

An Interpersonal Neurobiology Approach to Psychotherapy: Awareness, Mirror Neurons, and Neural Plasticity in the Development of Well-Being

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***Overview***

In this article the principles of an interdisciplinary approach to psychotherapy called “interpersonal neurobiology” will be summarized with an emphasis on neuroscience findings regarding the mirror neuron system and neural plasticity. Interpersonal neurobiology is a “consilient” approach (1) that examines the independent fields of knowing to find the common principles that emerge to paint a picture of the “larger whole” of human experience and development (2). Interpersonal neurobiology attempts to extract the wisdom from over a dozen different disciplines of science to weave a picture of human experience and the process of change across the lifespan.

The perspective of “interpersonal neurobiology” is to build a model within which the objective domains of science and the subjective domains of human knowing can find a common home (3). An interpersonal neurobiology approach to psychotherapy draws on the basic framework of this interdisciplinary view in exploring the ways in which one individual can help others alleviate suffering and move toward well-being. The central idea of interpersonal neurobiology is to offer a definition of the mind and of mental well-being that can be used by a wide range of professionals concerned with human development.

## **The Mind:**

*A Definition* – The mind can be *defined* as an embodied process that regulates the flow of energy and information. Regulation is at the heart of mental life, and helping others with this regulatory balance is central to understanding how the mind can change. The brain has self-regulatory circuits that may directly contribute to enhancing how the mind regulates the flow of its two elements, energy and information.

*Mind Emergence* – The mind emerges in the transaction of at least neurobiological and interpersonal processes. Energy and information can flow within one brain, or between brains. Naturally other features of our world, nature and our technological environment, can also impact on how the mind emerges. Within psychotherapy, we can see that relationships with another person profoundly shape the flow of energy and information between two people, and *within* each person.

*Mind Development* – The mind develops across the lifespan as the genetically programmed maturation of the nervous system is shaped by ongoing experience. We now know that about one third of our genome directly shapes the connections within our brains (4). Though genes are extremely important in development, we also know that experience shapes our neural connections as well. When neurons become active they have the potential to stimulate the growth of new connections among each other. With one hundred billion neurons and an average of ten thousand synaptic connections linking one neuron to others, we have trillions of connections within our brains. These synaptic linkages are created by both genes and by experience. Nature needs nurture. Experience shapes new connections among neurons by how genes are activated, proteins produced, and interconnections established within our spider-web like neural system.

*Mental Well-Being* – An interpersonal neurobiology view of well-being states that the complex, non-linear system of the mind achieves states of self-organization by balancing the two opposing processes of differentiation and linkage. When separated areas of the brain are allowed to specialize in their function and then to become linked together, the system is said to be

integrated. Integration brings with it a special state of functioning of the whole which has the acronym of FACES: Flexible, Adaptive, Coherent, Energized, and Stable. This coherent flow (5) is bounded on one side by chaos and on the other by rigidity (6). In this manner we can envision a flow or river of well-being, with the two banks being chaos on the one side, rigidity on the other. One way of viewing the symptoms of the Diagnostic and Statistical Manual (7) for psychiatric diagnoses is as manifestations of rigidity or of chaos. This flow of well being can be seen to reveal the correlations among an empathic relationship, a coherent mind, and an integrated brain as three points on a triangle depicting well-being.

### **Promoting Well-Being**

What does an interpersonal neurobiology approach to psychotherapy offer as a framework for considering how therapy works and how to work in therapy? Therapeutic experiences that move an individual toward well-being promote integration. Deviations from this integrated flow are revealed as rigidity and/or chaos and result in symptomatic conditions that may be experienced as inflexible, maladaptive, incoherent, deflated, and unstable. To achieve the goal of promoting integration it has been helpful to delineate at least nine domains of integration that can remain in the therapist's mind within the process of psychotherapy. After briefly outlining these domains, this article will then focus specifically on the nature of interpersonal integration highlighting recent contributions from the studies of the mirror neuron system and neural plasticity. A fuller description of the clinical implications of these domains within psychotherapy can be found in other publications (8).

### ***Domains of Integration***

#### **A. Integration of Consciousness**

The mind flows as energy and information are channeled through the process of attention. The nomenclature of science refers to the presence of three general mechanisms of attention: exogenous, endogenous, and executive (9). Exogenous attention is a form of attentional focus

driven by the immediacy of an often external stimulus, such as a loud sound. A more sustained, self-generated form is called endogenous attention in which the individual chooses to focus attention on a particular stimulus. With executive attention one can create a flexible response not governed by the external world or by a singular focus of attention. The integration of consciousness involves the development of executive forms of attention that are associated with the larger capacities for self-regulation, such as the balancing of emotion, improved stress response, and enhanced social skills. Self-awareness has its roots within the central regulatory systems of the brain and thus may play an important role in various forms of psychotherapy and in various psychiatric disorders (10). In many ways, how we have developed the capacity to have a receptive, flexible form of awareness enables us to have freedom to focus our attention in ways that are most helpful to us and to those around us.

Enhancing this receptive awareness in the present moment is sometimes called “mindful awareness.” Mindfulness is defined as paying attention, in the present moment, on purpose, without grasping onto judgments. Mindful awareness has the quality of receptivity to whatever arises within the mind’s eye, moment to moment. Recent studies of mindful awareness practices reveal that it can result in profound improvements in a range of physiological, mental, and interpersonal domains of our lives. Cardiac, endocrine, and immune functions are improved with mindful practices (11). Empathy, compassion, and interpersonal sensitivity seem to be improved. People who come to develop the capacity to pay attention in the present moment without grasping on to their inevitable judgments also develop a deeper sense of well-being and what can be considered a form of mental coherence.

Within psychotherapy the focus of attention on various domains of mental, somatic, and interpersonal life can create the neural firing patterns in the brain that enables new synaptic connections to be established. Neural plasticity, the change in neural connectivity induced by experience, may be the fundamental way in which psychotherapy alters the brain. Based on the modification and growth of synapses and the potential differentiation of neural stem cells into

fully integrated neurons, neural plasticity reveals how the brain's interconnectedness can change throughout the lifespan. Consciousness may play a direct role in harnessing neural plasticity by altering previously automatic modes of neural firing and enabling new patterns of neural activation to occur.

The basic steps linking consciousness with neural plasticity are as follows: Where attention goes, neural firing occurs. And where neurons fire, new connections can be made. In this manner, learning a new way to pay attention within the integration of consciousness enables an open receptive mind within therapy to catalyze the integration of new combinations of previously isolated segments of our mental reality (12).

### **B. Vertical Integration**

Taking the perspective of the vertical plane of our somatic architecture, we can envision the anatomically and functionally differentiated elements of our bodies to extend from our head to our toes. Vertical integration directly links these elements within awareness so that new connections can be established. We know that the mind is embodied, built in part from its roots in somatic reality, but often seduced to live in the land of the purely non-physical world we can isolate as “mental.” Linking the basic somatic regulatory functions of the brainstem with the limbic circuits' generation of affective states, motivational drives, attachment, and appraisal of meaning and laying down of memory is a first layer of vertical integration.

Above the limbic circuitry emerged the neocortex, or “outer bark” of our evolving brains. The cortex, unlike the brainstem, is quite underdeveloped at birth and is shaped by both genetics and especially by experiences out in the world. In general, the posterior regions of the cortex are specialized for perception of the physical world (our first five senses) and the body itself is registered in the more forward aspects of this posterior region. In the frontal lobe of the cortex we have our motor and pre-motor planning areas that enable us to carry out behaviors. The forward most part of this frontal lobe is the prefrontal cortex. The side part of this area, known as the dorsolateral prefrontal region, is considered an essential circuit for working memory that

enables us to pay attention to something in the here-and-now. Toward the middle of the prefrontal cortex, just behind the forehead area, are several regions that are sometimes thought to be the “higher part” of the limbic circuitry and a core aspect of the social circuits of the brain: the orbital frontal area behind the eyes, the medial prefrontal cortex behind the forehead, and the anterior cingulate just behind it. These more midline structures, along with a region called the insular cortex, serve important functions in linking body, affective state, and thought. For the purpose of this discussion of the beneficial effects of psychotherapy, we’ll refer to these midline structures as the “middle prefrontal cortex” as they generally work as a team with each other.

A review of the anatomy of the middle prefrontal cortex reveals that it has a major integrative function, linking body-proper, brainstem, limbic circuits, and cortex to each other. In this manner these middle prefrontal circuits may carry out what we are labeling as vertical integration. What does this term really mean? This idea means that fibers literally physically connect the input of somatic and vertically distributed neural structures with one another. A wide array of independent studies in basic brain research reveals that these middle prefrontal areas are crucial for generating nine aspects of life: 1. Body regulation: Balance of the sympathetic (accelerator) and parasympathetic (brakes) branches of the autonomic nervous system. 2. Attuned communication: Enables us to tune into others’ states and link minds. 3. Emotional balance: Permits the lower limbic regions to become aroused enough so life has meaning, but not too aroused that we become flooded. 4. Response flexibility: The opposite of a “knee-jerk” reaction, this capacity enables us to pause before acting and inhibit impulses giving us enough time to reflect on our various options for response. 5. Empathy: Considering the mental perspective of another person. 6. Insight: Self-knowing awareness, the gateway to our autobiographical narratives and self-understanding. 7. Fear extinction: GABA (an inhibitory neurotransmitter) fibers project down to the amygdala and enable fearful responses to be calmed. 8. Intuition: Being aware of the input of our body, especially information from the neural networks surrounding intestines (a “gut feeling”) and our heart (“heartfelt feelings”) enables us to

be open to the wisdom of our non-conceptual selves. 9. Morality. The capacity to think of the larger good, and to act on these pro-social ideas, even when alone, appears to depend on an intact middle prefrontal region.

By focusing awareness on the input from the body, our affective states, and our range of thoughts and ideas, the first steps toward vertical integration can be encouraged by the therapist. With a receptive mind, it may be that this vertical integration naturally occurs. But for many individuals coming to therapy, having the intention to pay attention to the body's signals is a purposeful act that can transform a disconnected way of living into a richer, more integrated way of living.

It is relevant to note that these nine middle prefrontal functions can be seen to emerge not only with mindful awareness practices, but at least the first seven are also be associated with the outcome of secure attachment between child and caregiver (13). This finding may suggest that experiences of “mental attunement” – interpersonal in the case of attachment or internal in the practice of mindful awareness – may be at the heart of developing an integrated brain and well-being. Healthy self-regulation, through relationships and self-reflective observation, may depend on the development of the integrated circuits of these prefrontal regions (12, 14, 15).

Mental attunement may depend on a quality of openness to living in the moment that may be essential for the therapist's own stance and serve as a strategic goal for the process of therapy itself (16, 17). Of note from the neuroscience literature are preliminary studies suggest that mindful meditation practice, as one example of a receptive mental state, may actually lead to enhanced growth of the middle prefrontal regions as well as preserved neural tissue in these regions with aging (18).

### **C. Bilateral Integration**

The nervous system of vertebrates is asymmetric with left being different from right in animals from zebra fish to lizards, toads, chickens, pigeons, apes, and us (19). With more complexity comes more adaptability. Cortical function and structure are driven by the lower

asymmetries of the limbic and brainstem areas and various forms of research have revealed that the right and left cortex perceive and create reality in quite distinct ways. In this brief overview these differences will be briefly highlighted to illustrate the importance of bilateral integration.

The right hemisphere develops first after birth, its activity and synaptogenesis more robust during the first two to three years of life (20). After that period, there are a series of cyclical waves of left, then right, and then left sided dominance in growth and activity (21). In general the right and left sides of the brain have the following characteristics that have been supported by a range of scientific and clinical investigations.

The right mode of processing: A. Holistic – things are perceived in the whole of their essence. B. Visuospatial – the right side works well with seeing a picture and is not proficient at decoding the meaning of these words. C. Non-verbal – eye contact, facial expression, tone of voice, posture, gestures, and timing and intensity of response are the non-verbal components of communication that the right mode both sends and perceives from others. D. A wide range of functions, including the stress response, an integrated map of the whole body, raw, spontaneous emotion, autobiographical memory, a dominance for the non-verbal aspects of empathy. The right mode has no problem with ambiguity and is sometimes called “analogic” meaning it perceives a wide spectrum of meaning, not just a digital restricted definition of something.

The left mode of processing: A. Linear – the left loves this sentence, one word following the next. B. Logical – specifically syllogistic reasoning in which the left looks for cause-effect relationships in the world. C. Linguistic – these words are the left’s love. D. Literal – the left takes things seriously. In addition, the left is sometimes considered the “digital” side, with on-off, yes-no, right-wrong patterns of thinking.

One proposed manifestation of impaired left-right integration can be that the drive of the left hemisphere to tell stories, to explain in a linear fashion using words, would be compromised if the story were about the self. Given the repeated finding of autobiographical memory being primarily mediated within the right hemisphere, what would a life-story be like if the narrating

left hemisphere could not easily access the non-verbal autobiographical details of the right side of the brain? Before we turn to such narrative incoherence, let's first look at the integration of memory.

#### **D. Integration of Memory**

Memory can be defined as the way in which a past experience alters the probability of how the mind functions in the future. Memory shapes how we experience the present and how we anticipate the future, readying us in the present moment for what comes next based on what we've experienced in the past. This broad view enables us to examine the findings of two aspects of memory and explore how their integration can promote well-being. Segregation of these memory functions, in contrast, may be seen as one aspect the source of mental suffering.

Experience creates the activation or "firing" of neurons. This neuronal activation can in turn lead to alterations in the connections among neurons, the basis of neural plasticity. Throughout our lives we embed experience into memory via a first layer of processing called "implicit" or "non-declarative" memory. Before one and a half years of age, this early implicit layer of memory is the only form available to the growing infant (22). But even beyond that early age, we continue to create implicit memories but they are then often selectively integrated into the next layer of processing called "explicit" or "declarative" forms of memory.

Implicit memory involves the perceptual, emotional, and behavioral neural responses activated during an experience. It is likely that our bodily sensations are also a form of implicit memory, but these have not been formally studied in research paradigms. Mental models, or generalizations of repeated experiences called "schema," are also a form of implicit memory. The brain also readies itself to respond in a fashion called "priming" in which past experiences shape the way we prepare for the future.

Implicit memory encoding does not require focal, conscious attention. A second crucial feature of implicit memory is that when we do retrieve an element of implicit memory into

awareness we do not have the internal sensation that something is being accessed from a memory of the past. We just have the perceptual, emotional, somatosensory, or behavioral response without knowing that these are activations related to something we've experienced before.

The second layering of memory is called explicit and involves the two forms of factual (or "semantic") memory and episodic (or memory for an episode of an experience in the past). Episodic memory has a sense of the self and of time. Both semantic and episodic memory appear to require focal attention for their encoding and when they are retrieved from storage into present awareness they do have the internal sensation that something is being activated from the past. The hippocampus may serve an important role in memory integration as it functions as an "implicit memory puzzle piece assembler" that clusters the basic building blocks of the various elements of implicit memory together into framed pictures of semantic and episodic memory. These framed pictures of explicit memory can then be further integrated into autobiographical memory, a function that may involve rapid eye movement sleep as our dreams integrate our past experiences, our daytime events, and our emotional themes of our lives.

One proposal about trauma's effects on memory is that it may transiently block the integrative function of the hippocampus in memory integration (23). With massive stress hormone secretion or amygdala discharge in response to an overwhelming event, the hippocampus may be temporarily shut-down (24). In addition to this direct effect of trauma of hippocampal function, some people may attempt to adapt to trauma by dividing their conscious attention, placing it only on non-traumatic elements of the environment at that time. The resultant neural configuration of blocked hippocampal processing, when reactivated, can present itself as free-floating, unassembled elements of perception, bodily sensation, emotion, and behavioral response without the internal sense that something is coming from the past. Beliefs and altered states of mind may also enter consciousness as the implicit mental models and priming become activated in response to environmental or internal triggers resembling

components of the original experience. This “implicit-only” form of memory can be one explanation for the flashbacks and symptomatic profile of Post Traumatic Stress Disorder.

The key to memory integration is the neural reality that focal attention allows the puzzle pieces of implicit memory to enter the spotlight of attention and then be assembled into the framed pictures of semantic and self-memories. With such reflective focus, what was once a memory configuration capable of intrusion on a person’s life can move into a form of knowing that involves both deep thoughts and deep sensations of the reality of the past.

### **E. Narrative Integration**

As we continue to grow throughout the first five years of life, explicit autobiographical recollection becomes even further integrated into narrative memory which involves the detection and creation of thematic elements of our lives. The brain appears to be able to have a narrative function that can detect themes of our life story and to draw heavily on prefrontal functions as they continue to integrate neural maps that form the underlying architecture of our episodic and autobiographical memory systems. With narrative reflection, one can choose, with consciousness, to detect and then possibly change old maladaptive patterns.

In the attachment research world, it is coherent narratives, stories that deeply make sense of our lives, which are the most robust predictor of how children will attach to us (25). This finding suggests that parents who’ve made sense of their lives, as revealed in their coherent life narratives, will be those that somehow offer their children patterns of communication that promote well-being. In brief, we can summarize the exploration of this finding by suggesting that it is the parents’ neural integration that helps them create a coherent narrative, and helps them be receptive to their child’s own mind and communicative signals (26). Such a pattern may reflect the central role of inter- and intrapersonal mental attunement in the development of well-being.

### **F. State Integration**

As the brain becomes activated in the moment, it coalesces its firing patterns into clusters of activation we can call a “state of mind.” These repeated and enduring states of activation of the brain can help define what we see as our personality, our patterns of perception and emotional and behavioral responses that help us denote who we are. We can embrace the differentiated states of mind and their drive to satisfy different needs for familiarity and comfort, novelty and challenge, connection and love, mastery and exploration. State integration refers to the way we embrace and nurture these different states and their defining needs across time. Late adolescence is thought to be a time of resolution of these conflictual states, with mental well-being emerging when such state integration is done well and mental turmoil present when resolution is not achieved (27). Finding balance in the integration of states enables us to find our needs satisfied and to create meaning in the pursuit of those various dimensions of our lives.

### **G. Temporal Integration**

As we move from our earliest years and our prefrontal cortices begin to develop our capacity for reflection on the nature of time begins to emerge. First available as a form of mental time travel that enables an early form of self-knowing awareness, this reflective capacity to link past, present, and future soon reveals itself in an awareness of the finite nature of our time on this planet. We learn that people’s lives are often limited to a century or so, and that the experience of death is an inevitable part of each of our lives. Temporal integration directly confronts this organizational role of time, and our transient lives, in helping us consider the deep questions of purpose in life.

### **H. Interpersonal Integration and the Mirror Neuron System**

Our brain is the social organ of the body. The structure of our neural architecture reveals how we need connections to other people in order to feel in balance and to develop well (28). As we’ve seen in the function of the middle prefrontal regions, the brain integrates input from other

people with the process of regulating the body, balancing emotional states, and the creation of self-awareness. This visceral, social, and self integration suggests that our minds are woven from the integration of aspects of reality that on the surface appear to be quite disparate. How could bodily, interpersonal and mental go together? To explore this dimension, let's use the example of mirror neurons to highlight the integration of these domains of reality (29).

Discovered in the mid-nineteen nineties, the mirror neuron system reveals how the brain is capable of integrating perceptual learning with motor action to create internal representations of intentional states in others. Initial studies in monkeys revealed that if a monkey sees someone pick up an object, his own motor system will become primed to imitate that same action. In humans, the mirror neuron system is much more complex and emerging studies reveal that many ways in which our internal, one-to-one, and larger social experiences may be shaped by the integrative nature of this system.

For example, the mirror neuron system is thought to be an essential aspect of the neural basis for empathy (29, 30). By perceiving the expressions of another individual, the brain is able to create within its own body an internal state that is thought to “resonate” with that of the other person. Resonance involves a change in physiologic, affective, and intentional states within the observer that are determined by the perception of the respective states of activation within the person being observed. One-to-one attuned communication may find its sense of coherence within such resonating internal states. In addition, the behavior of larger groups, such as families and social gatherings may reveal this shared state of internal functioning.

The clinical implications of this work are profound (30, 12) and help therapists to understand not only the inherently social nature of the brain but that their own bodily shifts may serve as the gateway toward empathic insights into the state of another person. Mediated via the insula, perceptions of another's affective expressions may alter our own somatic and limbic states and then be examined through a prefrontal process of interoception, interpretation, and attribution to another's states (31). Being open to our own bodily states as therapists is a crucial step in

establishing the interpersonal attunement and understanding that is at the heart of interpersonal integration. The term “countertransference” can be used to refer to this important way in which our own non-verbal shifts in brain state may offer us a direct glimpse into the internal world of our patients.

The mirror neuron system offers us a new vista into the neural basis of not only imitation, social behavior and empathy, but also the interpersonal experiences that may promote a state of well-being. Mirror neurons reveal the fundamental integration within the brain of the perceptual and motor systems with limbic and somatic regulatory functions. The mirror neuron system also illuminates the profoundly social nature of our brains. This social basis of neural function may offer new pathways for us to understand how psychotherapy leads to the process of change. When two minds feel connected, when they become integrated, the state of firing of each individual can be proposed to become more coherent. Literally this may mean that the corresponding activations between the body-proper, limbic areas and even cortical representations of intentional states between two individuals enter a state of “resonance” in which he matches the profiles of the other. The impairment of such shared states has been proposed to be a characteristic of forms of psychopathology, including schizophrenia (29). Recent studies in individual with autism spectrum disorder (32) reveal impairment in the capacity to perceive emotional expressions in others that is associated with markedly diminished mirror neuron activation. With impaired mirror neuron system functioning, the social brain is unable to share in the rapid social interactions that depend on a shared set of neural profiles that create an embedded matrix of both social behavior and non-verbal understanding of the meaning of social interactions.

In the process of psychotherapy with a range of individuals with intact mirror neuron systems, shared states with the therapist may be an essential component of the therapeutic process. As two individuals share the closely resonant reverberating interactions that their mirror neuron systems makes possible, what before may have been unbearable states of affective and

bodily activation within the patient may now become tolerable within conscious awareness. Being empathic with patients may be more than just something that helps them “feel better” – it may create a new state of neural activation with a coherence in the moment improves the capacity for self-regulation. What is at first a form of interpersonal integration in the sharing of affective and cognitive states now evolves into a form of internal integration in the patient. With the entry of previously warded-off states of being in conscious awareness, the patient can now learn to develop enhanced self-regulatory capacities that before were beyond their skill set. It may be that as interpersonal attunement initiates a new form of awareness that makes intrapersonal attunement possible, new self-regulatory capacities become available.

If the mirror neuron system were to be focused on one’s own states of mind, we can propose that a form of internal attunement would allow for new and more adaptive forms of self-regulation to develop. The practice of focusing attention in the present moment on one’s own intentions and somatic states, such as the breath, have been a mainstay of mindful awareness practices over thousands of years. The recent findings that such practices are associated with enhanced physiological, psychological and interpersonal functioning may fit into the larger framework that integrated states correlate with well-being. A “Mirror Neuron-Mindfulness Hypothesis” can be offered (12) that proposes that the focusing of one’s non-judgmental attention on the internal state of intention, affect, thought and bodily function may be one way in which the brain focuses inward to promote well-being. As the therapist attempts to achieve such an open, receptive state of awareness toward both internal state changes and for interpersonal signals sent by the patient, the patient’s own mind may be offered the important social experiences to create a similar state. In this way the mirror neuron system may serve a powerful role as the neural basis of mental attunement within and between both patient and therapist.

Studies of attachment reveal that the parent’s openness to a child’s signals and the coherence of the parent’s own narrative are important predictors of a child’s development of security of attachment (13). Such factors seem to promote a form of resiliency in the child which

helps self-regulation unfold as the child matures. Psychotherapy may naturally harness these developmental origins of well-being in creating a resonant state in which the therapist is sensitive to the patient's signals and also has made sense of his or her own life. Being open to the many layers of our experience, often involving the non-verbal world of sensation and affect in addition to our verbal understanding is an important stance for the therapist to create toward the internal and interpersonal worlds. Within this framework, the state of brain activation in the therapist serves as a vital source of resonance that can profoundly alter the ways in which the patient's brain is activated in the moment-to-moment experiences within therapy. Such interactive experiences allow the patient to "feel felt" and understood by the therapist, and they also may establish new neural net firing patterns that can lead to neural plastic changes. Ultimately lasting effects of psychotherapy must harness such experiences that promote the growth of new synaptic connections so that more adaptive capacities for self-regulation and well-being can be established.

#### **H. Transpirational Integration**

As individuals move forward in achieving new levels of integration across the eight domains described above, clinical experience reveals a fascinating finding in which people begin to feel a different sense of connection to both themselves and the world beyond their previously skin-defined sense of self. The term "transpiration" denotes how new states of being seem to emerge as a vital sense of life is breathed across each of the domains of integration. One feeling that many patients have articulated is a sense that they are connected to a larger whole, beyond their immediate lives, than the previous sense of isolation they may have been feeling from others, and even from themselves. It may be that our highly evolved mirror neuron systems reveal the fundamental ways in which we are neurally constructed to feel connected to each other. Because neural plasticity appears to enable the brain to change throughout the lifespan, it may be that psychotherapy for individuals at any age can allow for interpersonal experiences to open the door to change.

Our work as psychotherapists may to dedicate our lives to helping alleviate suffering in individuals, couples, and families, and also to be a part of a larger effort to bring integration and healing into the many layers of our interconnections with each other. When we examine the deep layers of our neural selves we come to glimpse not only the roots of our mental and social lives, but the essential reality of our selves as part of an integrated whole across the span of life.

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