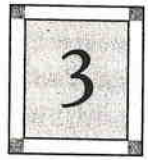


Bodies Talking to Bodies

When I'm watching an acrobat on a suspended wire,
I feel I'm inside of him.

—THEODOR LIPPS, 1903

One morning, the principal's voice sounded over the intercom of my high school with the shocking announcement that a popular teacher of French had just died in front of his class. Everyone fell silent. While the headmaster went on to explain that the teacher had suffered a heart attack, I couldn't keep myself from having a laughing fit. To this day, I feel embarrassed.

What is it about laughter that makes it unstoppable even if triggered by inappropriate circumstances? Extreme bouts of laughter are worrisome: They involve loss of control, shedding of tears, gasping for air, leaning on others, even the wetting of pants while rolling on the floor! What a weird trick has been played on our linguistic species to express itself with stupid "ha ha ha!" sounds. Why don't we leave it at a cool "that was funny"?

These are ancient questions. Philosophers have been exasperated by the problem of why one of humanity's finest achievements, its sense of humor, is expressed with the sort of crude abandonment associated with animals. There can be no doubt that laughter is inborn. The expression is a human universal, one that we share with our closest relatives, the apes. A Dutch primatologist, Jan van Hooff, set out to learn under which circumstances apes utter their hoarse, panting laughs, and concluded that it has to do with a playful attitude. It's often a reaction to surprise or incongruity—such as when a tiny ape infant chases the group's top male, who runs away "scared," laughing all the while. This connection with surprise is still visible in children's games, such as peekaboo, or jokes marked by unexpected turns, which we save until the very end, appropriately calling them "punch lines."

Human laughter is a loud display with much teeth baring and exhalation (hence the gasping for air) that often signals mutual liking and well-being. When several people burst out laughing at the same moment, they broadcast solidarity and togetherness. But since such bonding is sometimes directed against outsiders, there is also a hostile element to laughter, as in ethnic jokes, which has led to the speculation that laughter originated from scorn and derision. I find this hard to believe, though, given that the very first chuckles occur between mother and child, where such feelings are the last things on their minds. This holds equally for apes, in which the first "playface" (as the laugh expression is known) occurs when one of the mother's huge fingers pokes and strokes the belly of her tiny infant.

The Correspondence Problem

What intrigues me most about laughter is how it *spreads*. It's almost impossible *not* to laugh when everybody else is. There have been laughing epidemics, in which no one could stop and some even died in a prolonged fit. There are laughing churches and laugh therapies based on the healing power of laughter. The must-have toy of

1996—Tickle Me Elmo—laughed hysterically after being squeezed three times in a row. All of this because we love to laugh and can't resist joining laughing around us. This is why comedy shows on television have laugh tracks and why theater audiences are sometimes sprinkled with "laugh plants": people paid to produce raucous laughing at any joke that comes along.

The infectiousness of laughter even works across species. Below my office window at the Yerkes Primate Center, I often hear my chimps laugh during rough-and-tumble games, and cannot suppress a chuckle myself. It's such a happy sound. Tickling and wrestling are the typical laugh triggers for apes, and probably the original ones for humans. The fact that tickling oneself is notoriously ineffective attests to its social significance. And when young apes put on their playface, their friends join in with the same expression as rapidly and easily as humans do with laughter.

Shared laughter is just one example of our primate sensitivity to others. Instead of being Robinson Crusoes sitting on separate islands, we're all interconnected, both bodily and emotionally. This may be an odd thing to say in the West, with its tradition of individual freedom and liberty, but *Homo sapiens* is remarkably easily swayed in one emotional direction or another by its fellows.

This is precisely where empathy and sympathy start—not in the higher regions of imagination, or the ability to consciously reconstruct how we would feel if we were in someone else's situation. It began much simpler, with the synchronization of bodies: running when others run, laughing when others laugh, crying when others cry, or yawning when others yawn. Most of us have reached the incredibly advanced stage at which we yawn even at the mere mention of yawning—as you may be doing right now!—but this is only after lots of face-to-face experience.

Yawn contagion, too, works across species. Virtually all animals show the peculiar "paroxystic respiratory cycle characterized by a standard cascade of movements over a five to ten second period" that defines the yawn. I once attended a lecture on involuntary *pandiculation*

(the medical term for stretching and yawning) with slides of horses, lions, and monkeys—and soon the entire audience was pandiculating. Since it so easily triggers a chain reaction, the yawn reflex opens a window onto mood transmission, an essential part of empathy. This makes it all the more intriguing that chimpanzees yawn when they see others yawn.

This was first demonstrated at Kyoto University, where investigators showed apes in the laboratory the videotaped yawns of wild chimps. Soon the lab chimps were yawning like crazy. With our own chimps, we have gone one step further. Instead of showing them real chimps, we play three-dimensional animations of an apelike head going through a yawnlike motion. Devyn Carter, the technician who put these animations together, said he'd never yawned as much as during this particular job. Our apes also watch animations of a head merely opening and closing its mouth a couple of times, but they only yawn in response to the animated yawns. Their yawns look absolutely real, including maximal opening of the mouth, eye-closing, and head-rolling.

Yawn contagion reflects the power of unconscious synchrony, which is as deeply ingrained in us as in many other animals. Synchrony may be expressed in the copying of small body movements, such as a yawn, but also occurs on a larger scale, involving travel or movement. It is not hard to see its survival value. You're in a flock of birds and one bird suddenly takes off. You have no time to figure out what's going on: You take off at the same instant. Otherwise, you may be lunch.

The animated yawns of an apelike head (similar to this one) induce real yawns in watching apes.

Or your entire group becomes sleepy and settles down, so you too become sleepy. Mood contagion serves to coordinate activities, which is crucial for any traveling species (as most primates are). If my companions are feeding, I'd better do the same,

because once they move off, my chance to forage will be gone. The individual who doesn't stay in tune with what everyone else is doing will lose out like the traveler who doesn't go to the restroom when the bus has stopped.

The herd instinct produces weird phenomena. At one zoo, an entire baboon troop gathered on top of their rock, all staring in exactly the same direction. For an entire week, they forgot to eat, mate, or groom. They just kept staring at something in the distance that no one could identify. Local newspapers were carrying pictures of the monkey rock, speculating that perhaps the animals had been frightened by a UFO. But even though this explanation had the unique advantage of combining an account of primate behavior with proof of UFOs, the truth is that no one knew the cause except that the baboons clearly were all of the same mind.

The power of synchrony can be exploited for good purposes, as when horses were trapped on a piece of dry pasture in the middle of a flooded area in the Netherlands. Twenty horses had already drowned, and there were plenty of attempts to save the others. One of the more radical proposals was for the army to build a pontoon bridge, but before this was tried a far simpler solution came from the local horse riding club. Four brave women on horses mixed with the stranded herd, after which they splashed through a shallow area like pied pipers, drawing the rest with them. The horses walked most of the way, but had to swim a few stretches. In a triumph of applied animal knowledge, the riders reached terra firma followed by a single file of about one hundred horses.

Movement coordination both reflects and strengthens bonds. Horses that pull a cart together, for example, may become enormously attached. At first they jostle and push and pull against each other, each horse following its own rhythm. But after years of working together, the two horses end up acting like one, fearlessly pulling the cart at breakneck speed through water obstacles during cross-country marathons, complementing each other, and objecting to even the briefest separation as if they have become a single organism. The

same principle operates among sled dogs. Perhaps the most extreme case was of a husky named Isobel, who after having turned blind still ran along perfectly with the rest based on her ability to smell, hear, and feel them. Occasionally, Isobel ran lead tandem with another husky.

In Dutch bicycle culture, it's common to have a passenger on the backseat. So as to follow the rider's movements, the person in the rear needs to hold on tightly—which is one reason that boys like to offer girls a ride. Bicycles turn not just by steering but also by leaning, so the passenger needs to lean the same way as the rider. A passenger who'd keep sitting up straight would literally be a pain in the behind. On motorcycles, this is even more critical. Their higher speed requires a deeper tilt in turns, and lack of coordination can be disastrous. The passenger is a true partner in the ride, expected to mirror the rider's every move.

Sometimes, a mother ape returns to a whimpering youngster who is unable to cross the gap between two trees. The mother first swings her own tree toward the one the youngster is trapped in, and then drapes her body between both trees as a bridge. This goes beyond mere movement coordination: It's problem-solving. The female is emotionally engaged (mother apes often whimper as soon as they hear their offspring do so), and adds an intelligent evaluation of the other's distress. Tree-bridging is a daily occurrence in traveling orangutans, in which mothers regularly anticipate their offspring's needs.

Even more complex are instances in which one individual takes charge of coordination between two others, as described by Jane Goodall with respect to three wild chimpanzees: a mother, Fifi, and her two sons. One son, Freud, had hurt his foot so badly that he was barely able to walk. Mother Fifi usually waited for him, but sometimes moved off before he was ready to limp after her. Her younger son, Frodo, proved more sensitive:

> Three times when this happened Frodo stopped, looked from Freud to his mother and back, and began to whimper. He continued to cry until Fifi stopped once more. Then Frodo sat close to his big

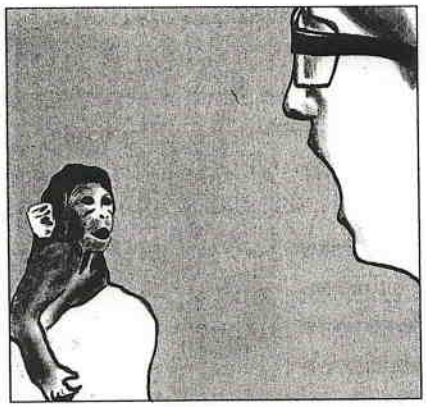
brother, grooming him and gazing at the injured foot, until Freud felt able to continue. Then the family moved on together.

This is not unlike my own personal experience. My mother has six sons, who all tower head and shoulders over her. Nevertheless, she has always been the leader of the pack. When she became older and frailer, however—which happened only in her late eighties—we had trouble adjusting. We'd step out of a car, for example, briefly help our mother out, but then walk briskly toward the restaurant or whatever place we were visiting, talking and laughing. We'd be called back by our wives, who'd gesture at our mother. She couldn't keep up and needed an arm to lean on. We had to adjust to this new reality.

Some of these examples are more complex than mere coordination: They involve assuming the perspective of someone else. Or, as in Goodall's and my family's account, alerting another to the situation of a third. The one thread that runs through all of these examples, however, is coordination. All animals that live together face this task, and synchrony is key. It is the oldest form of adjustment to others. Synchrony, in turn, builds upon the ability to map one's own body onto that of another, and make the other's movements one's own, which is exactly why someone else's laugh or yawn makes us laugh or yawn. Yawn contagion thus offers a hint at how we relate to others. Remarkably, children with autism are immune to the yawns of others, thus highlighting the social disconnect that defines their condition.

Body-mapping starts early in life. A human newborn will stick out its tongue in response to an adult doing so, and the same applies to monkeys and apes. In one research video, a tiny baby rhesus monkey intently stares at the face of an Italian researcher, Pier Francesco Ferrari, who slowly opens and closes his mouth several times. The longer the monkey watches the scientist, the more its own mouth begins to mimic his movements in a gesture that looks like the typical lip-smacking of its species. Lip-smacking signals friendly intentions and is as significant for monkeys as is the smile for humans.

I must say that I find neonatal imitation deeply puzzling. How does



A baby rhesus monkey stares at an experimenter and mimics his repeated mouth-opening.

a baby—whether human or not—mimic an adult? Scientists may bring up neural resonance or mirror neurons, but this hardly solves the mystery of how the brain (especially one as naïve as that of a neonate) correctly maps the body parts of another person onto its own body. This is known as the *correspondence problem:* How does the baby know that its own tongue, which it can't even see, is equivalent to the pink, fleshy, muscular organ that it sees slipping out from between an adult's lips? In fact, the word *know* is misleading, because obviously all of this happens unconsciously.

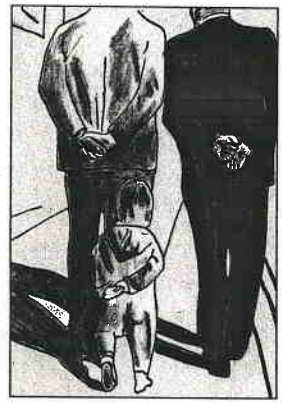
Body-mapping between different species is even more puzzling. In one study, dolphins mimicked people next to their pool without any training on specific behavior. A man would wave his arms, and the dolphins would spontaneously wave their pectoral fins. Or a man would lift up a leg, and the dolphins would raise their tails above the water. Think about bodily correspondence here, or in the case of a good friend of mine, whose dog started dragging her leg within days after he had broken his own. In both cases it was the right leg. The dog's limp lasted for weeks, but vanished miraculously once my friend's cast had come off.

As Plutarch said, "You live with a cripple, you will learn to limp."

The Art of Aping

Finding himself in front of the cameras next to his pal President George W. Bush, former British prime minister Tony Blair—known to walk normally at home—would suddenly metamorphose into a

distinctly un-English cowboy. He'd swagger with arms hanging loose and chest puffed out. Bush, of course, strutted like this all the time, and once explained how back home, in Texas, this is known as "walking."



Children often emulate the same-sex parent.

Identification is the hook that draws us in and makes us adopt the situation, emotions, and behavior of those we're close to. They become role models: We empathize with them and emulate them. Thus children often walk like the same-sex parent, or mimic their tone of voice when they pick up the phone. American playwright Arthur Miller described how it works:

> Nothing was more enjoyable than mimicry. I was about the height of my father's back pocket, from which his handkerchief always hung out, and for years I pulled the corner of my handkerchief out exactly the same distance.

Imitation is also an anthropoid forte, as reflected in the verb "to ape." Give a zoo ape a broom, and he'll move it across the floor the way the caretaker does every day. Give her a rag and she'll soak it and wring it out before applying it to a window. Hand him a key, and you're in trouble! But even though all of this is common knowledge, some scientists have been casting doubt on ape imitation. It just isn't there, they say. Do these scientists have a point, or might they have been testing their apes the wrong way?

In a typical experiment, an ape faces an unfamiliar white-coated experimenter, who sits outside the cage to demonstrate a novel tool that has no meaning in the ape's environment. After, say, five standardized demonstrations the tool is handed to the ape to see how she'll use it. Never mind that apes dislike strangers, and that it's always

harder to relate to another species than one's own. Apes do poorly in these tests compared with children. But then again, the children aren't kept behind bars, and happily sit on their mothers' laps. They are being talked to, and most important, they're dealing with their own kind. They obviously feel perfectly at ease and have no trouble relating to the experimenter. Even though these studies seem to compare apples and oranges, they have fueled claims of a cognitive gap between apes and children.

Soon the inevitable happened: Imitation was elevated to a uniquely human skill. Never mind that such claims are always tricky, which is why they're being adjusted every couple of years, and that animals learn remarkably easily from companions. Examples range from birds or whales picking up songs from one another to the picnic wars between bears and people in the American wilderness. The bears invent new tricks all the time (they've learned, for example, that jumping up and down on top of a specific brand of car will pop open all of its doors), which then spread like wildfire through the population (resulting in warning signs at park entrances for the owners of these particular cars). Clearly, bears notice one another's successes. At the very least, human uniqueness claims should be downgraded to something more reasonable, such as that our imitation is more developed than that of other animals. But even then I'd be cautious, because our own research has fully restored faith in the aping skills of apes. By eliminating the human experimenter, we have gotten quite different results from the above studies. Given a chance to watch their own kind, apes copy every little detail they see.

Let me start with spontaneous imitation. Small infants in our chimpanzee colony sometimes get a finger stuck in the wire fence. Hooked the wrong way into the mesh, the finger cannot be extracted by force. Adults have learned not to pull at the infant, who always manages to free itself in the end. In the meantime, however, the entire colony has become agitated by the infant's screams: This is a rare but dramatic event analogous to a wild ape getting caught in a poacher's snare.

On several occasions, we have seen other apes mimic the victim's

situation. The last time, for example, when I approached to assist I was greeted with threat barks from both the mother and the alpha male. As a result, I stayed back. One older juvenile came over to reconstruct the event for me. Looking me in the eyes, she inserted her finger into the mesh, slowly and deliberately hooking it around, and then pulling as if she too had gotten caught. Then two other juveniles did the same at a different location, pushing each other aside to get their fingers in the same tight spot they had found for this game. These juveniles themselves may long ago have experienced this situation for real, but now their charade was prompted by what had happened to the infant.

Our chimps obviously haven't read the scientific literature that says imitation is a way of reaching a goal or gaining rewards. They do so spontaneously, often without gains in mind. It's so much a part of their everyday life that I set up an ambitious research project together with a British colleague, Andy Whiten, who had been thinking along the same lines. In contrast to previous studies, we wanted to know how well apes learn from one another. From an evolutionary viewpoint, it doesn't really matter what they learn from us—all that matters is how they deal with their own kind.

To have one ape act as a model for another, however, is easier said than done. I can tell a co-worker to demonstrate a particular action and to repeat it ten times in a row, but try telling that to an ape! We faced an uphill battle, and our eventual success owes much to a rather "chimpy" young woman from Scotland, Vicky Horner. Mind you, "chimpy" isn't an insult for anyone who loves apes, and all I mean is that Vicky has the right body language (squatting down, no nervous movements, friendly disposition) and knows exactly which individuals act like divas, which ones demand respect, which just want to play and have fun, and which have eyes bigger than their bellies when there's food around. She deals with each personality on its own quirky basis, so that all of them feel at ease. If Vicky's rapport with apes was one weapon in our arsenal, the second was the rapport among the apes themselves. Most of our chimpanzees are either re-

lated or have grown up together, so they're more than willing to pay attention to one another. Like a close human family, they're one bickering and loving bunch, far more interested in one another than in us—the way apes ought to be.

Vicky employs the so-called two-action method. The apes get a puzzle box that they can access in two ways. For example, one either pokes a stick into it, and food rolls out, or one uses the stick to lift a lever, and food rolls out. Both methods work equally well. First, we teach the poking technique to one member of the group, usually a high-ranking female, and let her demonstrate it. The whole group gathers around to see how she gets her M&Ms. Then we hand the box over to her group mates, who obviously—if there is any truth to apes being imitators—should now favor the poking technique, too. This is indeed what they do. Next, we repeat our experiment at the same field station on a second group, which lives out of sight of the first. Here we teach another female the lifting technique, and lo and behold, her entire group develops a preference for lifting. We thus artificially create two separate cultures: "lifters" and "pokers."

The beauty of this outcome is that if chimps were to learn things on their own, each group should show a mix of solutions, not a bias for one or the other technique. Clearly, the example given by one of their group mates makes a huge difference. In fact, when we gave naïve chimps the same box, without any demonstrations, none of them was able to get any food out of it!

Next we tried a variation on the "telephone game" to see how information travels among multiple individuals. A new two-action box was built, one that could be opened by sliding a door to the side, or flipping the same door upward. We'd teach one individual to slide, after which another would watch the first, followed by a third watching the second, and so on. Even after six pairings, the last chimp still preferred sliding the door. Taking the same box to the other group, we produced an equally long chain that preferred the lifting solution.

Following the same procedures with human children in Scotland,

Andy obtained virtually identical results. I must admit to some jealousy, because with children such an experiment takes only a couple of days, whereas each time we set up a new experiment with our apes, we count on approximately a year to complete it. Our chimps live outdoors and participate on a volunteer basis. We call them by name, and just hope that they'll come in for testing (in fact, they know not only their own names, but also the others', which allows us to ask one chimp to fetch another). Adult males generally are too busy for our tests: Their power struggles and the need to keep an eye on one another's sexual adventures have priority. Females, on the other hand, have their reproductive cycles and offspring. If they come in alone, they may be very upset by the separation, which doesn't help our experiment, whereas if they do come with their youngest offspring, guess who will be playing with the box? That doesn't do us much good, either. If females are sexually attractive—sporting their balloonlike genital swellings—they may be willing to participate, but there will be three males who want to join incessantly banging on the door, thus killing all concentration. Or it could be that two chimps in a paired test have, unbeknownst to us, had a spat in the morning and now refuse to even look at each other. "It's always something," as we say, which explains why scientists have traditionally preferred setups in which apes interact with a human experimenter. This way, at least one party is under control.

Ape-to-ape testing is much harder but has huge payoffs. Allowed to imitate one another, apes entirely live up to their reputation. They're literally in one another's faces, leaning on one another, sometimes holding the model's hand while she's performing, or smelling her mouth when she's chewing the goodies she has won. None of this would be possible with a human experimenter, who is usually kept at a safe distance. Adult apes are potentially dangerous, which is why close personal contact with humans is prohibited. In order to learn from others, though, contact makes all the difference. Our chimps watch their model's every move, and often replicate the observed actions even before they've gained any rewards themselves. This means

that they've learned purely from observation. This brings me back to the role of the body.

How does one chimp imitate another? Is it because he identifies with the other and absorbs its body movements? Or could it be that he doesn't need the other, and focuses on the box instead? Maybe all he needs to know is how the thing works. He may notice that the door slides to the side, or that something needs to be lifted up. The first kind of imitation involves reenactment of observed manipulations; the second merely requires technical know-how. Thanks to ingenious studies in which chimps were presented with a ghost box, we know which of these two explanations is correct. A ghost box derives its name from the fact that it magically opens and closes by itself so that no actor is needed. If technical know-how were all that mattered, such a box should suffice. But in fact, letting chimps watch a ghost box until they're bored to death—with its various parts moving and producing rewards hundreds of times—doesn't teach them anything.

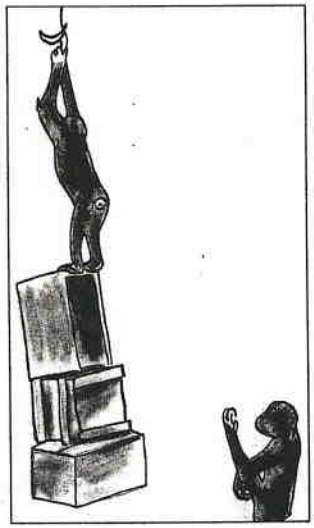
In order to learn from others, apes need to see actual fellow apes: Imitation requires identification with a body of flesh and blood. We're beginning to realize how much human and animal cognition runs via the body. Instead of our brain being like a little computer that orders the body around, the body-brain relation is a two-way street. The body produces internal sensations and communicates with other bodies, out of which we construct social connections and an appreciation of the surrounding reality. Bodies insert themselves into everything we perceive or think. Did you know, for example, that physical condition colors perception? The same hill is assessed as steeper, just from looking at it, by a tired person than by a well-rested one. An outdoor target is judged as farther away than it really is by a person burdened with a heavy backpack than by one without it.

Or ask a pianist to pick out his own performance from among others he's listening to. Even if this is a new piece that the pianist has performed only once in silence (on an electronic piano without headphones on), he will be able to recognize his own play. While listening,

he probably re-creates in his head the sort of bodily sensations that accompany an actual performance. He feels the closest match listening to himself, thus recognizing himself through his body as much as through his ears.

The field of "embodied" cognition is still very much in its infancy but has profound implications for how we look at human relations. We involuntarily enter the bodies of those around us so that their movements and emotions echo within us as if they're our own. This is what allows us, or other primates, to re-create what we have seen others do. Body-mapping is mostly hidden and unconscious but sometimes it "slips out," such as when parents make chewing mouth movements while spoon-feeding their baby. They can't help but act the way they feel their baby ought to. Similarly, parents watching a singing performance of their child often get completely into it, mouthing every word. I myself still remember as a boy standing on the sidelines of soccer games and involuntarily making kicking or jumping moves each time someone I was cheering for got the ball.

The same can be seen in animals, as illustrated in an old black-and-white photograph of Wolfgang Köhler's classic tool-use studies on chimpanzees. One ape, Grande, stands on top of wooden boxes that she has stacked up to reach bananas hung from the ceiling, while Sultan watches intently. Even though Sultan sits at a distance, he raises his arm in precise synchrony with Grande's grasping movement. Another example comes from a chimpanzee filmed while using a heavy rock as a hammer to crack nuts. The actor is being observed by a younger ape, who swings his own (empty) hand down in sync every time the first one



Sultan (sitting) making an empathetic grasping movement with his hand while watching Grande reach for bananas.

strikes the nut. Body-mapping provides a great shortcut to imitation.

Identification is even more striking at moments of high emotion. I once saw a chimpanzee birth in the middle of the day. This is unusual: Our chimps tend to give birth at night or at least when there are no humans around, such as during a lunch break. From my observation window I saw a crowd gather around Mai—quickly and silently, as if drawn by some secret signal. Standing half upright with her legs slightly apart, Mai cupped an open hand underneath of her, ready to catch the baby when it would pop out. An older female, Atlanta, stood next to her in similar posture and made exactly the same hand movement, but between *her own* legs, where it served no purpose. When, after about ten minutes, the baby emerged—a healthy son—the crowd stirred. One chimpanzee screamed, and some embraced, showing how much everyone had been caught up in the process. Atlanta likely identified with Mai because she'd had many babies of her own. As a close friend, she groomed the new mother almost continuously in the following weeks.

Similar empathy was described by Katy Payne, an American zoologist, for elephants:

> Once I saw an elephant mother do a subtle trunk-and-foot dance as she, without advancing, watched her son chase a fleeing wildebeest. I have danced like that myself while watching my children's performances—and one of my children, I can't resist telling you, is a circus acrobat.

Not only do we mimic those with whom we identify, but mimicry in turn strengthens the bond. Human mothers and children play games of clapping hands either against each other or together in the same rhythm. These are games of synchronization. And what do lovers do when they first meet? They stroll long distances side by side, eat together, laugh together, dance together. Being in sync has a bonding effect. Think about dancing. Partners complement each other's

moves, anticipate them, or guide each other through their own movements. Dancing screams "We're in synchrony!" which is the way animals have been bonding for millions of years.

When a human experimenter imitates a young child's movements (such as banging a toy on a table or jumping up and down exactly like the child), he elicits more smiles and attention than if he shows the same infantile behavior independently of the child. In romantic situations, people feel better about dates who lean back when they lean back, cross their legs when they do, pick up their glass when they do, and so on. The attraction to mimicry even translates into money. The Dutch may be notoriously stingy, but tips at restaurants are twice as high for waitresses who repeat their clients' orders ("You asked for a salad without onions") rather than just exclaim "My favorite!" or "Coming up!" Humans love the sound of their own echo.

When I see synchrony and mimicry—whether it concerns yawning, laughing, dancing, or aping—I see social connection and bonding. I see an old herd instinct that has been taken up a notch. It goes beyond the tendency of a mass of individuals galloping in the same direction, crossing the river at the same time. The new level requires that one pay better attention to what others do and absorb how they do it. For example, I knew an old monkey matriarch with a curious drinking style. Instead of the typical slurping with her lips from the surface, she'd dip her entire underarm in the water, then lick the hair on her arm. Her children started doing the same, and then her grandchildren. The entire family was easy to recognize.

There is also the case of a male chimpanzee who had injured his fingers in a fight and hobbled around leaning on a bent wrist instead of his knuckles. Soon all of the young chimpanzees in the colony were walking the same way in single file behind the unlucky male. Like chameleons changing their color to match the environment, primates automatically copy their surroundings.

When I was a boy, my friends in the south of the Netherlands always ridiculed me when I came home from vacations in the north, where I played with boys from Amsterdam. They told me that I talked

funny. Unconsciously, I'd return speaking a poor imitation of the harsh northern accent. The way our bodies—including voice, mood, posture, and so on—are influenced by surrounding bodies is one of the mysteries of human existence, but one that provides the glue that holds entire societies together. It's also one of the most underestimated phenomena, especially in disciplines that view humans as rational decision makers. Instead of each individual independently weighing the pros and cons of his or her own actions, we occupy nodes within a tight network that connects all of us in both body and mind.

This connectedness is no secret. We explicitly emphasize it in an art form that is literally universal. Just as there are no human cultures without language, there are none that lack music. Music engulfs us and affects our mood so that, if listened to by many people at once, the inevitable outcome is mood convergence. The entire audience gets uplifted, melancholic, reflective, and so on. Music seems designed for this purpose. I'm not necessarily thinking here of what music has become in Western concert halls with their stuffy, dressed-up audiences who aren't even tapping their feet lest they be considered undignified. But even these audiences experience mood convergence: Mozart's *Requiem* obviously affects a crowd differently than does a Strauss waltz. I'm thinking mostly of pop concerts at which thousands sing along with their idol while waving candles or cell phones through the air, or blues festivals, marching bands, gospel choirs, jazz funerals, even families singing "Happy Birthday," all of which permit a more visceral, bodily reaction to the music. At the end of a Christmas dinner in Atlanta, for instance, our whole table sang along melodramatically to *Elvis' Christmas Album*. The combination of great food, wine, friendship, and chant was intoxicating in more than one sense: We swung and laughed together, and ended up in the same spirit.

I once played piano in a band. It would be an understatement to say that we had little success, but I did learn that performing together requires role-taking, generosity, and being in tune—literally—to a degree found in few other endeavors. Our favorite song was "House

of the Rising Sun" by The Animals, which we tried to invest with as much drama as we could. We felt the song's doom and gloom without knowing exactly what kind of house we were singing about, which I figured out only years later. What stuck with me, though, was the unifying effect of playing together.

Animal examples are not hard to come by, and here I don't just mean a howling pack of wolves, male chimpanzees hooting together to impress their neighbors, or the well-known dawn choruses of howler monkeys—said to be the loudest mammals on earth. I am referring to siamangs, which I heard for the first time in the jungles of Sumatra. Siamangs are large black gibbons who sing high up in the trees when the forest starts to heat up. It's a happy, melodious sound that touched me at a much deeper level than birdsong, probably because it is produced by a mammal. Siamang song is more full-bodied than that of any bird.

Their song usually starts with a few loud whoops, which gradually build into ever louder and more elaborate sequences amplified by their balloonlike throat sacs. Their sound carries for miles. At some point, the human listener correctly decides that a single animal can't be producing it. For many animals, it's the male's job to keep intruders out, but with siamangs—which live in small family groups—both sexes work toward this end. The female produces high-pitched barks, whereas the male often utters piercing screams that at short range will put every hair on your body on end. Their wild and raucous songs grow in perfect unison into what has been called "the most complicated opus sung by a land vertebrate other than man." At the same time that the duet communicates "Stay out!" to other members of their species, it also proclaims "We're one."

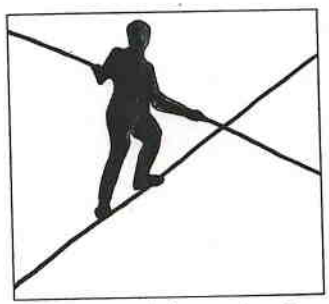
Like cart-pulling horses that work against each other before they work together, it takes time for siamangs to sing in harmony, and harmony may be critical to hold on to a partner or territory. Other siamangs can hear how close a pair is, and will move in if they discern discord. This is why German primatologist Thomas Geissmann noted: "Leaving a partner doesn't appear to be very attractive because

the duets of fresh couples are noticeably poor." He found that couples that sang together a lot also spent more time together and synchronized their activities better.

One can literally tell a good siamang marriage by its song.

A Feeling Brain

When Katy Payne offered us the image of a human mother resonating with her acrobat child, she unwittingly used the same example as the German psychologist responsible for the modern concept of empathy. We're in suspense watching a high-wire artist, said Theodor Lipps (1851–1914), because we vicariously enter his body and thus share his experience. We're on the rope with him. The German language elegantly captures this process in a single noun: *Einfühlung* (feeling into). Later, Lipps offered *empatheia* as its Greek equivalent, which means experiencing strong affection or passion. British and American psychologists embraced the latter term, which became "empathy."



We identify with a high-wire artist to the point that we participate in every step he takes.

I prefer the term *Einfühlung* since it conveys the movement of one individual projecting him- or herself into another. Lipps was the first to recognize the special channel we have to others. We can't feel anything that happens outside ourselves, but by unconsciously merging self and other, the other's experiences echo within us. We feel them as if they're our own. Such identification, argued Lipps, cannot be reduced to any other capacities, such as learning, association, or reasoning. Empathy offers direct access to "the foreign self."

How strange that we need to go back one century to learn about the nature of empathy in the writings of a long-forgotten psychologist. Lipps offered a bottom-up account, that is, one that starts from

the basics, rather than the top-down explanations often favored by psychologists and philosophers. The latter tend to view empathy as a cognitive affair based on our estimation of how others might feel given how we would feel under similar circumstances. But can this explain the immediacy of our reactions? Imagine we're watching the fall of a circus acrobat and are capable only of empathy based on the recall of previous experiences. My guess is that we wouldn't react until the moment the acrobat lies in a pool of blood on the ground. But of course this is not what happens. The audience's reaction is absolutely instantaneous: Hundreds of spectators utter "ooh" and "aah" at the *very instant* that the acrobat's foot slips. Acrobats often perform such slips on purpose, without any intention of falling, precisely because they know how much their audience is with them every step of the way. I sometimes wonder where Cirque du Soleil would be without this instant connection.

Science is coming around to Lipps's position, but this wasn't the case yet when Swedish psychologist Ulf Dimberg began publishing on involuntary empathy in the early 1990s. He ran into stiff resistance from proponents of the more cognitive view. Dimberg demonstrated that we don't decide to be empathic—we simply are. Having pasted small electrodes onto his subjects' faces so as to register the tiniest muscle movements, he presented them with pictures of angry and happy faces on a computer screen. Humans frown in reaction to angry faces and pull up the corners of their mouths in reaction to happy ones. This by itself was not his most critical finding, however, because such mimicry could be deliberate. The revolutionary part was that he got the same reaction if the pictures flashed on the screen too briefly for conscious perception. Asked what they had seen after such a subliminal presentation, subjects knew nothing about happy or sad faces but had still mimicked them.

Expressions on a screen not only make our face muscles twitch, they also induce emotions. Those who had been exposed to happy faces reported feeling better than those who had been exposed to angry ones, even though neither group had any idea of what they had

seen. This means that we're dealing with true empathy, albeit a rather primitive kind known as *emotional contagion.*

Lipps called empathy an "instinct," meaning that we're born with it. He didn't speculate about its evolution, but it's now believed that empathy goes back far in evolutionary time, much further than our species. It probably started with the birth of parental care. During 200 million years of mammalian evolution, females sensitive to their offspring outreproduced those who were cold and distant. When pups, cubs, calves, or babies are cold, hungry, or in danger, their mother needs to react instantaneously. There must have been incredible selection pressure on this sensitivity: Females who failed to respond never propagated their genes.

A good illustration is a female chimpanzee, named Krom, whom I knew at a zoo. Krom was fond of infants, and cared well enough for them so long as she could see them. Being deaf, however, she failed to respond to the soft yelps and whimpers of tiny infants in trouble, such as when they can't reach the nipple, are in danger of losing their grip on Mom's hair, or feel squeezed. I once saw Krom sit down on her infant and fail to get up when it burst out screaming. She reacted only upon noticing the worried reaction of *other* females. We ended up having another female adopt and raise this infant. Krom's case taught me how critically important it is for a mammalian female to be in tune with her offspring's every need.

Having descended from a long line of mothers who nursed, fed, cleaned, carried, comforted, and defended their young, we should not be surprised by gender differences in human empathy. They appear well before socialization: The first sign of emotional contagion—one baby crying when it hears another baby cry—is already more typical of baby girls than baby boys. Later on we see more gender differences. Two-year-old girls witnessing others in distress treat them with more concern than do boys of the same age. And in adulthood, women report stronger empathic reactions than men, which is one reason why women have been attributed a "tending instinct."

None of this denies male empathy. Indeed, gender differences

usually follow a pattern of overlapping bell curves: Men and women differ on average, but quite a few men are more empathic than the average woman, and quite a few women are less empathic than the average man. With age, the empathy levels of men and women seem to converge. Some investigators even doubt that in adulthood there's much difference left.

Nevertheless, to seek the origin of empathy in parental care seems logical, which is why Paul MacLean drew attention to the calls of young mammals that are lost and want their mother back, known as "separation calls." The pioneering American neuroscientist, who in the 1950s first described the "limbic system," was interested in the origin of parental care. Young mammals call when lost or frightened, and their mother responds by picking them up. She's in a great hurry to take care of the problem, and if she's big and strong, you just don't want to get in her way (which is another human-versus-bear story). The evolution of attachment came with something the planet had never seen before: a feeling brain. The limbic system was added to the brain, allowing emotions, such as affection and pleasure. This paved the way for family life, friendships, and other caring relationships.

The central importance of social bonding is hard to deny. We have a tendency to describe the human condition in lofty terms, such as a quest for freedom or striving for a virtuous life, but the life sciences hold a more mundane view: It's all about security, social companionships, and a full belly. There is obvious tension between both views, which recalls that famous dinner conversation between a Russian literary critic and the writer Ivan Turgenev: "We haven't yet solved the problem of God," the critic yelled, "and you want to eat!"

Our nobler strivings come into play only once the baser ones have been fulfilled. If attachment and empathy are as fundamental as proposed, we had better pay close attention to them in any discussion of human nature. There is also no reason to expect these capacities only in humans. They should manifest themselves in any warm-

blooded creature with hair, nipples, and sweat glands, which is part of what defines a mammal.

This obviously includes those pesky little rodents.

Commiserating Mice

I don't particularly enjoy telling this story, since it betrays prejudice, but I think anyone can understand why the Dutch, in the aftermath of World War II, were less than enamored with their neighbors to the east. As an undergraduate at the University of Nijmegen, I was taught by several German professors, who spoke Dutch with a thick accent. One of them was a grumpy old man, who was said to have been a concentration camp guard. Obviously, this couldn't be true, since he now would have been in jail, or worse, but this is what the rumor mill said.

To make matters worse, this professor manually killed the mice needed for our anatomy practicum. He didn't believe in death by ether, and would simply take a box with live mice and stand with his back turned to us. A few minutes later, a pile of dead mice with cracked necks lay on the counter.

In his defense, I must say that "cervical dislocation," as the practice is known, is probably quicker and more humane than other forms of euthanasia. But you can imagine that we found this professor a bit scary. And that's just us. How did the mice look at this procedure? The first mouse from the box didn't know what was coming, but what about the last one? Can rodents detect one another's pain? Do they feel one another's pain?

Before going any further, I must warn that reading up on the science of animal empathy can be a challenge for animal lovers. To see how animals react to the pain of others, investigators have often produced the pain themselves. I don't necessarily approve of these practices, and don't apply them myself, but it would be foolish to ignore the discoveries they've produced. The good news is that most of this

research was carried out decades ago, and is unlikely to be repeated today.

In 1959, American psychologist Russell Church published a scientific paper under the provocative title "Emotional Reactions of Rats to the Pain of Others." Church trained rats to obtain food by pressing a lever, and found that if one rat noticed that lever-pressing shocked a neighboring rat, it would stop. This is remarkable. Why shouldn't the rat simply continue to get food and ignore its companion dancing in pain on an electric grid? Did these rats stop pressing because they were distracted, worried about their companion, or fearful for themselves?

The explanation offered by Church was typical of a time when conditioning was thought to underlie all behavior. He argued that a rat fears for its own well-being when it sees a companion in distress. But does an untrained rat have any reason to associate the squeals of others with pain to itself? The animals in the experiment had grown up in the laboratory with controlled temperature and light, ample food, and no predators. They had never encountered a situation like this before. It seems more likely that the sight, sound, or smell of another rat in pain arouses an innate emotional response. One rat's distress may simply distress another.

This study inspired a brief flurry of experiments on animal "empathy," "sympathy," and "altruism"—always put between quotation marks so as to avoid the wrath of behaviorists, who didn't believe in such concepts. This work was subsequently ignored, due partly to the taboo on animal emotions, and partly to the traditional emphasis on the nasty side of nature. As a result, animal studies are now seriously lagging behind what we know about human empathy. This may be changing, though, thanks to a new study by Canadian scientists, titled "Social Modulation of Pain as Evidence for Empathy in Mice." This time, the word *empathy* is free of quotation marks, reflecting the growing consensus that emotional linkage between individuals has the same biological basis in humans and other animals.

The news came too late for my old anatomy professor, but Jeffrey

Mogil, head of the pain lab at McGill University, almost felt as if his mice were talking to one another about their pain. He was puzzled time and again by the fact that when he was testing mice from the same cage, the order in which they were used seemed to affect their response. The last mouse showed more signs of pain than the first. One possibility is that the last mouse was sensitized by having seen others in pain. Mogil compared it to sitting in a dentist's lobby and seeing other patients coming out of the room after an obviously unpleasant experience. One can't help becoming primed for pain.

Pairs of mice were put through a pain test. Each mouse was placed in a transparent glass tube such that it could see the other. Either one or both mice were injected with diluted acetic acid, known to cause—in the words of the investigators—a mild stomachache. Mice respond to this treatment with stretching movements, suggesting discomfort. The basic finding was that a mouse would show more stretching with an injected partner, who was stretching, too, as opposed to a control partner. Since this applied only to mice that were cage mates, not to strangers, it couldn't be due to a simple negative association, because then the reaction should have been the same regardless of whether they knew each other. Further experiments explored which sense was involved by comparing anosmic mice (which lack olfaction), deaf mice, and mice that were prevented from seeing each other. Vision turned out to be critical: The reaction occurred only between mice that could see each other.

The mice showed pain contagion. That is, the sight of another in pain intensified their own pain response. Interestingly, in the presence of a stranger in pain, sensitivity went *down*: The mice became strikingly passive. This counterempathic reaction, however, was restricted to males, which are also potentially the most hostile to one another. Were they less than empathetic with their rivals?

This gender effect reminds me of how humans empathize with another's distress. Seeing the pain of a person we have just cooperated with activates pain-related areas in our own brains. This applies to both men and women. Yet in some studies the same procedure has

been followed with partners who had been instructed to act unfairly in a game with the subject before the latter went into the brain scanner. Having been duped by someone, we show the opposite of empathy: At our seeing his pain, the brain's *pleasure* centers light up. We're getting a kick out of their misery! Such Schadenfreude occurs only in men, however, because women remain empathic. This may seem a typically human reaction, yet the underlying theme (male lack of empathy for potential rivals) resembles the mouse findings, and might well be a mammalian universal.

Finally, the investigators exposed pairs of mice to different sources of pain. One was the same acetic acid as before, but the second was a radiant heat source that might burn them if they came too close. Mice observing a cage mate in pain from the acid withdrew more quickly from the heat source, thus indicating heightened sensitivity to a completely different pain stimulus that required a different reaction. This precludes motor mimicry as an explanation: The mice seemed sensitized to pain in general. Any pain.

This study goes a long way toward reviving the tentative conclusions of the 1960s, showing that even with larger numbers of subjects and more rigorous methods, we get the same result: intensification of one's own experience based on the perceived reaction of others. This is close enough to "empathy" to call it that.

It's obviously not the imaginative kind of empathy that makes us truly understand how someone else feels, even someone we don't see, for example, when we read about the fate of a character in *War and Peace*. Yet it's good to keep in mind that imagination is not what drives empathy. Imagining another's situation can be a cold affair, not unlike the way we understand how an airplane flies. Empathy requires first of all emotional engagement. The mice show us how things may have gotten started. Seeing another's emotions arouses our own emotions, and from there we go on constructing a more advanced understanding of the other's situation.

Bodily connections come first—understanding follows.

Oscar the Cat

Oscar the Cat stares at us from a photograph in the prestigious *New England Journal of Medicine* along with an admiring description by a fellow expert. The author relates how Oscar makes his daily rounds at a geriatric clinic in Providence, Rhode Island, for patients with Alzheimer's, Parkinson's, and other illnesses. The two-year-old cat carefully sniffs and observes each patient, strolling from room to room. When he decides that someone is about to die, he curls up beside them, purring and gently nuzzling them. He leaves the room only after the patient has taken his or her last breath.

Oscar's predictions have been so dependable that the hospital staff counts on them. If he enters a room and leaves again, they know the patient's time isn't up yet. But as soon as Oscar starts one of his vigils, a nurse will pick up the phone to call family members, who then hurry to the hospital to be present while their loved one passes away. The cat has predicted the deaths of more than twenty-five patients with greater accuracy than any human expert. The tribute to the tomcat states: "No one dies on the third floor unless Oscar pays a visit and stays awhile."

How does Oscar do it? Is it the smell, skin color, or a certain pattern of breathing of dying patients? With so much variation in what ails them, it seems a bit unlikely that all patients end up showing the same telltale signs, but it's a possibility. Even more baffling is the question of what drives the cat. He has sometimes been the only one to be with an expiring patient, and the staff interprets this as him giving succor. But is this really what motivates our feline hospice?

I see two possible reasons for his behavior: It is either an attempt to comfort himself, if he's upset by what he senses is happening to a person, or an attempt to comfort the patient. But both possibilities remain perplexing. The first is so because it's unclear why Oscar would seek comfort with patients who have mostly become incapacitated: Wouldn't he be better off getting petted by some of the many people

who'd love to do so? The second possibility is even harder to believe: Belonging to a species of solitary hunters, why would Oscar be so much more generous than any other cat I've ever known? I've had many in my lifetime, and whereas most cats do like to snuggle, I don't read much concern about our well-being in their behavior. To be perfectly cynical: I sometimes wonder why our cats love us so much more the colder it gets.

I'm exaggerating, of course. Cats do give affection and can show strong emotional connectedness. Otherwise, why would they always want to be in the same room we are in? The whole reason people fill their homes with furry carnivores and not with, say, iguanas or turtles—which are easier to keep—is that mammals offer us something no reptile ever will: emotional responsiveness. Dogs and cats have no trouble reading our moods and we have no trouble reading theirs. This is immensely important to us. We feel so much more at ease, so much more attached to animals with this capacity. Even if Oscar wasn't exactly acting out of concern, as I surmise, it would still be a mistake to dismiss his behavior as irrelevant to the issue of empathy.

Every evolved capacity is assumed to have advantages. If emotional contagion was indeed the first step on the road toward full-blown empathy, the question is, how does it promote survival and reproduction? The usual answer is that empathy produces helping behavior, but this hardly works for emotional contagion, which by itself doesn't do so. Take the typical reaction of a human toddler who hears another child cry. Her eyes fill with tears, upon which she runs to a parent to be picked up and comforted. In doing so, she in fact turns her back on the source of discomfort. Due to this lack of other-orientation, psychologists speak of "personal distress." It is a self-centered response that doesn't provide a good basis for altruism.

But that doesn't make emotional contagion useless. Let's say a wild rodent hears another squeal in fear and as a result becomes fearful itself. If this causes him to flee or go into hiding, he may avoid whatever fate befell the other. Or take a rodent mother, who is upset

by her offsprings' ultrasonic distress peeps. She becomes restless herself, until she quiets her pups (and herself) by nursing them or moving them to a warmer spot. So without any deep interest in others' welfare, just by being emotionally aroused and reacting accordingly, animals may avoid danger or take care of their young. Things don't get any more adaptive than that.

The mother who "turns off" her pups' aversive noise by taking care of their problem is showing other-oriented behavior for self-centered reasons. I call this *self-protective altruism;* that is, helping another so as to shield oneself from aversive emotions. Such behavior does benefit others, yet lacks true other-orientation. Is this perhaps how concern for others evolved? Did it start with self-protective helping? Did this gradually evolve into helping geared toward the other's well-being? Libraries' worth of books try to draw a sharp line between selfishness and altruism, but what if we're facing an immense gray area? We can't exactly call empathy "selfish," because a perfectly selfish attitude would simply ignore someone else's emotions. Yet it doesn't seem appropriate either to call empathy "unselfish" if it is one's own emotional state that prompts action. The selfish/unselfish divide may be a red herring. Why try to extract the self from the other, or the other from the self, if the merging of the two is the secret behind our cooperative nature?

An intriguing example is how monkeys reacted in the same experiment discussed earlier for rats. In the 1960s, American psychiatrists reported that rhesus monkeys refused to pull a chain that delivered food to themselves if it shocked their companion. The monkeys went much further than the rats, which interrupted their behavior only briefly. One monkey stopped responding for five days and another for twelve days after witnessing the effect of its behavior on a companion. These monkeys were literally starving themselves to avoid inflicting pain on others.

Again, this was probably self-protective altruism: a desire to avoid unpleasant sights and sounds. It's just awful to watch others in pain, which is, of course, the whole point of empathy. Monkeys

are extremely sensitive to one another's body language. This was shown in another experiment. One monkey watched a video screen that showed the face of another, who could hear a click sound that announced the arrival of electrical shocks for both. By deciphering the other's reaction to the sound, the first monkey could quickly press a lever that turned off the shocks. Even though the monkeys were sitting in separate rooms, they were highly successful at staying pain free. Apparently, the monkey with the lever had no trouble reading the face of the one who could hear the warning. The monkey was better at reading the other's expressions than the scientists who watched the same screen and concluded that "a monkey was a much more skilled interpreter of facial expression in another monkey than was man."

Isn't it horrible that such procedures are deemed necessary to prove the sensitivity of animals to one another? Can't research on animal empathy be conducted without arousing our own empathy? I'm not going to defend these procedures, but it's good to keep in mind how extremely little we know about animal empathy. Compared with the attention science has paid to negative emotions, such as fear and aggression, there has been a profound neglect of positive ones. It should be possible, however, to study empathy in a more benign way, as we do with humans. We could use mild stressors, for example, or reactions to spontaneous life events. After all, the daily life of primates is full of strains.

In my own research, I avoid causing pain or deprivation even though this leaves me with one obvious drawback: I never get to see what happens on the "inside" of my animals. Once, however, I saw a chance for an exception when radio transmitters became small enough to be implanted under the skin. This allowed measurement of a monkey's heart rate. It was being done with pets, so why not primates? In the old days, scientists needed to put monkeys in a restraining chair or outfit them with a heavy backpack to get heart data, but we were able to do so with a freely moving rhesus monkey. Live radio signals were picked up by an antenna mounted next to a young student, Stephanie Preston, who sat in a tower overlooking an outdoor corral with mon-

keys. We wanted to know how body contact affects the heart. I had just published my 1996 book, *Good Natured*, which had broached the controversial topic of animal empathy. How primates reduce stress was a big part of my argument, which is why we wanted to take a peek at their hearts.

In retrospect, I agree with one of my teachers, Robert Goy (the scientist who convinced me to move across the Atlantic), who warned me long ago: "Frans, stay away from the heart, because it's a mess." Obviously, he didn't mean the metaphorical heart of love and affection—he meant that it's almost impossible to make sense of heart rate. The heart reacts to everything: sex, aggression, fear, but also nonemotional activities such as jumping or running. Even if a monkey just sits up and scratches itself, its heart rate shoots up. How is one ever to figure out what's going on? If the heart slows down following a fight, for example, is this because the monkey is at peace, or is it simply because it stopped running and is now catching its breath?

At least we could tell that the monkey with the transmitter knew her relationship network intimately. If she was quietly sitting in the shade and another monkey strolled by, her heart rate would remain steady provided the other was a member of her family or a low-ranking monkey. Her heart would start racing, however, if the other was of high rank. We couldn't see much in her face or posture, but her heart revealed high anxiety. Rhesus monkeys live in the most hierarchical society I know, in which dominant individuals rarely hesitate to punish subordinates. They control them so completely that they sometimes even take food out of their mouths, literally—holding their heads still while reaching in. Our monkey's heart showed the silent terror that is life in rhesus society.

Stress begs alleviation, which rhesus monkeys achieve through grooming. The relaxing effect of this activity wasn't easy to prove, however, because for every time our monkey was being groomed we needed a perfect match, such as an almost identical situation in which she was *not* being groomed. The difference in heart rate could then be attributed to the grooming. We found indeed that grooming slows

down the heart, which was the first such demonstration for any animal in a naturalistic setting. It confirmed the widely held assumption that grooming is an enjoyable, calming activity that serves not only to remove lice and ticks, but also to eliminate stress and foster social ties. Drops in heart rate have also been found in horses being petted by humans, and conversely, in humans petting their pets. In fact, animal companions are so effective against stress that they are increasingly recommended for heart patients.

I'll need to think of this the next time our cat, Sofie, wakes me up by tapping my face—ever so gently, but also ever so persistently—so she can slip under the covers.

In the winter, that is.

Empathy Needs a Face

During our heart rate study, Stephanie must have caught the empathy bug. After she'd gone on to study elsewhere, she decided to read more widely on the topic. The empathy literature is completely human-centered, never mentioning animals, as if a capacity so visceral and pervasive and showing up so early in life, could be anything other than biological. Empathy is still often presented as a voluntary process, requiring role-taking and higher cognition, even language. Stephanie and I wanted to go over the existing data from a different angle.

When I visited her years later in Berkeley, California, Stephanie dragged two large cardboard boxes from the corner of her office and put them on the table. I saw more articles on empathy than I had ever dreamed existed, neatly organized by topic, including historical papers, such as those by Theodor Lipps. Evidently, our review project had been growing larger and larger. The focus was on how empathy works, especially how the brain connects the outside world with the inside. The sight of another person's state awakens within us hidden memories of similar states that we've experienced. I don't mean conscious memories, but an automatic reactivation of neural circuits. Seeing someone in pain activates pain circuits to the point that we

clench our jaws, close our eyes, and even yell "Aw!" if we see a child scrape its knee. Our behavior fits the other's situation, because it has become ours.

The discovery of *mirror neurons* boosts this whole argument at the cellular level. In 1992, an Italian team at the University of Parma first reported that monkeys possess special brain cells that fire not only when the monkey itself reaches for an object, but also when it sees another do so. In a typical demonstration, a computer screen shows the firing of a cell as recorded by electrodes in a monkey's brain. If the monkey takes a peanut from the experimenter's hand, the neuron gives a brief signal burst that (through an amplifier) sounds like a machine gun. When, a little later, the experimenter picks up a peanut while being watched by the monkey, the very same cell fires again. This time, however, it responds to *someone else's* action. What makes these neurons special is the lack of distinction between "monkey see" and "monkey do." They erase the line between self and other, and offer a first hint of how the brain helps an organism mirror the emotions and behavior of those around it. It's like a Pink Floyd song of long ago that draws attention to eye contact between people: "I am you and what I see is me." The discovery of mirror neurons has been hailed as being of the same monumental importance to psychology as the discovery of DNA has been for biology. That this key discovery took place in monkeys has obviously not helped claims of empathy as uniquely human.

The automaticity of empathy has become a point of debate, though. For the same reason that Dimberg ran into resistance showing unconscious facial mimicry, some scientists profoundly dislike any talk of automaticity, which they equate with "beyond control." We can't afford automatic reactions, they say. If we were to empathize with everybody in sight, we'd be in constant emotional turmoil. I'd be the last to disagree, but is this really what "automaticity" means? It refers to the speed and subconscious nature of a process, not the inability to override it. My breathing, for instance, is fully automated, yet I remain in charge. This very minute, I can decide to stop breathing until I see purple.

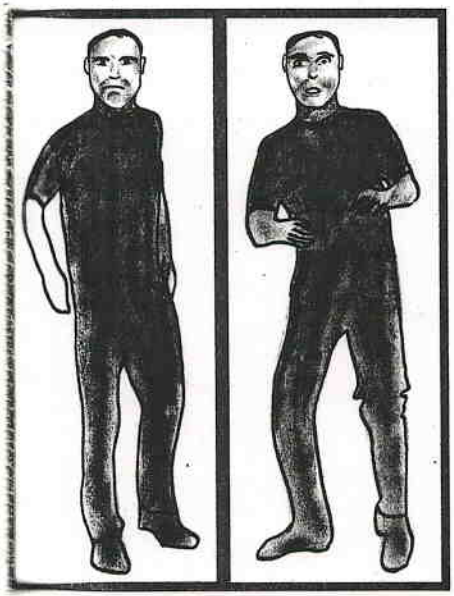
The ability to control and inhibit responses is not our only weapon against rampant empathy. We also regulate it at its very source by means of selective attention and identification. If you don't want to be aroused by an image, just don't look at it. And even though we identify easily with others, we don't do so automatically. For example, we have a hard time identifying with people whom we see as different or belonging to another group. We find it easier to identify with those like us—with the same cultural background, ethnic features, age, gender, job, and so on—and even more so with those close to us, such as spouses, children, and friends. Identification is such a basic precondition for empathy that even mice show pain contagion only with their cage mates.

If identification with others opens the door for empathy, the absence of identification closes that door. Since wild chimps occasionally kill one another, they must be capable of shutting the door completely. This takes place mostly when groups compete, which is of course also the situation in which humans run lowest on empathy. In one African reserve, a community of chimpanzees split into a northern and southern faction, eventually becoming two separate communities. These chimpanzees had played and groomed together, reconciled after squabbles, shared meat, and lived in harmony. But the factions began to fight over territory nonetheless. Shocked researchers watched as former friends literally drank one another's blood. Not even the oldest community members were exempt: An extremely frail-looking male was pummeled for twenty minutes, dragged about, and left for dead. This is why victims of chimpanzee warfare have been called "dechimpized," suggesting the same suppression of identification that marks dehumanization.

Empathy can also be nipped in the bud. Doctors and nurses in emergency rooms, for example, just cannot afford to be constantly in an empathic mode. They have to put a lid on it. There is a grisly side to this, such as the stories of Nazis who were quite sentimental about their own families, taking care of them as any normal father would, yet at the same time they had lamp shades made out of human skin and they exterminated masses of innocents. Or take Maximilien

Robespierre, the French revolutionary leader who rarely thought twice about sending "enemies of the Republic" to the guillotine—some of them former friends—yet loved to play with his dog, Brount, his sole companion on long walks. People who are perfectly attached and sensitive in one context may act like monsters in another.

But even if empathy is hardly inevitable, it is automatically aroused with those who have been "preapproved" based on similarity or closeness. With them, we can't help resonating. We often focus on the face, but obviously the entire body expresses emotions. As shown by Belgian neuroscientist Beatrice de Gelder, we react as rapidly to body postures as we do to facial expressions. We effortlessly read bodies, such as a fearful pose (ready to run, hands warding off danger) or an angry one (chest out, taking a step forward). When scientists played a trick on their subjects by pasting an angry face on the picture of a fearful body and a fearful face on an angry body, the incongruity slowed down reaction time. But the body posture won out when subjects were asked to judge the emotional state of the depicted person. Apparently, we trust postures more than facial expressions.



We show rapid reactions to angry (left) and fearful (right) body postures. In this drawing, the faces convey the same emotions as the bodies, but with the faces blacked out, we still show an emotional reaction purely based on posture.

How exactly the emotions of others affect our own is not entirely understood. One idea, which I'll call the "Body First Theory," holds that it starts with the body and that emotions follow. Someone else's body language affects our own body, which then creates an emotional echo that makes us feel accordingly. As Louis Armstrong sang, "When you're smiling, the whole world

smiles with you." If copying another's smile makes us feel happy, the emotion of the smiler has been transmitted via our body. Strange as it may sound, this theory states that emotions arise from our bodies. For example, our mood can be improved by simply lifting up the corners of our mouth. If people are asked to bite down on a pencil lengthwise, taking care not to let the pencil touch their lips (thus forcing the mouth into a smile-like shape), they judge cartoons funnier than if they have been asked to frown. The primacy of the body is sometimes summarized in the phrase "I must be afraid, because I'm running."

This surely seems an odd way of putting things: Emotions are supposed to move us, not the other way around. Shouldn't it rather be "I run, because I'm afraid"? After all, "emotion" means to "stir" or "move." This is, in fact, the second idea, which I'll call the "Emotion First Theory." From seeing someone's body language or hearing their tone of voice, we deduce their emotional state, which then affects our own. In fact, we don't need to see their face to adopt the same facial expression, as has been demonstrated by letting humans watch pictures of fearful body postures with the faces blacked out. While this ruled out facial mimicry, the subjects' faces still registered fear. Emotional contagion thus relies on a direct channel between the other's and our own emotions.

There are times when matching the other's emotions is *not* a good idea. When we're facing a furious boss, for example, we'd get into deep trouble if we were to mimic his attitude. What we need is a quick grasp of his emotional state so as to respond with the appropriate submission, appeasement, or remorse. This applies almost equally to situations where the boss is right as where he is wrong. It's just a matter of social rank—a dynamic intuitively understood by every primate. The Emotion First Theory explains such encounters much better than the Body First Theory.

Despite the importance of body postures and movements, the face remains the emotion highway: It offers the quickest connection to the other. Our dependence on this highway may explain why

people with immobile or paralyzed faces feel deeply alone, and tend to become depressive, sometimes to the point of suicide. Working with Parkinson's patients, a speech therapist noted that if in a group of, say, forty patients, five showed facial rigidity, all others would stay away from them. If they talked with them at all, it was to get simple "yes" or "no" answers. And if they wanted to know how they felt, they would rather speak with the companions of these patients. If empathy were a voluntary, conscious process of one mind trying to understand another, there would of course be no reason for this. People would simply need to put in a little more effort to hear the thoughts and feelings of these patients, who are perfectly capable of expressing themselves.

But empathy needs a face. With impoverished facial expression comes impoverished empathic understanding, and a bland interaction devoid of the bodily echoing that humans constantly engage in. As French philosopher Maurice Merleau-Ponty put it, "I live in the facial expression of the other, as I feel him living in mine." When we try to talk to a stone-faced person, we fall into an emotional black hole.

This is precisely the term used by a Frenchwoman who lost her face to a dog attack (her face had become nothing but a *grand trou*, she said, a "big hole"). In 2007, doctors gave her a new face, and her relief says it all: "I have returned to the planet of human beings. Those who have a face, a smile, facial expressions that permit them to communicate."