

The Confluence of Neuroscience and Structural Integration

A Discussion with Sandra Blakeslee

By Kevin Frank, Certified Advanced Rolfer™, Rolf Movement Faculty

Editor's Note: Sandra Blakeslee will be one of the keynote speakers at the 2009 annual meeting of the Rolf Institute of Structural Integration®.

Kevin Frank: On behalf of the Rolf community, I want to thank you both for your upcoming presentation to our 2009 annual meeting and for taking time for this conversation. I hope we can give readers a sense of the overlap between your interviews with the stars of the neuroscience world and the work we do as structural integrators. Let's first find out how you ended up writing about science for *The New York Times* and what led you to write your books. Can you give us some background?

Sandra Blakeslee: Sure, I come from a family of science writers. My grandfather, Howard, was one of the first science journalists in the country, beginning in the 1920s. My father, Alton, followed in his footsteps. Both worked for the Associated Press as the top science editors and writers. After a stint in the Peace Corps, in Sarawak, I began my career at the United Nations Bureau of *The New York Times* in 1967 as a lowly news assistant. I had no plans or desire to be a science writer. When a year later the newspaper offered me a position in the science department, I resisted. They said, "Oh, come on. Try it. You might like it." That was over forty years ago, and I have loved writing about science ever since. I can't believe I get paid to do this job. My son, Matt, is now following the Blakeslee tradition. Trained in neuroscience, he is a fabulous writer and translator of the brain sciences.



Although I am primarily a newspaper reporter, I have co-authored seven books. Four, written with Dr. Judith Wallerstein, are primarily about the long-term effects of divorce on children. But my first love is science. I helped the brilliant V.S. Ramachandran write *Phantoms in the Brain* and the equally brilliant Jeff Hawkins write *On Intelligence*.

The idea for *The Body Has a Mind of Its Own* came from a casual encounter with a researcher at the Society for Neuroscience meeting in 2000. The scientist stood in front of his poster titled "Unilateral Extinction and Bimodal Neurons in Peripersonal Space." I was intrigued. What was peripersonal space? The scientist, an irrepressibly enthusiastic Italian named Alesandro Farne, smiled and said, "You

know that your brain has maps of your body right?"

"Yes, of course. That was discovered in the 1940s by Wilder Penfield," I said. "Your brain contains swaths of tissue that literally hold point-to-point maps of each body part – hands, fingers, tongue, arms, legs. Everything from the top of your head to the bottom of your feet is mapped in your brain. One map is based on touch. Another on movement."

Dr. Farne thrust both arms forward. "Well, you also map the space around your body," he said, waving his arms up, down, and all around his body. "Your brain maps every point in this space, out to the ends of your fingertips."

I was stunned. I'd never heard of peripersonal space – much less that it was literally mapped somewhere in the brain. Then Dr. Farne held a pen four-feet away from my body and started moving it slowly toward my forearm. "When the tip of this pen enters the envelope of space around your body, cells that see and anticipate the pen moving toward your skin will start firing," he said. "Bzzzz. Bzzzz. Bzzzz." The pen moved closer. "Bzzzz. Those cells are firing more rapidly the closer this object gets," he said.

I felt like I was a little girl, convulsing with laughter, as my Dad moved his tickling fingers closer and closer and closer. "Really? There's a map in my brain of all the space around my body?"

"Yes," replied the Italian. "And it expands with tool use. Every time you get in your car, the map includes the space around your body as it extends to the boundaries of your car. If you learned to operate a crane, your body map would extend out to the tip of the crane's shovel."

I was enchanted. The idea that the we hold mental maps of our bodies and the space around our bodies; that these maps expand and contract as we use everyday objects; and that these maps can be affected by mental imagery, by physical practice, by illness or disease, or, as I was to learn, by what culture we grow up in, is nothing short of miraculous. Moreover, very little was known about the phenomenon. The creation of these body maps is so seamless, so automatic, so fluid and engrained that we humans don't even recognize it is happening, much less that it poses an absorbing scientific puzzle. Like

consciousness, the neural representation of our bodies *just is*.

I decided to find out what scientists know about body maps, body image, body schema and how they change throughout each day and over a lifetime. Is this why people get so upset in a fender bender accident? Is this what riders mean when they say they're "one" with the horse? Do pilots extend their peripersonal space out to the wingtips of a 747? What happens to our peripersonal space when we make love with another person? What happens to our body schema after an injury or from chronically poor posture?

Moreover, what are the wider implications of this knowledge? How is it being used by those who design simulators for training pilots and athletes, by teachers, by the military, by computer engineers and game designers? How will our body maps enter virtual realities and brain-machine interfaces? Will our children, as they enter cyberspace at ever more tender ages, be different from us in terms of body brain mapping?

To help me on this journey, I enlisted my son, Matt, to co-write *The Body Has a Mind of Its Own*. Published in September 2007, it has been well received by many audiences, including one that we did not anticipate – you, the structural integration community. Why we did not see the close match between the science we describe and the methods of structural integration escapes me. I suppose it's because neither Matt nor I had ever been exposed to structural integration other than to have heard the term. (I have since rectified the situation and underwent ten Rolwing® sessions with Jill Gerber in Santa Fe this spring.)

KF: Great. I hope you enjoyed the Rolwing sessions. We will be interested in how you interpret the experience in light of your own body maps. Over the years I have become convinced that body maps explain a lot about what we do. I'd like to start that discussion by describing what these two domains (structural integration and neuroscience) might have in common from this Rolfer's point of view and then ask you if you think we are on the right track.

For about eighteen years, one of our colleagues, a French Rolfer named Hubert Godard, has educated the structural integration community about scientific research relevant to structural integration. Much of this research is about perception

and coordination. Godard's synthesis led to a model of structural integration he calls Tonic Function." Tonic refers to the tonic system that automatically keeps us upright in gravity and is a background for all our actions. Godard's exercises give us new ways of thinking about our work based on gravity response. Godard isn't the only one, but he has been a major source. Others contribute to this inquiry: people like Robert Schleip, a German Rolfer, and there are now quite a few Rolwing teachers referencing perception and neuroscience.

The material Godard has pointed us to includes some of the discoveries you write about in *The Body Has a Mind of Its Own*: things like the mirror neuron phenomenon, body image and body schema, and Ramachandran's work with phantom limbs. I was excited that you and your son produced a book about all this. It's an accessible source from which structural integration practitioners can learn about the relevant neuroscience. The research papers are sometimes a bit dense.

The research you present goes a long way toward explaining why and how structural integration works. For fifty years, we thought in terms of Dr. Rolf's model that says structural integration is about de-gluing the fascial adhesions between muscles. It's not proven we do this, but it is attractive because it feels as though that's what is happening under our hands. Now we have a new way to look at the process, and it seems to be connected to the plasticity of body maps and how that may revive our ability to move and stand normally. In essence, our work may be more about the body's motor control than we previously thought.

Your title, *The Body Has a Mind of Its Own*, says essentially that a very intelligent system is in charge of how we perceive, feel and move. Structural integrators (as well as other body/mind therapies) must affect this system in a number of ways. Structural integration practitioners are skilled at connective-tissue manipulation. They also learn ways to evoke changes in coordination using perception. The perception part can be trickier to learn since it isn't something most people are used to. Your book helps us all appreciate what a big deal this perceptive system is. And how does our fascial work affect the body's "mind"? Is it possible that working on fascia may directly affect our body map as much as it frees the musculature? The

fascia and its associated mechanoreceptors may be directly linked to the "movement brain," as I like to call it. In which case, part of our task is to learn more about how we can speak to the "movement brains" of our clients. I am curious, given all the time you have spent with these neuroscience specialists, whether this relationship I am describing looks plausible to you.

SB: The relationship you describe makes perfect sense. Let me first give an overview of body maps and then unpack them, one by one, as each relates to the work you do in structural integration. In writing our book, Matt came up with a nice phrase that captures the complexity of the body maps in our brains: a mandala. In Eastern traditions, a mandala is a geometric pattern of images that symbolically maps out the universe from a human perspective. Similarly, your brain contains a network of patterns, or maps, that create your embodied, feeling sense of selfhood. Some maps are built from patterns that enter your brain from the outside world. (Note: your brain does not contain sights or sounds. It is dark in there. It is silent. All your brain's activity, aside from neurochemical aspects, is built on patterns of nerves firing.) Thus visual scenes enter your retina and are turned into patterns that travel up the optic nerve to eventually form a network of visual maps. Sounds enter your ear and are turned into patterns that form a network of auditory maps. When your skin senses external pressure or vibration, patterns travel up your spine and into a network of primary touch maps. The same goes for smell and taste. These maps are created in response to external stimuli. They are exteroceptive.

The maps you care most about as structural integrators are built from patterns that come from the body itself. They are interoceptive. Thus your brain builds a map of your body schema – its "held" position in space – from proprioceptors in muscle, bone and tendon. Your brain also contains a sprawling web of connections that give rise to your body image, defined as the deeply rooted beliefs you have about your body. The body image is not so much a map as it is an atlas of your life's experiences.

KF: I love your description. Just to say that historically structural integrators have primarily addressed interoception and proprioception. Our public image shows us pushing on fascia. At the same time, structural integration practitioners have also worked with hearing, seeing, smell

and taste, as well as the skin. This work has gained ground with the introduction of the tonic function model. When we address the three aspects of body perception, the effect seems to be the best for lasting change in posture and movement. But please continue.

SB: You are correct that Rolfing affects exteroceptive maps, including basic sensations of touch, but these tend to be related to conscious awareness. My point is that structural integration primarily works on interoceptive and proprioceptive aspects of brain function which for the most part operate unconsciously. Your interoceptive brain also has a so-called vestibular map that tells you where you are with respect to gravity. It maps all your movements and intentions to move, as well as the actions of others via a mirror system. Your brain maps feelings from your body – itch, tickle, cold, heat, sensual touch and pain – via special receptors in your skin that travel to a region of the brain called the insula. The insula also maps sensations from your heart, liver, lungs, intestines – all your internal organs – to give you an overall, ongoing report of “how do I feel?” Your social emotions are built from this map – lust, disgust, pride, humiliation, shame, love, hate and so on. Finally, there is the body map that keeps your autonomic nervous system in balance, which promotes homeostasis. Rolfers tap directly into this system when manipulation releases deeply held emotions.

One final key point about these maps. They are plastic. They change under the influence of experience. Amazingly, some of them also change under the influence of mental imagery. They are also amenable to change from the effects of attention. Paying attention to the body is a key factor in facilitating change. When these maps operate in synchrony, you have the illusion of being a whole, sentient, embodied Self. When the maps fall out of synchrony for any reason – think about trauma or disease – you can experience a wide range of symptoms. These can be familiar, like chronic pain, or spooky, like out-of-body experiences. The important thing to remember, from a structural integration point of view, is that all these maps interact and that you can promote synchrony, or healing, by entering the system from a variety of portals.

KF: You mention imagery. Can you say more about that?

SB: Yes, I understand that structural integrators sometimes use imagery with clients. Our book tells some interesting stories about how motor imagery – imagining playing the piano, for example – literally increases the size of a person’s finger maps in the brain. Athletes can improve their motor skills by imagining familiar movements used in their sport.

KF: And tonic function? Is that related to body maps?

SB: I think so. Your inner ear contains a special set of sensors that tell your body where you are in relation to gravity. This information is sent to a region called the parietal lobe, which is packed with multi-sensory neurons. Such neurons collect patterns of information from more than one sense. Thus, some combine hearing and touch. Others combine balance, vision and muscle stretch. And so on. By bringing a person’s attention to their vestibular processes – which almost always operate out of consciousness – it is conceivable that changes could be brought to the mandala.

KF: That ties synesthesia or the inter-sensorial phenomena to our gravity system. Great. What about fascia?

SB: I think freeing the fascia might help reorganize muscle which would then reorganize the brain’s motor regions. Again, the mandala changes. The person changes. The same goes for manipulations aimed at the body schema. When the body receives a new set of experiences, it can remap rapidly. When people lose limbs, their body maps reorganize in minutes. When you reorganize the body schema, the body image is also likely to open itself to change.

KF: Does peripersonal space undergo remapping?

SB: Probably. There are plenty of neurological conditions that perturb the mapped space around the body. One thing I think structural integration people should know about is a theory called “affordances.” It has to do with how people interact with objects.

KF: Yes, your book has a great section on that; and I believe perception pioneer James Gibson offered the affordance idea. (Godard, naturally, introduced us to Gibson.) The affordance idea helps structural integrator students appreciate the power of context in working with movement. For example, when we enter a room, our brain automatically knows what

sorts of movements the room’s contents will support – the affordances within the room. Or if we pick up even an unfamiliar tool, our body senses how it might use it. Like schema and image these ideas take time to sink in, but they add an important new dimension to our work. It points to something invisible but huge in terms of facilitating change.

Structural integrators are often consulted when people are in pain. There are many sources of pain but one seems to be abnormal plasticity. What can you say about that?

SB: Excellent question. Body maps are laid down in response to normal experiences. When there is an injury, particularly a repetitive injury or failure to rehabilitate an old injury, body maps can become “frozen.” They are stuck in an abnormal pattern that can reverberate into other body systems. Skilled manipulation can inform the brain that the held pattern is deleterious. It can release the constriction. But remember – the problem is not in the periphery. It is not in the sore knee, bad back, aching shoulder. The problem is central, in body maps in the brain.

KF: Yes, our clients come in convinced we need to fix the part they are pointing to. And, in addition to some palliative work in the area that bothers them, we try to enroll them in the idea that coordination, the body system, is what needs help – their body needs better information. For example, the body may have forgotten that it has joints in the foot, and with a little work there a tight hip lets go. I am beginning to think that what we are doing is reminding the body map of its articulations – articulations that usage patterns have blurred or erased to some degree. Does that seem plausible to you?

SB: Absolutely.

KF: Sandra your perspective is timely. Structural integration has tried to differentiate itself from some of the other forms of body therapy – Ida Rolf emphasized that our work is about restoring natural order of relationships in gravity. There are challenges to getting this point across: that it’s different from massage, chiropractic or osteopathy, or myofascial release, and that there is a particular need humans have to revive their body maps. Going forward, your and Matt’s articulation makes our job easier and helps Dr. Rolf’s work find better acceptance in the places it can make a

contribution. Thank you so much. Anything else you want to add?

SB: We have entered an exciting era in neuroscience with new discoveries about ourselves occurring on an almost daily basis. What I find particularly exciting is that observations that once seemed intuitive are now based on science. Therapists and healers have new ways to validate and improve their techniques. Matt and I are thrilled to get this information to people who will be inspired to use it. A lot of research in the lab tells us the "what." Your work pushes us forward to answer the "so what."

Sandra Blakeslee is a science writer who contributes regularly to The New York Times. She co-authored the books The Body Has a Mind of Its Own (with Matthew Blakeslee) and Phantoms in the Brain (with V.S. Ramachandran). For more information please see: www.sandrablakeslee.com and www.thebodyhasamindofitsown.com.