

The Role of Maternal Responsiveness for the Emergence of Imitation and Empathic Responding in Infancy

Inaugural-Dissertation

zur Erlangung des Doktorgrades der Philosophie
der Ludwig-Maximilians-Universität München

vorgelegt von
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geboren am 28.03.1993
in Köln

München
2023

Prüfungskommission

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Tag der mündlichen Prüfung: 16.05.2023

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Acknowledgments

Bei der Erstellung dieser Arbeit haben mich viele Menschen auf verschiedenste Weise unterstützt. Für ihre Begleitung auf diesem Weg möchte ich mich an dieser Stelle von Herzen bedanken.

Ein besonderer Dank gilt meinem Doktorvater **Markus Paulus** für die Herausforderungen, an denen ich wachsen konnte, die fachliche Unterstützung und das Verständnis für theoretisch fundierte Forschung. Vielen Dank auch an meine Zweitprüferin **Anne Frenzel** und an **Thomas Eckert**, der sich bereit erklärt hat die Rolle des Drittprüfers zu übernehmen. Ein besonderer Dank gilt **Carolina Pletti**, welche mir über die ganzen Jahre mit Rat und Tat zur Seite stand. Außerdem möchte ich mich bei **Burkard Gniewosz** bedanken, der mich kompetent, aber auch immer mit viel Humor im Statistikbereich unterstützte.

Lieben Dank an alle Kolleginnen und Kollegen am Lehrstuhl für die emotionale Unterstützung und spannende fachliche Diskussionen, die mich in meiner Arbeit vorangebracht haben. Ein besonderer Dank gilt **Maria** und **Nina** – ihr wart meine Felsen, um all die Hochs und Tiefs dieser Promotion gut zu überstehen. Mein weiterer Dank geht an **Samuel**, mit dem ich unser wunderbar komplementäres und dadurch so inspirierendes Team bilden durfte.

Danke auch an alle Studierenden, die als Hilfskräfte oder im Rahmen einer Abschlussarbeit einen wertvollen Beitrag zu dieser Arbeit geleistet haben. Insbesondere möchte ich hier **Lena** danken, durch deren Empathie und Organisationsgabe dieser Längsschnitt so wunderbar gelaufen ist.

Ein ganz besonderer Dank geht an all die **Familien**, die durch ihre Mitarbeit diese Dissertation erst ermöglicht haben. Von Herzen Danke für das entgegengebrachte Vertrauen und die vielen schönen Stunden, die wir zusammen verbringen durften.

Auch außerhalb der Uni möchte ich all meinen Herzensmenschen danken, die mich durch diese Jahre begleitet haben. Ein besonderer Dank geht hierbei an **Michi** für die befreienden Ablenkungen von unseren Promotionen.

Zuletzt herzlichen Dank an meine Familie. Danke an meinen **Papa**, der mir von klein auf das Gefühl gegeben haben, dass ich alles erreichen kann, was ich möchte und noch so viel mehr. Und Danke an meine wundervollen **Schwestern**, ohne die ich nicht dieselbe geworden wäre, weil sie auf unzählige Weise mein Leben bereichert haben.

Abstract

Social skills are crucial for humans for being part of a social community. They help us to interact with our environment, to communicate with others in social interactions, but also to learn further abilities from others. However, babies need to develop them first. A large body of literature has emphasized the role of the social environment in infant's development of social skills. Theoretical accounts have highlighted that the caregiver-child relationship serves as the cradle of learning in early childhood. The current thesis focused on maternal responsiveness as key aspect of caregiver-child interaction that support infant's development of imitation, empathy, and prosociality. The stage of infancy is particularly interesting as experience with the caregivers settle the ground for children's later interactions in their social environment. Despite a large body of research on children's social skills in general, yet only few studies have investigated the relationship of the occurrence of specific social skills based on the influence of maternal behaviour within the first two years of life. To this end, three studies were conducted, two focusing longitudinally on the development of imitation and empathic responding and one investigating cross-sectionally the mechanism of action between maternal sensitivity and children emotional helping.

The first study investigated the influence of maternal sensitivity and maternal imitation on children's imitation behaviour. In particular, the study examined the influence of maternal sensitivity and maternal imitation behaviour on children's spontaneous imitation behaviour and children's imitation abilities at 18 months. To this end, mothers and their children's natural imitation behaviour in a playing situation as well as maternal sensitivity were assessed. Beyond that, children's imitative skills in several tasks at 18 months were measured. Results revealed that maternal sensitivity was related to children's spontaneous imitation as well as children's imitation abilities. Furthermore, the relation between maternal sensitivity and children's imitation abilities was mediated by maternal imitation behaviour at 14 months, but not at 10 months. The study supports the notion that imitation is a learned ability and is impacted by mothers' own imitation behaviour as well as maternal sensitivity.

The second study investigated the onset of empathy as well as the influence of internal and external factors. In particular, the study examined children's reactions to others' emotion as well as maternal sensitivity, child's negative emotionality, and children's self-recognition within the first two years. To this end, mothers' behavior was observed in play interactions and children's empathic reactions to emotional displays were assessed at 6, 10, 14, and 18 months. Intraindividual changes models revealed that more sensitive maternal behavior at 6 months predicted changes in empathic reactions from 10 to 14 months positively. Before that maternal sensitivity had no effect on the empathic reactions, which were not clearly distinguishable from reactions towards a laughing person. The study supports the notion that maternal sensitive behavior plays a significant role in young children's development of empathy.

The third study investigated the relation of maternal sensitivity and emotional helping in toddlers. In particular, the study examined whether maternal sensitivity and children's emotional helping was linked by children's empathy or children's compliance. To this end, mothers' sensitivity was observed in play interactions and children's behaviour regarding empathy, compliance, and emotional helping were assessed in three experimental tasks at 18 months. Mediation models revealed that empathy, but not compliance mediated the link between maternal sensitivity and children's emotional helping. The study supports the notion that maternal behavior plays a significant role in young children's ability to help others.

Taken together, the current thesis offers notable insights into the specific relations of mother-child interaction and young children's acquisition of social skills. Our results suggest that high-qualitative interactions with caregivers are crucial for children's imitation abilities (Study 1) and for children's empathic abilities (Study 2). Furthermore, through acquired empathic abilities, maternal behaviours influence new social skills as prosocial behaviour (Study 3). This speaks to the importance of maternal behaviour for the acquisition of social skills. While maternal sensitivity and maternal mirroring are important factors in infant's acquisition of imitative abilities, maternal sensitivity plays additionally a crucial role for socio-emotional abilities like empathy and emotional helping. The current work has important implications for theories of child development by suggesting associative learning to be crucial for learning social skills such as imitation and empathy in mother-child interaction. In conclusion, the current thesis contributes to a better understanding of the role of mother-child interaction in young children's acquisition of social skills and provides implications for research on infant's and toddler's social development.

Zusammenfassung (Deutsch)

Soziale Fähigkeiten sind entscheidend für Menschen, um Teil einer sozialen Gemeinschaft zu sein. Sie helfen uns, mit unserer Umwelt zu interagieren, mit anderen in sozialen Interaktionen zu kommunizieren, aber auch, weitere Fähigkeiten von anderen zu erlernen. Säuglinge müssen soziale Fähigkeiten jedoch erst entwickeln. In der Fachliteratur wird die Rolle des sozialen Umfelds in der Entwicklung sozialer Fähigkeiten von Säuglingen immer wieder betont. In vielen Theorien wurde hervorgehoben, dass die Beziehung zwischen Bezugsperson und Kind als Wiege des Lernens in der frühen Kindheit dient. Die vorliegende Arbeit konzentriert sich auf die mütterliche Responsivität als Schlüsselaspekt in der Interaktion zwischen Bezugsperson und Kind, welche die Entwicklung von Imitation, Empathie und Prosozialität beim Kind fördert. Die Entwicklungsphase des Säuglingsalters ist hierbei besonders interessant, da Erfahrungen mit den Betreuungspersonen die Grundlage für spätere Interaktionen der Kinder mit ihrem sozialen Umfeld bilden. Trotz zahlreicher Forschungsarbeiten zu den sozialen Fähigkeiten von Kindern im Allgemeinen haben bisher nur wenige Studien den Zusammenhang zwischen der Entstehung spezifischer sozialer Fähigkeiten und dem Einfluss des mütterlichen Verhaltens in den ersten beiden Lebensjahren untersucht. Zu diesem Zweck wurden drei Studien durchgeführt, von denen sich zwei längsschnittlich auf die Entwicklung von Imitation und empathischer Reaktion konzentrierten und eine querschnittlich den Wirkungsmechanismus zwischen mütterlicher Sensibilität und emotionalem Helfen der Kinder untersuchte.

Die erste Studie untersuchte den Einfluss von mütterlicher Sensitivität und mütterlicher Nachahmung auf das Nachahmungsverhalten von Kindern. Die Studie untersuchte insbesondere den Einfluss der mütterlichen Sensibilität und des mütterlichen Imitationsverhaltens auf spontanes Imitationsverhalten und Imitationsfähigkeiten der Kinder im Alter von 18 Monaten. Zu diesem Zweck wurden das natürliche Imitationsverhalten der Mütter und ihrer Kinder in einer Spielsituation sowie die mütterliche Sensitivität erhoben. Darüber hinaus wurden die kindlichen Imitationsfähigkeiten in verschiedenen Aufgaben mit 18 Monaten gemessen. Die Ergebnisse zeigten, dass mütterliche Sensitivität mit der

spontanen Imitation und den Imitationsfähigkeiten ihrer Kinder zusammenhing. Zudem wurde der Zusammenhang zwischen der mütterlichen Sensitivität und den Imitationsfähigkeiten der Kinder im Alter von 14 Monaten durch das mütterliche Imitationsverhalten vermittelt, nicht jedoch im Alter von 10 Monaten. Die Studie unterstützt die Annahme, dass Imitation eine erlernte Fähigkeit ist und durch das eigene Imitationsverhalten der Mutter sowie die mütterliche Sensitivität beeinflusst wird.

Die zweite Studie untersuchte die Entstehung von Empathie sowie den Einfluss interner und externer Faktoren. Die Studie untersuchte insbesondere die Reaktionen der Kinder auf die Emotionen anderer im Zusammenhang mit mütterlicher Sensitivität, kindlicher negativer Emotionalität sowie kindliches Selbsterkennen in den ersten zwei Jahren. Zu diesem Zwecke wurde das Verhalten der Mütter in Spielinteraktionen beobachtet und die empathischen Reaktionen der Kinder auf emotionale Stimuli im Alter von 6, 10, 14 und 18 Monaten untersucht. Intraindividuelle Veränderungsmodelle zeigten, dass ein sensitiveres Verhalten der Mütter im Alter von sechs Monaten die Veränderungen der empathischen Reaktionen im Alter von zehn bis vierzehn Monaten positiv vorhersagte. Zuvor hatte mütterliche Sensitivität keinen Einfluss auf die empathischen Reaktionen, welche sich nicht deutlich von den Reaktionen gegenüber einer lachenden Person unterschieden. Die Studie stützt die Annahme, dass einfühlsames Verhalten der Mutter eine wichtige Rolle bei der Entwicklung der Empathie von Kleinkindern spielt.

Die dritte Studie untersuchte den Zusammenhang zwischen mütterlicher Sensitivität und emotionalem Helfen bei Kleinkindern. Speziell wurde untersucht, ob mütterliche Sensitivität und kindliches emotionales Helfen durch die Empathie der Kinder oder durch die Compliance der Kinder miteinander verbunden sind. Zu diesem Zwecke wurde die mütterliche Sensitivität in Spielinteraktionen beobachtet und das Verhalten der Kinder in Bezug auf Empathie, Compliance und emotionales Helfen in drei experimentellen Aufgaben im Alter von 18 Monaten bewertet. Mediationsmodelle ergaben, dass Empathie, nicht aber Compliance, den Zusammenhang zwischen mütterlicher Sensibilität und emotionaler Hilfeleistung der Kinder vermittelte. Die Studie unterstützt die Annahme, dass mütterliches Verhalten eine wichtige Rolle bei der Fähigkeit von Kleinkindern spielt, anderen zu helfen.

Insgesamt bietet die vorliegende Arbeit bemerkenswerte Einblicke in spezifische Beziehungen zwischen Mutter-Kind-Interaktion und Erwerb sozialer Fähigkeiten von Kleinkindern. Unsere Ergebnisse deuten darauf hin, dass qualitativ hochwertige Interaktionen mit Bezugspersonen entscheidend für die Imitationsfähigkeiten (Studie 1) und empathische Fähigkeiten (Studie 2) von Kindern sind. Darüber hinaus beeinflussen

mütterliche Verhaltensweisen durch erworbene empathische Fähigkeiten neue soziale Fähigkeiten wie prosoziales Verhalten (Studie 3). Dies spricht für die Bedeutung des mütterlichen Verhaltens für den Erwerb sozialer Fähigkeiten. Während mütterliche Sensitivität und mütterliches Spiegeln wichtige Faktoren für den Erwerb imitatorischer Fähigkeiten des Kindes sind, spielt mütterliche Sensitivität zusätzlich eine entscheidende Rolle für sozio-emotionale Fähigkeiten wie Empathie und emotionales Helfen. Die vorliegende Arbeit hat wichtige Auswirkungen auf Theorien zur kindlichen Entwicklung, da sie nahelegt, dass assoziatives Lernen für das Erlernen sozialer Fähigkeiten wie Imitation und Empathie in der Mutter-Kind-Interaktion entscheidend ist. Zusammenfassend lässt sich sagen, dass die vorliegende Arbeit zu einem besseren Verständnis der Rolle der Mutter-Kind-Interaktion für den Erwerb sozialer Fähigkeiten bei Kleinkindern beiträgt und Auswirkungen auf die Forschung zur sozialen Entwicklung von Säuglingen und Kleinkindern hat.

1 General Introduction

“Ἐκ παίδων συμκρῶν ἀρξάμενοι, μέχρι οὐ̃περ ἂν ζῶσι, καὶ διδάσκουσι καὶ νουθετοῦσιν.”

[Education and admonition commence in the first years of childhood, and last to the very end of life] (Plato, *Protagoras*, 325c). This quotation of the dialog between Sokrates and Protagoras in Platon’s *Protagoras* illustrates what thinkers have recognized since millenniums: the need of early learning processes and education for humans to become social creatures. In modern developmental psychology it has been claimed that humans are a social species and that social interactions are essential to develop a variety of abilities including social skills. Nowadays, these social skills are defined as skills we need to interact and communicate with others properly (Baron, 2000; Segrin, 2000). In contrast to Platon’s idea of socialization by state and society, current approaches of developmental psychology put a stronger focus on the education and child-rearing in the children’s families, particularly by their mothers (Boyer et al., 2016; Brownell, 2016; Feldman et al., 2004; Grusec, 2011).

Especially psychoanalytical theories focused on the mother’s role in early childhood (e.g., Freud, 1905; Lacan, 1957). In this field, Melanie Klein (1973) is considered as the pioneer in child psychology. In her object relations theory, Klein describes the internal representation of mothers within infants. In the first months of life, these representations consist of two opposing pictures representing their mother’s good and bad aspects. In an optimal development, infants integrate the two opposing internal pictures of their mothers to one holistic representation which contains good and bad aspects of the mother. However, Klein elaborates that an unsuccessful integration results in pathological behaviour in interpersonal relationships in children’s later life. Her perspective of children’s internalization of mothers led to various other schools (e.g., Kohut, 1976; Winnicott, 1953) which also targeted the question of what mothers need to provide to their children for a healthy development. One of her students, Donald W. Winnicott, saw mother and child in their early stage as an entity where a ‘good-enough’-mother responds to the needs of her child. Later, the ‘good-enough’-mother confronts her child with frustration of its needs on a manageable level to give the child the chance to develop appropriate self-regulation abilities

and prevent it from antisocial behaviour (Winnicott, 1953). Besides the criticism against psychoanalytical theories from a methodological point of view (Popper, 1963), those insights create the base for a broad field of research in developmental psychology. John Bowlby was another student of Klein, and his attachment theory elaborates the effects of maternal internalization and is relevant for developmental psychology until today. Attachment theory focuses on the development of children's attachment security through experiences with the caregivers in their early years (Ainsworth et al., 1974; Bowlby, 1969/82; Cassidy, 1994). Maternal sensitivity as the ability of the mother to sensitively receive the child's signals and react appropriately to it was claimed to play a key factor in the process of the internalization of beneficial attachment experiences (Ainsworth et al., 1978). Maternal sensitivity was not only proposed as one important factor for children's attachment but also for learning social skills (Deans, 2020). Social skills comprehend a wide group of skills that allow us to appropriately interact and communicate with other people, by predicting and understanding others' behaviors, intentions, and emotions (Soto-Icaza et al., 2015). Social skills as a foundation to interact with others are essential for children to adapt to a complex social environment and many of those social skills were found to develop in infancy (e.g., Jones, 2009; Svetlova et al., 2010; Zahn-Waxler et al., 1992). Even though questions on mothers' influence on their children have been a major topic of interest, specific mechanisms of action on how children learn social skills within social contexts have not been ultimately clarified. Therefore, the questions remains: How do experiences with others, specifically the mothers, influence the development of social skills? In particular, when do maternal sensitivity and maternal mirroring have an impact on the acquisition of social skills such as imitation and empathy? And beyond that, do social skills that infants acquire in mother-child interactions impact other social skills like emotional helping? These are questions the current thesis aims to address.

1.1 Early Social Development in Infancy

Social development has been defined as bringing one's own behavior into conformity with the expectations and conditions of social coexistence, and thus to integrate oneself into society (Lohaus et al., 2015). Relevant for social development are social skills through which humans can establish and maintain relationships with others. Parent-child interaction has been claimed to play an important role in children's learning of social skills within their first two years of life early (Groh et al., 2014/16; Steelman et al., 2002). Before looking at

caregivers' influence on their infants' social skills, important milestones of infants' social development are outlined as they settle the base for the social skills investigated in this thesis.

At the age between 2 and 4 months, babies start to interact with their social environment by smiling at others (Messinger & Fogel, 2007). At 9-15 months social interaction extend to joint attention with others (Mundy et al., 2007). It has been claimed that the onset of this ability (also called the nine-month revolution) is essential for social development as it builds the foundation for all kinds of human cooperation behaviour (Tomasello & Gonzalez-Cabrera, 2017). Moreover, from their second year onwards, infants communicate in social interactions by social referencing, that is, by looking at one's social partner in unfamiliar or threatening situations in order to get help (Walden & Ogan, 1988). Beyond the interaction with caregivers, children start to interact with their peer-group within the first year of life including behaviour like babbling, grabbing, or offering toys (Eckerman & Whatley, 1977). Due to a strong egocentric view, solitary and parallel play represents the essential part of peer-interaction in infancy and associative play occurs later, around the age of 3 years (Dyer & Moneta, 2006).

While interactive behaviors such as smiling, joint attention, and social referencing are essential aspects of social development, other areas of development contribute to children's increasing social skills as well. For instance, infant motor development is essential for social interactions because it allows for new ways to interact (Campos et al., 2000). More precisely, the ability to sit upright at around 6-8 months broadens the visual field of the infant (Kretch et al., 2014) and consequential, allows to better follow the caregivers' input (Frank et al., 2013). Beyond that, moving within a room (locomotion) enables children to approach others or withdraw from them. Before children start to walk, around their first birthday, they start moving around by robbing and crawling. These motor abilities allow the child to elicit the caregiver's attention by carrying objects to them. For interactions of giving and taking, another important motor aspect is the ability to grab objects. Grabbing selectively starts at the age of 4 to 5 months (Kienbaum et al., 2010). Furthermore, pointing behaviour (prototypical morphology of the extended index finger), which occurs at around 10 to 14 serves as an early prelinguistic conversational gesture that enables children to elicit joint attention (Soto-Icaza et al., 2015). Being able to grasp and move opens new possibilities to interact by either executing actions *with* others, like playing, or doing actions *for* others, like helping.

Another socially important area of development is language development. By being able to talk, children extend their possibilities to be part of their social environment. Language is closely linked to cognitive abilities and gives children new ways of expressing

their feelings and needs (Bloom, 1998). Another relevant social aspect of language lays in the necessity to imitate others as the essential mechanism for language development (Bloom et al., 1974). From 6 to 12 months, children start their vocalization with babbling. This development is followed by echolalia from 9 to 12 months, where children repeat words or part of a word spoken by others. Between 10 and 14 months, children usually speak their first word and start to use one-word-sentences. At 18 months, children can speak around fifty words. From there on, the number of words increases rapidly up to two hundred words over the next months (Metzinger, 2011). Being able to talk opens numerous new possibilities for children to express their intentions or their thoughts which allow more complex social interactions.

Another important ability for interacting with others is the ability to reliably regulate emotions and control emotional behavior (Harris et al., 2021). In the first months of life, emotion regulation is provided externally by parents through caressing, singing or soothing speech. At six months of age, infants show the first signs of self-regulation through gaze aversion. Between the first and second year of life, children learn to distract themselves more consciously by directing their attention to something else (Siegler et al., 2016). Being able to regulate oneself is a key factor in socio-emotional development as it gives children the possibility to focus on the emotions of others.

Overall, the development of numerous skills and abilities is diversified in infancy. These developments are influenced by internal developments, external influences and interactions of these two aspects. Thereby, the development of social skills and abilities is influenced and enhanced by children's development in other areas such as motor abilities, language, and emotion regulation. Those outlined abilities present fundamental requirements for the development of the investigated social skills. To expand the knowledge about the development of social skills, the current thesis establishes on the social origin and following on the external influences relevant for the development of social skills.

1.2 Three Selected Social Skills in Infancy

Though children develop numerous social skills in their early years (Brownell, 2013; Jones, 2009; Volling et al., 2002; Zahn-Waxler & Radke-Yarrow, 1990), the current thesis focuses on three social skills that are essential to develop in early childhood and are assumed to have a social origin, namely imitation, empathy, and prosociality. The first investigated social skill is imitation since imitation serves as a particularly important and efficient learning

mechanism for acquiring new knowledge (Fenstermacher & Saudino, 2016). Consequential, imitation represents an important social skill for the acquisition of competences and knowledge especially in infancy and early childhood (Hanika & Boyer, 2019). The second investigated social skill is empathy since concern for others is a key element in human life that connects people through an emotional bond and supports social interactions (Brazzelli et al., 2021; Brownell, 2016; Hoffman, 2000; Thompson, 2012). The third investigated social skill is prosociality since the development of prosocial behaviour plays a central role in children's social functioning. Prosocial behaviour also affects children's later life as it is positively linked to higher peer status (Warden & Mackinnon, 2003) and higher academic achievements (Gerbino et al., 2017).

1.2.1 Infant Imitation

The first investigated social skill of the current thesis is imitation. Imitation can be defined as behaviour which is sufficiently similar and causally connected to the behaviour of another person (Paulus, 2011). Through imitation children can learn actions not only by actively experiencing them, but also through the observation of actions performed by others (Paulus et al., 2011). The acquisition of essential abilities like language (Papoušek & Papoušek, 2016), new actions on objects (Huang & Charman, 2005) or even transmission of cultural practices and knowledge (Tomasello et al., 2005) have been linked to imitation. Considering the effectiveness of imitation as a learning mechanism in various areas, it is not surprising that imitation is an essential part of our daily social interactions (Over & Carpenter, 2013). Furthermore, it has been shown that this learning mechanism starts early as infants can learn several new behaviours per day through imitation (Barr & Hayne, 2010). Moreover, children can already imitate complex behaviors in early toddlerhood (Fenstermacher & Saudino, 2016).

Different perspectives regarding the onset of imitation exist: Though some studies showed that newborn infants can imitate tongue protrusions (see Davis et al., 2021 for a meta-analysis), evidence for newborns' imitation of other modeled behaviours is lacking. Moreover, alleged tongue protrusion imitation has often been explained alternatively, for instance as a general expression of arousal (Heyes, 2016; Jones, 2009; Oostenbroek et al., 2018). Based on this alternative explanation, recent theories have pointed out that the ability to imitate others might not be present at birth but might develop throughout infancy and beyond with an onset in the second year (Davis et al., 2021; Jones, 2009). This point of view has been supported by several studies presenting imitation abilities in the second year of life (Elsner, 2007; Masur & Rodemaker, 1999; Nielsen & Dissanayake, 2004). Taken together,

infants' imitation is an essential social skill and due to its unsettled origin, it requires more investigation.

1.2.2 Infant Empathy

Infants do not only acquire new skills by imitating actions of others but also have to get an understanding of others internal states and link emotions to them. In this context, empathy represents a crucial socio-emotional ability that children need to develop to establish and maintain relationships with others (Bazalgette, 2017; Reynolds & Scott, 1999; van Lange, 2008). Empathy is generally defined as the capability to recognize and share others' emotions, while keeping an other-oriented focus (Abramson et al., 2019; Davis., 1983; Decety & Svetlova, 2012; Walter, 2012). Thus, empathy comprises cognitive as well as affective aspects (Eisenberg et al., 2006). The cognitive aspect of empathy contains inquiring and apprehending the other's condition or needs, whereas the affective aspect of empathy contains the ability to experience emotional resonance with another's emotions (Davis, 1983; Zaki & Ochsner, 2012). To show an empathic reaction, one needs to remain focused on the distressed other and not get flooded by one's own emotions. If one shifts the focus to their own emotions, it rather reflects a self-focused distress response called 'self-distress' or 'personal distress' (Batson et al., 1987; Nichols et al., 2015; Roth-Hanania et al., 2011; Zahn-Waxler et al., 1992). Summing up, if a child sees a person in pain and can comprehend what is happening and resonates affectively, and furthermore, is able not to get overwhelmed by its own emotions, then this reaction of the child matches the definition of empathy.

It has been stated that human empathy emerges early in development (Brownell, 2013; Dahl & Paulus, 2019; Spinrad & Gal, 2018). In the ongoing debate regarding the ontogenetic emergence of empathy, some researchers assume the proneness to react automatically to emotional stimuli with matching emotions to be genetically inherited as it gives humans an evolutionary advantage as members of a social group (Bazalgette, 2017; De Waal & Preston, 2017; Preston & de Waal, 2002). However, other researchers question this postulation of empathy being innate and state that empathy develops over time in the interaction with others (Heyes, 2018). Indeed, several studies have shown that empathy arises within the second year of life (Campbell et al., 2015; Knafo et al., 2008; Nichols et al., 2009; Volbrecht et al., 2007; Young et al., 1999; Zahn-Waxler, Radke-Yarrow, et al., 1992; Zahn-Waxler, Robinson, et al., 1992) and is learned in social interactions (Knafo et al., 2008; Ornaghi et al., 2020; Stern & Cassidy, 2018). Taken together, empathy is an essential social skill and due to its unsettled onset and origin, it requires more investigation.

1.2.3 Infant Emotional Helping

Although reacting prosocially is not part of the definition of empathy, empathy is closely linked to prosocial behaviour (Malti et al., 2009; Paulus et al., 2017; Paulus, 2018). Prosocial behaviour is defined as behaviour that benefits others without receiving an immediate payoff for oneself (Eisenberg et al., 2015; Paulus, 2014b). In research, the multifaceted construct of prosocial behaviour has often been subdivided into helping, sharing, and comforting (Beier & Dunfield, 2018; Dunfield, 2014). The acquisition of prosocial skills plays a central role in children's social development as it promotes social functioning like supportive friendships (Clark & Ladd, 2000), is linked to higher peer status (Warden & Mackinnon, 2003) and higher academic achievement (Gerbino et al., 2017).

Children's empathy is known to be a positive predictor of children's prosocial behaviour (Young et al., 1999). Based on their empathy for others, a child can react with comforting or other kinds of prosocial behaviour. One form of prosociality that is related to the development of children's empathy abilities is emotional helping (Aitken et al., 2020; Svetlova et al., 2010). The aim of emotional helping is to alleviate other's negative emotional state by providing them with appropriate help (Svetlova et al., 2010). Thus, emotional helping represents an interesting intersection of helping (e.g., retrieving an out of reach object; Dunfield, 2014; Warneken & Tomasello, 2006) and comforting (e.g., offering verbal or physical support; Dunfield, 2014; Vaish et al., 2009), which are two essential aspects of reacting to an empathy inducing situation. As in empathy responses, for emotional helping a child has to take another persons' emotional state into account (Aitken et al., 2020). Therefore, emotional helping requires a certain level of social understanding (Svetlova et al., 2010), which might be the reason why it develops only within the second year of life (Hammond & Brownell, 2018; Malti & Dys, 2018; Waugh & Brownell, 2017) and thus later than instrumental helping, like helping someone in achieving an action-based goal or searching for something.

Summing up, for emotional helping a child has to empathize with the person in pain, understand their need and subsequently try to help, for instance by handing out its favorite stuffed animal to the person in pain. Here, the goal is to help regulating the other's negative emotional state by providing appropriate help.

Taken together, imitation, empathy, and prosociality are three essential abilities that occur in infancy and have a major effect on children's interactions. Before this thesis elaborates theories of the acquisition of these three specific social skills, first, prominent learning theories about the general acquisition of social skills are illustrated.

1.3 Developmental Theories on the Acquisition of Social Skills

In the 20th century, researchers established numerous theoretical ideas and studies on the acquisition of children's social skills, which were committed to very different psychological schools and views and were accordingly diverse (Krüger et al., 2002). Most relevant for the current thesis are five theories which all present infants as being formed by their social experiences.

Based on the idea of behaviourist learning theories (Pawlow, 1923; Skinner, 1971), the Social Cognitive Theory by Bandura (1969) assumes reinforcement learning or model learning as central learning mechanisms for the socialization process. Bandura suggests several essential steps through which children learn new abilities. Through children's observation of their parents, parents can become influential models for desired behavior. Therefore, in a first step, children have to pay attention to the modeling person. After memorizing the observed behavior (retention), children may imitate this behaviour later (reproduction). Bandura (1969) assumes that parents can motivate their children to execute these acquired behaviours by rewarding them for behavior that is considered appropriate or by punishing them for undesired behaviour.

Another well-known approach in developmental sciences is the Attachment Theory (Ainsworths, 1978; Bowlby, 1969). Attachment theory focuses on the effects of early childhood attachment experiences for an individual's later life. To explain how these early experiences with caregivers influence an individuals' cognition, emotions, and behaviour, Bowlby (1969/82) elaborated the concept of internal working models. These internal working models are internalized mental representations of experiencing caregivers' availability and responsiveness in stressful situations within the first years of life. The crucial concept for the development of attachment working models is maternal sensitivity which is defined as "the mother's ability to perceive and interpret accurately the signals and communications implicit in her infant's behaviour, and given this understanding, to respond to them appropriately and promptly" (Ainsworth et al., 1974). Based on the experiences of the caregivers' reactions towards the child in distress, the child forms expectations about the caregivers' typical behaviour and cognitive rules about attachment-related knowledge (Bowlby, 1969/82; Bretherton & Munholland, 2008; Main et al., 1985).

Another theoretical approach, which focuses on the implicit formation of rules is the Statistical Learning Approach. This approach highlights children's ability to learn by

extracting patterns and regularities from their environment. Those statistical regularities help infants to evolve expectations and predictions about their environment (Saffran et al., 2000). Originally, this phenomenon of statistical learning derives from research about language acquisition in infancy (Saffran et al., 1996). Nowadays, statistical learning is considered to be a generalized learning mechanism across different domains including speech, visual patterns, and actions (Saffran & Kirkham, 2018). According to this approach, associations are built automatically and unconsciously between stimuli when they occur together repeatedly (Barakat et al., 2012). Caregivers can influence their children's associative learning process by providing input high in quantity (for instance through sufficient repetitions) and quality (for instance through contingency in their reactions).

Vygotsky has enriched theories of development psychology with a sociocultural perspective. His Sociocultural Theory characterizes human learning as a social process within a society or culture. He states that social interaction plays a fundamental role in the development. In contrast to other views, he sees the process of the development of children's thinking not from the individual to the socialized but the other way around (Vygotsky, 1972). According to the Sociocultural Theory, children's cognitive development is strongly impacted by social interactions and their environment. According to Vygotsky, learning ideally takes place when children have a cognitive challenge to master that neither underchallenges nor overchallenges them. Guided participation by more competent individuals (e.g., parents) creates those. In this so-called Zone of Proximal Development, parents enabling the child through social support ('scaffolding') to reach the next level of cognitive development, which he or she is not yet able to do on his or her own. To provide the optimal guidance and scaffolding, caregivers need to perceive and understand the current developmental status and therefore capabilities of their children. One other aspect of the theory that reinstates the importance of others to learn is intersubjectivity. Intersubjectivity refers to a mutual understanding, which is applied to each other during communication and which can be expressed, for example, by joint attention with the caregivers or later social referencing towards the caregivers.

One of the leading frameworks to study the influence of individual and contextual factors on human development in modern developmental science is the approach of Relational Developmental Systems (RDS) (Carpendale et al., 2013). It is an extension of Developmental Systems Theory (DST) (Oyama, 2000). DST is a comprehensive theoretical approach on biological development, heredity, and evolution. Instead of the classic distinction of nature versus nurture, DST stresses an interaction of environment, genes, and

epigenetic factors to frame developmental processes. It claims that life cycles of an organism are not programmed only by genes. Rather, they are activated by external interactions with the organism's surrounding and by internal characteristics within the organism (Oyama, 2000). RDS also does not see nature and nurture as two separately acting entities but focuses on their interactions in human development. According to RDS, reciprocal exchanges between individual and contextual factors lead to developmental changes (Gayman et al., 2017). These developmental systems are not seen as completely confining. Though it is recognized that individual changes are limited in terms of culture, physics, and socio-historical circumstances, some constant factors in an individual's life exist. Summing up, RSD sees the root of all changes in human development in the interactions between characteristics of individuals and their surrounding environments throughout their whole lifespan.

In conclusion, the presented theories differ in their views on learning mechanisms. However, they also overlap in some aspects. Attachment Theory, Statistical Learning approaches, and Social Cognitive Theory point out that through their experiences with their social environment children build associations which reflect certain systematic patterns. RDS and Socio-Cultural Theory emphasizes the interplay between internal characteristics of the child and external input. Within the presented theories, Attachment Theory, Socio-Cultural Theory, and Social Cognitive Theory focus the strongest on the social aspect of learning. However, the common aspect that links all these theories is that they highlight the role of caregivers in the learning process.

1.4 Two Influential Maternal Behaviours

As elaborated above, many theories state that parent–infant social interactions set the foundation for children's psychological functioning. Especially the influence of the quality of mother-infant relationships on infants' social, emotional, and cognitive development has been well documented (Bowlby, 1969; Freud, 1940; Stern, 2018). In this context, two maternal characteristics have been claimed to be influential for children's learning process for their social skills based on social experiences. Therefore, this thesis focuses on maternal sensitivity and maternal mirroring, which will be described in the following paragraphs.

1.4.1 Maternal Sensitivity

Mary Ainsworth (Ainsworth et al., 1974; Ainsworths, 1978) developed the concept of sensitive responsiveness in the context of attachment theory (Bowlby, 1969). She described

behaviour of mothers that would lead to secure attachment. With this attempt of operationalization of secure attachment behaviour, Ainsworth originally defined sensitivity as a mother's ability to perceive and accurately interpret the child's signals and respond appropriately to them. Thus, maternal sensitivity contains several aspects of maternal behaviour as appropriateness, situational awareness, and timing (Deans, 2020). Later, this construct was complemented by different researchers by the aspect of emotional warmth (e.g., Biringen et al., 2014; Mesman & Emmen, 2013). Based on Biringen's definition (2014), a sensitive mother understands and reacts appropriately to the needs and intentions of her child while being emotionally warm towards her child. In research, maternal sensitivity is less frequently measured by self-report, but mostly measured by observation in natural interactions. Besides several other scales that use observer-coding based on videotaped material, the Emotional Availability Scales (EA Scales) by Biringen are widely reported (Biringen & Robinson, 1991) and therefore, used for the current thesis.

But why do children need maternal sensitivity to acquire new social skills? By initiating consequences caused by their own behaviour children detect the link between their actions and the reactions of their social environment. Crucially, predictable behaviour of the caregiver by appropriate responses is needed for building up contingencies. Then children can repeatedly recognize which behaviours evoke positive or negative reactions of others and use this information to develop different social skills (Mesman et al., 2018). To encourage an optimal development of their infants, caregivers must perceive and respond appropriately to their infants' behavioral and emotional cues (Musser et al., 2012). For instance, empirical research showed that more sensitive caregiving was linked to children's secure attachment (see Bakermans-Kranenburg et al., 2003 for a meta-analysis). Negative effects even remained apparent after eliminating the cause of the reduced maternal sensitivity (like suffering from depression) (Deans, 2020), which might be due to the lack of learning opportunities. Indeed, maternal sensitivity was found to be central for the development of several social abilities (Demo & Cox, 2000). One social skill relevant for the development of two subsequently investigated socio-emotional skills (empathy and prosociality) is emotion regulation. By helping the child to regulate their emotions, a sensitive mother provides a space for her child to express both positive and negative feelings. In the interaction with the sensitive caregiver the child learns effective strategies on how to modulate emotional experiences (Ainsworth et al., 1974; Bell & Ainsworth, 1972; Calkins & Hill, 2007; Cassidy, 1994). Another social skill where one can see the importance of maternal sensitivity is linguistic development (Tamis-LeMonda et al., 2003). Maternal

sensitivity contributes to linguistic development by perceiving infant's signals and imputing correct meaning to various communicative cues of the infant. This lays the foundation to build a turn-taking structure in the conversations between mother and child (Paavola et al., 2006). Several further emotional and cognitive abilities through infancy and childhood have been linked to maternal sensitivity by numerous studies (Bernier et al., 2010; Feldman, 2007; Feldman et al., 2004; Fraley et al., 2013; Kochanska et al., 2008; Mesman et al., 2012). However, in order to get a more congruent picture of the influence of maternal sensitivity on the three investigated social skills, data about relevant phases for the onset of those skills and underlying developmental mechanisms is needed.

1.4.2 Maternal Mirroring & Imitation

Mirroring was often defined as one aspect of Ainsworth's sensitive responsiveness in early studies (de Wolff & van Ijzendoorn, 1997; Grossmann et al., 1985). When infants start to explore communicative expressions in their first months, parents often respond by reproducing selected behaviours of the infant and marking their occurrences with, for instance, smiling, widening eyes, raised eyebrows or positive vocal sounds (Gergely & Watson, 1999; Grossmann et al., 1985). Parents mark their infants' behaviour by matching or slightly exaggerating the infants' behaviour in intensity and affect. Therefore, mirrored behaviour can be infants' exact facial, gestural, or vocal behaviors, but also infants' emotional states (Bigelow et al., 2018).

In one form called affect-mirroring, the parent moves beyond only imitating the external behaviour per se by reflecting the infants' subjective internal state. To this end, the parent tries to capture the affective state that underlies the infants' ostensive behaviour and displays the exaggerated facial, vocal, and gestural in an exaggerated way which Fonagy termed as marked (Fonagy et al., 2004). In these interactions, the caregivers demonstrate their understanding of the infant's internal state by their marked and contingent affective communication. At the same time, the parent signals that the referred internal state belongs to the child and the parent is not experiencing the same state themselves (Fonagy et al., 2007). Thus, this behaviour gives the child the opportunity to find their own emotional state in the face of the caregiver and enables the child to regulate his or her own affective states (Fonagy et al., 2004). Maternal affect mirroring in mother-child interaction has been linked to the regulation of negative emotions but also the formation of the self. Though, strictly speaking one could say that an exaggerated form of mirroring infants' expression leaves partly the definition of classic mirroring.

In another form of mirroring, which is classically referred to as imitation, the mother replicates the infant's external actions such as movements or sounds. Maternal empathic finely tuned imitative response has been linked to the mother's own attachment style. In their study on imitation and mirroring, Kim et al. (2014) showed that while imitation did not differ between secure and insecure mothers, marked affective communication was more than twice as frequently used in secure than insecure mothers. Infants on the other hand seem to recognize others' mirroring behaviour and react with increased positive affect and attention to such responses (Meltzoff, 2007). By provoking caregivers' emotionally salient and matching mirroring behaviour, children get an important opportunity to experience how their actions influence others (Bigelow et al., 2018). If caregivers' imitations are contingent and repeatedly shown in response to children's action, children can link their own executed movement to the visual feedback of the other person. Subsequently, parental mirroring is central for the development of neural mappings between visual and motor representations, which are in turn crucial for the children's ability to imitate (Rayson et al., 2017). The idea that visual representations are coupled with corresponding motor programs stems from the discovery of mirror neurons in primates in the 90s (Heyes & Catmur, 2022). These mirror neurons fire both when someone executes an action or while observing others performing an action. Therefore, they can link the observed behaviour of a model with the child's new abilities. Supported by findings from brain-stimulation and brain-imaging studies (Heiser et al., 2003; Iacoboni et al., 1999), these mirror-neuron brain areas could play a crucial role for imitating body movements.

The terms mirroring, imitation, and mimicking are often used overlappingly in research. In the current thesis, the term imitation is used for replications of opaque actions or sounds. The effect of this form of mirroring behaviour on children's imitative skills will be investigated.

1.5 Influence of Maternal Sensitivity & Imitation on Infants'

Social Skills

As described in the previous paragraphs, maternal behaviours have been theoretically and empirically linked to their children's developmental outcomes in various domains (Bakermans-Kranenburg et al., 2003; Bernier et al., 2010; Feldman et al., 2004; Fonagy et al., 2004; Kochanska et al., 2008; Mesman et al., 2012; Tamis-LeMonda et al., 2003). As maternal sensitive and mirroring behaviours are displayed in social interactions with the

infant from early on, they may be especially relevant for the early development of social skills. In the following sections, I will discuss how these two maternal behaviors might relate to specific social skills of infants, that is, infant imitation, infant empathy, and infant helping.

1.5.1 Influence of Maternal Sensitivity & Maternal Imitation on Infants'

Imitation Abilities

There are two commonly assumed cognitive mechanisms of learning imitation. In the Associative Sequence Learning (ASL) theory, Ray and Heyes (2011) state that the development of imitation is based on a highly experience-dependent mechanism, where seeing and doing the same action contingently results in the generation of a matching association between sensory and motor representation of a movement unit. This set of bidirectional excitatory links between sensory and motor representations of movement units is based on repeated contingent and contiguous coactivations of visual and motor representations of an act, not on innate favoring of specific sensory and motor combinations as supposed from Active Intermodal Mapping (AIM) by Meltzoff and Moore (1997). Similarly to the ASL, the ideomotor approach to imitative learning (IMAIL) model by Paulus (2014a) describes how the link between sensory and motor representations can lead to imitative behaviour. First, infants acquire first-order action-effect associations when they observe a visual effect of their own actions by linking the motor code to the action's typical visual effects (for instance, raising the hand results in the displacement of the hand). When they observe the same action performed by another person, the encoded visual effect produces motor activation through the first-order associations (Giudice et al., 2009). Later, other salient effects in the physical world (like an interesting sound or light) generated by the observed action become related to this activated motor code, which results in the additional acquisition of second-order action-effect associations. Indeed, these assumptions fit well with neuroscientific findings on imitation (Cooper et al., 2013; Cross et al., 2009; Iacoboni, 2009).

Both theories have in common the assumption, that matching associations between sensory and motor representation of movements can be built by oneself or by being imitated by others. This enables caregivers to influence the development of imitation skills of their children by providing more opportunities to link their children's sensory representations to their motor representations through maternal imitation. However, not only the amount of maternal imitation might be relevant for this process, but also qualitative aspects of maternal imitation. Sensitivity is known to be beneficial to children's learning process (Gueron-Sela

et al., 2016; Longhi, 2009; Lowe et al., 2013; Mulvaney et al., 2006; Wade et al., 2015) and therefore, could individually influence the learning curve by providing a well-stimulating environment for the child. In connection with maternal imitation behaviour, maternal sensitivity could be beneficial for the development of children's imitative abilities, as it leads to more proper maternal imitation in terms of timing, consistency, or intensity. Concretely, sensitive mothers choose relevant behaviour to imitate for the current developmental stage of their children, for instance focusing on vocal imitation in a sensitive phase for language development. Furthermore, reacting sensitively to children's cues could be expressed by especially contingent imitation on so that children can build those associations more easily.

Summing up, one possible way of how infants obtain the ability to imitate is by being imitated themselves. Therefore, we assumed that caregivers foster associative learning processes through imitating their children, which results in better imitative abilities of their children. To this purpose, we investigated mothers' and infants' imitation in dyadic interactions and in experimental imitation tasks and its relation with maternal sensitivity from the middle of the first year to the middle of the second year of life.

1.5.2 Influence of Maternal Sensitivity on Infant's Empathy

Not only movement can be learned by associative learning, also social-emotional abilities like empathy. But how do experiences in the early caregiving relationship facilitate children's developing abilities to show empathic behaviour towards others? In a wealth of research, mothers' responsiveness and warmth has been shown to influence children's emotional responses and empathic behaviour (Barnett, 1987; Eisenberg et al., 1992; Kiang et al., 2004; Kochanska et al., 1999; Spinrad & Stifter, 2006; Zahn-Waxler & Radke-Yarrow, 1990). According to cognitive theories in the attachment field, the mother provides examples on how to react in empathy-related situations depending on her own ability to respond sensitively to her child's cues. From early on, these experiences are internalized in the child in so called 'inner working-models', which serve as frameworks of possible reactions in such situations (internalized scripts) and can be provoked in different social and/or emotional situations (Stern & Cassidy, 2018). Some researchers claim that these inner working models are built through associative learning (Bosmans et al., 2020). Attachment theory postulates the acquisition of those inner working-models within the first year of life (Ainsworth, 1978; Bowlby, 1969/82). In combination with the ongoing debate on the exact onset of empathic reactions (Davidov et al., 2021), this opens the question of when exactly maternal sensitivity impacts building internalized associations resulting in children's empathic development.

It is stated that empathy is not innate but based on a set of learned associations which require social interactions (Heyes, 2016). In line with the assumption of learned associations, social psychology studies with adults have shown that imitation and mimicry facilitate empathy (Iacoboni, 2009). Matching emotional associations between the interoceptive aspects of emotions and the exteroceptive and perceptually opaque expressions of emotions (like facial expression and whole-body movements) are constructed by synchronous emotion and affect mirroring from the caregiver (Heyes, 2018). Subsequently, children can learn to differentiate between emotional states when they show these emotions and are correctly affect mirrored by their mothers. These so-built associations of emotions contain cues which enable emotional contagion with others. Moreover, through affect mirroring, mothers help their children to understand their feelings and thereby settle the base for children's own emotion regulation. Accordingly, maternal affect mirroring is crucial for the differentiation of emotional states and emotion regulation of their children. In this connection, maternal sensitivity plays a key role since the mother has to identify the child's emotions correctly in order to mirror them right and react appropriately.

Due to conflicting evidence, the question arises, if maternal sensitivity already influences the growth of empathy from early on in a rather steady way or if it takes effect at a later timepoint. Therefore, we investigated the influence of maternal sensitivity and children's characteristics such as temperament and self-recognition at a very young age on children's empathy development from recently claimed early signs of empathy in infancy to well establishes empathic reactions in toddlerhood.

1.5.3 Influence of Maternal Sensitivity on Infant's helping behaviour

Infant imitation and empathy are two abilities that can lay the ground for the acquisition of further social skills. Several theories state that prosociality—often predicted by empathy—arises from the experiences infants make in shared activities and relationships with others (Dahl & Paulus, 2019; Hammond & Carpendale, 2015). By receiving or observing prosocial responses from their socioemotional environment, mainly their caregivers, infants are provided with a framework to develop their own prosocial behaviours (Brownell, 2013/16; Schuhmacher et al., 2017). Hence, parental behaviours influence their children's prosocial development. In this context, sensitivity is once again proposed as one important parental characteristic (Deneault & Hammond, 2021; Newton et al., 2014). Sensitive parents facilitate the development of their children's ability to help others by providing emotional support and being responsive to their children's needs. Thereby, they repeatedly provide opportunities to

build up positive mental representations in their children on how to react in difficult, painful situations ('internal working models' in attachment theory) (Dahl & Paulus, 2019). This point of view is extended by emotion-sharing theories (e.g., Batson, 2011; Eisenberg & Strayer, 1987) which claim that people are motivated to act prosocially due to empathy that the suffering person evokes in them. Combining these two aspects, children help because they have experienced sensitive behaviour towards their own need and therefore, are able to empathize with the suffering person. However, contrasting theoretical views exist like internalization theory which proposes that parenting behaviour influences prosociality through children's compliance (Kochanska, 1997). Based on contradicting theoretical assumptions about the well-researched relation between prosociality and maternal sensitivity (Legerstee & Varghese, 2001), the question arises of how prosociality is influenced by maternal sensitivity. Therefore, we contrasted two common theories on the social basis of early prosocial behaviour. More precisely, we investigated whether maternal sensitivity and children's emotional helping are linked through children's compliance or through children's empathy.

2 The Current Thesis

2.1 Aims and Research Questions

In the current thesis, I investigated how social interactions influence infants' acquisition of social skills. More precisely, it was of interest how maternal behaviour influences the development of three specific social skills, namely imitation, empathy, and emotional helping.

The first aim of the current thesis was to investigate whether maternal sensitivity and maternal mirroring influence infants' **imitation** skills. In the introduction, I elaborated that children learn imitation abilities within their first years of life. From a theoretical perspective, the mechanism behind that and the following possible influences are of special interest. The investigation of the influence of maternal sensitivity and maternal mirroring on infants' imitation abilities will shed light on the question if children learn to imitate by being imitated. Thus, the first research question of the current thesis is whether, when exactly and in which combination maternal sensitivity and maternal mirroring are predictors of infants' imitation abilities within the second year of life (Research question 1).

The second aim of the current thesis was to investigate whether and when maternal sensitivity influences infants' **empathy** development. In the introduction, I argued that this maternal behaviour is important for the development of children's empathic abilities. For example, maternal sensitivity is related to children's empathy (Kiang et al., 2004; Spinrad & Stifter, 2006). From a theoretical perspective, it is especially interesting *when* maternal sensitivity affects children's empathy development. The investigation of the influence of maternal sensitivity on infants' empathy development will tell us more about when exactly maternal sensitivity relates to children's empathic abilities at an age at which children begin to empathize with others. Thus, the second research question of the current thesis is when maternal sensitivity serves as a predictor of infants' empathic reactions within the first two years of life and how this influence of maternal sensitivity differs depending on children's negative emotionality (Research question 2).

The third aim of the current thesis was to investigate whether maternal sensitivity leads to **emotional helping** by introduced empathy or compliance in their children. In the introduction, I described how caregivers’ behaviours are important for the development of children’s prosocial behaviour. Research showed that maternal sensitivity is related to children’s prosociality (Deneault & Hammond, 2021; Newton et al., 2016). From a theoretical perspective, it is especially interesting whether children in their second year of life react prosocially towards another person because they feel empathy with the other or because they learned to listen to what the mother tells them to do. The investigation of how maternal sensitivity is associated with toddlers’ emotional helping of a person in need will tell us more about whether maternal sensitivity leads to emotional helping through children’s compliance or children’s empathy. Thus, the third research question of the current thesis is whether children’s compliance or children’s empathy links maternal sensitivity and children’s emotional helping (Research question 3).

2.2 Outline of the Thesis and Author Contributions

Three studies were conducted to investigate the research questions presented above. Data from all three studies derives from one large longitudinal study. While Study 1 and Study 2 examine the growth of the imitation and empathy from 6 months to 18 months over several timepoints, Study 3 focuses on emotional helping at 18 months. For all three studies, we used behavioral tasks to measure childrens’ imitation skills, childrens’ empathic reactions, and childrens’ emotional helping and assessed mother’s sensitivity in interaction with their children (Biringen et al., 2008). Table 1 presents the author’s contribution to the studies.

Table 1. Author contributions to the studies

	Study Design	(Supervision of) Data collection	Data analysis	Manuscript writing
Study 1 (+)	(✓)	✓	✓	(✓)
Study 2	(✓)	✓	(✓)	(✓)
Study 3	✓	✓	(✓)	(✓)
<i>Note.</i> ✓ major contribution , (✓) joint contribution , (+) joint first authorship				

Study 1 addressed the first research question of whether caregivers facilitate the development of imitation skills by being sensitive and by imitating their children themselves. More precisely, if more maternal imitation leads to better imitation abilities of their children.

To this end, we assessed children's ($N = 127$) and mothers' spontaneous imitation behaviour in their interactions at 6, 10, 14, and 18 months of age. Moreover, we measured several standardized imitation tasks as outcomes at 18 months. We hypothesized that more imitation behaviour of the mothers and higher maternal sensitivity lead to more spontaneous imitation behaviour and better results in the standardized imitation tasks. Analyses revealed that the effect of maternal sensitivity on children's imitation abilities was partly mediated by maternal imitation behaviour. This mediating effect only appeared with maternal imitation at 14 months but not at 10 months.

Study 2 addressed the second research question, that is, when empathy arrives and what the relevant predictors are to this development. More precisely, Study 2 investigated the influence of maternal sensitivity, children's negative emotionality, and children's self-recognition on the development of empathy in their first and second year of life. To this end, we assessed children's ($N = 127$) empathic reactions in three different scenarios at 6, 10, 14, and 18 months of age. Moreover, we measured maternal sensitivity at 6 months, children's self-recognition in the rouge-task (Amsterdam, 1972) at 18 months, and children's negative emotionality using the IBQ-R short version (Putnam et al., 2014, German translation by Kristen, Eisenbeis, Thoermer and Sodian, 2007), at 6, 10, and 14 months. We hypothesized that children's empathy arises not before 18 months and that maternal sensitivity has a positive influence on its development. Furthermore, negative emotionality was hypothesized to influence empathy negatively, but its negative influence to be softened by maternal sensitivity. Analyses revealed that empathic responses differed inconsistently over the four measurement points, resulting in a clearer pattern with 18 months. Moreover, maternal sensitivity, negative emotionality and self-recognition showed its influences on children's empathic concern within the second year of life. Thus, the results of the influences of maternal sensitivity on children's empathy are not shown before the second year of life.

Study 3 addressed the third research question, that is how maternal sensitivity leads to emotional helping. More precisely, if empathy or compliance work as link for the relation between maternal sensitivity and children's emotional helping. To this end, we assessed 18-months-olds' ($N = 97$) emotional helping (Svetlova et al., 2010), children's compliance (Kochanska, 2002), and children's empathy (Davidov et al., 2013) in standardized behavioural tasks. Moreover, we measured mothers' sensitivity in an interaction with their children. We hypothesized that maternal sensitivity influenced children's emotional helping positively and that this relation was mediated by children's empathy. Analyses revealed that maternal sensitivity was positively related to children's empathy, children's compliance,

and children's emotional helping. Moreover, children's empathy but not children's compliance mediated the link between maternal sensitivity and children's emotional helping. Thus, children react with emotional helping due to empathy, implemented by maternal sensitivity.

3 General Discussion

In the following, I will outline how the three studies advance existing theories and research. Then, I will discuss more general contributions and implications of the findings, and directions for future research. This thesis will finally close with a general conclusion.

The aim of the current thesis was to examine the function of maternal mirroring and maternal sensitivity, as predictors of several social skills in infancy, namely, imitation, empathy, and empathic helping. Developmental theories (e.g., Ainsworth, 1978) and previous research have identified maternal behaviour to be especially influential in early childhood. Several studies have elaborated the effect of maternal mirroring and maternal sensitivity on different social skills in infancy. They found correlations between maternal imitation and infants' mimicry of facial interactions in 4-month-olds (de Klerk et al., 2018) and highlighted the role of maternal responsiveness (Bornstein et al., 2008) and maternal imitation (Masur & Olson, 2008) for infants' imitative behaviour in longitudinal studies. However, many of those studies lacked statistical power due to the small sample of around 40 children or less. Furthermore, longitudinal studies with an early onset and continuous equidistant measurements of maternal characteristics or social skills are rare, though those could contribute to answering the question about origin and development of social skills in infancy. Moreover, though many studies about the relation between maternal sensitivity and children's prosociality exist, research about underlying mechanisms of infant imitation is scarce. The present thesis examines these identified research gaps. For that purpose, three studies were conducted that focused on the role of maternal sensitivity and maternal mirroring for the development of imitation, empathy, and prosociality in infancy. With our longitudinal study design, we aimed to explain interindividual differences in the development of imitation and empathic reactions. Furthermore, our mediation models aimed to explain the relation of maternal sensitivity and prosociality through two social skills (empathy and compliance) of children. Taken together, the results illustrate that maternal

sensitivity and mirroring behaviour in the interaction with children have a strong effect on the development of social skills within the first two years of life.

The results of the current thesis support influential theoretical considerations on attachment (Ainsworth et al., 1978) and statistical learning (Saffran et al., 2016) and have important implications for research and practice. In the following sections, I will discuss how findings of the three studies expand our understanding of the mother's role in the infant's social learning.

3.1 The Role of Maternal Imitation on Infant's Learning of Imitation

To contribute to the debate on the role of maternal mirroring in infant's social learning, the current thesis investigated the relation of maternal imitation behaviour, maternal sensitivity, and children's imitation behaviour within the first two years of life. Results of Study 1 advance our understanding of the influence of maternal mirroring on infant's acquisition of imitation behaviour as a profound social learning skill. Our study showed that early maternal sensitivity predicted children's spontaneous imitation behaviour at 18 months. Furthermore, early maternal sensitivity predicted children's ability to imitate new movements at 18 months. This effect was mediated by maternal imitation behaviour at 14 months. The findings from Study 1 relate well to previous work on the onset and development of imitation within the first two years of life (Davis, et al., 2021; Jones, 2009; Oostenbroek et al., 2018) and work on the relation of maternal imitation and children's imitation (Heyes, 2010; Ray & Heyes, 2011). Our findings underline the idea of a prerequisite for imitative abilities and beyond that, a sensitive phase to learn those. The results suggest that maternal imitation behaviour in the sensitive period have an impact on how children's imitation ability of new movements is developed at 18 months.

Thus, Study 1 provides important evidence that furthers our understanding of the aspects of parent-child interactions related to social learning. It therefore supports notions identifying infancy as particularly important for establishing the base of this social skill.

The findings from Study 1 support theoretical considerations of associative learning theories (Ray & Heyes, 2011) and show that the ability to imitate emerges by being imitated. Some theories assume that matching association between sensory and motor representation of movements can be built by being mirrored by others (Iacoboni, 2009; Giudice et al., 2009;

Paulus, 2014a). This assumption of matching associations is in line with the associative sequence learning model that assumes the fundamental mechanism to be linking sensory representations of the others' actions to one's motor plans (Ray & Heyes, 2011). Moreover, the study supports the idea of the ideomotor model of a common representational format for action and perception units (Paulus, 2014a). While these theories mainly focus on the cognitive mechanisms of learning imitation, our study highlights the relevance of the social mechanisms underlying learning of imitation and therefore, expands the field of imitation research. Meanwhile, our research supports neuronal findings on parental mirroring influencing the development of neural mappings between visual and motor representations that are important for children's ability to imitate (Ferrari et al., 2017; Filippi et al., 2016; Heyes, 2010; Murray et al., 2016). Our study contributes to the field by indicating that maternal matching behaviour in the right time period impacts children's imitative ability. By imitating their children at the right time, mothers provide more opportunities for building connections between children's sensory representations and motor representations. This research opens the discussion of how mirror neurons, maternal behaviour, and children's ability to imitate are connected to one another.

Our findings have several theoretical and practical implications. First, the present work moves the field forward by demonstrating that it is very unlikely for imitation to be an inborn ability showing up in neonates. Even though behavioural matching of tongue protruding has been shown in the past (Davis et al., 2021; Meltzoff & Moore, 1977), those findings do not necessarily validate the interpretation of this behaviour as imitation. Rather, these first reactions could also be a sign of infant's arousal provoked by the demonstrated behaviour. Meltzoff and Moore claimed in their AIM theory that infants are born with the precondition to match information between different modalities. More precisely, they have the precondition to relate information from their own unseen body movements and the movements of perceived models. The assumption of this common framework for executed and perceived movements can neurally be linked to theoretical considerations of mirror neurons. Those neurons are assumed to fire whenever someone sees or executes a movement. However, the question remains of how those frameworks or mirror neurons should be pre-installed considering a preselection of specific movements for all humans.

Our findings on influential maternal behaviour support the point of view that imitation is a learned ability and develops only within the first two years of life (Jones, 2009; Oostenbroek et al., 2018). Still, it seems that infants have some abilities that make this process possible in the first place. That is, the ability to build connections between

movements stored in different modalities. In line with the approach of relational developmental systems (Carpendale et al., 2013), the learning process of imitation might emerge from an interaction between a sensitive developmental phase in the second year of life and proper stimulation from the environment, in this case from maternal behaviour.

Our study was able to enhance our knowledge by pointing out the relevant mechanism, that is, maternal imitation behavior, while also specifying the relevant timeframe for this development through our longitudinal design with four measurement points. Different learning theories are supported by the results of this thesis. The findings emphasize the importance of a sensitive phase for the effect of other's behavior on the process of learning new abilities. This is in line with Vygotsky's sociocultural theory (1972), according to which the teaching person has to sensitively realize the specific learning stage for the child to perform a new action or ability. Our results extend the original assumptions of this theory by emphasizing the effect of maternal behaviour on the acquisition of social skills in infancy.

In this sense, the influence of maternal sensitivity further complements the picture of the social learning process for imitation abilities. Study 1 of this thesis elaborated that the amount of imitation is only one factor that affects the development of imitation abilities. By imitating their children at the right time and not just plenty, mothers provide the scaffolding for next stages to learn movements, language, and other important skills. Maternal sensitivity was found to be the second influencing maternal behaviour, indicating that matching maternal behavior to signals of the child and creating a positive environment for the child to learn is also crucial. Instigating mirroring behaviour which is emotional salient and matching gives children an important opportunity to develop associations between sensory representations and motor representations. However, according to our findings this effect only takes place if it is the right time for the child to learn this new skill.

Related to these insights, (pre)-clinical interventions that are directed at parent or child adjustment and focused on their imitative interaction within the second year of life are of essential use. Through experts or early mother-child groups that stress the importance of imitation, develop imitative games or even supporting programs, parents could learn how to positively influence their children's development of imitative behaviours.

Taken together, these findings broaden the field substantially by emphasizing the social mechanism in the acquisition of imitative abilities. Since the ability to imitate is essential to acquire new (social) skills, the new insights provided by this thesis go beyond merely understanding the imitation of movements.

3.2 The Role of Maternal Sensitivity in Infant's Social Learning

While Study 1 focused on the profound social learning skill of imitation, Study 2 and Study 3 emphasized the influence of maternal sensitivity on children's socio-emotional skills, namely empathy and emotional helping. The results of Study 2 showed that empathic abilities arise within the second year of life. This development was shown to be influenced by maternal sensitivity. These findings suggest that empathy is not an innate ability but develops in a social learning process. Beyond that, Study 3 showed that the achieved level of empathy served as mediator between maternal sensitivity and children's empathic helping at 18 months.

The explored onset of empathy in the second year of life is in line with classic theories on empathy (Hofmann, 1984/2000; Bischof-Köhler, 2012) and contradicts recent claims about an earlier onset (Davidov et al., 2021; Roth-Hanania et al., 2011). The combination of a later onset of empathic behaviour within the second year of life and the maternal influence on this empathy development hints towards empathy being a learned ability and not an innate capability. This insight is in line with associative learning approaches of empathy development (Heyes, 2018). Our results speak against nativist views whose argumentation for innate empathy is based primarily on the idea of an evolutionary advantage for humans (de Waal and Preston, 2017; Preston and de Waal, 2002). Considering that empathic abilities are built in a social learning process, it is reasonable to further explore the influence of possible predictors such as maternal sensitivity. The results of Study 2 relate well to theoretical considerations of cognitive theories in the attachment field about the effect of maternal behaviour on children's socio-emotional development. Our studies' results showing the positive influence of maternal sensitivity on the growth of children's empathy match with empirical research that provided evidence for a relation between maternal sensitivity and children's empathy (Barnett, 1987; Eisenberg et al., 1992; Kiang et al., 2004; Kochanska et al., 1999; Spinrad & Stifter, 2006; Zahn-Waxler & Radke-Yarrow, 1990). Yet, longitudinal data on children's growth in empathy was lacking, in particular the investigation of children's empathic reactions in contrast to reactions towards other emotional stimuli. By investigating the development of empathic abilities and influences on the development of empathic reactions over four measurement points, we enhanced our understanding of the emergence of empathy and the role of the mother in this development (Study 2). We

observed that maternal sensitivity did not influence the growth equally at all timepoints but was most influential around children's first birthday.

Experiencing sensitive maternal behavior leads to the building of so called 'inner working-models' in the child, which serve as frameworks of possible reactions towards the needs of others (internalized scripts). Based on these working-models, children are able to react properly in different social and/or emotional situations, for example, by showing empathy or prosocial behaviour (Stern & Cassidy, 2018). Our study brought new insights to this field of research by identifying a sensitive time in the development of the investigated social skills, when maternal sensitivity starts to show its effect. In this sense, our results showed that the beginning of the second year is especially relevant.

Similar to the acquisition of imitative abilities, some researchers claim that children's inner working models are built through associative learning and therefore depend on social interactions (Bosmans et al., 2020; Heyes, 2018). Findings of social psychology studies with adults support this view by showing that imitation and mimicry facilitate empathy (Iacoboni, 2009). When comparing the results of Study 1 and Study 2, we see that the development of both empathic reactions and imitation abilities are significantly influenced by maternal behaviour in the beginning of the first year. Following associative learning theories, one could consider maternal sensitivity as a base for empathy, and maternal mirroring as a base for imitation in the associative learning process of these two new social skills. At this early age, children seem to be especially receptive to internalize those two maternal behaviours leading to the acquisition of new social skills. These findings open the question, which developmental processes within the child enable it to be specifically receptive to this kind of social information. One could think of the so-called "9 months revolution" of joint attention (Tomasello & Gonzalez-Cabrera, 2017) as an important base for this openness to specific maternal behaviour. Yet, the onset of joint attention usually appears earlier than the sensitive phase for associative learning of the social skills investigated in the current thesis. Another option could be forms of brain maturation that allow children to build those associations more successfully. It is up to future research to explore this interesting question in greater detail.

Summing up, the proposed mechanism of internalized maternal behaviour and the assumed sensitive phases towards maternal behaviour link the acquisition of imitative behaviour and empathy development through the experiences in mother-child interactions.

Moreover, the present thesis broadens our knowledge by showing how maternal sensitivity impacts social skills like empathy and how these abilities are relevant for learning

further social skills like helping (Study 3). Beyond the confirmation of the relation of infants' prosociality and their experiences with their caregivers (Brownell, 2013/16; Dahl & Brownell, 2019; Hammond & Carpendale, 2015; Schuhmacher et al., 2017), our study presented an underlying mechanism of this relation: Children helped because they had experienced sensitive behaviour towards their own need and therefore were able to empathize with the suffering person. This finding shows the relation of maternal sensitivity with two socio-emotional abilities and is in line with emotion-sharing theories (e.g., Batson, 2011; Eisenberg, 1986).

These findings have several theoretical implications. The present work moves the field forward by demonstrating how parents facilitate the development of different social skill in their children by providing emotional support and being responsive to children's needs (Dahl & Brownell, 2019). However, the influence goes beyond the theoretical link of maternal sensitivity and attachment (Ainsworth, 1978). Maternal sensitivity does not only impact attachment-related skills but also skills related to the acquisition on motor and vocal expressions (Study 1). Learning new movements and sounds is the essential base for children's interactions with their environment through gestures or communicating vocally and later verbally. In this sense, maternal sensitivity first creates a good space for children's learning. Second, maternal sensitivity leads to the appearance of other impacting maternal behavior, such as imitation, at a time when the child is ready to receive it. Moreover, by experiencing sensitive social interactions children can internalize this maternal behaviour and imitate interpersonal caring behavior resulting in socio-emotional abilities (Study 2 & Study 3).

Summing up, this thesis furthers the field by showing that maternal sensitivity contributes to infants' learning of the two important social skills of imitation and empathy. In turn, these skills can serve as base for other social skills such as prosocial helping.

3.3 Theoretical and Practical Consequences for Children's

Development of Social Skills

Learning social skills is a cumulative and lifelong task. Our studies could show that imitation, empathy, and prosociality have their origin in infancy and are learned through mother-child interactions. Although scholars disagree on the extent of external influences on children's development, there appears to be consensus that mothers' characteristics and

behaviour have an essential impact on children's development. Our studies show that maternal responsiveness in particular is the essential and comprehensive factor for infants to learn social skills in infancy. Thus, our studies specified theories on maternal influence by showing that a measurable pattern of maternal behaviour in different contexts is a crucial factor.

Beyond that, the current thesis showed that associative learning mechanisms are not only relevant for the development of imitative skills, but also for the development of socio-emotional skills such as empathy or prosociality. Thereby, it enriches traditional attachment theory by exploring additional outcomes of experiencing maternal sensitivity beyond attachment. By learning social skills through maternal sensitivity, children acquire new tools for their social development, which can benefit their later attachment experiences with others. Our research expands traditional attachment theory and its tendentially vague assumptions of internalization of attachment with the explanation of associative learning processes taking place through experiencing sensitive mothers. These built associations lead to better reaction through the acquired social skills, which can be expressed in social and attachment relevant contexts. The idea of associative learning through attachment-related experiences contributes to recent theoretical claims about the connection of attachment and conditional learning (Bosmans et al., 2020). Moreover, this thesis highlights sensitive time periods for learning social skills from the influence of mothers and thereby specifies traditional attachment theory and social-cognitive learning theory. Beneficial input of caregivers requires the right timing. Thus, the assumption of child's internal receptiveness to maternal behaviors connects traditional learning theories with assumptions of the relational developmental system approach.

Since lack of social skills can lead to long-term negative psychosocial outcomes and furthermore can affect subsequent generations, it is fundamental to expand the understanding of related and predictive factors. By presenting specific effects of sensitivity and mirroring on children's development within the first two years, the three studies add to research on the relation of caregiving and the development of children's social skills. Additional deeper insights were revealed by further explorative analyses. These analyses showed that children of mothers who reached the highest scores in sensitivity developed better socio-emotional skills (empathic concern and emotional helping) compared to the children of mothers with 'good enough'-scores in sensitivity at 18 months. This pattern was not found for children's imitation abilities at 18 months (see supplementals). This finding speaks partly against Winnicott's theory of the sufficiency of 'good enough'-mothers (Winnicott, 1953), since

children can benefit more from optimal maternal sensitivity. Taken together, the current thesis enhances the understanding of mechanisms of maternal sensitivity as well as maternal mirroring and points out the importance of social learning from caregivers.

If we think of interventions for children who do not perform well on important social skills, the results of this thesis highlight another starting point to improve children's social skills beyond focusing on development/enhancement of specific behavioral skills within the child: Mothers and their responsive behaviour. Therefore, these results open avenues for specific interventions to improve caregiving behaviour for the benefit of their children's social skills.

Maternal sensitivity in mother–infant interactions may be lacking for a variety of reasons. Research pointed out that environmental factors are associated with the development of maternal sensitivity (Deans, 2020). One possible factor is that mothers do have the capability to react sensitively but may not be able to show this behaviour due to other demands limiting mothers' personal capacity, for instance, own distress (Mesman et al., 2012) or depression (see Bernard et al., 2018 for a meta-analysis). Indeed, depression was found to negatively influence social learning (Brett et al., 2020; Kaplan et al., 2015; Perra et al., 2015; Segrin, 2000). Therefore, early interventions for mothers and provision of better comprehensive support systems to unburden parents are essential starting points.

Another possibility for lacking presented sensitivity is that mothers have enough capacity to focus on the child but do not have the ability to react fully sensitively. Research on interventions on how to improve maternal sensitivity found that those interventions that focused solely on maternal sensitivity, started after the infant was six months old, and used video feedback were most effective (Bakermans-Kranenburg et al., 2003).

Summing up, the current thesis deepens our understanding of how specific facets of caregiver–child interactions impact the development of social skills within children's first two years of life. This knowledge highlights the importance of interventions aiming at enhancing children's socio-emotional functioning by improving caregiver-child interactions.

3.4 Directions for Future Research

The findings of the current thesis open directions for future research. In the following, I will briefly outline new research avenues which are based on our findings but differ from the current approach with respect to sample characteristics and research design.

3.4.1 Neuronal foundations of associative learning

First, adding neuronal measurements could be of interest to explain underlying neuronal mechanisms or neuronal results of associative learning processes through social interactions. This would address the question of whether empathy is evoked through mirror neurons or neuronal networks that are built through associative learning. Even though first studies exist in this field (e.g., de Klerk et al, 2019; Rayson et al., 2017), a comprehensive picture of the interaction of social experiences in the mother–child dyad and neuronal correlates is missing. One special practical challenge of neuro-psychological studies is the lack of compliance of infants for wearing a cap and sitting still long enough, resulting in studies with small sample sizes. Nevertheless, longitudinal studies with enough statistical power are needed to address the questions around neuronal bases for social learning in infancy. Improved technical equipment that is less sensitive to movement artefacts could raise the possibilities to collect data even in the early stage of life.

3.4.2 Father, siblings, and other relational influences

Second, the current thesis contributes evidence for specific longitudinal relations of maternal sensitivity and children’s social skills in infancy. This is in line with theoretical accounts that have emphasized that especially early experiences with attachment figures can impact child’s later development (Bowlby, 1969/82; Sroufe, 1997). While most of the literature focuses on influences of mothers on their infants (e.g., Bigelow et al., 2018; Deans et al., 2020; Musser et al., 2012), it is necessary to also investigate the influence of other attachment figures. Due to social changes and new guidelines from legislature on parental leave, it becomes crucial to see children growing up in a whole network of social influences. Beyond the impact of fathers (Lucassen et al., 2011; Deneault et al., 2021) also the interaction with siblings might play an important role in the social development of children. Moreover, nowadays, many children do not only stay in their core family but spend a certain amount of their first years in daycare. This is also a relevant social impact which could be addressed in future research.

Regarding the impact of experiences with the caregivers, it would be interesting to investigate how often children need to be exposed to their mothers’ influence for them to have a substantial effect on their child’s development. Is the social learning process one that rather improves with quantity of the interactions or do few interactions but with high quality have a bigger impact? This kind of investigation can offer evidence for the optimal timepoint to give children into external daycare.

3.4.3 Cross-cultural aspects of maternal sensitivity

Third, the results of the studies are limited by the sample of this study, which could be diversified in terms of economic background. Many studies suffer from their WEIRD sample (Henrich et al., 2010). The participating mothers in our study also had a high educational level on average. Even though the two longitudinal studies were controlled for educational background of the mothers, future research would profit from a more diverse sample.

Moreover, future studies should investigate if those influences of maternal sensitivity are a transcultural finding. It needs to be considered that maternal sensitivity is a construct based on western values. Uniformity seems not to be given and cultural differences were discovered in maternal sensitivity interactions (Arace, 2006; Deans, 2020). As a result, some authors even question if sensitivity can be seen as a universal construct (Keller et al., 2017; Mesman, 2018; Mesman et al., 2016). Even if only the expression of maternal sensitivity is culture-specific, measurements need to be adapted (Cheung & Elliott, 2016; Dawson et al., 2021). The perspective of maternal sensitivity as a crucial impact is based on an individualistic society, where children's needs are often constituting the center of decisions. Furthermore, the core family consists of mostly parents and their children. However, it would be interesting to investigate the dynamic when there are several important influencing people as a network in which a child is raised. "It needs a village to raise a child." This saying points out the influences that go beyond the dyad of caregiver and child already in infancy. What influences the development of children's social skills in this situation? Do children pick out the most sensitive person? Or the one they spend the most time with? Or are they rather combine all the experiences they make with different people? All these questions remain open. Therefore, future studies should be conducted in samples with diverse cultural background.

3.4.4 Long-term effects of maternal sensitivity on social life

Lastly, the current thesis provides insights into the influence of maternal sensitivity and maternal mirroring on children's development of social skills during the first two years of life. Though the relations between maternal responsiveness and children's skills are well investigated, data on long-term trajectories is limited. It would be interesting to investigate how child adjustment during infancy relates to children's coping with adverse situations later in their lives. That is, do children's experiences of their mothers during infancy impact children's more sophisticated social skills at later life stages? Maybe even in adulthood? Therefore, longitudinal examinations of developmental trajectories from very early

experiences in infancy onto later living scenarios in adulthood (success in work, success in relationships) would be particularly interesting. Such designs could provide more insights into the effect of those early experiences and how much they lay the ground for a person's life.

3.5 Conclusion

The current thesis contributes to our knowledge on the role of social experiences with caregivers in infants' and toddlers' learning of social skills. By relying on four time points of data collection, this thesis demonstrates that maternal mirroring influences children's imitation abilities, that the emergence of empathy within the second year of life is influenced by maternal sensitivity, and that maternal sensitivity and children's emotional helping are linked by children's empathy. Thus, it provides important insights into the influence of maternal sensitivity and maternal mirroring on different social skills in the infant's early years.

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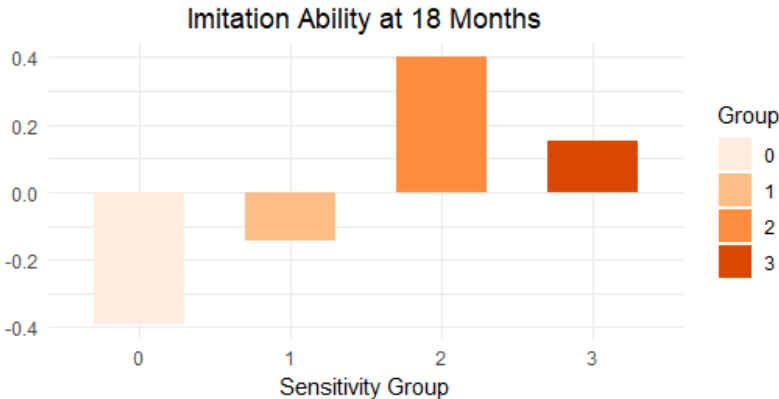
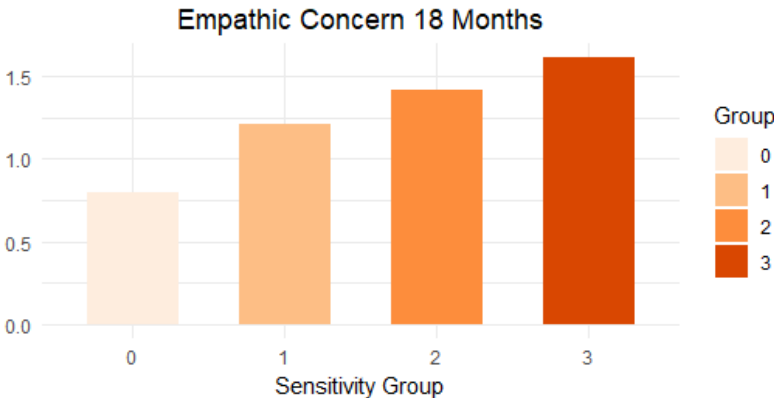
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Supplementary Material

Figures.

Comparison of different social skills of 18-months olds. Groups divided based on maternal sensitivity: Group 0 not sensitive (1-3), Group 1 apparently sensitive (3.5-5.0), Group 3 good enough sensitive (5.5-6.0), Group 4 optimally sensitive (6.5-7.0)



Appendices

A Paper by Becher, Essler, Pletti, Gniewosz & Paulus (in prep)

– Study 1

Becher, T., Essler, S., Pletti, C., Gniewosz, B. & Paulus, M. (2022). Do infants learn imitation by being imitated? [Manuscript in preparation]. Department of Developmental Psychology, Ludwig-Maximilians-University.

Do infants develop their imitation abilities by being imitated?

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Word count = 4798

Keywords: Imitation; Maternal sensitivity; Structuring

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Acknowledgements: The study was supported by a Fellowship from the Jacobs Foundation to MP (JRF 2016 1217 12). Preparation of the article was supported by a James S. McDonnell Foundation 21st Century Science Initiative in Understanding Human Cognition-Scholar Award to MP (No. 220020511)

Declaration of Conflicting Interests: The authors declare no conflict of interest.

Abstract

The ability to imitate is considered as one of the competences which make human the social beings they are. Imitation enables us to learn about actions not only through active experience, but also through observing these actions by others. Although its relevance is well established, the origins are discussed. Children's (N = 127) and mothers' spontaneous imitation behaviour in their interactions at 6, 10, 14, and 18 months of age. Moreover, we measured several standardized imitation tasks as outcomes at 18 months. Analyses revealed that the effect of maternal sensitivity on children's imitation abilities was partly mediated by maternal imitation behaviour. This mediating effect only appeared with maternal imitation at 14 months but not at 10 months. The results suggest that maternal imitation behaviour in the sensitive period has an impact on how children's imitation ability of new movements is developed at 18 months.

Do infants develop their imitation abilities by being imitated?

Humans are widely considered the socially most sophisticated species on the planet. Their remarkable abilities in navigating the social world have given rise to complex societies, the refinement of cultural repertoire across generations, and the advancement of cultural intelligence. But how do we become the ultra-social beings we are? Theoretical advances in social sciences purport imitation as one key to understanding humans' sociality (e.g., Byrne, 2005; Heyes, 2021; Tomasello et al., 2005). As such, imitation (i.e., reproducing others' actions in one's own movements) has been found to play an important role in fundamental social capacities such as language development (Adank et al., 2010), understanding and sharing others' intentions (Iacoboni, 2005), and the cultural evolution of communicative behaviors (Heyes, 2021) while imitation difficulties have been linked to clinical disorders such as autism (Avikainen et al., 2003). Thus, uncovering human sociality relies on a clear understanding of the ontogeny of imitation. Yet, how humans become able to imitate, that is, how imitation emerges in human ontogeny, is unclear and intensely debated. The present study offers first evidence that imitation is of social origins.

How humans come to imitate others has been subject of theoretical debates over the last decades. Influential work has raised the possibility of imitation as an innate ability already present in newborns (Davis et al., 2021; Slaughter, 2021). This view proposes that newborns possess an innate capability to map observed and executed actions together resulting in imitation behavior (Meltzoff & Moore, 1977, 1997; Nadel & Butterworth, 1999; Soussignan et al., 2011). However, recent studies raise doubts in failing to replicate earlier findings (Anisfeld et al., 2001; Jones, 2007, 2009; Oostenbroek et al., 2016, 2018; Redshaw, 2019). For example, in a widely debated contribution, Oostenbroek et al. (2016) longitudinally investigated infants' imitation of gestures at 1, 3, 6, and 9 weeks of age. They showed that infants produced the gestures in response to control models as much as in response to matching models and thus found no evidence for neonatal imitation behavior (see also Jones, 2017). Early behaviors that

seem to look like imitation do not predict the development of social-cognitive abilities (Redshaw et al., 2020). These studies suggest that infants acquire imitation abilities early in life, but leave open the question when and how imitation develops.

Recent advances in psychological theorizing have proposed that imitation develops through social interactions. The observation of others' behavior leads to coactivations of visual and motor representations of that behavior via mirror neurons (Heyes, 2021; Paulus, 2014). From these activated motor representations, infants can reproduce the observed action strengthening the associations between sensory (i.e., the observed action) and motor (i.e., the reproduced action) representations (i.e., solving the correspondence problem; see Brass & Heyes, 2005). This learning process is well known from research on action control that proposes that the acquisition of action-effect-associations subserves goal-directed behavior (Frings et al., 2020; Hommel & Wiers, 2017). Infants' observation of others' behavior might be especially beneficial if the other's behavior constitutes an imitation of their own behavior. Specifically, maternal imitation if sensitive, contingent, and contiguous (Biringen et al., 2014) could be the developmental process underlying infants' increasing imitation abilities (Rayson et al., 2017; Sauciuc et al., 2020). That is, more sensitive mothers might display more adequate imitation of their infants' behavior resulting in infants' higher imitation abilities. Thus, maternal imitation could be the key in early social interactions driving children's acquisition of imitation abilities. If this were to be true, it would make a strong case for the social basis of imitation and, by extension, for our understanding of human sociality.

The aim of the present study was to investigate the link between maternal imitation as psychological underpinning of infants' developing imitation abilities. We hypothesized that sensitive mothers would facilitate infants' imitative learning through imitating their infants. To this end, we longitudinally studied mother-infant dyads from 6 to 18 months at four measurement points. Thus, we observed maternal sensitive caregiving and maternal imitation of infants. As central outcome measures, we assessed infants' imitation abilities through

standardized imitation tests and infants' spontaneous imitation behavior at 18 months. These measures are frequently used in the field, but rarely together. Following previous work demonstrating little imitation behavior with 6 months and increasing imitation behavior in the year thereafter (Jones, 2007; Oostenbroek et al., 2016), we studied the development of imitation from 6 to 18 months of age.

2. Methods

2.1 Participants

The final sample consisted of 127 mothers and their infants (57 female). Infants were born within 4 weeks of their expected due dates. For the first assessment (T1), infants visited the research lab within 4 weeks after becoming 6-months old ($M = 194.0$ days, $SD = 8.47$). Mothers mean age at T1 was 34.40 years of age (range 23–45). A randomly selected half of the sample came back for a second assessment (T2) at 10 months of age ($N = 63$, $M = 320.0$ days, $SD = 16.42$) and the other half at 14 months of age (T3, $N = 57$, $M = 437.4$ days, $SD = 9.59$). For the final assessment (T4), children ($N = 97$) were tested no later than 4 weeks after becoming 18-months old ($M = 557.5$ days, $SD = 35.78$). Parents gave written and informed consent before participating. The study was approved by the local ethics committee.

2.2 Longitudinal procedure

The assessments were part of a longitudinal study on social learning in infancy. At each assessment, a research assistant greeted the families, explained the study procedures, and had a brief warm-up period with the infants. Parents were reimbursed for their travel costs and infants received a toy for their participation. Maternal and children's spontaneous imitation were continuously tested on all four timepoints, whereas all modelled imitation tasks were collected on the last assessment at 18 months. Maternal sensitivity was assessed at 6 months.

2.3 Measures

2.3.1 Maternal & Child's Spontaneous Imitation. Adapted from established procedures (e.g., Masur, 1987), mothers were instructed to play with their infants for 8 minutes without any toys to keep them from focusing on the objects instead of one another. To prevent the participants from only performing standardized routine movements like finger plays or children's songs, those were also restricted.

The playing situation took place in a playpen [5qm] to restrict the radius of the interaction and concurrently give enough space to interact. Some objects like surrounding furniture or their clothes could not be prevented from usage. Three digital hand-cameras recorded the interaction of mother and infant from different angles and distances. The experimenter left the room for the 8-minute interaction.

Coding maternal spontaneous imitation. Based on prior research (see Mazur & Rodemaker, 1999 for a complete description) all episodes of imitation behavior by mothers were categorized into verbal, vocal, object-related actions, and actions without objects. An interaction was coded as imitation if the mother copied the infants' action within 10 seconds, resulting in an individual score for each category and an overall imitation score. One primary coder coded all dyads and a second reliability coder coded 25% of these videos. Interrater reliabilities (intraclass correlations) were 0.79 (T2) and 0.81 (T3).

Coding infants' spontaneous imitation. All episodes of imitation behavior by infants were categorized into the same categories as described above. An interaction was coded as imitation if the infant copied the mothers' action within 10 seconds, resulting in an individual score for each category and an overall imitation score. One primary coder coded all dyads and a second reliability coder coded 25% of these videos. Interrater reliability (intraclass correlation) was 0.86.

2.3.4 Modeled Imitation Tasks. Four tasks were conducted to experimentally measure children's imitation abilities. The setting was consistent over all these tasks. Children were

placed at a table facing the experimenter on the other side of the table. The child was either sitting the mother's lap or on a chair with the mother behind it.

Synchronous Task. The task contained four objects (Nielsen & Dissanayake, 2004). The experimenter modelled repeatedly two movements for all four objects. Every movement was presented for 15 seconds. First, the experimenter placed the object in front of her and offered a duplicate object to the infant. As first movement, the experimenter repeatedly tapped on the bottom of a reversed cup. Afterwards, she turned it around on its bottom and back again. Following, the experimenter moved a toy hammer from side to side through a 90° arc and then patted the handle. Thirdly, the experimenter used a toothbrush to brush her hair and then brushed her arm. Finally, the experimenter executed a sawing movement on her forearm with a toy saw and afterwards patted its blade with her hand. For each task, we coded whether an infant executed the action correctly (0 or 1 point for each action, resulting in a range of 0-2 for each object). Afterwards, a mean of the conducted tasks was calculated, resulting in one score for each child. One primary coder coded behaviors of all infants and a second reliability coder coded 25% of these videos. Interrater reliability was good with Cohen's kappa = 0.81.

Immediate imitation on objects. Two objects were chosen from Meltzoff and colleagues (1988). For both, the experimenter first presented a specific action and afterwards, handed the object to the child without explicitly motivating the child to imitate. The first object was a small stuffed bear with a cord attached on top of its head. The experimenter took this bear by the cord and dangled it up and down like the bear was dancing on the table. The second object was a box with a round shaped lamp with a light bulb on the surface. The experimenter demonstrated to switch on this lamp with the top of his forehead by leaning forward from the waist and putting her hands right beside the box. For each task, we coded whether an infant executed the action correctly (0 or 1 point for each action) resulting in a general score from 0 to 2. One primary coder coded behaviors of all infants and a second reliability coder coded 25% of these videos with an interrater reliability of Cohen's kappa = 0.89.

Imitation Battery. For this task, we adapted the imitation battery from Rogers and colleagues (Rogers et al., 2003). The battery contained actions on objects (pull duplos apart and bang them together, turn car upside down and pat it, pat squeaky toy with elbow), oral-facial movements (extend tongue and wiggle, blow cotton ball across table, make a ‘noisy’ kiss) and manual items (open close both hands simultaneously, pat chest with one hand, pat elbow). In addition to the nine original tasks, we added pat head to our battery. All objects were given to the child for a short exploration prior to presented action. After having the attention of the child, the experimenter said “[Name], do this” and showed the described movements three times straight for three times in a row. Based on Rogers and colleagues’ coding scheme, each item was scored on a 0 to 2 -point scale, with 0 reflecting no proper action at all, 1 reflecting some correct movements relating to the target movement, and 2 reflecting a correct imitation. Afterwards, the scores obtained for each task were averaged, resulting in one score for each child. One primary coder coded behaviors of all infants and a second reliability coder coded 25% of these videos. Interrater reliability (intraclass correlation) was 0.99.

Deferred Imitation – FIT-18. The Frankfurter Imitations-Test (FIT-18) (Kolling & Knopf, 2015) is a standardized, deferred imitation task which contains five different age-appropriate movements with objects. The test consisted of a demonstration, a delay, and an imitation phase for all movements. During the demonstration and the imitation phase, the child sat on the mothers’ lab on a table opposite to the experimenter. In the demonstration phase the experimenter made sure that the infant was paying attention and introduced each action by saying “Look, what I got here, [name]!”. Following the standardized procedure, each action was presented three times within 30 seconds one after another. After returning to the setting after a 30-minute delay, the experimenter handed each toy over to the child for 30 seconds. After that the experimenter requested back the toy and handed over the next one. This procedure was repeated for all five toys. If an infant executed the action correctly, it was coded with 1, if not with 0. Afterwards, a mean of the conducted tasks was calculated, resulting in one score

for each child. One primary coder coded behaviors of all infants and a second reliability coder coded 25% of these videos resulting in an interrater reliability (intraclass correlation) of 0.82.

2.3.5 Maternal Sensitivity. Mothers and infants were engaged in a free-play task with standardized, age-appropriate toys. They included plush toys, building blocks, rattles, and a glove puppet. Interactions were recorded on a 2x2m picnic blanket supplemented by a playpen. Mothers were asked to play as naturally as possible with their infants within the predetermined place. Experimenters were outside the room during the interactions and the interaction was videotaped with two hand cameras. Many empirical studies use the EA Scales to code parent-child interactions lasting between 5 to 15 minutes (for a review, see Biringen et al., 2014). Therefore, our 8-minute interaction at T1 seemed to be enough to assess EA. All videos were coded using the fourth edition of the Infancy/Early Childhood Version of the Emotional Availability Scales (Biringen, 2008). The EA scales are well-established and empirically validated (Biringen & Easterbrooks, 2012) to measure adult-child relationship quality. The scales are coded on a 7-point Likert Scale with the upper end scores represent an optimal level of EA. 25% of the sample at each time point were randomly chosen and coded by a second trained coder. The two coders were certified as reliable after successfully completing the online training. The intraclass reliability coefficient for the sensitivity scale was 0.77.

2.4 Data Analyses

We randomly divided the sample for the middle timepoints and tested half the children at 10 months of age and the other half with 14 months. The equidistant timepoints (Usami et al., 2019) allowed us to estimate and input missing data without confounding the variables (Wu & Jia, 2021). Missing data was handled by multiple imputations (500 imputed data sets), applying the mice package in R (van Buuren & Groothuis-Oudshoorn, 2011).

Multiple Linear Regressions were conducted using the stats package in R (R Core Team, 2013). To test our hypothesis, children's overall imitation ability and children's spontaneous imitation were regressed on maternal imitation and maternal sensitivity. An overall mean of all

four z-standardized imitation tasks served as dependent variable for the overall imitation ability.

The data are available at [links follows].

3. Results

3.1 Descriptives

Table 1 depicts descriptive statistics for the study variables. These first results show that maternal imitation at 14 months positively relates to child imitation ability at 18 months.

Table 1

Means, standard deviations, and correlations of imputed study variables

Variable	<i>M</i>	<i>SD</i>	1	2	3	4
1. Maternal Sensitivity 6 months	5.42	1.11				
2. Maternal Imitation 10 months	13.80	7.14	-.02			
3. Maternal Imitation 14 months	14.27	8.01	.22 ⁺	.06		
4. Child Spontaneous Imitation 18 months	5.28	3.85	.28**	.06	.08	
5. Child Imitation Ability 18 months	0.01	0.80	.24*	.09	.29*	.20 ⁺

Note. + indicates $p < .10$; * indicates $p < .05$; ** indicates $p < .01$

3.2 Multiple Linear Regression Models on Child Imitation Abilities and Child Spontaneous Imitation

To test which factors predicted child imitation abilities at 18 months and child spontaneous imitation at 18 months, we computed two multiple linear regression models. Maternal sensitivity at 6 months and maternal imitation at 10 months (model 1) and at 14 months (model 2) served as predictors. The two child imitation measures were the outcomes in both models (see Table 2). Regarding the model with maternal imitation at 10 months, all predictors explained 7% of the variance (for imitation abilities) and 8% of the variance (for spontaneous imitation). Regarding the model with maternal imitation at 14 months, all predictors explained 12% of the variance (for imitation abilities) and 8% of the variance (for spontaneous imitation).

STUDY 1

Table 2

Results of the multiple regression models on child imitation abilities and child spontaneous imitation at 18 months with maternal imitation at 10 months (above) and maternal imitation at 14 months (below)

Predictor	Child Imitation Abilities 18 months				Child Spontaneous Imitation 18 months			
	<i>b</i>	<i>se</i>	<i>z</i>	<i>p</i>	<i>b</i>	<i>se</i>	<i>z</i>	<i>p</i>
Maternal Imitation 10 months	0.010	0.009	1.041	0.298	0.034	0.050	0.675	0.500
Maternal Sensitivity 6 months	0.169	0.054	3.131	0.002**	1.006	0.274	3.667	<0.001**

Predictor	Child Imitation Abilities 18 months				Child Spontaneous Imitation 18 months			
	<i>b</i>	<i>se</i>	<i>z</i>	<i>p</i>	<i>b</i>	<i>se</i>	<i>z</i>	<i>p</i>
Maternal Imitation 14 months	0.026	0.009	3.039	0.002**	0.007	0.043	0.173	0.863
Maternal Sensitivity 6 months	0.131	0.055	2.366	0.018*	0.991	0.281	3.530	<0.001**

Note. *b* = regression coefficient, *se* = standard error, *z* = z-value, ** indicates $p < .01$; * indicates $p < .05$

3.3 Meditation Analysis

To further investigate how maternal sensitivity at 6 months supported the development of child imitation abilities at 18 months, we conducted a mediation model with maternal imitation at 14 months as the mediator. Results showed that the total effect of maternal sensitivity at 6 months on child imitation abilities at 18 months, $c = 0.168$, $se = 0.054$, $z = 3.105$, $p = 0.002$, was partially mediated by maternal imitation at 14 months, $ab = 0.037$, $se = 0.018$, $z = 2.046$, $p = 0.041$ (proportion mediated = 22%). After accounting for the mediation effect, the direct effect remained significant, $c' = 0.131$, $se = 0.053$, $z = 2.449$, $p = 0.014$. Thus, the more sensitive mothers were at 6 months, the more they imitated their child at 14 months, leading to higher child imitation abilities at 18 months.

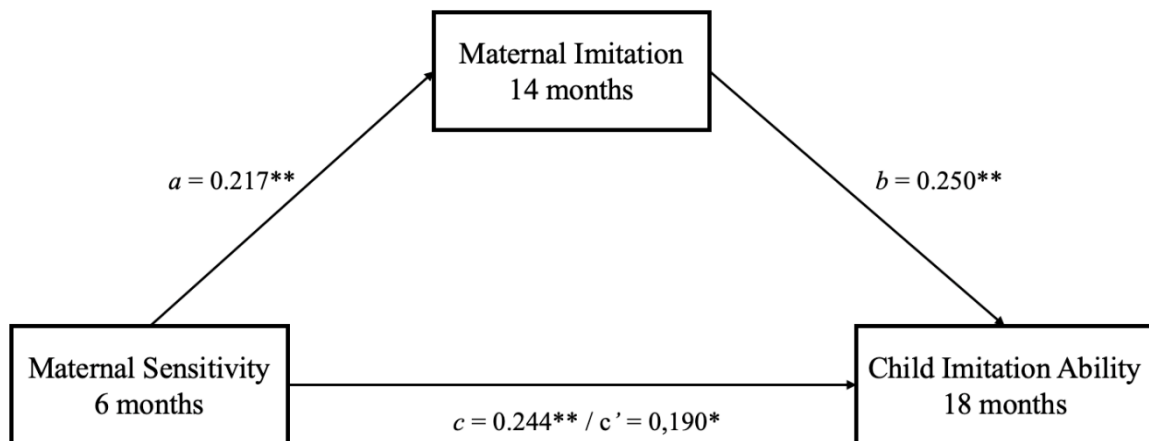


Figure 1. Standardized coefficients of the indirect effect of maternal sensitivity at 6 months on children's imitation abilities at 18 months through maternal imitation at 14 months.

** indicates $p < .01$; * indicates $p < .05$

4. Discussion

The present study offers insights into human sociality by investigating the social interactive basis of infants' imitation abilities. Specifically, we examined if maternal imitation can be considered a developmental process underlying infants emerging imitation abilities. Results showed that (1) maternal imitation at 14 months positively predicted infants' imitation abilities at 18 months and (2) mediated the positive effect of maternal sensitivity at 6 months on infants' imitation abilities at 18 months. These findings have far-reaching implications for our theoretical understanding of human social agency.

The ability to imitate others constitutes a cornerstone of cultural learning, collaborative interactions, and communicative exchanges. Much previous work suggests that this imitation ability is largely not inborn (e.g., Oostenbroek et al., 2016; Redshaw, 2019). But how then does imitation develop? The current findings make an important contribution to this theoretical debate within the social sciences. They demonstrate that being imitated by others represents a key developmental mechanism supporting the growth of infants' imitation abilities. This relates well to accounts stressing the coactivation of visual and motor representations by observing someone's action as the basis for reproducing this action (Heyes, 2021; Paulus, 2014). Specifically, as infants observe someone else imitating themselves, the motor representation of their executed action (e.g., infant waving hand) becomes associated with the visual representation of that action from a third party perspective (e.g., mother waving hand). This lays the foundation for the reverse direction, that is, starting from the visual representation (e.g., observing mother waving hand), infants motor representation of that action is activated via mirror neurons leading infants to imitate the action (e.g., infant waving hand). Crucially, this highlights the fundamental importance of contingent social interactions in developing imitation abilities early in life.

Interestingly, sensitive caregiving at 6 months is strongly related to infants' imitation abilities and to infants' spontaneous imitation at 18 months. This suggests that contingent and warm caregiving (Biringen et al., 2014) sets the stage not only for the quality but also the quantity of imitation behavior infants show one year later. As such, sensitive caregiving is a driver for infants to engage with their social environment through imitation and to successfully adapt observed behavior into their own behavioral repertoire thereby facilitating cultural learning (Over & Carpenter, 2013). This makes a strong case for the inherently social basis of human sociality.

Importantly, our results open a new window into the processes underlying imitation development. Specifically, maternal imitation at 14 months mediated the effect of sensitivity on imitation abilities but not of sensitivity on spontaneous imitation. This suggests a dissociation of two processes in the development of imitation. First, the quality of infants' imitation behavior (i.e., imitation abilities) not only relies on sensitive caregiving, but also on maternal imitation of their infants. As such, the mechanism underlying infants' growing imitation abilities is a distinct reversed imitation process (mother imitating infant to support infant imitating mother). Second, the quantity of infants' imitation behavior (i.e., spontaneous imitation) relies on sensitive caregiving in general rather than specific imitative interactions initiated by the mother. Thus, infants' spontaneous imitation might represent a general tendency to engage in social interactions with their environments independent of their imitation abilities. This interpretation relates well to the finding that imitation abilities and spontaneous imitation correlate weakly, thereby leaving room for dissociable imitation processes in the development of human sociality.

The current study leads to new questions for future research such as combining neural and behavioral data to further map out the social basis of imitation, investigating imitation behavior in infants' daily lives, and looking into cross-cultural stabilities of imitation

development. In conclusion, we present leading-edge findings advancing stalled theoretical debates on the innateness of imitation by demonstrating a clear social path in the development of imitation abilities and human sociality early in life.

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**B Paper by Paulus, Becher, Christner, Kammermeier,
Gniewosz & Pletti (under review) – Study 2**

Paulus, M., Becher, T., Christner, N., Kammermeier, M., Gniewosz, B. & Pletti, C., (2022). Caring Babies? A longitudinal study on the ontogenetic growth of empathic concern across the first two years of life. [Manuscript submitted for publication]. Department of Developmental Psychology, Ludwig-Maximilians-University.

**Caring Babies? A longitudinal study on the ontogenetic growth of empathic concern
across the first two years of life**

Human concern for others is a key element in human life because it connects people through an emotional bond and supports social interactions (Brazzelli et al., 2021; Brownell, 2016; Hoffman, 2000; Thompson, 2012). A central aspect of concern for others is empathy (Dunfield, 2014; Eisenberg et al., 1996; Spinrad & Gal, 2018). Empathy can generally be described as the capability to recognize and share others' emotions, while keeping an other-oriented focus (Davis, 1983; Decety & Svetlova, 2012). Developing early in life (Brownell, 2013; Dahl & Paulus, 2019; Spinrad & Gal, 2018), empathy is essential for building and maintaining relationships with others. Reversely, a lack in empathy is linked to the development of mental disorders (Findlay et al., 2006; Young et al., 1999), most notably higher aggression and externalizing problems (Paz et al., 2021; Rhee et al., 2020). Developmental research has demonstrated that empathy is a positive predictor of prosocial behaviour (Young et al., 1999) and improves social functioning, contributing to supportive friendships for instance (Clark & Ladd, 2000). Given the importance of empathy for human social life, we aimed at examining the ontogenetic emergence of empathy and at exploring supporting psychological processes.

Empathy is a multifactorial construct that includes both cognitive and affective facets (Eisenberg et al., 2006): Inquire and apprehension of another's conditions or needs reflect the cognitive facet of empathy, whereas the ability to experience emotional resonance with another's emotions reflects the affective facet of empathy (Davis, 1983). When confronted with a suffering other, empathic concern can result when someone is focused on the distressed other. However, if one is not able to shift the focus from oneself to the suffering person, one might be overwhelmed by the situation. Consequently, stress-feelings like disturbance or anxiety might emerge, reflecting a self-focused distress response (Batson et al., 1987; Nichols et al., 2015; Roth-Hanania et al., 2011; Zahn-Waxler, Radke-Yarrow, et

al., 1992). Therefore, self-distress as a contagion reaction is not considered to be an empathic response but displays the absence of empathy. Following, self-distress would lead to self-comforting behaviour rather than to comforting behaviours towards the victim (Zahn-Waxler, Radke-Yarrow, et al., 1992). Though prosocial behaviour is closely linked to empathy (Malti et al., 2009; Paulus et al., 2017), it is not part of its definition. Summing up, if one sees a suffering person, can understand cognitively what is happening, resonates affectively, and is able to regulate the self-distress response, we talk about an empathic response. This, in turn, could support an other-oriented behavioral response (prosocial behaviour) like comforting. Although one can also resonate with positive emotions, most research has focused on reactions to negative emotions, as it indicates children's concern for the well-being of others and their goal to relieve another individual's distress (Batson et al., 1987; Dunfield & Kuhlmeier, 2013; McHarg et al., 2019; Robinson et al., 1994).

The onset of empathy

But when exactly does empathy emerge in humans? Some researchers assume humans to be born with a disposition to feel for others. This is proposed to constitute an evolutionary advantage that makes them better parents and social group members (Bazelgette, 2017; De Waal & Preston, 2017). Others challenge this assumption and claim empathy not to be an innate behaviour but to develop over time (Heyes, 2018). Empirical research has attempted to speak to this debate. For example, studies demonstrated that newborns react to another's baby crying sound with own crying (Sagi & Hoffman, 1976; Simner, 1971). Yet, Hoffman (1984, 2000) has highlighted that this behavior rather constitutes a self-distress reaction as infants are overflooded by the other's emotion rather than real empathic behaviour. When does empathy then develop? One line of developmental theorizing proposed that empathic behaviour emerges during the second year of life, based inter alia on the emergence of self-other differentiation (Bischof-Köhler, 2012; Hoffman, 1984, 2000; Zahn-Waxler & Radke-Yarrow, 1990). This theoretical view has received support by a set

of empirical studies (Knafo et al., 2008; Nichols et al., 2009; Young et al., 1999; Zahn-Waxler et al., 1992).

More specifically, empathy has been claimed to be based on the ability to psychologically differentiate between oneself and the other person, accompanied by the ability to take the perspective of the other person. That is, related to the onset of self-other differentiation children should show a decrease in personal distress and an increase in empathic behaviours when seeing another person's suffering (Bischof-Köhler, 2012; Zahn-Waxler & Radke-Yarrow, 1990; Zahn-Waxler et al., 1992). Classically, self-other differentiation is measured by the rouge test (Amsterdam, 1972). In this test, children are placed in front of a mirror with a red dot on their nose to see if they already recognize themselves what is indicated by them touching their nose. In one influential study, Zahn-Waxler and colleagues (1992) used this test in combination with different stress simulation conditions (like respiratory distress or pain induced by bumping one's foot or head) reported from home. Additionally, the researchers tested reactions towards strangers in simulated pain at 18, 21, and 24 months. The data indicated that the development of self-recognition was linked to empathic behaviour like showing concern towards the others' negative emotion or trying to help others.

However, two recent studies claim that first signs of empathic behaviour are evident already before the second year (Davidov et al., 2021; Roth-Hanania et al., 2011) - long before children are able to show self-recognition. Davidov and colleagues (2021) analysed the reaction of 165 infants from 3 to 18 months in two classical conditions frequently used in empathy research: a simulated pain-suffering-condition by their mothers and by the experimenter, who hurt themselves by bumping their knee or hitting their finger with a block, and a peer distress simulation on video. The authors argue that an implicit self-awareness seems to be sufficient in order to understand that the negative emotion is coming from another person instead from the self. Therefore, they reject developmental theories that

propose that empathy emerges in the second year of life and that an explicit self-concept plays a central role (e.g., Hoffman, 2000), and claim that empathy arises already within the first months of life.

However, a closer inspection of the coding schemes reveals that these very early signs of empathy were mostly based on small facial changes (for concern) or attentional shifts (for inquiry behaviour). For example, the presence of concern for victims was coded based on a “slight change in facial expression (usually at a low intensity), including sobering, brow furrow, or sad expression“ (Davidov et al., 2021, p. 17). Yet, brow furrows are unspecific facial reactions that could also result from a surprise reaction (e.g., based on raising the brows; Reisenzein et al., 2013). Similarly, sad expression could be the result of emotional contagion rather than empathic concern for the other (Hoffman, 2000). Thus, the question arises if those reactions are real indicators for empathic concern or if they are rather undifferentiated reactions to a surprising emotional situation or indicators of own negative emotional states. Indirect evidence in line with this alternative explanation comes from other studies: Nichols and colleagues (2015) pointed out that 12-month-olds discriminated between a crying infant doll and a content, neutral one, but showed no particular interest in both before 18 months. Beyond that, there is little work comparing young children’s responses to suffering others with control conditions. Davidov and colleagues (2021) used an emotionally neutral situation in which mothers read a book aloud as a control condition. Yet, this condition is not comparable in terms of emotionality or presenting a surprising event. Interestingly, Ruffman and colleagues (2019) characterized the responses of 2-year-olds to videos of crying babies as reaction to aversive stimuli rather than true empathy, since their expressed extent of happiness in comparison to sadness did not differ to a control condition that consisted of a video with white noise. Simultaneously, the children showed significantly more happiness in the second control condition where a laughing baby was presented. This study represents a first effort to tease apart true empathic concern to others’

suffering from unspecific responses. However, it lacks a perspective on early ontogeny and there was no specific coding of empathic concern. Thus, it remains an open question from which age children react with empathic concern specifically towards a suffering other, but not an otherwise emotional other. Relatedly, is having an explicit self-other-differentiation related to the development of empathy?

Particular with respect to the ontogenetic onset of empathic reactions such as empathic concern, it would be interesting to explore the psychological factors that contribute to its emergence. In the following, we will focus on two factors that play a central role in developmental theorizing.

Impact of Maternal Sensitivity on Children's Empathy Development

According to Hoffman's developmental theory (1984, 2000) and attachment theoretical considerations (Stern & Cassidy, 2018; Thompson, 2019), the development of empathy is supported by maternal behaviours, most notably by sensitive and attuned caregiving. This view is encouraged by a wealth of research focusing on how the experiences in early caregiving relationships promote childrens' developing abilities to show empathic behaviour towards others (Brownell, 2013).

From an attachment theory perspective, Ainsworth and colleagues (1978) primarily defined maternal sensitivity as the ability to notice the child's signals, interpret those correctly and respond appropriately. Following this approach, Biringen (2008) enriched the concept of sensitivity with the aspects of warmth and proper reactions to emotional cues of the infant. Interestingly, also from a social-cognitive learning theoretical point of view, these maternal reactions play an important role. In this theoretical tradition, they can be interpreted as a form of social guidance and modelling (Bandura, 1977). Therefore, mothers who display sensitive and attuned caregiving in empathy-requiring situations can provide a role model for how to react appropriately if another person is in distress for their children (Murphy & Laible, 2013; Panfile & Laible, 2012). A mother's ability to react sensitively to her child's

cues, serves as example on how to handle others' needs. According to cognitive theories in the attachment field, these experiences result in inner working-models that contain information about actions in internalized scripts and are activated in different social and/or emotional situations (Stern & Cassidy, 2018). Children with uncertain inner-working models are claimed to have experienced less attuned caregiving, resulting in a lack of internalized knowledge of how to react appropriately towards another person's pain (Kestenbaum et al., 1989). Moreover, sensitive caregiving and attachment security have been linked to appropriate affective arousal and adequate emotion regulation of one's own emotions in stressful situations, which predicts toddlers' and preschoolers' empathic responses (Brett et al., 2020; Daniel et al., 2016; Kiang et al., 2004; Spinrad & Gal, 2018; Spinrad & Stifter, 2006).

A considerable amount of literature has supported the link between maternal sensitivity or maternal warmth and empathic behaviour (Barnett, 1987; Kiang et al., 2004; Spinrad & Stifter, 2006; Zahn-Waxler & Radke-Yarrow, 1990) as well as emotion regulation in children. In longitudinal studies, Kiang et al. (2004) and Spinrad and Stifter (2006) provided evidence for the influence of maternal behaviour on children's later empathy from 18 to 24 months. Yet, despite theoretical claims (Hoffman, 2000; Stern & Cassidy, 2018), little is known on whether maternal sensitivity affects the emergence of empathic reactions in early ontogeny before the second year of life. Knowledge on this issue would be particularly interesting as it could help to reveal when in ontogeny empathy emerges. Consequently, our study aimed to investigate the influence of maternal sensitivity on infants' empathy development across their first two years of life.

Impact of Infants' Temperament on Empathy Development

Moreno and colleagues (2008) pointed out that sensitive parental behaviour is not the only important predictor for children's empathy. Rather, also children's individual personality characteristics – in early ages often described as temperament – are proposed to

account for the transmission from parents' caring for their children to children's learning to care for others. Individual differences in children's temperament can mostly be observed in differences in reactivity and self-regulation (Mervielde & De Pauw, 2012; Rothbarth, 2012). The negative form of reactivity (negative emotionality) can be characterized as the child's tendency to react with discomfort, fear, or distress in new, stressful, or frustrating situations (Rothbarth, 2012). This characteristic could lead to children being more easily overwhelmed by another's person distress and therefore lead to non-empathic behaviour (Eisenberg et al., 1996; Sagi & Hoffman, 1976).

Several studies reported evidence for the association between temperamental aspects of children and a lower empathic response in toddlers (Young et al., 1999; Zhai et al., 2020), insecurely attached girls (van der Mark et al., 2002), pre-schoolers (Findlay et al., 2006), 5-7 year-olds (Kienbaum et al., 2018) and in neural processing of 8-month-olds (Crespo-Llado et al., 2018). Recent studies showed a significant change of temperamental influence over time (Abramson et al., 2019): Infants who showed negative reactivity at 9 months, reacted with more empathy later at 18 months, if they had achieved sufficient regulation abilities in the meantime.

According to Kochanska (1997), temperament influences empathy not only directly, but also by moderating the impact of parenting on empathy development. This is supported by longitudinal data showing that maternal responsiveness promoted prosocial behaviours especially in fearful 4-year-olds (Kochanska, 1997) or empathy in inhibited toddlers (Wagers & Kiel, 2019). Yet, instead of an moderating effect, Kiang and colleagues (2004) showed that temperament mediated the effect of parenting on children's empathy. Thus, recent empirical evidence is inconclusive and there is considerable lack of studies focusing on the impact of temperament on the early ontogeny of empathy.

Given the shortage of data from infancy, the question remains which role temperament plays individually or in interaction with maternal sensitivity in early

development of empathy. Since maternal sensitivity should improve infants' self-regulation abilities, and self-regulation abilities are necessary in order to react with empathic concern instead of personal distress (Daniel et al., 2016; Kiang et al., 2004; Spinrad & Gal, 2018; Spinrad & Stifter, 2006), maternal sensitivity should lead to higher empathic responses in children. Additionally, sensitive mothers should be even more beneficial for children with higher negative emotionality tendencies. Thus, we aimed to clarify the interaction between infant temperament and maternal sensitivity in the early ontogeny of empathy.

Present study

Taken together, current empirical evidence is inconclusive and does not allow for clear conclusions about the ontogenetic onset of empathy. This study intends to clarify the question if empathy occurs before or in the course of the second year of life, including an appropriate emotional control condition, and whether maternal sensitivity and child's temperament predict the development of empathy within the first two years. The current study speaks to these questions by presenting data from mother-child dyads and empathy-related situations at multiple time points over the first and second year of life.

Specifically, we assessed different components of empathy at 6, 10, 14, and 18 months. We assessed infants' expressed empathic concern in facial expressions, gestures or vocalizations, infants' inquiry behaviour as the intention to understand what is happening in the distress situation, as well as infants' display of self-distress. Additionally, we assessed children's explicit self-recognition at 18 months given proposals that it supports the emergence of empathy (Hoffman, 2000). Lastly, in order to compare our findings with previous infant studies, we measured prosocial behaviour as a potential consequence and expression of empathy.

Children's responses were not only tested in a situation in which another person expressed suffering, but also in a control condition with a laughing person. This situation constitutes a potentially similarly arousing emotional situation that does not require empathic

concern. Usually, empathy is measured by coding facial expressions for concern or looking/pointing to the victim for inquiry behaviour while someone is simulating pain. To our knowledge, no study compared a pain simulation to another emotional control condition in an infant sample. Thus, it remained unclear whether the facial expressions or looking and pointing behaviour reported in previous infant studies (e.g., Davidov et al., 2021) really expressed empathy or if infants would react the same way to other kinds of emotional stimuli. Through introducing this control condition, we aimed to distinguish between true empathic responses or rather undifferentiated, general reactions to sudden, arousing, emotional stimuli.

Moreover, we compared children's responses to the distress of a familiar person (mother) and an unfamiliar person (experimenter). Since empathy is proposed to be a general skill, one would assume to see a relation between both situations (despite potential mean level differences) as soon as empathy is emerged. Following frameworks assuming an early emergence of empathic reactions (Davidov et al., 2013), one would hypothesize that already in the first year, infants' reactions towards mother and unfamiliar persons should relate to each other. Yet, if empathy emerges in the second year of life (Hoffman, 2000), one would hypothesize to see this relation in the second year of life only.

By choosing an early first assessment at 6 months and three following measurement points in four-month intervals, including assessment of empathic reactions towards familiar and unfamiliar others as well as an emotional control condition, the study aimed at providing an empirical touchstone for current developmental theories on the emergence of empathy. If empathy is an inborn or very early emerging ability (e.g., Davidov et al., 2013), infants at 6 months should show empathic behaviour, and thus, react with concern to someone crying but not to someone laughing. Consequently, we would expect to see, first, unequivocal indicators of empathic concern at 6 months as well as, second, more empathic concern and inquiry behaviour for a suffering than for a laughing other at 6 months. On the opposite, if

empathy develops in the second year of life, around the age of 18 months as proposed by Hoffman's developmental theory (2000), we should observe more enhanced empathic concern and inquiry behavior towards a suffering than towards a laughing other by 14-18 months. Additionally, we would expect the growth of concern, inquiry behaviour and prosocial behaviour from 6 months to 18 months to be significantly higher for the crying condition than for the laughing condition. Finally, we assessed theoretical claims that explicit self-recognition that emerges around 18 months relates to the development of empathy (Hoffman, 2000).

Developmental theories on individual differences in infants' emerging empathy or more particular empathic concern highlighted two factors: caregiver sensitivity and child temperament. By relying on a longitudinal assessment starting in early infancy, we investigated to which extent these factors support the early emergence of empathic concern. The longitudinal design allowed not only for an assessment when these factors impact this crucial aspect of empathic behaviour, but also to investigate a truly developmental question, that is, how they influence the growth of empathic concern in early development. To this end, the current study investigated the dynamics of developmental changes by applying True Intraindividual Change (TIC) Models (Steyer et al., 2000).

Based on attachment theoretical considerations (e.g., Stern & Cassidy, 2018; Thompson, 2019), we hypothesized children with more sensitive mothers would not only display more empathic concern at 18 months, but also show increased growth of empathic concern across early development. Additionally, Kochanska (1997) proposed that children low in negative emotionality show more empathic behaviour in response to distress of another person. Therefore, we expected negative emotionality to be a predictor of the growth of empathic concern. Furthermore, as one could hypothesize that sensitive mothers should be even more beneficial especially for children with higher negative emotionality, we explored the interaction between both factors. We assessed both predictors at 6 months in

order to explore their impact from early in development. Taken together, previous studies have investigated the relation between caregiver sensitivity, self-recognition, temperament, and empathic behaviour at single ages. Yet, a development model exploring the ontogenetic growth over infancy including these predictors has not yet been tested. Through our longitudinal design with four equidistant assessments from 6 to 18 months, we were able not only to explore the outcome on single specific ages, but also to investigate when empathic concern arises, how it grows and what predictors influence the ontogenetic growth.

Methods

Participants

The final sample consisted of 127 mothers and infants (57 female). Infants were born within 4 weeks of their expected due dates. Families were recruited from birth records in a large city in Germany. The majority of the sample was of middle socioeconomic status and most children were caucasian. For the first assessment (T1), infants participated at 6 months ($M= 194.0$ days, $SD=8.47$). Mothers' mean age at T1 was 34.30 years (range 23-45 years). A randomly selected half of the sample participated at the second assessment (T2) at 10 months of age ($N= 63$, $M=320.0$ days, $SD=16.42$), the other half at the third assessment (T3) at 14 months ($N= 57$, $M=437.4$ days, $SD=9.59$). For the final assessment (T4), all remaining children were tested at 18 months ($N= 97$; $M=557.5$ days, $SD=35.78$). Parents gave written and informed consent. The study was approved by the local ethics committee.

Longitudinal procedure

At each visit, the experimenter explained the study procedure and had a brief warm-up period with the infants. Parents were reimbursed for their travel costs with 5 Euro and infants received a toy for their participation. Emotion simulation tasks were continuously tested at all four assessments and temperament was assessed by questionnaires. Maternal sensitivity was assessed at 6 and 18 months, infants' self-recognition at 18 months. Our study design followed a planned missingness design (PMD). In PMD, partial data is intentionally

collected only from a part of the sample. Without confounding the analysis result, PMD uses multiple imputation (MI) to deal with missing data points (Wu & Jia, 2021). For the first measurement points at 6 months and the last one at 18 months we collected data from all participants. Within the two middle measurement points, we randomly split the sample and tested half the children at 10 and the other at 14 months.

Measures

Children participated in two different distress simulation conditions, one relying on the mother and one relying on the experimenter. This design follows established procedures for the assessment of empathy in young children (for instance, Knafo et al., 2008; Zahn-Waxler et al., 1992). Additionally, we introduced a laughter condition as control condition. The two distress simulations were tested the same way on each measurement point. In a pilot study, we learned that authentic laughing was too difficult to simulate for many mothers. Thus, the laughing condition was only run with the experimenter as actor. As some children had to be excluded due to fussiness or experimenter error, see Table 1 for the specific number of children included in each task.

Experimenter's Distress Simulation.

The child sat on the mother's lap on the floor facing the experimenter, so that the possibility for approach behaviour was given. After securing child's attention, the experimenter pretended to retrieve something. Following Roth-Hanania et al. (2011), she bumped her foot in approximately 2 metres distance from the child and simulated pain for one minute. This simulation contained 30 seconds of whining and 30 seconds of whimpering and slowly calming down. Afterwards, the experimenter dissolved the simulation by turning to the child and smilingly telling them that she feels better now. During the simulation the experimenter avoided direct eye contact with the child, while the facial expression was clearly visible.

Maternal Distress Simulation.

The condition was constructed the same way as the distress simulation of the experiment, except that the child sat on the experimenter's lap. The mother was instructed to hit her finger with a building brick (following Roth-Hanania et al., 2011) and to show her pain in the same way the experimenter did approximately 20 minutes before. For standardized timing of the stimulation, the experimenter gave subtle time hints by harrumphing after 30 seconds and 60 seconds.

Experimenter's Laughing Simulation.

In the control condition, the setting was the same as in the experimenter's distress condition. The experimenter sat on the floor, pretended to read a funny book, and started to laugh out loudly and continuously for 60 seconds. Similar to the distress simulation, direct eye-contact was also avoided, and the facial expression was visible.

Coding Children's Responses.

Based on coding schemes of Zahn-Waxler and colleagues (1992) as well as Davidov and colleagues (2021) children's behaviour was coded for emotional, cognitive, and behavioural aspects of empathy on 4 point-scales (see below for overview), in which 0 represented the absence of the requested reaction. 25% of the sample at each time point were randomly chosen and coded by a second trained coder who was blind to the hypotheses of the study. The intraclass correlation coefficient (ICC) for all empathy scales at every time point ranged from .76 to 1.00 for the experimenter's crying simulation, from .77 to 1.00 for the maternal crying simulation and from .80 to .96 for the experimenter's laughing simulation.

Concern for victim. Children's affective concern was rated based on gestural, facial, and verbal expression. 0 indicated no other-oriented concern, 1 indicated slight concern (e.g. sad expression or brief vocalisation), 2 represented moderate concern (e.g. eyebrows or lips down, gestures towards the victim) and 3 (clearly sad but other-oriented facial expression combined with sympathetic vocalisation and gestures) great concern (Zahn-Waxler,

Robinson, et al., 1992) Based on the definition of empathy discussed above (Davis, 1983; Decety & Jackson, 2004; Decety & Svetlova, 2012;) and following the coding scheme of Zahn-Waxler (1992) and Davidov (2013), empathic concern was also coded 0, when the affective expression occurred simultaneously to crying due to self-distress.

Inquiry behaviour. Inquiry behaviour was coded based on children's attentional and cognitive reaction. 0 was defined as absent, 1 was given for quite simple inquiry behaviour (e.g., intense looking), whereas 2 represented a combination of vocal and non-vocal behaviour (e.g., a single vocalization with questioning intonation combined with intense looking). Children received a 3 for repeated, sophisticated attempts to understand the suffering of the victim (Zahn-Waxler et al., 1992).

Personal distress. Children with a 0 displayed no self-related distress, 1 was coded if the personal distress was expressed by non-vocal facial expressions or gestures (e.g., high body tension), 2 represented whimpering and 3 full blown crying.

Prosocial behaviour. Children with a 0 displayed no prosocial behaviour. Attempts of the child to console the victim were coded with 1 for a short, simple support (e.g. one pat), 2 for repeated or more long-lasting attempts to help (e.g. hugging for 3-5 seconds), whereas 3 represented ongoing support for more than 5 seconds (Zahn-Waxler et al., 1992)

Self-recognition. At 18 months, self-recognition was assessed using the well-established rouge paradigm (Amsterdam, 1972; Lewis et al., 1989). Mothers were asked to put a red dot on the nose of their child with a lipstick as unnoticeably as possible during their play. Subsequently, the experimenter moved the child in front of a big mirror and pointed on the reflection of the child asking, "Look at that! Who is that?" for three times. If children touched their nose within one minute, they received a score of 1, otherwise a 0 (Lewis et al., 1989). 30% of videos were coded by two different persons, which resulted in a Kappa of 0.83. Due to fussiness some children were not tested in this task ($n=24$).

Maternal Sensitivity.

Procedure. Mothers and infants were engaged in an 8 min video recorded free-play task with standardized, age-appropriate toys. They included plush toys, building blocks, rattles, and a glove puppet. Interactions were recorded on a 2x2m picnic blanket. This is comparable to other empirical studies that used the Emotional Availability (EA) - Scales to code parent-child interactions lasting between 5 to 15 minutes (for a review, see Biringen et al., 2014). Mothers were asked to play naturally with their infants while the experimenter left the room. The interaction was videotaped with two hand cameras. Due to fussiness, some children were not tested in this task ($n= 5$)

Coding. All videos were coded using the fourth edition of the Infancy/Early Childhood Version of the Emotional Availability Scales (Biringen, 2008). The EA scales are well-established and empirically validated (see Biringen et al., 2014) measures of adult-child relationship quality by using verbal and non-verbal indicators. The scale *sensitivity* is coded on a 7-point Likert Scale, in which the upper end scores represent an optimal level of sensitivity. 25% of the sample at each time point was coded by a second trained coder. Both coders were certified as reliable after completing the online training. Intra-class reliability coefficients (ICC) for the sensitivity-scale was .77.

Temperament.

Infants' emotional negativity was measured using the short version of the revised Infant Behaviour Questionnaire (IBQ-R-VsF) (Putnam et al., 2014, German translation by Kristen, Eisenbeis, Thoermer and Sodian (2007), shortened by Fuchs and Pillhofer (2013)). The IBQ-R is a parent report measuring temperament in infants from three months to one year of age. It assesses the frequency of several behaviours of the child in the previous week on a 7-point scale. The IBQ-R-VsF consists of 37 items, grouped into three dimensions: Positive Affectivity/Surgency (PAS), Orienting/Regulatory Capacity (ORC) and Negative Emotionality (NEG) (cfr. Rothbart and Bates (1998)). In our study, we used only the NEG-subscale, for which Cronbach's Alpha ranged from .72 and .88 (Putnam et al., 2014).

Data Analyses

In the present study, missing data was handled by multiple imputations (500 imputed data sets), using the mice package in R (van Buuren & Groothuis-Oudshoorn, 2011). Because of the sample size and power issues, data were imputed separately for each set of analyses.

For each scale representing children's responses (empathic concern, inquiry behaviour, prosocial, distress) four measurement points were available: at 6, 10, 14, and 18 months. To use the full potential of the longitudinal data set and to investigate the developmental changes and dynamics of children's responses, we applied True Intraindividual Change (TIC) Models (Steyer et al., 2000), relying on neighbor models for manifest variables. Thus, we specified a latent intercept depicting the children's time point 1 on the respective variable and a latent change variable. In all models, the precedent time point was used as reference category for change over time (neighbor models). All analyses were conducted using the Lavaan package in R (Rooseel, 2012). In a first step, we compared changes between experimental conditions (distress, laughter), testing hypothesis one. In a second step, we calculated whether the change in empathic concern – as the most central aspect of empathy- could be predicted by maternal sensitivity, negative emotionality, and self-recognition, testing hypothesis two. All tests were conducted two-sided with exception of the test on the impact of self-recognition as hypotheses on this factor were clearly directional. The data are available at [links follows].

Results

Descriptives

Table 1 depicts descriptive statistics of children's responses at each measurement point.

Table 1

APPENDICES

Means, standard deviations, and ranges of children's responses over all three conditions at the four different measurement points.

Age	Variables	1) Crying Mother	2) Crying Experimenter	3) Laughing Experimenter
		<i>M (SD)</i> [Range]	<i>M (SD)</i> [Range]	<i>M (SD)</i> [Range]
6 months 1) <i>n</i> =94 2) <i>n</i> = 106 3) <i>n</i> = 37	Concern	0.71 (0.52) [0-2]	0.32 (0.51) [0-2]	0.14 (0.35) [0-1]
	Inquiry	0.86 (0.38) [0-2]	0.90 (0.31) [0-1]	0.90 (0.31) [0-1]
	Prosocial	0.00 (0.00) [0-0]	0.00 (0.00) [0-0]	0.00 (0.00) [0-0]
	Distress	0.66 (1.06) [0-3]	0.25 (0.68) [0-3]	0.11 (0.39) [0-2]
10 months 1) <i>n</i> =51 2) <i>n</i> = 60 3) <i>n</i> = 53	Concern	0.47 (0.61) [0-2]	0.42 (0.50) [0-1]	0.23 (0.51) [0-2]
	Inquiry	1.02 (0.47) [0-2]	0.98 (0.40) [0-2]	1.19 (0.48) [0-3]
	Prosocial	0.35 (0.72) [0-3]	0.03 (0.26) [0-2]	0.02 (0.14) [0-1]
	Distress	0.82 (1.12) [0-3]	0.23 (0.62) [0-3]	0.17 (0.61) [0-3]
14 months 1) <i>n</i> =50 2) <i>n</i> = 57 3) <i>n</i> = 46	Concern	1.00 (0.81) [0-3]	0.95 (0.72) [0-2]	0.15 (0.42) [0-2]
	Inquiry	1.14 (0.57) [0-3]	1.18 (0.50) [0-3]	1.22 (0.76) [0-3]
	Prosocial	0.80 (0.99) [0-3]	0.09 (0.47) [0-3]	0.00 (0.00) [0-0]
	Distress	1.08 (1.24) [0-3]	0.61 (0.86) [0-3]	0.09 (0.46) [0-2]
18 months 1) <i>n</i> =87 2) <i>n</i> = 95 3) <i>n</i> = 84	Concern	1.15 (1.13) [0-3]	1.24 (1.07) [0-3]	0.07 (0.34) [0-2]
	Inquiry	1.47 (0.86) [0-3]	1.45 (0.77) [0-3]	1.04 (0.72) [0-3]
	Prosocial	0.71 (1.07) [0-3]	0.01 (0.10) [0-1]	0.13 (0.46) [0-2]

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Distress	0.63 (1.15) [0-3]	0.15 (0.53) [0-3]	0.07 (0.40) [0-3]
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Notes. n = number of children for each measurement time point, M = Mean, SD = Standard deviation, Score Range 0 – 3

For a zero-order correlational matrix of children’s reactions within one measurement point, see supplementals. There were significant associations between children’s responses predominantly in the maternal distress condition. Empathic concern and inquiry behaviour correlated from 10 months onward, yet only in the maternal distress condition. Table 2 shows the relation between children’s responses towards the crying experimenter and the crying mother. Most importantly, children’s responses towards the experimenter were unrelated with those towards the mothers until the age of 18 months. At 18 months, however, several indicators correlated significantly between the two conditions.

Table 2

Correlations between childrens’ responses towards the experimenter and towards the mother within each measurement points

Age	Concern	Inquiry	Distress	Prosocial
6 months	.13	-.10	.17	-
10 months	.09	.21	.14	.22
14 months	.08	.17	.26 ⁺	.04
18 months	.29**	.42**	.21*	.19 ⁺

Notes. ⁺p < 0.01, *p < 0.05, **p < 0.01.

Due to physical setup requirements, prosocial behaviour was not present at 6 months.

Change Models

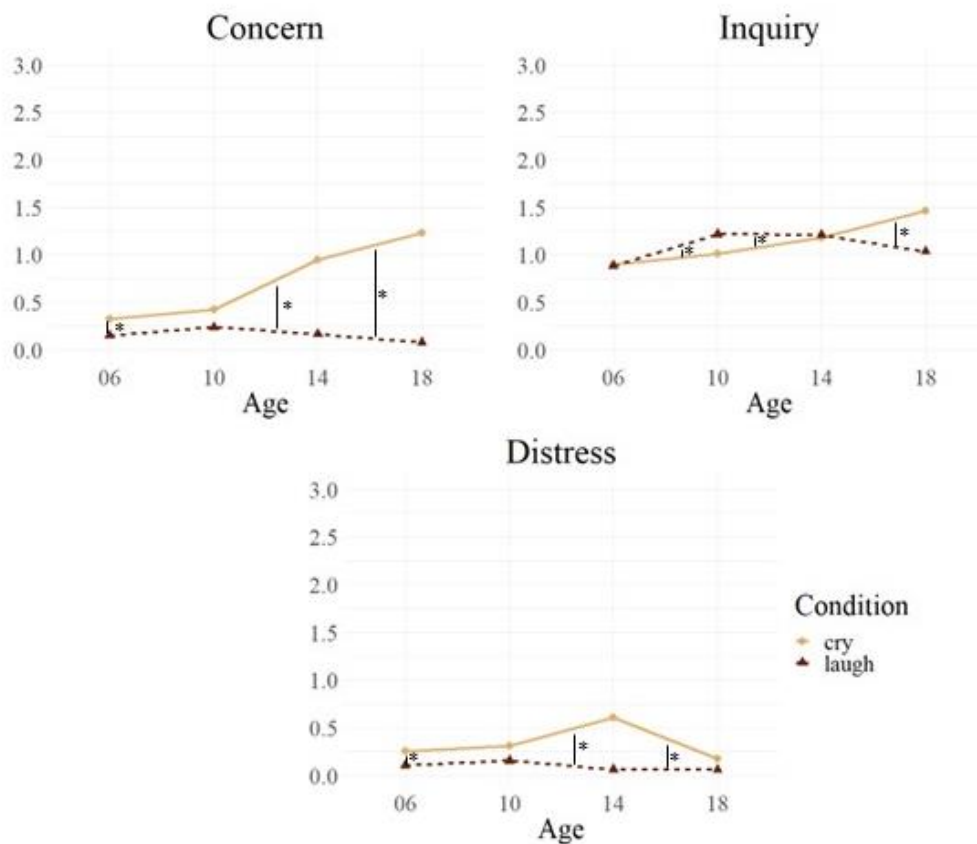
To test whether and when children’s responses towards the crying and the laughing experimenter differ, we specified separate change models for the different responses in both conditions. We compared changes relative to the preceding assessment within one condition. Beyond that, we compared the changes for each assessment also between conditions (see

Figure 1). Since prosocial behaviour could not be measured at 6 months (see Table 1) and variance was minimal at 10 months, this variable could not be included in these analyses.

Concern. At 6 months, concern was significantly higher in the crying condition than in the laughing condition ($\Delta_{\text{Mean}} = .17$, $s.e. = .05$, $z = 3.24$, $p < .01$). There was no significant difference in the change of concern at 10 months ($\Delta_{\text{Change}} = .01$, $s.e. = .09$, $z = 0.16$, $p = .87$). Afterwards, there were significant differences of the change between both conditions at 14 months ($\Delta_{\text{Change}} = .60$, $s.e. = .09$, $z = 6.59$, $p < .01$) and at 18 months ($\Delta_{\text{Change}} = 0.16$, $s.e. = .12$, $z = 3.13$, $p < .01$) (see Figure 1).

Figure 1

Changes over time in empathic concern, inquiry behaviour and distress compared between the laughing and crying condition



Notes. * marks a difference between both condition, respectively a significant change between two assessments within one condition.

In the crying condition empathic concern increased significantly from 10 to 14 months and from 14 to 18 months. Simultaneously, there were no significant increases in the laughing condition at any timepoint (see Table 3).

Inquiry. At 6 months, inquiry behaviour towards the laughing and the crying experimenter showed no statistically significant difference ($\Delta_{\text{Mean}} = .01$, $s.e. = .03$, $z = 0.46$, $p = .64$). At 10 months, children showed significantly more change in inquiry behaviour towards the laughing experimenter than towards the crying experimenter ($\Delta_{\text{Change}} = -.22$, $s.e. = .07$, $z = -3.36$, $p < .01$) There was also statistically significant difference at 14 months ($\Delta_{\text{Change}} = .18$, $s.e. = .07$, $z = 2.41$, $p = .02$), where children showed more change in the crying condition. At 18 months the inquiry behaviour was significantly higher in the crying condition ($\Delta_{\text{Change}} = .45$, $s.e. = .10$, $z = 4.55$, $p < .01$) (see Figure 1).

In the crying condition, inquiry behaviour increased continuously. In the laughing condition, children's inquiry behaviour only increased from 6 to 10 months and decreased from 14 to 18 months (see Table 3).

Distress. At 6 months, children showed more distress in the laughing condition than in crying condition ($\Delta_{\text{Mean}} = .15$, $s.e. = .06$, $z = -2.32$, $p = .02$). There was no statistically significant difference between the change in the crying and the laughing condition at 10 months ($\Delta_{\text{Change}} = -.05$, $s.e. = .09$, $z = -0.53$, $p = .60$), but distress at 14 months in the laughing condition dropped resulting in a significant difference of the change in distress between both simulations ($\Delta_{\text{Change}} = .39$, $s.e. = .09$, $z = 4.41$, $p < .01$) at that time. At 18 months, the distress in the crying condition dropped, but the difference in the change between both simulations was still statistically significant ($\Delta_{\text{Change}} = -.43$, $s.e. = .07$, $z = -6.36$, $p < .01$) (see Figure 1).

In the crying condition, distress significantly increased from 10 to 14 months and then significantly decreased from 14 to 18 months. Infants' distress level did not change in the laughing condition (see Table 3).

Table 3

Estimates of the changes over the different assessments for the laughing and crying simulation of the experimenter

Notes. M= latent means score of the intercepts and change variables, s.e. = Standard Error, z = z-Value

	Change	Laughing Experimenter				Crying Experimenter			
		M	s.e.	z	p	M	s.e.	z	p
Concern	6 months	.15	0.03	4.70	.00	.32	0.05	7.14	.00
	6-10 months	.09	0.06	1.58	.11	.10	0.06	1.70	.09
	10-14 months	-.08	0.05	-1.41	.16	.52	0.08	6.72	.00
	14-18 months	-.09	0.04	-2.07	.04	.28	0.11	2.64	.01
Inquiry	6 months	.90	0.03	31.00	.00	.90	0.03	33.36	.00
	6-10 months	.33	0.06	5.63	.00	.11	0.06	2.00	.05
	10-14 months	-.01	0.07	-0.11	.91	.17	0.06	2.91	.00
	14-18 months	-.17	0.08	-2.26	.02	.28	0.08	3.47	.00
Distress	6 months	.11	0.03	3.22	.00	.25	0.06	4.21	.00
	6-10 months	.06	0.06	0.89	.37	.00	0.08	0.05	.96
	10-14 months	-.09	0.06	-1.61	.11	.29	0.08	3.73	.00
	14-18 months	-.00	0.05	-0.02	.99	-.43	0.08	-5.70	.00

Prediction of Developmental Changes

As a second step, we tested which predictors at which developmental timepoint related to children's responses. For this analysis, the change in empathic concern served as dependent variable, maternal sensitivity served as one predictor, child's negativity served as second predictor, and the interaction of those both variables as third predictor. For each time point apart from T1, we used the negativity measure from the respective previous time point as a predictor. For T1, we had to use the negativity measure from the same timepoint, therefore resulting in a correlative predictor only. Mother's educational degree and child's

gender were entered as control variables (see Table in supplementals). In a following step, we analyzed self-recognition as a predictor on empathic concern at 18 months.

Maternal Sensitivity.

Maternal sensitivity positively predicted the change of empathic concern towards the experimenter from 10 to 14 months ($\beta = .25$, $s.e. = .06$, $z = 4.09$, $p < .01$)

Negative Emotionality.

Children's negative emotionality showed a tendency to predict the change of empathic concern towards the experimenter from 14 to 18 months positively ($\beta = .27$, $s.e. = .14$, $z = 1.91$, $p = .05$): Children with more negativity would develop more empathic concern towards the experimenter from 14 to 18 months. There was no such effect on empathic concern towards the mother from 14 to 18 months ($\beta = -.09$, $s.e. = .27$, $z = -.33$, $p = .74$) or on earlier indicators of developmental change ($p > .05$, see Table in supplementals).

Interestingly, the interaction between maternal sensitivity and child's negativity negatively predicted the change in empathic concern towards the experimenter ($\beta = -.33$, $s.e. = 0.11$, $z = -2.86$, $p < .01$) and towards the mother ($\beta = -.28$, $s.e. = 0.11$, $z = -2.62$, $p < .01$) from 14 to 18 months. Thus, children with higher negativity and more sensitive mothers showed less increase in empathic concern

Self-recognition.

This analysis explored whether self-recognition relates to empathic concern. Therefore, we analyzed if self-recognition at 18 months is linked to empathic concern with simple regressions. Self-recognition did not predict empathic concern towards the experimenter ($\beta = -.04$, $s.e. = .05$, $z = -.85$, $p = .20$) but positively predicted empathic concern towards the mother ($\beta = .37$, $s.e. = .20$, $z = 1.86$, $p = .03$). Note that this effect turns non-significant when using two-sided tests.

Discussion

Developmental science has a longstanding interest in exploring how empathic concern for others emerges in human ontogeny. Yet, its early origins are debated. This study investigated the ontogenetic emergence of empathic concern and the psychological processes that contribute to its developmental growth over the first two years.

Influential theories hypothesized that empathy emerges within the second year of life (e.g., Bischof-Köhler, 2012; Hoffman, 2000). On the other hand, recent theorizing assumes the existence of an early onset of concern for others, and therefore hypothesized the existence of empathic concern early within the first year of life (Davidov et al., 2013). The first line of theorizing also proposed an impact of explicit self-other differentiation on the development of empathy for others (Hoffman, 2000). Yet, there is little systematic longitudinal work examining these hypotheses in the same design. Furthermore, empirical evidence on this important question lacks systematic controls and remained inconclusive. The current study aimed at closing this gap by assessing empathic responses to different emotional stimuli, including a pain simulation and a laughing simulation, in 6- to 18-month-old infants. Moreover, in order to explain development in children's empathic concern, we assessed maternal sensitivity and children's emotional negativity as central predictors. Taken together, the study aimed at providing a comprehensive assessment of the early emergence of empathy in human ontogeny. Overall, several findings are noteworthy and will be discussed in the following sections.

Ontogenetic emergence of empathy

We investigated when children begin to show empathy by comparing their reactions towards a crying and a laughing person. Based on developmental theorizing (e.g., Bischof-Köhler, 2012; Hoffman, 2000) we expected to observe clear differences between those two situations within the second year of life. Indeed, the results show clear differences between the two emotional contexts for empathic concern and inquiry behaviour at 18 months. Furthermore, a closer inspection on younger children's responses revealed that there was no

consistent pattern at 6 and 10 months rendering it unlikely that infants in their first year of life display true empathic concern for others. In the following, the central findings on the three empathy related behaviours (empathic concern, inquiry behaviour, and no self-distress) will be discussed.

As the most central aspect of empathy development, we assessed infants' empathic concern. A first analysis showed a difference in empathic concern between crying and laughing at 6 months onwards. At first sight, this seems to be in line with proposals of an early emerging empathic ability (Davidov et al., 2013). Yet, a closer inspection indicates that differences between conditions were subtle and at a low level of the scale that comprises rather weak and ambiguous movements in the brows and in the mouth area. We decided to rely on this scale in order to keep our results comparable to previous infant studies. However, without further indicators of true empathic concern, this is one of many possible interpretations of these subtle cues. Alternatively, these behavioral reactions could indicate a surprise reaction (see Reizenstein et al., 2013), stress signals in an unfamiliar situation, or emotional contagion (Hoffman, 2000). Interestingly, analyses also indicated that at 6 months, there was a significant correlation between the empathic concern scale and self-distress for both, the mother and the experimenter. This relation was absent at older ages. The overlap is suggestive that the subtle cues might not indicate true empathic concern at this young age, but rather an unspecific reaction.

Interestingly, empathic concern showed a pronounced developmental growth over the successive months. Moreover, the difference in infants' reactions towards these the different emotional scenarios become more pronounced and reliable. Thus, empathic concern towards suffering people emerges as a specific and sophisticated response over the first two years of life. This general pattern seems to be in line with theories proposing empathic concern to emerge in the course of early development (e.g., Bischof-Köhler, 2012; Hoffman, 2000), while it also seems to indicate a rather linear growth than a sudden onset.

As second indicator of empathy development, we analysed inquiry behaviour. Interestingly, children showed more inquiry behaviour in the laughing condition at 10 months. The expected difference in inquiry behavior with a more pronounced occurrence when confronted with crying than with laughing others was found at 18 months. The early effect might reflect a general attentional focus on emotional and interesting situations. At 18 months, inquiry behavior – often also interpreted as cognitive empathy – was specific for the crying condition, supporting theoretical approaches that true empathy emerges in the course of the second year of life.

As third variable of interest, we analysed self-distress. Both emotional conditions elicited a certain amount of stress in the children. However, only in the crying condition children showed a change pattern that relates well to theories on emotional contagion in the first year. While we saw no increase of distress for laughter, the distress for crying increased at 14 months and decreased at 18 months. This is in line with theories about emotional contagion as a basis for the development of empathic concern (Eisenberg, 2000; Hoffman, 2000; Panfile & Liable, 2012).

Taken together, while there were subtle indicators of empathy related behaviour in both conditions before the second year of life, there overall pattern was inconsistent and the reactions were subtle and unspecific. One could argue that these findings open a third perspective between recent (Davidov et al., 2013) and classical (Hoffman, 2000) theories on the emergence of empathy. Following Davidov et al. (2013), it is important to note that some kind of interpersonal reactivity to others' distress exist even in the first year of life. Yet, those indicators should not be interpreted as representing true empathic concern. Instead, it's more reasonable to see them as precursors (e.g., interpersonal reactivity) that might support the emergence of emotional contagion (as found in our study by around 10-14 months) and true empathic concern (as evident by 14-18 months).

This study demonstrates how a specific response to others' suffering rather than an unspecific response to others' emotions emerges in the course of infancy. It extends previous work that has focused on older children (Moreno et al., 2008; Wagers & Kiel, 2019; Zhai et al., 2020) and/or mainly compared children's reactions to a suffering other with a neutral condition (Davidov et al, 2021). Our study supports a developmental approach according to which empathic concern is not a given prerequisite of human prosocial development, but itself the result of developmental processes (e.g., Brownell, 2013; Hoffman, 2000; Paulus & Moore, 2012).

Notably, we found correlations between empathic responses towards the mother and the experimenter only at 18 months. As empathy is by definition not a sensitive reaction towards one familiar person but a general ability, this behaviour should occur with different people. The present finding of a general response tendency across different persons is line with Hoffman's (2000) theory and extends previous research (Robinson et al., 2001; Zahn-Waxler et al., 1992). However, Nichols and colleagues (2009) found a relation of empathic responses towards peer distress and mother's distress already at 12 months. Yet, in this setup children were not directly presented with a distressed peer but only with recordings of crying sounds. It thus remains unclear whether to interpret this as a person-specific response. The current study, in contrast, directly compared children's reactions towards two different people.

Finally, our analysis revealed that self-recognition showed relations with the level of empathic concern towards the mother at 18 months. Interestingly, self-recognition only affected empathic concern towards the mother, not towards the experimenter. One could speculate that it might be more difficult for infants to differentiate themselves from the mother as a very close and familiar person. Indeed, research on self-development showed that infants are more sensitive to bodily overlap with their mother than with strangers (Maister et al., 2020). We leave it to future research to explore this possibility in greater detail.

In a nutshell, our findings support the assumptions of developmental theories (e.g., Bischof-Köhler, 2012; Hoffman, 2000) that empathy arises within the second year of life. Subtle responses to emotionally aroused others before the second year of life are not sophisticated and distinct enough to label them as empathy. In Hoffman's theory, empathy-related reactions of children in the first year are described as 'egocentric empathic distress'. This behavior does not fulfil the criterion of 'other oriented focus' that is key for true empathic concern. Indeed, this description fits well to the finding that the coding of empathic concern correlated with infants' own distress.

Predictors of early empathy development

In order to analyse the early influences on the development of children's empathic concern, we investigated if and when maternal sensitivity and emotional negativity act as predictors of this empathy development.

Maternal Sensitivity.

Following attachment theoretical considerations, we hypothesized maternal sensitivity to support the development of empathic concern. Regression analyses revealed that maternal sensitivity was positively related to the growth of empathic concern in the second year of life. Our results contribute to a clearer picture of when caregiving behavior affects children's empathy development. This relates well to findings by Spinrad and Stifter (2006) who reported that maternal sensitivity measured at 10 months influenced their children's concerned attention at 18 months. Furthermore, other studies found an influence of maternal sensitivity on children's empathic responses towards the end of the second year of life (Kiang et al., 2004) or at 3 years of age (Panfile & Laible, 2012). Our result support the assumptions that the way of how children experience sensitivity towards their own needs influences their own empathic concern towards other. Thereby, the sensitive behaviour of the mother can serve as an role model for children. The finding that maternal sensitivity did

not relate to young children's reactions towards suffering others further supports the view that young infants' behavior in these tasks should be interpreted with caution.

Negative emotionality.

Following Kochanska (1997), we hypothesized children's negative emotionality to negatively influence their empathy development. In fact, our data revealed the opposite. Surprisingly, higher negative emotionality showed a tendency of more increase in empathic concern from 14 to 18 months. Before that age negative emotionality had no effect on empathy development. Notably, our findings relate well to previous work by Spinrad and Stifter (2006), who showed that infant fear predicted higher concerned awareness in 18-month-olds, as well as by Abramson et al. (2019), who showed that negative reactivity at 9 months predicted empathy at 18 months. Our findings extend these results by a stronger developmental perspective. How to explain this effect? It has been suggested (Edwards, 2015; Spinrad & Stifter, 2006), that children who often experience negative emotions might be able to better recognize them in others. At the same time, Abramson and colleagues (2019) pointed out that sufficient self-regulation abilities were crucial for children high in negative emotionality to be able to show empathic behaviour. Yet, our study presents inconsistent findings here. Sensitivity negatively influenced the effect of negative emotionality on empathic concern. Children high in negative emotionality developed less empathic concern from 14 to 18 months in both situations when they had more sensitive mothers. Concerning the maternal crying condition, children with higher negativity and more sensitive mothers showed a higher increase in empathic concern from 6 to 10 months. Eisenberg (2000) argues that in order to allocate mental and emotional resources to someone else's affective state, children must first be able to manage their own emotions. It might be the case that emotionally more negative children need their sensitive mothers at this timepoint to regulate their own emotions and profit from the role model function for reacting

on others negative emotions only later in development. It would be interesting to explore this issue in a more comprehensive and longer lasting longitudinal study.

Limitations and future directions

While our study entered novel grounds by adding a laughing control condition to the assessment of infants' empathy development, future studies could add further non-emotional, but facial control stimuli to better pinpoint the situational characteristics that lead infants to show the empathy-related behavior. Thereby, one could differentiate purely attentional reactions towards socially interesting stimuli and stress-related responses even better. Finding appropriate stimuli for comparison is a challenging task that needs to be targeted in future research.

Future studies could complement our approach by employing additional physiological measures. Measures of emotional arousal and self-distress through heartbeat could extend the previous work based on behavioural measures. For example, previous studies showed that unsecure-avoidantly attached children express weaker stress signals in stressful conditions related to attachment. However, when applying psychophysiological measures, especially those children showed clear stress symptoms (Zelenko et al., 2005). It would be interesting to explore whether this pattern might also occur in emotional challenging situations in which another person is in pain. Self-distress measured only based on video codings might miss out the self-distress of children who do not show these signs of stress on the outside. This would allow us to obtain a deeper understanding of the interrelation between self-distress, emotion regulation, and empathy development.

As with most research in this field, the exclusive focus on mothers' influence is a limitation of this study. Despite the predominant role of mothers as primary caregiver in our society, children grow up in a whole system of potential social influences. If empathy emerges out of infants' experienced social interactions with significant others (Hoffman, 2000), future research needs to investigate social influences other than only mothers. This

consideration supports a need for more research on the influence of fathers, siblings, or childcare on empathy development of children. While there is some research with preschool children (e.g., Ferreira et al., 2016; Kienbaum, 2001), nothing is known on whether and/or how these persons support the early emergence of empathy in infancy.

Conclusion

Taken together, our results only showed minor differences in children's responses to laughing and crying persons before the second year of life. Due to the low subtle and unspecific nature as well as their inconsistent appearance, we do not interpret these reactions as empathic responses, but rather as precursors of early empathy development. Furthermore, for the first time investigating the developmental growth of empathic concern, our study revealed consistent impact of maternal sensitivity and emotional negativity on the unfolding developmental dynamics of early empathy. Our findings provide novel evidence that empathy development is related to explicit self-other differentiation, maternal influence, and temperamental characteristics in the second year of life.

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Becher, T., Essler, S., Pletti, C., & Paulus, M. (2023). Compliance or empathy – what links maternal sensitivity and toddlers’ emotional helping? *Journal of Experimental Child Psychology*, 226, 105547. <https://doi.org/10.1016/j.jecp.2022.105547>



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Journal of Experimental Child Psychology

journal homepage: www.elsevier.com/locate/jecp



Compliance or empathy—What links maternal sensitivity and toddlers' emotional helping?



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ARTICLE INFO

Article history:

Received 6 November 2021

Revised 25 August 2022

Keywords:

Prosocial behavior

Empathy

Compliance

Maternal sensitivity

Helping

Prosociality

ABSTRACT

Emotional helping—that is, helping based on others' emotional distress—has been suggested to be a central prosocial response to others in need. Developmental theorizing proposed that emotional helping has social origins. Whereas research indeed demonstrated a link between maternal sensitivity and children's emotional helping, developmental theories stress different mediating processes. Emotion-sharing theories claim empathic concern to be the crucial link for helping, whereas internalization theories base children's helping on children's compliance. To investigate these hypotheses, the current study explored empathy and compliance as two possible mediators for the relation between maternal sensitivity and children's emotional helping at 18 months of age. Overall, maternal sensitivity was positively related to children's empathy, children's compliance, and children's emotional helping. Interestingly, children's empathy—but not children's compliance—mediated the link between maternal sensitivity and children's emotional helping. These findings deepen our understanding of the psychological processes subserving emotional helping during infancy and support theories that stress the socioemotional origins of children's prosocial behavior.

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Introduction

The development of prosocial behavior plays a central role in children's social functioning. Prosocial behavior is positively linked to higher peer status (Warden & Mackinnon, 2003) and higher academic achievements (Gerbino et al., 2018). It is described as behavior benefiting others without receiving an immediate pay-off (Eisenberg et al., 2015; Paulus, 2014). Notably, early prosocial behavior is a multifaceted construct with different social-cognitive demands and motives (Paulus, 2018). It has often been subdivided into helping, sharing, and comforting (Beier & Dunfield, 2018; Dunfield, 2014). One intensely investigated type concerns emotional helping (Aitken et al., 2020; Svetlova et al., 2010), that is, providing help to others to alleviate a negative emotional state (Svetlova et al., 2010).

In comparison with helping action-related instrumental contexts, emotional helping or empathic helping thus constitutes an interesting intersection of helping and comforting. Following Svetlova and colleagues (2010), it can be described as helping in emotional situations where a person needs an object to alleviate a negative emotion (p. 1817). We refer to this behavior as emotional helping. Note that other parts of the literature used the label "empathic helping" for similar tasks (Drummond et al., 2014; Svetlova et al., 2010). Yet, this wording implies a priori that empathy is the main driver of this kind of behavior. However, as will be argued here in the Introduction, this cannot be taken for granted given the role that compliance could also play. The term "emotional helping" is less biased because it refers to the task's characteristics (the experimenter displaying emotions) and not to the potential underlying mechanism. For instance, handing a beloved teddy bear to a crying child is a form of emotional helping: Through the provided help, the child's negative emotional state gets regulated. Because emotional helping requires consideration of one's emotional state (Aitken et al., 2020), it has been regarded as a prosocial response based on other-oriented concern (Svetlova et al., 2010) requiring a certain level of social understanding. This might explain why emotional helping develops later than instrumental helping (e.g., helping someone to achieve an action-based goal such as searching for something) within the second year of life (Hammond & Brownell, 2018; Malti & Dys, 2018; Waugh & Brownell, 2017). In their study, Svetlova and colleagues (2010) contrasted instrumental helping and emotional helping. In both tasks, the latter sequence of the chain of events was the same; however, they differed in their initial part. Instrumental helping started with an interaction with an object and involved unsuccessful attempts by the experimenter, who was not able to complete the action. On the other hand, emotional helping started with an emotion expressing an need followed by the same help-seeking cues as in the instrumental condition. Therefore, an emotional helping task can be seen as a hybrid of comforting task and instrumental helping task. In the referred study, Svetlova and colleagues (2010) showed that both 18- and 30-month-olds readily helped in an instrumental helping task, whereas the performance of the 18-month-olds was lower in an emotional helping task than in the instrumental helping task.

Although we possess considerable knowledge on the developmental timeline of emotional helping, the developmental origin of emotional helping as well as the underlying mechanisms are still a matter of debate. Influential developmental theories have proposed a strong social influence on the development of prosociality (Brownell, 2016). Most interesting for our research question, children's emotional helping has been linked to maternal sensitivity (e.g., Newton et al., 2014), but it remains unclear how maternal sensitivity influences children's emotional helping exactly. In the following, the general social origin of prosocial behavior and two possible mechanisms linking maternal sensitivity and emotional helping are presented.

Social origins

Whereas prosocial behavior is of great interest in developmental research, the specific role of single mechanisms and motives that prompt the emergence of prosociality during infancy are intensely discussed (Brownell, 2013; Hammond & Drummond, 2019; Paulus, 2014). Notably, influential theories have highlighted the role of social influences in the emergence of prosocial behavior (Brownell, 2016; Dahl & Brownell, 2019). In particular, these theories suggest that prosociality emerges out of

infants' shared activities and relationships with others (Dahl & Brownell, 2019; Hammond & Carpendale, 2015); through experiencing prosocial responses from their socioemotional environment toward themselves or toward other persons, infants can gradually form own prosocial motives and behavior (Brownell, 2013, 2016; Schuhmacher et al., 2017). It has been proposed that in this context, one important parental characteristic is sensitivity (Deneault & Hammond, 2021; Newton et al., 2016). Ainsworth and colleagues (1978) originally defined sensitivity as the ability to perceive and accurately interpret children's signals and respond appropriately to them. Later, this construct was complemented by different researchers by the aspect of emotional warmth (e.g., Biringen et al., 2014; Mesman & Emmen, 2013). Based on Biringen and colleagues' (2014) definition, a sensitive mother understands and reacts to the needs and intentions of her child correctly while being emotionally warm toward her child. Parents who provide emotional support and are responsive to their children's needs support their children in developing the ability to help others. This is shown through positive mental representations in their children (also known as "internal working models" in attachment theory) (Dahl & Brownell, 2019). Although the link among sensitivity, parental responsiveness, and emotional helping is well established (Blandon & Scrimgeour, 2015; Davidov & Grusec, 2006; Gross et al., 2017; Kienbaum et al., 2019), the underlying mechanism remains open (for review, see Paulus, 2014). Some theories consider empathy as the driving mechanism between experiencing maternal sensitivity and helping others (Eisenberg & Miller, 1987; Hoffman, 2000), whereas others claim socialization of norms to be fundamental (Kochanska et al., 2005). We present both accounts in the following paragraphs.

Emotion-sharing theories

Emotion-sharing theories (e.g., Batson, 2011; Eisenberg, 1986) claim that people are motivated to act prosocially through empathy. Accordingly, children help because they empathize with the suffering person. Empathy is defined as the capability to recognize and share others' emotions while maintaining an other-oriented focus (Davis, 1983; Decety & Jackson, 2004). By definition, prosocial behavior or emotional helping is not the same as empathy but is one possible result thereof. Indeed, several findings have shown that empathy relates positively to prosocial behavior (Decety et al., 2016; Hay et al., 1999; Spinrad & Gal, 2018; Van Lange, 2008). Within the second year of life, infants begin to empathize with a distressed person and try to comfort the person. For instance, Zahn-Waxler and colleagues (1992) used different stress simulation situations with 18-, 21-, and 24-month-olds. The data indicated that children showed rising empathic concern within the second year of life. Furthermore, research showed that it plays a key role in prosocial behavior of toddlers (Young et al., 1999) and older children (Malti et al., 2009). So, if a child sees someone suffering, a prosocial act can be the result of the evoked empathy. The definition also implies that empathy does not necessarily lead to prosocial behavior.

Hoffman (2000) claimed that the development of empathy is supported by parental behavior. A wealth of research indicates that caregivers' sensitive reactions toward their children's needs indeed foster children's ability to show empathic behavior (see Stern & Cassidy, 2018, for a review). Similar results have been obtained when studying the impact of child-care teachers on child sympathy (Kienbaum et al., 2001). Nevertheless, especially maternal sensitivity and warmth have been shown to influence children's empathic behavior (Eisenberg et al., 1996; Kiang et al., 2004; Kochanska, 1997; Spinrad & Gal, 2018; Spinrad & Stifter, 2006; Zahn-Waxler & Radke-Yarrow, 1990). Hereby, caregivers provide support for the growth of children's emotional self-regulation capabilities, which enhances their capacity to react on the other's need (Thompson, 2019). Moreover, children actively draw on their parents to support prosocial interventions (Paulus et al., 2017). Parental demonstration of empathic behavior such as need-oriented sensitive behavior can act as a model for their children. To help adequately, it is not enough for one to know that children should help somebody. Children also must understand the emotional needs of the suffering person (Eggum et al., 2011), which can be promoted by caregivers' sensitivity toward children's needs. Whereas relations between maternal sensitivity and children's empathy and between empathy and prosocial behavior are well established (e.g., Abramson et al., 2019; Panfile & Laible, 2012), there are only a few studies combining both lines of research. Specifically, based on emotion-sharing theories and attachment theory (Beier et al., 2019;

Deneault & Hammond, 2021; Gross et al., 2017; Stern & Cassidy, 2018), one would expect empathy to be the underlying psychological mechanism connecting parental sensitivity to children's emotional helping behavior. For instance, Panfile and Laible (2012) found a positive relation of secure attachment and empathy through the meditation of emotion regulation in 3-year-olds, assessed mainly by questionnaires. Reported empathy predicted observed prosocial behavior. Accordingly, if experiencing maternal sensitivity leads to a greater empathic reaction when seeing others in need, children should then act more prosocially toward others by helping them.

Internalization theory

However, not all the possible motivations for behaving prosocially must be other-oriented. Prosocial behavior can also be driven by self-oriented objectives such as concrete rewards, social approval, and reciprocal prosocial responding (Eisenberg, 2005). Consequently, prosocial acts do not need to be based on empathy. Prosocial acts can also be the result of compliance with others' request as people follow what they think they should do. Emotion-sharing theories and internalization and conscience models stress the role of the social environment in fostering and supporting the emergence of prosocial behavior. Yet, they conceive this role very differently. These models specifically focus on the acquisition of rules and social norms in social interactions and how they relate to the development of prosocial behavior (Dahl & Paulus, 2019; Kochanska, 1997).

Importantly, previous research has demonstrated that early instances of prosocial behavior are connected to an explicit verbal or nonverbal request from another person (e.g., Dunfield et al., 2011; Nichols et al., 2009). That is, infants' prosocial behavior in some cases might be based on compliance with an explicit request for help. For example, in the study by Dunfield and colleagues (2011), 18- and 24-month-old infants engaged in more helping and sharing behavior when the adult experimenter reached toward a toy that fell off a table (in the helping context) or showed an outstretched arm with the palm facing upward (in the sharing context). These findings highlight that early prosocial behavior may rely on young children's correct interpretation of verbal and nonverbal prompts from the social environment. This perspective connects well to recent work demonstrating longitudinal relations between the understanding and production of giving gestures (a relevant component of prosocial acts) during early development (Juvrud et al., 2019). Thus, the degree to which young children comply with cues from their social environment might be one factor explaining early prosocial behavior.

In line with this assumption, Kochanska and colleagues (2005) showed that early mother-child positive interactions within the first 2 years of life positively influenced children's moral behavior (including prosocial acts) at 56 months. This path was mediated by children's committed compliance at 33 months. These results indicate a relation between children's compliance as a tendency to respond to environmental cues and their later moral and prosocial behavior. Taken together, parental sensitivity can be hypothesized to positively predict children's level of compliance, which can be hypothesized to positively relate to children's early prosocial behavior. Examining this alternative mediation mechanism prompting children's prosocial behavior was one goal of the current study.

The current study

Based on these different theoretical views on the role of social processes in the emergence of prosocial behavior, the question arises whether maternal sensitivity and children's emotional helping are linked through either children's compliance or children's empathy. Internalization theories suggest parenting behavior's influence on emotional helping through compliance (Kochanska, 1997), whereas emotion-sharing theories propose enhanced emotional helping through empathy in children (Hoffman, 2000). So far, different studies have focused on only one of these possible mechanisms. Both views can cite empirical support; however, the studies are not directly comparable due to methodological differences. To our knowledge, there is no study that took both aspects into account to directly compare central assumptions of both theoretical perspectives. A strong empirical test of theories would require assessing their predictions in the same study.

Our study contrasted the role of empathic concern and compliance in infants' emotional helping. We assessed infants at 18 months of age, when emotional helping (Svetlova et al., 2010) and empathy (Zahn-Waxler et al., 1992) have been shown to emerge and children's compliance becomes increasingly expected by infants' environment (Daniel et al., 2016). The current study combined two hitherto separated lines of research by directly examining the psychological processes that relate maternal sensitivity to infant emotional helping. The emotional helping task deliberately includes explicit requests. It represents a characteristic prosocial context in which helping behavior might stem from compliance as well as from empathic concern. Therefore, we assessed maternal sensitivity, emotional helping, and both children's compliance and empathy at 18 months of age. All measures were obtained from established behavioral tasks. Because we aimed to test the effect of these two mediators (compliance and empathy) separately, each needed to be assessed in separate tasks specifically designed to measure them independently. So, we measured compliance in a task where no emotional reactions were present and we measured empathy in a task where no explicit request was present. Furthermore, to ensure no bias with respect to the criterion, we conducted both of them in independent tasks from the outcome variable.

Based on theoretical considerations on social origins of prosociality (Brownell, 2016), we expected sensitive mothers to have children who show more emotional helping behavior. Attachment theoretical considerations (e.g., Gross et al., 2017) and emotion-sharing theories (Batson, 2011; Eisenberg, 1986) would predict children of sensitive mothers to be more empathic and thereby show emotional helping behavior better (Mediation Effect 1). In contrast, internalization theory (Kochanska, 1997) would predict children of sensitive mothers to be more compliant and thereby show better emotional helping behavior (Mediation Effect 2). Our study aimed to contribute to the field by empirically contrasting these two theories on the social basis of early prosocial behavior.

Method

Participants

The final sample contained 97 mothers and their 18-month-old infants ($M_{\text{age}} = 561.65$ days, $SD = 9.94$; 47 female). The reported data were derived from a larger ongoing longitudinal research project and were taken from one measurement point. Mothers and their full-term born infants were recruited from birth records in a large city in Western Europe. Families were of mostly middle to high socioeconomic status (63.92 % held a university degree, 13.40 % finished technical college, and 11.34 % completed vocational training), and most children were Caucasian. The study was approved by the local ethical committee, and the parents provided informed consent. At each visit, parents were reimbursed for their travel costs and infants received a toy.

Procedure

The children were tested on two separated sessions at 18 months of age. On average, the second session took place after 9.28 days ($SD = 9.16$). All predictor variables were tested in the first session, whereas the outcome variable was measured in the second session.

Measures

Emotional helping

The emotional helping task was adapted from Svetlova and colleagues (2010). In this task, children could alleviate the experimenter's distress by bringing a targeted object. Three different negative internal states (frustration, freezing, and sadness) were shown in three emotion-matching conditions. In the familiarization phase, the experimenter presented three objects (hairclip, scarf, and toy owl) to the child and explained their benefit (see below). Then, the experimenter placed the objects on a spot for the child to reach and not close to the experimenter. In the test phase, the experimenter sent increasingly obvious cues indicating her need of the object. In the first trial, the experimenter needed

the hairclip because she had her hair hanging on her face and was not able to see. Unsuccessfully, she tried to move her hair away and expressed her frustration. In the second trial, the experimenter needed the scarf because she was suddenly freezing. She chattered her teeth and rubbed her arms and expressed her freezing. Lastly, the experimenter needed her favorite toy owl because she was sad. After receiving a call, she whimpered with a sad facial expression and expressed her distress. The experimenter sent increasingly explicit cues every 5 s starting from a simple bodily expression of her internal state (e.g., whimpering), to verbalization (e.g., "I'm so sad"), to verbal expression of need (e.g., "I need something to comfort") and verbal expression of needed object (e.g., "I need my favorite toy owl"). These cues were followed by looking back and forth from the child to the object, pointing to the needed object, a general helping request ("[Child's name], can you help me?"), and finally the explicit request of bringing the object ("[Child's name], can you bring me my favorite toy owl?"), respectively. When the child brought the targeted object, the experimenter showed relief of the internal state but never thanked the child explicitly so as to not reinforce helping behavior in the following trials. If the child did not bring the targeted object after the last cue, the experimenter got up and took the object herself and showed the same relief.

Based on Svetlova and colleagues (2010), toddlers' emotional helping behavior toward the experimenter was coded in relation to the increasingly explicit communicative cues in each trial. If children brought the targeted object after the first cue, they received an 8. Children received a 1 if they brought the targeted object after the last cue. Those who did not bring any object or brought the wrong object to the experimenter received a 0. In the end, a mean was calculated over the three trials. Children's data were excluded if the mother interfered ($n = 8$). Data of another 16 children were missing because they did not participate in this task. The videos were coded by two raters. The second rater coded 30 % of the sample, resulting in an unweighted intraclass correlation coefficient (ICC) of .99 for toddlers' emotional helping behavior.

Maternal sensitivity

Mothers and infants were engaged in an 18-min video-recorded free-play task with age-appropriate toys such as plush toys, building blocks, and puzzles. Mothers were asked to interact as naturally as possible with their infants while two hand cameras filmed their interaction in the surrounding playpen. During this time, the experimenter waited outside the room.

Maternal sensitivity was assessed with the Emotional Availability Scales (EAS; [Biringen, 2008](#)), a well-established and empirically validated measure of adult-child relationship quality ([Biringen et al., 2014](#), [Biringen & Easterbrooks, 2012](#)). Maternal sensitivity focuses on emotional warmth and appropriate responsiveness to children's cues using verbal and nonverbal indicators. Coding was based on the 18-min dyadic interactions and was rated on a scale of 1–7, where 7 represents an optimal level of sensitivity. Thus, an optimal sensitive mother shows awareness to her child's signals and reacts appropriately to them, for instance, with comforting to stress signals. Furthermore, she interacts with her child with a genuine affect expressed, for instance, by eye contact and smiling.

One fourth (25 %) of the sample was coded by a second trained coder. Both coders were certified as reliable after successfully completing training. ICCs resulted in .89. In this task, data collection of 2 children from the initial sample was not possible due to emotional fussiness.

Compliance

Based on [Kochanska \(2002\)](#), compliance with the mother was observed in a cleanup task. After a playing situation with a box of toys, mothers were instructed to ask their children to pick up the scattered toys from the floor and put them into the toy box within the next 5 min. Mothers were not allowed to put more than four toys into the box.

Scores indicated to which degree children followed maternal directives based on the adapted coding scheme from [Kochanska \(2002\)](#). After dividing the task into 30-s coding segments, children's predominant behavior was coded for each segment. Occasionally, children finished the task before the allotted time. Therefore, a general compliance score was created by dividing the coding for each segment by the number of coded segments.

Committed compliance (score of 3) was coded when the child eagerly put the toys in the box, collected the scattered toys spontaneously, or showed signs of joy (e.g., beaming, clapping) after putting

toys in the box. *Situational compliance* (score of 2) was coded when the child's attention quickly shifted away from the task and toward playing; the child cooperated only halfheartedly or as a straight response to a maternal directive. *Opposition* (score of 1) was coded as either passive noncompliance (child ignored maternal directives and continued to play), overt negotiation (child questioned or tried to negotiate maternal directives), or defiance (child directly challenged maternal directives or was reluctant). Again, 25 % of the sample was coded by a second rater, resulting in an interrater reliability of Cohen's kappa = .80. In this task, data collection of 12 children from the initial sample was not possible due to emotional fussiness.

Empathy

The child sat on the floor next to the mother facing the experimenter. Approximately 2 m (6.6 feet) away from the child, the experimenter pretended to bump her foot and feigned distress and pain for 1 min (the first 30 s whimpering extensively and the second 30 s whining moderately and slowly calming down). The facial expression was clearly visible to the child; however, the experimenter avoided making eye contact. In contrast to the emotional helping task, there was no direct addressing of the child or explicit request. At the end, the experimenter dissolved the situation by making eye contact with the child, smiling, and saying that she was feeling well again. Based on the coding scheme from Roth-Hanania and colleagues (2011), an adapted version of the well-established coding scheme of Zahn-Waxler and colleagues (1992), children's reactions were coded for affective (empathic concern) and cognitive (inquiry behavior) aspects of empathy on a 4-point scale. Again, 25 % of the sample was scored by a second trained coder, resulting in an unweighted ICC for empathic concern of .90 and for inquiry behavior of .95. In this task, data collection of 2 children from the initial sample was not possible due to emotional fussiness. Note that for exploratory purposes we also assessed whether children showed prosocial behavior in this task (following Roth-Hanania et al., 2011, and Zahn-Waxler et al., 1992). Only 1 child showed a subtle instance of prosocial behavior, supporting our choice of this task as an independent measure for children's empathic concern.

Empathic concern for victim. The affective expression of the concern for the victim was rated regarding facial cues, gestures, and vocal expressions. Slight expression of concern, such as a sympathy face (eyebrows are drawn down and lips are downturned), was coded as 1. Moderate expression of concern, such as a combination of a sympathy face and simple vocalization, was coded as 2. A 3 was assigned for the expression of great concern with clear sobering facial expression and several vocalizations. The child received a score of 0 if sobering expressions and vocalizations were an expression of self-distress (indicated by extensive crying and comfort seeking from the mother) or showed no signs of empathic concern.

Inquiry behavior. The dimension of trying to cognitively comprehend the other's state was coded by looking at the hypothesis testing behavior of the children. Quite simple inquiry behavior (e.g. looking from foot to face) was coded as 1, whereas a 2 was given for a combination of vocal and nonvocal behavior (e.g., looking and "Oh?"). A 3 expressed sophisticated repeated attempts to understand the suffering of the victim (e.g., pointing). If there were no signs of inquiry behavior, the child received a score of 0.

Data analyses

For the prosocial helping task, we calculated the mean across all three trials (hairclip, scarf, and toy owl). Concerning maternal sensitivity, we used the scores ranging from 1 to 7 as described above. For the compliance measure, we averaged children's compliance scores (ranging from 1 to 3) across all 10 episodes (or fewer episodes if cleanup was finished earlier) to obtain an overall compliance score. Given the high intercorrelation between empathic concern and empathic inquiry ($r = .64, p < .001$), we averaged both measures of empathy to obtain an overall empathy score including both affective and cognitive dimensions of empathy.

For our main analysis, we ran a path model with two mediators to investigate the main research question, that is, whether empathy and/or compliance served as a mediator of the effect of maternal

sensitivity on emotional helping. For that purpose, we used the *lavaan* package in R (Rosseel, 2012). We used the full information maximum likelihood (FIML) method to account for missing data and avoid losing statistical power in our path model. The data are available at https://osf.io/jqm4g/?view_only=db5aa9ef234041fbb4a78b4e4331186b.

Results

Descriptives

Table 1 displays a zero-order correlational matrix of all study variables. These first results show that maternal sensitivity is indeed positively related to empathy and compliance. In addition, sensitivity and empathy show significantly positive correlations with emotional helping. Interestingly, empathy and compliance seem to be unrelated.

Path model with empathy and compliance as mediators

To examine the mechanisms underlying the relation between maternal sensitivity and emotional helping behavior, we conducted one path model with two mediators (Fig. 1). We tested children’s empathy and children’s compliance as possible mediators between maternal sensitivity and emotional helping. Results showed that the hypothesized direct effect of sensitivity on prosocial behavior, $\beta_{std} = .239$, $SE = .119$, $z = 2.01$, $p = .045$, was not mediated by children’s empathy, $ab_{std} = .063$, $SE = .036$, $z = 1.74$, $p = .082$, although it went into the hypothesized direction. In addition, the direct effect was also not mediated by children’s compliance, $cd_{std} = .025$, $SE = .028$, $z = 0.87$, $p = .382$. The total effect was significant, $\beta_{std} = .326$, $SE = .113$, $z = 2.89$, $p = .004$.

Exploratory analysis: Single mediation model with empathy and different forms of compliance

Given the significant correlations among sensitivity, empathy, and emotional helping (see Table 1), we computed a single mediation with empathy as mediator to follow up on the path model (see Fig. 2). This analysis included all children with complete data in all four tasks ($n = 69$). Results showed that the total effect of sensitivity on emotional behavior, $c = .451$, $p = .008$, was partially mediated by children’s empathy, $ab = .095$ (95 % confidence interval [CI] = .007–.260), $p = .026$ (proportion mediated = 21 %, $p = .034$). After accounting for the mediation effect, the direct effect remained significant, $c' = .356$, $p = .036$.

Table 1
Means, standard deviations, and correlations with confidence intervals.

Variable	M	SD	1	2	3
1. Maternal sensitivity <i>n</i> = 95	5.58	0.93			
2. Child’s empathy <i>n</i> = 95	1.35	0.83	.26* [.06,.44] <i>n</i> = 94		
3. Child’s compliance <i>n</i> = 85	1.61	0.44	.24* [.03,.44] <i>n</i> = 83	.06 [−.16,.27] <i>n</i> = 84	
4. Child’s emotional helping <i>n</i> = 73	1.13	1.27	.29* [.06,.49] <i>n</i> = 71	.30* [.07,.50] <i>n</i> = 72	.16 [−.08,.38] <i>n</i> = 71

Note. Values in square brackets indicate the 95% confidence intervals.
* $p < .05$.

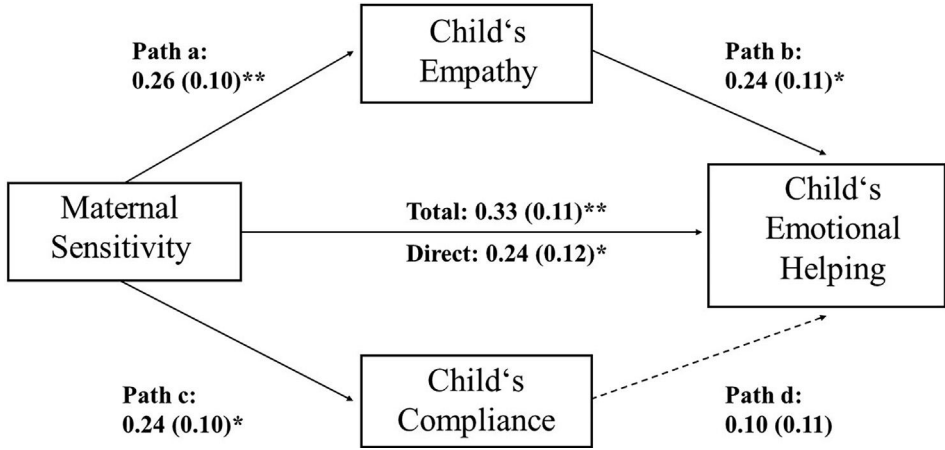


Fig. 1. Parallel mediation model for the mediators, child's compliance, and child's empathy with regression coefficients. Values in parentheses indicate standard errors. Solid arrows indicate significant paths. * $p < .05$; ** $p < .01$.

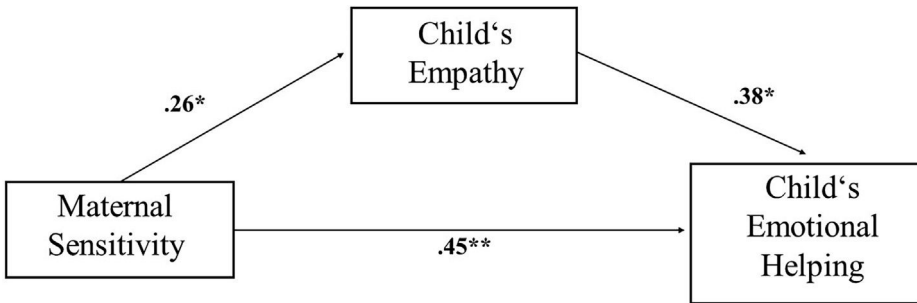


Fig. 2. Indirect effect of the sensitivity on emotional helping through empathy. * $p < .05$; ** $p < .01$.

To ensure that our results were not driven by the aggregation of the different compliance forms into one score, we furthermore conducted two mediation models for situational and committed compliance. Both mediations were not significant (see online [supplementary material](#)).

Discussion

Recent developmental theories have highlighted the social origins of early prosocial development. In particular, caregivers' sensitivity has been suggested to be a key factor. Yet, the precise psychological mechanisms linking caregivers' sensitivity to children's prosocial behavior remain subject to debate. Our study served as an empirical touchstone for two influential theories—one stressing that the impact of sensitivity is due to enhanced empathy (Gross et al., 2017) and the other proposing that child compliance is a key process (Kochanska, 2002). To this end, we investigated whether children's compliance or children's empathy mediated the effect of maternal sensitivity on children's emotional helping at 18 months of age. Our study provides clear evidence for empathy, but not for compliance, as a mediating factor.

As a first finding, our study replicated the positive relation between maternal sensitivity and children's empathy (see Stern & Cassidy, 2018, for a review). Higher maternal sensitivity was related to more empathy of the children. Second, the study identified the mediating role of empathy between experiencing maternal sensitivity and helping others in emotional need. As a result, our findings

are in line with a model suggesting more maternal sensitivity leading to more empathy in children, which results in more emotional helping.

Our finding supports emotion-based theories of emotional helping, especially during infancy. As emotion-sharing theories claim, children help because they empathize with the suffering person (e.g., [Batson, 2011](#); [Eisenberg, 1986](#)). Our finding relates well to previous work that emphasized the role of empathy for prosocial acts and suggested that especially emotional helping requires the ability to empathize with the need of another person ([Knafo et al., 2008](#); [Zahn-Waxler et al., 1992](#)). Notably, this study assessed the relation of maternal sensitivity and prosocial development at an early time point of 18 months of age, when empathy ([Zahn-Waxler et al., 1992](#)) and emotional helping ([Svetlova et al., 2010](#)) are just emerging.

On the other hand, compliance showed no influence on children's emotional helping. Although we confirmed previous research on a relation between maternal sensitivity and child compliance ([Kochanska et al., 2005](#)) at 18 months of age, our findings suggest that compliance is not the underlying mechanism relating maternal sensitivity to children's emotional helping.

To integrate into social communities, it has been claimed that children need to acquire social norms ([Grusec, 2011](#); [Kochanska et al., 1998](#)), for instance, "One should help others" and "One should be nice to others" ([Smetana et al., 2000](#)). However, compliance with maternal requests is just one aspect of adaptive socialization that was found to not be key for emotional helping. Emotional helping might confront children with a task that requires abilities that go beyond the internalization of social norms to act prosocially by helping others. This might be because emotional helping requires perspective taking to help adequately. Our findings suggest that children act prosocially based on understanding the other's situation and experiencing empathic concern for the other, not based on the immediate social recognition from others or out of an inner sense of duty. Nevertheless, internalized compliance could still be relevant toward other targets, for instance, their parents and other types of prosocial behavior such as sharing ([Ulber et al., 2015](#)). Compared with emotional helping, instrumental helping does not rely on children's emotion understanding. In the current study, empathy related to emotional helping. Children's empathic understanding of others' negative emotions facilitated their attempts to reduce others' negative emotional states. In contrast, compliance might rather be related to children's positive emotions after fulfilling social obligations. For example, school children were proud after helping another agent when they knew they should help ([Sabato & Eyal, 2022](#)). Thus, compliance might play a more pronounced role at later developmental stages when children have an increased self-awareness of their actions being compliant to environmental requests and subsequently experience positive self-evaluative emotions such as pride. Furthermore, it might be the case that compliance influences helping behavior, including emotional helping at a later age, especially given that social norm and rule following arises by 2 or 3 years ([Rakoczy & Schmidt, 2013](#)). Beyond empathy and compliance, other mechanisms might mediate the relation between maternal sensitivity and emotional helping. Relevant factors regarding the mother could be mental-state language ([Newton et al., 2016](#)) and emotion understanding regarding the child ([Walle & Lopez, 2020](#)).

It should be noted that all variables were assessed in separate tasks and involved different measures. One strength of our study is that we assessed them in two different tasks (contexts) so that—in contrast to many earlier studies that assessed similar constructs in the same task—any relation cannot be reduced to having been assessed in the same task. Moreover, the former focused on child facial and vocal expression, whereas the latter variable assessed object-based helping behavior.

By this setup, we amplify findings of studies in which empathic concern and helping is assessed within the same situation (e.g., [Zahn-Waxler et al., 1992](#)). It is also interesting to note that maternal sensitivity predicted toddlers' responses toward another person in need. That is, the effect of maternal sensitivity is not restricted to children's responses toward the mother but rather generalizes even to toddlers' interactions with strangers.

How children become social beings who help others in need, how parental socialization influences prosociality, and whether this ability arises from empathy or social norms are key questions for developmental psychology. As stated from attachment theorists ([Ainsworth et al., 1978](#); [Biringen & Easterbrooks, 2012](#)), children learn the ability to react sensitive toward the needs of others through experiencing the caregivers' sensitivity toward their own needs and emotions. It has been claimed that children use these internalized experiences to provide a basis for their own prosocial engagement

(Hastings et al., 2007). Experiencing empathy toward children's own needs leads to children's empathy for others. As a result, prosocial behavior is often motivated through empathy (Eisenberg et al., 2006). Our findings link parental socialization with children's empathy as a motivator of children's prosociality by pointing out the mediating effect of empathy for emotional helping during toddlerhood.

Future directions

This study focused outstandingly on a very early time point of emotional helping and therefore provided new insights into infants' prosociality. But prosocial helping is known to rise within the second and third years of life (Knafo et al., 2008). In our data, many children showed rather low helping behavior because helping behavior only starts to occur at this age. Therefore, it would be interesting to investigate in studies with older children whether this effect increases or changes over time. Due to the correlative design of our study, caution is needed regarding the interpretation of causal inferences. Optimally, future studies should investigate the development of emotional helping and its social influences in longitudinal designs. Especially studies with larger samples could strengthen the previous findings of our study.

As with most research in this field, the exclusive focus on mothers' influence is a clear limitation of this study. Despite the predominant role of mothers as primary caregivers in our society, children grow up in a whole system of potential social influences. If prosociality emerges out of infants' shared activities and relationships with others as suggested by theories on social origins (Dahl & Brownell, 2019), future research needs to investigate social influences other than only mothers. This consideration supports a need for more research on the influence of fathers, siblings, and child care on emotional helping of children.

Conclusion

Taken together, these results show that children help others not because they follow caregivers' norms but rather because they feel for the other persons. Overall, in line with emotion-sharing theories, these results suggest that emotional helping behavior at 18 months of age is a product of empathy rather than of social rule following.

Data availability

Data is available at https://osf.io/jqm4g/?view_only=db5aa9ef234041fbb4a78b4e4331186b

Acknowledgments

This study was supported by a Fellowship from the Jacobs Foundation to M.P. (JRF 2016 1217 12). Preparation of the article was supported by a James S. McDonnell Foundation 21st Century Science Initiative in Understanding Human Cognition–Scholar Award to M.P. (220020511). Moreover, we thank one of the reviewers for helpful statistical input.

Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jecp.2022.105547>.

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