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The \*Animal Self\*  
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A big-city aquarium after closing hours is an eerie, spectral place. With the lights turned down in the empty viewing galleries, the luminous dioramas of the different fish fairly swell against your senses, rendering you the viewed and startled captive, adrift in your own natural medium, in a literal suspension of disbelief. "Help yourself," Sal Munoz, a night-shift biologist at the Seattle Aquarium, told me one night this past fall, pointing to the huge 12-foot-high glass tank in which the subject of my specially arranged private encounter that evening resided: a 70-pound giant Pacific octopus named Achilles.

I was first introduced to Achilles earlier that day by Roland Anderson, another scientist at the aquarium, and I was still having trouble with Anderson's description of him as "a young, pretty male." There are, as fellow life forms go, few as deeply alien -- in both substance and appearance -- as the giant Pacific octopus. "G.P.O." adults can weigh more than 100 pounds, and yet all of their throbbing, multi-tentacled mass can pass like water through a drain pipe no bigger in circumference than an apple, just wide enough to accommodate the octopus's cartilaginous beak, its only solid body part. These creatures look, at rest, like cracked leather discards from a handbag factory; in motion, like wind-swept hot-air balloons in severe deflation distress, with no one at home in the balloon's gondola but for a pair of unsettlingly knowing black eyes.

It was those eyes more than anything that I had asked Anderson for special permission to come back and stare into on my own. Just me and Achilles. With no one else around to make me \*self\*-conscious for engaging in a protracted stare-down with an octopus. For reading impossible complexities into his muffled side of the conversation. For tapping my fingers on the glass in hopes of getting Achilles riled. For behaving, in short, in a way that even I, an inveterate lingerer before zoo enclosures and fish tanks, would have considered preposterous had I not heard Anderson's real-life octopus stories earlier that day.

Anderson told me that he and his staff started naming the G.P.O.'s at the Seattle Aquarium 20 years ago. Not out of cutesy sentimentality. Anderson, a longtime marine biologist and the son of a sea captain, is not given to that sort of thing. It was, he said, because they couldn't help noticing the \*animals'\* distinct personalities. G.P.O.'s live about three or four years, and the aquarium typically keeps three on the premises -- two on display and one backup or understudy octopus -- so there have been a good number of G.P.O.'s at the aquarium over the past

two decades. Still, Anderson had little trouble recalling them: Emily Dickinson, for example, a particularly shy, retiring female G.P.O. who always hid behind the tank's rock outcroppings, or Leisure Suit Larry, who, Anderson told me, would have been arrested in our world for sexual assault, with his arms always crawling all over passing researchers. And then there was Lucretia McEvil. She repeatedly tore her tank apart at night, scraping up all the rocks at the base, pulling up the water filter, biting through nylon cables, all the parts left floating on the surface when Anderson arrived in the morning.

One particularly temperamental G.P.O. so disliked having his tank cleaned, he would keep grabbing the cleaning tools, trying to pull them into the tank, his skin going a bright red. Another took to regularly soaking one of the aquarium's female night biologists with the water funnel octopuses normally use to propel themselves, because he didn't like it when she shined her flashlight into his tank. Yet another G.P.O. of the Leisure Suit Larry mold once tried to pull into his tank a BBC videographer who got her hand a bit too close, wrapping his tentacles up and down her arm as fast as she could unravel them. When she finally broke free, the octopus turned a bright red and doused her with repeated jets of water.

Just across from Achilles that night was another G.P.O. named Mikala, their two tanks connected by an overhead, see-through passageway, the doors to which were closed. Mikala was a recent replacement for Helen, who had just been released back into the sea after a failed attempt by the scientists to mate her with Achilles. Anderson told me that they had left Achilles and Helen together in the same tank for a week, but, he said, "there wasn't any chemistry." In the coming months, they would be trying the same routine with Mikala, to see if anything clicked.

At one point I decided to absent myself from Achilles' stare and walk around to the far side of his tank to look at Mikala in hers. Standing in the narrow space beneath the overhead passageway, I found her sound asleep, mushed between her tank's outer glass and some craggy rocks. I thought about tapping the glass to see if I could stir her, but decided to leave her be. When I turned around, Achilles was right there behind me, bobbing against the glass, bright red, his black eyes opened wide.

"How do we even define what an emotion is in an \*animal?\*" I recalled Roland Anderson asking earlier that day. "And why do they even have these different temperaments?"

It was back in 1991 that Anderson and Jennifer Mather, a psychologist from the University of Lethbridge in Alberta, Canada, first decided to undertake a joint personality study of 44 smaller red octopuses at the aquarium as a way to begin to codify and systematize what they thought they had been observing. Using three categorizations from a standard human-personality-assessment test -- shy, aggressive and passive -- their data would ultimately show that the \*animals\* did consistently clump together under these different categories in response to various stimuli, like touching them with a bristly test-tube brush or dropping a crab into the tank.

"The aggressive ones would pounce on the crab," Anderson told me. "The passive ones would wait for the crab to come past and then grab it. The shy \*animal\* would wait till overnight when no one was looking,

and we'd find this little pile of crab shell in the morning.'

Anderson and Mather's resulting 1993 paper in the Journal of Comparative Psychology, entitled 'Personalities of Octopuses,' was not only the first-ever documentation of personality in invertebrates. It was the first time in anyone's memory that the term 'personality' had been applied to a nonhuman in a major psychology journal.

Scientists are not typically disposed to wielding a word like 'personality' when talking about \*animals.\* Doing so borders on the scientific heresy of anthropomorphism. And yet for a growing number of researchers from a broad range of disciplines -- psychology, evolutionary biology and ecology, \*animal\* behavior and welfare -- it is becoming increasingly difficult to avoid that term when trying to describe the variety of behaviors that they are now observing in an equally broad and expanding array of creatures, everything from nonhuman primates to hyenas and numerous species of birds to water striders and stickleback fish and, of course, giant Pacific octopuses.

In fact, in the years since Anderson and Mather's original paper, a whole new field of research has emerged known simply as '\*animal\* personality.' Through close and repeated observations of different species in a variety of group settings and circumstances, scientists are finding that our own behavioral traits exist in varying degrees and dimensions among creatures across all the branches of life's tree. Observing our fellow humans, we all recognize the daredevil versus the more cautious, risk-averse type; the aggressive bully as opposed to the meek victim; the sensitive, reactive individual versus the more straight-ahead, proactive sort, fairly oblivious to the various subtle signals of his surroundings. We wouldn't have expected to meet all of them, however, in everything from farm \*animals\* and birds to fish and insects and spiders. But more and more now, we are recognizing ourselves and our ways to be recapitulations of the rest of biology. And as scientists track these phenomena, they are also beginning to unravel such core mysteries as the bioevolutionary underpinnings of personality, both \*animal\* and human; the dynamic interplay between genes and environment in the expression of various personality traits; and why it is that nature invented such a thing as personality in the first place.

\*Animal\* personality studies are only the most recent manifestation of the inroads that science is now making into what has long been uncharted terrain: the very inscrutability of our fellow creatures that has, from the dawn of human consciousness, both begotten and bound us to our wildest imaginings about them. All sorts of research has been done in recent years revealing various aspects of \*animal\* complexity: African gray parrots that can not only count but can also grasp the concept of zero; \*self\*-recognition, empathy and the cultural transference of tool use in both chimps and dolphins; individual face-recognition among sheep; courtship songs in mice; laughter in rats. This is no longer merely the stuff of anthropomorphism or isolated anecdote. As Jaak Panksepp, the neuroscientist who first discovered rat laughter, has pointed out: 'Every drug used to treat emotional and psychiatric disorders in humans was first developed and found effective in \*animals.\* This kind of research would obviously have no value if \*animals\* were incapable of experiencing these emotional states.'

Now, with the emergence of \*animal\*-personality studies, we are gaining

an even fuller appreciation not only of the distinctiveness of birds and beasts and their behaviors but also of their deep resemblances to us and our own. Somehow, through the very creatures we have long piggybacked upon to tell stories about ourselves, we are beginning to get at the essence of that one aspect of the \*self\* we have long thought to be exclusively and quintessentially ours: the individual personality. The octopuses' garden is proving to be quite deeply and variously shaded indeed.

Appropriately enough for a newly emerging psychological science, the world's first \*Animal\* Personality Institute, or A.P.I., is still more of a proposition than a physical place. Indeed, outside of a newly established Web site with a flashy bright blue logo, A.P.I.'s only visitable locale can be found on the third floor of the psychology-department building at the University of Texas in Austin, in the small, book-crammed office of A.P.I.'s founder, Sam Gosling, a London-born, 37-year-old professor of psychology. "This here is my collection of \*animal\*-personality literature," Gosling told me one afternoon in October, pointing to a long row of thick blue binders along the top shelf of his office's bookcase, including \*animal\* studies from fields as diverse as agricultural science, anthropology, psychology, veterinary medicine and zoology. "We're trying to scan them all and make them available, because part of. . . I mean. . ."

A tall, gaunt figure whose flowing locks, untucked striped shirt, slightly flared bell bottoms and ankle-high leather boots give him the appearance of a 60's-era British rock star, Gosling is given to switching gears midsentence, his active mind going in a number of directions at once. "Part of what we're trying to do here," he continued, "is create a field."

Gosling, who often refers to himself as "a bit of a fraud," being what he calls "a personality expert who knows very little about actual \*animals,\*" was a young graduate student in psychology at the University of California, Berkeley, when he first came upon Anderson and Mather's paper on octopus personality. It was not at all an area of research he expected to be poking his nose into, having originally attended Berkeley to pursue a degree in human personality. But in the course of one of his first seminars, he suddenly found his thoughts going in an unlikely direction, what he now refers to as his "reductio ad absurdum moment."

"It was a basic seminar in human personality," he recalled. "We were considering the question of what is personality. And I thought, O.K., let's try to push it to its limit. To find out what personality is, let's start by taking what's clearly outside that category and discover what's different about that. Let's take \*animals.\* They obviously don't have personality. So then I thought, O.K., if \*animals\* don't have it, then what is it that makes them not have it, and I couldn't come up with an answer."

A standard answer, of course, is that \*animals\* do not, as far as we know, reflect upon and argue with their experiences, emotions and behaviors in the way that we humans do. They do not possess, in other words, that dynamic, \*self\*-reflective, internal dialogue the very outcome of which is, many scientists say, our personality. Of course, whether or not \*self\*-knowledge is truly a defining characteristic of personality is a question scientists disagree on, as they do about much

else in the field. Indeed, the whole notion of personality is one that we only began trying to measure and codify in the past century. Personality theory started showing up in the writings of Ivan Pavlov and Sigmund Freud as a somewhat vague, broadly drawn concept. It has only been in the last 60 years or so that the modern science of human personality began to emerge, a system of assessing distinct personality traits that has its roots in World War II, when the U.S. government assigned to the Office of Strategic Services (the forerunner of today's C.I.A.) the task of identifying which individuals had the right traits to be spies. A number of different personality-mapping methods and traits-assessment tests have been developed over the years, all of them pivoting around the principle that certain traits can be consistently observed in individuals across time and different situations. The most widely applied test today uses the categories defined by what is known as the Five-Factor Model (F.F.M.): openness, conscientiousness, extroversion, agreeableness and neuroticism. Under each of these broad dimension headings are so-called clusters of recognizable traits: an extroverted person, for example, is more sociable, outgoing and assertive; a neurotic one, more anxious, moody and stressed.

Gosling, however, was intent on exploring personality at its most rudimentary level -- below the radar, if you will, of human consciousness. Applying some of the very same personality assessments that we use on humans, he wondered whether we could observe in \*animals\* essential traits like fearfulness, aggressiveness, affability or calmness, traits that can exist outside of cognition and yet are clearly and repeatedly apparent in varying measures in different individual \*animals\* within a given species.

Does one duck, in other words, behave consistently differently from another duck, over time and across situations? If so, why doesn't that meet the definition of personality as we apply it to ourselves, regardless of the presence or absence of \*self\*-awareness? In a sense, Gosling was posing a psychologist's rendition of that old philosophical query about whether the tree that falls in the forest, miles from anyone's ears, still makes a sound. That is, if an \*animal\* behaves in distinctly consistent ways but isn't fully cognizant of such behaviors, can the behaviors still be aspects and indications of its personality?

One way Gosling set about answering that question was to focus on a colony of 34 hyenas being kept on the Berkeley campus by Steve Glickman, a professor of psychology. With Glickman's blessing, Gosling asked four caretakers of the colony to independently fill out questionnaires about each \*animal,\* using a modified version of the F.F.M. test. He soon found that the caretakers' assessments had the same level of agreement, or ''convergence,'' as is found in assessments done on humans, with such distinct human dimensions as ''excitability,'' ''sociability,'' ''curiosity'' and ''assertiveness'' being repeatedly observed.

Gosling then reviewed 19 different previous behavioral studies of nonhuman species through the same F.F.M. framework and found a similar recurrence of those dimensions across a surprisingly broad spectrum of species. Among the traits remarked upon were such things as ''opportunistic, \*self\*-serving'' behavior in certain vervet monkeys; ''emotionality'' in rats; ''fear avoidance'' in some guppies and ''extroversion'' in others; and, in Anderson and Mather's 1993 paper, both ''boldness'' and ''avoidance'' in octopuses.

'The evolutionary continuity between humans and other \*animals\* suggests that some dimensions of personality may be common across a wide range of species,' Gosling wrote in the resulting paper he published in 1999 in the journal *Current Directions in Psychological Science*.

'Scientists have been reluctant to ascribe personality traits, emotion and cognitions to \*animals,\* even though they readily accept that the anatomy and physiology of humans is similar to that of \*animals.\* Yet there is nothing in evolutionary theory to suggest that only physical traits are subject to selection pressures.'

Gosling told me that his seminar adviser thought the whole thing sounded a bit 'goofy' at first. Some of his fellow students, meanwhile, were irked at him for trying to bring the field of personality to disrepute, as Gosling put it, by studying silly, trivial, frivolous stuff. The major sticking point, of course, was his insistence on using the obviously loaded word 'personality,' a choice that he admits was purposefully provocative.

In some quarters, the term still rankles. 'Personality ratings have been done with chimps where you can see in them intimations of human characteristics,' says Jack Block, an emeritus professor of personality psychology at Berkeley. 'Now, where you want to take that, I don't know. Even with chimps, it is a big extrapolation from them to us. But personality in fruit flies or octopi? Heck, no. All living organisms do react to pain and seek what they have developed to want in terms of food or mating. But they cannot manifest the complexity of responses that human beings can.'

John Capitanio, a psychology professor at the University of California, Davis, who does extensive behavioral studies with rhesus monkeys, is more willing to extrapolate. '\*Animal\* behaviorists or behavioral ecologists are mostly interested in what the \*animal\* is presenting them with in terms of behavior,' he told me recently. 'And yet the behaviors exhibited are not dissimilar from our own, and that's what causes us to infer these personality characteristics. Now do they really exist in \*animals?\*' I think the answer is yes, they do in some form.'

In many of his early talks, people would ask Gosling why he didn't use the word 'temperament' instead of personality. His response was -- and is -- that temperament is always invoked as a purely biological, inherited quality, whereas personality is thought of as a 'higher order phenomenon' that grows out of the interaction of our inherited temperaments and our experiences. If he used only the word temperament with \*animals,\* he would be dismissing the possibility that they may have some of the same personality processes as humans. 'I don't want to rule that out,' Gosling told me. 'I also think the word personality is as appropriate for \*animals\* as it is for us. Of course, we still have to be suspicious. People will also rate the personality of a loaf of bread or a car. A colleague has poked fun at me about that: 'A temperamental car is difficult to start across time and situations. So why isn't that personality?' Well, the fundamental difference, of course, is that with an \*animal\* there is an underlying physiology and biology. Saying my car is temperamental is an analogy. And some people will rate dogs not only as friendly or fearful but as philosophical. Now, I do not believe dogs are philosophical, whereas I do believe in their fearfulness. So we have to be careful where to draw the line

between what's reality and what's analogy.'

Dogs, in a way, offer the most obvious proof of the existence of \*animal\* personality. They have long been bound to us and bred by us precisely for their very particular physical and temperament traits, and, of course, even among specific breeds there are all kinds of variation in the personalities of individuals. Indeed, \*animals\* like dogs and cats point up what often appears to be a paradoxically prodigious ''duh factor'' behind this otherwise cutting-edge science. While scientists may tussle endlessly over the validity of applying the word personality to nonhumans, for people in the everyday world -- especially those who spend any time around \*animals\* -- the assertion that they have distinct personalities seems absurdly obvious.

Not so very long ago, concepts like \*animal\* sentience, emotion and personality were not merely the stuff of anecdotes told by farmers and pet owners; they were wholly embraced by the scientific community as well. In the late 19th century, \*animal\* emotion and behavior were integral aspects of the newly emerging science of human psychology. Charles Darwin devoted much of his time after the publication of ''The Origin of Species'' to researching ''The Expression of the Emotions in Man and \*Animals,\*'' published in 1872. Although that era's cross-species conjecturing and comparing was often naive or intuitive, the impulse behind it went on to inform human psychological study well into the 20th century. Beginning with the appearance in 1908 of more sober, scientifically sound works like John Lubbocks's ''On the Senses, Instincts, and Intelligence of \*Animals\* With Special Reference to the Insects'' or Edward L. Thorndike's ''\*Animal\* Intelligence,'' \*animal\* studies figured prominently in standard human psychology textbooks well into the 1940's. And then, steadily, the \*animals\* began to disappear.

At one point in his Austin office on the afternoon I met with him, Sam Gosling pulled from his shelves the 1935 edition of ''A Handbook of Social Psychology,'' a standard human psychology textbook of the time, and showed me the table of contents. More than a quarter of the textbook's chapters were devoted to studies of \*animals\* and other life forms, titles like ''Population Behavior of Bacteria,'' ''Insect Societies'' or ''The Behavior of Mammalian Herds and Packs.'' There is even a chapter devoted to ''Social Origins and Processes Among Plants.'' But in the 1954 edition of a similar work called ''The Handbook of Social Psychology,'' there is but one chapter devoted to nonhuman research. Titled ''The Social Significance of \*Animal\* Studies,'' it is essentially a desperate last plea to social psychologists not to abandon \*animal\* studies, arguing at one point that ''social psychology must be dangerously myopic if it restricts itself to human literature.'' The warning clearly went unheeded. The most recent edition of the handbook, from 1998, is devoted entirely to humans.

The banishment of our fellow beasts from psychological literature can be blamed by and large on that branch of psychology known as behaviorism. The field's major proponents, eminent psychologists like B.F. Skinner, stressed the inherent inscrutability of mental states and perceptions to anyone but the person experiencing them. And even though the behaviorists were themselves major proponents of the use of \*animals\* in behavioral research, they sought to rein in subjective verbal descriptions of the \*animals'\* mental states, as well as the sorts of experiments that relied on such necessarily vague data. If the human

mind was, as Skinner famously referred to it, ''a black box,'' then surely the minds of \*animals\* were even further beyond our ken.

''The great and enduring contribution of behaviorism,'' Gosling says, ''is that it introduced the scientific method to the study of behavior. They said, 'Let's get rid of the fuzzy, sentimental higher-level descriptions.' And they did. They went to great efforts to record specific behaviors, things like how many times a chimpanzee scratched its head or nose. But it's hard to study higher-order phenomena, things like personality and emotion, in just those ways. In the end, what you're left with is this long catalog of meaningless descriptions. If I need to know whether I can go into that cage or not to clean it, it's not useful to tell me the chimp scratched its nose 50,000 times in the past year. Just tell me, Is it aggressive or not?''

In their dogged pursuit of hard science and their strict avoidance of what Sam Gosling referred to in his first published paper as the ''specter of anthropomorphism,'' the behaviorists, especially in the eyes of many who currently study \*animal\* behavior, greatly limited the field of psychology by ultimately outlawing things like intuition, inference and common sense. Now, however, the pendulum has begun to swing back in that direction, and it is a shift that has been impelled, somewhat surprisingly, by hard science.

Advances in fields like genetics and molecular and evolutionary biology have lent to the study of psychology something that it really didn't have when behaviorism first came to the fore: a better understanding of the biological and bioevolutionary underpinnings of behavior. No longer is the study of \*animal\* behavior rooted in that inherently naive and anthropocentric desire to see ourselves in \*animals\* or to project upon them our thoughts and feelings. \*Animal\* personality, along with such integral fields as \*animal\* behavior, behavioral ecology and evolutionary biology, all pivot now around what might be called deep analogies. The more detailed and specific our knowledge has become of the \*animals\* and of the many differences between them and us, the more clearly we can see what is analogous about our respective behaviors.

\*Animal\* personality, in other words, is now redirecting psychology's focus in a direction the behaviorists would most appreciate: away from airy abstractions about personality and down to its very tangible and widely dispersed roots. It might be thought of as a kind of biological Buddhism or muscular mythologizing or armed anthropomorphism: a more disciplined and detailed form of that idle speculating we have all done in front of the head tilt of a dog or the sudden skyward shift of a flock of sea gulls or the comings and goings of ants around their respective mounds.

''Now, those there I can almost guarantee you are females,'' Jason Watters, a behavioral ecologist at the University of California, Davis, told me one afternoon this past autumn. He was pointing to a cluster of water striders that had climbed up the side wall of one of the collecting pools in the artificial stream that Watters had erected at the far western edge of the Davis campus for a six-month study that he and his lab director, Andy Sih, recently completed on the role of genetic and environmental factors in the expression of behavior in water striders: those spindly black, surface-flitting wraiths whose indent on their tenuous native terrain is never more than four slightly concave,

lunar-module-like landing cups.

Watters personally reared several thousand water striders for the experiment and would come to know them about as intimately as any human can an insect. He knew each strider's parents and siblings. He photographed and marked each of them with paint-on numbers and then tracked them through more or less every circumstance and experience in their roughly yearlong lives: what and how they ate, their responses to new environments or to simulated predator attacks, their social interactions and mating practices out in the simulated stream.

'I haven't gathered all the data yet,' Watters said, grabbing one of the clustered striders and confirming his suspicion about its sex. 'But what we do know is that these water striders express consistent behavioral types. Like in the presence of a predator some individuals will run and get right out of the water. Others don't seem concerned whatsoever. Just sit there. Others get out and then get back in after a little while. So there's a great deal of variation in what they do. Especially in a mating situation, here in the stream we've found among the males that there is the consistently more aggressive guy -- so that's his type or his personality -- and then there are these very active, hyperaggressive males. They're the ones who are always forcing females to have sex and driving them out of the water and really messing things up for themselves and everybody. We don't know yet if this is really the best way to be or what the point of it is. We're working on that. But I've got to believe there's going to be some circumstances where it's a good idea to be a really mean, brutish type of guy and others where it's not.'

A similar array of behaviors is now being encountered in other insects. In her current research at Davis, Judy Stamps, a professor of biology and \*animal\* behavior, has been looking into how early experience affects habitat selection in drosophila, better known to you and me as the common fruit fly. Stamps escorted me one afternoon to one of the biology department's '\*animal\* rooms,' where she and her students have been conducting their experiments. The room was the size of a small walk-in closet, barely large enough to contain the 11-foot-long metal table before us.

To a tiny fruit fly, however, the strange, artificial fruit-bowl habitats of upward twisting wire set at either end of the table are separate universes, the various fruit-shaped planets of which, Stamps has discovered, fruit flies approach and settle in a number of ways, some of which depend on early experience and some on their distinct personalities. Fruit flies born and raised on a plum, for example, will seek out the next plum to settle upon, as will the offspring that they raise there: a 'no place like home' impulse. But in the course of their research, Stamps and her students have also encountered everything from overly shy, timorous fruit flies to bold trailblazers to downright feisty and ultimately \*self\*-defeating bullies.

'You don't think of drosophila in that way,' Stamps told me. 'They can be very territorial, and some of the males are fairly aggressive. They tussle with each other. When we did our free-range fly experiments, we marked them individually. We put little colored paint dots on their thorax. The students loved it. They'd say: 'You know Blue? He's been attacking everyone this morning. He's on Banana A, and everyone else is

on Banana B. He's the ruler of Banana A.' Of course, the other thing we've noticed is that individuals that behave like Blue get into trouble because, you see, they end up with nobody to mate with.'

Another member of Andy Sih's lab, Alison Bell, has done extensive studies of the three-spined stickleback fish, a tiny prehistoric-looking fish with armorlike outer lateral plates and serrated, lancelike spines protruding from the dorsal region. As well as finding the same spectrum of behaviors in sticklebacks -- from extremely bold and bullying sticklebacks to extremely shy and timid ones -- Bell has found groups of sticklebacks that exhibit a similar type of behavior: tribelike populations of bold and aggressive sticklebacks, for example, or of extremely timid ones. Their collective disposition seems to have been shaped by the respective environment in which they were raised -- whether it was predator-free or predator-laden -- and their physical appearance reflects their environment as well: the timid sticklebacks having far heavier armor and longer, more serrated spines.

The questions that scientists are now beginning to address are why evolution has wielded such a variety of temperaments in *animals* and why it hasn't weeded out the clearly deleterious ones: the shyness and timidity that deprives some members of a group of food or mates or the overaggression and extreme risk-taking behavior that can often result in both the disruption of the group's overall reproductive success and the aggressors' becoming some other creature's food.

Roland Anderson sees the diversity of temperaments as a manifestation of that most basic biological imperative of survival, an array of personality traits being kept in play in a given species because of the differing, shifting environmental circumstances that groups may encounter. 'What happens,' he asked, 'if a big school of herring comes along and eats all the aggressive, fearless males in a group of smaller fish? Well, there will still be some of the more passive or shy ones hiding under that rock that can say: 'Hey, they're all gone now. There's a nice-looking female over there. I think I'll reproduce with her.''

Andy Sih, like most of his colleagues at Davis, views personality differences in *animals* in a Darwinian context. He considers specific behaviors and preferences from an evolutionary perspective and tries to determine how various traits affect the long-term survival of a given species. And in the course of his research on everything from water striders to salamanders, Sih has become fairly obsessed with what he calls 'stupid behaviors,' ones that don't seem to make any evolutionary sense whatsoever.

'You'd expect *animals* to be doing smart stuff,' Sih told me one evening over dinner. 'The whole tradition in most of evolutionary ecology has been to emphasize adaptation where organisms do smart things. But I've been making the case for a while that the most interesting behaviors are actually the stupidest.'

It's typically the males of a given species that seem to figure most prominently in the stupid-behavior department -- the militant, mayhem-causing water striders and sticklebacks, for example, or fierce male Western bluebirds, who spend so much time defending nests or courting females that they completely neglect their own offspring. But

perhaps the most glaring instance of dumb-\*animal\* doings is to be found in the female North American fishing spider. Studies have shown that a good number of female fishing spiders are from a very early age highly driven and effective hunters. It is a trait that serves them well most of their lives, particularly in lean times, but it wholly backfires during mating season, when these females can't keep themselves from eating prospective suitors.

'Now why would anybody, why would any organism do that?' asked Sih. 'If you look at these female spiders just in the context of mating behavior, you would conclude that they're doing something mighty stupid here. But their behavioral type is very good for them for much of their life growing up in a highly competitive world where food is often scarce. They're so geared up, though, that when mating season comes around, they really mess up. And experiments have shown that even if they're given a reasonable amount of food, they'll still behave this way.'

These same hyped-up females have also been shown to be the most fearless in the face of predators. In simulated attacks, all fishing spiders retreated underwater. The overaggressive, ravenous females, however, were always the first to pop back up, giving them at once the greatest chance of getting available food and, if the predator was still around, of becoming its meal. Of course, a good proportion of female fishing spiders are able to make the distinction between sex and dinner and between finding and becoming dinner. But for Sih and others, the persistence in certain members of a species of these extreme behaviors and the inability of some to modulate that behavior give rise to a more profound question about the nature of personality types in general and how plastic or not they actually are, whether in \*animals\* or humans.

In \*animals,\* it is now becoming evident, there is a certain degree of evolutionary inertia when it comes to their behavior, wherein the very behaviors that accord some members of the group a distinct evolutionary advantage in one set of circumstances can do them in in the next. They are stuck, to some extent, with their distinct ways of being. We humans, on the other hand, tend to think of our personalities as protean, mutable entities that, unlike our physical selves, we can shape to suit shifting circumstances. Sih disagrees. He says he thinks that our behaviors, no matter how complex the human social contexts that help to shape them, are not nearly as pliant as we believe them to be.

'Behavioral ecologists actually tend to model \*animals\* and humans as both being very flexible, as being capable of changing their behaviors as necessary to do the right things in all situations,' he said. But in our own day-to-day experience, he said, we recognize that humans don't really behave that way. 'We all know that overly bold person,' he pointed out. 'We have friends like that. They do things that are just like: Hey, this can get you killed. What are they doing that for? And there are people that are shy, and they're missing out on opportunities they could have had.'

There is currently a paucity of human studies along these lines, but a recently published human-personality study of 545 people by Daniel Nettle of the University of Newcastle in England shows a strong parallel with some of these recent \*animal\* studies. It found that the more extroverted and outgoing people were, the more sex partners they tended to have, an evolutionary edge that was mitigated by the fact that these

were the same people who were most likely to end up in the hospital because of stupid risk-taking behaviors.

Indeed, however elaborate an argument we humans may have with our own biology, we are each of us to some extent locked into a personality type, a consistent way of being without which we would each be, in a sense, unrecognizable to ourselves or others. The oft-heard comment "Hey, that's not like you" is a tacit acknowledgment of your recognizably consistent way of being. If, in other words, someone were to be entirely flexible and unpredictable in their behavior, were able to respond with any one of the full palette of behavioral responses in any given circumstance, they would be not only, as Andy Sih put it, "scary to be around," but they would also be someone of whom you could say, they have no personality.

This set of ideas, Sih told me, suggests new questions that are rarely posed about humans. "Like why do we even have a personality?" he asked. "Why do we have a relatively narrow range of responses as opposed to a full range? Why can't we all be bold when we need to be and cautious and shy when we need to be? Then we'd have no identifiable personality, and that would free us all to become optimal."

For Sih, the answer seems to be that our personality is a manifestation of a complex interplay between genetic inheritance and environment and early-life experience. Bold people, for example, are both naturally disposed to boldness and, further, choose to be bold, becoming ever better at it, building from an early age a mountain of abilities and tendencies that become a personality. It might happen, as well, that an inherently shy person is induced by an early-life experience to venture away from his or her natural disposition and cultivate a bold personality. But whether a person ends up building and climbing a shy or a bold mountain, it may become increasingly difficult to come back down and build another one.

"It's not impossible," Sih said, "but it's not going to be easy. I'll give you another human example. It's always mystified me why anyone would be a pessimist. It seems to me like optimism has to be the way to go. But, in fact, there is some recent literature that shows that pessimists are good at being pessimists. And that when things go badly, they expected it anyway, and it doesn't hurt them. And so it's this notion that personality types build because of these feedback loops."

In human beings, of course, as with other highly social species, the shaping of personality entails a complex web of influences and imperatives. It is not merely about the acquisition of food or mates but involves as well issues of group interaction, cooperation, deception and so on. It is a dynamic that, in an ever more complex series of evolutionary feedback loops, at once impelled the formation of larger and more sophisticated brains and the more nuanced emotional responses to social interaction -- feelings of embarrassment, guilt, empathy, confidence, etc. -- that such a brain allows.

The attempt to parse that web of entanglements has for decades been a motivation of fields like psychology, psychiatry and sociology. What seems so promising about the field of *animal* personality is that in the course of allowing us to better understand and more effectively conserve the *animals* themselves, it is also affording scientists new

pathways of understanding ourselves and our behavior, through the kind of experimentation that we are unable to perform on humans.

'Do thrill seekers thrive in certain speculative business or military environments?' Sih asked. 'I don't know. But I can do experiments to look at analogous situations in \*animals,\* can take different \*animals\* with different personalities and see how they do in different environments -- in a high-predation-risk situation, in a cooperative situation, during a courtship-mating situation. Along similar lines, we can test ideas like, Are \*animals\* particularly aggressive when they invade new regions because it is primarily the bold, aggressive individuals that tend to immigrate to new areas? How does the personality of the immigrant pool in humans differ from those who stay behind, and does that difference influence success -- and does this basic view apply to the melting pot of America?'

Alison Bell has done related experiments with sticklebacks. It has long been clear to researchers that fish that have lived for many generations in the proximity of dangerous predators are less bold and less aggressive than \*animals\* that have lived relatively risk-free. What Bell discovered is that those cautious tendencies outlast the presence of risk, even by a generation. When she moved sticklebacks who had always lived in a high-risk environment into a low-risk environment, she found that not only did they retain their cautious tendencies, but so did their offspring. Even fish raised from birth in a low-risk environment behave more fearfully if raised by a particularly vigilant father from a high-risk background.

'There's definitely the effect of genetic difference,' Bell explained, 'but there's also the effect of what is experienced as they grow up. Genotype and environment interactions make it difficult to detect the effects of genes, because you have to take the environment into account. This is annoying to geneticists.' To scientists like Bell who are studying the interplay of genes and environment, however, it is of profound interest.

In the coming year, the sequence of the full stickleback genome will have been assembled, which will open doors into all kinds of cross-species research on the relationship between genes and environment. Alison Bell will be looking at such things as risk-taking behavior in sticklebacks -- which may, by extension, give us insight into the behavior of humans. The same genes and hormone receptor systems associated with such behaviors have been conserved across a broad spectrum of species from sticklebacks to rhesus monkeys to us. John Capitanio has already done a number of experiments with rhesus monkeys that look into how the manner of their rearing affects what Capitanio (in a hedge on the loaded P-word) calls an \*animal's\* 'biobehavioral organization' -- and how, in turn, that biobehavioral organization affects everything from gene expression to immune-system function against ailments like simian AIDS.

What once seemed the hopelessly subjective pursuit of understanding human behavior and personality is now increasingly being tied down to and girded by the objective moorings of our own and other \*animals'\* biology. The very names of newly emergent fields like biological psychiatry, molecular psychiatry and, of course, \*animal\* personality reflect this trend. It is not, as Capitanio points out, a reductionistic

concept but more of a holistic one, one that allows for an unprecedentedly subtle reading of the integrative influences -- genetic, experiential and environmental -- that shape each individual's personality.

Capitanio is currently writing, with Sam Gosling, the first chapter on \*animal\* personality to be included in 'The Handbook of Personality,' a standard reference book of human-personality psychology. This week, he will be in Palm Springs, Calif., presenting a paper on personality in rhesus monkeys as part of an \*animal\*-social psychology symposium led by Gosling at the annual meeting of the Society for Personality and Social Psychology, the first symposium of its kind at a human psychology conference. For Gosling, it is the realization of the very thing he envisioned when he first started pursuing the possibility of personality in \*animals\* at Berkeley back in the mid-1990's.

'What really got me interested when I started exploring this,' Gosling told me, 'is I noticed that what the \*animal\* researchers were doing in practice was exactly what human researchers were saying would be the perfect study they could do in a perfect world. Like you ask a human personality researcher, they might say what we'd do is take a bunch of individuals, and we'd watch them from conception till death and record all the major events in their lives and know who mated with whom and who had a fight with whom. And if we wanted, we could give them frightening stimuli and so on. And a lot of my job is saying to those in human psychology: 'Hey, you should talk to these other guys. What they're doing is really relevant.' I'm like the middleman.'

Looking through some of the \*animal\*-personality literature in Gosling's office that afternoon, I came upon an intriguing paper titled 'Microscopic Brains,' published in the March 13, 1964, edition of the journal *Science*, in the midst of the great \*animal\* blackout from psychological literature. Written by a professor of zoology and psychology at the University of Pennsylvania named Vincent Dethier, the paper is at once a study of insect behavior and a remarkably prescient argument for a more intuitive, empathetic and integrative approach to the study of psychology.

'The farther removed an \*animal\* is from ourselves,' Dethier writes, 'the less sympathetic we are in ascribing to it those components of behavior that we know in ourselves. There is some fuzzy point of transition in the phylogenetic scale where our empathizing acquires an unsavory aura. Yet there is little justification for this schism. If we subscribe to an idea of a lineal evolution of behavior, there is no reason for failing to search for adumbrations of higher behavior in invertebrates.'

Dethier concludes on a decidedly haunting note: 'Perhaps,' he writes, 'these insects are little machines in a deep sleep, but looking at their rigidly armored bodies, their staring eyes and their mute performances, one cannot help at times wondering if there is anyone inside.'

We will never know, of course, one way or the other. And yet somehow, science, of all things, is rendering the empirical answer to such a question incidental to a more felt and intuitive one. Perched now, like entranced children, along the banks of their respective simulated streams, scientists are staring for hours at the least human of

creatures -- everything from bullying fruit flies to ravenous, oversexed water striders and fishing spiders to perilously fearless hordes of armored stickleback fish -- and are beginning to see in them not just their distinct patterns of behavior but also something deeply and distinctly recognizable. Something, well, not altogether inhuman.

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