Mutual Regulation and Unique Forms of Implicit Relational Knowing

Il Processo di Mutua Regolazione e la creazione di forme precoci del "Conoscere Relazionare Implicito"

Fabia Eleonora Banella[a,*], Anna Maria Speranza[a], Ed Tronick[b]

[a] *Department of Dynamic and Clinical Psychology, Sapienza, University of Rome*
[b] *University of Massachusetts Boston and Harvard Medical School, Boston MA*

ARTICLE INFO

Submitted: 09 October 2018
Accepted: 09 November 2018
DOI: 10.4458/1415-06

ABSTRACT

The Mutual Regulation Model (MRM; Tronick, 1989) sees infant and caretaker as components of a larger dyadic regulatory system, where each person - infant and adult - influences and is being influenced by the communications of the other, in a circular, moment-by-moment, continuous manner. A co-created relationship emerges out of this ongoing co-creative and messy process of mutual exchange. The mutual regulatory process is seen as the formative process for relationships (Tronick, 2001; 2003).

These co-creative processes lead to changes in the infant's and child's moods and state of knowing about themselves in relation to the world, and generates implicit relational knowing and implicit ways of being together (Tronick et al. 1979; Tronick 2002a). In this paper, we focus on the co-creative process, the process of mutual regulation, and recent research on the development of implicit relational knowing in infants and mother-infant dyads.

Keywords: Mutual Regulation Model (MRM); Implicit Relation Knowing (IRK); Unique Implicit Relational Knowing (UIRK); Face-to-Face Still-Face; Intersubjectivity.

RIASSUNTO

Secondo il Modello di Mutua Regolazione (MRM, Tronick, 1989; 2001; 2003) il bambino e il caregiver fanno parte di un più ampio sistema di regolazione diadica, in cui ogni persona - bambino e adulto - influenza ed è influenzata dalle comunicazioni dell'altro, in maniera circolare, dinamica e continua. Il continuo processo di scambio reciproco, creativo ma al tempo stesso caotico, consente la co-creazione di una relazione unica. Pertanto, il MRM può essere considerata una teoria sui processi attraverso i quali vengono a crearsi le relazioni affettive.

I processi co-creativi generano cambiamenti nel bambino, nei suoi stati d'animo e nella conoscenza di se stesso in relazione al mondo, che danno vita a un conoscere relazionale implicito (IRK) e a modalità implicite di stare in relazione (Tronick et al., 1979; Tronick 2002a). In questo articolo, verrà trattato il processo di mutua regolazione affettiva, i processi co-creativi e una recente ricerca sullo sviluppo del conoscere relazionale implicito nei neonati e nelle diadi madre-bambino.

Parole chiave: Modello di Mutua Regolazione (MRM); conoscere relazionale implicito (IRK); Face-to Face Still-Face; Intersoggettività.

*Corresponding author.
Fabia Eleonora Banella
Department of Dynamic and Clinical Psychology, Sapienza, University of Rome
Via degli Apuli 1, 00181, Roma.
e-mail: fabia.banella@uniroma1.it (F.E. Banella)

Mutual Regulation and Unique Forms of Implicit Relational Knowing

The enormous amount of research studies on child development conducted in the past 40 years dismantled the old model of thinking of the newborn as helpless and ready to be shaped by his environment.

We now know that since the very beginning of his life, the baby is equipped with astonishing self-regulatory competencies, as well as communicative abilities. Studies on newborn imitation and protoconversation (Meltzoff, 2002; Trevarthen, 1998) provide the evidence that immediately after birth infants are capable to express appreciation of the adult's communicative intention and feelings.

Researches also have shown that infants are receptive to subjective states in other persons and are capable of appreciating the meaning behind or embedded in the affective displays of others (Tronick 1989).

Furthermore, infants have the capacity to display communicative intentions, primarily but not only, through affective displays that express a variety of neurosomatic meanings. These displays are organized into coherent multimodal configurations of the face, voice, gestures (i.e., reaching gestures), postures, gaze and less well understood or still unknown forms of neurosomatic displays (i.e., hormones level) (Weinberg, Tronick 1994, Tronick 2009).

Besides these communicative skills, infants also display self-regulatory capacities, to modulate their own affective and psychobiological states and reactivity (Brazelton 1974; Field 1977; McCall, McGhee, 1977; Spitz 1965; Stern 1974, 1977). Self-organizing neurobehavioral skills enable the infant to organize behavioral states, such as sleep, alertness and distress, and other bio-psychological processes, such as arousal, attention, temperature regulation, moods, hunger, and social engagement (Gianino, Tronick 1988; Tronick 2007; Tronick et al. 2004). Clearly, these self-regulatory competencies are limited and immature at the beginning of the infants' life, and the parent plays a crucial role in scaffolding and sustaining the infants' appropriate development of self- and interactive regulatory capacities (Beeghly, Tronick 2011).

Self-regulatory and communicative capacities enable infants to seek and engage in interpersonal and affectionate relationships, demonstrating what Trevarthen and Tronick referred to as innate intersubjectivity, or what could be thought of as an interpersonal intelligence (Trevarthen 1974, 1979, 1998; Trevarthen, Aitken 2001; Tronick 1989).

The Mutual Regulation Model, developed by Tronick (MRM, Tronick, 1989) conceptualizes infant and caretaker as components of a larger dyadic regulatory system, in which each person - infant and adult - influences and is being influenced by the communications of the other, in a circular, moment-by-moment, continuous manner.

The central concept of the MRM is that infants and caregivers, even in their earliest interpersonal exchanges have a specific interactive goal of achieving reciprocity of shared intentions and meanings (Brazelton et al. 1974; Gianino, Tronick 1988; Tronick et al. 1978; Beebe, Stern 1977). To achieve this goal both infant and caregiver actively employ their psychobiological affective communicative capacities to intentionally make possible mutually coordinated and bidirectional interactions (Beeghly, Tronick 2011; Cohn, Tronick 1983; Gianino, Tronick 1988; Tronick 1980, 1989).

In the dyadic interactive process between adult and infant, self- and interactive regulatory patterns are integrated, since each person must both regulate their inner state and coordinate with their partner's state (Beebe, Lachmann 2015). According to the results of studies examining early mother-infant face-to-face interactions using time-series analysis (Gianino, Tronick 1988; see also Beebe et al. 2010; Jaffe et al. 2001) self- and interactive regulation have been demonstrated to be simultaneous and reciprocal processes, each affecting the outcome of the other. Therefore, the same interactive repertoire that allows the infant to initiate, maintain, modify or avoid and terminate interactions, simultaneously enables him to perform self-regulatory functions.

In the parent-infant regulatory processes, interactions are jointly regulated to achieve a state of reciprocity, characterized by a state of matching (attunement, synchrony). However, in typical successful social exchanges, states of reciprocity alternates with states of mismatches, which occur approximately two-thirds of the time. Mismatches and not-coordinated states may occur for different reasons, such as misreading of the other partner's signal, mistimed behaviors, a changing of intention,

and so forth (Cohn, Tronick 1988). Nevertheless, in most cases (70% on average), when a state of mismatch is entered, the two persons return to matched states within 2 seconds and experience a reparation of the communicative and affective disruption.

In essence, the typical interaction is a messy and dynamic process that moves back and forth between matching states, characterized by coordination and synchronicity, and mismatching states followed by jointly and actively accomplished reparatory states (Tronick, Beeghly 2011; Tronick, 2008).
Although reciprocity is important, perhaps the experience of reparation of mismatches has an even more central role, serving a multiplicity of functions essential for the infant's development. Successful interactive reparations provide opportunities to develop self- and interactive regulatory skills useful for coping with stress (Tronick 1989; Tronick et al. 1978). In interactions characterized by typical rates of reparation, the infant learns how to use effective coping and communicative strategies that facilitate the reparation, and in turn, reinforce his coping and interactive skills. Micro-analytic data reveal that the mean duration of reparation during the reunion episode of the FFSF is significantly correlated with infant cortisol reactivity (Muller et al. 2015), suggesting that quicker interactive repair provides better physiological stress regulation in infants (Tronick 2007).

Co-creation, Uniqueness of relationship and Implicit Relational Knowing

A dynamic systems framework for the MRM helps us to understand early parent-infant interactions, the complexity of infant's development and the formation of individuals' unique ways of being in relation to the world of people and things, and in relation to his or her self.
Infant-parent relationships are uniquely different from one another: they show unique and specific ways of *being together* which arise from a dynamic process of co-creation. In this way, relationships are unique and have unique effects on each of the individuals within them, and over time, their way of being together becomes highly specific and increasingly differentiated from others. The term *co-creation* itself implies that any kind of dyadic regulation (mother-infant, brother-sister, etc…) is an unpredictable and variable or messy process which creates continuous changes in the relationship that shape its uniqueness and specificity.
Sander (1977) observed evidence of early specificity (uniqueness) in the interactions between the infant and the caregiver by the end of the first week of life. He hypothesized that the regulation of the mother-infant pair becomes more and more specific for every dyad and leads to the distinctive and idiosyncratic characteristics of exchange. According to Sander the specificity of each dyad is a complex gestalt involving timing, sequence, cue, etc. Hinde (1979) also emphasized the uniqueness of relationships when he described, in contrast to the limited categories of attachment theory, different dimensions of relationships, such as their intensity, their rhythm, their intimacy, their attunement, the quality of what the infant and mother actually do together, and how they use particular gestures and facial expressions (Tronick, 2002).

Unique ways of being together are procedurally and implicitly generated. Infant research has highlighted how infants make sense of the world and of their relationship with others through implicit messages related to nonverbal cues, body movements, sensation, affect and expectations (e.g., Ainsworth et al. 1978; Beebe, Lachmann 1994; Montirosso et al. 2013; Tronick, 1989). Therefore, the interactional experiences are organized and held by the infant in an implicit representation that is non-symbolic, non-verbal, procedural and primarily out of awareness (Tronick et al. 1998).
These representations, referred to as implicit relational knowing (IRK), emerge from the daily reiteration of co-created moment-by-moment interactions (Boston Change Process Study Group, 2002, 2005; Tronick 1998, 2002). IRK refers to «representations of the ways individuals relate to one another that are outside both focal attention and conscious verbal experience» (Tronick, 1998, p.905). In other words, it is the implicit knowledge that two interactants – infant and adult – have about their ways of being together, how to proceed and do things with the other, that gradually arises in the interactional processes that take place between baby and caretakers (Tronick 1989; Stern et al., 1998).

The IRK is an important domain of implicit psychobiological memory processes. It is different from other forms of procedural knowledge, such as how to ride a bicycle or drive a car, because it emerges and grows in the dynamic and mutual exchange of affect and relational intentions between infant/child and others. The implicit memory has a special regulatory function, which acts in an

automatic and unconscious way. It is not only cognitive, in the way that neuroscientists think of cognitive/brain processes, but also affective and interactive. The Boston Change Process Study Group (BCPSG, 2002, 2005) emphasized that IRK does not contain semantic knowledge and is thought to continue to operate implicitly throughout life and over time, yet it can be expanded into more conscious, articulated, coherent and complex states in collaboration with another person, especially during therapeutic relationships.

Implicit procedures and knowing are specific and unique to each relationship the child experiences. An example of how uniqueness in relationship is generated can be seen in the course of all the repetitive activities related to specific time and context of an infant's and parent's daily life together (sleep, waking up, feeding, diapering, playing, changing, etc.). These *time-activity-contexts* (Tronick 2002, p.479) are co-experienced and mutually regulated by the infant and the caregivers, and over time develop a specificity of temporal organization and sequential relations that also differs from other time-activity-contexts regulated by another dyad.

The co-creative communicative process leads to unique characteristics of the interaction both at a micro-temporal level through micro-affective mutual regulation and at a macro-level through the generation of IRK about how to be together (BCPSG 2002; Tronick 2002; Stern et al. 1998). That is, IRK can take various forms.

One form of IRK is micro-interactive and constitutes an integration of the repeated relational micro-interactive moves of the dyad (Tronick et al. 1998). This micro-interactive knowing comprises the features and details of different exchanges, such as unique games played by the infant with someone (i.e. mother, father or others). Clearly, behavioral routines such as games can manifest themselves in several dyads but will have different meaning and form in each relationship and specific context. For example, the infant wrinkling his nose with the father could be part of a face-to-face game, and mean «let's start to play!», whereas with the mother may carry the meaning «I don't like what we are doing, let's stop!».

Tronick (2003) has hypothesized that much of the IRK generated at this level may not be transfer-able to other relationships, because the meaning of specific behaviors between two persons may remain exclusive to a particular relationship; that is cryptic to other individuals.

The second kind of IRK is meta-procedural, and it is related to how two persons are able to *work out things together* (e.g., how we repair mismatches). Compared to the micro-interactive form, it has to do with a more general way of *working together*, no matter what the content of the mismatch is. For example, the infant and the caretaker could share the IRK that «we can move from a mutual negative state to a positive state». The variety of meta-procedural knowing generates ways of feeling about one's self in relationship, such as «I feel my efficacy», «I feel trustful» or «I feel helpless», «I feel hopeless». Although they are specific to a particular relationship, contrary to micro-interactive knowing, these feelings can be transferable and affect other kind of relationships.

Despite the uniqueness of relationships being generally acknowledged (Tronick, 2003), there is a lack of research that pays attention to the individual differences of the interactive regulatory patterns which lead to stable and unique dyadic characteristics. Research studies on mother-infant exchanges in typically developing populations have primarily focused on mutual regulatory processes, their variation and development, in order to understand the organization of the interaction and to explore potential maladaptive regulatory patterns in the presence of an infant, parental, and familial risk factors.

However, this search for generalities regarding the organization or structure of relationships needs to be balanced with the recognition of the specificity, uniqueness, differentiation, and complexity of the features of human relationships (Hinde 1995). Uniqueness in relationships emerges out of mutual regulated co-creative interactive processes that generate unique implicit and procedural knowing of *how we are together*. Starting from this basic finding, the study of the ways in which unique mother-infant relationships are generated needs to focus on dyadic regulatory processes including IRK.

Forms of Implicit Relational Knowing

Recently, Banella and Tronick (2018) explored and described forms of *Unique Implicit Relational Knowing* (UIRK) and how they develop in early mother-infant interactions in the context of a social stressor. UIRKs were hypothesized to be an expression of the infant's IRK of how to interact with his/her mother in unique ways.

In their research it was employed the experimental procedure Face-to-face Still Face (FFSF, Tronick et al. 1978), to explore infants' use of UIRK in the interactive context. The FFSF is composed of 3 episodes, each one lasts 2 minutes: in the first play episode there is a face-to-face play interaction, in the second episode the caretaker is asked to stop talking or touching the baby and show a flat unresponsive face. In the last episode of reunion, the caretaker is asked to resume interacting with his baby.

What has been observed in the large number of studies that employed the FFSF is that infants have a typical response to the still-faced mother (Adamson, Frick 2003; Mesman et al. 2009): they attempt to solicit mother's attention, showing an array of typical signaling behaviors, such as smiling, pick-me-up gestures or other gestural signals. But when their efforts fail they look away, withdraw and express protest, sad and angry affects.

To elicit mother's attention most infants might use what can be thought of as Typical Eliciting Behaviors (TEBs), such as smiles, pick-me-up gestures, *fake* cries, or other gestural signals. However, it was observed that infants might also use UIRKs as communicative and coping strategies, to elicit the mother's response. UIRK are unique interactive behaviors (e.g., finger games, arms gestures, etc.) seen during their play with the mother that are then used by the infants to elicit her attention during the Still-Face (Banella, Tronick, 2018).

An example of an observed UIRK can be described from a brief episode of a FFSF video recording of a mother and her 10-month-old baby girl.

Mother and infant are playing peek-a-boo together, co-creating the game in unique fashions: while the mother was gesturing and modulating the game with her tone of voice and facial expressions of surprise and happiness, her baby was going along with it, smiling and placing both the palms of her hands peripheral to the eyes. After 2 minutes of playful interaction, the mother stopped interacting and displayed a still-face. The first reaction of her baby was a wary gaze at her mother, and then she smiled.

The baby girl got no response to this signal, and after few seconds of pause she put both hands next to his eyes, reproducing their peek-a-boo game, and stare at her mother for few seconds. It seemed that the baby was waiting for the mother to take her turn, but again her mother was unresponsive and still-faced. The baby attempted again to reproduce the same gestures of peek-a-boo as if she was trying to get her mother back in their normal playful interaction, but then, after few more efforts without any response, she withdrew and started protesting and fretting. It looks like the little girl had expectations about her mother's behaviors and get surprised and frustrated when these expectations were violated. What we were observing in this video, was that the infant was capable to intentionally reproduce an interactive unique gesture that was part of a shared and co-created interactive play, in an attempt to start or continue a perturbated interaction. The baby learned in the context of the interaction a procedural communicative behavior related to how to play pick-a-boo with her mother and was then able to make use of these unique eliciting behavior (UIRK) in a different context - when the interaction was disrupted, and with a different purpose -to get the mother back to the normal interaction.

In UIRKs research, infant behavior was observed at 2 different ages, 6 and 11 months, in 2 different episodes. In the Play episodes UIRKs, as well as TEBs were coded and then in the Still-Face episodes it was observed if the infants used UIRKs and/or TEBs to elicit the mothers in a different context and with a different goal. All of the infants at both ages displayed UIRKs in the Play episode. However, only 11-month old babies displayed UIRKs during the Still-Face Episode whereas no UIRKs were observed in the 6-month old infants.

To our knowledge, this research was the first one aimed to explore the process of formation of IRK in the interactive exchange and has several implications for infants' development and meaning-making processes, and how forms of IRK are co-created and give shape to uniqueness in the relationships.

First and foremost, the evidence that both 6- and 11-month olds engage in UIRKs during the Play episode shows evidence of unique pattern in dyadic interactions between the infant and the parent

at both ages (Banella, Tronick, 2018) The presence of this type of interaction confirms findings from longitudinal studies (Beebe et al. 1979, 1985; Bruner, Sherwood 1975; Fogel 1977; Jasnow, Feldstein 1986; Mayer, Tronick 1985; Ratner, Bruner 1978; Stern 1971; Stern et al. 1977) that reveal that infants gradually develop an intricate, precise, and selective coordination with the mother's expressions of communication and dramatized actions of play, which become more repetitive and increasingly richly modulated and rhythmically patterned (Trevarthen, Aitken 2001).

The finding that UIRKs were not observed in any of the 6-month old babies in the Still-Face episode, while 11-months old do use UIRKs, points to an important early developmental change between 6- and 11- months of age. By the first year of life, infants develop more coherent socio-emotional, cognitive and motor capacities. The capacity of older infants to utilize UIRKs purposefully to elicit a response from an unresponsive still-faced mother demonstrates a form of mutually adjusted intentionality that is not yet developed at 6 months of age (Banella, Tronick, 2018). This developmental change is consistent with the evidence of secondary intersubjectivity of older infants that develops around 9 months (Trevarthen, Hubley 1978) compared to the primary intersubjectivity of younger infants (Tronick, 1980; Tronick et al., 1980).

The research confirms that through mutual regulatory processes, the parent-infant dyad creates individualized and unique ways of being together, which are incorporated for each partner into memory and lead to an implicit procedural and relational knowing on how to proceed and do things with intimate others in a unique way. According to Banella and Tronick (2018) UIRKs observed in the FFSF are implicit and procedural, and infants acquire them with repetitions of typical play-interactions with their caretakers, early in development.

IRK gradually arises in the interactive interchanges between baby and caretakers (BCPSG, 2002; Tronick, 1998; Lyons-Ruth et al., 1998; Stern, et al, 1998; Tronick, 1989; Tronick et al., 1979). The child-parent relationship in the early years shapes the child's sense of self. These relationships are created by daily, repeated interactions that involve bodily experience, such as feeding, diapering, bathing, and soothing, and as the child becomes older also include disciplining, teaching, and social play. Through a repeated positive routine game, a baby gains a sense of his own agency and efficacy, as well as a sense of positive relationship. The infant-parent dyadic system creates new forms of meaning for each partner, which are incorporated into memory, with or without consciousness, increasing each partner's socio-affective complexity. The memories that young children have of the parent are body-based and interactive so that the earliest mental representations consist of the ways the parent did things with the child.

Conclusion

IRK are a form of procedural knowledge that arises in the interactional processes between infants and caregivers. Further studies could clarify the process of the formation of IRK in the interaction and also the concept of transferability and non-transferability of unique features of the interaction to other relationships.

IRK as well as UIRKs permeate infants and likely adults' ways of being in the world, and this suggests that interventions cannot refrain from taking into account aspects of dyadic organization as well as IRK shaped in the past but operating in the present.

More research on IRK and UIRKs would add to our understanding of how to identify ones that arrive from the past and distort the present. Importantly, a greater understanding of these processes would aid in the development of techniques for changing them in effective and security enhancing ways for moving forward in the therapy given how deeply rooted in the past and in our neurosomatic meaning-making systems the IRK may be.

It would be interesting to verify the hypothesis that, as it happens between mother and child, also the analyst and the patient develop an increasingly unique implicit relational knowing about one another and about their relationship. This happens in time and over the course of their being together.

Future research study on implicit relational knowing in the context of therapy could also evaluate if repeated patient-therapist interactions generate changes in the patient's (and in the therapist) implicit relational knowing, with the possibility for new and more coherent ways of being with the therapist and, in turn, with other.

Compliance with Ethical Standards

Conflict of interest

The authors declare that they have no competing interests.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

References

Adamson, L. B., Frick, J. E. (2003). The still face: A history of a shared experimental paradigm. *Infancy*, *4*(4), 451-473.

Ainsworth, M. D., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation.* Hillsdale, NY: Erlbaum.

Banella, F.E., Tronick, E. (in stampa). Mutual Regulation and Unique Forms of Implicit Relational Knowing. In Apter, G., Devouche, E. (2018). Infant psychopathology and early interaction: From theories to practice. Boston: Springer.

Beebe, B., Lachmann, F. M. (1994). Representation and internalization in infancy: Three principles of salience. *Psychoanalytic Psychology*, *11*(2), 127.

Beebe, B., Jaffe, J., Feldstein, S., Mays, K., & Alson, D. (1985). Interpersonal timing: The application of an adult dialogue model to mother-infant vocal and kinesic interactions. In Field, T.M., Fox, N. A. (Eds.). *Social perception in Infants* (pp. 217-247.). Norwood, N.J: Ablex.

Beebe, B., Jaffe, J., Markese, S., Buck, K., Chen, H., Cohen, P., & Feldstein, S. (2010). The origins of 12-month attachment: A microanalysis of 4-month mother–infant interaction. *Attachment and Human Development*, *12*(1-2), 3-141.

Beebe, B., Stern, D. N. (1977). Engagement-disengagement and early object experiences. In Freedman, N., Grand S. (Eds.). *Communicative structures and psychic structures* (pp. 35-55). New York: Springer.

Beebe, B., Stern, D., & Jaffe, J. (1979). The kinesic rhythm of mother-infant interactions. In Sieqman, A. W., Feldstein, S. (Eds.). *Of speech and time: Temporal speech patterns in interpersonal contexts* (pp. 23-34). New Jersey: Laurence Erlbaum Associates.

Beeghly, M., Tronick, E. (2011). Early resilience in the context of parent–infant relationships: A social developmental perspective. *Current Problems in Pediatric and Adolescent Health Care*, *41*(7), 197-201.

Boston Change Process Study Group. (2002). Explicating the implicit: The local level and the microprocess of change in the analytic situation. *The International Journal of Psychoanalysis*, *83*(5), 1051-1062.

Boston Change Process Study Group. (2005). The "Something More" than Interpretation Revisited: Sloppiness and Co-Creativity in the Psychoanalytic Encounter. *Journal of the American Psychoanalytic Association*, *53*(3), 693-729.

Brazelton, T. B. (1974). Does the neonate shape his environment?. *Birth Defects Original Article Series*, *10*(2), 131-140.

Brazelton, T. B., Koslowski, B., & Main, M. (1974). The origins of reciprocity: The early mother-infant interaction. In Lewis M, Rosenblum L., (Eds.). *The effect of the infant on its caregiver* (pp.49-76). New York: Wiley.

Bruner, J. S., Sherwood, V. (1975). Peekaboo and the learning of rule structures. In Bruner, J.S., Jolly, A., & Sylva, K. (Eds.). *Play: its Role in Development and Evolution* (pp. 277-285). Middlesex, England: Penguin.

Cohn, J. F., Tronick, E. Z. (1983). Three-month-old infants' reaction to simulated maternal depression. *Child development*, *54*(1), 185-193.

Cohn, J. F., Tronick, E. Z. (1988). Mother-infant face-to-face interaction: Influence is bidirectional and unrelated to periodic cycles in either partner's behavior. *Developmental Psychology*, *24*(3), 386.

Field, T. M. (1977). Effects of early separation, interactive deficits, and experimental manipulations on infant-mother face-to-face interaction. *Child development, 48*(3) 763-771.

Fogel, A. (1977). Temporal organization in mother-infant face-to-face interaction. In H. R. Schaffer (Ed.), *Studies in mother-infant interaction* (pp. 119-152). London: Academic Press.

Gianino, A., Tronick, E. Z. (1988). The mutual regulation model: The infant's self and interactive regulation and coping and defensive capacities. In Field, T., McCabe, P. & Schneiderman, N. (Eds.). *Stress and Coping* (pp. 47–68). Hillsdale, NJ: Erlbaum.

Hinde, R. A. (1995). A suggested structure for a science of relationships. *Personal Relationships*, *2*(1), 1-15.

Jaffe, J., Beebe, B., Feldstein, S., Crown, C. L., Jasnow, M. D., Rochat, P., & Stern, D. N. (2001). Rhythms of dialogue in infancy: Coordinated timing in development. *Monographs of the society for research in child development, 66*(2), i-149.

Jasnow, M., Feldstein, S. (1986). Adult-like temporal characteristics of mother-infant vocal interactions. *Child development*, *57*(3), 754-761.

Lyons-Ruth, K., Bruschweiler-Stern, N., Harrison, A. M., Morgan, A. C., Nahum, J. P., Sander, L., & Tronick, E. Z. (1998). Implicit relational knowing: Its role in development and psychoanalytic treatment. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health*, *19*(3), 282-289.

Mayer, N. K., Tronick, E. Z. (1985). Mothers' turn-giving signals and infant turn-taking in mother-infant interaction. In Field, T.M., Fox, N.A. (Eds.). *Social perception in Infants* (pp. 199-216). Norwood, N.J: Ablex.

Montirosso, R., Tronick, E., Morandi, F., Ciceri, F., & Borgatti, R. (2013). Four-month-old infants' long-term memory for a stressful social event. *PloS one*, *8*(12), e82277.

McCall, R. B., McGhee, P. E. (1977). The discrepancy hypothesis of attention and affect in infants. In Uzgiris, I, Weizmann, F. (Eds.). *The structuring of experience* (pp. 179-210). New York: Springer.

Meltzoff, A. N., Prinz, W. (Eds.). (2002). *The imitative mind: Development, evolution and brain bases* (Vol. 6). Cambridge University Press.

Mesman, J., van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2009). The many faces of the Still-Face Paradigm: A review and meta-analysis. *Developmental Review*, *29*(2), 120-162.

Müller, M., Zietlow, A. L., Tronick, E., & Reck, C. (2015). What dyadic reparation is meant to do: an association with infant cortisol reactivity. *Psychopathology*, *48*(6), 386-399.

Ratner, N., Bruner, J. (1978). Games, social exchange and the acquisition of language. *Journal of child language*, *5*(03), 391-401.

Sander, L. (1977). The regulation of exchange in the infant-caretaker system and some aspects of the context-content relationship. *Interaction, Conversation, and The Development of Language*, *5*(40), 579-593.

Spitz, R. A. (1965). The first year of life: *A psychoanalytic study of normal and deviant development of object relations*. New York: International University Press.

Stern, D. N. (1971). A micro-analysis of mother-infant interaction: Behavior regulating social contact between a mother and her 3 1/2-month-old twins. *Journal of the American Academy of Child Psychiatry*, *10*(3), 501-517.

Stern, D. N. (1974). The goal and structure of mother-infant play. *Journal of the American Academy of Child Psychiatry*, *13*(3), 402-421.

Stern, D. N. (1977). *The first relationship*. Cambridge, MA: Harvard University Press.

Stern, D. N., Beebe, B., Jaffe, J., & Bennett, S. L. (1977). The infant's stimulus world during social interaction: A study of caregiver behaviors with particular reference to repetition and timing. In H. R. Schaffer (Ed.), *Studies in mother-infant interaction* (pp. 177-202). London: Academic Press.

Stern, D. N., Sander, L. W., Nahum, J. P., Harrison, A. M., Lyons-Ruth, K., Morgan, A. C., Tronick, E. Z. (The Boston Change Process Study Group) (1998). Non-interpretive mechanisms in psychoanalytic therapy: The 'something more' than interpretation. *The International Journal of PsychoAnalysis*, *79*(5), 903-921.

Trevarthen, C. (1974). The psychobiology of speech development. In E. H. Lenneberg (Ed.), *Language and brain: Developmental aspects: Neurosciences Research Program Bulletin*, *Vol. 12* (pp. 570–585). Boston, MA: Neuroscience Research Program.

Trevarthen, C. (1979). Communication and cooperation in early infancy. A description of primary intersubjectivity. In M. Bullowa (Ed.), *Before speech: The beginning of human communication* (pp. 321–347). London : Cambridge University Press.

Trevarthen, C. (1998). The concept and foundations of infant intersubjectivity. In S. Bräten (Ed.), *Intersubjective communication and emotion in early ontogeny* (pp. 15–46). Cambridge: Cambridge University Press.

Trevarthen, C., Aitken, K. J. (2001). Infant intersubjectivity: Research, theory, and clinical applications. *Journal of Child Psychology and Psychiatry*, *42*(1), 3-48.

Trevarthen, C., Hubley, P. (1978). Secondary intersubjectivity: confidence, confiding and acts of meaning in the first year. In

Lock, A. (Ed.). *Action, gesture and symbol: The emergence of language* (pp.183–229). London: Academic Press.

Tronick, E. (1989). Emotions and emotional communication in infants. *American Psychologist*, *44*(2), 112-119.

Tronick E. (1998) Interventions that effect change in psychotherapy: A model based on infant research. *Infant Mental Health Journal, 19*(3), 277-279.

Tronick, E. (2001). Emotional connections and dyadic consciousness in infant-mother and patient-therapist interactions: Commentary on paper by Frank M. Lachmann. *Psychoanalytic Dialogues*, *11*(2), 187-194.

Tronick, E. (2003). "Of course all relationships are unique": How co-creative processes generate unique mother–infant and patient–therapist relationships and change other relationships. *Psychoanalytic Inquiry*, *23*(3), 473-491.

Tronick E. (2002b). The increasing differentiation and non-transferabilty ways of being together. The primary attachment is specific, not prototypical. *Journal of Infant, Child and Adolescent Psychotherapy, 2*(4), 47-60.

Tronick, E. (2007). *The neurobehavioral and social-emotional development of infants and children.* New York, NY: Norton.

Tronick, E. (2008). Multilevel meaning making and dyadic expansion of consciousness theory: The emotional and the polymorphic polysemic flow of meaning. In Fosha, D., Siegel, D.J. & M. Solomon (Eds.). *The healing power of emotion: Affective neuroscience, development, and clinical practice* (pp. 86–110). New York, NY: Norton.

Tronick, E. (2009). Social interaction**.** In Haith, Benson, J. (Eds.). *Social and emotional development in infancy and early childhood* (pp.429-436). San Diego: Elsevier.

Tronick, E., Als, H., & Adamson, L. (1979). Structure of early face-to-face communicative interactions. In Bullowa, M. (Eds.). *Before Speech* (pp. 349-371). Cambridge: Cambridge University Press.

Tronick, E., Als, H., Adamson, L., Wise, S., & Brazelton, T. B. (1978). The infant's response to entrapment between contradictory messages in face-to-face interaction. *Journal of the American Academy of Child psychiatry*, *17*(1), 1-13.

Tronick E., Als H., Brazelton T. B. (1980). The infant's communicative competencies and the achievement of intersubjectivity. In M. R. Key (Ed.), *The relationship of verbal and nonverbal communication* (pp. 261-274). New York: Mouton Publishers.

Tronick, E. Z., Bruschweiler-Stern, N., Harrison, A. M., Lyons-Ruth, K., Morgan, A. C., Nahum, J. P., Stern, D. N. (1998). Dyadically expanded states of consciousness and the process of therapeutic change. *Infant mental health journal*, *19*(3), 290-299.

Tronick, E. Z., Olson, K., Rosenberg, R., Bohne, L., Lu, J., & Lester, B. M. (2004). Normative neurobehavioral performance of healthy infants on the neonatal intensive care unit network neurobehavioral scale. *Pediatrics*, *113*(3), 676-678.

Weinberg, M. K., Tronick, E. Z. (1994). Beyond the face: An empirical study of infant affective configurations of facial, vocal, gestural, and regulatory behaviors. *Child development*, *65*(5), 1503-1515.