The Embodied Mind and the Origins of Human Culture

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Forty years ago, before the term "cognitive science" came into existence, there was a view broadly held—in logic, philosophy, artificial intelligence, neurobiology—that reason, inference, and some kinds of understanding are transcendent, independent of any incidental platform: computer, brain, whatever. According to this formalist view, thought must be computational, and computation can be described formally, and therefore, the core of human thought must in principle be independent of the physical device that performs the labor. On this view, logical operations as such are independent of hardware.

Today, this previously-attractive notion of the transcendent disembodied mind has almost disappeared from cognitive science. Since brains are built to drive bodies, it is not a surprise that the nature of the body informs the nature of thought. Consider a body evolved for locomotion in an environment that includes a gravity vector. Such a scenario provides a severe constraint, an embodiment constraint, running across insects, fish, mammals.

In retrospect, it is astonishing how far the scientific *Zeitgeist* has swung. A new generation arrives, and enthusiasm sets off in a different direction.

The Central Problem

If minds are embodied, we face a central problem, the one I want to discuss today.

Presumably, mammals all have embodied minds.

All mammals have basic mammalian bodies and basic mammalian brains. Presumably, all mammals, to the extent that they have minds at all, have embodied minds, with mental operations for driving their mammalian bodies.

But evidently, an embodied mind is only the beginning*:*

All mammals have embodied minds, but only cognitively modern human beings have robust culture.

An embodied mind is evidently insufficient: A community of embodied minds need not have robust culture. In fact, almost no communities of embodied minds have anything approaching robust culture. How then do we explain the origins and development of culture? Pointing to embodied minds does not point us to an answer.

The Human Mind is Not Built To See Into The Human Mind

There is a second problem in attempting to account for the existence of culture. Commonsense notions—easy hypotheses, widely found in café philosophy, ready to hand, hypotheses readily available to aspiring cognitive scientists—have proved again and again to be comprehensively wrong. The hardest task in cognitive science is to see past everyday ideas to a well-digested, well-cogitated hypothesis. Hypotheses in cognitive science are a dime a dozen if one takes them from the surrounding culture, including the surrounding academic culture, but intelligent hypotheses have proved to be few and far between. The challenge in cognitive science is to have a good idea, to form a hypothesis worthy of being checked against available data. Checking a misconceived hypothesis against so-called data is what we used to call GIGO, or "garbage in, garbage out," for a variety of reasons, most prominently that data are themselves not conception-neutral. If one categorizes data according to unrefined notions—e.g., here is syllogistic reasoning, here is social reasoning, and they are opposed—then correlations across events in the data merely echo the facile conceptions used to organize them. One can do a lot of statistical analysis on such so-called data sets, and show various levels of significance, without actually doing any science. Successful cognitive scientists have needed instead to train themselves to do mental backflips: they are trying to use human powers of mind to explain human

powers of mind, and this has turned out to be a surprisingly difficult job. It's not just that our minds are not designed to look into themselves with accuracy. It's that our minds are designed *not* to look into themselves. Almost all the heavy lifting in human thought and action appears to be done in the backstage of the mind, in ways that feeble consciousness is powerless to see, much less conduct. What we see in consciousness is not thought but the smallest tip of the iceberg—usually a simple, compressed product of thought, something to keep us going.

The human brain has perhaps 10 to 100 billion (10^{11}) neurons. The average number of synaptic connections per neuron is perhaps ten thousand (10^{4}). The total number of connections in the brain is therefore maybe ten trillion to a quadrillion (10^{14}-10^{15}). 10^{15} connections are about ten thousand times as many stars as astronomers think might be in the entire Milky Way galaxy (10^{11}). Ten thousand Milky Ways, inside your head. All those connections, inside your head, in a system weighing about 1.4 kilograms, working, working, working. The timing and phases of firing in neuronal groups, the suites of neuronal development in the brain, the electrochemical effect of neurotransmitters on receptors, the scope and mechanisms of neurobiological plasticity—all going on, in ways we cannot even begin to see directly. The only time we are likely even to sense that our mental system is so complicated is when something goes wrong—as when someone's language degrades because of stroke, or our field of vision starts to swim because of food poisoning.

Let's take some examples. Why is it that we see something—a cup, a tree, a person—as one thing? The answer seems obvious: because it is one thing, and its unity shoots straight from the world through our senses into our minds. But cognitive science knows that nothing like that happens. Finding an answer to this question is considered one of the hardest problems in perceptual and cognitive neuroscience. It is called the "binding problem."

Here's another example: how do we see color? The answer seems obvious: color is right there in the world, and the color we see is determined by the light reflected from the object. Vision science knows that this is false. Color is a product of human brainwork, and "color constancy"—as it is called in vision science, meaning that the apple looks red morning, noon, and evening—is the result of processes far more complicated than anyone ever imagined. Color is

projected onto the world by the human mind in highly complex and variable ways, requiring fabulous computation in the brain, and not at all according to our everyday notions of how we see.

Here's another example: how do we know how to speak and to make sense of what people say? The answer seems obvious: we were taught language and we know the rules we were taught, such as "make your subject and verb agree in number, singular versus plural." But again, almost everything we are doing in language happens backstage, in ways we can't see, following patterns we can't state, indeed patterns we don't even know we are following. This is true no matter who the speaker is or how much education the speaker has enjoyed.

Here's another example: suppose we are looking at a scene, maybe the street where we live, and we glance away, and then back, and in that time some *huge* change has occurred, such as a child's running away, or a car's parking in front of a house. We are likely to notice the change when it is highly salient all on its own rather than as a change—as when you look back and see someone in a deformed posture and with an anguished expression, bleeding all over the street. But otherwise, will we notice the change? Probably not, even though we feel with great conviction that we have a memory of the scene and can compare that memory with what we think we are seeing. But the evidence does not support our conviction. It appears that we are all deluded about what we can pick out when it comes to change. In cognitive science, this is called "change blindness."

None of the examples I have given is controversial to scientists. In general, *the way we think isn't the way we think we think*. We are not designed to look into the way we think. We are designed *not* to see what makes us human. Commonsense, ready-to-hand ideas about the way we think have proved to be a very poor guide, perhaps a kind of distracting reassurance provided by cultures so we can have a sense that we have some idea of who or what we are and how we work. The first requirement for a cognitive science is a strong mental defense against being taken in by such commonsense hypotheses.

There Are No Good Animal Models

Where can we look for clues to the origin and nature of culture? Can we look at the world of life—all those other mammalian species with embodied minds?

In principle, it's a brilliant strategy to study nonhuman animals to learn what we are by finding similarities between us and them. Unfortunately, the limits are quick and hard. To be sure, animals have amazing abilities. We are weak in various ways, and we simply lack some of the abilities they command. Even for mental abilities at which we are superb, we lie on a gradient with other animals, not in a separate galaxy.

But the barrier to taking our scientific guidance from the capacities of other animals is instant and insurmountable. The facts are not controversial: We have extremely robust culture; human cultural evolution is much faster than biological evolution; we are immensely creative in the sense that we invent new concepts and activities that are not shared by all human beings; the scope of human culture is vast. No animals begin to compare with our ability for culture.

Nonhuman animals have a legitimate place in the study of the human mind—we are like them in many ways, such as vision. Science depends upon these animals in comparative research. Patients—you and me—are often willing to take prescription drugs because those drugs have been tested on animals. We reason that, for the relevant biological systems, those animals work the way we do, so a test on them is a pretty good indicator of how the drugs would work on us. When we find a nonhuman animal that works the way we do for some aspect of our existence—like vision or drugs, for example—we say it is a robust "animal model."

But for distinctively human cognition—religion, grammar, surfing—these nonhuman animals are nothing at all like us. Biologically, we resemble other animals. Mentally, we leave them in the dust. When it comes to what makes us human, we are, as Tyger might say, "the only ones." Cats are an extremely good animal model for vision, but can't don't paint, they don't read advertisements, and they don't invent and develop robust cultures. Neither do chimpanzees, bonobos, gibbons, orangutans, squirrel monkeys, bottlenose dolphins, border

collies, New Zealand rooks, barn owls, jaguars, antelope, humpback whales, white mice, or sharks.

It Doesn't Scale Up

The last forty years have seen many attempts to explain human thought and action by starting small, in the hope of scaling up. Artificial intelligence in the 1960s and 70s, for example, enjoyed considerable success with what are now called "mini-worlds." A mini-world might be a set of little blocks, for example, and a mechanical arm that could move them: you would type simplified commands into a terminal "telling" the program what to do, and it would "do" what you "asked," such as "Stack the yellow block on the green one."

Of course, the mini-world mechanical arm had no idea of you, or language, or that you had desires, or that you were instructing it, or that it was responding to you, or even that it was doing anything at all, or even that it existed, because of course it had no ideas of any sort, no thoughts, nothing. Similarly in linguistics, in mathematical and logical models, in models of neuronal systems, there are many little models of human thought and action. The great hope underlying these attempts is that the small-scale autonomous models will, with much more work, scale up appropriately to models of human behavior. The justification for creating them is that—so goes the logic—we must start small to do science. We must build up from the simple to the complex. The hope is to create some little model that works just a little, and later to scale it up to bigger things. In practice, "later" means "never." That's no accident. Although many impressive systems and models have been invented—as in computer expert systems, for example, which provide the human being who is making decisions and taking action with great technological support—none of these systems has ever scaled up. There isn't any evidence that human thought and action are the result of scaling little things up, or that what makes us human is a linear sum of lots of little unconnected bits.

It's fun to put together these little so-called explanations for little so-called abilities, in artificially restricted domains. Building them fits our commonsense hypotheses about how knowledge works—first you learn one word, then

another; first you learn to count, then you learn to add; first you invent the light bulb, then the computer chip, then the internet. But these little explanations have actually provided negligible insight into the scope and nature of rich, vibrant, inventive culture.

In principle, it's not automatically wrong that a system might be the product of a bunch of tiny, independent systems. It's a fine fantasy, and it has worked for some parts of natural science. But as far as I can see, banging away on this assumption for a century has come up with pretty much nothing when it comes to distinctive human abilities like language, creativity, art, science, mathematics, . . . It was an approach that deserved a hearing. It has had that hearing, and we have been left with empty hands.

Current Experimental Methods Are Very Weak on What Makes Us Human

And there is one last major problem in seeking an explanation for the origin and nature of human culture. Human beings are evolved for rich, vibrant, messy situations, in which full-bore complex human thought is alive and active. Experiments on human subjects, by contrast, are run for the most part only in very restricted, more or less alien environments, and do not provide us with a way to see our advanced mental operations. These experiments have been very useful in investigating perception, for example, and have often shown that there are certain patterns in human behavior in these restricted dimensions, patterns that certainly need explaining, but decades of very active research using these approaches have produced very little insight into how we learn and create, invent and discover, understand and express.

There are new methods that are receiving attention, such as brain imaging—Event-Related Potential (ERP), Positron-Emission Tomography (PET), and Functional Magnetic Resonance Imaging (fMRI), to name a few. Non-invasive brain imaging on neurotypicals is only a couple of decades old, and extremely crude. The very seductive fMRI images we see in magazines are seductive partly because most readers are unaware of how they are produced. They are crude measures of the "paramagnetism of relatively deoxygenated hemoglobin"—which means that they, well, sort of, measure blood flow in the

brain. fMRI requires a lot of repetition for very simple tests. It has very low signal-to-noise ratios. All of these methods are useful, and I use them myself, but at present they do not offer an over-arching hypothesis concerning the origin and nature of robust culture.

Surfing

Most researchers accept that writing is cultural, in the strong sense: there are cultures even now that do not include writing, and many illiterate human beings. Writing has been present for, it seems, at most 8,000 years, really more like 3,000 years, and literacy as a normal condition has been with us for only some hundreds of years. It can be harder to see that basic mathematical concepts aside from the few numerical operations that we seem to share with many animals (such as subitizing) are in the same category of cultural invention.

But now let us take something that is clearly cultural, in the strong sense: surfing. Here in Portugal, there is surfing, north along the beaches from Lisboa. Where I was raised, surfing was a strong part of the culture. It formed one of the major planks of my early socialization, as a kind of cultural religion: few people where I was raised actually surfed, by everybody knew about it, and surfing counted substantially in the cultural scale. Mating, character, life were framed via the conception of surfing. Songs, even music without lyrics ("surf guitar"), and literature were conceived around surfing. Restaurants had surf themes. Life was to be viewed through the lens of surfing.

And yet, surfing as an activity was brought to San Diego, where I was raised, not even a century ago: Duke Kahanamoku mounted a legendary demonstration in San Diego in 1916 and George Freeth had brought it to Southern California a few years before that. Fully cognitively modern human beings had lived for hundreds of years on the West Coast of North America without surfing. In Portugal, they had lived for thousands of years without surfing.

As a child, I watched in real-time as surfing exploded across the world's coastal cultures, documented in films like *Endless Summer*. The Beach Boys, in 1963, when I was 9 years old, released a song about it, "Catch A Wave":

Not just a fad 'cause it's been going on so long
Catch a wave, catch a wave
All the surfers going strong
They said it wouldn't last too long
They'll eat their words with a fork and spoon and watch 'em
They'll hit the road and all be surfin' soon
And when they catch a wave they'll be sittin' on top of the world
Catch a wave and you're sittin' on top of the world

The Beach Boys were certainly right: surfing is now, far from an exotic and rarely-seen activity, a worldwide, multi-billion dollar industry, with elaborate "lifestyle" influence on consumer items purchased by nonsurfers: clothing, sunglasses, music . . . I was astonished, when I moved to Case Western Reserve University in 2004, to learn that there is a surfing community in Cleveland, Ohio. Lake Erie is a Great Lake with respectable waves, but "The strongest winds and waves come in winter, just before Lake Erie freezes" (Maag 2006.) So it is a challenge for the surfers to avoid hypothermia.

Clearly, learning to surf is hard, just like reading and writing, but, just like reading and writing, once you have caught a wave and are sitting (actually standing, or rather, crouching with your knees bent and your feet pointed sideways) on top of the world, it seems like the most natural thing in the entire world, second nature.

When I was young, those who inhabited the cultural niche of surfing, even a little, reveled in its exclusivity. During high school, some of my older acquaintances died in Vietnam. A few years later, when I was a student at Berkeley, I managed to get a very big number in the draft lottery. The lottery was run by drawing birthdates in succession. The earlier your birthdate came up, the more likely you were to go to Vietnam. Vietnam carried enormous cultural weight in the United States during those years, so there were immediate connections to surfing. The film *Apocalypse Now* (1979) contains a famous surf scene set in Vietnam, in 1970, the year before I went to Berkeley. A boat crew requests air transport for their boat from Lieutenant Colonel Bill Kilgore, "First of the Ninth Air Cav," who deflects their request. But then Kilgore hears that

Lance Johnson, the professional surfer, is a member of the boat crew. He tells Lance, "I've admired your noseriding for years. I like your cutback, too. I think you have the best cutback there is." He introduces his guys: "Mike from San Diego, Johnny from Malibu. Pretty solid surfers. None of us are anywhere near your class, though." Mike-from-San-Diego lets drop that the beach where the crew wants to go has great surf: a six-foot peak—meaning that it breaks both right and left. "Tube City." Although Kilgore has already called the village "kinda hairy," and his staff has told him it's "Charlie's point"—meaning the Viet Cong completely dominate it, Kilgore calls for surfboards, transport, and attack. He provides a complete explanation: "Charlie don't surf!" A major who tries to suggest that Kilgore surf somewhere else is scolded: "What do you know about surfing, Major? You're from *New Jersey*!" Of course, the major meant that maybe surfing was beside the point in this situation, but Kilgore responds to the major's suggestion as if it were a question not about whether or not to surf, but only where, and this shows Kilgore's cultural status in the world of surfing.

The Cleveland surfers, by the way, reportedly constitute their identity partly by blending themselves with the early California surfers:

> Cleveland surfers believe they are the last remnants of the original surf culture in the 1940s and '50s, when surfing was still a renegade sport of social misfits who scouted virgin breaks, surfed alone and lived by a code of friendliness to newcomers and respect for the water. They keep their best surf spots secret. They consider themselves part of an underground society. And they hope to keep it that way. (Maag, 2006)

In a pattern common to cultural transmission, surfing in Southern California began to connect to seemingly everything. Old surfers wore Iron Crosses. "Old," meant about eighteen. I thought these major dudes got the Iron Crosses from their fathers and grandfathers, or surplus stores, or pawn shops. San Diego was full of veterans and shot through with the aftermath and paraphernalia of World War I, World War II, and Korea. The Iron Crosses mixed with fun, turning into Surfer's Crosses, with an image of a bouncy surfer on a

roiling wave. Only real surfers wore those, but many young males wore a Christopher—a small circular medal, an amulet, suspended on a chain around the neck, invoking St. Christopher, who carried Christ over the water. My Christopher had a ruby red center with a pearl white border bearing the invocation, "Saint Christopher, Protect Us." You gave your Christopher to your girl. I had many Catholic friends as a child, but the majority of Christopher medals were worn by people who had never been inside a Catholic church, indeed, maybe people who would not have been able to recognize a Catholic church when they saw one.

I remember, in particular, an ad for guitars. A muscled surfer in boardshorts, head slightly cocked, short blond hair not even mussed, rode his surfboard on a cresting wave, playing surf guitar as he looked at you. The ad said, "You won't part with yours either." This made sense to me. Mentally, I blend that surfer with Dick Dale, the legendary "King of the Surf Guitar." It's an ad for *Fender* guitars, and Dale did a lot to make the Fender Stratocaster the most recognized electric guitar in the world. The surfer in the ad can't be Dick Dale, because he's playing right-handed, while Dale played a right-handed guitar left-handed without restringing it, which is wild. That's on-the-fly culture.

If you look at the surf guitar ad, it's amazing the creativity it involves. How was surfing invented? In retrospect, like most cultural inventions, it can seem like an obvious combination, but it isn't. Standing on something flat, like the ground, or a floor, or a board, presents no fun or challenge and is nothing like surfing, which requires transforming one's body into a shifting symphony of careful and sometimes energetic dynamic adjustments in order to stay upright. In the scene where you are standing on a floor, or on a board on the ground, it's not even a consideration that you will stay upright and that the board will stay horizontal; the question doesn't even arise. But when you are surfing, that's the big deal. When you are standing on land, there's no forward motion or variable speed; you are stationary. But in surfing, movement along an undetermined path at speed is essential. Your movement is driven not by intention alone ("look where you want to go") and not by responses to the environment alone, but by a blend of both: the wave gets to decide what it wants to do (an anthropomorphic blend), and you have to anticipate and respond, but you

decide when and where you catch the wave and where you want to go. Every movement blends, almost instantaneously, all that physics and all those intentions.

In walking or running, you are the motive force of moving along a path. You must move your feet and legs in certain ways. In surfing, you move along a path, but you are *not* the motive force. You must move your feet and legs all the time, not by placing one foot in front of another, but by adjusting your stance. These movements do not provide the motive force. Instead, they provide small accents to the physical situation of motion, which comes from the wave.

Surfing isn't just a cut-and-paste combination of things you already do. It is a blend of many of them, with startling emergent properties: in the blend, standing is a means of locomotion, and the way you stand is a means of changing your path.

If you saw a dolphin or seal surfing a wave, it could trigger the invention of surfing, but that could happen only if you mentally blended yourself with the dolphin, so that now in the blend, you are doing what the dolphin is doing. This blending is highly selective. In the mental blend, you are the dolphin: the dolphin is aware and so are you; the dolphin moves and so do you. But on the other hand, you don't have a dolphin's body. The dolphin is horizontal but you are vertical. The dolphin has a tail, but you have legs and feet.

In board surfing, you are extremely unlike the dolphin: in the blend, you are the dolphin, but the surfboard is also the dolphin! The dolphin's goals and movement on the wave are blended with yours. But the dolphin's shape, anatomy, and fins are blended with the surfboard!

It goes on: if you saw a bird sitting on a tree branch carried to shore by a wave, you wouldn't think it was surfing: the bird does not try to change the branch's direction; the bird does not try to get the branch back out to sea to do it again; the bird has completely different goals from the surfer's—the surfer is not trying to find a place to land; the surfer was already on the perfectly stable beach and chose to paddle a board out through the waves. The bird couldn't get the branch out through the break zone, and the dolphin couldn't push your surfboard through the break zone. In fact, to surf at all, you have to get out to where the surf is just breaking. This is a technical and sometimes difficult part of

surfing with its own techniques—breaking through, the Eskimo roll, the duck dive. These techniques are simply absent from walking, running, the dolphin's surfing, the bird on the branch carried forward by the wave.

Cognitively modern human beings do not just have embodied minds. Surfing is entirely embodied, but the embodiment does not produce the surfing. Surfing requires the ability to construct aggressive conceptual blends, integrations of different concepts, often concepts that clash violently. For example:

- Running has locomotion.
- Standing still in one spot has no locomotion.
- Floating on the water usually has no significant horizontal motion. It's just up and down. Think of all those shore birds out on the sea—they float, but the last place you will see them is just ahead of the breaking wave, which is exactly where the surfer wants to be. Sea ducks will dive under the crashing wave so it does not hammer them, but then they come back up right where they were, while the surfer, by contrast, instantly paddles out so as to get beyond the break zone.
- Tree branches and logs moved by the waves have no desire, no fun, no intentions, no control whatever, and they get hammered in a breaking wave. They also don't wear Christopher medals.
- Dolphins in a wave move partly by using their motion, but they have no board and they don't stand up. They don't have to learn how to wipeout, either.

All of these inputs can contribute to the invention of surfing, but none of them constitutes embodied human board surfing or contains it, and surfing is not a cut-and-paste combination of parts of each of them. On the contrary, the most central aspects of surfing—such as the all-important motion that takes you from lying prone on the board in a chicken-wing position, your hands spread on the rails, to a push-up position, to standing with your feet sideways, knees bent—are not in any of these inputs!

Some of the most obvious parts of surfing took a long time to invent. Here's one: the dolphin is both the surfer and the board, and the dolphin's body does not split apart, but the surfer and the surfboard get separated all the time—there are surf guitar classics meant to be the programmatic soundtrack for these wipeouts—and this falling off the board creates serious problems. For starters, if you fall off and your board keeps going, you must swim all the way into the beach to get the board again. Or you might have tried catching its side in mid-air or just after you were separated, hoping the fins don't injure you.

When I was a kid, many surfers were injured, a few killed, when they popped up after a wipeout, only to have their twelve-foot wooden longboard, plummeting down, land on their head. It took a while for surfers to learn to stay down until you hear the big slap on the water. That's your board! Now it's safe to surface. When you do a faceplant in a wipeout or in any other way fall off ahead of your board, you need to have a sharp sense of where the board was going so you can avoid it. It's best to fall off the board *backward*, covering your head for good measure.

Then there was the problem that the board, freed from your management, would gun right down into a swimmer's head. Most lifeguard teams zone beaches for surfing and board games versus swimming, and for the most part, you won't find the surfers trying to surf the swimming zone, but the swimmers, especially the tourist swimmers, are usually oblivious, and send their children into the waves on the surfing beach. The good surfers are mostly out a way from the beach and don't often come in close, but the beginning surfers, with the least control of the board, surf the soup to learn how to control the board and how to fall off it, and when they do fall off, that board can scoot into a seven-year-old.

Amazingly, the leash was not invented until I was in college. Legend has it that Pat O'Neill—son of Jack O'Neill, the inventor of the wetsuit—invented the surf leash. At first, he used surgical tubing and a suction cup, and was disqualified in a surfing competition for doing so. The surgical tubing turned out to be much too stretchy—the board would slingshot back at the surfer. Ironically, Jack O'Neill lost his left eye to his board for this reason. The surfer in the Fender ad isn't wearing a leash, of course. The modern leash is just what you'd think: it attaches to the tail of the board and has a velcro cuff that you strap

onto your back ankle—right ankle in the normal position, left ankle if you surf right-foot forward, which is called "goofy foot," because Goofy surfed that way in the 1937 Disney classic, "Hawaiian Holiday." Lieutenant Colonel Kilgore, First of the Ninth Air Cav, introduces himself to Lance not as Lieutenant Colonel but as "goofy foot."

It took serious blending to invent the surf leash. The natural connection between dog-on-a-leash and surfboard-on-a-leash might seem to be simple: the master is the surfer, and the dog is the board. But it's not that simple: you put the collar on the surfer, not on the board, and the surfer does not hold the leash. The purpose of the surf leash is to compensate for falling down, but that's not at all the purpose of the dog leash. The leash is a central part of walking the dog but plays no role at all in the actual surfing. You can train the dog to the leash but you can't train the surfboard. Sure, putting an animal on a leash is an input to the surf-leash blend, but the animal-on-a-leash input does not give you what you need to come up with the surf leash. What you need are emergent properties in the blend that are not in any of the inputs. Notice that in all the other inputs—dolphins surfing, floating branches, birds on flotsam, human beings standing still in one spot—there's no leash at all. You don't leash yourself to the ground when you are standing, and even if you are trying to balance on a beam, or walk on a fallen tree over water, you don't leash yourself to the beam or the tree.

Blending

Surfing, as we have seen, depends on several spectacularly creative mental blends. Each blend has important new meaning, and guides our action. The idea of surfing is a cultural product that we can assemble because of our uniquely human advanced blending abilities. The principles of blending and its operations are presented in (Fauconnier & Turner 1998 and 2002).

Now think of the blending needed to invent music. Then think of the blending needed to invent a guitar—frets, sound holes—and to learn to play it. Now blend board surfing with playing guitar at the same time. Now blend sales, ambition, vanity, language, advertisement. And don't forget the instant

blending Dick Dale did when Leo Fender met Dale and asked him to try out his new invention, the Fender Stratocaster electric guitar, and Dale grasped the right-handed guitar, flipped it over to play left-handed, without restringing it, and changed chord positions appropriately on the fretboard on the fly. You get the idea . . .

Above all, there are people in this surf guitar ad. There is the surfer, and you are supposed to recognize how he feels. This is a fascinating blend of the sort we make effortlessly and without even recognizing it, all the time. (Turner 2004).

The most advanced kind of blending networks are "double scope" blending networks, also known as "vortex" blends. A vortex network has inputs with different (and often clashing) organizing frames and an organizing frame for the blend that includes parts of each of those organizing frames and has emergent structure of its own. In such networks, both organizing frames make central contributions to the blend, and their sharp differences offer the possibility of rich clashes. Far from blocking the construction of the network, such clashes offer challenges to the imagination and the resulting blends can turn out to be highly creative.

In all such cases, there is emergent structure in the blend. We have seen the varieties of emergent structure that arise in surfing: structure not available from the inputs. For the surfer playing guitar, although we have no access whatever to his mind, perceiving only his appearance, we can create a blend with what we know of ourselves—that we have human minds—and now, in the blend, he has one, and we think that this blend is true, even when we apply our greatest scientific rigor. In cognitive science, the human ability to imagine another human being as having a separate, different mind is called "having a theory of mind." It's not a theory in the usual sense, not a scientific or academic theory, but rather an everyday, common idea, a blend. It really means an idea of *other* human minds. But it should not be limited to other human minds: we can construct mental blends for the minds of seals, dogs, cartoon characters. We also do it—and very young children do it—for tank engines, trees, buildings, cars, coffee makers, the Pacific sea off the San Dieguito river, which might not like to receive the agricultural runoff, . . .

But wait a minute . . . we are also doing it for ourselves, and that's the point of the ad. We create not just blends for other minds but also blends for future and past selves (Turner 2009). Once we have a concept of the surfer-guitarist mind in the blend—someone who is so dedicated to his axe that he takes it surfing—we are then supposed to blend his mind back with ours: "You won't part with yours either." We understand his passion, motive, and behavior because we can blend him with ourselves. But now we understand our future self by blending him with our future self: we'll have the guitar, and the dedication, and the fun, and although we might not surf, it's not surfing per se that we must project to the blend: in the blend, we do whatever we do, just as the surfer does what he does, but now we have the Fender guitar and won't part with it.

We also understand that the blend is a compression and an exaggeration. Although we see only the surfer with the guitar on this one wave, we use that scene as a compressed mental anchor for a much more elaborate mental network in which the surf guitarist goes through his life—this beach, that beach, this restaurant, that party, this job, that shower, this date, that date—dedicated to his guitar. This mental blend with the surfer who plays guitar while surfing serves to capture and compress the entire network of his life. The surfing guitarist is a blend already, but now we use it as an input to a blend for ourselves: we blend the specific moment of the surfer-guitarist on the wave with some specific moment in our life in which it might be unreasonable to have a guitar. That new blend has us, and it serves as an anchor for the mental network that counts not as the surfer's life, but our life, including our future self, the person we are after we buy the Fender guitar, the future self who used to yearn, back when it was looking at the ad, for a Fender guitar, but who, unlike our present self, is satisfied.

It's not just an idea of *other* human minds that human beings can construct, and not just an idea of *other* nonhuman minds (including the mind of the sea), but also an idea of self. We need creativity of just this sort to understand who we are individually, in ways no other species is capable of.

Then there's the girl. The ad seems to be missing the girl, but not really. Mentally, we see the surfer looking at us. Through blending, we can put the girl

in our position: now she's the girl he is looking at, and she's looking at him. Alternatively, there is also no difficulty at all for the girl to read the ad and become, in the blend, the surfing guitarist. But now the girl reading the ad can blend the surf guitarist with her current perspective and focus, so that the surf guitarist becomes the one on the beach looking at her on the surfboard.

The burrito shack is there, too. It's behind the girl looking at the surf guitarist. When he rides into shore, they are going to climb the sandstone cliffs to get fish tacos.

The ad with the surfing guitarist has music, language, pictures, surfing, other minds, future selves, . . . a vast range of things that belong to only human beings and that are part of our everyday sense of who we are. How do we conceive of these ideas? What mental operations make it possible for us to live and think like this?

Human minds are complicated, partly because we complicate them. Evolution did not so much make us human as provide us with the mental abilities we need to make ourselves human. The central such mental ability is vortex blending. Making ourselves human through blending is an on-going, dynamic, process, at once individual and cultural, like surfing. And, like surfing, it comes with hope and uncertainty stretching out over our actions, past, passing, and to come.

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