

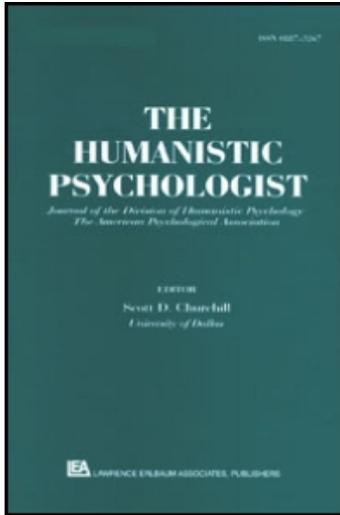
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Mindful Awareness, Mindsight, and Neural Integration

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Mindful awareness has been demonstrated to alter brain function, mental activity, and interpersonal relationships toward well-being. This article hypothesizes that mindful awareness promotes these positive changes through a proposed “internal attunement” that catalyzes the fundamental process of integration. Integration—the linkage of differentiated elements of a system—leads to the flexible, adaptive, and coherent flow of energy and information in the brain, the mind, and relationships. This coherent flow enables the individual to attain an intentionally established state of mindfulness with practice in the moment and creates the experiential substrate for developing mindful traits in daily life. By freeing the individual from the top-down associations of memory, mindfulness also promotes an emergent sense of a vital and resilient self.

Let’s begin our exploration of mindful awareness with a discussion of a list of nine functions that may relate to seemingly independent fields. As you read through this list, you might let your mind imagine what processes might generate such a divergent set of functions into one grouping.

1. Number one on the list is *body regulation*. The term body regulation is a phrase referring to the way the accelerating branch of the nervous system, which revs the body up, is balanced with the decelerating branch. This is the sympathetic branch of the autonomic nervous system—how it balances out with the parasympathetic branch to allow, for example, your heart rate to be in balance, or your gastrointestinal system to balance, or your respiratory system.

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2. Number two is *attuned communication*. If you look around at the people sitting next to you, if you look into their eyes, you can feel you are tuning in to each other. Attuned communication is when two systems are allowed to become a part of one resonating whole. Attunement is found in every culture on this planet as a part of healthy relationships in general, and, in particular, between children and their caregivers.
3. Number three is *emotional balance*. This phrase refers to the idea that we have affective states of arousal inside of us; the subjective feeling that you can describe as life having meaning and life having a sense of richness to it. If this arousal gets too revved up, life can become chaotic; and if it is too depleted, life can become depressed. There is an optimal flow, which we are calling emotional balance.
4. Number four is called *fear extinction* or *fear modulation*. This is the way we modify a fear after having an experience that generates a fear response to that stimulus. This is the way we undo or unlearn a learned fear.
5. Number five is a process called *response flexibility*, which a patient of mine had a beautiful term to describe: "It's pausing before acting." Response flexibility is the way that you put a space between impulse and action. This is the space of the mind, if you will, the space of mindful awareness.
6. Number six is the term we are all familiar with, that is called *insight*. In scientific terms, it is auto-noetic consciousness or self-knowing awareness. It has a quality of what Endel Tulving (1993) a researcher in memory, described beautifully as mental time travel. Insight is how we explore our memory of the past and our experience of the present and our anticipation and freedom to imagine the future.
7. Number seven is *empathy*. Empathy is the capacity to put yourself in the mental perspective of another person. Empathy is different from attunement, which is more akin to our generic idea of compassion or feeling with another person. Empathy, as we are using it here, is the process of seeing the mind of another person. In fact, if we combine insight—seeing our own mind—with empathy—seeing the mind of another person—then we can define the term *mindsight*. The way the brain can actually map out the mind of oneself or of others is mindsight.
8. Number eight is *morality*, which is the notion that we can imagine an action that is for the social good. We can not only imagine this behavior, but we can enact it even when we are alone. All sorts of people who don't have morality can know what they are supposed to do, but when they are alone they do whatever they want. Acting on behalf of the larger social good is moral action which often involves a moral imagination.
9. And then the final one on this list of nine is *intuition*. From the scientific point of view, this is the way the nonverbal information processing of

areas of our experience, including the body, come into our awareness and we can have access to them. So that we'll call intuition.

What process or processes can you imagine might generate this odd list of nine functions? "What are the benefits of mindfulness?" many might ask. In fact, this is a research-proven list in which all nine processes are felt to be the benefits of mindful practice. A researcher and leader in the field of mindfulness, Jon Kabat-Zinn (2004), has demonstrated these elements as a research outcome for mindfulness practice. Kabat-Zinn, the founder of mindfulness-based stress reduction approaches, once commented that was "this is not only the outcome of mindfulness—this list is a very clear description of living mindfully."

What other questions might we post about other processes that might produce this list? "What is a possible definition of optimal mental health?" is another question people often offer. Certainly, we could say this is a useful description of mental health. Some people might suggest that this list points to the qualities of a good therapist. Certainly you would hope your therapist would be both mentally healthy and mindful! So you could argue that whatever could get you to this place might be something good to promote in the training of mental health practitioners. "What might healthy attachments promote?" is another question about a process that could engender this list. Most of these are proven outcomes of secure attachment.

So now we have the following three processes: mindfulness practice, mental health (and what a good therapist might be), and secure attachment that produces the first eight functions of this list based on research outcome measures. The ninth function, intuition, has just never been looked at in studies thus far.

This list was actually generated from a totally independent field: neuroscience. I was caring as a child psychiatrist for a family in which the mother, unfortunately, had suffered from a terrible brain injury as a result of an automobile accident. To help the family make sense of how she had changed, I took her brain scans to the library and looked up everything I could about the areas of the brain behind the forehead where the steering wheel had struck her during the accident. These areas included the orbito-frontal cortex; the medial and ventrolateral prefrontal regions, and portions of the anterior cingulate. As these regions work together as a team, I used the plain-language term "middle prefrontal cortex" to denote this midline set of areas.

What struck me in helping this family grieve the loss of these previously existing functions in the mother was how essential these functions were in being a healthy, attuned parent. As an attachment research-trained person,

I also noticed how this brain-study based list also corresponded to the outcome findings in attachment research. Then the field of mindfulness came into view, and this list seemed to overlap with that process as well. What could be going on with such seemingly independent fields as attachment, mindful awareness, and prefrontal function? What is it about the prefrontal cortex and attachment—what is it about love and the development of the brain—that would make this area of the nervous system so important in such a strangely wide array of processes from regulating your intestines and your heart to moral thinking? And what might these have to do with being mindful?

FINDING COMMON GROUND

I want to explore with you the notion that this finding of the prefrontal functions, secure attachment, what we are also proposing is perhaps mental health, and mindfulness all share something in common.

In addition to these four domains, if you look at the modern studies of wisdom—of people considered “wise” in their communities—many items of this list are on the research findings. So we can add “wisdom traditions” to the list of domains.

Why would this be the case? And what does this discussion have to do with meditation and psychotherapy anyway? What I want to suggest to you is that the reason these various domains—from mental health and attachment to wisdom and mindfulness practices—go together is absolute coincidence. They have nothing to do with each other. No, just kidding. In fact, there may be a reason for this overlap of various domains. The kind of reasoning we’re going to use to explore this is called *consilience*.

INTERPERSONAL NEUROBIOLOGY AND CONSILIENCE

E. O. Wilson has written a wonderful book called *Consilience* (1998), which is a term meaning finding truths that are common and derived from independent ways of knowing. I didn’t know the concept of consilience when I wrote the book, *The Developing Mind* (Siegel, 1999). Yet, in retrospect, I was using a consilient approach to combine over a dozen different disciplines of sciences to form this one framework, called “Interpersonal Neurobiology.” You might ask, “Where is the science behind it?” And the science does exist. The scientific approach is consilience.

We are now going to examine this consilient finding in which the independent fields of attachment research; mindfulness practice and research;

wisdom traditions; mental health—and its corollary, psychotherapy—each have something in common with the prefrontal functions. As we'll see, that commonality is something called “integration.” But first, let's see what the brain might have to do with this.

THE BRAIN IN THE PALM OF YOUR HAND

If you take your hand and place the thumb in the middle and put your fingers over the top, this is a handy model of the brain. In this model the face of the person is in front of your fingernails and knuckles. The top of the head would be at the top, and the back of the head would be the back of your hand. The spinal cord comes up from your arm and is represented in your wrist.

If you lift your fingers up, and then lift up your thumb, the first part of the brain we're going to talk about, the brainstem, is here, represented in your palm. The brainstem helps regulate basic aspects of alertness, such as being asleep or awake. It also helps regulate aspects of bodily function, like breathing and heart rate. The brainstem is also important in having the clusters of neurons, called nuclei, which are responsible for the fight–flight–freeze response we activate under threat—our basic survival reactions.

The brainstem is the deepest and oldest part, so it is sometimes referred to as the “reptilian brain.” Once we became mammals over 200 million years ago, we developed the limbic area that sits on top of the brainstem. If you put your thumb down onto your palm, this represents the limbic area. Two thumbs would be ideal, representing the two sides of the brain, left and right.

The limbic area is important for carrying out at least five functions. (a) It works very closely with the brainstem to generate *motivational states*. The limbic and brainstem regions drive us to meet our reward-drives, to satisfy basic motivational drives like thirst, hunger, reproduction, and other needs like these. (b) Second, the limbic area is also important for the *appraisal of the meaning* of things—determining if things are meaningful or not meaningful. These functions are carried out by the very important appraisal centers residing in the limbic region. (c) A third limbic function, created in close collaboration with the brainstem and body, is in the *generation of affect*, what some people call “emotion,” a term surprisingly without a commonly held definition. Affective states are generated by a combination of body, brainstem, and limbic areas working together. Because these three areas are all below the next area of the brain, the cortex, they can be referred to as the “subcortical” areas. The activity in these subcortical regions of

body, brainstem, and limbic zones generate our emotional or affective state. (d) A fourth process is that the limbic area helps *differentiate different kinds of memory*. The hippocampus is a limbic region that helps link elements of the basic building blocks of implicit memory together into the integrated and elaborated memory forms representing facts or lived experience, the latter known as episodic (oneself in an episode of time) or autobiographical memory. (e) A fifth aspect of our experience that our limbic area is essential for is our *attachment relationships*. At home, we raise tropical fish and frogs—amphibians. Fish and amphibians do not have attachments. They do know when I am coming to feed them: They have nervous systems that allow them to learn. But they are not attached to me. The dogs that we have do create attachments—to each other, and to us. Mammals create a whole different experience than fish and amphibians. Our dogs are not only nutty, they are loving: They have a limbic area—they have attachments.

But our dogs don't have much of a cortex. My kids are always asking, "What are the dogs thinking about?" I say, "Well, they are not thinking about the meaning of life, I don't think, because they don't have much of a prefrontal cortex that burdens us with those kinds of life questions."

If you put your fingers over the top of your thumb, you'll see our neomammalian cortex. The frontal lobes of the cortex became really big as we grew as primates. From your second to last knuckles down is the area on our model that represents the frontal lobe. From the last knuckles down to your fingernails (this is bigger in your actual brain) is the prefrontal cortex. This is the region that enables us to create much of our humanity—for good and for bad. The prefrontal region, as we'll see, is responsible for giving us insights into ourselves and each other. This front-most frontal region also enables us to think about the future, to consider the idea and eventuality of death, and to reflect on the meaning of life.

THE PREFRONTAL CORTEX

The prefrontal cortex can be divided into a lot of different areas. We are going to focus on the middle regions, including an area called the medial prefrontal cortex. This sector is in the middle, looked at horizontally. This medial prefrontal region works closely with, and is sometimes considered a part of, an area just behind the orbit of the eyes, the orbitofrontal cortex. These midline prefrontal areas also work together with a region in the middle from a vertical perspective, the ventrolateral prefrontal cortex. All of these are midline structures—vertically or horizontally—so I just use the term middle prefrontal cortex. You won't find that term in any science writings, because it is not a scientific term, it is just plain English. The term

middle prefrontal cortex includes the medial, orbitofrontal, and ventrolateral regions. I also include the anterior cingulate with these more traditional prefrontal areas. The anterior cingulate is sometimes considered a part of this midline grouping that works together as a team. In the appendix of the book, *The Mindful Brain* (Siegel, 2007a), there are extensive quotes and references as to why it seemed scientifically justified to cluster these four or five “independent” regions together into one name and calling them the middle prefrontal cortex.

People who love the prefrontal cortex sometimes have stated that they feel like I am not paying enough attention to the side area, called the dorsolateral. I say,

The side area of the prefrontal cortex is very important for paying attention. There is no question about it. Anytime you bring something to the front of your mind, you are activating the side prefrontal cortex, called the dorsolateral prefrontal cortex. But this side region does not uniquely contribute to the nine functions we have listed. When someone brings any of those nine functions into awareness, of course it involves the dorsolateral prefrontal cortex. So for awareness, the side region seems to be essential. But for these nine functions, we do not need to have the dorsolateral involved. For morality, attunement, empathy, and insight, uniquely we activate the middle prefrontal area.

Why would the middle prefrontal areas be so important in mediating these nine functions? This is because the middle prefrontal area is “connected to everything”—it touches the limbic area. It links the cortex, of which it is fundamentally a part; with the limbic area (which it has extensive enervation of, unlike the dorsolateral); with the brainstem (which it has enervation of); and with input directly from the body (it actually receives input from an area called the insula, allowing us to have “interoception” or perception of the interior world. The insula works intimately with the middle prefrontal area to allow us, for example, to perceive our breathing).

INTEGRATION AND THE BRAIN

The middle prefrontal area connects everything together—in the body—and mediates empathy too: It also makes maps of other people’s minds.

If you are mapping the mind of others, we will call that a *social map*. We are mapping the social—the interpersonal world, the world of other minds. The middle prefrontal region is also mapping the body, the somatic. We also are mapping the brainstem, which has these fight–flight–freeze responses, of whether you are safe or not safe. We are mapping the limbic areas with all those five functions we were talking about. And we are mapping the cortex as well.

And what is a term that we use when we take differentiated parts and link them together? *Integration*. Yes! *Integration* is the scientific term, for the *linkage of differentiated parts*. Integration requires those two things: Domains or regions need to be differentiated and they need then to be linked. And voila, you get integration.

The middle prefrontal area is one of the most integrative zones in the whole nervous system. You have other integrative areas, like the hippocampus that mediates memory integration; the corpus callosum linking the left and right hemispheres; the cerebellum integrating a wide array of processes in the body and also forms of information processing. But the prefrontal area is a wonderfully integrative area that ties the social, the somatic, the brainstem, the limbic, and the cortical, all into one.

If we think about integration as a concept, what we get is this incredible opportunity from a consilience point of view, from the lens of Interpersonal Neurobiology, to make the following proposal: *Integration may be the process that is shared among all the processes that led to this list of nine functions*. This is the proposal I want to make to you. Integration is the commonality among:

1. Prefrontal function—where differentiated regions of neural firings are linked together.
2. Secure parent-child attachment—for those of you who have kids or watch parents with kids, or those of us who are researchers in attachment, integration describes healthy attachment. When a parent can honor the sovereignty and uniqueness of their children, and then link to them in a deep, intimate internal way of acknowledging their feelings, their thoughts—of seeing their mind—that is an integrated relationship. Romantic relationships involve the same linking process. When relationships are integrated, they are healthy. So we have relational integration. In fact, we can propose that when we make sense of our lives—in adult attachment terms when we have developed a coherent attachment narrative (Main, 2000; Siegel, 1999)—we likely are revealing that we've achieved a common state of mindful awareness. Secure adult attachment and mindfulness traits may go hand-in-hand—a research project yet to be carried out.
3. Mental Health—mental health is perhaps synonymous with an integrated system—whether it is integrated nervous systems, minds, relationships, families, schools, and societies.

The notion and reality of integration has the promise of being a scientifically grounded view that allows us to make sense of this incredible convergence, this consilient perspective, linking each of the domains from

mindfulness to mental health to secure attachment to brain function. Mindfulness, I suggest, is a powerful practice that promotes integration as it promotes the linkage of differentiated parts. And we will explore more on that soon.

MINDFULNESS, INTERNAL ATTUNEMENT AND THE RELATIONAL BRAIN

I had just come from presenting these ideas about the list of nine functions to Jon Kabat-Zinn at the Psychotherapy Networker meeting a few weeks earlier, so I felt kind of spunky, and I said,

I don't know anything about mindfulness, but you know, it could be that mindfulness is actually not only a form of attention training (which many investigators studied it as). And it is not only a form of affect regulation training (which some people were studying it as being as well). Maybe mindfulness is actually a relational process where you become your own best friend.

If that view holds true, we should be able to look to the social circuits of the brain, not just the attentional circuits, and find activation during mindfulness practice. And that activation should lead to synaptic strengthening and thickening in the areas related to the middle prefrontal region and related areas that allow you to become attuned with yourself—"To have attunement with the self," a form of "intrapersonal attunement." With secure attachment we have interpersonal attunement—a form of relational integration. And in mindfulness, we have "intrapersonal attunement" as an internal form of integration. And this would be the underlying reason you get the development of these integrative fibers of the brain. Interpersonal attunement is a form of integration and intrapersonal attunement would be another form of integration: Each fundamentally links differentiated elements to each other. And then I sat down and this guy, Carl Marci, the head of social neuroscience at Harvard, comes up to me and he grabs my shoulder, and puts his handsome tall head in front of my ear, and he says, "Dan, Dan . . . we just proved that you are right. It isn't published yet, but Sara Lazar and others here have shown that those are the areas that grow in mindfulness meditators." I was later able to talk and teach with Sara Lazar, the Harvard research psychologist focusing on mindfulness and the brain (Lazar et al., 2005). This whole experience opened up a professional and personal exploration of the idea that it is the social circuitry of the brain that is activated in mindfulness practice.

Mindfulness and the Self

In many ways, mindful practice changes a person's relationship with the self. Understanding these ideas intellectually, I was encouraged by a number of teachers to immerse myself in direct experience of mindful awareness. After undertaking two week-long retreats, a 3-day exploration of transformation and mindfulness (Ackerman, Kabat-Zinn, O'Donohue, & Siegel, 2006), and intensive journeys into poetry and the brain (O'Donohue & Siegel, 2006); and delving into the interconnections between Buddhist psychology and Interpersonal Neurobiology (Kornfield & Siegel, 2008), it became clear that the more you experience, the more you realize how little we really know. But even in the face of this reality of the mystery of the mind, the brain, and personal transformation, it became evident in many people's experience that mindful practice awakened the mind by altering a previously engrained sense of the self. Beyond enabling us to become filled with more equilibrium internally and more empathy interpersonally, mindfulness appears to change how we see ourselves in the world. Indeed, our experience of the self changes with mindfulness.

So what I want to talk to you about soon is the neurobiology of self and discuss not so much the notion of dissolving the self but of the *liberating experience from the constraints of a rigid self*. This may be a very different take on the notion of identity than is commonly considered. When the nonmeditating people in my life hear what I'm exploring, some of them have said, "What is that identity that you are getting rid of, the self? I'm having a hard enough time finding a self and then you guys want us to get rid of it—What's with that?"

I introduce meditation to patients frequently now. Because I don't have a big background in meditation, I don't feel like I'm a religious zealot because I'm just offering this form of mental training because I think it is a part of *brain hygiene*. This is literally what I tell my patients: "I'm going to teach you a technique that is a form of brain hygiene. You brush your teeth everyday, right? This is a way of brushing your brain every day." And I also say it's a form of *mental floss*. You know, you're getting the garbage out between the different synapses, loosening the hardening of our categories. Maybe its simpler if we just leave the image as simply brushing your brain.

Mindful awareness expands our sense of self by dissolving the prison of repeating patterns of thought and response. We become freed to sense the world more from the "bottom-up," rather than being constrained by prior learning and habit in the form of "top-down" constraints on how we live. These constraints can skew our perceptions, mold our emotional reactions, and restrict our behavioral options. Mindfulness can loosen the way top-down representations from various forms of memory restrict our way of experiencing the world, others, and ourselves.

Mindful Awareness Practices: MAPs

We have a phrase we use called *MAP*, a *mindful awareness practice*. Whether it's yoga, tai chi, qigong, centering prayer, mindfully doing the dishes, mindful walking or engaging in mindfulness meditation, each of these mindfulness practices seem to share some common fundamental components. Some have been researched more than others, but there is no reason to believe that one form is any better than any other. Certain approaches will be good for certain people, certain temperaments, in certain situations, in certain times of their lives, so we just call them MAPs. Mindfulness meditation is one form of MAP. MAPs include *two fundamental processes: awareness of awareness, and paying attention to intention*. When I'm doing the dishes mindfully, I'm aware of my awareness and I'm paying attention to my intention to be aware of my awareness of doing the dishes, dish by dish. I love mindfully practicing dishwashing.

Initially, doing a mindful awareness practice, like mindfulness meditation, often creates a deep sense of calm. Why is it that when you focus on your breath most people feel that deep sense of entering a state of what you can call "self-engagement?" Steven Porges (1998) has a useful term called "the social engagement system" (p. 845). Porges, a researcher at University of Illinois at Chicago, writes about the polyvagal theory that explores the ways the brain assesses safety or nonsafety. He has suggested that we activate the social engagement system when we have a state that he calls "love without fear" (Porges, 1998, p. 847). Porges describes an intricate neurobiology to that process. We can apply his work to the feeling that people seem to get when they are activating what we can call a *self-engagement system* that is a form of, in Porges' terms, "love without fear."

One of my young adolescent patients, a boy we'll call Jonathon, learned the basic technique of mindfulness of the breath. This technique of mindfulness of the breath can be introduced with the following instructions: "When you're attention wanders, lovingly return your attention to the breath, sensing the in-breath, the out-breath—riding the wave of your breath and returning your attention again and again whenever you notice that your focus as strayed from the breath."

After just 5 min, Jonathan's whole body relaxed; he came out of the meditation and said the most amazing thing: "Oh my god, I have never felt so peaceful before in my life. It feels as if absolutely nothing can harm me and nothing can go wrong." This was the first time for him, for just 5 min, to experience mindfulness of the breath. After we talk about the neurobiology of the self, we will talk about why breath is such a common focus of attention for mindfulness practices and what might be the neural mechanisms underlying this activation of the self-engagement system so that you get this deep sense of love without fear.

Love of the self, self-compassion, a feeling of fullness, of wholeness, may emerge from the experience of being *integrated*. We run around in life, busy focusing on the external world, checking in with other people. “What do you need, what do you need, what do you need?” “Ok I gotta do this; I gotta check that; I gotta go.” So part of even just taking 5 min, let alone a week, to pause and become silent, is to let that external focus become internal. Ironically, we come to feel attuned to ourselves while we also attain a sense of being connected to a much larger whole. This interconnection between internal acceptance and interconnectedness with a larger world emerges, I believe, from the central process of integration at the heart of mindfulness as it promotes self-and other-focused compassion within healthy development.

This interplay of our internal and interpersonal focus of attention is also revealed in the overlap of circuits involved in self-reflection and in empathy. We can use the term “mindsight” for this blend of seeing the mind—of the self and of others (Siegel, 1999, 2009). A related process of the brain at rest is called the *default mode*. The default mode (Raichle et al., 2001) is the bane of a functional brain imager’s existence because there is a way at rest in which the brain is very active and it is hard to use that as a simple baseline. When the brain is at rest, it turns out that the social circuits of the brain are very active. They seem to be a part of the mind’s process of trying to figure things out in both the internal world and the social environment, trying to answer the internal question, “What’s going on, what’s going on, what’s going on?” Mindfulness meditation may be taking that default mode, which involves the middle prefrontal cortex’s activity at rest, and instead of aiming its focus on our busy lives outwardly, in meditation we give this important region the opportunity to focus in an attuned manner inwardly.

We evolved as a social species—we did not really evolve as a contemplative species. I think contemplation is fantastic, and I also believe it’s important for mental health. In my view, reflection in mindfulness is not just an extra feel-good thing; it may actually be a necessary thing for our survival. We first evolved as social creatures, and we are likely using this more ancient social circuitry to actually perform activity of focusing inward, reflecting on the very nature of the mind itself. In this way, reflection may use social circuits to understand and transform the self.

SOCIAL CIRCUITS ARE REGULATORY

Jonathon, the boy I mentioned earlier who felt so calm and safe, was a person with a very busy and dysregulated life. He, unfortunately, had serious dysregulation with affective storms and attentional problems. His default

mode may have been quite erratic and flooding him with busy mental chatter (Siegel, 2010). Now, with this pause of mindful reflection, he was able to take some time to calm down his busy, wild, and wacky social circuitry. This social region of the brain overlaps with his regulatory circuitry—a reality in the brain that’s a little secret that you hardly ever hear about—that influences affect and directs attention. This is the powerful issue that an Interpersonal Neurobiology approach reveals: The immature brain born into the world requires the more mature brain of the caregiver to allow its social/regulatory circuitry to develop. The infant uses social connections to develop regulatory ability.

Attuned communication, between caregiver and child, leads to what’s called *dyadic regulation*. This is how the young, immature nervous system achieves equilibrium—through attuned communication. Such social influences on our internal regulation occur throughout the lifespan, but for the immature nervous system of an infant, it requires it for proper development. Then dyadic regulation becomes more autonomous but never hermit like. More autonomous self-regulation, the path attuned communication leads to by way of dyadic regulation, involves repeated patterns of attunement that enables the growth of self-regulatory circuits in the middle prefrontal cortex.

Here is the proposal. When this young teenager spends 5 min to take a pause in his busy, busy mind, it is like suggesting, “Hey, take 5 min and go inward. Let’s take that social regulatory circuitry of yours and see what happens when we go not to interpersonal attunement, but to *intrapersonal attunement*.” That’s the whole model of this perspective. So he does this and activates a “love without fear” state of self-engagement. He is harnessing the power of his social/regulatory circuitry to create a state of equilibrium by way of attunement—this time with internal attunement.

THE UNIVERSALITY OF THE BREATH IN MINDFULNESS PRACTICES

Across many mindful awareness practices, including meditation, we start with the breath. This may be because the breath has several important and universal features. The breath is an interface between the internal and the external. It is at the boundary between the involuntary and the voluntary, the automatic and the effortful. Some people see the breath as the domain of the ethereal and the physical. The breath is the stuff of life, the vital flow that gives us vitality. The breath is also rhythmic, and rhythm is important in the way the nervous system functions.

But one additional thing is that with breath awareness, we have a repeated process where the in-breath is always followed by the out-breath. There is something about this repeated pattern that might help us understand

Jonathon's experience of activating that deep state of calm and clarity—the notion of being beneath the surface of the ocean where it's calm and clear and, no matter what waves are happening at the surface, you stay in this state of clarity and tranquility. What is it about focusing on the breath that brings us to that deep place in our mental sea? That's the question.

At the Center for Culture, Brain, and Development, I work with a colleague, Marco Iacoboni. Marco is one of the people who brought the study of a set of neurons called *mirror neurons* to the study of humans (Iacoboni, 2008). Researchers have been studying mirror neurons in primates in Italy. Marco discovered last year that mirror neurons existed in living human tissue during open brain surgery. Mirror neurons function on the border between perception and action. They carry out an important mirror property in that if you see someone do something with an intentional act, you get yourself ready to do that same act. That's why they're called mirror. These neurons work with another area called the superior temporal cortex in making a map of intentional states. What this means is that when you look at another person, like if you watch me now, you may not be able to map anything even though I have a repeated behavior of lifting my hand. Now, if I do this new action of lifting a glass held in my hand, notice how you feel differently. Now what did you feel when I had the glass in my hand doing the exact same action? "Thirsty," "water going down," those sensations are likely derived from your mirror neurons. When there's an intentional act, the mirror neurons pick up the predictable sequence of observable actions. Mirror neurons don't get activated in response to any motion. It's only motions that have intention behind them, like physical motions where you can figure out what the next action will be. *Intention has sequence imbedded in it*. You perceive intention because you know what's going to happen next. The way mirror neurons work is through what I termed SIMA, the Sensory Implications of Motor Action.

The superior temporal cortex works with the mirror neurons, in a SIMA process described in detail in the appendix of *The Mindful Brain*. The SIMA process allows a person to see an action, and decode the immediate-next of now. This is not the same as planning for the future; it is anticipating the next part of now in the frame of the present moment. In one view, described by Dan Stern in his Interpersonal Neurobiology series book, *The Present Moment* (Stern, 2005), there is an immediate next of now that is a part of the present moment, not the prefrontal cortex's planning for the future. SIMA allows a person to get to the horizon of the present as it moves toward the future but it's still part of the present moment. This is just the way the brain works. It's as close to now as you can get.

So when you see me lift the cup, you know I'm about to lift the cup and if I were to violate that, like hurl the cup up in the air, you would get startled

because your SIMA process gets you ready for what my intentional act is planning to create. Here's what came to my mind, because I was already immersed in mirror neuron findings and attachment relationships and therapy, before I even knew there was a term called mindfulness: Mindfulness practices seemed to be focusing attention on intention. This fundamental component raised the possibility that we might be using the same apparatus to focus on our own intentional state when we sense others' intentions. If this were the case, we might be able to focus our SIMA/mirror neuron system on the rhythmic sequences of the breath.

When you breathe in, if your awareness is focusing on your breath, the SIMA process will be activated to detect for a possible intentional sequence. You have the breath as the target of attention—this is not just when you are breathing, but when you are actively focusing on the cycle of the breath itself—focusing awareness on the breath in a mindful way. When you are in awareness of the present sensations, your SIMA process will be activating the immediate next of the in-breath: The out-breath. SIMA will be creating a neural representation of the out-breath while the in-breath is still happening. This is just what SIMA does, whether you like it or not. This is as close to NOW as the anticipating brain can get. When I present this idea, some people say “No, that's not the present moment, Dan. Just be here now.” So I say “That is being here now for the brain.” Until you're dead, your brain is always anticipating the immediate next of now—this is just what it does.

SIMA creates a map of now. This map is different from being imprisoned by expectations. Those top-down constraints created by past learning are likely processed in a totally different part of the brain than the SIMA sense of the immediate next of now.

The immediate next in the SIMA of the in-breath is the out-breath. And what happens then? The out-breath comes. So there is a resonance—or match—between what SIMA was anticipating and then what actually comes. If you're then focusing on the out-breath, your SIMA process creates a map of the immediate next—the representation of the in-breath. And then what happens? The in-breath comes and suddenly, within a few cycles, you have this coherently integrated, resonating system of SIMA, which is mapping out the immediate next of now, with the now of what's actually happening in sensory experience.

So mindfulness of the breath is a profoundly integrative state. This is what can be called “reflective coherence” (Siegel, 2007a, p. 174). When you are reflecting on the breath, you're inviting your nervous system to become integrated.

An integrated system has the qualities of what can be called FACES (Siegel, 2007a). The term, FACES stands for the system's flow: *Flexible*,

Adaptive, Coherent, Energized, and Stable. This notion comes straight out of Complexity Theory. When a system is integrated, it achieves maximal complexity and it moves in a FACES flow. So when Jonathon opens his eyes and says “Oh my god,” the feeling in him through his previously out-of-control brain is now achieving a FACES flow. These new sensations, achieved during mindfulness of the breath, emerge from the creation of a high-complexity state of an integrating system. Mindfulness of the breath, we are proposing, utilizes the SIMA process that allowed him to map out the immediate next with the sensory now.

The intentional creation of the integrated state of mindful awareness happens during mindfulness meditation. *With regular practice, this effortfully created intentional state may be able to become an effortlessly established trait of the individual.* Mindfulness traits have been described by Baer, Smith, Hopkins, Krietemeyer, and Toney (2006) as including the propensity in life to:

1. act with awareness—that is, you are feeling the water in the shower as you’re taking a shower and you’re here in the sensory now;
2. be less reactive—which means you have emotional reactions to things but you come back to equilibrium quickly;
3. be nonjudgmental—which really means that you’re not imprisoned by your prior expectations, you’re not grasping onto judgments. One problem with the term, nonjudgmental, is that you’re always making judgments. In fact, the brain is always making judgments until you’re dead. So, the idea actually is not to be imprisoned by those judgments. This distinction is significant, as otherwise newcomers to the practice of mindfulness may feel like failures when they perceive themselves as being judgmental;
4. develop the ability to label and describe with words the internal world. This capacity is exactly what we do in psychotherapy: to be present enough so your left hemisphere’s labeling ability can talk about the internal world, a world mapped out more directly by the right hemisphere. This capacity to use left hemisphere words to relate right hemisphere processes is a form of what can be called bilateral integration; and
5. self-observe—this trait of self-observation, which refers to the ability to observe oneself objectively, appears to be present as an independent trait only in those who were trained as meditators.

The possibility is that if you carry out mindfulness practice (no one’s done this research yet), you will develop mindful traits. These traits would include the five that Baer and her colleagues (2006) described. Additionally, mindfulness practice reveals that such mind training also cultivates the list

of nine middle prefrontal functions we discussed previously. The key idea is that reflective coherence attained through mindfulness practices creates a state of neural integration that is at the heart of these traits and functions—and of secure attachment. In short, the proposal here is that mindfulness is an integrative process that promotes well-being in body, mind, and relationships.

THE NEUROBIOLOGY OF THE SELF

What, then, is a neurobiological view of how mindfulness impacts a sense of self? We can explore this question by first examining what is known about the way the cortex works. There's a beautiful book that's written by Jeffrey Hawkins and Sharon Blakeslee, called *On Intelligence* (2004), that has a readily accessible description of what I'm about to tell you. Basically, the cortex appears to work like this. Your cortex has six layers, layers six through one. When you have an experience like this (clapping noises) and you just hear the sound of my hands coming together, that would be close to a *bottom-up experience* in which the input of the sound comes in at layer six, goes up to layer five, and then comes up to layer four. That's bottom-up. When we've learned something, such as the name of this thing (clapping noises), we can refer to it in a "*top-down*" way called a "clap." We have prior learning that flows down from layer 1, 2, and then to 3. In *On Intelligence*, it's called an invariant representation. The older term that you're probably familiar with is a "*top-down constraint*," a top-down influence. Your effort to hear me make this sound (clapping), and hear it from a bottom-up way, is going to be constrained by your prior experience of clapping. I said clapping; I should have said of this kind of experience. Words are an example of a top-down constraint, but it's not just words. It's any prior learning.

In *The Mindful Brain*, I explore the idea that *mindfulness as a practice, attempts to dissolve the top-down constraints* of layer 1, 2, and 3 that crash down like a tidal wave on the relatively fragile and tenuous input from present ongoing sensory experience flowing from layers 6, 5, and 4.

From a psychotherapeutic viewpoint, mindfulness offers us an unbelievable opportunity to give our clients the important gift of living fully, of freeing themselves from the prison of the past in which they are constrained by top-down influences that come from levels 1, 2, and 3, and dominate the relatively weaker inputs in common life, especially adult life, of layers 6, 5, and 4. With the crashing of these two flows of information between layer 4 from the bottom-up and layer 3, which is coming from top-down, our awareness is shaped by this intertwining of top-down and bottom-up. Often our perceptual awareness may become dominated by top-down. The result

is that our awareness may be imprisoned by prior learning, even without our knowing it. We are left within a perceptual prison that we don't even know we're in. Adults can even come to feel dead inside and they don't know why. When we do mindfulness practice, a breath of fresh air comes into our lives. I think this is because mindfulness practice develops reflective coherence in one's life and strengthens the input of layers 6, 5, and 4. When this bottom-up input becomes strengthened, it has the capacity to stand up to that prior learning that so often constrains us. We are not imprisoned by prior judgments and come to experience the world with fresh eyes.

Mindfulness enables us to sense the reality that awareness is not a unitary process but may have distinct layers. With mindful awareness training, individuals can learn to modify their capacity to distinguish among these various forms of mental processing (see Farb et al., 2007). Mindfulness may entail the ability of the individual to differentiate these unique streams of awareness and then combine them in new ways (see the discussion of Farb et al., 2007, findings in Siegel, 2007b). In other words, the streams of awareness that permit us to perceive the world may not be just a single stream. I'm not suggesting that this is absolutely true or false: You can try it out for yourself. From my personal experience, I discovered that, with deep reflection, there was not just one stream of awareness. In this perspective, there was a stream of awareness that could begin with *sensation*. Sensation is a really important bottom-up experience. It's a flow of bottom-up detail that is extremely helpful for us to be able to hold onto the present moment, not getting lost in prior learning or worries about the future. It brings us right into the present moment and in this way is fundamental to mindfulness. Sensation is the beginning of the story in mindfulness practice because it allows you to clearly separate this bottom-up input from top-down constraints that shackle the mind. In his book, *Coming to Our Senses* (2004), Kabat-Zinn describes sensation as a great starting place. Similarly, from my own experience, and that of my patients, I observe that sensation is a beginning place but not the endpoint.

Another stream of awareness is observation, just as Baer and her colleagues (2006) described in their description of the trait of self-observation.

Let's say you're eating an apple. This is the experience that is happening in the present moment. The sensory stream would enable you to feel the apple on your lips, to taste it on your tongue, enable you to smell it and hear the crunch of the apple. That is all the sensory stream. But you can also sit in a room observing that you are among many people eating apples; and you too, are also eating an apple. And you're kind of observing yourself from afar. That is a form of mindfulness, when you're observing yourself. It's not exactly a sensation; it's just a different stream of awareness. Observation is not necessarily imprisoned by top-down constraints, it's just a different stream than sensation. Very important, but different.

Another stream of awareness is a conceptual stream. This conceptual stream allows you to say “This is an apple. I’m eating a fruit. This fruit, I know, came from an orchard and for hundreds, maybe thousands, of generations, human beings have cultivated fruits and I am the recipient of this unbelievable gift.” And you can feel a sense of generosity not just because of the sensory stream, but because, conceptually, you know you’re experiencing an act of gratitude for being alive, and that is a concept. Now how do you feel the concept? This is because you can have a sensory awareness of your conceptual stream.

Then there’s also a fourth stream of awareness—a stream of knowing. The first letters of these various streams spell a word that can help us to remember them: *SOCK*. Sensory, Observing, Conceptual, and Knowing is our *SOCK* of awareness. The knowing is a deep sense of knowing—a knowing before and beyond concepts, observation, and sensation. This sense of knowing, for example, can give us awareness that we are all a part of one whole.

CONCLUSION: BEFRIENDING OURSELVES AND OTHERS THROUGH MINDFULNESS

I conclude with a brief discussion of what we do with this idea of four streams of awareness, of how we can dissolve the sense of self that constrains us, of the reflective coherence that mindful integration creates, and the way in which all these things may go together. This story involves our sense of compassion. A group called *Seeds of Compassion* was formed and convened a meeting in April, 2008. I was one of the four scientists who were able to meet with His Holiness the Dalai Lama and engage in a discussion about the science of compassion, and what we can do to promote more compassion in the world. The Dalai Lama said something to the gathering (www.seedsofcompassion.org) that I found to be so useful. He spoke about two kinds of compassion: one that he called the limited and biased form. This is a “*near*” form of compassion that I believe can be generated through attachment relationships in which you learn to love people, like your family and your friends. This near form of compassion involves having empathy for those near to you in your life. This is a really important starting point in all of our lives. A lot of people in this world do not have this love, so, at a minimum, we need to help all people develop this near form of compassion.

The Dalai Lama explained that there is a second form of compassion, which he described as unlimited and unbiased. Let’s call this an “*extended*” form of compassion. The extended compassion is the compassion you have

for people you've never met, what the Dalai Lama said is the kind of compassion you could have for your enemy. We might recall that His Holiness received the Nobel Prize in 1989 for his nonviolent approach to the situation in Tibet. In our discussion, the Dalai Lama said that, in his view, although it may be difficult to feel the near kind of compassion for your enemy, nevertheless it may be possible to offer the extended form.

I asked His Holiness how we could increase these forms of compassion in the world and related to him two findings from neuroscience relevant to this pressing world issue. First, we now know that when people are under threat, they highlight the differences between those who are similar or dissimilar to them. Second, we also know from research that when we are presented with an image in a brain scanner of someone who is similar to us, our middle prefrontal are lights up in the scan as the circuits of compassion become active. When we are presented with someone not like us, they don't light up. Given these findings, I asked His Holiness, what can we do to actually allow ourselves to not go on automatic pilot, whereby we shut off our circuitry of compassion? How can we keep compassion alive even when confronted with threat(s)?

The Dalai Lama said something very funny and something very important, and for some people perhaps somewhat disturbing. He said, "You need mind training" to develop the extended form of compassion. Mindfulness training was likely what His Holiness was referring to, though he doesn't use that specific term. In other words, we need training of the mind—something beyond just love from our parents—to move beyond the near kind of compassion and develop the vital extended form of compassion in which we can have empathy for those not like us.

This discussion illuminated the notion that we need reflective skills to be taught to our patients, to ourselves, to our colleagues, to students in schools. Our personal, public, and planetary health requires that we actively develop reflection in our lives. This reflective skill training enables compassion to move from the near to the extended form. Such intentional training of the mind is crucial for us to avoid being on automatic pilot. Developing the reflective mind, nurturing the mind's awareness of itself in the development of mindfulness, is what is needed to build this wider circle of compassion.

When I asked His Holiness how we can promote this kind of skill training, he smiled and at first he said something like, "I'm not gonna tell you—it's private!" He chuckled his contagious laugh and said that this was a matter of everyone's personal practice—that being a Buddhist, he uses the Buddhist approach, but he was not going to tell others what to do. But then he got serious and said (and this is the disturbing part I imagine for some people), that religion had failed to make the world more compassionate. Whether it's a theistic religion or a nontheistic religion, like his own Buddhist tradition,

religion has failed, he said emphatically, to bring peace to this planet. And then looked at the four of us on the panel and said that it was up to us as scientists to bring a secular ethic to our world.

That moment, for me, was a deep inspiration to think more deeply about the notion of creating a secular ethic that nurtures compassion in our world. That ethic, for example, could be health, which I think a lot of people would accept with an open mind. And based upon what we have talked about today, we could make an argument that integration, promoted through loving relationships, promoted through mindfulness practice, is actually a way to bring this secular ethic of health into the world. Through our attuned relationships and our reflective practices, we can all work together to make this a kinder, more compassionate place for all of us now and for generations ahead. Befriending ourselves and others as we have seen is not just good brain hygiene or good for the world. Ultimately it is plain good common sense.

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