

Janet L. Jones, PhD

Author of *Understanding Psychological Science* and
The Psychotherapist's Guide to Human Memory

HORSE BRAIN



HUMAN BRAIN

The Neuroscience of Horsemanship

*Getting Smart About How Horses and Humans
Think, Act, and Work Together*

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The Brain—is wider than the Sky—
For—put them side by side—
The one the other will contain
With ease—and You—beside—

The Brain is deeper than the sea—
For—hold them—Blue to Blue—
The one the other will absorb—
As Sponges—Buckets—do—

The Brain is just the weight of God—
For—Heft them—Pound for Pound—
And they will differ—if they do—
As Syllable from Sound—

Emily Dickinson, c. 1862

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PART ONE



Animals in a
Human World

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CHAPTER ONE

The Horse-and- Human Team

“**H**ere. I don’t even wanna *hold* ‘er. Don’t wanna *see* ‘er! Nutcase still won’t get in the trailer. Jus’ set her out by the road with a sign ‘round ‘er neck: ‘Free flippin’ *horse*.’” My red-faced friend stomped off, leaving me on the dumb end of a sweaty sorrel’s lead rope. Apparently, their teamwork over the past several hours had not gone well.

Horses and people have been working together, or trying to, for at least 5500 years. Evidence comes from Kazakhstan, where Stone Age tools show that horses were milked for human food and bridled for riding or driving. Since then, we’ve joined these creatures of power and beauty on all sorts of tasks: military, agricultural, transportation, law enforcement, therapy, performance sports, ranch work, companionship, exercise, and recreation. Horses have played starring roles in almost every aspect of human life.

Today, horses are an estimated 60 million strong worldwide. The American Horse Council Foundation reports that our four-legged friends pack a financial punch of \$122 billion a year and create almost 2 million full-time jobs in the United States alone. About 27 million Americans ride. That’s a lot of cross-species pairs trying to work with each other.

Horse Brain, Human Brain explains and applies principles of brain function that improve horsemanship across the entire spectrum of horse-and-human teams. And what a spectrum it is! Disciplines include driving, jumping, reining, vaulting, foxhunting, cutting, rodeo, barrels, endurance, racing, pulling, ranch work, dressage, roping, trail, and much more—the equine family is über-versatile. We cubbyhole types of riding: Western,

English, dressage, Australian, hunt seat, jumping seat, saddle seat, jockey seat, bad seat, and so on. Okay, I'm kind of kidding with that last one, but not much!

Worldwide, at least 4,150 different breeds of horses exist today. Many of them are specialized for their disciplines. For example, we'd be surprised to see a Clydesdale in a saddle-seat equitation class or a Selle Français roping. *Equus caballus* is a species of tremendous range.

Of the few factors common to such dizzying variety, the most critical is the brain. It controls every behavior, from an eye blink to an aerial capriole. Every horse and every human has one, and it determines the success or failure of our partnerships. So if you want a better team, get to know your horse's brain—and your own.

Trial and Error

Through most of our past, people have used trial and error plus apprenticeship to train horses and riders. We set a simple goal for a horse, try several means of achieving it, and use the one that works. Trainers then teach other handlers the selected technique.

This method has been popular for centuries, but doesn't work all that well. For one thing, trial and error means making a lot of mistakes. With each effort, we run the risk of teaching the horse something we didn't really want him to know. Then we have to “un-teach,” which is often difficult and sometimes dangerous. The horse becomes confused—or worse, annoyed—with his career as an experimental guinea pig.

For another, the old method is generic. “One size fits all” doesn't work well with animals. Each horse—like each human—is unique, with a different background, and various experiences, strengths, and weaknesses. Even the brain of a cloned horse differs from the original because his daily experiences are not the same. So, the training technique that achieves a goal for one team might be useless or detrimental with the next.

Add to this the fact that quite a few training techniques are not as teachable as we might like. Raise your hand if your trainer has ever said, “Move your leg like this,” in a manner that your leg couldn't approach if

it was made of silly putty. Without superb apprenticeship, it takes a lot of time to hunt, peck, and cuss your way to a well-mannered horse and a skilled rider.

And too often, our chosen technique flies in the face of brain function. For example, we can urge a mounted horse straight toward a frightening object, as most riders do, but this method works *against* his brain rather than with it. Riding against the brain occurs more frequently than you might guess. As you learn more about equine and human brains, you'll see the conflict often.

The root of our trouble with trial and error followed by apprenticeship is that it fails to say why or how a particular technique works. Here's where brain science can lighten our load. By learning the why and how of horse and human brains, we can improve a team's skills far beyond the norm. We ask why a horse does something then ask how that behavior can be changed at the level of his brain. When we know the principles common to equine noggins, we have greater ability to predict which techniques will work.

Brain-based horsemanship also helps us design creative new techniques that work best for specific teams. Using the basics of brain function, we can train horses and riders to perform in harmony with the inner workings of their natural minds—while still taking their individual differences into account. It's akin to the old saw that if you give people fish, you feed them for a day, but if you teach them to fish, you feed them for a lifetime. Both parties end up happier and more successful.

Human and Equine Brains

Horse sports are just beginning to include brain science for riders. A few psychologists work with equestrians to build the mental discipline needed to perform and compete. Sports psychology teaches riders to focus even under the circus top of a horse show, to steady our nerves against stage fright, to practice challenging tasks and overcome daily weaknesses with self-discipline, and to accept the criticism that daily training entails. Such lessons benefit horses indirectly because good riders transmit focus, calm, discipline, and confidence to their mounts.

Still, these goals represent only one grain of sand in the arena of brain-based horsemanship. They fail to address the ways that the human brain directs the body while working with a horse—the precise physical timing, tiny balance shifts, and wondrous range of sensitivities that are necessary. They ignore many of the emotional aspects of training a horse—the almost pathological measure of calmness that horses sometimes need from us, combined with the ability to deliver varying degrees of authority. They disregard the communicative aspect of horse-and-human collaboration—knowing when to use which voice or posture, how to transmit zen, and why we must comprehend body language between species.

Our sport offers a tiny grain of brain science for riders at this point, but almost no knowledge of brain function in horses. There's a dollop of anatomy here and a smidgen of physiology there—but the material tends to be speculative, inapplicable, or irrelevant. Too often, it's also inaccurate. Why? There are several reasons:

- Many facts about the brain are new and much of the science is still in flux. Forty years ago, we didn't have brain imaging machines that could look inside the head or parallel processing computers powerful enough to simulate thought. Now we do, but we're still in the process of developing this new knowledge and extending it across scattered domains.
- Horses are hard to test. You can keep a hundred lab rats in a room and experiment with them pretty easily, and you can call in 100 people to volunteer as research subjects—but 100 test horses will run you ragged. They need more space, time, staff, food, water, cash, equipment, and specialized knowledge than other animals do. Not to mention all the liability insurance.
- Most people, horsey or not, don't realize how much training our animals need. The task seems simple on the surface, so people wonder why they should cram a bunch of factoids about equine biology into their busy minds. Just hop on and ride! Too many riding students have swallowed the illusion that one lesson a week breeds true skill. Three-day colt starting contests suggest to newbies that training is completed

in a weekend. Novice owners still pay for 30-day wonders—horses who are expected to meet complex training goals in a month—without realizing these are the province of fraudulent operators.

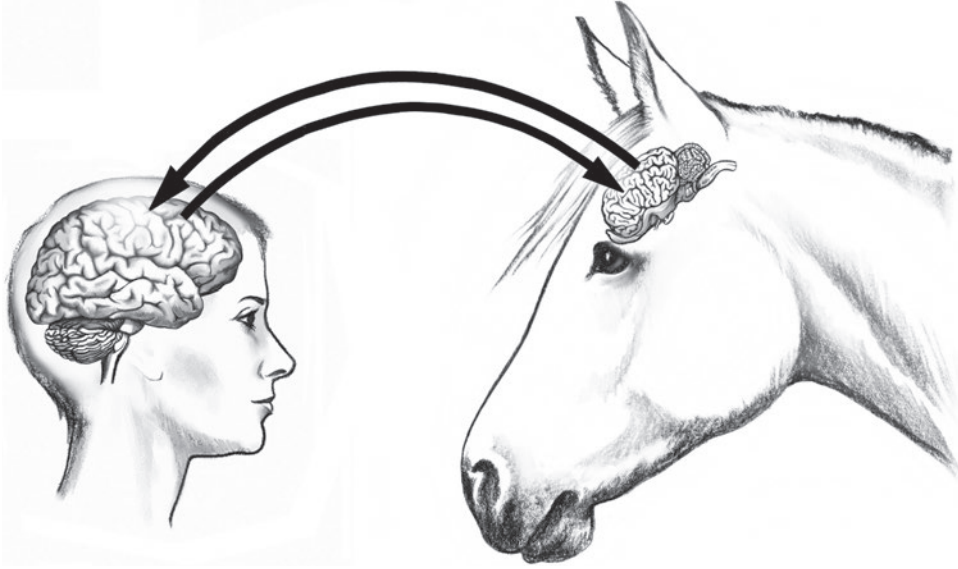
In fact, freshly started horses don't even know how to walk a straight line. They can't balance the weight of a rider and haven't realized they need to turn a corner when they reach one. They have no idea what the rider's most basic cues mean. These youngsters are still learning the basics of "stop," "go," and "don't you dare buck me off." The human world is a bewildering jumble of chaos to the green horse. Years of work are needed to train him for reliable human interaction and solid performance.

- There's precious little cross-talk between brain scientists and horse trainers. We live in different worlds and don't lean on the barn fence together to chat about our work. The person who links brain science to horsemanship needs to wear a lab coat and breeches at the same time, some crusty old cowboy boots too; somebody who can explain neurology without using the word "neurology." A straight-talking, ink-stained, horse nerd.

Brain Interaction

Beyond learning how horse and human brains operate in isolation, we must reflect on how they interact. Mutual interaction is the key to teamwork. It's the rare partnership in life that lets two brains work together, especially two brains from different species, but that's exactly what brain-based horsemanship offers (fig. 1.1). A flutter of nerve cells fires in your brain as you ask a horse to move forward. The horse takes a step, while his brain sends neural signals back to you. You pick them up, and so on. Two brains dancing together like this is as natural a form of communication as two species can enjoy. How does the process work? Why does it sometimes fail? How can you maximize it for greater success?

One thing to do is reject the notion that horses must always bow to human ways of thinking. Of course, you set clear boundaries and firm expectations, but training is much more effective—and more



1.1 Mutual interaction within the horse-and-human team depends on communication between two species' brains.

rewarding—when you listen to what your horse is trying to convey. Hollywood sells that romantic myth of horse whispering, but the best trainers don't whisper—they *watch, listen, learn, and think*. The horses do the whispering. The human's job is to rivet attention to their faintest hints. Let's try to connect with animals at their level, instead of demanding that they constantly adjust to us.

To develop mutual interaction of this sort, ask yourself what's going on inside the horse's head. Suppose you want your horse to lead quietly. Most educated handlers start with the question, "How can I teach him that?" But you need to take a step farther back, asking, "How does he learn?" You want him to stop shying at unexpected sights, "How does he see? Why is he afraid?" You'd like to develop a closer attachment with him, "How does he bond? What does security mean to him?"

All well and good, you might say, but tick...tock.... Asking these questions and learning the answers takes time. It's faster to just make a horse follow orders. (Well, sometimes.) But forcing is not teaching, and it doesn't

last. Instead, why not pique the horse's interest, appeal to his natural curiosity, encourage him to *want* to meet our needs? And, in turn, let's meet his!

Working with a horse's brain—instead of against it—smoothes every mutual interaction, from a pasture greeting to open flight over an eight-foot puissance wall. Too often, horse-and-human partnerships are a one-way street on which we command and they respond. To a surprising degree, many horses accept unilateral pronouncements. But training improves by leaps and bounds—becoming safer, gentler, faster, more effective, and immeasurably more interesting—when communication within the partnership flows in both directions. We then begin to experience the world through the brain of another species. It's an amazing feeling, and it illuminates everything we can know about true horsemanship.

Cross-Species Communication

Asked which species of animal is best at mutual communication with humans, most people would guess dogs. After all, dogs are the most common pet and have evolved an innate alertness to human signals. But I believe the potential for cross-species communication is much greater between horses and riders. Why? Because in addition to the voice, gesture, and body language we use with dogs, our bodies are in frequent contact with our horses. Each party transmits and receives information through skin, muscles, tendons, weight distribution, and balance. This contact triggers that dance between equine and human neurons that I mentioned a moment ago.

Despite their size, horses are unbelievably sensitive. Imagine asking a horse to slow his pace while working under saddle. One of the cues a good rider offers is to squeeze her shoulder blades together, opening the upper chest. This change causes a neural network to fire in the horse's brain. The trained horse instantly responds by slowing slightly. That response is conveyed through the rider's body directly to her brain, which sends the next message to the horse. And so on, with neurons firing from equine brain to human brain and back. It's the equivalent of a direct neural link with no translation needed—like mainlining nitroglycerine straight to the heart instead of letting a pill melt under your tongue.

Horse Brain, Human Brain explores our own and our horses' minds to achieve several goals:

- We can deepen bonds by adapting our forms of communication to theirs. Connect with a horse, and suddenly he trusts you to take him to fearful places and ask him to perform difficult feats.
- With knowledge of his brain, we can train an animal with insight and kindness instead of force or demand. If the animal knows we understand his fears and will accommodate them while teaching, we are on the road to success.
- We can comprehend a horse's misbehavior in ways that prompt creative new solutions. Why is this sorrel mare refusing to load? Let's look at how her brain works and what she's telling us with her form of communication.
- By analyzing the differences between species' brains, we can reduce our own mistakes. Any animal trainer will tell you that the hardest part of the job is training the human.

Obstacles to the Goal

We could yammer all day about the need for brain science in handling horses. Most people would agree it's a reasonable idea. But in practice, there are obstacles. Let's push them aside right now:

"Brain science? Are you kidding? I barely escaped college." Brains might be the most fascinating frontier in the universe, but they are not the easiest. In this book, I will talk "brains" in the most direct way—without a wheelbarrow full of high falutin' Latin syllables. You don't have to grasp every nuance of neural operation in order to apply some useful knowledge to your riding.

"Pfft. I'd rather ride than read." For sure, riding is a lot of fun. But it's even more fun when you ride well enough to establish a true relationship with your horse. Understanding how he thinks will help you do that. Plus, it's not only about the riding. Your horse wants to get to know you. With his help, you can prove that brains rule.

“Just show me the ‘obey’ button.” Ah, if only I knew where it was! The behavior you want is probably too complicated for one or two buttons—getting a racehorse to stand still, for example, takes scores of buttons. Now, it is true that you could take your horse to a trainer for a year or two of tutoring, and that trainer might create some buttons and teach you how to push them. But then you’re not really interacting with the animal. If you just want an “obey” button, buy a golf cart. It eats less.

“Anything with the word ‘science’ is boring and obscure.” Scientists are just regular people. We’re curious about the hows and whys of life, and we break our work down into basic steps to manage it from one day to the next. You probably do the same in your job. It’s actually kind of fun to learn how your brain works: “Why did I think that? Uh-oh, why did I say that?” It also feels good to see the interest in your horse’s eye when you try something brainy with him and he gets it.

“I’m the human, the horse does what I say.” One very natural aspect of the human brain is that it is centered on itself. It has to be in order to survive. Human egocentrism has been part of horse training ever since the Greek philosopher Xenophon wrote about riding back in 350 BC. But getting a 1,200-pound fear-based prey animal to do your bidding isn’t like training a puppy. You can’t just press his hips down and say, “Sit!” in an ever-louder voice. Learn about your horse’s brain, and you will be much more likely to succeed.

“Riding is easy. Let’s not make a big deal out of it.” Most anybody can huff and puff onto a mounting block, stretch their legs into the air like long pretzels, and slither up onto a school horse’s back just long enough to get dizzy from the height. Real riding, however, is not easy. It takes strength, coordination, effort, knowledge, skill, and a boatload of practice. In return, all that work brings joy and mastery to our lives. It makes for comfortable healthy horses, too.

That Horse Nerd

My interest in horses and brains began in Scottsdale, Arizona, where horses were a way of life and a means of childhood transportation. Scottsdale was

a four-square-mile cow town of 10,000 people back then, surrounded by large horse and cattle ranches. Most of my childhood was spent reading in a palo verde tree or sweating on the back of a horse. We kids rode ponies on dirt tracks to each other's houses and hopped bushes in the desert for fun. At some point, my father took me to a horse show where he explained why the riders were bouncing up and down. "It's called posting," he said, and I was instantly obsessed. Riding was now my mission.

For years, I lived at a 60-horse barn, riding under the supervision of two trainers. Most of our mounts were young or difficult because that's what training stables get—a diverse influx of babies who don't know the human world yet and bad actors no one else wants to handle. I schooled seven or eight of them a day and taught beginning riders.

The brains came into it early one morning on a three-year-old Quarter Horse colt. Dee Sea topped out at 16.3 when he grew up, with the mighty engine of a Doc Bar butt to match. We were playing with live cattle for the first time, to see whether he'd have any talent for cutting in the future. Turns out he did.

I thought we were just soaking up the milieu. But shortly into our adventure, Dee Sea pinned his ears at a young steer, dropped low, and whirled 180 degrees in a millisecond—every bit as fast as an established cutting horse would turn. I stayed on but accidentally caught his side with the half-inch spur I shouldn't have been wearing. He bucked high and hard, blasting me head-first into a railroad tie standing vertically as a fence post. This was back in the Dark Ages—harnessed helmets and plastic fencing hadn't been invented.

I regained consciousness that afternoon, having worked several other horses in the meantime—speaking, walking, tacking up, and riding in a manner everyone called normal. (What "normal" says about my early personality is best left unexplored.) I suffered bouts of amnesia for a couple of years, "coming to" at various times and places with no recollection of how I got there or what I had been doing. And I asked myself how my brain could keep me functioning during complete lapses of awareness that lasted anywhere from two hours to two days.

To answer that question, I began reading about brains between rides, eventually earning a Ph.D. in cognitive science. Don't worry, "cognitive science" is just a fancy phrase for figuring out what happens inside normal noggins on a regular day. I then taught college students how human brains perceive, learn, remember, communicate, and think. There's nothing quite like teaching the innards of a neuron to bleary-eyed 18-year-olds at eight in the morning. I had to explain brains in ways that would at least keep these kids awake.

My life ran on two tracks for many years, but horses and brains finally converged in 2014, long after meeting that railroad tie. Leaving my position as a tenured professor, I renewed my equine occupation, running a successful horse training business of my own. Deciphering brain function within the horse-and-human team was now my goal.

The Trail Ahead

Horse Brain, Human Brain is written in five parts. Part One introduces the book and considers the challenges of forming teams between predators and prey, with attention to the pressures of evolution that created our brains.

Part Two focuses on taking the world in—perceiving sights, sounds, smells, tastes, touch, and awareness of body positions. Human egocentrism raises its head right away, with riders often assuming that horses perceive the world just like we do. This incorrect assumption confuses horses and frustrates handlers.

Part Three looks at how horses learn, imitate, solve problems, and remember. Why do equine brains learn best with positive reinforcement, despite the fact that trainers usually rely on its opposite? Why is timing so critical as natural chemicals flow through brain tissue, and why are edible rewards both a blessing and a curse? Why is punishment the worst method of teaching? Once the basics of associative learning are in place, I'll introduce the power of indirect training. Part Three ends by exploring the dangers that crop up when goal-driven human brains try to command stimulus-driven equine brains.

Part Four homes in on equine attention, emotion, and forethought. We have to capture horses' attention and regulate their emotions before we can teach them anything. Fear, anxiety, and trust are addressed, in addition to the ways horses express their emotions and interpret ours. We'll also tackle questions of strategy here. Are equine brains capable of planning in advance? If so, are they culpable for their actions?

Finally, Part Five takes on the topic of *true horsemanship*. Of course, knowledge and skill are part of horsemanship, but I'm also talking about an ethical philosophy of care. True horsemen—both male and female—put the horse's needs first and offer a generous spirit even when the animal misbehaves. *Horse Brain, Human Brain* teaches people to understand the equine noodle not only so that we can ride better, train more effectively, and protect our animals' welfare. It also applies brain science to horsemanship so that we can understand each animal at a deep level that encourages mutual bonds of trust and responsibility between the two species.

All in All

Throughout this book, you'll find barn-side applications of brain science. I want you to ride with your brain in real life, not just ponder a handsome theory from your reading chair. Every chapter includes true stories about real horses I've worked with, stories that illustrate my successes and failures in trying to understand equine minds. Along the way, I'll explain how brain cells work when they fire their tiny electric sparks and shoot homemade chemicals around. Source notes appear at the end of this book and are referenced by page number. Illustrations are offered throughout, with drawings of the horse brain enlarged for visual ease. A glossary and index are included, too. That way, you can find information quickly if your horse makes you run from the arena to look something up!

Horse Brain, Human Brain is written for everyone who interacts with horses. Our group includes raw beginners and seasoned experts, practitioners of any equestrian discipline, and members of all equine professions. An understanding of the horse's brain is pertinent to all of us.

Unfortunately, this breadth gives me the opportunity to offend everyone by either talking down to the expert or talking up to the novice. Please forgive me for points that are pitched to alternate skill levels.

Leonardo da Vinci is credited with the quote, “Simplicity is the ultimate sophistication.” I hope Leo’s right because no book can convey the full complexity of the human or equine brain. To do so would require many volumes crammed with high-dollar vocabulary. That would dishonor the intent of this project. Explanations here are accurate but simplified, so that we can concentrate on our main character: the horse.

The Horse

Where in this wide world can
man find nobility without pride,
friendship without envy or beauty
without vanity? Here, where
grace is laced with muscle, and
strength by gentleness confined.

Ronald Duncan, Poet

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With brain-based horsemanship, we have access to the immense privilege of collaborating with an individual of another species, of shaping his brain and allowing him to shape ours. But to succeed, we have to work *with* the principles of human and equine brains instead of against them.