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EARLY SOCIAL LEARNING AND CONSTANCY IN CLOSE RELATIONSHIP

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Abstract

Social development starts early in the prenatal period and continues intensively throughout infancy. An infant's experiences with a caregiver, their first close relationship, are encoded, stored, and used for further social development and functioning later in life. In this article, I outline a new theoretical view: through repetitive, sustained interaction with a primary caregiver infants acquire an implicit knowledge and higher memory schema of constancy in close relationship. That guides their ability to form and maintain close relationships not just in childhood, but throughout the lifespan as well. Furthermore, absence of a primary caregiver in infancy results in specific impairments in social functioning. Thus, I propose that absence of constancy in close relationship should be considered a specific form of early social adversity.

Keywords

Social groups, close and casual relationships, memory system, early social learning, memory schema primary caregiving, constancy in close relationship

1. SOCIAL GROUPS AND SOCIAL FUNCTIONING

1.1 Social Beings

The human brain organizes and processes an enormous amount of social information. We are experts at communicating with others and sharing thoughts, emotions, and what we imagine about the future (Lieberman, 2013). We coordinate our mental and physical lives with those of others, collaborate, and learn from each other. We can learn about another person from their subtle and rapidly changing facial expressions (Ulmer-Yaniv, et. al., 2020). We even manage the complex process of perceiving social information from two or more sources simultaneously (Adolphs, 2009). For example, a wife may talk to her mother-in-law about a holiday visit and simultaneously recognize that her husband, who is present in the room, is not pleased, although he hasn't said a word.

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1.2 Living in Hierarchical Social Networks

Anthropologist Robin Dunbar and his colleagues propose that our social life is not random and that we live in large and hierarchically organized social networks. The most significant of these networks comprises a circle of three to five close relationships. Typically, close relationships include parents and children, partners, and best friends. These relationships have different qualities compared to casual relationships in which we do not share intimate information, know less about others, and spend less time with them (Brown & Brown, 2006). These are what we may refer to as casual relationships. For example, relationships with our colleagues at work. People usually have approximately 15–30 others in their casual social circle. Then, we typically also have connections with approximately 250 or more people, who are more peripheral (Dunbar, 1998).

1.3 Close Social Relationships

Social brain theory (SBT), also proposed by Dunbar and his team, suggests that the size of the neocortex correlates with our intensive social life, and with our ability to form and maintain close social relationships (Dunbar, 1998, 2007, 2008). Thus, through evolution, the brain was largely shaped by differentiated and complex social lives. In fact, social interaction accounts for a large proportion of our brain activity (Dunbar, 2008).
We have few close relationships, but they are our most important bonds. We seek emotional support, constancy, acceptance, and belonging in them. We feel part of that small, select group (Brown & Brown, 2006). For example, in our nuclear family, we may feel happy and satisfied or angry, sad, and desperate in close relationships. Nonetheless, without them, we are likely to suffer deep loneliness, even hopelessness. Moreover, if an individual has severe difficulties managing relationships and social ties, this can be a sign of mental health issues. Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (2013) recognizes these as significant impairments in interpersonal social functioning.
The following section outlines how and when people may acquire the art of forming and maintaining close relationships.

2. SOCIAL DEVELOPMENT AND LEARNING ABOUT CLOSE RELATIONSHIPS IN INFANCY

2.1 How Newborns Recognize Their Mother

Babies start learning about social connection with their mother in utero and this process continues in infancy. For example, research in prenatal sensory and social development indicates that babies can hear and distinguish different types of sounds approximately 3 months before birth. After birth, newborns recognize their mother's

voice and language and prefer these to other voices and languages. They also react differently to the emotionality of speech. The rhythm, pitch, and volume of speech vary with emotional intensity and infants are sensitive to these variations (Nazzi, Bertoncini & Mehler, 1998; Moon, 2017; Byers-Heinlein, Burns & Werker, 2010; Mastropieri & Turkewitz, 1999).

The sounds and other sensory information about the mother that are encoded during prenatal development play a crucial role in an infant's further social development. A newborn infant can use that information to distinguish their mother from other people. The world is new to them, but they can use their prenatal memories of their mother's scent, sounds, taste, and touch to identify her as a familiar person and environment. Sound may play an especially critical role because the infant can perceive the familiar sounds of their mother even when they are not physically close. This early learning about the mother is understood to be the beginning of learning how to later form a close and unique attachment relationship with her (Moon, 2017).

2.2 Mother's Face

Research in social cognitive neuroscience suggests that one of the most powerful types of social information for humans is the face. Face recognition depends on the fusiform face area and is highly active in early infancy (Tzourio-Mazoyer et al., 2002). A few hours after birth, newborns are more interested in face configuration than other visual stimuli (Johnson, Dziurawiec, Ellis & Morton, 1991); furthermore, they quickly encode the face of their mother or primary caregiver over the repetitive time they spend together (Bushnell, 2001). Newborns also connect visual and auditory information about their mother's face and voice. For example, a study exposed newborns to the face of their mothers and those of strangers and played the sound of their mother's voice. The newborns were able to identify their mother's face upon hearing the familiar sound of their mother's voice (Coulon, Guellai & Streri, 2011).

2.3 Synchrony, the Role of the Amygdala, and Regulation of Emotion

An infant and their primary caregiver develop intimate knowledge about each other, form comfortable closeness, and synchronize their behavior and physiology. Ruth Feldman (2015) states that infant and primary caregiver create a special behavioral and emotional synchrony. Through continuous "online connection," they specialize in each other's facial expressions, tone of voice, and changes in behavior, and regulate each other's physical and psychological states. Thus, an infant gains implicit nonverbal knowledge about their primary caregiver and themselves through repetitive, shared interaction (Feldman, 2015). Approximately at the age of 1 year, an infant develops sufficient motor skills to be able to move from their primary caregiver and explore the world more independently. The encoded intimate knowledge of the primary caregiver's presence and the consistency of their behaviors are now critical for the infant's orientation in the social world. The infant can explore and then safely return to the well-known and familiar primary caregiver, who

can be safely distinguished from other people.
The amygdala (AMG) and prefrontal cortex (PFC) are brain regions that are highly active in social and emotional functioning. The AMG is responsible for processing and encoding intense emotional information, positive and negative, especially that which is important for survival. The AMG is active when people experience threatening situations, and thus, it also activates processes involved in stress management (Herman & Cullinan, 1997). Therefore, the AMG is involved in emotional learning (Tottenham & Sheridan, 2010). The AMG is structurally developed at birth, starts to function in the first year of life, and develops throughout childhood (Tottenham, Hare & Casey, 2009). For example, animal research shows that the AMG is highly involved when young rhesus monkeys exhibit a preference for their mother. When the researchers lesioned the AMG in young monkeys, these offspring exhibited distant behavior toward their mother and treated them like strangers. Prior to the experiment, they had shown fully developed attachment behavior with their mother (Bauman, Lavenex, Mason, Capitanio & Amaral, 2004).

2.4 Presence of a Primary Caregiver Regulates Amygdala Activity

Research in affective developmental neuroscience indicates that an overly active AMG is typically involved in psychological problems, including social functioning. The presence of a primary caregiver is understood to regulate the processing of fear and other strong emotions in infants. An infant's experience of closeness and trust associated with their primary caregiver is processed by the AMG, the hippocampus, and the PFC (Perry, Blair & Sullivan, 2017). The experience of this bonded relationship has an impact on these regions of the brain such that they learn to regulate mental states, primarily states of fear and stress, more effectively. Here, I speculate that the constancy of the primary caregiver's presence is encoded. The infant learns either that the primary caregiver represents safety or that they represent dysregulation and stress. This implicit information about the quality of their close relationship is then used to assess and interpret subsequent social interactions and relationships.
Researchers in early social cognition agree that newborns and infants are intrinsically motivated to seek social cues. They quickly encode and recall social information and learn to connect with social partners (Raz & Saxe, 2020). I propose that infants also learn how close familiar connections differ from casual ones. This learning occurs when the infant repeatedly spends time with their primary caregiver in physical proximity, and they learn about each other's physical features, emotional states, and behaviors. However, learning is only effective when the information is encoded and saved in the memory system, and used for predictions about the world, imagination, problem solving, and decision making. The next section examines how memory systems function in infancy.

3. MEMORY AND SOCIAL LEARNING: GENERAL SCHEMAS FIRST, THEN EPISODIC LEARNING

3.1 Memory

Memory is a system that maintains our coherent sense of self and relationships with others (Kandel, 2008). In cognitive neuroscience, memory has been studied for decades; however, our understanding of the memory system's functions remains still limited. Here, I focus on two major types of memory – namely explicit and implicit. The explicit memory system forms, maintains, and retrieves knowledge about events, episodes, and facts; for example, we remember episodic situations, such as spending time with family at the weekend in Paris. We also recall explicit semantic information, such as, Paris is the capital of France. By contrast, the implicit memory system refers to several memory subsystems, including skills, habits, conditioning, priming, habituation, sensitization, and perceptual and emotional learning (Squire, & Wixted, 2011). Implicit memories are unconscious and not accessible through deliberate effort; for example, one cannot remember why and how recognizes the best friend's voice. However, implicit memories strongly navigate people when they respond to the world. They drive people's likes, dislikes, and preferences; color meanings of events and social communication (Howeison, 1996). Thus, implicit memories are also activated when people process different types of social relationships; for example, when we see a friend after a long absence, we feel joyful and "at home" with them. We anticipate and resume predictable patterns of interaction and emotional responses.

3.2 Memory Systems in Infancy

Infants rapidly learn an enormous amount of knowledge about the world, self, and other people and numerous skills. According to the literature, explicit memory is rather limited at the beginning of life and significantly increases during childhood (Ornstein & Haden, 2001; Fivush, Haden, & Reese, 2011). Conversely, implicit memory is functional at birth and does not significantly improve after the age of 3 months (Schneider & Pressley, 2013). Early implicit memories are the foundation for later learning, and, at the same time, they may remain stable and continue to influence our feelings, beliefs, and judgments throughout life. Bargh and Shalev (2012) argue that early childhood experiences play a significant role in the development of implicit (automatic) relational processes, including sense of self and self-regulation in social relationships.

3.3 Infantile Amnesia

Most people do not have episodic memories from the first 2–4 years of life. This phenomenon is called infantile amnesia. The reason for this absence of early episodic memories has not been determined. Research in cognitive neuroscience shows that adverse childhood experiences (ACEs), including physical abuse and neglect, which occur before

age 4, have a profound negative impact on neuropsychological and social development during childhood. ACEs are also believed to contribute to adult psychopathology (Sheridan&McLaughlin, 2020). However, despite the impact of ACEs, episodic memories of early trauma typically cannot be retrieved later in life (Campbell & Spear, 1972).

3.4 Examples of Learning Outside Awareness: Statistical Learning and Generalized Schemas in Infancy

How do infants learn so much about the world and retain it in long-term memory and yet do not store episodic memories during this time? How do they learn so much without conscious effort or focused training? Research suggests that infants learn automatically and rapidly through exposure to information, and the memory system encodes and stores regularities and novelties without being directly instructed. This process is called statistical learning, which is active in infancy, childhood, and adulthood. Statistical learning depends on recognition of patterns through repeated experience with certain events (Aslin, 2017). When a pattern is detected, the generalized meaning is stored as a template, and used to respond in similar situations. For example, when an infant (or adult) is exposed to a new language, gradually they begin to recognize vowels and consonants that repeatedly occur together in a predictable sequence. Then they recognize words, phrases and simple sentences. The brain has extracted patterns within the given language based on "statistics", that is, how often things occur together (Romberg and Saffran, 2010). Statistical learning is automatic and outside awareness. It creates stable memories of higher organization and meaning within everyday events in the environment, such as language and behavior (Turk-Browne, 2012; Ellis et al. 2021). Another type of generalized memory process is creation of memory schemas. Memory schemas organize past repetitive experiences that are associated with the same context. For example, when an infant learns about dogs, the first one may be their grandmother's dog; however, then they see other dogs, and their brain creates a higher category, a memory schema, for "dog" – a four-legged, furry, merry animal that barks and sometimes bites. Memory schemas are learned through repetition and create higher categories of experiences in an individual's environment. Later, it is easier to learn details because the template for the category already exists in the memory system. For example, the child can now use the category of "dog" to easily learn about different types of dogs. Memory schemas guide our attention and influence how we understand the world and make choices (Ghosh & Gilboa, 2014).

Neuroscience research indicates that the PFC and certain parts of the hippocampus (monosynaptic pathway in the anterior hippocampus) are involved in statistical learning and generalization. During infancy, the hippocampus is active in statistical learning before it starts processing long-term explicit episodic memories (Ellis, 2021; Turk-Browne, 2012). Nim Tottenham (2020) suggests that medial-prefrontal circuitry may be involved in processing affective schemas in infancy. For example, traumatic experiences with a primary caregiver acquired by an infant are not remembered as episodic events, but they are encoded as affective schematic knowledge about trauma (Tottenham, 2020).

3.5 Learning Through Repeated Experience with a Primary Caregiver

Primary caregivers are the dominant social partners for infants and the "expected environment" for their healthy development (Tottenham, 2012). Every parent has a limited repertoire of caregiving behavior for the child. Over time, the interaction between caregiver and infant has many regularities and fewer surprises or novelties. In this way the infant learns the caregiver's schematized relational behaviors. Such memories may be highly stable as they are reinforced repeatedly and over a long period. If this learning has a positive meaning and supports the development of a positive close relationship, it will be encoded as a positive conviction about self and the relationship with the caregiver. Similarly, if it is negative, it may leave rather strong negative meanings of the relationship and the child's self (Pesso, Pesso Boyden & Vrtbovska, 2009; Winnette & Baylin, 2016, Cairns, 2002). Here, I speculate that the memory system creates a memory schema for close relationships by extracting and encoding features of multiple relational experiences with a constant caregiver, which include physical proximity, time spent together, and interactive involvement of self and the other. This schematic memory template may influence how people form and maintain close relationships later in life.

4. ACES AND EARLY SOCIAL ADVERSITY

4.1 The Impact of ACEs on Physical and Mental Health

The term "adverse childhood experience" was coined by the American doctors Vincent Felliti and Robert Anda, who authored the original ACE study. This study demonstrated that ACEs, such as physical abuse, sexual abuse, physical neglect or emotional neglect, have a long-term impact on physical and mental health. The study found that children who experience three or more ACEs have a significantly greater negative impact on their health as an adult compared with children with fewer ACEs (Felitti et al., 1998). Felliti, Anda, and their colleagues later proposed the following hypotheses: (1) The negative consequences of ACEs will appear in different areas of health and functioning because different parts of the developing brain were affected; (2) the probability of negative consequences reflects the number of adversities experienced; and (3) the number and type of disorders reflect the extent of impaired brain functions (Anda et al., 2006). These results and the concept of ACEs have been widely accepted and have inspired further research in the disciplines of psychology and medicine (Krinner et al., 2021; Sahle et al., 2022).

However, the ACE study only reported on ACEs that the participants remembered (could retrieve from long-term episodic memory) and reported in the ACE questionnaire as adults did not include adversities associated with infancy and early childhood, which occur before the development of episodic memory.

4.2 Absence of a Primary Caregiver in Infancy

Social and affective developmental neuroscience research suggests that the primary caregiver is an "expected environment" for infants and children (Tottenham, 2012). This relationship is essential for healthy development in multiple domains. One of the most critical domains is sociability, which includes the ability to form and maintain various types of relationships. It is widely agreed if an infant does not experience sensitive and involved primary caregiving, they will feel insecure in relationships later in life (Bowlby, 1969; Ainsworth & Bell, 1970). But, what happens when an infant does not experience constancy in close relationship because the primary caregiver is not present at all or is present, but in a changeable, fragmented manner?

4.3 Primary Caregiver Absence Means the Absence of Constancy in Close Relationship in Infancy

Absence of a primary caregiver in infancy can occur in various instances. In institutional care, infants experience rotating caregivers and unpredictable, radical changes in their social environment. In a less extreme form, it can also occur in a family setting (Feldman, 2015). For example, if the mother suffers from a serious illness or depression, the infant may experience her as distant, and often unavailable. In another instance, an infant may experience separation from their primary caregiver for medical reasons. In such circumstances, many different family members or a nanny may provide care for the child, meaning that the infant experiences many different faces, physical features, and behaviors during caregiving.

Those caregivers may make a genuine effort to be close to the infant and to meet the infant's needs. The infant is safe with them. However, from a social development perspective, in all of the aforementioned situations the infant would not experience and encode some of the most crucial qualities of close relationships – frequent proximity with a single caregiver over a long period of time, intimate knowledge of the primary caregiver, a sense of familiarity, implicit memories of the self and the other in synchrony, and trust that the relationship and connection will continue. Therefore, the infant might not learn enough cues on how to form and maintain a unique, close relationship because their caregiver did not provide the experience of sufficient constancy in close relationship for the child to learn this skill.

The coined term constancy in close relationship means, that the infant experiences presence of primary caregiver as a repeated familiar close social connection, and encodes it as implicit memories, and also as generalized memory schema. This early learning of constancy in close relationship might be one of the essentials for development of ability to form and maintain close relationships later in life.

4.4 Consequences of Primary Caregiver Absence During Infancy

Institutional care in infancy represents the most extreme version of the absence of a primary caregiver and constancy in close relationship. Research in developmental psychology indicates that children with such a history often suffer from consequences in many social domains, not just when they are placed in institutions and also long after they are adopted (for review Gunnar & Reid, 2019; Tarullo & Gunnar, 2005). For example, many of these children exhibit signs of disorganized attachment relationships. They are eager to receive attention and socially engage, but they repeatedly fail in their efforts to form and manage both close and casual relationships satisfactorily. Moreover, they often exhibit affective and behavioral dysregulation when connecting with people, including their adoptive parents or foster carers. Thus, they may overreact to ordinary daily social cues in the family and easily become stressed by minor social conflicts. Some will also display signs of social apathy, avoid social situations, and have difficulties in learning how to make friends and behave in social groups (quasi-autistic patterns of behavior) (Rutter et al., 1999). They also often experience problems distinguishing between their parents and other adults (Olsavsky et.al., 2013). According to research and clinical experience, the consequences of institutional care in infancy seem to be persistent and significant, especially in terms of social behaviors (for review Nelson, Zeanah & Fox, 2019; Vorria, et al., 2003; Rutter, et al., 2007; Sheridan et al., 2012; Gee et al., 2013).

Neuroscience research suggests that these children have a larger and hyperactive AMG as well as accelerated development of connections between the PFC and AMG. It is believed that the absence of primary caregiving leads to the premature accelerated development of independence (Gee et al., 2013). For example, a 2-year-old child adopted from an institution may never seek support or help from their parents when injured or stressed. When the child goes to a playground with their adoptive father, he runs away and joins other parents. It is difficult for him to recognize who is his father and who are total strangers.

I propose that many of the aforementioned social difficulties in children with a history of absent primary caregivers in infancy are related to the absence of learning higher knowledge about close relationships in infancy and early childhood. This may lead to a serious deficit in social development and cause many psychological issues to appear later in childhood, adolescence, and adulthood, such as promiscuity, social isolation, loneliness, difficulty finding a partner and starting a family, and parenting problems.

5. CONCLUSIONS

My main conclusions and outline of the theoretical concept of constancy in close relationship are as follows.

I. Close and casual relationships present different relational schemas. Although they overlap in some ways, they seem to be partially processed by different brain areas (Roseman et al. 2022). Developmental neuroscience suggests that babies before birth and infants learn implicitly, but rapidly through repetitive and multiple exposures to their

social environment. Higher knowledge extracted from repeated experiences are also saved in the form of generalized memory schemas. Such schemas are used for orientation in the social world and are the foundation for further social learning. Although we typically do not have episodic memories of events in infancy and early childhood, apparently, beginning of necessary social learning is done implicitly, and without awareness.

II. I speculate that early learning about closeness is encoded in implicit memory, and in 'memory schemas of constancy in close relationship'. These schemas influence our ability to form and maintain close relationships throughout life.

III. Infants who do not have a consistent primary caregiver may not experience the constancy in close relationship needed to develop schemas to guide them in establishing close relationships as children and adults. Consequently, they may have significant problems in their social functioning in general.

I propose that failure to encode sufficiently experience of constancy in close relationship in infancy and early childhood due to the absence of a primary caregiver should be considered a specific form of early social adversity.

This theoretical framework may inspire new considerations about early child development and generate new research questions. However, deeper focus, discussion, and research is needed to clarify this developmental concept further.

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