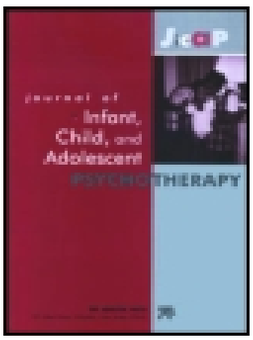

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Scaffolding the Brain: Infant Parent Psychotherapy during the Primary Biological Entrainment Period

Ruth P. Newton, Ph.D.

ABSTRACT

The unparalleled development of the infant brain occurring within and simultaneously with the forming of a primary attachment bond challenges clinicians to incorporate developmental neuroscience into infant/parent psychotherapy. There is growing evidence that evolution has selected the last trimester of pregnancy continuing through the first two to 2.5 years of life as a Primary Biological Entrainment Period when the quality of infant/parent care and attuned communication (or its lack) affects brain development, secure attachment, and emotional regulation. The manuscript is primarily a theoretical contribution arguing for the need of deeper biological work in infancy. The author suggests the use of an evidenced informed neurobiological scaffold for Infant Parent Psychotherapy called Integrative Regulation Therapy during the Primary Biological Entrainment Period.

Introduction

The clinical application of the now robust neuroscience on attachment is still in its infancy (Cassidy & Shaver, 2008; Schore, 1994, 2001a, 2001b; Schore & Newton, 2013; Zeanah, 2019). Yet clinicians experiencing hard to conceptualize implicit, nonverbal patterns of interaction in infant parent dyadic therapies are turning to neuroscience for assistance. Introducing the section on evidence-based interventions in the *Handbook of Infant Mental Health*, Zeanah (2019) commented that "although the growing evidence base is a very good thing, what is lacking … is research that attempts to answer what works for whom" (p. 481). The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (American Psychiatric Association, 2013) is helpful in organizing specific downstream outcomes into explicit diagnostic features, but it is not capable of adequately profiling the lived, dyadic experience of infancy. The five-axis Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood (DC: 0–5; ZERO TO THREE, 2016) provides more assistance in profiling relational concerns seen in infancy, but the nosology continues to be organized around diagnostic thresholds for clinical disorders without adequately addressing the attachment organization of the parent known to play a significant role in the attachment organization of the child (Benoit & Parker, 1994; Sroufe, Egeland, Carlson, & Collins, 2005; van IJzendoorn, 1995).

Karlen Lyons-Ruth and her colleagues (2017) profile a growing worldwide concern of increasing parent/caregiver stress affecting infants and suggest that organizations serving parents with infants and young children be adequately trained in infant mental health. Given the distinctive nature of experience-dependent brain development in infancy (Schore, 1994, 2001a, 2001b, 2005), dyadic models are needed to assist infants and their parents during this unparalleled development period. Because toxic stress in infancy is associated with lifelong effects as levels of stress hormones interact with brain development (Skonkoff & Garner, 2012), and the first year of life is associated with the

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formation of infant attachment (Ainsworth, Blehar, Waters, and Wall, 1978) with insecure attachment associated with anxiety, depression, and externalizing problems (Fearon, Bakersman-Kranenberg, van IJzendoorn, Lapsley, & Roisman, 2010; Lyons-Ruth & Jacobvitz, 2008; Sroufe et al., 2005), and insecure-disorganized attachment associated with serious mental health issues (Carlson, 1998; Carlson, Cicchetti, Barnett, & Braunwald, 1989; Granqvist et al., 2017; Lyons-Ruth, 1996; van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999), a neurobiological brain-based dyadic approach is needed to support infant/parent dyads.

The author will suggest that Infant Parent Psychotherapy (IPP: Fraiberg, 1980; Fraiberg, Adelson, & Shapiro, 1975; Lieberman, 1992; Lieberman, Silverman, & Pawl, 2000) an evidence-based dyadic therapy be scaffolded by an evidence-informed, brain-based neurobiological scaffold called Integrative Regulation Therapy (iRT: Newton, 2009/2013, 2017) and used in dyadic therapies during the Primary Biological Entrainment Period covering infancy and toddler years. Clinicians trained to use the Integrative Regulation Therapy (iRT) scaffold relationally integrate within a typical IPP therapy that is based upon referral concerns, the neurobiological principles of nonverbal communication, right brain development, attunement, resonance, and synchrony in infant communication, and its resulting regulation of affect. iRT is a multi-leveled approach to an infant/parent relational family system that attends to the development of infant, the health of the parent, and the quality of their relationship all within presenting concerns. The author suggests that Infant Parent Psychotherapy scaffolded with Integrative Regulation Therapy (IPP/iRT) during the Primary Biological Entrainment Period best supports the relational nature of the infant/parent dyad within its family system during this unprecedented period of brain development and entrainment.

Primary biological entrainment period

Entrainment is a term commonly associated with circadian rhythms involved in infant sleep/wake cycles entrained to the earth's light/dark cycle (Mirmiran, Kok, Boer, & Wolf, 1992). Other neuroendocrine hormones, such as the stress hormone cortisol, are also entrained during the first months of life showing reliable circadian patterns by 3 months of age (Gunnar and Donzella, 2002). Sander (2008a), however, found evidence that infants who were fed on demand from their mothers began to synchronize their sleep cycles toward a 24 hour rhythm within 4 to 6 days of life versus those infants fed on an every 4 hour schedule by different hospital nurse carers indicating that the quality and consistency of parental response is also involved in entrainment.

Biological entrainment organizes ranges within neural systems associated with infant survival in the environment born into (Schore, 1994). Sander (2008a) expands the concept of entrainment to include multiple levels of microregulation of biological and psychological processes related to the timing or *biorhythmicity* of events, which leads to a "basic organizational structure for a life-support framework" (p. 117). The emphasis on *timing* of events, such as what immediately follows an infant-initiated bid for play, comfort, food, etc., and the corresponding consistency of response, forms an implicit *background*, according to Sander (2008b), which "organiz[es] the infant's perceptual focus in the foreground " (p. 188).

Basic evolutionary-built biological principles interacting within genetically unfolding developmental stages and the inner representations created through lived experience within primary attachment relationships (Stern, 1985, 1995; Tronick, 2007) set up what John Bowlby (1969/1982) called the internal working model templates, Sander (2008a, 2008b) the implicit background, Tronick (2007) coping responses resulting from the quality of mutual regulation, and Stern (1985, 1995) the affect/feeling schemas associated with primary relationships in infancy. The biological tools by which these models are created rely on neurobiological principles such as 1) what fires together wires together (Hebb, 1949), 2) neural responses increase as more episodes occur, called long-term potentiation (Teyler & Di Scenna, 1987), 3) repeated stimulation of a network lowers the firing threshold thus firing faster (Goddard, 1967; Goddard, McIntyre, & Leech, 1969), and conditioned stimuli generalize to unconditioned stimuli (Pavlov, 1927). Given that the brain has a bottom

up developmental trajectory, that is, the phylogenetically older subcortical brain systems mature first (Gogtay et al., 2004; MacLean, 1990) and the core self is thought to be more subcortical and interwoven within the primary sensory affects (Damasio, 2018; Edelman, 2004; Panksepp, 2012), the quality of lived-experience in infancy within primary attachment relationships is critical for the health and well-being of infants, their families, and the next generation.

Evolutionary processes appear to have selected and conserved a critical period for developing an infant/parent attachment bond that develops over the first year of life and is measurable between 12 and 18 months of age in multiple cultures (Ainsworth et al., 1978; Grossmann, Grossmann, & Waters, 2005; van IJzendoorn & Kroonenberg, 1988). Schore (1994, 2001a, 2001b, 2005) theorizes that the attachment bond formation corresponds to a sensitive period for the right cerebral hemisphere, that is, the last trimester of pregnancy (Mento, Suppiej, Altoe, & Bisiacchi, 2010) to about 2 to 2.5 years of life (Chiron et al., 1997; Schore, 1994, 2001a, 2005). Fawcett and Frankenhuis (2015) point out that sensitive periods or "sensitive windows" are periods in development when the "phenotype [infant] is particularly responsive to environmental conditions" (p. 2) allowing for maximal adaptiveness to cues in the environment.

Although there are substantial differences between the infant and toddler stages of development, both stages appear to be subsumed within a right hemisphere sensitive period (Chiron et al., 1997; Newton, 2006, 2008; Schore, 2001a), a period when dynamic relational patterns interacting with expanded development continue to be created, reinforced and entrained. The left hemisphere appears to go into its sensitive period of development around 3 years of age (Chiron et al., 1997) corresponding with the preschool developmental period (Newton, 2008). Thus, the entire right hemisphere sensitive period is considered a part of the Primary Biological Entrainment Period (Newton, 2009/2013, 2017); it is this period the author wishes to suggest a neurobiological scaffolding for infant/parent dyadic therapies be used.

Gainotti (2012) has hypothesized that events occurring within pregnancy and the first 2 years of life are encoded in an unconscious memory that cannot be removed. Schore (2001a) proposed that three regulatory centers in the right hemisphere (amygdala, anterior cingulate, and orbitofrontal cortex) are online at birth, between 3 and 9 months, and 10 and 12 months, respectively, giving further weight to a biological critical period during the first two to 3 years of life. These centers continue to mature throughout the toddler years with the orbitofrontal cortex continuing to mature throughout life (Schore, 1994, 2005). Thus, the Primary Biological Entrainment Period may be viewed as a unique time in development when evolutionary principles interact with lived experience to build a brain and install a unique "operating system" for living within the environment born into.

Because the quality of the infant/parent attachment is well associated with emotional regulation and self-development (Cassidy & Shaver, 2008; Sander, 2008a; 2008b; Schore, 1994, 2000, 2003a, 2003b; Stern, 1985, 1995; Tronick, 2007; Trevarthen & Aitken, 2001), the nonverbal implicit language of eyes, facial expressions, voice prosody, gestures, touch, and scent, the language that all infants are born speaking, is primary in infancy. This requires both primary and secondary carers to enter into good-enough, attuned, synchronous nonverbal conversations with infants for healthy biological development to occur. This also means that parents, other infant carers, and clinicians can comprehend and respond with good enough empathy, attunement, and synchrony to the human race's ancient implicit language that is still two-thirds of all communication, across all cultures, even today (Burgoon, Guerrero, & Floyd, 2010).

However, infant attachment security with its associated self-regulation, and the growth and maturity of an unique core self-developing toward greater complexity, integration, coherence, consciousness, and agency appear to require something more, that is, a key ingredient that might be described as the need of an attuned, sensitive, and committed partner willing to dance within ongoing conversations in the process of becoming *known* (Beebe et al., 2010; Newton, 2009/2013, 2017; Sander, 2002, 2008b; Schore, 2011; Stern, 1985, 1995; Trevarthen & Aitken, 2001; Tronick, 2007). For Sander (2002), "*the experience of recognition* that is, the specificity of a moment of one's

knowing that one is *known* by an *other* gradually expands as the infant moves to increasingly complex levels of function" (p. 13, emphasis his). Sander (2002) suggests,

> Why not begin with uniqueness as a central principle in the organization of a living system? I suggest … that specificity of recognition of that uniqueness – in an interactive system – is key to an organizing process based on constructing the essential specificity of connection between components that is necessary to achieve the coherence or wholeness of the system required for continuity of its life. (Sander, 2002, p. 35)

Tronick (2007) adds that these dyadic states of infant/parent emotional connection lead to an emerging dyadic, or shared, consciousness that expands the complexity and coherence in both. "During an interaction, information about the infant's state of consciousness (e.g., intentions, affects, and arousal level) is conveyed through affective configurations that are apprehended – come to be known – by the mother." (p. 407). Being *known* then maybe the core and necessary ingredient in brain organization, coherence, consciousness, and secure self-development. In fact, it appears to lead the process.

In the author's opinion, this means that early childhood treating clinicians have to not only have the knowledge of brain development occurring within the Primary Biological Entrainment Period, but more importantly, have this knowledge integrated at such a level as to apply it. This level of integration can help clinicians to achieve the flexibility needed to move from difficult nonrelational comments (such as those seen in the Clinical Concerns sections) to a response that conveys understanding, but at the same time weaves an attuned microchange into the parent's awareness. This is the skill and the art. If a response is attuned enough, all in the room tend to experience a freshness or as Tronick (2007) has said "something new, something expanded, and something [uniquely] singular" (p. 410). And this begins a process of change.

Nonverbal communication

Evolution is deeply invested in pregnancy and infancy to ensure that infants survive to reproductive maturity thus insuring the survival of the race. Adapting to the environment and preserving what "fits" is the very essence of evolutionary interests (Darwin, 1871/2006). Thus, the human infant's body/brain continues to unfold, stage-by-stage within good enough attuned primary relationships, reflecting the phylogeny of the entire human race. All mammalian infants appear to be born speaking the ancient implicit nonverbal language of the sensory affects (Panksepp & Biven, 2012) that is, the language found in eyes, facial expressions, voice prosody, touch, gestures, and smells. It is only the human infant that will go on to develop verbal language in most cases.

For the past several decades, neuroscience has steadily moved with greater authority toward the early years of development, the priorities of evolution, and the invariant position of survival. Although an important part of our evolving clinical heritage, the predominance of psychological theory focused on the structure of behavior and mind is quickly dissolving into a deepening awareness of the primacy of nonverbal implicit affective communication and its role in both organizing and shaping the neurobiological base (Damasio, 2018; Edelman, 2004; Panksepp, 2012). The emergence of Evolutionary Developmental Psychology (Bjorklund, 2018; Geary & Bjorklund, 2000), the evolutionary neurodevelopment theory put forth by Ellis, Boyce, Belsky, Bakermans-Franenburg, and van IJzendoorn (2011), the evolving psychoanalytic thought toward relational developmental processes (Sander, 2002; Seligman, 2019; Stern, 1985, 1995; Trevarthen & Aitken, 2001), the evolving shift from biology into *dialogic* mechanisms (Lyons-Ruth, 2008), and returning the mind to the body (Edelman, 1992) all appear to be moving an evolving biology into its fundamental orientation to relational development.

The phylogenetic primacy of nonverbal communication is ancient and far preceded verbal articulated language estimated to be only 50,000 years old (Wade, 2006). In fact, life itself seems to have erupted out of nonconscious movement with its inherent implicit responses (see Damasio, 2018; Woolley-Barker, 2017 for a more in-depth discussion). Thus, awareness, sensing, and the

intent of movement appear to have developed into a nonverbal language that has meaning. According to Panksepp and Biven (2012), this primal implicit language is shared among all mammals, and human infants are born "speaking" it. Musicality is inherent in infant/parent nonverbal communications (Malloch, 2000; H. Papousek, 1996a; M. Papousek, 1996b; Trevarthen, 2000; Trevarthen & Aitken, 2001) and is the foundation for expressive communications or *proto-conversations* that convey meaning (Trevarthen, 2000). Body movements are also a part of this first evolving language that conveys emotion or the state of being (de Gelder, 2006).

The intensity, rhythm, and shape of vocalized nonverbal sounds and movements have phylogenetic meaning for both human and nonhuman mammals (de Gelder, 2006) suggesting that implicit language is primarily a body-based affective language. In support, Fruhholz, Trost, and Kotz (2016) reviewed neuroimaging studies in humans and animals across four types of emotional sounds 1) nonhuman environmental sounds, e.g., thunder, 2) human nonverbal expressions, e.g., baby laughter; 3) emotional speech, e.g., anger inflected speech and 4) musical emotions, e.g., folk music. Not surprisingly, they conclude that both the subcortical amygdala and the auditory cortex are involved with decoding affective sounds; however, they also found cross-domain interactions in "identified brain regions, which have been largely neglected due to strong with-in domain positions" (p. 21) perhaps supporting the amodal perception infancy (Stern, 1985). Furthermore, Cowen, Elfenbein, Laukka, and Keltner (2019) analyzed 2,032 vocal bursts elicited from participants aged 18 to 35 years across four countries to specific scenarios created for 30 emotions; these responses were then rated by 284,512 raters. Raters reliably recognized 26 of the 30 emotions. "Overall, 77% of the 2,032 vocal bursts were reliably identified with at least one category" suggesting that the majority of these nonverbal emotional sounds were universally understood across cultures (Cowen et al., 2019, p. 704).

Evaluating the strength of a parent's comprehension of the meaning of her infant's vocalizations and gestures is a part of the iRT scaffold. As is true for any therapy, this requires the clinician to be reasonably aware of their own lived attachment experiences. However, this reflective awareness (Flowers & Burgeson, 2015) has to extend into the use of the body-based affective nonverbal language that infants speak (and parents may have defenses against based on their own early life attachment experiences) as iRT clinicians use clinical affect in all dyadic sessions and are comfortable with multiple levels of voicing (that is, the voice prosody inherent in affective intensity, rhythm, and shape portrayed by Stern, 1985) driven by an intuitively felt sense of what the infant and/or parent is feeling.

Clinical concerns

What if a mother can't comprehend the nonverbal language of infancy and responds to her 3-month-old baby boy's low vocalization with, "Now what do you want?" And when he begins to cry says, "See he cries *just because*."

Right cerebral hemisphere

As is now well defined, the right nonlinear cerebral hemisphere not only has deeper connections to the subcortical areas of the brain (Barbas, 2007), these connections are myelinated for faster transmission (Griffin et al., 2006) beginning in infancy (Deoni et al., 2011). The right orbitofrontal cortex has connections from and to all senses (Barbas, 2007) and the autonomic nervous system (Balbernie, 2001) to integrate emotion, arousal, and behavior (Devinsky, Morrell, & Vogt, 1995). Higher human capabilities such as humor, empathy, intuition/instinct, insight, and originality are all associated with right hemisphere processing (Allman, Watson, Tetreault, & Hakeem, 2005; Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; Grabner, Fink, & Neubauer, 2007; Griffin et al., 2006; Jung-Beeman et al., 2004; Kringelbach et al., 2008; Mobbs, Hagan, Azim, Menon, & Reiss, 2005; Saxe & Wexler, 2005; Shamay-Tsoory, Tomer, Berger, Goldsher, & Aharon-Peretz, 2005; Volz & von Cramon, 2006).

Most importantly, the right hemisphere is dominant in emotional perception and communication found in eyes, faces, voices, gestures, smells, and pheromones (Benowitz et al., 1983; Blonder, Bowers, & Heilman, 1991; Brancucci, Babiloni, Rossini, & Romani, 2005; Brancucci, Lucci, Mazzatenta, & Tommasi, 2009; Devinsky, 2000; Lattner, Meyer, & Friederici, 2005; Le Grand, Mondloch, Maurer, & Brent, 2003; Mitchell, Elliott, Barry, Crittenden, & Woodruff, 2003; Snow, 2000). Agency, motivation, initiation, and intention are all controlled by the right hemisphere (Devinsky, 2000; Heilman & van den Abell, 1979; Kuhl & Kazen, 2008). Therefore, a parent's ability to attune and synchronize to her infant's nonverbal implicit language in a good-enough fashion is a right-brain-to-right-brain function (Schore, 2001a, 2005).

The chronic inability to understand and respond to the primary implicit needs of infants is a form of deprivation associated with emotional neglect, emotional insecurity, brain development, and physical and mental health disorders (Anderson & Whitaker, 2011; Danese et al., 2009; Sroufe et al., 2005; van der Kolk & d'Andrea, 2010; van IJzendoorn, 1995). Tronick (2007) also warns that there are adverse effects for infants when the natural expansion and coherence that comes from shared consciousness is denied. Although the infant is within the Primary Biological Entrainment Period, parents come to this point in time with their own attachment histories and neurobiological organizations. A meta-analysis of over 10,000 Adult Attachment Inventories (AAI: George, Kaplan, & Main, 1984/1985/1996; Main, Goldwyn & Hesse, 2002) reveals that only 56 percent of mothers and 51 percent of fathers in nonclinical populations coded secure (Bakermans-Kranenburg & van IJzendoorn, 2009). And the generational turnover of attachment styles is high (Benoit & Parker, 1994; Hesse, 1999; van IJzendoorn, 1995) if no intervention is given.

Having a way to determine the quality of infant/parent interactions during this early entrainment period by evaluating the attachment organization of the parent helps the clinician to guide the dyad toward improved attunement and synchrony. The iRT scaffold includes a process for making a *probable map* of the parent's neurobiological organization that helps clinicians determine not only the point of entry into the dyadic system, but also what *emotional language* might be necessary (e.g., different approaches that are often needed to work with insecure preoccupied, insecure dismissive, and insecure disorganized organizations to create a relational alliance (Newton, 2009/2013, 2017)).

Clinical concerns

What if a mother avoids her 4-month-old baby and acts like he isn't in the room, but suddenly kicks a Kleenex box toward him and says harshly, "Wipe your nose?"

Attunement, resonance, and synchrony

In every culture, implicit nonverbal communication is the language spoken by all infants despite the verbal dialect of their parents (Kuhl, 2004). Coupled with survival principles and the ontogenetic nature of development, evolution is highly invested in providing the infant with needed skills to live in and survive the environment born into. Infants require a primary attachment relationship that provides good-enough attunement and care. The quality of the primary infant/parent attachment varies depending upon multiple interacting factors such as available resources, parents' own attachment history, time, place, and culture born into, and parents' ability to attune, synchronize, and resonate with the infant's nonverbal, yet vocalized, communications (Newton, 2008, 2009/2013, 2017).

Attunement, synchrony, and resonance are important properties of nonlinear systems, such as relationships, and are critical to healthy self-development (Newton, 2008, 2009/2013, 2017; Schore, 1997; Schore & Newton, 2013; Stern, 1985). Lorenz (1993) describes nonlinear systems, as understood by complexity and chaos theory, as "a system in which alterations in an initial state need not produce proportional alterations in subsequent states" (p. 210). For Sander (2008b), "the living system is described … as a nonlinear dynamic system, a system far from equilibrium having the

features of sensitivity … uncertainty … and an open-endedness of its trajectory" (p. 219), and for Marks-Tarlow (2008), nonlinear systems are "systems whose behavioral output is disproportionate to their input" (p. 307). For Schore (1997), a nonlinear system is "the source of rapid change and novel structure … and the source of potential order and stability … it can produce positive (amplifying) or negative (dampening) feedback, stability or instability, convergence (coupling or entrainment) or divergence" (p. 599). Schore (1997) suggests that right-to-right hemisphere attuned connections are capable of amplifying energy to the level of resonance and synchrony. Stern (1985) also believed that attunement had nonlinear properties involved in intensity, time, and motion common to perception and could be achieved using any sense modality such as facial expressions, voice prosody, eye contact, gesture, touch, or any combination.

In a review of studies, Leciere and colleagues (2014) conclude that synchrony is a key feature in interactions describing phenomena ranging from the micro-to-macro levels of processing in multiple domains (including the weather), but between interactive partners, synchrony implies,

> Temporal structure of behavior between interactive partners [such as] verbal and non-verbal communicative and emotional behaviors [in] gestures, postures, facial displays, vocalizations, and gazes. [These] synchronous interactions entail coordination between partners and intermodality [in which] caregivers and their children are able to respond to each other using different modalities starting from birth. Thus, synchrony differs from mirroring. (Leciere et al., 2014, p. 3)

Parent-infant synchrony, described by Feldman, Magori-Cohen, Galili, Singer, and Louzoun (2011), is a process of coordinating physiological, hormonal, and behavioral stimuli between a parent and infant. These researchers found that 3-month-old infants and their mothers had coordinated heart rhythms with lags of less than a second (Feldman et al., 2011). Also, Feldman (2003) studied parent infant synchrony with 5-month-old infants with their mothers and fathers and found that both mothers and fathers were able to engage in second-by-second synchrony with their infant; however, there was closer synchrony in same gendered dyads with father-son dyads showing the most synchrony.

The establishment of intersubjectivity between infant and carers begins a shared dialogue that is organizing and regulating (Trevarthen & Aitken, 2001). For Trevarthen (1979, cited in Trevarthen & Aitken, 2001), infants have to have two skills before they can share "mental control" with others: 1) "They must be able to exhibit to others at least the rudiments of individual consciousness and intentionality" (which Trevarthen calls *subjectivity*) then 2) "infants must also be able to adapt or fit this subjective control to the subjectivity of others [that is,] they must also demonstrate intersubjectivity" (p. 5). "Thus, human intersubjectivity is conceived as a process that makes it possible for subjects to detect and change each other's minds and behavior, by purposeful, narrative expressions of emotion, intention, and interest" (Trevarthen & Aitken, 2001, p. 18).

For most, infants are born ready to communicate. For example, infants can imitate adult facial gestures (Meltzoff & Moore, 1983) and finger extension (Nagy, 2006) and can discriminate the sound of their mother's voice (DeCasper & Fifer, 1980; Fifer & Moon, 1995), face (Bushnell, 2001), and scent of her breast (Porter & Winberg, 1999) soon after birth. Even in utero (third trimester), human fetuses appear to recognize the sound of their mother's voice over a stranger's (Kisilevsky et al., 2003).

In a sample of ethnically diverse, well educated, first time mothers who despite having empathy for their infants, had difficulty attuning and synchronize with their 4-month-old infants' nonverbal communications, researchers found that 20 percent of the infants coded disorganized (19 percent coded ambivalent/resistant) at 12 months of age (Beebe et al., 2010). Infant attachment disorganization is associated with trauma ranging from maltreatment to witnessing violence, accidents, invasive medical treatments but also associated with parental unresolved trauma (Hesse & Main, 2000) and mental health concerns (Granqvist et al., 2017; Lyons-Ruth & Jacobvitz, 2008; Lyons-Ruth et al., 2017). Clinical identification of disorganized attachment features in particular and dyadic parent/infant relationship concerns in general is urgently needed with the goal of providing infant/parent dyadic treatment addressing the parent, the infant, and the relationship. Beatrice Beebe and

colleagues (2010) suggest that the disorganized infant's experience with his/her mother would be as follows:

> "I can't read you, influence you, or count on you, especially when I am upset;" and he represents confusion in sensing and knowing himself, especially at moments of distress; "I can't tell what I feel, I can't sense my self, I can't help myself." Thus the emerging internal working model of future D infants represents confusion about their own basic emotional organization, their mothers' emotional organization, and their mothers' response to their distress, setting a trajectory in development which may disturb the fundamental integration of the person. (Beebe et al., 2010, p. 79)

The ability to attune to an infant, that is, the ability to see, feel, connect, and communicate with an infant's implicit inner world in an accurate-enough fashion is seen as a critical parental ability to regulate infant affect toward healthy development (Schore, 2001a, 2001b, 2005). Specifically, attunement and synchrony appear to lead to the infant 1) feeling known (Beebe et al., 2010; Newton, 2008; Sander, 2008a, 2008b; Tronick, 2007), 2) making internal foundational representations of perceptional experience used to understand the world (Meltzoff & Moore, 1998; Stern, 1985), 3) having healthy right-brain connectivity leading to emotional regulation (Schore, 1994, 2001a, 2005; Schore & Newton, 2013), and, 4) having a secure socioemotional base upon which all future development rests (Newton, 2006, 2009/2013, 2017). Thus, problems in parental attunement (or mismatched parent/infant communication) and infant affect regulation (Schore, 2001b, 2005) can have a profound impact on an infant's neurobiological development shaping internal working models (Bowlby, 1969/1982, 1988) or patterns deep into subcortical brain systems of how to interact and survive.

However, it is not only infant/parent attunement that is of concern to dyadic clinicians but also the parent's own need for a deeply attunement relationship. Using a probable map of the parent's own neurobiological organization, iRT clinicians attempt to simultaneously attune to the parent's inner core Self thus attempting to attune to both the infant as a person, the parent as a person, and their unique relationship together.

Clinical concerns

What if a mother, like Maurine, provides instrumental care, like feeding, diapering, dressing, but doesn't appear to attune to her beautifully dressed but hesitant and quiet 6-month-old daughter's core Self? Maurine says, "Isn't she a doll; I just got this outfit for her and everyone loves it."

Affect regulation and the autonomic nervous system

The autonomic nervous system (ANS) is associated with the body's energy management in the service of homeostasis and consists of two branches: the parasympathetic nervous system (PNS) associated with balancing the body's energy and the sympathetic nervous system (SNS) associated with increasing the body's energy (Balbernie, 2001; Nobrega, Castro, & Araujo, 1990; Porges, 2011; Schore, 1994). The organizational balance between these two branches of the ANS is associated with optimal arousal ranges in the ANS (Schore, 1994).

Stephen Porges (2011) elucidates the role of the vagus nerve in regulation, that is the 10th cranial nerve innervating the face and heart, that is a component of the PNS. The phylogenetically newer myelinated vagus (neomammalian) is different from the older unmyelinated (reptilian) vagus and both operate unconsciously and react differently to stressors (Porges, 2011). Unlike the reptilian vagus that "responds with massive increases in vagal tone that slow the heart and constrict the bronchi … promot[ing] adaptive responses such as … behaviorally freezing (i.e., feigning death)" if needed (Porges, 2011, p. 93), the newer neomammalian vagus can allow for "the mobiliz[ation of] energy resources for the classic flight-or-fight response" (Porges, p. 92). Porges (2011) believes that the evolved linkage between "the brainstem motor systems for cardiovascular functions and those [systems] necessary for regulating the face, head, and neck, forms an integrated social engagement

system" that functions within an optimal arousal range (Porges, 2011, p. 125). The freeze or still responses seen in childhood disorganization (Main & Hesse, 1990; Main & Solomon, 1990) involve the reptilian vagal system (Porges, 2011).

With an amalgam of genetics, temperament, and lived experience within primary attachment relationships, neurobiological ranges appear to be entrained within subcortical systems creating response ranges in the autonomic nervous system (ANS) (Schore, 1994, 2001a, 2001b; Schore & Newton, 2013). For example, an infant who is embedded in parental domestic violence hearing and perhaps seeing violence on a regular basis may have an amygdala (a rapidly firing subcortical threat detection structure capable of harnessing the ANS: Barbas, 2007) entrained toward hyper-responding to every sound. Conversely, a hypo-freeze-response could occur if a threat without a resolution is experience that is associated with infant disorganization (Main & Hesse, 1990; Main & Solomon, 1990) or fear-inducing behavior in the parent that becomes an unresolvable conflict for an infant (Lyons-Ruth, Repacholi, McLeod, & Silva, 1991).

Regulating high SNS infant arousal can be challenging even in the best of circumstances but regulating low arousal can also be a challenge for parents more on the insecure/trauma spectrum. We have found in many dyads we have worked with, particularly dyads where there has been significant trauma in the mother, low PNS infant arousal ranges are experienced as a relief because it does not require as much ongoing infant/parent interaction. Instead, these babies who have low vocalizations and flat affect are experienced as "good babies." Increasing infant arousal (or up-regulation) in play is just as important for entrainment of the ANS as is soothing high arousal states (or down-regulation). We have seen a number of staring babies with flat affect that go unnoticed by their parents (Newton, 2014).

Arousal ranges are typically noted in all dyadic work iRT clinicians do. Specifically, the range of arousal experienced by the infant and by the parent is evaluated. We not only help parents to more effectively soothe infant high arousal states, up-regulated low arousal states in play, but we also help parents become more aware of their own need for regulation, soothing, and self-care.

Clinical concerns

What if an infant, now a toddler, who has had very little intersubjectivity with her mother accompanies her mother to therapy and her mother states, "She is cranky and wants me too much … she throws things at me … she uses me?"

Conclusion

In the opinion of this author, helping parents and infants within the Primary Biological Entrainment Period does require dyadic work that focuses on the neurobiology of the parent, the developing neurobiology of the infant, and the attuned, synchronous, loving health of their relationship. This three-fold-focus requires clinicians to have a reasonable understanding of typical infant development and the parent's probable neurobiological organization. Adding a neurobiological scaffolding to Infant Parent Psychotherapy (IPP) deepens the intervention to include the natural bottom-up brain development that is occurring in the infant who depends on the quality of the shared and synchronous-enough parent/infant implicit language of affect communicated through eyes, facial expressions, voice prosody, gesture, and scent, that is, the primary sensory affects. Primary affect is needed to wire up the right hemisphere, and its development is a mirror for the quality of the infant/parent relationship.

The Integrative Regulation Therapy scaffold creates a probable map of the parent's neurobiological organization by assessing impressions of the parent's 1) attachment organization, 2) self-concept, 3) ANS organization, 4) quality of self-soothing, 5) defenses, 6) use of intuition/instinct, 7) ability to reflect, and 8) level of agency all compared with 9) the parent's stated hopes/dreams. Probable maps are continuously updated and revised as sessions unfold. The success we have experienced, I believe, is two-fold. First, iRT clinicians have a sense of knowing the point of entry

into a dyadic system while mindful of the implicit emotional language that the parent speaks based upon her attachment organization, i.e., insecure preoccupied, insecure dismissive, insecure disorganized versus secure. And two, the clinical use of affect. iRT clinicians are encouraged to use attuned and synchronous affect in response to felt concerns of the dyad and to join the dyadic system using the natural affective language of eyes, faces, and gestures *while* verbally speaking with the parent(s) who comes with concerns of her own.

Clinical training to use the iRT scaffold is extensive as the clinician is using a strong right-brain approach that leads and affectively colors the interactions with infant, parent, and dyad. However, the clinician must also have a natural flexibility to switch to an attuned left-brain approach to meet the parent's narrative. For the clinician, this is basically a good-enough whole brain integration. By balancing one-to-one implicit conversations with the infant and naturally highlighting any interactions that reflect improved synchrony while supporting mother with attuned affect and empathy for her presented concerns, with an increased focus on self-care that often leads to improved problem solving, helps move the parent/infant/dyad back into a homeostatic relational range. By synchronizing clinical affect to the felt truth of the dyad, the infant, parent, and dyad's lived story begins to appear.

For some parents, genuinely joining their infant in intersubjectivity is difficult. Clinicians trained in iRT try to assist parents in their life concerns while helping them return to the delight of resonant affective intersubjectivity that may have been missing from their own early lives. In most cases, infants eagerly respond to affect, particularly in their mothers, that can lead to moments of the infant and parent feeling known by the other. This not only increases confidence in the parents, it can improve the infant's expressiveness which can lead to joyful, intimate moments for all (including the clinician) as a natural, attuned, and genuinely felt relationship emerges. We find that parents often experience that the natural delight found in the relational affective world of the infant feeds them too thus reinforcing this ancient two-way dance that leads to security.

Lastly, all of the above clinical concerns were real referral issues that we received for infant/parent dyadic intervention in our grant work; all were seen by iRT trained clinicians, and all had improved relational outcomes within 10 to 14 sessions. Research comparing IPP with and without the Integrative Regulation Therapy (iRT) neurobiological scaffold is needed to show the efficacy of this promising approach. In a separate contribution, the author will present aggregate outcome data on the dyadic work done using IPP/iRT and delineate the iRT assessment, training, and intervention processes within session examples. The author wishes to end by stating the need for strong advocacy supporting the social change necessary to fully support infants, parents, and families during the Primary Biological Entrainment Period (Newton, Flowers, Hartwell, and Hervatin-Hergesheimer, 2015).

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