Thoughts on Mirror Neurons Systems

First of all, one more grateful thank you to Jessica Boyatt for leading us into the field of mirror neuron systems, a complex and challenging terrain. Jessica provided us both with current papers and with her concept of the importance of relating in the intersubjective space, a concept which she describes in "The Relational Synapse (attached)."

I'd like to add some of my thoughts on mirror neurons systems. My thinking has moved through multiple layers of networks, from evolution to neural net systems, ending up, as it usually does, attempting to bridge these concepts at the subjective and intersubjective level. I hope you will use this as a platform to add your thoughts.

I. About the Existence of Mirror Neuron Systems (MNS)

Any theory of how external information is represented internally must be consistent with evolution and not just with mammals but also with their precursors. Marc Hauser states that when a scout bee returns to the hive, it shares information with other bees through a dance. That is pretty amazing. He then adds, "But this is all that they do."

How do they do that? The scout bees emit information through their sensory and motor capacities, which their colleague bees receive through smell, vision, and sound. And this information "creates inner comprehension" in their bee colleagues, which in turn, results in future action sequences. Could mirroring exist at an early evolutionary level?

Pro-MNS researchers feel that MNS have been observed in humans (premotor, inferior frontal, inferior and superior parietal cortices, and possibly in the somatosensory areas), primates, and birds. Ramachandran believes they are important to imitation and language acquisition.

Other researchers disagree with MNS imaging results. They claim that the imaging results are evidence of *separate* selective movement activity for *observed* and *executed* movements. They feel there may be minor MNS activity in small neuron groups for *both* observation and execution of movement but that these neuron groups do not dominate the fMRI responses.

Although MNS remain in the realm of theory, they offer us the first biological possibility that when we experience purposeful sensory stimulation, our brains may *simulate* this external experience neurophysiologically using multisensory inputs (including auditory, visual, affective, olfactory, appetitive, gustatory, and, most importantly, feelings). For example, we largely use the visual realm to simulate motor movement. However, if our eyes are closed, touch, proprioception, smell, hearing, and feelings translate external movement into internal experience. Researchers call this perception action coupling.

II. Simulation and Theory of Mind (TOM)

Simulation theory (which appeared a decade before MNS) and TOM are very big topics currently. They are seen as complementary systems with different developmental time courses. MNS may simulate observed actions and allow us to infer goals and intentions and thus contribute to TOM skills. This is a very powerful contribution to our current understanding of the human reflective self.

Another major advance in understanding the human self was published last year by Buckner et al. entitled "the default network." They describe a "self" network that is active when we are not focused on specific tasks. The huge surprise for students of memory is that our brain is more active when we are not focused on a given task then when we are. And those brain regions that light up constitute the area that "free associates," multitasks, imagines, and makes meaning.

In order to understand all these systems in the adult, we need to understand them developmentally. Our studies of the infant brain/mind have fostered less metaphysical paradigms in the past few decades. Actually libido and structural theories are very compatible with findings epitomized by Schore's exploration of the maturation of the R brain/mind of the infant during the first year of life and the cognitive developmental (TOM) paradigm of Fonagy et al. These paradigms help us to understand the epigenetic evolution of imitation, joint attention, symbolic thinking, perspective taking, memory, voluntary motoric and affect regulation, agency, and ultimately the highest human capacity, empathy. In essence this is the epigenetic development of the emotional, cognitive, and motoric human self, the reflective self. And that is what the default network describes.

III. The Notion of Empathy

A few luminary researchers have independently argued that the MNS is involved in empathy. The creature in our house with the biggest and totally unambivalent empathy is our dog, Justy.

I find it problematic that all the MNS writers use empathy in the way psychoanalysts used to use contagion of affect and sympathy. This recent definition was created by psychologists in the 1990s and implies a resonance with the feelings of the other *in all conditions.* I believe empathy for others and for ourselves is one of the highest emotional/cognitive mentalization capacities. If we are lucky, it evolves over the course of life and allows us to have compassionate understanding when the other's position is different from ours.

Empathy does allow the analyst to hold in mind in a positive, unambivalent way the patient who is angry at the analyst. I think that when empathy succeeds, we have received the patient's anger through contagion of affect and have inhibited our own feelings. We experience the vibes but don't act on them. We taste the anger but don't swallow it. If MNS are contributors to imitation, they may also be important to inhibition.

Most of us, especially during our training years, have on occasion found ourselves mirroring the patient's anger and been flooded with our own unmetabolized anger. OOPS! And then we were caught in the unfolding of the phenomenon of projective identification. MNS is a good vehicle for understanding contagion of affect. However, how we experience an overwhelming emotion involves our own life experience of that emotion, implicit and explicit, in all its textures and colors. And that is a semi-hard wired intrapsychic structure/function that has evolved, especially in infancy, in relationships with others. Those of us who are good poker players are pretty good at not letting others pick up a lot in the intersubjective space.

My own bias is that putative MNS and simulation capacities allow for contagion of affect and recognition of intent. And if the parent's (or therapist's) affect is indeed empathic, the child will resonate with the empathy, and it will calm her anger. She may implicitly know how the parent holds her in mind and how she can feel about her own pain. If she can identify with that, she is indeed lucky!

IV. The Intersubjective and Intrapsychic

I am adding these thoughts so that we can compare them with Jessica's evocative portrayal of "the relational synapse." The problem is that intrapsychic and intersubjective are too often presented as either/or paradigms when in fact they are both/and paradigms.

Psychoanalysis spent most of the twentieth century exploring the private, *intrapsychic* subjective domain of human experience. As a necessary corrective, we began to explore attachment and relational paradigms about three decades ago. In infancy coconstruction of experience is crucial to the epigenetic unfolding of feeling, thought, and memory processes. However, the toddler who recognizes himself in a mirror is already able to consciously and then unconsciously hold in mind private thoughts and feelings. This ability represents the earliest expression of conscious withholding from others and the beginning of Freud's dynamic unconscious. Deception, which our species has perfected, may also begin at this time. We are very adept at hiding our private experience both from ourselves and others. As we continue to grow, our individual perspective is increasingly shaped by our individual emotions, motivations, and thoughts. These all reflect our interconnections with others but are then recursively recontextualized within ourselves. Coconstruction of experience occurs not just with those directly present but also with those who came before through their writings, art, music, philosophy, and scientific thought. And most importantly, we have dialogues with ourselves; we exist in relation to ourselves. That is the essence of human imagination, language, and consciousness, which thrive on both imitation and innovation (Tomasello, 1999). This is what promotes the continuous cultural evolution of the human self.

The relational perspective has been a wonderful and necessary addition, but it does not take precedence over the intrapsychic one. Had Freud, Jung, and Janet begun by studying the intersubjective experience, we would now be focusing on the private, intrapsychic experience of the brain/mind. Dreams illustrate this concept well. No one has ever been able to convey to

another the dream sounds, colors, architectural wonders, or narratives—the total phenomenological complexity of a single dream. The best we can do is to create skeletal shadows of our dreamscapes.

V. Deception and Defense Mechanisms

The psychoanalytic perspective includes Tomasello's idea that every human infant/child imitates and then innovates. This resonates with our sense that the brain makes meaning and that "imagination is the highest prerogative of men" (Darwin).

The early facial affect studies of Ekman show that the nine-month-old infant will smile spontaneously in a semi-obligatory manner when shown an actress smiling. If we invoke MNS at this age, this may suggest that the inhibitory aspect of that system is not yet functional or online. We used to call this "the limbic smile" before the event of MNS. Of particular importance is that this appears to be a semi-obligatory response in the infant that disappears in the older child (P.I.) who is learning agency, namely volitional control over motor, affect, and cognitive systems. Volitional control involves attention, excitation, and inhibition.

This brings us to a crucial phenomenon in the growing child, namely inhibition and its role in generating flexible and adaptive strategies. MNS theory postulates that a major part of the perception action sequence is inhibition of action.

Our current convention is that crucial maturational changes occur in the infant at about 18 months. These include the beginning of self recognition, symbolization, and the dynamic unconscious. This is point in time when the parent can no longer assume she knows what her toddler is feeling and thinking. The toddler is beginning to have private thoughts and feelings. Prior to this developmental phase, spontaneous dissociation in the face of stress was the "defense mechanism" when parental availability was inadequate to maintain a trusting connection. And, as we know from Borderline Personality Disorder, such a developmentally early dissociation response can become conditioned. It is so damaging because it interrupts the connection with the other. Imaging work has shown that in BPO prefrontal executive inhibition is inadequate, the amygdala and related midbrain and limbic areas are overly active, and the structure and function of certain basal ganglia (L putamen and globus pallidus) are altered. (Karlen Lyons Ruth has had participants in a very long-term stress study imaged to try to correlate the effects of early stress.)

Currently many feel that in the older "neurotic" child, inhibition, meaning defense mechanisms like repression, allow the relationship to be sustained while excluding certain thoughts and feelings from consciousness. Repression and its variants appear to occur more on the cortical/subcortical level, creating less distressing limbic and midbrain arousal. As we pursue the vast field of dissociation, we need to be able to parse the individual's developmental history, including her defense mechanisms.

That's it folks. Thanks for taking the time to read it. If you have come this far, please post your ideas.