon. She encountered patients who were blind but didn’t know it. “That really kicked the slats out of the idea that you can learn very much about the nature of the mind or the nature of the brain by asking what’s imaginable,” she says. “It’s

not imaginable to me that I could be blind and not know it, but it actually happens. So its being unimaginable doesn't tell me shit!"

Each evening, after the children were in bed, she would teach Paul everything she had learned that day, and they would talk about what it meant for philosophy. They later discovered, for instance, that the brain didn't store different sorts of knowledge in particular places—there was no such thing as a memory organ. Even dedicated areas like the visual cortex could be surprisingly plastic: blind people, and people who could see but had been blindfolded for a few days, used the visual cortex to read Braille, even though that would seem to be a thoroughly tactile activity. All this boded well for Paul's theory that folk-psychological terms would gradually disappear—if concepts like “memory” or “belief” had no distinct correlates in the brain, then those categories seemed bound, sooner or later, to fall apart.

Gradually, Pat and Paul arrived at various shared notions about what philosophy was and what it ought to be. They agreed that it should not keep itself pure: a philosophy that confined itself to logical truths, seeing itself as a kind of mathematics of language, had sealed itself inside a futile, circular system of self-reference. Why shouldn't philosophy concern itself with facts? Why shouldn't it get involved with the uncertain conjectures of science? Who cared whether the abstract concepts of action or freedom made sense or not? Surely it was more interesting to think about what caused us to act, and what made us less or more free to do so? Yes, those sounded more like scientific questions than like philosophical ones, but that was only because, over the years, philosophy had ceded so much of the interesting territory to science. Why shouldn't philosophy be in the business of getting at the truth of things?

They were confident that they had history on their side. In the classical era, there had been no separation between philosophy and science, and most of the men whom people now thought of as philosophers were scientists, too. They were thought of as philosophers now only because their scientific theories (like Aristotle's ideas on astronomy or physics, for instance) had proved to be, in almost all cases, hopelessly wrong. Over the years, different groups of ideas had hived off the mother sun of natural philosophy and become proper experimental disciplines—first astronomy, then physics, then chemistry, then biology, psychology, and, most recently, neuroscience. Becoming an experimental discipline meant devising methods that allowed propositions to be tested that had previously been mere speculation. But it did not mean that a discipline had no further need of metaphysics—what, after all,

would be the use of empirical methods without propositions to test in the first place? Philosophy could still play a role in science: it could examine the concepts that scientists were working with, testing them for coherence, and it could serve as science's speculative branch, imagining hypotheses that were too outlandish or too provisional for a working scientist to bother with but which might, in the future, yield unexpected fruit.

In 1974, when Pat was studying the brain in Winnipeg and Paul was working on his first book, Thomas Nagel, a philosopher at Princeton who practiced just the sort of philosophy that they were trying to define themselves against, published an essay called "What Is It Like to Be a Bat?" Imagine being a bat, Nagel suggested. You are small and covered with thin fur; you have long, thin arms attached to your middle with webbing; you are nearly blind. During the day, you hang upside down, asleep, your feet gripping a branch or a beam; at dusk you wake up and fly about, looking for insects to eat, finding your way with little high-pitched shrieks from whose echoes you deduce the shape of your surroundings. "Insofar as I can imagine this (which is not very far)," he wrote, "it tells me only what it would be like for *me* to behave as a bat behaves. But that is not the question. I want to know what it is like for a *bat* to be a bat."

The purpose of this exercise, Nagel explained, was to demonstrate that, however impossible it might be for humans to imagine, it was very likely that there was *something* it was like to be a bat, and that thing, that set of facts—the bat's intimate experience, its point of view, its consciousness—could not be translated into the sort of objective language that another creature could understand. Humans might eventually understand pretty much everything else about bats: the microchemistry of their brains, the structure of their muscles, why they sleep upside down—all those things were a matter of analyzing the physical body of the bat and observing how it functioned, which was, however difficult, just part of ordinary science. But what it is like to *be* a bat was permanently out of the reach of human concepts.

This shouldn't be surprising, Nagel pointed out: to be a realist is to believe that there is no special, magical relationship between the world and the human mind, and that there are therefore likely to be many things about the world that humans are not capable of grasping, just as there are many things about the world that are beyond the comprehension of goats. But if the bat's consciousness—the what-it-is-like-to-be-a-bat—is not graspable by human concepts, while the bat's physical makeup is,

then it is very difficult to imagine how humans could come to understand the relationship between them. To describe physical matter is to use objective, third-person language, but the experience of the bat is irreducibly subjective. There is a missing conceptual link between the two—what later came to be called an “explanatory gap.” To argue, as some had, that linking consciousness to brain was simply a matter of declaring an identity between them—the mind just *is* the brain, and that’s all there is to it, the way that water just is H₂O—was to miss the point.

Nagel’s was the sort of argument that represented everything Pat couldn’t stand about philosophy. “Various philosophers today think that science is never going to be able to understand consciousness,” she said in her lectures, “and one of their most appealing arguments—I don’t know why it’s appealing, but it seems to be—is ‘I can’t *imagine* how you could get pain out of meat, I can’t *imagine* how you could get seeing the color blue out of neurons firing.’ Now, whether you can or can’t imagine certain developments in neuroscience is not an interesting metaphysical fact about the world—it’s a not very interesting psychological fact about you.” But when she mocked her colleagues for examining their intuitions and concepts rather than looking to neuroscience she rarely acknowledged that, for many of them, intuitions and concepts were precisely what the problem of consciousness was about. Those were the data. Most of them were materialists: they were convinced that consciousness somehow is the brain, but they doubted whether humans would ever be able to make sense of that.

Part of the problem was that Pat was by temperament a scientist, and, as the philosopher Daniel Dennett has pointed out, in science a counterintuitive result is prized more than an expected one, whereas in philosophy, if an argument runs counter to intuition, it may be rejected on that ground alone. “Given a knockdown argument for an intuitively unacceptable conclusion, one should assume there is probably something wrong with the argument that one cannot detect,” Nagel wrote in 1979. “To create understanding, philosophy must *convince*. That means it must produce or destroy belief, rather than merely provide us with a consistent set of things to say. And belief, unlike utterance, should not be under the control of the will, however motivated. It should be involuntary.” The divide between those who, when forced to choose, will trust their instincts and those who will trust an argument that convinces them is at least as deep as the divide between mind-body agnostics and committed physicalists, and lines up roughly the same way.

When Pat first started going around to philosophy conferences and talking about the brain, she felt that everyone was laughing at her. Even thoroughgoing materialists, even scientifically minded ones, simply couldn't see why a philosopher needed to know about neurons. Part of the problem was that, at the time, during the first thrilling decades of artificial intelligence, it seemed possible that computers would soon be able to do everything that minds could do, using silicon chips instead of brains. So if minds could run on chips as well as on neurons, the reasoning went, why bother about neurons? If the mind was, in effect, software, and if the mind was what you were interested in, then for philosophical purposes surely the brain—the hardware—could be regarded as just plumbing. Nobody thought it was necessary to study circuit boards in order to talk about Microsoft Word. A philosopher of mind ought to concern himself with what the mind did, not how it did it. Moreover, neuroscience was working at the wrong level: tiny neuronal structures were just too distant, conceptually, from the macroscopic components of thought, things like emotions and beliefs.

As far as Pat was concerned, though, to imagine that the stuff of the brain was irrelevant to the study of the mind was no more than a new, more sophisticated form of dualism. Software and hardware, immaterial spirits and pineal glands—it was Descartes all over again, she would fume to Paul when she got home. This was what happened when a bunch of math and logic types started talking about the mind, she thought—they got all caught up in abstractions and forgot that humans were animals. The mind wasn't some sort of computer program but a biological thing that had been cobbled together, higgledy-piggledy, in the course of a circuitous, wasteful, and particular evolution. Yes, of course neuroscience felt pretty distant from philosophy at this point, but that was only—why couldn't people see this?—because the discipline was in its infancy. The connections hadn't been filled in yet. What she objected to was the notion that neuroscience would *never* be relevant to philosophical concerns. That seemed to her just plain stupid.

When Nagel wrote about consciousness and the brain in the nineteen-seventies, he was an exception: during the decades of behaviorism, the mind-body problem had been ignored. But then, in the early nineteen-nineties, the problem was dramatically revived, owing in part to an unexpected rearguard action launched by a then obscure long-haired Australian philosopher named David Chalmers. Chalmers is a generation younger than the Churchlands, and he is one of a very few philosophers these days who are avowedly dualist. He believes that consciousness isn't physical.

It's pretty easy to imagine a zombie, Chalmers argued—a creature physically identical to a human, functioning in all the right ways, having conversations, sitting on park benches, playing the flute, but simply lacking all conscious experience. So if one could imagine a person physically identical to the real David Chalmers but without consciousness then it would seem that consciousness could not be a physical thing.

Maybe consciousness was actually another sort of thing altogether, he thought—a fundamental entity in the universe, a primitive, like mass, time, or space. This theory would be a kind of dualism, Chalmers had to admit, but not a mystical sort; it would be compatible with the physical sciences because it would not alter them—it would be an addition. As Chalmers began to develop his theory of consciousness as a primitive, the implications started to multiply. Once you had separated consciousness from biology, a lot of constraints simply disappeared. If consciousness was a primitive like mass or space, then perhaps it was as universal as mass or space. Perhaps even systems like thermostats, he speculated, with their one simple means of response, were conscious in some extremely basic way. You could start talking about panpsychism—the idea that consciousness exists, in some very basic form, in all matter, even at the level of the atom. On the face of it, of course, he realized that panpsychism sounded a little crazy. And there was a pretty good philosophical argument against it (of the customary form: either it's false or it's trivial; either you are pushed into claiming that atoms are thinking about cappuccinos or you retreat to the uninteresting and obvious position that atoms have the potential to contribute to larger things that think about cappuccinos). But he found it appealing anyway, and, despite its mystical or Buddhist overtones, it felt to Chalmers, at root, naturalistic. He liked the idea that humans were continuous with the rest of the world, even the inanimate parts of it, even stones and rivers—that consciousness penetrated very deep, perhaps all the way down into the natural order of things.

Right from the beginning, Pat was happy to find that scientists welcomed her. They certainly were a lot friendlier to her than many philosophers. When she started attending neuroscience conferences, she found that, far from dismissing her as a fuzzy-minded humanities type, they were delighted that a philosopher should take an interest in their work. At a conference in the early eighties, she met Francis Crick, who, having discovered the secret of life, the structure of DNA, as a young man, had decided that he wanted to study the other great mystery, consciousness.

“Francis discovered Pat at a meeting back East and was amazed that a philosopher had all the same prejudices that he did,” Paul says. “He invited her out to the Salk Institute and, on hearing that she had a husband who was also interested in these things, invited me to come out, too. We came and spent, what was it, five days?”

“Yes, we did.”

“He was still having weekly meetings with you when he knew he was dying. You would come home despairing at making headway with him.”

“He thought the strategy of looking for the neural correlates of consciousness was likely to be fruitful, but I became very skeptical of it. It seemed to me more likely that we were going to need to know about attention, about memory, about perception, about emotions—that we were going to have to solve many of the problems about the way the brain works before we were going to understand consciousness, and then it would sort of just fall out.”

“He was one of the people who made the problem of consciousness respectable again,” Paul says. “Some people in science thought that it was a ghost problem. The behaviorists thought talk of inner subjective phenomena was a waste of time, like alchemy.”

“There were lots of neuroscientists who thought consciousness was such a difficult issue that we’d never get there.”

The psychologist and neuroscientist V. S. Ramachandran turned up at U.C.S.D. as a junior faculty member around the same time Pat and Paul arrived. Paul met him first, when Ramachandran went to one of his talks because he was amused by the arrogance of its title—“How the Brain Works.” Then Pat started observing the work in Ramachandran’s lab. She saw him perform a feat that seemed to her nearly as astonishing as curing the blind: seating at a table a patient suffering from pain in a rigid phantom arm, he held up a mirror in such a way that the patient’s working arm appeared in the position of the missing one, and then instructed him to move it. As if by magic, the patient felt the movement in his phantom limb, and his discomfort ceased. Pat spent more and more time at Ramachandran’s lab, and later on she collaborated with him on a paper titled “A Critique of Pure Vision,” which argued that the function of vision was not to represent the world but to help a creature survive, and that it had evolved, accordingly, as a partial and fractured system that served the more basic needs of the motor system.

These days, many philosophers give Pat credit for admonishing them that a person who wants to think seriously about the mind-body problem has to pay attention to the brain. But this acknowledgment is not always extended to Pat herself, or to the work she does now. “Although some of Churchland’s views have taken root in mainstream philosophy, she is not part of it,” Ned Block, a philosopher at New York University, wrote in a review of one of her books. “Unfortunately, Churchland . . . approaches many conceptual issues in the sciences of the mind like the more antiphilosophical of scientists.” Although she tried to ignore it, Pat was wounded by this review. But it was true; in some ways she had simply left the field. Although she often talks to scientists, she says she hasn’t got around to giving a paper to a philosophy department in five years. These days, she often feels that the philosophical debate over consciousness is more or less a waste of time.

There is one area of traditional philosophy, however, in which Pat still takes an active interest, and that is ethics. She and Paul are the two philosophers in an interdisciplinary group at U.C.S.D. that is trying to drum up funding for research into the implications of neuroscience for ethics and the law.

“I think the more we know about these things, the more we’ll be able to make reasonable decisions,” Pat says. “Suppose someone is a genetic mutant who has a bad upbringing: we know that the probability of his being self-destructively violent goes way, way up above the normal. How do we treat such people? Do we wait until they actually do something horrendous or is some kind of prevention in order? Should all male children be screened for such mutations and the parents informed so that they will be especially responsible with regard to how these children are brought up?”

“Why not?” Paul says. “I guess they could be stigmatized.”

“There’s a guy at U.S.C. who wanted to know what the activity of the frontal cortex looked like in people on death row, and the amazing result was this huge effect that shows depressed activity in frontal structures. These people have compromised executive function. Now, we don’t really know whether it’s a cause or an effect—I mean maybe if you’re on death row your frontal structure deteriorates. But of course public safety is a paramount concern. We don’t want these people running loose even if it’s not their own fault that they are the way they are.”

“Well, given that they’re such a severe danger to the society, we could incarcerate them in some way,” Paul says. “We could put a collar on their ankles and track their

whereabouts. We could say, We have to put this subdural thing in your skull which will monitor if you're having rage in your amygdala, and we can automatically shut you down with a nice shot of Valium. It's like having somebody who's got the black plague—we do have the right to quarantine people though it's not their fault. Heinlein wrote a story—”

“We're back to Heinlein! How funny.”

“This just reminded me. He had wild, libertarian views. The story concerned how you treated people who were convicted by criminal trials. Either you could undergo a psychological readjustment that would fix you or, because you can't force that on people, you could go and live in a community that was something like the size of Arizona, behind walls that were thirty feet high, filled with people like you who had refused the operation. The story was about somebody who chose to go in. What annoyed me about it—and it would annoy you, too, I think—was that Heinlein was plainly on the side of the guy who had refused to have his brain returned to normal. He tells this glorious story about how this guy managed to triumph over all sorts of adverse conditions in this perfectly awful state of nature.”

Paul stops to think about this for a moment.

“You and I have a confidence that most people lack,” he says to Pat. “We think we can continue to be liberals and still move this forward.”

“I'm not so sure,” Pat says.

It's been a long time since Paul Churchland read science fiction, but much of his work is focussed far into the future, in territory that is almost completely imaginary. For instance, both he and Pat like to speculate about a day when whole chunks of English, especially the bits that constitute folk psychology, are replaced by scientific words that call a thing by its proper name rather than some outworn metaphor. Surely this will happen, they think, and as people learn to speak differently they will learn to experience differently, and sooner or later even their most private introspections will be affected. Already Paul feels pain differently than he used to: when he cuts himself shaving now he feels not “pain” but something more complicated—first the sharp, superficial A-delta-fibre pain, and then, a couple of seconds later, the sickening, deeper feeling of C-fibre pain that lingers. The new words, far from being reductive or dry, have enhanced his sensations, he feels, as an oenophile's complex vocabulary enhances the taste of wine.

Paul and Pat, realizing that the revolutionary neuroscience they dream of is still in its infancy, are nonetheless already preparing themselves for this future, making the appropriate adjustments in their everyday conversation. One afternoon recently, Paul says, he was home making dinner when Pat burst in the door, having come straight from a frustrating faculty meeting. “She said, ‘Paul, don’t speak to me, my serotonin levels have hit bottom, my brain is awash in glucocorticoids, my blood vessels are full of adrenaline, and if it weren’t for my endogenous opiates I’d have driven the car into a tree on the way home. My dopamine levels need lifting. Pour me a Chardonnay, and I’ll be down in a minute.’” Paul and Pat have noticed that it is not just they who talk this way—their students now talk of psychopharmacology as comfortably as of food.

When their children, Mark and Anne, were very young, Pat and Paul imagined raising them according to their principles: the children would grow up understanding the world as scientists understood it, they vowed, and would speak a language very different from that spoken by children in the past. Paul told them bedtime stories about boys and girls escaping from danger by using science to solve problems. He took them outside at night and showed them how, if they tilted their heads to just the right angle, so that they saw the ecliptic plane of the planets as horizontal, they could actually see the planets and the earth as Copernicus described them, and feel, he told them, “at home in the solar system for the first time.” Then, one evening when Mark was three or four, he and Paul were sitting by the fire—they had a fire every night in Winnipeg in the winter—and Paul was teaching him to look at the flames like a physicist. He told him how the different colors in the fire indicated different temperatures, and how the wood turned into flame and what that meant about the conversion of energy. The boy was fascinated; but then it occurred to Paul that if he were to sit in front of a fire with a friend his age they would barely be able to talk to each other. He suddenly worried that he and Pat were cutting their children off from the world that they belonged to. Better to wait until the world had changed, he thought.

Neither Pat nor Paul feels much nostalgia for the old words, or the words that will soon be old. They appreciate language as an extraordinary tool, probably the most extraordinary tool ever developed. But in the grand evolutionary scheme of things, in which humans are just one animal among many, and not always the most successful one, language looks like quite a minor phenomenon, they feel. Animals don’t have language, but they are conscious of their surroundings and, sometimes, of

themselves. Pat and Paul emphatically reject the idea that language and thought are, deeply, one: that the language we now use reflects thought's innate structure; that thought can take only the form in which we humans now know it; that there could be no thought without language. Moreover, the new is the new! It is so exciting to think about revolutions in science leading to revolutions in thought, and even in what seems, to the uninitiated, to be "raw feeling," that, by comparison, old words and old sentiments seem dull indeed.

In recent years, Paul has spent much of his time simulating neural networks on a computer in an attempt to figure out what the structure of cognition might be, if it isn't language. Linguistic theories of how people think have always seemed to him psychologically unrealistic—requiring far too sophisticated a capacity for logical inference, for one thing, and taking far too long, applying general rules to particular cases, step by step. In order to operate at the astonishing speed at which biological creatures actually figure things out, thinking must take place along parallel, rather than serial, paths, he believes, and must be able to take immediate advantage of every little fact or rule of thumb it has gleaned from experience in the past. Thinking must also be distributed widely across the brain, since individual cells continually deteriorate without producing, most of the time, any noticeable effect. It seems to him likely that thinking takes place simultaneously along millions of different neural pathways, each of which was formed by a particular stimulation in the past and which is, in turn, greatly or minutely altered by the new experience of the present. All of these pathways, connecting each neuron to millions of others, form unique patterns that together are the creature's memory. When the creature encounters something new, its brain activates the pattern that the new thing most closely resembles in order to figure out what to do—whether the new thing is a threatening predator or a philosophical concept. Humans being animals, cogitating on the highest level is, Paul believes, just an esoteric form of ordinary perception.

Sometimes Paul likes to imagine a world in which language has disappeared altogether. We know that the two hemispheres of the brain can function separately but communicate silently through the corpus callosum, he reasons. Presumably, it will be possible, someday, for two separate brains to be linked artificially in a similar way and to exchange thoughts infinitely faster and more clearly than they can now through the muddled, custom-clotted, serially processed medium of speech. He already talks about himself and Pat as two hemispheres of the same brain. Who

knows, he thinks, maybe in his children's lifetime this sort of talk will not be just a metaphor.

If, someday, two brains could be joined, what would be the result? A two-selved mutant like Joe-Jim, really just a drastic version of Siamese twins, or something subtler, like one brain only more so, the pathways from one set of neurons to another fusing over time into complex and unprecedented arrangements? Would it work only with similar brains, already sympathetic, or, at least, both human? Or might a human someday be joined to an animal, blending together two forms of thinking as well as two heads? If so, a philosopher might after all come to know what it is like to be a bat, although, since bats can't speak, perhaps he would be able only to sense its batness without being able to describe it. ♦



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