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EDITORIAL

The Nature of Love Revisited: How Social Bonds Shape Development

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1 | Let's Call Love: Love

In his seminal paper, *The Nature of Love* (1958), Harlow set the stage for the scientific study of love. Harlow, who suffered from severe depression, was driven by the fundamental belief that love was at the root of the condition that troubled him: “Love created, love destroyed, and love regained,” as he wrote in his personal writings (van Rosmalen et al. 2022). His work has provided an empirical basis for attachment theory and many other traditions that emphasize the importance of warm, responsive, and loving relationships in children’s healthy development. Surprisingly, most researchers are reluctant to use the word *love* while studying phenomena that clearly represent the thing we intuitively call love, perhaps because love is seen as a mysterious and ultimately subjective experience. The terminology that has replaced love, therefore, derives mostly from attachment literature and comparative research (Panksepp 1998). Love became deconstructed in concepts such as attachment, warmth, affiliation, and sensitivity (Cassidy and Shaver 2018).

This special issue is our plea to bring back *love* in research on love. Since Harlow, we have learned a tremendous deal about love, its manifestations, its consequences, and its neurobiological underpinnings. The 20 papers part of this special issue showcase cutting-edge research in these domains. By putting love back in center stage, we can foster an interdisciplinary approach by bridging different fields and perspectives on this topic. We hope that our special issue will not only improve our understanding of love but also inform efforts to promote the quality of loving relationships, with the aim of facilitating the healthy development of infants and children.

1.1 | Nature of Love

How do parents express love to their children? The most fundamental aspect of the parent–child relationship is spatial closeness: being present. It is no coincidence that excluding a child from the parents’ presence (e.g., through time out) is an often employed discipline technique. Bowlby also described physical closeness as the basis of a safe haven (Bell and Richard 2000). In a longitudinal study on non-human primates in this special issue, Godoy et al. (2024) demonstrate the validity of spatial closeness as an index of sociality. They show that capuchin monkey mothers that spend more time in close proximity to group members have daughters (but not sons) who are more socially close as juveniles and young adults. In a study with human children, Abramson et al. (2024) investigated the acute effect of parental presence. In a neuroimaging study, children completed a fear conditioning task, in which they observed various shapes; some shapes were paired with uncomfortable noise blasts. The within-subjects experimental manipulation was that the parent was either present (staying close to the child and laying a hand on the child’s hand or leg) or absent. Parental presence resulted in reduced activation of the *centromedial amygdala*—a key output region of the amygdala complex for fear responses—during the noise blasts, indicating a buffering effect of the physical closeness of the parent. To what extent physical touch is critical for this effect is unclear from the present study, but previous work demonstrates that even a small touch by the parent can have substantial effects on children’s emotion processing (Brummelman et al. 2019).

In our special issue, relationship quality was often defined as attachment security or sensitivity. Attachment refers to the more

static quality and experienced safety of the relationship between child and parent, whereas sensitivity refers to the parent's ability to accurately perceive the child's signals and to respond to those signals adequately and promptly (Ainsworth 1978). Sensitivity reflects a characteristic of behavioral interactions, yet it can be seen as an antecedent of attachment relations (Wolff and IJzendoorn 1997). These constructs can be measured with diverse instruments (Mesman and Emmen 2013; Ravitz et al. 2010). The current collection reflects this diversity. The studies investigating attachment relied on questionnaires (Clinchard et al. 2024; Vannucci et al. 2024), interviews (Nguyen et al. 2024), and children's responses to scenario's played out with dolls (Misch et al. 2024). The studies investigating sensitivity (Orlitsky et al. 2024; Stern et al. 2024; Wade et al. 2024; Xu et al. 2024; Yang et al. 2024) all relied on observations of parent-child interactions, yet used different coding protocols.

Other measures of expressions of love encountered in this special issue include self-reports of feeling loved (Xia et al. 2024), praise by parents (Li et al. 2024), and observed reciprocity (Paz and Frenkel 2024). Whereas some studies observed naturally occurring variations in love, others used experimental manipulations to elicit love (e.g., encouraging reciprocal self-disclosure between parent and child; Brummelman et al. 2024). Clearly, love can be expressed in a variety of ways, and even loving parents can be hampered in their capacities to show love. And sometimes, expressing love can be as simple as being present.

1.2 | Consequences of Love

The importance of presence and touch is shared by most, if not all, developing mammals. Humans are, however, also verbal animals and often use language to express their love. A vital feature of loving human interactions is reciprocal self-disclosure, where individuals disclose intimate information about themselves. Brummelman et al. (2024) examined whether encouraging reciprocal self-disclosure in parent-child dyads would make children (ages 8–13) feel more loved. Dyads were assigned randomly to engage in self-disclosure or small talk. Linguistic analyses show that reciprocal self-disclosure instigated conversations that were more emotionally charged, social, reflective, and meaningful, even addressing deeply personal topics, including the passing of loved ones. Importantly, reciprocal self-disclosure made children feel more loved by their parents.

Several studies in this collection employed a longitudinal approach to study the longer-term effects of love. Focusing on the youngest population investigated in this special issue, Orlitsky et al. (2024) examined which aspect of maternal behavior predicted the development of empathic concern in infants aged between 3 and 18 months. Mothers' responsiveness to the infant's distress—but not responsiveness to non-distress cues or maternal expression of positive affect and affection in non-distress—predicted the development of empathic concern in infants. Also, in this special issue, Paz and Frenkel (2024) studied reciprocity between mother and infant during play, showing that it predicted children's prosocial behavior at 12 months of age. This effect was most pronounced in children with a strong response to the still-face procedure—suggesting that children

who are more sensitive to parental responsiveness benefit more from parent-child reciprocity.

Investigating a much longer timespan, Yang et al. (2024) showed that mothers' sensitivity to their 15–24-month-old infants predicted the quality of children's friendships at age 15. This was partially mediated by children's ability to describe situations reflecting secure attachment with parents, assessed at age 10. Also, in this issue, Vannucci et al. (2024) examined internal working models, originally described by Bowlby (1983). Children aged 6–12 years who experienced greater early adversity in the domain of caregiving (e.g., parent-child separation or emotional- and physical maltreatment) endorsed more false insecure memories, assessed with a false memory task probing the content of affective semantic memories 2.5 years later. These insecure memories were based on photo stories that contained a storyline in which the child's needs were not met by the parent. Finally, in this special issue, Misch et al. (2024) examined how attachment representations affect intergroup dynamics in children. While most children showed a strong and robust ingroup bias (e.g., liking the ingroup better, allocating more resources to the ingroup), children with an insecure-ambivalent attachment representation were treated in- and out-group similarly. Together, these studies show that love leaves traces in children's mental representations of social relationships, affecting their future social relationships, even outside of the family.

The study by Clinchard et al. (2024) extends these findings by looking at the attachment relations of adolescents with their mothers and fathers separately. Paternal (but not maternal) attachment, assessed during middle adolescence, predicted externalizing symptoms during late adolescence, which, in turn, predicted heightened alcohol use during the transition to young adulthood. Also, the study by Wei et al. (2024) investigated the outcomes of parenting behavior in a group of Bangladeshi families with 5-year-old children living in poverty. The study showed that parents (predominantly mothers) with higher educational levels showed greater autonomy support and conceptual scaffolding (referring to the use of more abstract language). These parenting practices, in turn, were related to children's verbal intelligence, suggesting that loving interactions can be a mechanism through which parents perpetuate socioeconomic disparities.

There is one study part of this special issue that focused specifically on romantic relations in adolescence. Such relationships emerge in adolescence, so the scarcity of research in this area is surprising. Ha et al. (2024) investigated the role of support in romantic relations in dealing with daily stress. On days when adolescents felt less loved by their partner, they felt more stressed—except when they had a supportive partner. This confirms the importance of such romantic relations, especially supportive partners, for well-being in this critical developmental period, when the social focus shifts from parents to peers. That parents are still of critical importance for adolescent well-being, is demonstrated by Xia et al. (2024). Their study showed that feeling more loved by one's caregiver predicted adolescents' psychological well-being one year later.

These papers overall demonstrate that, from an early age, loving relations strongly impact social relationships and

socio-emotional development later in life, even in under-resourced contexts (e.g., Bangladeshi families living in poverty). Also, they demonstrate that children's mental representations (e.g., of their parents or partners being loving) can buffer the impact of adverse experiences.

1.3 | The Neural Mechanisms of Love

The term love has been used in the social neurosciences more than in any other discipline (Cacioppo et al. 2012). This field embraces the term because it ambitiously seeks to reveal previously unobservable subjective states and feelings through neural measures. As neuroimaging methods have become more accessible to researchers worldwide, research on the neuroscience of love has begun to bloom. For example, functional near infrared spectroscopy (fNIRS) and electroencephalography (EEG)—non-invasive and portable neuroimaging techniques—have enabled researchers to probe young children's brain activity in naturalistic settings.

How are children's brains influenced by experiences of love? In this special issue, Stern et al. (2024) examined the impact of maternal sensitivity on neural responses in infants (as measured with fNIRS) to the emotional expressions of adult females. Infants whose mothers showed more sensitivity demonstrated stronger activity of the dorsolateral prefrontal cortex—a region relevant for emotional control—already at 5–7 months. Also, in this issue, Wade et al. (2024) examined how caregiving quality—such as sensitivity, stimulation, and positive regard for the child—during the first 3.5 years of life predicted executive functioning at age 8 in both institutionally-reared and family-reared children. As predicted, higher caregiving quality predicted better executive functioning. This was explained, in part, by EEG-measured theta power, which is thought to reflect better goal-oriented attention (Putman et al. 2014). These findings suggest that early caregiving experiences impact brain functioning, which, in turn, shapes social and cognitive functioning.

A novel technique is *hyper-scanning*, which involves the simultaneous measuring of brain responses in two or more individuals, for example, during interaction. This is especially relevant for the topic of love, as love is an intrinsically interpersonal concept. Theoretical models of bio-behavioral synchrony (e.g., Feldman (2012) highlight the importance of synchronization of mind-body systems of parent and child. The resonance of neural, physiological, and endocrine systems between parent and child from birth onward is seen as key for the development of attachment relations. Building on this insight, Nguyen et al. (2024) used fNIRS to investigate the interpersonal neural synchrony of parents and children aged 5 and 6 years during a cooperative and individual problem-solving task. Neural synchrony was stronger during the cooperative task than the individual task. Insecure maternal attachment representations were related to higher mother-child frontal neural synchrony, and daughter attachment representations were related to higher daughter-parent temporal neural synchrony. Along similar lines, Li et al. (2024) measured parent-infant interpersonal neural synchrony during a challenging task. When parents and children showed positive affect, they showed higher synchrony in the temporo-parietal region, which is important for cognitive empathic abilities. Together,

these studies suggest that caregiving experiences not only shape the child's own neural development; they also shape the neural synchrony between parent and child.

Synchrony also encompasses physiological systems beyond the brain, such as the cardiovascular system. Indeed, children easily attune and synchronize to the physiological stress responses of their caregivers, even without being aware of the source of stress, a dynamic also observed between romantic partners (Ditzen et al. 2007; Engert et al. 2019). Focusing on children aged 6–12, Xu et al. (2024) investigated parent-child synchrony in respiratory sinus arrhythmia (RSA), a marker of parasympathetic activity. Parents' and children's RSA was measured in a conflict discussion task, and parents' emotional support, children's emotion regulation, and relationship quality were observed and coded. Higher RSA parent-child synchrony was related to higher relationship quality, but only among dyads whose parents were emotionally supportive, demonstrating consideration, validation, and appropriate responses to the child's emotional needs. This suggests that emotionally supportive relationships create a context in which synchrony is more adaptive.

The studies presented here are at the forefront of a new research area that attempts to understand how strongly intertwined the neurophysiology of those that give and receive love are, and how such interactions relate to relationship quality and behavioral outcomes.

1.4 | The Diversity of Love

Whereas most of the studies in this special issue focus on loving relations between parents (predominantly mothers) and children, the special issue also shows that loving relations are diverse and varied. Humans are flexible when it comes to the shape of their relationships. This can be explained by our evolutionary background as cooperative breeders, for whom alloparental care—care provided by others than biological parents—is essential for reproductive success (Hrdy 2005). Fortunately, fathers are involved increasingly in research on parenting, although they are still underrepresented (Cabrera et al. 2018). Also in the current issue, several studies included fathers in their sample, revealing unique contributions of fathers to child outcomes (e.g., Clinchard et al. 2024; Nguyen et al. 2024).

The study by Riem et al. (2024) investigated an even more neglected group of caregivers: grandparents. In a sample of children with and without adverse childhood experiences (e.g., child abuse, parental mental illness), they examined how grandparental support predicted children's later prosocial and externalizing behavior. Grandparental support predicted increased prosocial behavior and reduced externalizing behavior, specifically among children with experiences of adversity—underlining the importance of alloparental care in today's society, perhaps especially among those whose biological parents are unable to provide a safe haven.

Our dependency on alloparental care is, however, at odds with the modern tradition in most industrialized societies to raise children in the context of nuclear families. This puts pressure on parents, especially mothers, who are often primarily responsible. It also

places strong demands on the relationship quality between both parents, which often declines after childbirth (Doss and Rhoades 2017). Echoing this, Murray-Perdue et al. (2024) investigated the effects of a conflict communication intervention on parents from 6 to 18 months postpartum. As predicted, romantic attachment and observed constructiveness between partners decreased over 1 year, but this effect was mitigated in fathers (but not mothers) who took part in the intervention. This finding highlights the promise of interventions targeting the parents (rather than the parent–child relationship) and the importance of including all primary caregivers in research on parenting.

The field should not only embrace diversity in terms of relationships, such as including father–child relationships and addressing the relationship between parents, but should also strive for greater diversity in terms of cultural background and socioeconomic status. In our special issue, Western, Educated, Industrialized, Rich and Democratic (WEIRD) samples are overrepresented (Henrich et al. 2010), with a few notable exceptions. Williams et al. (2024) demonstrate why cultural and socioeconomic diversity should be embraced. They studied the expression of love in Chinese American immigrant families. Analysis of parental speech suggested three types of affection: training (the parent expressing high expectations and firm control while ensuring harmonious relationships), relational affection (the child feeling close to and loving the parent in response to the parent’s benevolence), and validation (the parent accepting and encouraging the child’s own expression of thoughts, feelings, and behaviors). Parents who were less engaged with American culture showed more training. Parents with lower incomes showed more training, more relational affection, and less validation. Children whose parents showed more training and validation, in turn, had greater attachment security. These findings suggest that, while the need for love and care is universal, there is considerable variation in its antecedents, manifestations, and consequences.

1.5 | Future Research: The Study of Love

Love is a subjective feeling that can be communicated and received in various ways. It is an interactive process that can be in or out of sync. One can feel love but communicate fear, one can perceive love as an act of pity or lust. Yet all scholars contributing to this issue will agree on the critical importance of love for children’s healthy development. This special issue also identifies key challenges for future research.

First, developmental scientists should embrace the diversity of human nature and development. Despite the efforts of many concerned researchers there are still strongly underrepresented groups such as fathers, non-WEIRD populations, and queer parents and children. The field of child and family studies should also critically look at its approach towards parenting, which sometimes still embraces an idealization of the traditional family, disregarding the role of wider family networks and alloparents in human history.

Second, developmental scientists should develop theoretical frameworks on how different antecedents and manifestations of love are related. In our special issue, every study used a unique set of theoretical frameworks and measures to tap into highly

similar underlying processes. How are these different aspects of love related, and how do they shape children’s development over time? From personal experience, we all know that seemingly small messages—a pat on the back, a quick embrace, a kiss on the cheek—can leave a lasting impression on children. We encourage researchers to use multiple measures to develop an integrative understanding of when, why, and how different aspects of love matter. Qualitative approaches could give richer insight into the mechanisms that we attempt to explore in the experimental work such as that by Brummelman et al. (2024) and Vannucci et al. (2024).

Third, and perhaps most importantly, developmental scientists should embark on truly interdisciplinary research. As this special issue shows, the most exciting questions about love exist at the intersection of disciplines, such as psychology, sociology, neuroscience, biology, and anthropology. What are common ways in which mammals show love, such as proximity and touch? What is the difference between romantic love and love for one’s children? Do these experiences of love rely on distinct or shared neural mechanisms? How are these mechanisms shaped by culture and socioeconomic status? How do humans take care of children outside of the typical parent–child relationships? What is the unique importance of grandparents, teachers, nurses, friends, and romantic partners? How are experiences of love embedded biologically, generating neural and physiological synchrony between multiple individuals? How can interventions best improve feelings of love at a young age, such as through proximity, touch, sensitivity, and mentalization?

As we built on the seminal work of Harlow, we sought to demonstrate, once again, that love is a scientific concept that can be studied empirically. We encourage multimethod and interdisciplinary approaches to love, which will help generate an integrative perspective on love as a critical ingredient of healthy child development. An encompassing view and understanding of love will ultimately lead to the development of interventions aimed at strengthening loving relations and optimal child development.

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