

The Role of Maternal Emotional Availability and Attachment in Child Emotion Regulation

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Abstract

Emotions are an essential aspect of human life. They help us to evaluate the importance of an event, to act quickly in a variety of situations, and to communicate with others in social interactions. However, the intensity or duration of emotional responses may not always be adaptive in a given situation or social context. Thus, the ability to regulate emotions is crucial for ones' well-being, mental health, and socio-emotional functioning. A vast body of literature has emphasized the role of the social environment in children's development of emotion regulation. Theoretical accounts have emphasized the significance of experiences within caregiving relationships that contribute considerably to the development of (mal-) adaptive emotion regulation (Cassidy, 1994; Kopp, 1989; Sroufe, 1996a). The current thesis focused on attachment security (Ainsworth et al., 1974; Bowlby, 1969/82; Cassidy, 1994) and maternal emotional availability (Biringen, 2008; Biringen et al., 2014) as two key aspects of caregiver-child relationship quality that support children's development of adaptive emotion regulation. Despite a large body of research on child emotion regulation, not all stages of emotion regulation have been addressed equally in young children. The stage of attentional regulation is particularly interesting as attentional distraction is one of the earliest regulation strategies that emerge. Yet, only few studies have investigated young children's attentional regulation in response to facial expressions. Furthermore, the stage of behavioral regulation is particularly important in difficult social interactions with others. However, young children's behavioral regulation in frustrating situations has so far not been researched in cooperative interactions with others. Considering the importance of the domain of emotional development for later developmental outcomes, the current thesis focused on the role of attachment and maternal emotional availability for young children's attentional and behavioral regulation. For that purpose, three studies were conducted, focusing on two age groups, that is, preschool and toddler period.

The first study investigated the relation of attachment security and attentional regulation in preschoolers. In particular, the study examined the relation between preschoolers' attachment security and their visual attention to facial emotional expressions.

To this end, 5-year-olds' generalized attachment representations and their attention duration to pictures of negative and positive facial expressions were assessed. Results revealed that secure attachment was related to prolonged attention to fearful, sad, and neutral facial expressions. The study supports the notion that attachment security plays a significant role in young children's attention to emotional information.

The second study investigated the relation of maternal emotional availability and attentional regulation in toddlers. In particular, the study examined the reciprocal relations of maternal sensitivity and non-intrusiveness and children's visual attention to emotional facial expressions. To this end, mothers' behavior was observed in play interactions and children's attention to negative and positive facial expressions were assessed at 12 and 24 months. Cross-lagged panel analyses revealed that more sensitive behavior at 12 months predicted prolonged attention to sad and happy expressions at 24 months, while less intrusive caregiving at 12 months predicted prolonged attention to sad expressions at 24 months. Concurrent maternal emotional availability had no effect on toddlers' attentional regulation. The study supports the notion that maternal sensitive behavior plays a significant role in young children's attention to emotional information.

The third study investigated the relation of maternal emotional availability and behavioral regulation in toddlers. In particular, the study examined whether maternal sensitivity and non-intrusiveness contribute to children's behavior in difficult cooperative interactions beyond child cognitive skills and temperament. To this end, mothers' sensitivity and non-intrusiveness were observed in play interactions and children's behavior to interruptions in two difficult cooperative interactions was assessed at 24 months. Results revealed that maternal intrusiveness was related to child disengagement from the task and approach to the mother. Yet, active help seeking was predicted only by toddler cognitive skills, while reengagement of the experimenter was predicted neither by maternal nor by child characteristics. The study supports the notion that maternal behavior plays a significant role in young children's use of specific behavioral strategies in frustrating situations.

Overall, the current thesis supports specific relations of caregiver-child relationship aspects and young children's attentional and behavioral regulation. In the preschool period and the toddler period, attachment security (Study 1) and maternal emotional availability (Study 2) are related to children's attention to emotional facial expressions. Yet, effects are more pronounced in relation to negative emotions and for influences of attachment security and sensitivity. Furthermore, in the toddler period, dimensions of maternal emotional availability contribute differently to the development of attentional and behavioral regulation

strategies. While sensitive caregiving is an important factor in toddlers' attention to positive and negative emotions, intrusive caregiving plays a crucial role for toddlers' attentional avoidance of negative emotions and for their behavioral disengagement from difficult interactions. In conclusion, the current thesis contributes to a better understanding of the role of caregiver–child relationship quality in young children's emotion regulation and provides implications for research on child socioemotional development.

Zusammenfassung (Deutsch)

Emotionen sind ein wesentlicher Aspekt des menschlichen Lebens. Sie helfen uns, die Bedeutung eines Ereignisses einzuschätzen, in einer Vielzahl von Situationen schnell zu handeln und in sozialen Interaktionen mit anderen zu kommunizieren. Die Intensität oder Dauer emotionaler Reaktionen ist jedoch nicht in allen Situationen oder sozialen Kontexten adaptiv. Daher ist die Fähigkeit, Emotionen zu regulieren, entscheidend für das eigene Wohlbefinden, die psychische Gesundheit und die sozio-emotionale Funktionsfähigkeit. Umfangreiche Literatur hat die Rolle des sozialen Umfelds in der Entwicklung der kindlichen Emotionsregulation hervorgehoben. Theoretische Darstellungen unterstreichen die Bedeutung von Erfahrungen in Beziehungen mit engen Bezugspersonen, die wesentlich zur Entwicklung einer (mal-)adaptiven Emotionsregulation beitragen (Cassidy, 1994; Kopp, 1989; Sroufe, 1996b). Die vorliegende Arbeit konzentrierte sich auf die kindliche Bindungssicherheit (Ainsworth et al., 1974; Bowlby, 1969/82; Main et al., 1985) und mütterliche emotionale Verfügbarkeit (Biringen, 2008; Biringen et al., 2014) als zwei Aspekte der Beziehungsqualität zwischen Bezugspersonen und Kind, die die Entwicklung der adaptiven Emotionsregulation von Kindern unterstützt. Trotz umfangreicher Forschung zur kindlichen Emotionsregulation wurden bisher nicht alle Phasen der Emotionsregulation bei kleinen Kindern gleichermaßen berücksichtigt. Die Phase der Aufmerksamkeitsregulation ist besonders interessant, da die Aufmerksamkeitsablenkung eine der frühesten Regulationsstrategien ist, die in der kindlichen Entwicklung auftaucht. Nur wenige Studien haben allerdings bisher die Aufmerksamkeitsregulation von Kleinkindern als Reaktion auf emotionale Gesichter untersucht. Darüber hinaus ist die Phase der Verhaltensregulationsstrategien in schwierigen sozialen Interaktionen mit anderen besonders wichtig. Allerdings wurde die Verhaltensregulation von jungen Kindern in frustrierenden Situationen bisher noch nicht in kooperativen Interaktionen mit anderen erforscht. Angesichts der Bedeutung des Bereichs der emotionalen Entwicklung für den weiteren Entwicklungsverlauf konzentrierte sich die vorliegende Arbeit auf die Rolle der kindlichen Bindungssicherheit und der mütterlichen emotionalen Verfügbarkeit in der

Aufmerksamkeits- und Verhaltensregulation von jungen Kindern. Zu diesem Zweck wurden drei Studien durchgeführt, welche zwei Altersgruppen, nämlich das Vorschul- und das Kleinkindalter, untersuchten.

Die erste Studie untersuchte den Zusammenhang von Bindungssicherheit und Aufmerksamkeitsregulation bei Vorschulkindern. Insbesondere untersuchte die Studie den Zusammenhang zwischen der Bindungssicherheit von Vorschulkindern und ihrer visuellen Aufmerksamkeit auf emotionale Gesichtsausdrücke. Zu diesem Zweck wurden die generalisierten Bindungsrepräsentationen von Fünfjährigen und deren Aufmerksamkeitsdauer auf Bilder mit negativen und positiven Gesichtsausdrücken erfasst. Die Ergebnisse zeigten, dass eine sichere Bindung mit einer längeren Aufmerksamkeit auf ängstliche, traurige und neutrale Gesichtsausdrücke zusammenhängt. Die Studie unterstützt die Annahme, dass Bindungssicherheit eine bedeutende Rolle bei der Aufmerksamkeit junger Kinder auf emotionale Informationen spielt.

Die zweite Studie untersuchte den Zusammenhang zwischen mütterlicher emotionaler Verfügbarkeit und Aufmerksamkeitsregulation bei Kleinkindern. Die Studie untersuchte insbesondere die wechselseitigen Beziehungen von mütterlicher Feinfühligkeit und Unaufdringlichkeit sowie der visuellen Aufmerksamkeit der Kinder auf emotionale Gesichtsausdrücke. Zu diesem Zweck wurde das Verhalten der Mütter in Spielinteraktionen beobachtet und die Aufmerksamkeit der Kinder auf negative und positive Gesichtsausdrücke jeweils im Alter von 12 und 24 Monaten erfasst. Cross-Lagged-Panel Analysen zeigten, dass feinfühleres mütterliches Verhalten mit 12 Monaten eine längere kindliche Aufmerksamkeit auf traurige und fröhliche Gesichter mit 24 Monaten vorhersagte, während weniger aufdringliches mütterliches Verhalten mit 12 Monaten eine längere kindliche Aufmerksamkeit auf traurige Gesichter mit 24 Monaten vorhersagte. Querschnittlich zeigte sich kein Einfluss der emotionalen Verfügbarkeit der Mutter auf die Aufmerksamkeitsregulation von Kleinkindern. Die Studie unterstützt die Annahme, dass feinfühliges mütterliches Verhalten eine wichtige Rolle bei der Aufmerksamkeit kleiner Kinder auf emotionale Informationen spielt.

Die dritte Studie untersuchte den Zusammenhang zwischen mütterlicher emotionaler Verfügbarkeit und Verhaltensregulation bei Kleinkindern. Insbesondere untersuchte die Studie, ob mütterliche Feinfühligkeit und Unaufdringlichkeit über die kognitiven Fähigkeiten und das Temperament des Kindes hinausgehend das Verhalten von Kindern in herausfordernden kooperativen Interaktionen vorhersagen. Zu diesem Zweck wurden im Alter von 24 Monaten die Feinfühligkeit und Unaufdringlichkeit der Mütter in zwei

Spielinteraktionen bewertet und das Verhalten der Kinder während Unterbrechungsphasen in zwei schwierigen kooperativen Interaktionen beobachtet. Die Ergebnisse zeigten, dass die mütterliche Aufdringlichkeit mit der Abwendung des Kindes von der Aufgabe und der Annäherung an die Mutter zusammenhing. Das aktive Hilfesuchen wurde jedoch nur durch die kognitiven Fähigkeiten des Kleinkindes vorhergesagt, während das erneute Einbeziehen der Versuchsleiterin weder durch die mütterlichen noch durch die kindlichen Merkmale vorhergesagt wurde. Die Studie unterstützt die Annahme, dass das mütterliche Verhalten eine bedeutende Rolle bei der Anwendung spezifischer Verhaltensstrategien von Kleinkindern in frustrierenden Situationen spielt.

Insgesamt unterstützt die vorliegende Dissertation spezifische Zusammenhänge zwischen Aspekten der Bezugspersonen-Kind-Beziehung und der Aufmerksamkeits- und Verhaltensregulation von Kleinkindern. Bindungssicherheit (Studie 1) und mütterliche emotionale Verfügbarkeit (Studie 2) hängen im Vorschul- und Kleinkindalter mit der Aufmerksamkeit der Kinder auf emotionale Gesichtsausdrücke zusammen. Allerdings sind die Effekte bei negativen Gesichtsausdrücken und für Einflüsse der Bindungssicherheit und Feinfühligkeit ausgeprägter. Darüber hinaus tragen Dimensionen der mütterlichen emotionalen Verfügbarkeit unterschiedlich zur Entwicklung von Aufmerksamkeits- und Verhaltensregulationsstrategien im Kleinkindalter bei. Während feinfühliges mütterliches Verhalten ein wichtiger Faktor für die kindliche Aufmerksamkeit auf positive und negative Emotionen ist, spielt aufdringliches mütterliches Verhalten eine entscheidende Rolle für die kindliche Aufmerksamkeitsvermeidung negativer Emotionen und für ihr Verhalten, sich aus schwierigen Interaktionen zurückzuziehen. Zusammenfassend trägt die vorliegende Dissertation zu einem besseren Verständnis der Rolle der Beziehungsqualität zwischen Bezugsperson und Kind in der Emotionsregulation von jungen Kindern bei und liefert Implikationen für die Forschung zur kindlichen sozioemotionalen Entwicklung.

1 General Introduction

Emotions are an essential aspect of human life. They help us to direct attention to important environmental aspects, improve cognitive processes, prepare behavioral responses, and enable and promote social interactions (Gross, 2014). However, when valence, intensity or duration of emotional responses are not adequate in a given situation, the ability to regulate emotions is crucial for successful adaptation to the situational and personal demands. Adaptive emotion regulation contributes to a variety of developmental outcomes, such as ones' psychological well-being, mental health, and social functioning (cf. Eisenberg et al., 1993, 2001). Thus, the regulation of emotional states is an important developmental task children have to engage in from early on.

Influential developmental theorists have highlighted the role of social interactive aspects in children's development of emotion regulation (Bowlby, 1980; Cassidy, 1994; Kopp, 1989). First, emotion regulation is a crucial ability for successful engagement in social interactions and relationships (Calkins et al., 2001; Denham et al., 2003; Eisenberg et al., 1993). Thus, children's ability to regulate their emotions in a way to successfully engage with others in their social environment can be described as an important aspect of children's developing social competencies (Waters, & Sroufe, 1983). Furthermore, while the development of regulation skills also relies on maturation of cognitive skills, neurobiological changes, or temperamental characteristics (Calkins, 1994; Thompson & Meyer, 2007), experiences within the social environment contribute considerably to the development of (mal-)adaptive emotion regulation skills. Particularly important are caregiving relationships, which provide the emotional context for children's development from early dyadic regulation to increasing self-regulation of emotion (Bell & Ainsworth, 1972).

Within the literature on child emotion regulation and caregiver-child relationship, attachment theory (Ainsworth et al., 1974; Bowlby, 1969/82; Cassidy, 1994) and the emotional availability framework (Biringen, 2008; Biringen & Robinson, 1991) have emphasized the influence of caregivers on child emotional development. Children's attachment security and caregivers' sensitive and supportive responses have been shown to

support children's development of adaptive emotion regulation strategies (e.g., Fearon et al., 2010; Leerkes et al., 2009; Mortensen & Barnett, 2019; Waters et al., 2010). Thus, the current thesis will focus on attachment security and maternal emotional availability as two aspects of caregiver-child relationship quality. As emotion regulation refers to the modification of external or internal aspects of the emotional experiences, regulation processes can come into use at different stages of the emotion generation process (Gross, 1998, 2014). Despite a large body of research on child emotion regulation, not all stages of emotion regulation have been equally addressed in young children. The current thesis will focus on children's attentional regulation in response to facial expressions of others as well as children's behavioral regulation in difficult cooperative interactions with others as two stages of emotion regulation.

Given the importance of the domain of emotional development, it is important to understand the role caregivers play in supporting emotion regulation processes in early childhood. In the current thesis, I will address these issues, with a particular focus on the importance of attachment and caregivers' emotional availability for young children's attentional and behavioral regulation.

1.1 Child Emotion Regulation

Research on emotion regulation has provided various conceptualizations of emotion regulation without achieving a consensus definition. A possible definition is to describe emotion regulation as "all of the conscious and non-conscious strategies we use to increase, maintain, or de-crease one or more components of an emotional response" (Gross, 2001, p. 215). This definition implies that some emotion regulation strategies may be conscious and explicit, while others may be automated and implicit (see Zimmermann, 1999). A more comprehensive definition describes emotion regulation as "the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one's goals" (Thompson, 1994, p. 27).

Thompson's definition includes several important features of emotion regulation (Thompson, 1994): First, while emotion regulation is most often targeted to inhibit or dampen emotional arousal (especially negative arousal), regulation processes may as well aim to maintain and enhance emotional arousal. Second, emotion regulation more commonly affects the intensity and temporal features, such as latency, duration, onset and offset of emotional responses rather than just the experience of a specific discrete emotion (see also

Gross, 2014). Third, the function of emotion regulation must be considered in terms of the regulator's goals for a particular situation. The possible goals may differ depending on situational features, individual differences or developmental changes, and serve as a motivator for regulatory processes. Related to the activation of such goals, Gross (2014) differentiated between intrinsic emotion regulation, that is, the goal of emotion regulation is activated in oneself (typically investigated in adults), and extrinsic emotion regulation, that is, the goal of emotion regulation is activated in another (typically investigated in infants and children). Last and most important for the current thesis, while emotion regulation includes an individual's self-regulation strategies, it also encompasses the influences of the social environment on emotion regulation processes. For instance, caregivers use direct interventions as well as indirect strategies to regulate infants' and young children's emotions and socialize emotional expression and behavior in relation to the cultural context the child grows up in. While in infancy, regulatory processes of the caregiver and the infant are mutually intertwined, as young infants are completely dependent on the dyadic regulation within the caregiver–infant relationship, when children get older, they become more independent in their regulation abilities. Holodynski described this ontogenetic course of emotional development in terms of a change from interpersonal emotion regulation to intrapersonal emotion regulation (Holodynski, 2006), thereby building on previous theoretical accounts (e.g., Sroufe, 1996b; Tronick, 1989).

The definitions by Thompson (1994) and by Gross (2001, 2014) present an understanding of emotion regulation I consider as relevant for the current thesis in several ways: First, while infants and young children may engage in forms of intrinsic self-regulation, for a great part they will experience extrinsic regulation provided by the caregiver. Second, young children's own efforts to regulate their emotional states may be mainly unconscious and automated processes aimed to modify their emotional states. In contrast, caregivers may more consciously monitor, evaluate and modify children's emotional states and needs. Last, the goal of emotion regulation in a given situation may differ for caregiver and child. While the caregiver's goal may be to reduce child distress or to control the child's expression of negative affect, the child's goal may be to increase the expression of negative affect as a means to communicate and connect with the caregiver (cf. Cassidy, 1994).

Note that not all forms of emotion regulation are adaptive in the sense that they lead to balanced emotional arousal and healthy emotional development. In the literature, two forms of maladaptive emotion regulation are described (Cassidy, 1994; Cole et al., 1994;

Keenan, 2000; Martins et al., 2012). Under-regulation refers to the maximization of emotional states in terms of intensified negative emotionality and vigilance, problems with down regulation of emotion arousal, and overdependence on external regulation from others (e.g., the caregiver) (Cassidy, 1994; Cole et al., 1994; Keenan, 2000). In contrast, over-regulation refers to the minimization of emotional expression in terms of a limited range of emotional experience, a lack of openness of emotional expression and over relying on self-regulatory behaviors (e.g., self-distraction) (Cassidy, 1994; Cole et al., 1994; Sroufe, 2000). Both maladaptive styles are characterized by a restricted emotional flexibility in response to changes in environment and to personal needs (Gross, 2014). It is thus an interesting question, which factors influence the development of young children's adaptive emotion regulation.

1.1.1 Process model of emotion regulation

According to the process model of emotion regulation (Gross, 1998), presented in Figure 1, emotions can be influenced at different stages of the emotion generation process. Emotion regulation in this information-processing model targets the sequence of processes involved in emotion generation, that is, the situation, attention, cognition, or response (Gross, 2014). At a broader level, the model distinguishes between antecedent-focused regulation strategies, that is, strategies that come into play before the full activation of emotional response tendencies, and response-focused regulation strategies, that is, strategies that come into play after emotional response tendencies have been generated (Gross, 1998, 2001). At a more specific level, the model highlights five stages at which individuals can regulate their emotions: situation selection, situation modification, attentional deployment, cognitive change, and response modulation (Gross, 1998, 2014).

Situation selection refers to actions that affect the likelihood to get into situations for which one anticipates specific desired (or undesired) emotional experiences. An example (for extrinsic regulation) is a caregiver's decision not to take a tired child to the supermarket. The difficulty at this stage of emotion regulation is that it is not clearly predictable how one (e.g., the caregiver) or another person (e.g., the child) will feel in different situations.

Situation modification involves the direct modification of a situation, more specifically, aspects in the external environment, in order to change its effect on one's emotion. For example, when a parent is in the supermarket with a tired child, situation modification may take the form of suggesting that the child can help with shopping by "taking care" of (i.e., by holding) a product.

Attentional deployment refers to the selection of aspects one focuses on in a given situation. Distraction is a commonly used form of attentional deployment and can be either external by redirecting attention to other aspects or away from the situation or internal by changing the focus of one's thoughts. An example for extrinsic regulation is a caregiver who distracts the child from candy bars at the cash register by counting flowers on the caregiver's dress.

Cognitive change refers to the modification of one's appraisal, that is, one's evaluation of a situation as personally meaningful. While reappraisal as one form of cognitive change refers to thoughts about the situation itself, other forms refer to thoughts about one's ability to manage situational demands. For example, the caregiver in the supermarket might remind her/himself that strong emotional reactions are not unlikely for young children rather than being concerned how others might judge her/his parenting competences. The appraisal of a situation determines which experiential, behavioral, and physiological response tendencies will be generated.

Response modulation is the last stage in the process model of emotion generation and refers to attempts to influence experiential, behavioral, or physiological components of response tendencies once they have been initiated. A commonly used form of response modulation is expressive suppression, that is, the inhibition of ongoing negative or positive emotion-expressive behavior. In our example, response modulation on the caregiver's side might take the form of hiding angry responses towards the people who are commenting on the child's tantrum.

The focus of the current thesis lies on the stage of attention deployment and the stage of response modulation, which I will refer to as *attention regulation* and *behavioral regulation*. The focus on these two stages in young children is quite relevant as attentional and behavioral regulation may require less planning (situation selection, situation modification) or cognitive demands (cognitive change) than other strategies, and thus, may be frequently implemented by young children to regulate emotion. Moreover, those stages are particularly interesting as attentional distraction is one of the earliest strategies that emerge in development, and behavioral regulation is especially important in interactions with others. However, developmental research has only scarcely examined attentional and behavioral regulation in young children. In the following sections, I will further discuss the stages of attention regulation and behavioral regulation.

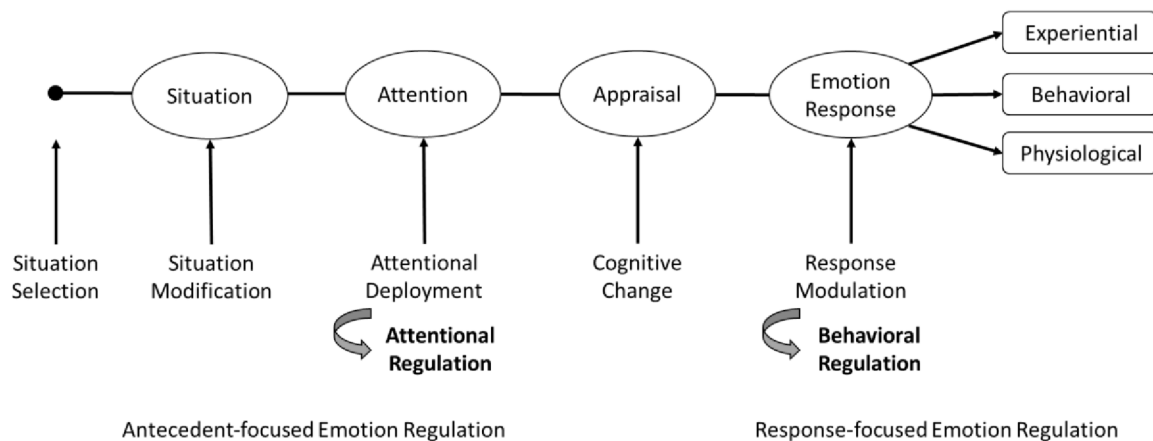


Figure 1. Process model of emotion regulation. Adapted from Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology*, 2(3), 271–299. and Gross, J. J. (2014). Emotion regulation: Conceptual and empirical foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (2nd ed., pp. 3–20). Guilford Press.

1.1.2 Attention regulation

Attention is a cognitive process that allows focusing on specific information in the environment while disregarding other information (Posner, 1994; Taylor, & Amir, 2010). As attention operates at an early stage in information processing, it controls which stimuli are further processed. This conceptualization of attention as a “gatekeeper” that determines which stimuli get access to further processing highlights the important regulatory function of attentional processes (Taylor, & Amir, 2010). By determining the duration that a person is exposed to an emotionally arousing stimulus or situation, attentional processes influence the subsequent stages of emotion generation and thus modulate the emotional response (Gross, 2014; Taylor, & Amir, 2010).

As described in the process model of emotion regulation (Gross, 1998), attentional deployment modifies response tendencies through attentional direction toward or away from aspects of a situation – a strategy that is particularly useful when selection or modification of a situation are not possible (Gross, 2001; Livingstone & Isaacowitz, 2018). This explains why attentional deployment as an emotion regulation process appears quite early in development (Thompson, 1994). While young infants are limited in their capacity to modify a situation and to change cognitions or response tendencies yet, between 3 and 6 months of age, they develop the capacity to shift attention between stimulus events voluntarily, for instance, by orienting their attention away from novel and intense stimuli towards the mother

(Rothbart et al., 1990, 1992). Thus, visual disengagement from emotionally arousing events is one of the first strategies commonly used by very young infants themselves (e.g., Gianino & Tronick, 1988; Tronick & Weinberg, 1997) as well as by their caregivers. With increasing age, caregivers and children use and acquire more complex attentional regulation strategies. For example, caregivers redirect their children's attention by focusing on positive situational aspects during a frightening situation, while older children internally redirect their attention by thinking about something pleasant during a stressful event (Thompson, 1994).

As attentional distraction allows disengaging quickly from potential emotionally arousing events by focusing on non-emotional aspects of the situation, it is mostly perceived as an adaptive emotion regulation strategy (Gross, 1998; Livingstone & Isaacowitz, 2018). However, strong biases in attentional selectivity may contribute to dispositional emotional vulnerability and emotional pathology (cf. MacLeod & Grafton, 2014; Mathews & MacLeod, 2005). Indeed, research investigating biases or deficits in attentional regulation have emphasized the role attention processes play in children's development of anxiety disorders, depression, or social withdrawal (Bar-Haim et al., 2007; Connell et al., 2013; Pérez-Edgar et al., 2011). While research on biases in selective attention mainly focused on biased attention *toward* negative or threatening stimuli in adults and children (Bar-Haim et al., 2007; Peltola et al., 2009; Torrence & Troup, 2018) as a form of maladaptive regulation, the current thesis considers biased attention *away* from emotionally arousing stimuli (i.e., attentional avoidance) as a form of maladaptive emotion regulation. As facial emotional expressions of others are highly relevant for affective communication in social interactions, I will extend previous research findings by focusing on children's attention to emotional faces as potentially arousing stimuli.

1.1.3 Behavioral regulation

As described in the process model of emotion regulation (Gross, 1998), response modulation is the last regulatory stage, which refers to the modification of experiential, behavioral, or physiological components of response tendencies that have already been generated (Gross, 1998, 2001). While expressive suppression is a form of emotion regulation modifying the behavioral component, alcohol, drugs, or food may be used to modify the experiential component, and physical exercise or relaxation techniques may serve to modify experiential and physiological components.

In the current thesis, I will use the term behavioral regulation to refer to children's use of behavioral strategies to modify the experiential and physiological component of

emotional response tendencies, for example, strategies of approach, withdrawal, avoidance, distraction, help seeking, social referencing, or self-soothing behaviors (e.g., children's thumb sucking or holding a transitional object for security) (cf. Diener & Mangelsdorf, 1999). Such strategies will most likely be used to reduce negative emotional arousal in frustrating or distressing situations but might also be applied to maintain positive and negative emotional arousal. Related to this, Thompson (1994) described the availability of external support, that is, one's access to material and interpersonal coping resources, as an aspect of emotion regulation and highlighted the importance of social partners such as parents or peers. While adults and older children may seek out emotional support of friends, family or close peers when angry, anxious, or sad, infants and younger children primarily rely on their caregivers as most familiar social partners who may support their coping with negative emotional experiences by providing comfort, security, or familiar objects as material coping resources (Schieche & Spangler, 2005; Thompson, 1994).

The use of behavioral strategies to regulate emotional arousal might be particularly important in direct social interactions with others. Social interactions are challenging and miscommunication, distortion or interruptions are likely to occur. Nonetheless we are able to repair these interactions, allowing for continuation of interactions (e.g., Müller et al., 2015; Riek & Mania, 2012). The successful repair of social interactions likely depends on the interaction partners' abilities to regulate their emotions by choosing behavioral regulation strategies that allow them to cope with frustration or anger and to continue their engagement in the interaction. For example, in frustrating play interactions with peers who do not want to share toys, children may have difficulties to tolerate or reduce negative arousal through behavioral regulation (e.g., distraction with another toy or seeking support from an adult). Consequently, those children might either display socially inadequate behavior, such as hitting other children, or develop a tendency to avoid future peer interactions altogether (as a strategy of situation selection). The potential negative or lacking peer interactions might prevent children from broadening their repertoire of behavioral regulation strategies and consequently from making positive social experiences that are important for their social development. Previous research has mainly focused on young children's behavioral strategies in problem-solving tasks or challenging interactions with the mother. Yet, other particularly interesting interactive contexts are cooperative interactions with others, that is, interactions in which two persons have to work together simultaneously to achieve a goal together (Tomasello & Hamann, 2012). Thus, in the current thesis, I will extend previous

research by focusing on children's behavioral strategies in difficult cooperative interactions with others.

1.2 Caregivers' Role in Child Emotion Regulation

The development of emotion regulation is influenced by a variety of factors, some of them intrinsic and some extrinsic. Intrinsic factors include underlying neural and biological systems, behavioral and temperamental traits, cognitive components, and knowledge and understanding regarding emotions (Calkins, 1994; Calkins & Hill, 2007). Extrinsic factors include aspects of the caregiver-child relation, direct and indirect parental interventions, as well as the emotional family climate (Calkins, 1994; Calkins & Hill, 2007; Thompson & Meyer, 2007). Figure 2 provides an overview of possible intrinsic and extrinsic factors that influence the stages of child emotion regulation.

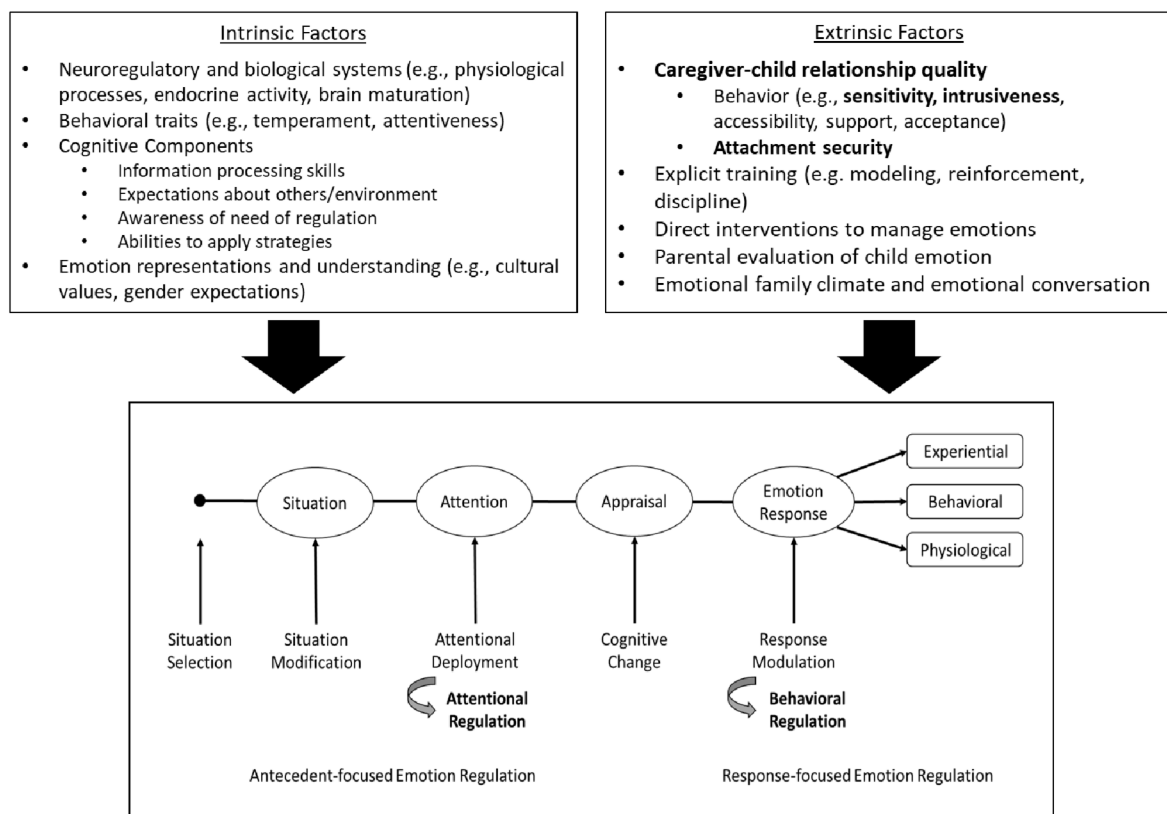


Figure 2. Intrinsic and extrinsic factors influencing processes of emotion regulation.

Factors relevant for this thesis are marked in bold. Extrinsic and intrinsic factors are based on Calkins & Hill, 2007; Calkins, 1994; Thompson & Meyer, 2007.

Developmental theorists have focused on the importance of social interactions in close personal relationships for children's socio-emotional development (Bowlby, 1969/82; Cassidy, 1994; Tiffany Field, 1994; Sroufe, 1996a; Thompson & Meyer, 2007; Tronick, 1989). Some theoretical perspectives suggest that the quality of caregiver–child interactions may influence how children attend to and process social and emotional information (Dykas & Cassidy, 2011; Main et al., 1985). Others emphasize the role of caregiver–child interactions for the development of children's social competences and adaptation (Gauvain, 2001; Hammond & Carpendale, 2015; Sroufe, 1979). Most importantly for the current thesis, developmental research has particularly highlighted the importance of attachment security and specific aspects of caregiver–child relationship quality such as caregiver sensitivity in children's socio-emotional development (Calkins, 1994; Cassidy, 1994; Kopp, 1989; Sroufe, 1996c).

In the following sections, I will present concepts and perspectives of the attachment theoretical framework (Ainsworth et al., 1974, 1978; Bowlby, 1969/82, 1973, 1980) as well as the emotional availability framework (Biringen, 2008; Biringen et al., 2014; Biringen & Robinson, 1991). Moreover, I will discuss how these theoretical frameworks are relevant for theoretical perspectives on caregivers' role in child emotion regulation.

1.3 Attachment

Bowlby developed the key tenets of attachment theory on the basis of psychoanalytical, psychological, ethological, and evolutionary ideas (Bretherton, 1992). He proposed that infants are predisposed to form an *attachment*, that is, an affective bond, with an attachment figure – usually a primary caregiver – and to show *attachment behaviors* that facilitate the formation of such a caregiver–infant relationship (Ainsworth et al., 1978; Bowlby, 1969/82, 1973). The biological function of this special relationship between infant and caregiver that evolves over the first year of life is the protection of the immature infant.

One of the key concepts in attachment theory is the *attachment behavioral system*, which is an organized system of a variety of attachment behaviors that promote the infant's physical proximity to the caregiver (Ainsworth et al., 1971; Bowlby, 1969/82). As proximity to a caregiver provides protection from predators, the function of attachment behavior is to ensure the child's survival. Infant attachment behaviors, such as crying, approaching the attachment figure, but also smiling and vocalizing (Belsky & Cassidy, 1994), are suggested to lead to activation of the attachment figure's *caregiving behavioral system* that facilitates the attachment figure's response to the child's need for proximity (Solomon & George,

1996). In threatening situations, the attachment figure functions as a secure base for the child that provides protection as well as a feeling of security and regulation of the child's emotional arousal – the psychological functions of attachment (Ainsworth et al., 1971; Sroufe, 1996c; Sroufe & Waters, 1977; Zimmermann, 1999b). In non-threatening situations, a complementary system to attachment – the *exploratory behavioral system* – is activated that allows the child to learn about the environment through exploration. Bowlby (1969/82) postulated that the attachment behavioral system and the exploratory behavioral system are mutually inhibiting and activated cyclical depending on characteristics of the environment and the caregiver's availability. As the attachment behavioral system promotes children's feeling of security (Sroufe, 1996c) it also contributes to a better quality of exploration in the sense of more open exploration in non-threatening but unfamiliar environments (Ahnert & Spangler, 2014).

While an attachment bond is consistently existent over time, attachment behavior is situational and differs depending on quality of attachment, that is, the internal organization of attachment behavior (Belsky & Cassidy, 1994). Those individual differences in organized attachment behavior are based on infants' early experiences and expectations regarding their caregivers' availability and responsiveness to child signals of distress (Bowlby, 1969/82). Building on Bowlby's work, Ainsworth developed the Strange Situation procedure as a method that made it possible to test empirically for individual differences in organized attachment patterns of infants in the context of separation from and reunion with the attachment figure. Moreover, Ainsworth defined maternal sensitivity – the critical caregiver behavior in the formation of secure attachment (Ainsworth et al., 1971) – as “the mother's ability to perceive and interpret accurately the signals and communications implicit in her infant's behavior, and given this understanding, to respond to them appropriately and promptly” (Ainsworth et al., 1974, p. 127).

Securely attached infants experience that their caregiver is responsive and available, when the infant seeks proximity in threatening situations, and provides a secure base in times of exploration. Thus, securely attached children openly show their distress and are able to re-establish an optimal level of arousal in contact with the caregiver. Insecure-avoidantly attached infants experience that their caregiver is unresponsive to the infant's signals and that a reduced expression of attachment behaviors might increase the likelihood that the caregiver responds to the child. Thus, insecure-avoidantly attached infants rarely express their distress openly and avoid proximity upon reunion, although they are experiencing a high level of emotional arousal (Spangler, & Grossmann, 1993). Insecure-ambivalently

attached infants experience that their caregiver is inconsistently responsive and that extreme emotional reactions increase the likelihood to get an unreliable caregiver's attention in threatening or distressing situations. Thus, insecure-resistently attached infants express a high level of distress, but are not able to reduce their emotional arousal even when proximity to the caregiver is established. In sum, the organizational patterns of attachment result from the interactional history of the particular dyad. While the secure attachment pattern is characterized by a balance of attachment behavioral and exploratory behavioral system, avoidant and ambivalent attachment patterns are characterized by a hypo-activation (i.e., de-activation) or hyper-activation of the attachment behavioral system, respectively (Mikulincer & Shaver, 2007).

To explain how early experiences with an attachment figure influence the development of a particular pattern of attachment Bowlby introduced the concept of internal working models (Bowlby, 1969/82; Main et al., 1985). Internal working models are mental representations, in which attachment experiences become internalized and organized within the first years of life. They include knowledge and expectations about attachment figures' availability and typical behavior in response to child distress as well as cognitive rules that guide the child's perception and behavior in attachment-relevant situations (Bowlby, 1969/82; Bretherton & Munholland, 1999; Main et al., 1985). Internal working models are proposed to affect also other cognitive processes such as direction of attention or organization of attachment-related memories and knowledge (Bowlby, 1969/82, 1980; Main et al., 1985). As attachment-related experiences and strategies become generalized in internal working models, they will influence an individual's feelings, thoughts and expectations in later social relationships with others outside the immediate caregiver-child relationship (Calkins & Hill, 2007; Main et al., 1985; Thompson, 2016).

In sum, early experiences with caregivers' availability and responsiveness in stressful situations lead to the formation of internal working models that organize an individuals' cognitions, emotions and behavior and with growing age increasingly influence the autonomous adaptation of the individual relevant for other social relationships later in life (Bowlby, 1980; Bretherton & Munholland, 1999; Main et al., 1985).

1.3.1 Attachment and emotion regulation

According to (Sroufe, 1996c), attachment is inherently an emotional construct that is characterized in terms of the regulation of infant emotion within the caregiver-child dyad. During the second half year of life – a developmental period of the emergence of attachment

relationships – infants become more active and intentional agents in dyadic emotional regulation. This means that infants explicitly signal their caregivers when they are distressed and require the caregivers' assistance to re-establish an optimal level of arousal (Ainsworth et al., 1974; Calkins & Hill, 2007). In this sense, attachment behaviors are emotional signals of the child that function to promote proximity to the caregiver and signal the caregiver that the child is in need of dyadic regulation. Thus, attachment behavior in infants has been described as a first organized form of emotion regulation in interaction with the caregiver (Spangler & Zimmermann, 2014).

Sroufe (1996c) proposed that dyadic regulation represents a prototype for self-regulation and that distinctive patterns of dyadic regulation lead to individual differences in emotional self-regulation. In a similar manner, Cassidy (1994) suggested that infant emotion regulation is part of the infants implementation of an attachment strategy that serves to maintain the relationship with the attachment figure. Thus, emotion regulation is thought to be influenced by the attachment relationship through the internal working models in which attachment experiences and behavioral strategies or patterns are organized (Bowlby, 1980; Cassidy, 1994; Zimmermann et al., 2001). Relatedly, Zimmermann (1999) described internal working models in terms of two components with different functions: The function of the information processing component is the perception, interpretation, and appraisal of internal and external cues in relation to attachment experiences regarding the acceptance and regulation of negative emotions. The function of the emotion and behavior regulation component is activated when negative emotions arise out of the appraisal process and lead to specific forms of attachment or coping behavior. In this sense, internal working models are thought to manage attentional regulation by determining whether potentially threatening or emotionally negative information is further processed.

A secure working model is associated with an open and flexible perception and expression of a range of negative and positive emotions as securely attached infants experienced that an open affective communication with the caregiver is the most effective strategy to maintain the relationship and proximity to the caregiver during times of distress (Bretherton, 1993). Moreover, securely attached children learn to tolerate negative affect temporarily, as they have experienced that the caregiver responded sensitively to the expression of both positive and negative emotions and supported them regulating their emotional states effectively (Bowlby, 1980; Cassidy, 1994). In contrast, an insecure working model is linked to biased and inflexible expression of children's emotions and likely promote the development of maladaptive emotion regulation (i.e., over-regulation or under-

regulation). Thus, insecurely attached children may not be able to tolerate negative emotional experiences or to attend to negative emotional stimuli for a long time, as they have not experienced effective external regulation by the caregiver. Attachment theoretical accounts refer to biases in processing of attachment-relevant information as *defensive exclusion*, which functions to protect the individual from potentially distressing emotional experiences (Bowlby, 1980).

Taken together, attachment theory suggests that attachment working models impact emotion regulation abilities and social information processing from early on (Bowlby, 1980; Bretherton & Munholland, 1999; Dykas & Cassidy, 2011; Zimmermann & Iwanski, 2015). Thus, I propose that attachment security likely influences children's attentional regulation as one stage of emotion regulation and emotion processing.

1.3.2 Empirical evidence for the relation of attachment and child emotion regulation

The association between attachment security and emotion regulation of emotions has been well established for a variety age groups and contexts. Several studies suggests that adolescents' secure attachment representations are related to adolescents' flexible and adaptive emotion regulation (Kobak & Sceery, 1988; Zimmermann, 1999a), emotion regulation patterns during a joint problem-solving situation with a friend (Zimmermann et al., 2001) and during a mother-teen problem solving task (Kobak et al., 1993; Zimmermann et al., 2009). At younger ages, research supports that attachment security is related to behavioral strategies in emotional regulation in infants and toddlers (Diener et al., 2002; Frankel & Bates, 1990; Matas et al., 1978; Schieche & Spangler, 2005), as well as to emotional communication, organization, social adaption, and constructive coping with stress in preschool age and middle childhood (Contreras et al., 2000; Suess et al., 1992; Waters et al., 2010). Moreover, there is empirical evidence on longitudinal relations of infant attachment security and children's socio-emotional adjustment and development (i.e., internalizing symptoms, externalizing behavior and socio-emotional competencies) (Fearon et al., 2010; Fearon & Roisman, 2017; Groh et al., 2012, 2017). Relatedly, a meta-analytic review from infancy to adolescence showed that caregiver-child attachment was associated with more positive and less negative affective experiences, less expression of negative affect, better emotion regulation abilities and more cognitive and social support coping strategies (Cooke et al., 2019).

While empirical evidence clearly supports associations of attachment and emotion regulation skills from infancy to adolescence, few studies have focused on children's attention to emotional information as a stage of emotion regulation. Research indicated longitudinal relations of infant attachment security to 6-year-olds' attention to a family photograph (Main et al., 1985), 3.5-year-olds' attentional preference for drawings of affectively positive, negative, and neutral mother-child interactions (Kirsh & Cassidy, 1997), as well as biases in attention to emotional face stimuli in middle childhood (Meinz et al., 2017). However, a cross-sectional eye-tracking study did not support effects of children's attachment security on attention to emotional expressions of others in middle childhood (Vandevivere et al., 2014).

In sum, while previous research provided ample evidence for a relation between attachment security and emotion regulation in children, findings regarding attentional regulation are inconsistent and focused on different aspects of emotion processing.

1.4 Emotional Availability

In the Emotional Availability (EA) framework, Biringen and Robinson (1991) integrated several theoretical perspectives such as attachment theory, emotions theory, as well as systemic and transactional perspectives (Biringen, 2008; Biringen et al., 2014). The conceptualization of attachment relationships and particularly Ainsworth's concept of caregiver sensitivity are an important foundation of the EA framework. Studies have confirmed that caregiver emotional availability is related to children's attachment security (for review see Biringen et al., 2014).

In addition to attachment theory, the EA framework has been influenced by emotion theories by Mahler, Pine, and Bergman (1975) and Emde (1980). Mahler and colleagues first described the idea of the mother as an emotionally available figure "being there" in the background in the course of the separation-individuation process (Mahler et al., 1975). The mother's supportive presence serves as a secure "home base" to which the child can return for "emotional refueling" that is established through bodily contact with the mother (Mahler et al., 1975). The mother's quiet availability provides a framing context for child exploratory behaviors and autonomic activities and facilitates child cognitive, motoric, and emotional development. Emde (1980) originally used the term 'availability' to refer to the quality of the relationship between therapist and patient and broadened this therapeutic principle by redefining it as a developmental principle. Emde (1980, 1989) described emotions as a barometer of the caregiver-child relationship and applied the term emotional availability to

refer to parental sensitivity and affective responsiveness to the child's emotional signals and needs rather than merely to parents' physical availability or behavioral responsiveness.

Furthermore, the EA framework integrated system (e.g., Guttman, 1991) and transactional perspectives (Sameroff, 2009). In systems theory, the family relationships are considered within a system, in which cognitions, emotions, and behavior of the family members mutually affect each other, and that regulates itself through emotional and behavioral feedback (Guttman, 1991). The EA conceptualization incorporated this perspective, but focused on the dyadic system between two individuals rather than the whole family (Biringen & Easterbrooks, 2012). The transactional model (Sameroff, 2009, 2010) emphasized that a child's development is influenced by continuous dynamic interactions of the child and her/his social context (e.g. her/his caregiver) over time. Sameroff (2009, 2010) pointed out that particularly the self-regulatory influences of the parent are analogous to Vygotsky's (1978) constructivist perspective on learning in the child's *zone of proximal development* (ZPD). Thus, in interaction with adults children are provided with fitting experiences to the developmental status of the child (ZPD) that are important for the development of the child's own cognitive, emotional, and behavioral self-regulation (Sameroff, 2009, 2010).

In sum, the EA framework expands attachment theoretical ideas and the concept of caregiver sensitivity and relationship quality by placing greater emphasis on emotional and dyadic aspects of an interaction or relationship, instead of merely behavioral responsiveness of the adult (Bretherton, 2000; Mesman & Emmen, 2013).

While Ainsworth's concept of sensitivity was developed mainly to assess caregiver–infant interactions across the first year of life, the EA Scales are applicable for a wide age range beyond infancy and various contexts, since the emotional feedback loop between child and caregiver is an important aspect of emotional availability regardless of the age of the child (Biringen et al., 2014). In the fourth edition of the EA Scales four caregiver dimensions (sensitivity, structuring, non-hostility, and non-intrusiveness) and two child dimensions (responsiveness and involvement) are operationalized (Biringen, 2008). While separate dimensions for the adult's and the child's side acknowledge both partners' contribution to the relational interaction, the dyadic perspective of the EA Scales is also present within the single dimensions. This means that the score of a dimension (e.g., maternal non-intrusiveness) can only be meaningfully assessed when the emotions and behavior of the interaction partner are taken into account (e.g., child reactions to maternal interference in play). Thus, the EA Scales evaluate relationship quality by scoring how the members of a

dyad mutually affect each other, rather than how caregiver and child behave individually in interaction.

Given its strong focus on emotional and dyadic aspects, the EA framework is a suitable measure to investigate the relation between caregiver behavior and child emotion regulation. In the current thesis, I focused on two emotional availability dimensions, that is, sensitivity and non-intrusiveness as I argue that from a theoretical perspective those should be most influential for child emotion regulation (Ainsworth et al., 1971; Cassidy, 1994; Cassidy & Berlin, 1994).

1.4.1 Sensitivity and emotion regulation

Sensitivity in the EA framework assesses a variety of adult qualities related to the caregiver's ability to be warm and emotionally connected with the child (Biringen, 2008; Biringen et al., 2014; Saunders et al., 2015). A sensitive caregiver creates a positive emotional atmosphere and is able to read and respond behaviorally and emotionally to child signals. A sensitive caregiver shows genuine, authentic, verbally and nonverbally congruent affective expressions or appropriate animation of the child, leading to clearly observable caregiver and child enjoyment of the interaction. The sensitive caregiver has a clear perception and correct awareness of the child's cues and is willing to respond appropriately and promptly. Furthermore, sensitivity is characterized by caregiver awareness of timing, attentional and behavioral flexibility, fun and creativity during play. A sensitive caregiver accepts and respects the child as a separate person, provides an adequate level of interaction and accessibility and is competent in resolving conflicts in interaction with the child.

With regard to child emotion regulation, sensitive caregivers provide a context in which children can openly express both positive and negative emotions and learn how to regulate emotional experiences and to maintain an optimal level of arousal (Ainsworth et al., 1974; Calkins & Hill, 2007; Cassidy, 1994). Sensitive responses to a range of children's emotional states likely foster open and unbiased emotional communication as children experience that direct expression of emotional states is a useful and effective strategy to modulate affective states in interaction with the caregiver (Bell & Ainsworth, 1972). In particular, sensitive responses to children's display of negative affect, such as fear, anger or sadness, likely reduces children's experience of negative affect as frightening and increases their ability to tolerate negative emotions (Cassidy, 1994). Moreover, sensitive caregivers' supportive presence likely helps children to act autonomously and persevere longer in emotionally challenging situations, as they know they can rely on their caregivers' assistance

in case a situation gets more stressful or frustrating (Sroufe, 1979). Thus, sensitive caregiving promotes children's ability to coordinate own emotions and behavior in social interaction and exploration contexts and to regulate emotional states on their own or with cooperation of their caregiver. In contrast, less sensitive or unresponsive caregivers who are ignoring or rejecting their children's emotional needs do not support open and undistorted expression of children's emotions and likely promote the development of biases in emotion regulation (i.e., over-regulation or under-regulation). Thus, children with less sensitive caregivers may not be able to tolerate negative emotional states for long periods but rather avoid negative emotional experiences, as they have not experienced effective external regulation by the caregiver.

1.4.2 Non-intrusiveness and emotion regulation

Non-intrusiveness in the EA framework refers to the caregiver's ability to be available to the child without being intrusive or undermining the child's autonomy. A non-intrusive caregiver respects the child as an autonomous person, follows the child's lead in play and refrains from over-stimulation or interference with ongoing activities (Biringen et al., 2014; Saunders et al., 2015). If a non-intrusive caregiver joins the child's activity, he/she finds non-interruptive points of entry into the interaction, that is, he/she waits for optimal natural breaks and never interferes physically. Furthermore, non-intrusiveness is characterized by talking and teaching that considers the child's communication in and contribution to the relationship. A non-intrusive caregiver uses commands and directives sparingly and verbal interferences only if necessary. Importantly, the child's reaction to caregiver behavior is an indicator of whether the child perceives the caregiver as being intrusive.

With regard to child emotion regulation, non-intrusive caregivers provide a context in which children can progressively learn to regulate emotional states autonomously and independently. Non-intrusive caregivers are available for their children if needed, follow their children's pace and affective needs and use mood setting techniques that are adequate for the children's current affective state and situational affordances. Thereby non-intrusive caregivers support children's attempts of regulating their own arousal and seeking age-appropriate levels of independence. In contrast, intrusive caregivers' interruption of child actions likely undermines children's ability to tolerate especially negative emotional experiences temporarily as children might expect immediate external regulation by the caregiver. In addition, children with overly directive and controlling caregivers might have fewer opportunities to learn and improve behavioral strategies for self-regulation in

frustrating situations and for dealing competently with social conflicts. Thus, intrusive caregivers impede children's development of age-appropriate autonomous regulation as frequent interference of the child's activities force the child to redirect the attention to the caregiver (Cassidy & Berlin, 1994).

Taken together, the theoretical conceptualization of sensitivity and non-intrusiveness in the EA framework suggests that sensitivity and non-intrusiveness affect children's emotion regulation abilities. Thus, I propose that caregivers' sensitivity and non-intrusiveness likely influences children's attentional and behavioral regulation as two stages in child emotion regulation.

1.4.3 Empirical evidence for the relation of sensitivity, non-intrusiveness and child emotion regulation

The association between caregiver emotional availability, sensitivity or non-intrusiveness and child emotion regulation has been well established for a variety of age groups and contexts. Studies examining predictors of early emotion regulation have reported that sensitive and supportive maternal caregiving is related to longer latency to distress, less affect dysregulation, better arousal regulation in infants (Frick et al., 2018; Gable & Isabella, 1992; Leerkes et al., 2009), and effective behavioral strategies in anger-eliciting contexts in toddlers (Diener & Mangelsdorf, 1999). Furthermore, non-intrusive maternal behavior was related to toddlers' development of better emotion regulation abilities and lower distress and less aggressive behaviors in response to frustrating situations (Calkins & Johnson, 1998; Graziano et al., 2010; Mortensen & Barnett, 2019). Regarding studies using the EA framework to assess maternal behavior and relationship quality, several studies support that emotional availability, sensitive and non-intrusive caregiving are associated with greater emotional control during challenging situations and more adaptive regulation during problem-solving tasks in infants (Little & Carter, 2005; Martins et al., 2012), and with higher frustration tolerance in toddlers' play (Robinson & Little, 1994).

While empirical evidence clearly supports associations of sensitive caregiving and children's early emotion regulation skills, research has put less focus on relations of maternal behaviors and children's attention to emotional information as one stage of emotion regulation. Research in middle childhood and youth suggests that maternal depression (Connell et al., 2013; Gibb et al., 2009) as well as positive and negative maternal affect during interaction (Connell et al., 2013) are related to children's and adolescents' attention to positive and negative emotional facial expressions. Research focusing on effects of

maternal depression relates to theoretical claims on the significant role of sensitivity for child emotion development as mothers with depressive symptoms tend to show less sensitive caregiving (e.g., Bernard et al., 2018). Moreover, an infant study found associations of maternal emotional disposition and 7-month-olds' looking time to positive and negative facial expressions (de Haan et al., 2004). In addition, neurocognitive studies have provided evidence for relations between maternal behavior and children's brain activity during perceptual processing of positive and negative emotional face stimuli in infancy (Taylor-Colls & Pasco Fearon, 2015) and middle childhood (James et al., 2018; Romund et al., 2016)

Even less research focused on the association of maternal sensitive behavior and children's behavioral regulation in emotionally challenging tasks and interactions. Longitudinal studies on potential factors linked to toddlers' behavioral strategies in difficult problem solving tasks showed that maternal positive involvement measured at home (Frankel & Bates, 1990) as well as maternal support during problem-solving (Schieche & Spangler, 2005) were related to dyadic effective problem solving, responsiveness to maternal suggestions, frustration level, engagement in the task, and help seeking behavior. Moreover, research suggests that caregiver emotional availability is related to toddlers' emotional competence and compliant behavior in interactions with the mother (Lehman et al., 2002; Volling et al., 2002). Yet, those studies focused on children's behavioral strategies in specific interactive contexts with the mother.

In sum, while previous research provided ample evidence for a relation between maternal sensitive and non-intrusive behavior and emotion regulation in children, little is known about how directly assessed maternal sensitivity and non-intrusiveness are related to children's attentional regulation in response to others emotional expressions and to children's behavioral regulation in cooperative interaction with other persons than the mother.

2 The Current Thesis

2.1 Aims and Research Questions

The current thesis aimed to investigate the role of caregiver–child relationship and interaction quality in child emotion regulation. More precisely, I was interested how children’s attachment security and maternal emotional availability are related to two aspects of child emotion regulation, that is, attentional regulation and behavioral regulation.

The first aim of the current thesis was to investigate whether attachment security and maternal emotional availability as indicators of the caregiver–child relationship influence children’s **attentional regulation**.

Above I presented children’s attachment security as one possible factor that influences children’s attentional regulation. I have elaborated that attachment security is a crucial factor affecting children’s attention to emotional information. From a theoretical perspective children’s attention to facial emotional expressions of others is very interesting as facial expressions provide information about others’ current emotional states and intentions in social interaction as well as their orientation toward the relationship (Keltner & Haidt, 1999; Van Kleef, 2009; Van Kleef et al., 2010). Yet, empirical studies regarding associations of attachment security in infancy and middle childhood with children’s attention to emotional face stimuli have provided equivocal findings (Meinz et al., 2017; Vandevivere et al., 2014). In the introduction, I have emphasized the role of internal working models, that is, attachment representations, in the development of emotion regulation. Starting from about 4–5 years (i.e., in preschool age), generalized attachment representations (i.e., internal working models) can be reliably assessed in children (Gloger-Tippelt et al., 2002; Psouni & Apetroaia, 2014). The investigation of preschoolers’ generalized attachment representations will tell us more about how attachment representations relate to attentional processes of emotion regulation at an age at which children increasingly engage in social interactions with different persons (peers, teachers, etc.). Thus, the first research question of the current

thesis is whether preschoolers' attachment security (i.e., generalized representations) is related to their attention to emotional facial expressions (Research question 1).

As a second factor that influences children's attentional regulation, I presented maternal emotional availability, more precisely, maternal sensitivity and non-intrusiveness. I have elaborated that sensitive and non-intrusive caregiving is crucial for children's attentional regulation in response to emotional information. Yet, few empirical studies have assessed maternal behavior directly in interaction with the child (Connell et al., 2013; Taylor-Colls & Pasco Fearon, 2015). Whereas maternal intrusiveness is likely associated with insensitive maternal caregiving, the conceptualization of sensitivity and non-intrusiveness as separate dimensions allows exploring unique contributions of both dimensions. From a theoretical perspective, an interesting period for the investigation of emotional regulation is the second year of life. While in infancy, emotion regulation is primarily managed by the caregiver, beginning with the second year of life children become increasingly autonomous in their emotion regulation and self-regulation (Kopp, 1989; Matas et al., 1978; Sameroff, 2010; Thompson, 1994). The investigation of predictive relations of maternal sensitivity and non-intrusiveness with toddlers' attention in emotion processing will tell us more about how maternal emotional availability relates to attentional regulation at an age period in which children become more autonomous in their emotion regulation. Thus, the second research question of the current thesis is whether maternal sensitivity and non-intrusiveness are predictors of toddlers' attention to emotional facial expressions (Research question 2).

The second aim of the current thesis was to investigate whether maternal emotional availability as an indicator of the caregiver–child relationship influences children's **behavioral regulation**.

In the introduction, I have established that sensitive and non-intrusive caregiving is important for children's behavioral regulation in frustrating events or difficult interactions. For example, maternal supportive behavior is related to toddlers' behavioral regulation in problem solving tasks (Frankel & Bates, 1990; Schieche & Spangler, 2005). While young infants mainly produce unplanned signals to the caregiver or engage in self-soothing behaviors, toddlers use more playful strategies and start to involve their social environment for support in regulation of negative emotion – which highlights the increasing importance of social interactive aspects in emotion regulation in toddlerhood (Kopp, 1989). From a theoretical perspective, particularly interesting interactive contexts are cooperative interactions, that is, interactions in which two persons have to work together simultaneously

to achieve a goal together (Tomasello & Hamann, 2012). The investigation of how maternal sensitivity and non-intrusiveness are associated with toddlers' behavioral strategies in difficult cooperative interactions will tell us more about how maternal emotional availability relates to behavioral regulation in emotionally challenging situations. Thus, the third research question of the current thesis is whether maternal sensitivity and non-intrusiveness are related to toddlers' behavioral regulation in difficult cooperative interactions with others (Research question 3).

2.2 Outline of the Thesis and Author Contributions

Three studies were conducted to examine the three research questions presented above. While Study 1 was a cross sectional study and focused on preschool children, Study 2 and Study 3 were part of a longitudinal study and focused on infants and toddlers. In Study 1, we assessed children's attachment security on a representational level, in Study 2 and 3 we assessed mothers' emotional availability directly in interaction with their children. We used the same eye-tracking technology and task in Study 1 and 2, and used two behavioral tasks in Study 3 to measure child emotion regulation. 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	✓	✓	✓	✓

Note. ✓ major contribution, (✓) joint contribution

Study 1 addressed the first research question, that is, whether preschoolers' attachment security is related to their attention to emotional facial expressions. More precisely, Study 1 investigated the relation between preschoolers' generalized attachment representations and their visual attention to facial emotional expressions. To this end, we assessed 5-year-old children's ($N = 49$) attachment security on a representational level using an Attachment Story Completion Task (GEV-B; Gloger-Tippelt & König, 2016). Moreover, we measured children's visual attention (i.e., fixation duration) to pictures of neutral, angry, fearful, sad, and happy facial emotional expressions in an eye-tracking task. We hypothesized that children with more secure attachment representations will attend more openly (i.e., longer) to both negative and positive emotional expressions than children with

less secure attachment representations. Analyses revealed that attachment security was a significant predictor of children's attention to neutral and sad expressions (while controlling for age, gender, and temperament). Moreover, securely attached children looked longer at the fearful expression than insecurely attached children. Thus, secure attachment was related to prolonged visual attention to fearful, sad, and neutral emotional facial expressions.

Study 2 addressed the second research question, that is, whether maternal sensitivity and non-intrusiveness are predictors of toddlers' attention to emotional facial expressions. More precisely, Study 2 investigated the cross-lagged reciprocal relations of maternal sensitivity and non-intrusiveness and children's visual attention to emotional facial expressions in a longitudinal design. To this end, we assessed mothers' sensitivity and non-intrusiveness in free play interactions with their children at the age of 12 ($N = 118$) and 24 months. Moreover, at each time point we measured children's visual attention (i.e., fixation duration) to pictures of neutral, fearful, sad, and happy facial emotional expressions in an eye-tracking task. We hypothesized that more sensitive and less intrusive maternal behavior will predict more open attentional allocation (i.e., longer attention duration) to both negative and positive emotional expressions. Cross-lagged panel analyses revealed that maternal sensitivity at 12 months predicted child attention to sad and happy expressions at 24 months. Moreover, maternal non-intrusiveness at 12 months predicted child attention to sad expressions at 24 months. Thus, more sensitive behavior predicted prolonged visual attention to both the sad and the happy expression, while less intrusive caregiving predicted prolonged visual attention to the sad expression.

Study 3 addressed the third research question, that is, whether maternal sensitivity and non-intrusiveness are related to children's behavioral regulation in difficult cooperative interactions with others. More precisely, Study 3 investigated which factors predicted children's behavior in difficult cooperative interactions and, in particular, whether maternal emotional availability (i.e., sensitivity and non-intrusiveness) contributed beyond child cognitive skills and temperament (i.e., shyness). To this end, we assessed mothers' sensitivity and non-intrusiveness in a free play interaction and a task context at the age of 24 months ($N = 90$) as well as child language skills, self-control, and shyness. Moreover, we examined toddlers' behavior to interruptions in two difficult cooperative interactions, that is, their disengagement from the task, approach to the mother, active help seeking, and reengagement. We first examined child cognitive skills and child temperament as predictors. In a second step, we examined whether maternal sensitivity and maternal non-intrusiveness explained additional variance. We hypothesized that sensitive and non-intrusive maternal

behavior will predict toddlers' behavior in the cooperative interactions. Results revealed that maternal intrusiveness was significantly related to child disengagement from the task and approach to the mother, while toddler self-control and language skills were related to approach to mother and active help seeking, respectively. Thus, higher maternal intrusiveness predicted more child disengagement and more approach to the mother.

3 General Discussion

Developmental research suggests that early social experiences play a significant role for children's healthy social and emotional development, and highlights the importance of caregiver-child relationship quality for child emotion regulation (Bowlby, 1969/82; Cassidy, 1994; Sroufe, 1996a; Thompson & Meyer, 2007; Tronick, 1989). The current thesis aimed to provide insights into influences of attachment representations and maternal emotional availability on two aspects of child emotion regulation (i.e., attentional and behavioral regulation). For that purpose, 3 studies were conducted that focused on the role of attachment security and maternal emotional availability in preschoolers' and toddlers' attentional and behavioral regulation. Findings revealed that attachment security (Study 1) as well as maternal emotional availability (Study 2) were related to preschoolers' and to toddlers' attention to emotional facial expressions. Moreover, maternal non-intrusiveness was related to toddlers' behavioral strategies in a difficult cooperative interaction (Study 3). Across studies, the current thesis suggests specific relations of attachment security and sensitivity with antecedent-related emotion regulation and non-intrusiveness with response-related emotion regulation.

In the following, I will first outline the contribution of these studies to existing theories and research before providing general contributions and implications, directions for future research, and a general conclusion.

3.1 Caregivers' Role in Preschoolers' and Toddlers'

Attentional Regulation

The first aim of the current thesis was to examine the relation of attachment security and maternal emotional availability as indicators of the caregiver-child relationship and children's attentional regulation. Theoretical accounts have discussed that attachment representations and sensitive caregiver behavior in interaction with the child may influence how openly children attend to emotional information (Bowlby, 1980; Dykas & Cassidy,

2011; Main et al., 1985). Empirical research provided evidence for relations between attachment security (Kirsh & Cassidy, 1997; Main et al., 1985; Meinz et al., 2017) as well as caregiver behavior (Connell et al., 2013; de Haan et al., 2004; Gibb et al., 2009; Taylor-Colls & Pasco Fearon, 2015) and children's attention to emotional stimuli. Yet, methods and operationalization of the key constructs differed considerably across studies and the pattern of findings was equivocal. In order to advance the debate on the role of caregiving in child attentional regulation, the current thesis investigated the relation between caregiving (i.e., attachment security and maternal emotional availability) and attentional regulation in preschool children and toddlers. It is particularly interesting to examine attention to facial emotional expressions, as facial expressions convey important information regarding others' emotional states in social interactions (Ekman, 1993; Keltner & Haidt, 1999). Thus, attentional regulation in response to others' emotional expressions might affect further interaction with others. In the following sections, I will discuss how findings of Study 1 and 2 expand our understanding of caregivers' role in young children's attentional regulation.

3.1.1 Attachment, maternal sensitivity, and child attention to emotions

The results of Study 1 and Study 2 support the idea that attachment as well as maternal emotional availability are related to children's attention to emotional facial expressions. Study 1 revealed that secure attachment representations in preschoolers are related to attention to negative (i.e., sad and fearful) and neutral facial emotional expressions but not to positive (i.e., happy) expressions. These findings suggest that preschool children regulated their attention differently in response to negative and positive emotional expressions. While less secure attachment representations seem to reduce the looking duration to sad and fearful facial expressions, the current thesis does not support effects of attachment on attention duration to happy facial expressions. Our findings add to research with adults and children that supports associations of attachment security with differences in processing of emotional facial expressions (Dewitte & De Houwer, 2008; Meinz et al., 2017; Vandevivere et al., 2014). Study 2 supports these findings by showing that less sensitive and more intrusive maternal behavior predicted shorter visual attention to the sad expression one year later. In addition, Study 2 showed that more sensitive caregiving predicted prolonged visual attention to the happy expression one year later. Thus, while attachment security seems to be related to preschoolers' concurrent attentional regulation in response to negative emotional expressions, specific caregiver behavior seems to be related longitudinally to toddlers' attentional regulation in response to both negative and positive emotional expressions. The

current thesis adds to previous empirical evidence for associations between attachment, caregiving and processing of emotional facial expressions in infancy, middle childhood, and adolescence (Connell et al., 2013; de Haan et al., 2004; Gibb et al., 2009). In general, the findings of Study 1 and Study 2 support theoretical accounts that propose that internal working models guide information processing, and that individuals with secure working models more likely process emotional information in an open manner compared to individuals with insecure working models (Dykas & Cassidy, 2011; Thompson, 2016). The predominant findings for negative emotional expressions are in line with the theoretical notion that children's experiences within the caregiver-child relationship are particularly relevant for processing and regulation in contexts of negative emotions (Bowlby, 1980; Cassidy, 1994; Dykas & Cassidy, 2011).

A possible explanation refers to the more adequate and effective external regulation that sensitive and non-intrusive caregivers provide especially in their responses to children's negative affective states. Given this adequate external regulation, children might perceive negative emotions as less hurtful and might be able to attend more openly (i.e., longer) to negative emotional information (Bowlby, 1973; Cassidy, 1994). This extends theoretical ideas that early experiences in personal relationships impact children's socio-emotional development, possibly by influencing how emotional stimuli are processed, that is, perceived, attended to, interpreted or remembered (e.g., Hadwin et al., 2006; Pollak & Tolley-Schell, 2003). Moreover, the findings of this work are consistent with the theoretical claim that insecurely attached individuals are more inclined to defensively exclude negative emotional information than securely attached individuals (Bowlby, 1980; Dykas & Cassidy, 2011). Defensive exclusion can be explained by the different organization of internal attachment working models in secure and insecure individuals that filter incoming information according to the attachment representation.

The current thesis adds to our understanding of the role of internal working models of early experiences for emotion regulation in several ways. First, the pattern of results on effects of attachment (Study 1) and maternal behavior (Study 2) on attention in response to negative facial expressions supports theoretical claims that children's experiences in interactions with their caregivers become internalized and organized in internal working models (Bowlby, 1969/82; Main et al., 1985). The similar effects of maternal emotional availability (Study 2) and attachment representations (Study 1) on attention to negative expressions in toddlers and in preschoolers suggest that the organization of emotion and behavior into internal working models might already be established at one year of age when

distinct patterns of attachment are first observed. Therefore, specific caregiver behavior in earlier interactions in toddlerhood might influence later child attention to negative emotional expression in a similar way as internal working models of attachment later in development. Although from a theoretical perspective, sensitivity is the most important caregiver behavior for the formation of secure attachment, other aspects of caregiving might as well contribute to the organization of attachment working models. While Study 2 supports theoretical claims that sensitive caregiving is a relevant contributor to children's attachment security – thereby affecting child attentional regulation in response to negative emotions – the current thesis suggest that maternal intrusiveness also adds to the development of child emotion regulation probably through the influence on internal working models.

Second, while in preschool age concurrent relations between attachment representations and attention exist (Study 1), in infancy and the toddler period only longitudinal relations from 1 year to 2 years (Study 2) emerged. This interesting finding highlights the importance of early interactional experiences – at a time that is important for attachment formation – for later development (Sroufe, 1996b). During the toddler period children become increasingly independent from their caregivers and assume a more active role in dyadic emotion regulation, thus concurrent caregiver behavior might be less influential. Moreover, as internal working models are actually representing and including earlier experiences the concurrent effects of internal working models on child attentional regulation might reflect effects of the specific caregiver–child history on child emotion regulation. Thus, the current thesis demonstrates that effects of caregiver behavior in interaction – a proximal aspect of relationship quality – on child attentional regulation might emerge after a certain time, while effects of attachment internal working models – a distal aspect of relationship quality – as a reflection of earlier experiences might manifest concurrently.

Third, Studies 1 and 2 suggest that effects of internal working models on emotion regulation become generalized and affect processing of social and emotional information beyond the specific caregiver–child relationship. From an attachment point of view, internal working models are initially organized to guide and regulate behavior in attachment relevant situations with the caregiver. Thus, effects of internal working models are proposed to arise in interaction with attachment figures as in relationships with attachment figures emotion regulation and behavior strategies are most relevant. By confirming effects of attachment security and maternal behavior on attention to emotional facial expressions of unfamiliar persons, the current thesis supports the theoretical idea that already in toddlerhood

experiences with caregivers' sensitivity and intrusiveness affect how children respond to emotional expressions of other persons (Cassidy, 1994; Main et al., 1985; Main, 2000).

3.1.2 Gaze avoidance as an attentional regulation strategy

The current thesis adds to ideas that young infants' gaze avoidance (i.e., attentional disengagement) is an adaptive way to regulate their emotional distress in response to maternal affective unavailability (Tronick, & Weinberg, 1997). Infants' typical response in the classical "still-face paradigm" (Tronick, et al., 1978) is indicated by reduction in gaze to parent, reduction of positive affect, and an increase of negative affect from an initial interaction episode to a still-face episode in which the mother displays a neutral face and does not react to the child (see Mesman et al., 2009). Those behavioral responses are thought to reflect the interactive history of a caregiver–child dyad in which infants have experienced specific patterns of interaction with the caregiver and learned how to respond when expectations regarding interactional patterns are violated. Related to this paradigm, infants' regulation of gaze can be described as two functions: gaze towards the mother is interpreted as social bidding (e.g., Carter et al., 1990), while gaze away from the mother is interpreted as a form of self-soothing (e.g., Tarabulsy et al., 2003).

The current thesis relates to this interpretation by indicating that children who have a history of experiences with sensitive, available caregivers might expect their caregivers to respond to their social bidding and thus might be more inclined to regulate their gaze towards the caregiver. The findings of Study 2 that sensitivity is related to longer looking time to happy expressions is in line with this notion, as children with sensitive caregivers might have experienced that caregivers' positive facial expressions are an indicator of caregivers' openness for interaction. Children with a history of experiences with less sensitive caregivers might be more used to caregivers' display of negative emotions, which might be more distressing, as sad or fearful expression indicate less availability of the caregiver. Thus, they might expect their caregivers to not respond to them and use gaze avoidance as a strategy to soothe themselves. This gaze avoidance may situationally be adaptive and reduce feelings of distress – a notion that is in line with claims that attentional distraction is an adaptive emotion regulation strategy (Gross, 2014; Taylor, & Amir, 2010). However, visual avoidance of emotionally arousing stimuli as an attentional regulation strategy can be maladaptive when it becomes a generalized attentional regulation strategy in response to others' emotions.

Taken together, the current thesis expands our understanding of the relevance of the caregiver–child relationship for attentional processes in child emotion regulation (Cassidy,

1994; Tronick, 1989) and broadens our knowledge on caregivers' role in the development of children's potentially maladaptive regulation strategies.

3.1.3 Age-dependent experience with emotions in social communication

The current work indicates that attention to different discrete emotional expressions of others might not be equally influenced by caregiver–relationship in toddlers' and in preschoolers' social communication. This difference might be due to the specific meaning of different emotional expressions and the information they convey about others' internal states and their orientation toward the relationship. The current thesis demonstrates a predominant effect of attachment and caregiving on attention to sad facial expressions (Study 1 and Study 2). A sad face indicates that the other person is currently more concentrated on his/her own needs (Van Kleef et al., 2010) and might be less likely to respond to the child, such as in the case of depressed mothers who are emotionally less available for their children (e.g., Bernard et al., 2018; Trapolini et al., 2008). While in infancy sad expressions of the mother might be particularly relevant, sad expressions of others may also be relevant as an indicator of availability from early on. Although the same may be true for fearful expressions, only preschoolers' attachment security (Study 1) but not maternal behavior in toddlerhood (Study 2) was related to attention to fearful faces. It is possible that the effect of caregiving on attention to fearful faces is not as strong in toddlerhood as later at preschool age, because in the first two years of life young children may have less experience with the expression of fear, unless in contexts of attachment disorganization (Granqvist et al., 2017). Indeed, children's expression of fear requires greater experiences with threatening situations and is based on children's cognitive abilities (e.g., memory) and appraisal processes (Sullivan & Lewis, 2003). Likewise, younger children might be less skilled to interpret potential meanings of ambiguous neutral expressions (Study 2), while older (insecurely attached) children might interpret them as indifference or disinterest and might therefore perceive them as negative or threatening (Cassidy, et al., 1996; Raikes & Thompson, 2008) (Study 1). Consequently, influences of caregiving on attention to fearful and neutral expressions might be smaller (i.e., too small to be measurable with the design of Study 2) in toddlerhood than in preschool age. Interestingly, attention to happy facial expressions seems to be affected by caregiver–child relationship behavior more strongly in toddlers (Study 2) than in preschool children (Study 1). Experiences of positive emotions in interactions with the caregiver may be relevant in children's development of emotion regulation (Cassidy, 1994) as they usually signal a benevolent orientation toward the relationship and a willingness to

provide support (Van Kleef et al., 2010). However, in preschool age effects of other factors – such as activity level as a temperamental characteristic in Study 1 – may be stronger than effects of caregiving on children's attentional regulation in response to positive expressions compared to toddlerhood.

Taken findings of Study 1 and Study 2 together, the current thesis expands theoretical and empirical notions that caregiving plays an important role in young children's attentional processing and regulation in response to emotional information.

3.2 Caregivers' Role in Toddlers' Attentional and Behavioral Regulation

The current thesis focused on an important age period in the development of child emotion regulation, that is, the toddler period. During the toddler period, children become more autonomous, independent and competent, which makes the toddler period a crucial developmental phase for the emergence and development of emotional self-regulation (e.g., Calkins & Johnson, 1998). Toddlers' increasing knowledge of causes of emotional distress allows them to use more planful strategies as well as assistance of their social environment for regulation of their emotional distress (Kopp, 1989; Thompson, 1994). Empirical research has shown that with increasing age infants and toddlers use more self-distraction and behavioral avoidance as well as more distal interactive strategies (Mangelsdorf et al., 1995; Rothbart et al., 1992; Schieche & Spangler, 2005). While there is a general increase in use of self-regulatory strategies in toddlers, research suggests that individual differences in children's emotional regulation are based on caregiving quality and external support provided by the caregiver (Diener & Mangelsdorf, 1999; Kopp, 1989; Schieche & Spangler, 2005). In order to advance this debate, the current thesis investigated the relation between maternal emotional availability and toddlers' attentional regulation towards facial emotional expressions as well as their behavioral regulation in difficult social interactions. In the following sections, I will discuss how findings of Study 2 and 3 expand our understanding of caregivers' role in toddler's attentional and behavioral regulation.

3.2.1 Maternal emotional availability, child attention to emotions, and behavioral strategies

Study 3 addressed the second aim of the current thesis (i.e., to examine whether maternal emotional availability influences children's behavioral regulation) and revealed that

maternal intrusiveness was significantly related to child disengagement from a difficult cooperative task and to child approach to the mother. While Study 3 addressed research question 3 (i.e., whether maternal sensitivity and non-intrusiveness are related to toddlers' behavioral regulation in difficult cooperative interactions), a more comprehensive picture of caregivers' role in child emotion regulation can be discussed in relation to research question 2 (i.e., whether maternal sensitivity and non-intrusiveness are related to toddlers' attentional regulation in response to emotional facial expressions).

The current thesis highlights specific contributions of different dimensions of maternal emotional availability to toddlers' regulation of attention and behavior. While sensitive maternal behavior appears to play a greater part in toddlers' attentional regulation (Study 2), non-intrusive maternal behavior appears to be most relevant for toddlers' behavioral regulation (Study 3). Notably, the current thesis does not support an effect of sensitive caregiving on children's use of behavioral strategies in frustrating contexts (Study 3). This contrasts previous research on effects of maternal supportive behavior during a frustrating situation and indirect effects of sensitivity via attachment security (Diener et al., 2002; Frankel & Bates, 1990; Matas et al., 1978; Schieche & Spangler, 2005).

A possible explanation of this pattern of results refers to the development of the two different stages of emotion regulation. Attentional regulation as an emotion regulation strategy emerges early in development and is easily implemented (Rothbart et al., 1990; Thompson, 1994). Thus, children's previous experiences with sensitive caregivers might have already affected the development of specific patterns of attentional regulation, while sensitivity might not be as influential on concurrent development in toddlerhood anymore. Concurrent relations of sensitivity and toddlers' behavioral regulation might only be observable in terms of maternal sensitivity directly provided in challenging situations or interactions as the implementation of behavioral strategies might require more support from caregivers due to higher demands of problem-solving or social contexts.

Maternal sensitivity as conceptualized in the EA framework refers to sensitive and appropriate responses towards both positive and negative emotional expression of the child (Biringen et al., 2014; Saunders et al., 2015). This kind of responsiveness to child emotional signals may be more relevant when the child is younger and not yet able or less skillful to regulate own emotional arousal. With toddlers' increasing need for autonomy and independence from the caregiver in the second year of life concurrent effects of sensitive caregiving might be reduced. Maternal (non-) intrusiveness refers to the support of children's need for autonomy, thereby affecting how children learn to cope independently with

emotionally challenging situations. Compared to a reduced relevance of concurrent sensitive caregiving, the current thesis suggests an increasing importance of non-intrusiveness for toddlers' use of specific behavioral strategies. The results of Study 2 that non-intrusiveness is related to toddlers' attention to negative but not to positive emotional expressions adds to the idea that caregivers' intrusiveness might be especially important for children's regulation in response to negative arousal. Non-intrusiveness might affect children's attentional processing of negative emotions because children might have experienced that their caregivers are more likely to intervene in an intrusive way when children show negative affect than when they show positive affect (e.g., Calkins et al., 2004; Spinrad & Stifter, 2002).

In sum, while the current work confirms longitudinal effects of sensitivity on toddlers' attentional regulation as well as concurrent and longitudinal effects of non-intrusiveness on toddlers' attentional and behavioral regulation, it does not provide evidence for concurrent effects of sensitivity on children's attentional and behavioral regulation.

3.2.2 Avoidant coping strategies in attentional and behavioral regulation

The findings of the current thesis relate to literature on coping, that is, a goal-oriented process in which individuals engage in cognitive and behavioral efforts in order to manage responses to stressors or to eliminate the source of stress (Lazarus, 1993; Lazarus & Folkman, 1984). The coping literature refers to three different coping dimensions: problem-focused coping, emotion-focused coping, and avoidance focused coping (Compas et al., 2001; Lazarus, 1993; Lazarus & Folkman, 1984). Problem-focused coping refers to resolving a stressor, for example, by seeking solutions and attempting to change a stressful situation. Emotion-focused coping refers to dampening one's emotional arousal caused by a stressor, for example, by expressing emotions to get support from others. Avoidant or disengagement coping refers to orienting away from the stressor itself or from internal cognitive or emotional states triggered by the stressor, for example, by withdrawal from the stressor. Although coping is conceptualized as a conscious volitional regulation process in response to stressful situations (e.g., Compas et al., 1997), coping strategies might emerge from autonomous, unconscious processes of emotion regulation that develop earlier in life. The development of cognitive skills and of an increasing understanding on the effectiveness of certain strategies in managing emotional experience in response to stressful situations might contribute to this development.

Given the findings on attentional and behavioral regulation in toddlers, the current thesis demonstrates that the use of avoidance coping strategies may arise from insensitive and intrusive caregiving. Within the emotional context provided by sensitive caregivers, infants learn to express their emotional states openly and to perceive caregivers' positive and negative expressions not as a threat for the relationship but as part of a healthy affective communication. In contrast, the context provided by less sensitive caregivers might comprise frequent displays of negative emotions that might indicate less availability of the caregiver. Thus, children with less sensitive caregivers might develop avoidance or disengagement coping strategies in response to emotional facial expressions of others. Concerning child behavioral regulation, two possible mechanisms may explain how intrusive caregiving influences toddlers' use of avoidance strategies in challenging situations (Study 3). First, children with intrusive caregivers might over rely on their caregiver as a provider of external regulation and quickly approach the caregiver who might prevent them from developing problem-focused strategies and competencies. Second, as caregivers' interferences with child ongoing activities are likely frustrating for children, experiences with intrusive caregivers might lead to the development of avoidance coping strategies. Those avoidance strategies may manifest as withdrawal from frustrating situations and at the same time as avoidance of caregivers as children might expect an increasing level of frustration in contact with an intrusive caregiver. This interpretation is in line with the notion that intrusive caregiving contributes to the development of both avoidant as well as ambivalent attachment strategies (Ainsworth et al., 1971; Berlin & Cassidy, 2003; Cassidy, & Berlin, 1994).

In sum, the current thesis adds to our understanding of the role of caregiver behavior in child emotion regulation by presenting specific relations of caregiver behavior with both toddlers' attentional and behavioral regulation. While early sensitivity is important for toddlers' attentional regulation in response to negative and positive emotions, non-intrusiveness contributes to toddlers' attentional regulation in response to negative emotions as well as to toddlers' behavioral strategies in frustrating interaction, indicating that non-intrusiveness is particularly relevant for children's ability to tolerate and regulate negative emotional states.

3.3 General Contributions and Implications

This thesis connects research on attachment and caregiver behavior and research on child emotion regulation by focusing on scarcely investigated aspects of child emotion regulation. Overall, the current work supports the significant role of attachment security as well as

maternal sensitivity and intrusiveness for young children's attentional and behavioral regulation. In the following section, I will discuss general contributions to research on factors affecting child emotion regulation and implications for child socio-emotional development.

3.3.1 Extrinsic and intrinsic factors related to child emotion regulation

The current work contributes to developmental research on extrinsic and intrinsic factors influencing the development of emotion regulation in children (Calkins, 1994; Thompson & Meyer, 2007).

Concerning extrinsic factors, the current thesis highlights specific relations of caregiver-child relationship quality on young children's regulation of attention and behavior. The theoretically and empirically related constructs of attachment and sensitivity (Ainsworth et al., 1971; De Wolff & van Ijzendoorn, 1997; Verhage et al., 2016) play an important role in preschoolers' and in toddlers' attentional regulation in response to other emotions (Study 1 and 2). Facial expressions are intense emotional stimuli that increase the observer's emotional arousal (Adolph & Alpers, 2010; Ekman, 1993). When children can no longer tolerate negative arousal, a regulation strategy to reduce arousal quickly is to direct attention away from the emotional stimulus. The current thesis shows that secure attachment and sensitive caregiving are important extrinsic factors that contribute to children's attentional regulation as an antecedent-focused emotion regulation strategy. Furthermore, the construct of maternal non-intrusiveness is a relevant extrinsic factor in toddlers' development of behavioral regulation in difficult cooperative interactions. The interruption of cooperative interactions is a frustrating situation that challenges toddlers' abilities to cope competently with their negative arousal within social interaction. Intrusive caregiving promotes children's use of strategies aimed to disengage from the situation without further attempts to repair the interaction together with the interaction partner or with the caregiver's help. Thus, the current thesis shows that intrusive caregiving is a relevant extrinsic factor that contributes to children's behavioral regulation as a response-focused emotion regulation strategy.

Note that all three studies included in the current thesis controlled for temperamental characteristics and thereby considered an intrinsic factor influencing child emotion regulation. While children's activity level contributed to preschoolers' attention to sad and happy facial expressions (Study 1), toddlers' surgency and effortful control (Study 2) as well as toddlers' level of shyness (Study 3) were not related to attentional or behavioral regulation, respectively. This pattern of mixed results may be due to methodological

differences in the three studies. While Study 1 focused on a very specific aspect of preschoolers’ temperament, Study 2 assessed two temperamental dimensions that each comprise several aspects that contribute to the temperamental dimension (e.g., surgency comprises of positive anticipation of pleasurable activities, enjoyment of high stimulus intensity or novelty, and child activity level and impulsivity). Thus, the temperamental dimensions in Study 2 may have been too broad to capture characteristics that relate to child emotion regulation. In Study 3, toddlers’ shyness was observed towards an experimenter different to the experimenter who interacted with the children in the cooperative games. Moreover, shyness may be more relevant for the question whether children were willing to engage in a cooperative interaction in the first place. A second interpretation of the mixed pattern of results is that temperamental characteristics play a greater role for children’s attentional regulation in preschool, whereas in toddlerhood effects of temperament on child emotion regulation are less strong compared to effects of maternal emotional availability. More research is needed to investigate the contribution of temperament as an intrinsic factor on child attentional and behavioral regulation.

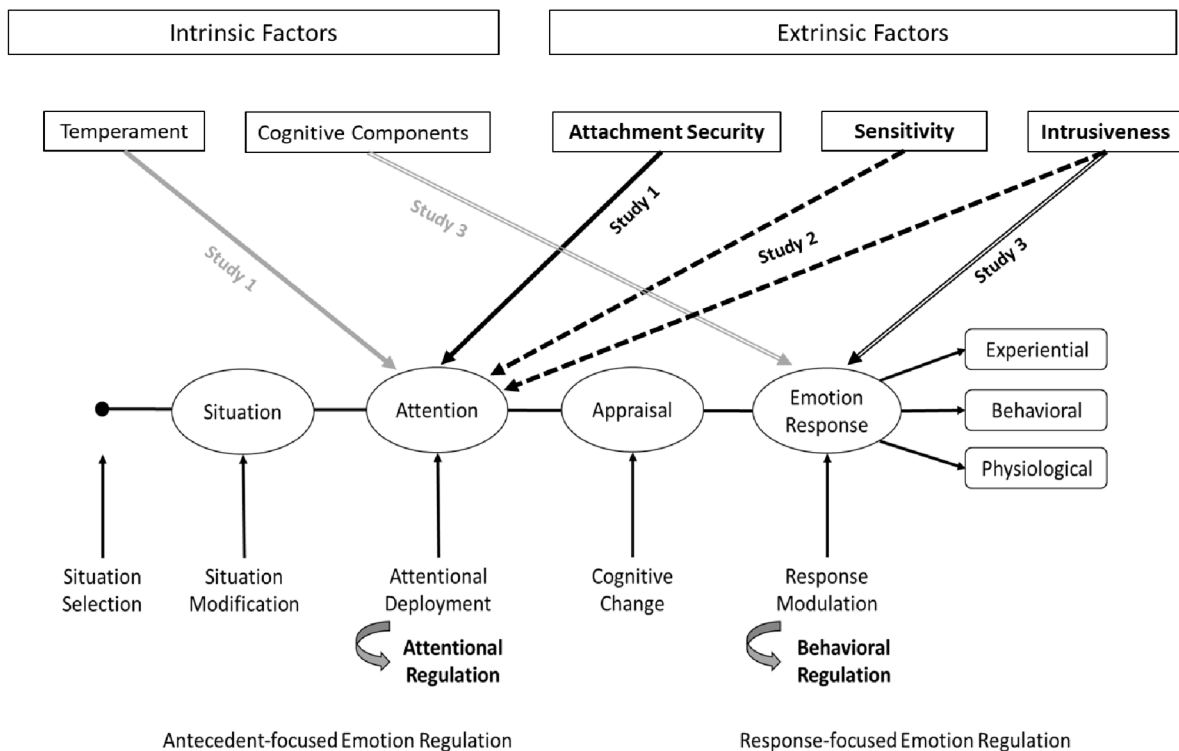


Figure 3. Graphical representation of relations supported by the three studies of this thesis. Extrinsic factors and relations to emotion regulation that were in the main focus of Studies 1-3 are marked in bold. Relations of intrinsic factors and emotion regulation that were included additionally in Study1 and Study 3 are marked in grey.

In addition, Study 3 addressed children's cognitive skills as another intrinsic factor and revealed that language skills and self-regulation in a delay task are associated with strategies directed to the caregiver (i.e., approach and help seeking). This is in line with theoretical claims that with increasing age young children develop cognitive skills that enable them to understand the relevance of their social environment for the implementation of behavioral regulation strategies (Calkins, 1994).

Taken together, the current thesis contributes to better understanding of the influence of certain extrinsic factors (i.e., attachment security, maternal sensitivity and non-intrusiveness) and intrinsic factors (i.e., temperament, cognitive skills) on specific aspects of children emotion regulation (i.e., attentional regulation and behavioral regulation) (see Figure 3).

3.3.2 Consequences for child socio-emotional development

The current thesis advances our understanding of the influences on attentional and behavioral regulation processes that contribute to children's socioemotional functioning and their adaptive emotion regulation in social interactions.

The ability to regulate emotions effectively is an important skill in social interactions and relationships. Better emotion regulation is related to higher social competence and better peer relationships (Calkins et al., 2001; Denham et al., 2003; Eisenberg et al., 1993). The current thesis focused on two stages of emotion regulation that might play different roles in social interactions. The regulation of attention in response to emotional stimuli might influence the further processing of these stimuli, for example, recognition of emotions (Serrano et al., 2018) or memory processes (Mulligan, 1998; Mulligan & Hartman, 1996). For instance, insecure attachment is associated with less accurate recognition and understanding of others' emotions (Laible & Thompson, 1998; Steele et al., 2001). Thus, attentional regulation might affect social interactions indirectly through the impact on other emotion regulation and generation processes. At the same time, attention away from emotional expressions of others might signal the other person that one is no longer interested to interact with that person.

Behavioral strategies used to regulate emotion response tendencies most likely affect social interactions directly. The current thesis demonstrates that toddlers use withdrawal as a possible strategy that leads to termination of a difficult interaction. Yet, other socially less adequate strategies (e.g., aggressive behavior towards the interaction partner that serves to reduce emotional arousal) may lead to conflict with the interaction partner. Children's

frustration in interactions with intrusive caregivers might also foster the experience of physiological arousal in socializing contexts, which might reduce children's learning experiences in social contexts (Eisenberg et al., 1998). Consequently, socially maladaptive behavioral regulation strategies may decrease the likelihood that children successfully engage in social interaction; thereby eliminating children's opportunities to further improve their socio-emotional skills.

Maladaptive or ineffective attentional and behavioral regulation may contribute to the development of internalizing and externalizing problem behavior (Eisenberg et al., 2001). While internalizing problem behavior refers to anxiety, social withdrawal, depression, and psychosomatic reactions, externalizing problem behavior refers to aggression, disruptiveness, defiance, hyperactivity, and impulsivity (Achenbach, 1991). For instance, research provides evidence for the role of attention in the development of later anxiety or social withdrawal (Pérez-Edgar et al., 2011, 2014) and the role of adaptive behavioral coping strategies in domains of mental health and social adjustment (Smith et al., 2006; VanMeter et al., 2020). As internalizing and externalizing problems lead to long-term negative psychosocial outcomes, it is important to further the understanding of related and predictive factors. By confirming specific relations of attachment, sensitivity and non-intrusiveness with two different stages of emotion regulation, the current thesis adds to research on the relation of caregiving and the development of child internalizing and externalizing problem behavior (Fearon et al., 2010; Groh et al., 2012; Pinquart, 2017). It is well established that relationship-based caregiver–infant interventions that focus on aspects of caregiver behavior can foster the development of effective and adaptive emotion regulation strategies in children (cf. Bosmans, 2016). The effectiveness of such interventions on attachment and caregiver behavior can be further enhanced through a greater understanding that attachment and dimensions of caregiver emotional availability are associated differently with children's attentional and behavioral regulation.

In conclusion, the current thesis deepens our understanding of how specific aspects of the caregiver–child relationship affect different stages in child emotion regulation. This knowledge contributes to the implementation of interventions targeted to enhance child socio-emotional functioning through improvement of the caregiver–child relationship.

3.4 Directions for Future Research

The findings of the current thesis open up directions for future research. I will briefly discuss possible improvements regarding sample characteristics and research design.

3.4.1 Sample characteristics

First, the current thesis fills an important research gap concerning effects of maternal caregiving on children's attentional and behavioral regulation. The relation of the caregiver–child relationship and child emotion regulation is a key theoretical consideration (Bowlby, 1980; Cassidy, 1994; Gianino & Tronick, 1988; Kopp, 1989), yet, little is known about effects of paternal caregiving on child emotion regulation. Inclusion of fathers is important given that research on differences in maternal and paternal influences on child emotion regulation and social competencies is inconsistent. While one line of research supports that caregiver behavior and effects on child emotion regulation and cooperative competencies are different for mothers and fathers (Deichmann & Ahnert, 2021; Gülseven et al., 2021; Volling et al., 2002), other research supports concordance between children's use of emotion regulation strategies with the mother or the father (Diener et al., 2002; Martins et al., 2016). Thus, future research should recruit both fathers and mothers to investigate how paternal and maternal caregiving contribute to the development of different aspects of children's emotion regulation abilities.

Second, the current thesis supports relations of caregiver–child relationship quality and child emotion regulation in highly educated, low-risk samples. These findings relate to research that sensitive caregiving behavior contributes to healthy child development by affecting child resilience, that is, the ability to adapt in positive emotional way in face of stress and adversity (Conway & McDonough, 2006; Faure et al., 2017). However, parental psychopathology, substance abuse or socioeconomic factors are associated with lower quality of parent–child relationship in high-risk samples (Chaudhuri et al., 2009; Flykt et al., 2012; Van Doesum et al., 2007). At the same time caregivers' sensitive responses and attention to children's emotions may serve as a protective factor in the association between exposure to interparental aggression and violence and children's socio-emotional development and psychological adjustment (Caiozzo et al., 2018; Manning et al., 2014). It might be therefore very interesting to examine the relation of caregiver behavior and child emotion regulation in high-risk populations in order to broaden our understanding of how specific components of relationship quality are associated with child developmental outcomes.

3.4.2 Research design

Third, the current work provides evidence for specific longitudinal relations of maternal emotional availability and child attentional regulation. This is in line with theoretical

accounts that have emphasized that particularly earlier experiences with caregivers might impact later child outcomes (Bowlby, 1969/82; Sroufe, 1996b). While a large body of literature focused on unidirectional influences of caregivers on infants (e.g., Calkins & Hill, 2007; Groh et al., 2014; Leerkes et al., 2009), other lines of research support influences of child behavior on caregiver behavior or bidirectional effects (Beebe et al., 1997; Northrup et al., 2019; Sameroff, 2009; Wiggins et al., 2014). Although the current thesis does not support bidirectional longitudinal relations of caregiving and child emotion regulation, prior research demonstrates effects of infants' attentional processing of facial expressions on later relationship quality (i.e., attachment) (Peltola et al., 2015, 2020). Considering both directions, it is an interesting question for future research that may be addressed with cross-lagged designs that allow examining the causal direction of caregiver and child effects (Study 2). Such designs will provide a more comprehensive picture of concurrent and longitudinal relations of caregiver–child relationship quality and different stages of child emotion regulation and potential changes over time. Longitudinal examinations that cover longer periods from infancy to adolescence would be particularly interesting and could examine the developmental trajectory from interpersonal and more automated to intrapersonal and more conscious regulation.

Fourth, while the current work focused on attachment and maternal emotional availability in separate studies, it might be interesting for future research to focus on both aspects of caregiver–child relationship quality as predictors of child attentional and behavioral regulation. As attachment theory is part of the theoretical foundation of the emotional availability framework and the concept of sensitivity, we suggest that future studies could focus not only on unique contributions of attachment security and caregiver emotional availability but also focus on potential mediation or interaction effects. Moreover, the current thesis focused on two important but less investigated stages of emotion regulation that might be most common in young children. With increasing age children acquire more knowledge about causes of emotions, develop cognitive abilities to understand the meaning of emotional experiences, and learn about rules about culturally accepted expression of emotion. Thus, they might be able to use emotion regulation strategies in terms of cognitive change (Carthy et al., 2010; Cole et al., 2009) or modulation of emotion expression (cf. Gross, & Cassidy, 2019). It might be interesting for future research to consider how attachment and dimensions of caregiving might affect other aspects of the process model of emotion regulation.

3.5 Conclusion

The current thesis contributes to our knowledge on the role of social experiences with caregivers in toddlers' and preschool children's emotional self-regulation. The thesis focused on children's attachment security and mothers' sensitivity and non-intrusiveness as indicators of caregiver–child relationship quality and children's attentional and behavioral regulation as two aspects of emotion regulation.

Attachment security and maternal emotional availability relate to preschoolers' and to toddlers' attention to emotional facial expressions. Yet, caregiver influences on attentional regulation differ in regard to their effect on attention to negative versus positive emotions and the specific dimension of emotional availability. Effects are more pronounced in relation to negative facial expressions and for influences of attachment security and sensitivity.

In the toddler period, dimensions of maternal emotional availability differently contribute to the development of attentional and behavioral regulation strategies. While sensitive caregiving plays a crucial role for toddlers' attention to positive and negative emotions, the current thesis does not support effects of sensitive caregiving on toddlers' behavioral strategies in difficult cooperative interactions. The relation of maternal non-intrusiveness and toddlers' attentional avoidance of negative emotions as well as toddlers' behavioral disengagement from difficult interactions highlights the role of non-intrusive caregiving for children's coping with negative arousal and frustrating situations.

Overall, the integration of findings presents a picture of specific relations of caregiver–child relationship aspects and young children's attentional and behavioral regulation. A comprehensive framework addressing the role of caregiver–child relationship in children's socio-emotional development thus needs to consider different aspects of caregiving and account for varying relations for different stages of emotion regulation and across age.

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Appendices

A Paper by Kammermeier, Duran Perez, König, & Paulus (2020) – Study 1

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Attachment security and attention to facial emotional expressions in preschoolers: An eye-tracking study

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According to attachment theory, internal working models of attachment affect the way in which social and emotional information is processed. The current study examined this theoretical claim by investigating the association between attachment security and attention to facial emotional expressions in 5-year-old children. Attachment security was assessed on a representational level using an Attachment Story Completion Task. Children's attention to facial emotional expressions was measured during an eye-tracking task. Gaze data (fixation duration) were collected during the presentation of pictures displaying five different facial emotional expressions (neutral, angry, fearful, sad, and happy) of unfamiliar persons. Moreover, the Emotionality-Activity-Sociability Temperament Inventory was used to control for children's temperament and was filled out by children's mothers. Regression analyses revealed that attachment security was a significant predictor of children's attention to neutral and sad expressions while controlling for age, gender, and temperament. Moreover, a *t*-test revealed that securely attached children looked longer at the fearful expression than insecurely attached children. These findings provide direct evidence that even on a basic perceptual level attachment security is a predictor of children's emotional information processing.

Statement of contribution

What is already known on this subject?

- Attachment representations substantially affect the way in which emotional information is processed.
- Insecure attachment representations are negatively related to children's attention to emotional stimuli.

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What does this study add?

- Eye-tracking technology was used to measure children's visual attention to facial emotional expressions.
- Secure attachment was related to prolonged visual attention to neutral and negative facial emotional expressions.
- Attachment security influences children's emotional information processing even on a basic perceptual level.

Attachment theory proposes that during the first year of life infants' experiences with their primary caregivers are organized in mental representations or 'internal working models' of attachment (Bowlby, 1969/82; Main, Kaplan, & Cassidy, 1985). Moreover, it is suggested that differences in early experiences with the primary caregivers' availability and responsiveness result in the development of different working models, that is, in either secure or insecure working models (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969/82). As internal working models are proposed to affect cognitive processes such as the direction of attention or organization of memories (Bowlby, 1969/82, Bowlby, 1980; Main *et al.*, 1985), differences in these working models are assumed to lead to differences in information processing (Dykas & Cassidy, 2011; Zimmermann & Iwanski, 2015). According to Bowlby (1973), especially the processing of social information is influenced by attachment working models. More precisely, social information processing is likely biased in ways corresponding to a person's working model, that is, depending on whether this person has a secure or an insecure working model. According to Bowlby's concept of 'defensive exclusion' (Bowlby, 1980, p. 45), individuals with insecure working models will either block further processing of attachment-relevant social information by orienting their attention away from emotionally painful aspects, or they will redirect their attention from the arousing aspects to their own expression of distress. In contrast, individuals with secure working models are expected to process both negative and positive emotional aspects of social information in an open manner because they experienced that their attachment figures have supported them in tolerating and regulating their emotional states effectively (Bowlby, 1980; Dykas & Cassidy, 2011).

An important form of social information is emotional information (Keltner & Haidt, 1999; Van Kleef, 2009). The role of attachment in processing of emotional information becomes evident when attachment is described in terms of emotion regulation (Spangler & Zimmermann, 2014). From this perspective, differences in the attachment working models are interpreted as differences in emotion regulation strategies that influence processing of emotional information (Cassidy, 1994). As attention is an important regulatory processing stage, attachment-related biases are particularly likely in attentional processing of emotional information (Silva, Soares, & Esteves, 2012).

The relation between attachment security and attentional processing of emotional information has mostly been investigated in adults using reaction-time tasks (e.g., Atkinson *et al.*, 2009; Dewitte & De Houwer, 2008; Dewitte, Koster, De Houwer, & Buysse, 2007; Edelstein & Gillath, 2008; Gillath, Giesbrecht, & Shaver, 2009; Zeijlmans van Emmichoven, Van IJzendoorn, De Ruiter, & Brosschot, 2003). These studies have shown that, for instance, adults with dismissing, preoccupied, and unresolved representations as well as adults with higher attachment anxiety and/or avoidance oriented their attention away from threat indicating words (Dewitte *et al.*, 2007; Zeijlmans van Emmichoven *et al.*, 2003) and showed reduced attention for threatening facial expressions (Dewitte & De Houwer, 2008), whereas adults with secure representations did not. In addition,

neurocognitive studies have provided evidence for attachment-related differences in brain activity during perceptual processing of emotional stimuli (Dan & Raz, 2012; Zilber, Goldstein, & Mikulincer, 2007). Hence, findings of adult studies have supported the theoretical idea that differences in attachment representations are associated with differences in attentional and perceptual processing of emotional information.

However, even though attachment theory represents a genuine developmental approach, this theoretical idea has been less researched in developmental populations. To date, only few studies have focused on associations between infants' and children's attachment security and their visual attention to emotional stimuli. In one of the few studies assessing attachment security and processing of emotional information, Main *et al.* (1985) examined whether infant attachment security measured in the Strange Situation Procedure (SSP; Ainsworth, Blehar, Waters, & Wall, 1978) was related to 6-year-old's openness to a family photograph of the child and his/her parents. Insecurely attached children were less open than securely attached children; that is, they actively oriented their attention away from the photograph. In two tasks of their longitudinal study, Kirsh and Cassidy (1997) simultaneously presented drawings of affectively positive, negative, and neutral mother-child interactions to 3.5-year-old children and assessed children's attentional preference (i.e., looking duration). Avoidantly attached children (assessed in the SSP) looked away more from each of the drawings than securely attached children. A second task directly compared children's attentional preference in eight sets of drawings. In each set, a drawing of an affectively positive mother-child interaction and a drawing of a non-interacting, affectively neutral adult pair were presented simultaneously. Again, insecurely attached children looked less at the positive drawings than did securely attached children. More recently, Meinz, Morton, Pederson, and Moran (2017) investigated the longitudinal link between attachment security (SSP with 12 months) and attentional bias in a classical dot-probe task (*cf.* MacLeod, Mathews, & Tata, 1986) in middle childhood. More avoidantly attached children showed higher preferential attention to neutral object stimuli than to emotional infant face stimuli. However, Belsky, Spritz, and Crnic (1996) did not find a longitudinal relation between infants' attachment security and 3.5-year-olds' attention to positive and negative social situations acted out by puppets. A cross-sectional eye-tracking study by Vandevivere, Braet, Bosmans, Mueller, and De Raedt (2014) investigated 8- to 12-year-old's attention to stimuli that contained simultaneously presented facial expressions of their mother and of eight unfamiliar females. Self-report questionnaires were used to measure children's attachment security, attachment avoidance, and attachment anxiety, but no effects on children's attention to the emotional expressions were found. In sum, while the majority of studies discussed here have provided initial evidence for a relation between attachment security and processing of emotional information in children, the findings were equivocal and focused on different aspects of emotion processing.

Our study aimed at filling this research gap by contributing empirical evidence regarding the relation between attachment security and attentional processing of emotional information in children. From a theoretical point, it is important to investigate this relation because attention influences later stages of information processing, such as emotion recognition (Serrano, Owens, & Hallowell, 2018) or memory (Mulligan & Hartman, 1996). However, due to simultaneous presentation of attachment-related/emotional stimuli with non-attachment-related/neutral stimuli (Kirsh & Cassidy, 1997; Vandevivere *et al.*, 2014) or intentional distractions (Belsky *et al.*, 1996), most of the previously discussed studies have assessed attentional measures in the context of other

processes. Moreover, the dot-probe task used by Meinz *et al.* (2017) has been shown to be a rather unreliable measure of attentional biases (Thigpen, Gruss, Garcia, Herring, & Keil, 2018). Although Main *et al.* (1985) measured attention on a more basic level, the measure was solely based on raters' estimations made *post-hoc* from videotapes. In order to provide a more direct and precise measure of children's visual attention, we decided to use eye-tracking technology. In the current study, pictures of unfamiliar faces displaying various emotional expressions (i.e., neutral, angry, fearful, sad, and happy) were presented individually, and children's fixation duration was assessed as a measure of attention. To the best of our knowledge, no study has investigated attachment-related attentional biases to emotional stimuli on such a basic perceptual level in children.

Regarding the assessment of children's attachment security in our study, we decided to use a story stem technique. We did so for two reasons. First, we aimed at assessing children's attachment security on a representational level (i.e., their generalized attachment working models). We were interested to assess children's generalized attachment working models because these generalized models affect children's interactions with other persons in general and are not specific for a particular person (e.g., the mother). The SSP, which was applied in most of the previous studies, was not suitable for this purpose because it allows assessing attachment security only on a behavioural level and towards a particular person in a particular situation. We also decided against the use of the mentioned self-report measure of attachment (in Vandevivere *et al.*, 2014) because the validity of self-reports of attachment has been a subject of debate in the literature (e.g., Jacobvitz, Curran, & Moller, 2002). In contrast, story stem techniques allow assessing children's generalized attachment representations (i.e., working models) with a highly valid and reliable measure (Psouni & Apetroaia, 2014; Psouni, Di Folco, & Zavattini, 2015). In this methodology, children's narratives and enactments in play during the completion of attachment story stems are assumed to reflect their generalized attachment representations. The advantage of this method is that it places little verbal or cognitive demands on children. Thus, story stem tasks can be reliably applied starting from about 4–5 years (Gloger-Tippelt, Gomille, König, & Vetter, 2002). A second reason for using a story stem technique is the possibility to calculate a continuous security measure, which allows considering different degrees of attachment security rather than just attachment subcategories in statistical analyses. Continuous attachment measures, such as the coherence scale of the Adult Attachment Interview (Main, Goldwyn, & Hesse, 2003), have been reliably used in research with adults (e.g., Reese, 2008). Continuous security scores can be calculated also for measures of attachment security in childhood (i.e., story stem tasks) (*cf.* Di Folco, Messina, Zavattini, & Psouni, 2017). In the current study, we assessed the attachment representations of 5-year-old children by means of the German adaption (GEV-B; Gloger-Tippelt & König, 2016) of the Attachment Story Completion Task (ASCT; Bretherton, Ridgeway, & Cassidy, 1990). This story stem task has frequently been employed to assess attachment security in middle childhood (e.g., Gloger-Tippelt & Kappler, 2016; Paulus, Becker, Scheub, & König, 2016) and allows to calculate both a continuous attachment measure and a categorical attachment measure.

In order to make sure that the association between attachment security and attention duration would not be influenced by intra-individual factors of the child, we assessed children's activity level. Activity can be defined as the amount of energy spent on bodily movements, that is, aspects of restlessness and of a constant urge to move (Buss & Plomin, 1984). Children with a lower activity level might be better able to focus on the story stem

procedure as well as the eye-tracking procedure because they are better in regulating and orienting their attention. It is therefore important to control for this aspect of child temperament in our study.

Based on the above reviewed theoretical considerations (Bowlby, 1980; Dykas & Cassidy, 2011), we made the following predictions:

1. We hypothesized a positive relation between children's attachment security and their attention to negative emotional information. More precisely, we expected that children with insecure attachment representations will look less long at the angry, fearful, and sad faces than children with secure attachment representations. Moreover, we hypothesized that attachment security will be predictive of attention durations to angry, fearful, and sad faces.
2. With respect to children's attention to the neutral face, we did not have a clear hypothesis. Although previous research has shown attachment-related attentional biases for emotionally neutral stimuli (Kirsh & Cassidy, 1997; Meinz *et al.*, 2017), attachment theory does not make a clear prediction. It is possible that attachment does not play a role in processing of neutral social stimuli. At the same time, it is proposed that secure attachment is related to more openness for the exploration of new stimuli (e.g., Green & Campbell, 2000). It is therefore also possible that more securely attached individuals attend more openly (i.e., longer) to neutral faces of unfamiliar persons.
3. There were two possible hypotheses regarding children's attention to the happy face. If an attentional bias exists only for negative emotional information, we expected that attachment security would not be predictive of attention duration to happy faces. In contrast, if an attentional bias exists for emotional information in general, we expected that attachment security would be predictive of attention duration to happy faces. The two hypotheses were derived from previous studies that showed attachment-related biases also for positive emotional information (Kirsh & Cassidy, 1997; Main *et al.*, 1985) as well as from attachment theory, which does not make specific predictions regarding positive emotional information.

Methods

Sample

The present study was part of a larger study that focused on the mother-child relationship during preschool age. Mothers and their children were recruited via public birth records and flyers in local kindergartens. All interested German-speaking mother-child dyads with typically developing children between the age of 5.5 and 6 years were included in the study. A total of 49 5.5-year-old children ($M = 69.11$ months, $SD = 1.40$, range = 66.30–71.67 months, 22 females) and their mothers participated in the study. Data of five additionally tested children were excluded due to child's missing willingness to participate ($n = 1$), procedural errors during the attachment assessment ($n = 2$), missing eye-tracking data ($n = 1$), and general health problems ($n = 1$). All children were white and came predominantly from middle-class families. Of the parents in the final sample, 67.3% of mothers and fathers had a university degree. All children except one were enrolled in a kindergarten. Mothers and their children were informed about the content and procedure of the study, and mothers gave informed written consent. The study was approved by the local ethics committee.

Procedure

Participating children and their mothers were invited into the laboratory for one testing session lasting approximately 90 min. All children were tested individually. The testing session started with the German adaption (Geschichtenergänzungsverfahren, GEV-B; Gloger-Tippelt & König, 2016) of the ASCT (Bretherton *et al.*, 1990). During this task, children were alone in the room with a female experimenter, while mothers were filling out questionnaires on demographic information and child temperament in another test room of the laboratory. Following recommendations of Gloger-Tippelt and König (2016), the GEV-B procedure was always administered first. This was done to convincingly present the GEV-B procedure as a play situation rather than a test situation, so children would be comfortable in playing openly with the experimenter. The GEV-B procedure lasted between 20 and 60 min and was followed by other tasks (e.g., a mother–child play interaction), which are not relevant for the study presented here. Thereafter, an eye-tracking task on children’s attention to facial emotional expressions was administered. By administering the eye-tracking task last, we aimed to minimize potential transmission effects of the attachment assessment on the eye-tracking task.

Measures

Attachment security

The German adaption (GEV-B) of the ASCT was used to assess attachment security on a continuous scale. The GEV-B is a semi-projective measure for 5- to 8-year-old children. It consists of several stories that are supposed to activate children’s attachment system. Based on how children let the figures in the stories behave, the underlying internal working model of children’s attachment representations can be inferred.

Materials of the GEV-B were five bendable, wooden toy figures representing a family consisting of mother, father, grandmother, and two siblings (a girl and a boy). Further materials were used to present the context of each story (e.g., chairs, beds, a wooden stick).

During the GEV-B procedure, children’s caregivers were not present. The experimenter explained that she will tell the beginning of a story that children could then complete. After a short familiarization with the materials, children were presented with the seven GEV-B stories. In these stories, the child protagonist, who was matched to participants’ gender, is confronted with different situations. The first and the last story are neutral stories. The first story presents a birthday party theme and is intended to familiarize the child with the task. The last story depicts the context of a family trip and is intended to provide a positive ending of the GEV-B procedure. The five stories in-between are ordered in a way supposed to represent an increase in attachment-relevant content and therefore an increase in activation of the attachment system (e.g., spilled juice in the first story or reunion with the parents after a separation in the fifth story). In each story, children were asked to continue the story and were then asked two additional questions: ‘How does [protagonist’s name] feel?’ and ‘Is [protagonist’s name] thinking of something?’

Data were coded only from video recordings by a trained coder who coded two different attachment measures. First, a global attachment security score for each child was calculated that represents the strength of a child’s attachment security (i.e., how much the child trusts in the attachment figure’s availability and support). This was done by rating each of the five stories based on a coding scheme that includes specific indicators of

secure and insecure attachment representations (Gloger-Tippelt & König, 2016). For instance, in the ‘monster’ story an elimination of the monster or reassuring behaviour by the parents is an indicator of secure attachment, whereas rejection by or fear of the parents is an indicator of insecure attachment. In addition, there are indicators of insecure attachment that can occur in each of the stories, such as bizarre events or avoidance of attachment-relevant contents. For each story, a score between 0 (=extremely insecure) and 4 (=very secure) was given, and an overall score was computed. Second, a categorical measure of children’s attachment representations was created by assessing the global attachment pattern across all five stories. In this coding procedure, elements in each story are identified that indicate qualitative differences in the strategies children apply when dealing with the addressed attachment themes (i.e., pain, fear, separation, reunion) (Gloger-Tippelt & König, 2016). For instance, if the attachment theme is denied or avoided, this is an indication of an insecure-avoidant attachment pattern. If the attachment theme is addressed by the child and there is a solution from competent adults or an active greeting during reunion, a secure attachment pattern can be assumed. If the child is exaggeratedly focusing on the attachment theme and stories are characterized by danger, violence, drama, and incoherence, this indicates an insecure-ambivalent attachment pattern. Moreover, bizarre events, blocking, and/or lack of an identifiable strategy indicate a disorganized attachment status. The assessment of the predominant attachment strategy across all stories resulted in the classic attachment subtypes: secure ($n = 18$), insecure-avoidant ($n = 24$), insecure-ambivalent ($n = 5$), and insecure-disorganized ($n = 2$). This pattern is similar to the pattern reported by other studies on attachment in middle childhood (Gloger-Tippelt *et al.*, 2002; Gloger-Tippelt & Kappler, 2016). In order to assess reliability, a second trained coder rated 20 of the videos (38%). Inter-rater reliability was excellent: Cohen’s kappa = .81 (90% agreement).

Attention to facial expressions

Building on previous studies that assessed visual attention to facial emotional expressions (e.g., Horovitz, Lindenfeld, Melamed, & Shechner, 2018; Peltola, Forssman, Puura, van IJzendoorn, & Leppänen, 2015; Vandevivere *et al.*, 2014), we used eye-tracking technology to collect children’s gaze data during presentation of ten facial stimuli displaying five different emotional expressions. The facial stimuli were chosen from the NimStim set of facial expressions (Tottenham *et al.*, 2009) and included pictures of two female models each posing neutral, angry, fearful, sad, and happy expressions (Figure 1a). In order to control for perceptual features of the face stimuli, we decided to use face sets of only one gender. Following previous research (Bayet, Behrendt, Cataldo, Westerlund, & Nelson, 2018; Peltola *et al.*, 2015), we used female faces as stimuli. Eye movements were recorded with a Tobii TX300 eye-tracker (120 Hz sampling rate, Tobii Technology, Stockholm, Sweden). Tobii Studio 3.4.5 software (Tobii Technology) was used to present the stimuli on an integrated 23" TFT monitor.

Participants sat on a chair at a distance of approximately 60 cm from the screen. Data collection started with a 9-point calibration. In case of missing calibration points, the calibration procedure was repeated until all nine points were calibrated. Before (and if necessary, during) stimulus presentation, children were instructed to move as little as possible and not to talk during the eye-tracking task. After the calibration, the experimenter told children ‘I’ll show you some pictures now. Just have a look at them’ and then started the stimulus presentation.



Figure 1. Presented stimuli from the NimStim set of facial expressions (Tottenham et al., 2009) (a) and an example of the AOI ‘face’ displayed for the fearful emotion (b). [Colour figure can be viewed at wileyonlinelibrary.com]

For each female face, the five facial expression pictures were shown one by one in the same order (due to the correlational approach): neutral, angry, fearful, sad, and happy. To prevent that the novelty of the faces and the displayed emotional information are confounded, the neutral facial expression was always presented first for each face. Each picture was presented for 10 s and followed by 2 s of a black screen to exclude transmission effects from one trial to the next. Before the presentation of the first picture and before the presentation of the second face, a short attention-getter was presented on the centre of the screen. After completion of the task, a short movie was played as a reward.

To identify fixations from the raw data, the Tobii standard fixation filter I-VT with a maximal time between fixations of 75 ms and a maximal angle between fixations of 0.5° was used. The minimal fixation duration was set to 100 ms in order to account for the differentiation between fixation and other eye movements (Manor & Gordon, 2003). We determined two areas of interest (AOI). One rectangle-shaped AOI (AOI ‘screen’) covered the whole screen and had the same size and same position for all of the pictures. A second

elliptical AOI (AOI 'face') covered the area of the face including the eyes, the nose, and the mouth because these are the most relevant areas in processing of facial emotional expressions (Beaudry, Roy-Charland, Perron, Cormier, & Tapp, 2014; Ekman, 1982). The AOI 'face' had the same size for all the pictures (85,055 pixels) and covered 4.1% of the screen. In order to cover the relevant areas of eyes and mouth, the position of the AOI 'face' was slightly adapted for some pictures. Figure 1b shows an example of the position of the AOI 'face'. We calculated the total fixation duration to both AOIs for each of the pictures. This metric measures the sum of the duration for all fixations within an AOI. In order to define trials with insufficient gaze data, we analysed the total fixation duration to the AOI 'screen' for each picture and excluded all trials with less than 500 ms of gaze data (5.1% of all trials).

In order to test our hypotheses, we analysed the total fixation duration to the AOI 'face' for each of the pictures. For each emotion, we then calculated the mean of these total fixation durations over the two faces. If gaze data were only available for one trial of an emotional expression, the fixation duration of this trial was used for analyses. This was the case for 17 trials. In four additional cases, valid values were missing in both trials. This resulted in slightly different case numbers: neutral face ($n = 49$), angry face ($n = 49$), fearful face ($n = 48$), sad face ($n = 48$), and happy face ($n = 47$).

Temperament

The German version of the EAS (Emotionality-Activity-Sociability) Temperament Inventory (Buss & Plomin, 1984; German adaptation by Angleitner, Harrow, Hempel, & Spinath, 1991) was used to assess children's temperament. The EAS Inventory measures children's temperament on four scales, but for the present study only the activity scale was of interest. This scale consists of five items describing behavioural characteristics related to children's physical activity level. Items are, for example, 'Child is very energetic' or 'Child prefers quiet, inactive games to more active ones (reversed item)'. For each item, mothers were asked to indicate on a 5-point scale (from 1 = not characteristic to 5 = very characteristic) how characteristic the behaviour is for their own child. For statistical analyses, we calculated the mean of the activity scale.

Results

Descriptive statistics

The average score of the global attachment security score was $M = 2.5$ ($SD = 0.87$, range 1.0–4.0). On average, children looked 5.7 s ($SD = 2.0$) to the neutral expression, 5.0 s ($SD = 2.1$) to the angry expression, 4.9 s ($SD = 2.3$) to the fearful expression, 5.0 s ($SD = 2.3$) to the sad expression, and 5.1 s ($SD = 2.1$) to the happy expression. With regard to children's temperament, the mean score of 4.0 ($SD = 0.63$) indicated a rather high activity level, which is comparable to other studies (Bornstein, Hahn, Putnick, & Pearson, 2019; Rowe & Plomin, 1977; Spinath, 2000).

Inferential statistics

Preliminary analyses

A repeated-measures ANOVA revealed that children's mean attention duration differed significantly between five emotional expressions, $F(4, 184) = 2.84$, $p = .026$. However,

Bonferroni-corrected *post-hoc* tests did not indicate significant differences in attention duration between any of the five emotional expressions (all *ps* = .069–1.000). Table 1 shows the correlations between our main variables (attachment security, attention to facial expressions, and activity level) as well as gender and age.

Continuous attachment measure

Five separate hierarchical linear regression analyses were conducted to predict fixation duration to each of the emotional expressions. We excluded missing data using the listwise option based on recommendations by Field (2018). Due to the wide age range, we included age in days as a control variable. The variables were entered in two steps: In the first model, we entered the three child characteristics gender, age (in days), and activity level as control variables using the enter method. In a second model, children's attachment security score was added using the enter method. Results for the regression analyses are depicted in Table 2. Attention to the neutral expression was predicted by attachment security only. Attention to the angry expression was not predicted by any of the variables in the regression analysis. Attention to the fearful expression was predicted by attachment security only. However, the overall regression model for the fearful expression was not significant. In the regression analysis for the sad expression, activity level as well as attachment security turned out to be significant predictors. Attention to the happy face was predicted by activity level only. However, the overall regression model for the happy expression was not significant.

Categorical attachment measure

While our regression analyses focused on the security score to make use of the continuous nature of the measure, we also explored whether our results are mirrored in analyses focusing on group differences. Due to the small number of participants classified as insecure-ambivalent and insecure-disorganized, we used the secure versus insecure categorization in these analyses. Following our directed hypotheses for negative emotions, the respective analyses were conducted one-tailed. Analyses showed significant differences between the secure and insecure group for attention to the neutral expression, $t(47) = -3.058$, $p < .004$, two-tailed, and for attention to the fearful expression, $t(46) = -1.889$, $p = .032$, one-tailed. There were no differences between

Table 1. Correlations between activity level, attachment security, attention duration, gender, and age

	1	2	3	4	5	6	7	8
1. Attachment security	1							
2. Activity level	-.12	1						
3. Attention duration neutral	.45**	-.18	1					
4. Attention duration angry	.21	-.20	.67**	1				
5. Attention duration fearful	.31*	-.14	.68**	.76**	1			
6. Attention duration sad	.24	-.35*	.62**	.83**	.76**	1		
7. Attention duration happy	.24	-.35*	.60**	.79**	.74*	.82**	1	
8. Gender ^a	.17	.11	.08	-.08	-.09	-.15	-.10	1
9. Age in days	-.24	.06	.07	.14	.03	.22	.04	-.21

Notes. ^aSpearman-Rho with dummy coding 0 = male and 1 = female.; ** $p < .01$, * $p < .05$, two-tailed.

Table 2. Predictors of attention to the neutral, angry, fearful, sad, and happy facial expression

Variables	Neutral (<i>n</i> = 48)		Angry (<i>n</i> = 48)		Fearful (<i>n</i> = 47)		Sad (<i>n</i> = 47)		Happy (<i>n</i> = 46)	
	β	R^2	β	R^2	β	R^2	β	R^2	β	R^2
Model 1										
Gender	.08		-.02		-.10		-.11		-.13	
Age	.10		.14		-.01		.19		-.00	
Activity level	-.20		-.20		-.13		-.34*		-.34*	
R^2		.04		.06		.03		.18		.14
<i>F</i>		.68		.93		.44		3.12*		2.30†
Model 2										
Gender	.00		-.06		-.16		-.16		-.18	
Age	.19		.19		.05		.24		.04	
Activity level	-.13		-.17		-.11		-.31*		-.32*	
Attachment security	.48*		.25		.35*		.30*		.27†	
R^2		.25		.11		.14		.26		.21
<i>F</i>		3.63*		1.38		1.71		3.77*		2.69*
ΔR^2		.21		.05		.11		.08		.07
<i>F</i> change		11.95*		2.64		5.40*		4.83*		3.44†

Note. ** $p < .01$, * $p < .05$, † $p < .10$, two-tailed.

groups regarding children's attention to the angry ($p = .196$, one-tailed), the sad ($p = .097$, one-tailed), and the happy expressions ($p = .291$, two-tailed). Thus, t -test results for the neutral, angry, and happy expressions are in line with results of the regression analyses.

Moreover, from a theoretical point of view there should be a clearer difference between insecure-avoidant and secure attachment strategies than between insecure-ambivalent/disorganized and secure attachment strategies. For this reason, and because there were only few participants classified as insecure-ambivalent ($n = 5$) or insecure-disorganized ($n = 2$), we repeated analyses with only the secure and insecure-avoidant subgroups. Analyses showed significant differences between the secure and avoidant groups for attention to the neutral expression, $t(39.23) = -3.436$, $p < .001$, two-tailed, and for attention to the fearful expression, $t(39) = -1.804$, $p = .040$, one-tailed. There were no differences between groups regarding children's attention to the angry ($p = .232$, one-tailed), the sad ($p = .105$, one-tailed), and the happy expressions ($p = .379$, two-tailed). Thus, t -test results for the neutral, angry, and happy expressions are in line with results of the regression analyses.

Discussion

The present study aimed to investigate the relation between children's attachment security and their attention to facial emotional expressions. To this end, we measured 5-year-old children's attachment representations via an ASCT (GEV-B; Gloger-Tippelt & König, 2016). Thereafter, we assessed children's attention duration to neutral, negative, and positive facial expressions in an eye-tracking task. We found that attachment security was associated with children's attention duration to fearful, sad, and neutral facial

expressions. Overall, these results support theoretical proposals that attachment is related to basic attentional processes (Dykas & Cassidy, 2011; Main *et al.*, 1985).

More precisely, in line with hypotheses derived from attachment theory, attachment security was related to children's attention duration to the fearful (*t*-tests) and sad expressions (regression analyses). That is, (more) securely attached children looked longer and (more) insecurely attached children looked shorter to these negative expressions. This is consistent with the theoretical claim that insecurely attached individuals are more likely to use defensive exclusion strategies in processing of negative emotional information than securely attached individuals (Bowlby, 1980; Dykas & Cassidy, 2011). Yet, there was no significant effect for the angry expression even so the direction of the effect was the same as for the fearful and sad expressions. One can speculate that anger is a less painful emotional experience than fear or sadness. Anger is usually rather directed to others and likely expressed by aggressive behaviour, whereas fear and sadness are more directed to oneself and communicate a need for assistance (Van Kleef, De Dreu, & Manstead, 2010). In order to avoid emotional pain, it might therefore be more relevant to regulate oneself in confrontation with fear or sadness than in confrontation with anger. As it has been suggested that attachment styles can be interpreted as patterns of emotion regulation (e.g., Spangler & Zimmermann, 2014), this might explain attachment-related differences in attention to fearful and sad expressions but not to angry expressions.

Moreover, attachment security was related to attention duration to the neutral facial expression. This relates to previous studies that reported links between attachment security and attentional biases to neutral stimuli (Kirsh & Cassidy, 1997; Meinz *et al.*, 2017). This finding can be explained by the proposal that ambiguous stimuli, such as neutral facial expressions, are likely processed corresponding to the underlying attachment working model (Bretherton & Munholland, 1999; Dykas & Cassidy, 2011). That is, insecurely attached individuals are more likely to process even neutral social information with a negative bias, and, conversely, more securely attached children are more open in processing of social information (Dykas & Cassidy, 2011; Zimmermann & Iwanski, 2015). It is important to note that in our study the neutral stimulus was always the first presented. Therefore, a transmission effect from negative facial expressions is unlikely. Moreover, the neutral facial expression was always the first encounter with each of the unfamiliar faces. As securely attached individuals are more open to explore new stimuli (Green & Campbell, 2000), the relation of attachment security and attention might be due to the novelty of the face rather than to the neutrality of the expression. More research is needed to investigate this issue.

Regarding the happy expression, we stated two contrasting hypotheses. We expected that attachment security will not be predictive of attention duration to happy faces if an attentional bias exists only for negative emotional information. In contrast, we expected that attachment security will be predictive of attention duration to happy faces if an attentional bias exists for emotional information in general. Our findings showed that there was no relation between attachment security and attention duration to the happy expression. This contradicts the second hypothesis regarding the happy face, namely, that an attentional bias exists for emotional information in general. This finding is in line with attachment theory, which refers to biases in processing of potentially painful social information but not of positive emotional information (Bowlby, 1980; Dykas & Cassidy, 2011). Our findings extend previous research with adults, where differences in attachment security were not related to differences in processing of positive information (Dewitte *et al.*, 2007; Zeijlmans van Emmichoven *et al.*, 2003).

In general, our findings are in line with the theoretical view that insecure attachment is associated with defensive exclusion of potentially painful social information (Bowlby, 1980; Dykas & Cassidy, 2011). From a theoretical perspective, our results do not support an effect of attachment security on attentional processing of facial emotional expressions in general but rather suggest a specific effect for negative and neutral facial expressions. This can be explained by the fact that different facial emotional expressions convey different information about a person's internal state and his/her orientation towards the other. Negative expressions like fearful or sad faces indicate that the other person is currently more concentrated on his/her own need for help (Van Kleef *et al.*, 2010). This makes it less likely that the person is available for the child. This is in line with studies on maternal depression, which suggest that depressed mothers are emotionally less available and less sensitive to their children than non-depressed mothers (Bernard, Nissim, Vaccaro, Harris, & Lindhiem, 2018; Trapolini, Ungerer, & McMahon, 2008). Neutral facial expressions are more ambiguous and might therefore be misinterpreted by insecure children as more negative than they really are (Cassidy, Kirsh, Scolton, & Parke, 1996; Raikes & Thompson, 2008). In addition, neutral facial expressions might be interpreted as indifference or disinterest and might therefore be perceived as potentially hurtful by insecure children. Consequently, the proposed exclusion effect in attention is likely relevant in confrontation with negative and neutral faces. Because positive facial expressions usually signal an benevolent orientation towards the relationship and a willingness to provide support (Van Kleef *et al.*, 2010), avoidance of such information is less likely for insecure children.

It is noteworthy that attachment security was a predictor of attention duration to the sad and neutral facial expressions even so we included children's activity level as a control measure. This excludes the possibility that insecurely attached children are just more physically active and therefore attended shorter to the emotional expressions. In addition, even though activity level was associated with children's attention duration to the sad facial expression, attachment security was a significant predictor as well. This shows the high predictive value of attachment security in attentional processing of emotional stimuli.

Our findings are theoretically relevant because attention is a process that operates at early stages of information processing, which in turn influences the following processes, such as recognition of emotions (Serrano *et al.*, 2018) or memory processes (Mulligan, 1998; Mulligan & Hartman, 1996). If already attention duration to emotional expressions is influenced by attachment security, then it is likely that the shorter or longer perceptual processing of the emotional information influences further processing, especially in emotionally negative situations. This claim can be supported by studies that show that insecure children are less accurate in recognizing and understanding emotions of others (Laible & Thompson, 1998; Steele, Steele, Croft, & Fonagy, 2001). Research in the area of emotion regulation also shows that, compared to insecurely attached children, securely attached children report more cognitive engagement strategies when explicitly asked (Colle & Del Giudice, 2011) and more often use cognitive and social support strategies themselves (Cooke, Kochendorfer, Stuart-Parrigon, Koehn, & Kerns, 2018). Our study adds to this research by focusing on a basic level of emotion regulation, namely attentional regulation strategies. Therefore, our findings are also informing theoretical considerations regarding the relation of attachment and different aspects of children's emotion regulation. It might be interesting for future research to assess different aspects of children's emotion regulation (i.e., attentional/behavioural strategies as well as explicit knowledge) together in one study.

The current study also adds to the field by measuring children's attention on a basic perceptual level. By applying eye-tracking technology, we were able to precisely assess fixation duration to the facial expressions. This means, we directly assessed visual attention instead of inferring attentional processes from indirect measures, such as the dot-probe task (Meinz *et al.*, 2017). Moreover, previous studies mostly measured attention during simultaneous presentation of emotional and neutral stimuli (Kirsh & Cassidy, 1997; Meinz *et al.*, 2017). In contrast, in the current study we presented each facial stimulus individually and thereby ensured that children's attention to the displayed emotion was not confounded with other processes. Thus, the current study extends previous work by focusing more directly on visual attention to facial emotional expressions.

One could speculate that the findings of our study have implications for clinical practice. If attachment security influences the processing of emotional information not just in interactions with attachment figures but also in other social interactions, this is relevant for children's later emotion regulation and social functioning outside the attachment relationship. It is likely that positive effects of attachment interventions that focus on improving parental attachment-relevant behaviours, such as sensitivity, can be further enhanced through greater understanding of attachment-related differences in social information processing.

Even though our study contributes empirical evidence to fill an important research gap, there are some limitations that should be addressed in future research. First, although our sample size was similar to those in previous studies, a larger sample size might have helped to reveal also smaller effects, for example, for the angry or happy facial expressions. Future studies should therefore assess attachment security and attentional processing in larger samples. This would also make it possible to include further predictor variables. For instance, parental sensitivity has been shown to be a crucial factor in the development of a secure attachment style (Grossmann, Grossmann, Spangler, Suess, & Unzner, 1985; Lucassen *et al.*, 2011) and to be related to children's emotion regulation (Frick *et al.*, 2018). Therefore, sensitivity might be predictive of children's attentional processing of emotional stimuli as well. Another variable of interest is children's verbal ability. While some studies suggest that this factor is related to attachment security assessed in story stem tasks (*cf.* Stievenart, Roskam, Meunier, & van de Moortele, 2011; Veríssimo *et al.*, 2017), other research does not support an effect of verbal abilities on attachment security (Veríssimo, Santos, Fernandes, Shin, & Vaughn, 2014). It might therefore be interesting to consider this factor in future research. Furthermore, although our categorical analyses based on the secure and insecure (-avoidant) subgroups largely supported our main analyses, a larger sample would allow investigating differences between all four attachment patterns. Second, although the present study provides empirical evidence for a relation between attachment security and attentional processing of emotional information, the cross-sectional and correlational design precludes causal claims. As we noted before, it is possible that parental sensitivity plays a role for the association between attachment security and children's attention to emotional facial expressions. Future research should therefore focus on effects of such potential mediating or interacting variables. A third limitation refers to the limited cultural generalizability of our study, as the sample included only German children. Research has suggested that the activation of the attachment system depends not only on individual factors but also on cultural context (see Mesman, van IJzendoorn, & Sagi-Schwartz, 2016 for a review). Thus, it is important for future studies to consider possible cultural differences when investigating the relation between attachment security and emotion processing. In

addition to the future research directions derived from the discussed limitations, we suggest that future studies could also assess how accurate children are in identifying the emotional expressions and if this is related to their visual attention duration. Moreover, it might be interesting whether and how findings may change, when videos rather than motionless pictures of emotional expressions are used as stimuli.

Taken together, our study examined whether preschool children's attachment security is related to their attentional processing of emotional facial expressions. We provide first empirical evidence that attachment security influences attentional processes to negative and neutral emotional information on basic perceptual level.

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Conflicts of interest

All authors declare no conflict of interest.

Data availability statement

Research data are not shared.

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Maternal sensitivity and non-intrusiveness at 12 months predict attention to emotional facial expressions at 24 months: A cross-lagged panel approach

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Abstract

Following theoretical proposals emphasizing the role of caregiver behavior for child emotion processing, this study investigated whether maternal sensitivity and non-intrusiveness predicted child attention to emotional facial expressions, assessed via eye tracking, as the earliest stage of emotion regulation. Maternal behavior and child attention were assessed at 12 (N = 118) and 24 months. Cross-lagged panel analyses revealed predictive effects of maternal sensitivity at 12 months on child attention to sad and happy expressions at 24 months. Moreover, maternal non-intrusiveness at 12 months predicted child attention to sad expressions at 24 months. Effects were independent of child gender and temperament. The findings highlight the pervasive impact of caregiver sensitivity on emotion processing in the early years.

KEYWORDS

attention, emotional availability, emotional facial expressions, emotion regulation, eye tracking

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1 | INTRODUCTION

The ability to focus attention on specific information in the environment plays an important role in information processing, especially in processing of emotion information communicated in social interactions. As attention operates at an early stage in information processing, it determines the duration a person is exposed to emotional stimuli and controls which stimuli are processed further (Posner, 1994). Research investigating biases or deficits in attentional regulation has highlighted the role attention processes might play in children's socio-emotional development (Bar-Haim et al., 2007; Connell et al., 2013; Pérez-Edgar et al., 2011). Thus, attentional regulation is considered to be an important mechanism in emotion regulation as attentional processes modulate the emotions experienced in response to emotional stimuli (Gross, 2014; Taylor & Amir, 2010). Several influential developmental theories have focused on the importance of social interactions in personal relationships for children's socio-emotional development (Cassidy, 1994; Sroufe, 1996; Tronick, 1989), with some theories suggesting that the quality of parent-child interactions may influence how children attend to and process emotional information (Dykas & Cassidy, 2011; Main et al., 1985).

Most notably, the attachment theoretical framework emphasizes the role of infants' early experiences with their attachment figures (i.e., their caregivers) for the development of behavioral strategies that are activated in emotionally challenging contexts (Bowlby, 1969/1982). More precisely, these strategies are based on infants' expectations regarding their caregivers' responsiveness in stressful situations, and involve infants' regulation of attention, perception, and emotion (Cassidy, 1994; Main et al., 1985; Sroufe, 1996). The attachment theoretical framework assumes that attachment-related experiences and strategies become generalized in form of internal working models, which influence processing of emotion information later in life (Bowlby, 1969/1982; Main et al., 1985) and in other social relationships (Calkins & Hill, 2007; Groh et al., 2014; Thompson, 2000). The proposed relation between attachment security and children's attentional processing of emotion information has been supported by several studies (Diener et al., 2002; Kammermeier et al., 2020; Main et al., 1985; Meinz et al., 2017). From an attachment theoretical perspective, sensitivity is the critical caregiver behavior in the formation of secure attachment (Ainsworth et al., 1971). Sensitive caregivers promote the development of secure attachment by accurately understanding and accepting their children's needs and emotions and by adapting their own responses accordingly.

Although the concept of sensitivity defined by Ainsworth is mostly based on mothers' behavioral responsiveness to child signals, a more articulated view on caregiver sensitivity and relationship quality is presented by the Emotional Availability (EA) framework (Biringen, 2008; Biringen et al., 2014). The EA framework originates in attachment theory but also emphasizes emotional aspects of the interaction (for a review see Mesman & Emmen, 2013). With respect to the caregiver, four dimensions are operationalized in the fourth edition of the EA Scales (Biringen, 2008): sensitivity, non-intrusiveness, structuring, and non-hostility. Studies have confirmed that caregiver EA is related to children's attachment security (for review see Biringen et al., 2014). Moreover, the EA Scales are applicable to a wide age range and various contexts as well as warranting cross-context generalizability and stability (Bornstein et al., 2006). Given its strong focus on emotional aspects, the EA Scales are a suitable measure to investigate the relation between caregiver behavior and attentional processing of emotion information.

Although it may seem interesting to investigate all scales, the EA dimensions are interrelated and to investigate all may increase the number of statistical tests. In order to minimize multiple testing, we decided to focus on the EA dimensions sensitivity and non-intrusiveness as from a theoretical perspective these dimensions are highly relevant for models of early development (e.g., Ainsworth et al., 1974) and as both dimensions are related empirically to the early socio-emotional functioning. Indeed, studies using the EA Scales have supported the predictive value of sensitive and non-intrusive caregiving on children's attentional and emotion regulation in early years (e.g., Martins et al., 2012; Taylor-Colls & Pasco Fearon, 2015). Moreover, research indicated differential developmental effects of each of the EA dimensions (Paulus et al., 2018).

Sensitivity in the EA Scales is defined as the caregiver's behavioral and emotional responsiveness to the child. A sensitive caregiver creates a positive affective atmosphere and is aware of and appropriately responsive to child signals (Biringen et al., 2014; Saunders et al., 2015). Most important for our research question, sensitive caregivers provide a

context in which children learn how to regulate their own emotional experiences and to maintain an optimal level of arousal (Ainsworth et al., 1974; Calkins & Hill, 2007; Cassidy, 1994). Moreover, sensitive responses to children's negative emotions likely foster open and unbiased emotional communication, which likely reduces children's experience of negative affect as frightening and increases their ability to tolerate negative emotions (Cassidy, 1994). In contrast, less sensitive or unresponsive caregiving likely leads to biases in processing of emotion (i.e., over-regulation or under-regulation), especially in response to negative emotional information (Cassidy, 1994). Research has supported this theoretical idea by showing that more sensitive caregiving is, for example, related to longer latency to distress (Frick et al., 2018), less affect dysregulation (Leerkes et al., 2009), and adaptive regulation, especially of negative emotions (Beijersbergen et al., 2012).

A second dimension of caregiver EA, which might influence children's processing of emotion information, is non-intrusiveness. Non-intrusiveness refers to the caregiver's ability to follow the child's lead in play and to avoid controlling the child's ongoing activities. A non-intrusive caregiver respects the child as an autonomous person and does not overstimulate or interfere (Biringen et al., 2014; Saunders et al., 2015). Thus, non-intrusive caregivers are available and follow their children's pace and affective needs, thereby supporting children's attempts to regulate their own arousal. In contrast, intrusive caregivers' interruption of child actions likely undermines children's ability to tolerate especially negative emotional experiences temporarily as children might rely on immediate provision of external regulation by the caregiver. Previous studies have shown that lower intrusiveness is related to toddlers' better emotion regulation skills (Graziano et al., 2010; Mortensen & Barnett, 2019).

Relations of the EA dimensions of structuring and non-hostility and child attentional regulation are theoretically less conclusive. Structuring is indicated by positive guiding and scaffolding that promotes children's autonomy. Although it supports children's autonomous use of cognitive skills (see e.g., Ravindran et al., 2021), there is no clear link to attention to emotion information. As non-hostility refers to caregivers' regulation of own negative affect, one could assume that non-hostility and child socio-emotional development are related. However, in low risk samples there often is not enough variance of non-hostility to investigate potential effects on child development appropriately (Biringen et al., 2014; Frigerio et al., 2019). In sum, our study focuses on sensitivity and non-intrusiveness as those EA dimensions are theoretically and empirically most relevant for our research question.

The theoretical claim that sensitive caregiving affects the way in which emotion information is processed and responded to (Bowlby, 1973; Cassidy, 1994), leads to the intriguing hypothesis that it relates to children's attentional regulation as a first stage of emotion processing (Dykas & Cassidy, 2011). Thus, the leading hypothesis of this study was that children of more sensitive caregivers will direct their attention openly to positive and negative emotion information, whereas children of less sensitive caregivers will tend to avert their attention especially from negative emotion information.

First evidence comes from studies investigating the relation between maternal depression or affective disposition and children's attention to emotional facial expressions. Mothers with depressive symptoms tend to show less sensitive caregiving (Bernard et al., 2018). Gibb et al. (2009) examined the relation between maternal major depressive disorder (MDD) and 8- to 12-year-olds' attentional bias towards emotional faces. They found that children of mothers with MDD history showed greater attentional avoidance of sad faces but not of happy or angry faces, compared to children of non-depressed mothers. Connell et al. (2013) investigated the relation between maternal depressive symptoms and youth attentional bias for sad and happy faces, as well as positive and negative maternal affect during interaction. Maternal depression predicted attentional avoidance of sad faces in youth with high levels of suppression (i.e., a measure of emotion regulation), which highlights the role of regulatory processes in response to negative faces. Moreover, higher positive affect in mothers with lower depressive symptoms predicted youth bias toward happy faces, whereas higher negative maternal affect predicted youth attentional avoidance of sad faces. Although both studies indicate a relation of caregiving and children's attention to emotions, they focused on older children and youth, whereas, from an attachment point of view, effects earlier in development are theoretically interesting. Moreover, in both studies attention was assessed in a dot-probe task (MacLeod et al., 1986), which is a rather unreliable measure of attentional biases (Thigpen et al., 2018). In an infant study, de Haan et al. (2004) assessed attention by

measuring 7-month-olds' looking time to happy and fearful faces. The study focused on maternal emotional disposition, assessed via the Positive and Negative Affect Schedule, which is related to measures of depression (Watson et al., 1988). They found that infants of mothers with high positive affect tended to look longer at fearful than at happy faces.

More indirect support comes from studies investigating the relation between infants' and children's attachment security and their attention to facial expressions. For instance, in a longitudinal study Meinz et al. (2017) found that more avoidantly attached children showed a higher attentional preference for neutral object stimuli than for emotional face stimuli in a classic dot-probe task. In a recent study by Kammermeier et al. (2020), preschoolers' attention to emotional facial expressions was assessed more directly by measuring children's looking duration to positive and negative facial expressions. Results showed that secure attachment was related to prolonged visual attention to neutral, sad and fearful expressions, but not to angry expressions.

In addition, neurocognitive studies have provided evidence for relations between parenting behavior and children's brain activity during perceptual processing of emotion stimuli. Romund et al. (2016) showed that higher maternal warmth and support, as reported by 13- to 16-year-olds, was related to lower activation to fearful faces in the amygdala. This finding indicates that children with warmer and more supportive mothers were less threatened by fearful expressions of others. In a study with 7- to 11-year-olds, James et al. (2018) found that children of highly critical parents were less attentive (i.e., more avoidant) to fearful, sad, and happy facial expressions, as indicated by smaller LPP magnitudes. In an infant study, Taylor-Colls and Pasco Fearon (2015) found that sensitive parenting was associated with 7-month-olds' attention to happy facial expressions as indicated by increased amplitudes on the face-sensitive ERP component. In sum, the results of the studies discussed here suggest that caregiving affects children's development of attentional processing of emotional faces. However, only two of the discussed studies directly assessed caregiver behavior in interaction with the child (Connell et al., 2013; Taylor-Colls & Pasco Fearon, 2015). Thus, our study directly assessed caregiver behavior in interaction in order to examine whether and how caregiver sensitivity and non-intrusiveness are related to children's attention to emotional facial expressions.

Although previous research on caregiving and child attention to emotion has focused on various age groups, empirical research lacks investigations of this relation in toddlers. Previous research with infants had reported effects of reduced visual attention to fearful facial expressions and reduced ERP differentiation of fearful from non-fearful faces at 7 months on attachment security at 14 months (Peltola et al., 2015, 2020). A possible interpretation of these results is that children of sensitive mothers are more open in processing of negative emotions and at the same time develop a secure attachment. Thus, these results are highly informative for the question on how attachment as an indicator of caregiving and attention to emotional information are related in infancy. Yet, they focus on a developmental phase in which the attachment relationship is about to be established. In contrast, we were especially interested in the effects of caregiving on toddlers' attention when the attachment relationship is established. The study of this relation in early toddlerhood (i.e., 1 to 2 years of age) is especially important, given that in this phase of development children become increasingly independent and more organized in their behavioral and emotion regulation (Bowlby, 1969/1982; Diener et al., 2002). As attention is a mechanism in emotion regulation, toddlerhood represents an important phase for the development of attention to emotion information. Moreover, from the age of 9 to 12 months organized attachment strategies start to emerge. Therefore, it would be very interesting to investigate the effect of maternal caregiving on children's attention to emotional faces in this important phase of socio-emotional development. In sum, although the influence of sensitive caregiving on children's attentional processing of emotional information is a key theoretical claim, current evidence for an important phase in socio-emotional development is inconclusive.

Our study aimed at filling this research gap by investigating the relation between maternal sensitivity and young children's attentional processing of emotional information directly in a longitudinal study from late infancy (12 months) to early toddlerhood (24 months). Building on previous studies that assessed visual attention of infants and children to emotional faces (e.g., Kammermeier et al., 2020; Peltola et al., 2015), we used eye tracking technology as a precise measure of visual attention. In contrast to previous studies which primarily used the dot probe task and

presented emotion stimuli simultaneously with neutral or distracting stimuli, we presented pictures of emotional faces individually. Simultaneous presentation of competing stimuli likely measures attention in the context of other processes (e.g., distractibility or preference), whereas individual presentation allows assessing attention on a basic perceptual level (i.e., looking duration). Based on previous studies (e.g., de Haan et al., 2004; James et al., 2018; Kammermeier et al., 2020), we decided to include fearful and sad faces as negative emotional expressions, happy faces as a positive emotional expression, and neutral facial expressions.

1.1 | The current study

In summary, the purpose of the present longitudinal study was to investigate the relation of two dimensions of maternal EA—maternal sensitivity and maternal non-intrusiveness—with children's visual attention to emotional facial expression. The relevance of these dimensions has been highlighted theoretically (Ainsworth et al., 1974) as sensitive and non-intrusive caregiving provides adequate external regulation of children's emotional states through appropriate responses to children's needs, thereby supporting children's socio-emotional development. In order to go beyond correlational or unidirectional approaches, we relied on cross-lagged panel analyses in a longitudinal design. By modeling cross-lagged paths we were able to control for reciprocal effects which allowed for a clearer assessment and interpretation of the causal direction of the hypothesized effects (Little et al., 2007). More specifically, we examined whether there was a directional effect of maternal EA at 12 months on toddlers' attention to emotional expressions at 24 months, while controlling for the effect in the opposite direction (i.e., the effect of infant attention at 12 months on maternal EA at 24 months). Furthermore, we controlled for child temperament, namely surgency and effortful control. Surgency refers to child enjoyment of high stimulus intensity or novelty as well as level of activity; while effortful control refers to child attention shifting and focusing as well as inhibitory control (Putnam et al., 2010). As both temperamental dimensions might be related to attentional regulation (Frick et al., 2018; Morales et al., 2016), it is important to control for these aspects.

Based on the above reviewed theoretical considerations (Bowlby, 1969/1982; Calkins & Hill, 2007; Cassidy, 1994), our main hypothesis was that sensitive parenting behavior in infancy would predict attentional processing of emotion information. We expected that sensitive parenting behavior is especially influential for children's attentional regulation with regard to negative emotions (Bowlby, 1980). More precisely, we expected that more sensitive and less intrusive parenting would be associated with a more open and unbiased attentional allocation (i.e., longer attention duration) to fearful and sad expressions. Concerning children's regulation in response to positive emotions, attachment theory does not make specific predictions. However, based on the theoretical idea that sensitive parenting is related to more open and unbiased processing of emotional information (Cassidy, 1994), we can assume that sensitive parenting plays a role also for children's attentional regulation in context of positive emotions. Thus, we explored whether more sensitive and less intrusive parenting would be associated with a more open and unbiased attentional allocation (i.e., longer attention duration) to happy expressions. Concerning children's attention to neutral facial expressions, we did not have a specific hypothesis as one could speculate that sensitive parenting might promote children's openness to novel emotional stimuli in general, or that parenting behavior does not play a role in processing of rather neutral emotional stimuli.

2 | METHOD

2.1 | Participants

The present study was part of an ongoing longitudinal study on the mother-child relationship and social development from infancy to childhood. The families were recruited from public birth records of a large city in Southern Germany.

All interested German-speaking mother–child dyads with typically developing 12-month-old children were included in the study. All children but two were white and came predominantly from middle to upper middle class. All infants were healthy, normally developed, and full-term. The initial sample of the study comprised 120 mother–child dyads at T1 and 98 mother–child dyads at T2. Of the 22 families who dropped out at T2, nine could not be recontacted via phone or email, 12 were interested but did not have time to participate, and one declined participation due to lack of interest. Two participants had to be excluded from analysis due to missing eye tracking data at both time points ($n = 1$) and a visual impairment of the mother ($n = 1$). Children in the final sample (T1: $n = 118$, T2: $n = 96$) were 12 months at T1 (first testing session: $M = 12.64$, $SD = 0.25$; 55% female) and 24 months at T2 ($M = 24.9$, $SD = 0.38$; 54% female). A post hoc power analysis (G*Power) was computed to determine whether a sample size of 118 provided sufficient power to detect a medium-sized effect for a single regression coefficient (i.e., for the cross-lagged path coefficient from EA T1 on attention T2) in a linear multiple regression. With $N = 118$ participants and $\alpha = 0.05$, the statistical power to detect a medium effect ($f^2 = 0.15$) exceeded 0.99. In addition, we computed a post hoc power analyses for structural equation models with the R package *semPower* (Moshagen & Erdfelder, 2016) to determine whether our sample size provided sufficient power for rejecting false models overall. With $N = 118$, power to reject a wrong model (with $df = 6$ degrees of freedom and $p = 4$ observed variables) corresponding to AGFI (Adjusted Goodness-of-Fit Index) = .90 on $\alpha = .05$ was $> .80$. In the final sample, 68% of mothers had a university degree, 15% had a high school diploma, and 17% had lower secondary school diploma. Seventy-nine percent of mothers were currently not working, 20% were working part-time, and one mother was working full-time. The majority of mothers (86%) were married to or living with the child's father, 12% were single, and 2% were divorced or widowed. Sixty-four percent of mothers reported that they are the primary caregiver; 36% reported that both parents take care of the child equally. Thirty percent of children were cared for regularly in an institution, by a childminder or by relatives. Most children had no siblings (73%). Thirty-one percent of children were bilingual. Mothers were informed about the content and procedure of the study and gave informed written consent. The university ethics committee approved the study.

2.2 | Measures

Data collection at the age of 12 months took place between March and December 2016 in two sessions in the laboratory. All children were tested individually. Mother–child interaction quality was assessed in the first testing session using the Emotional Availability Scales (Biringen, 2008). Children's attention to emotional facial expressions was assessed in an eye tracking task in a second testing session approximately 1 week later ($M = 8.00$ days, $SD = 3.55$). At the age of 24 months data for both measures were collected between March and December 2017 in one testing session. As a control measure, child temperament was assessed via the ECBQ (Putnam et al., 2010, March) at T2.

2.2.1 | Mother–child interaction quality (12 and 24 months)

At the age of 12 months (T1), mother–child interaction was assessed during a free play situation lasting 10 min. Following previous studies (e.g., Bornstein, 2009; Taylor-Colls & Pasco Fearon, 2015), mothers and infants were seated on a blanket on the floor and provided with a box with different age-appropriate toys (e.g., a xylophone, picture books, and wooden building blocks). Mothers were instructed to play with their infant as they usually would do at home. At the age of 24 months (T2) mother–child interaction was assessed again in a free play situation lasting about 7 min. In an additional task that provided a more age-appropriate context for assessing differences in EA at 24 months, mothers and their children were asked to put together a puzzle that was too difficult for the children (cf. Kluczniok et al., 2016). Mothers were instructed to solve the puzzle together with their children within 7 min. For T2, the interaction quality was rated across the two situations (i.e., free play and puzzle task).

Emotional availability of the mother–child dyads was rated as measure of relationship quality. The EA Scales (Biringen, 2008) assess caregiver EA on four dimensions: sensitivity, structuring, non-intrusiveness, and non-hostility. All dimensions are rated on a scale from one to seven. Sensitivity assesses a variety of adult qualities related to the ability to be genuinely warm and emotionally connected with the child as well as responsive to the child's signals. Non-intrusiveness refers to the adult's ability to be available to the child and follow the child's lead without being intrusive or undermining the child's autonomy. Due to our hypotheses, structuring and non-hostility were not considered for this study.

Coding of the mother-child interactions was done by three coders who had completed training and obtained reliability by Zeynep Biringen. The first coder rated all cases of T1 and T2. In order to assure interrater reliability, 20% ($n = 24$) of the T1 sample and 31% ($n = 30$) of the T2 sample were rated by the second and the third coder, respectively. At T1 the intraclass correlation coefficient (ICC) was .90 for sensitivity and .83 for non-intrusiveness. At T2, the ICC was .84 for sensitivity and .87 for non-intrusiveness. Therefore, interrater reliability was good to excellent for both EA dimensions at both time points.

2.2.2 | Attention to facial expressions (12 and 24 months)

Following previous studies (e.g., Kammermeier et al., 2020; Peltola et al., 2015), we used eye tracking to assess children's visual attention during presentation of eight facial stimuli displaying four different emotional expressions. Similar to Kammermeier et al. (2020), facial stimuli comprised pictures of two female models each posing neutral, fearful, sad, and happy expressions (Figure 1a). The facial pictures were chosen from the NimStim set of facial expressions (Tottenham et al., 2009). Eye movements were collected with a Tobii TX300 eye tracker (120 Hz sampling rate, Tobii Technology, Sweden). Tobii Studio 3.4.5 software (Tobii Technology) was used to present the stimuli on an integrated 23" TFT monitor.

The eye tracking procedure was the same for both time points (i.e., at 12 months and at 24 months). Children sat on their mothers' lap at a distance of approximately 60 cm from the screen and performed a 5-point calibration procedure first. If more than two calibration points were missing, the calibration procedure was repeated. Before calibration, the height of the eye tracker was adapted to the child's position, which was low enough that the mother's eyes were not in trackable position. In addition, mothers were instructed to close their eyes during calibration to ensure that the eye tracker was calibrated to children's eyes. Mothers were also asked to take care that their children would move as little as possible after the calibration and during stimulus presentation. After the calibration the experimenter started the stimulus presentation. Mothers were instructed not to comment on or to point at the faces during presentation.

Due to the correlational approach, the four facial expression pictures were shown one by one in the same order for each female face: neutral, fearful, sad, and happy. Each picture was presented for 7 s. Between face pictures a black screen was displayed for 2 s to exclude transmission effects from one trial to the next. In order to get children's attention to the screen, a short attention-getter was presented on the center of the screen accompanied by a sound before the presentation of the first face and before the presentation of the second face. Before presentation of each of the other face pictures, a brief tiptoe sound was played as an auditory attention-getter during display of the black screen. A short movie was played as a reward afterwards.

We used the Tobii standard fixation filter I-VT with a maximal time between fixations of 75 ms and a maximal angle between fixations of 0.5° to identify fixations. In order to account for the differentiation between fixation and other eye movements (Manor & Gordon, 2003), we set the minimal fixation duration to 100 ms.

As a measure of attention, we calculated the total fixation duration, that is, the sum of the duration for all fixations within an area of interest (AOI). We did this for two areas of interest (AOI): A rectangle-shaped AOI "screen" and an elliptical AOI "face". The AOI "screen" covered the whole screen with the same size and position for all of the stimuli. The AOI "face" covered the area of the face including the eyes, the nose, and the mouth. The AOI "face" had the same size for all the pictures (85055 pixels) and covered 4.1% of the screen. Figure 1b shows the position of the AOI "face"



FIGURE 1 (a) Presented stimuli from the NimStim set of facial expressions (Tottenham et al., 2009) and (b) an example of the AOI “face” displayed for the fearful emotion

for the fearful face. In order to define trials with missing or insufficient gaze data, we analyzed the total fixation duration to the AOI “screen” for each picture and excluded all trials with less than 200 ms of gaze data (10.9% of all trials at T1 and 3.6% of all trials at T2).

We used the total fixation duration to the AOI “face” for each of the pictures as a measure of attention in our statistical analyses. For each emotional expression the mean of total fixation durations over the two faces were calculated. If gaze data were missing for one trial of an emotional expression, only the fixation duration of the other trial for this emotional expression was used in analyses. Due to cases with missing values in both trials, slightly different case numbers were obtained for the four emotional expressions: neutral face ($n = 114$ at T1 and $n = 96$ at T2), fearful face ($n = 114$ at T1 and $n = 96$ at T2), sad face ($n = 109$ at T1 and $n = 95$ at T2), and happy face ($n = 111$ at T1 and $n = 95$ at T2).

2.2.3 | Child temperament (24 months)

To assess child temperament, parents completed the German version of the Early Childhood Behavior Questionnaire Very Short Form (ECBQ, Putnam et al., 2010) at 24 months. In this questionnaire parents are asked to indicate how

often their children had expressed specific behaviors in a variety of situations during the last 2 weeks on a 7-point Likert-type scale (from 1 = *never* to 7 = *always*). The Very Short Form of the ECBQ consists of 36 items. For the Very Short Form, three subscales have been extracted by exploratory factor analyses of the standard instrument. For the present study only two subscales were considered: Surgency assesses approach behavior, positive anticipation of pleasurable activities and interactions, enjoyment of high stimulus intensity or novelty, child activity level and impulsivity. Effortful control assesses child attention shifting and focusing, inhibitory control, the amount of enjoyment related to low stimulus intensity, complexity or novelty. Internal consistency was acceptable for surgency (Cronbach's alpha = .72) but questionable for effortful control (Cronbach's alpha = .67). However, as Putnam and colleagues reported adequate internal consistencies for both scales (Cronbach's alphas = .72) of the Very Short Form (Putnam et al., 2010), the Very Short Form of the ECBQ is a reliable measure of toddler temperament.

2.3 | Analyses

To examine the longitudinal reciprocal effects between maternal EA and children's attention to emotional faces, cross-lagged panel analyses were performed using the lavaan package in R (Rosseel, 2012). We computed eight cross-lagged panel models, one for each of the two EA Scales (sensitivity and non-intrusiveness) with each of the four emotional faces (neutral, fearful, sad, and happy). All models predicted maternal EA at T2 and child attention at T2 by their preceding values at T1 (i.e., autoregressive effects) and by the cross-lagged path from other exogenous variables at T1 (i.e., effects of maternal EA at 12 months on children's attention at 24 months and effects of children's attention at 12 months on maternal EA at 24 months). All models included covariances between variables assessed at the same timepoint. Based on previous studies that used gender and child temperament as control variables in their regression models (Kammermeier et al., 2020), child gender as well as surgency and effortful control were included as covariates.

Preliminary analysis applying Little's MCAR test (Little, 1988) showed that missing data were completely at random (MCAR), $\chi^2(322, n = 118) = 308.65, p = .694$. Thus, no biases have to be expected when using imputation methods for dealing with missing data. We applied the Full Information Maximum Likelihood (FIML) estimation, because parameter estimation is more reliable and less biased in this approach compared to listwise or pairwise deletion (Graham, 2009).

Model fit was assessed by the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR) and the χ^2 -test statistics. Acceptable fit is indicated by CFI close to or above .95, SRMR close to or below .08 and RMSEA close to or below .06 (Hu & Bentler, 1999). An insignificant χ^2 -test result based on the traditional $\alpha = .05$ statistical significance test indicates a good model fit (Barrett, 2007).

3 | RESULTS

3.1 | Descriptives

Table 1 presents descriptive statistics for maternal EA, attention duration and child temperament. For both time points, maternal sensitivity was relatively high, ranging between inconsistent and neutral sensitivity, and maternal behavior was generally nonintrusive. Children looked longer at all emotion expressions at T2 than at T1. Moreover, they showed longer attention to neutral and fearful expressions than to sad and happy expressions at both timepoints. Regarding child temperament, mothers reported that children displayed surgency and effortful control more than half the time within 1 week.

Table 2 displays the correlations between the main variables (maternal EA, attention duration) and covariates (gender, temperament). Children's attention duration was correlated more highly for different expressions within one timepoint than for the same expression across timepoints. Sensitivity at T1 was related to children's attention duration, namely to attention duration to the sad expressions and the happy expressions at T2. There were no correlations

TABLE 1 Descriptive statistics of maternal and child measures

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max
Sensitivity T1	118	5.23	0.86	3	7
Sensitivity T2	95	5.44	0.80	4	7
Non-intrusiveness T1	118	5.32	0.97	3	7
Non-intrusiveness T2	95	5.23	0.96	3	7
Neutral Face T1	114	2.82	1.70	0	6.5
Neutral Face T2	96	3.30	1.63	0	6.4
Fearful Face T1	114	2.73	1.79	0	6.3
Fearful Face T2	96	3.57	1.69	0	6.5
Sad Face T1	109	2.31	1.55	0	6.5
Sad Face T2	95	3.15	1.65	0	6.4
Happy Face T1	111	2.34	1.60	0	5.8
Happy Face T2	95	3.03	1.65	0	6.3
Surgency T2	96	5.29	0.70	3.1	6.8
Effortful Control T2	96	4.76	0.65	3.1	6.1

of maternal EA or child attention duration with the covariates temperament or gender. Therefore, we did not include any covariates in our analyses.

3.2 | Cross-lagged panel models of relations between sensitivity and attention to emotional faces

As all four models for sensitivity were just identified (i.e., the number of data points equals the number of estimated parameters), all models yielded perfect fit statistics. Model coefficients (β) for all four models are reported in Table 3. Significant stability for both maternal sensitivity and attention to emotion expressions was demonstrated in all four models. Significant cross-lagged associations emerged in the models testing relations between sensitivity and attention to the sad expression (Figure 2a) as well as sensitivity and attention to the happy expression (Figure 2b). A higher level of maternal sensitivity at 12 months was associated with longer attention duration of children to the sad expression at 24 months ($\beta = .27, p = .006$), indicating a small effect. Attention duration to the sad expression at 12 months did not predict maternal sensitivity significantly at 24 months ($\beta = -.12, p = .216$). Moreover, a higher level of maternal sensitivity at 12 months was associated with longer attention duration of children to the happy expression at 24 months ($\beta = .22, p = .026$), indicating a small effect. Attention duration to the happy expression at 12 months did not predict maternal sensitivity significantly at 24 months ($\beta = -.04, p = .700$).

3.3 | Cross-lagged panel models of relations between non-intrusiveness and attention to emotional faces

As all four models for non-intrusiveness were just identified, models obtained perfect fit statistics. Model coefficients (β) for all four models are reported in Table 3. Significant stability for both maternal non-intrusiveness and attention to emotion expressions was demonstrated in all four models. Significant cross-lagged associations emerged in the model testing relations between non-intrusiveness and attention to the sad expression (Figure 2c). A lower level of intru-

TABLE 2 Correlations between maternal EA, child attention, child temperament, and child gender

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Sensitivity T1														
2. Sensitivity T2	.42**													
3. Non-intrusiveness T1	.49**	.19 [†]												
4. Non-intrusiveness T2	.26*	.51**	.34**											
5. Neutral Face T1	.02	-.06	.05	-.18										
6. Neutral Face T2	.16	.17	.12	.10	.45***									
7. Fearful Face T1	.09	-.02	.14	-.11	.82***	.44**								
8. Fearful Face T2	.19 [†]	.15	.16	.12	.41***	.86**	.41**							
9. Sad Face T1	-.01	-.12	.04	-.16	.81***	.33**	.80**	.30*						
10. Sad Face T2	.25*	.13	.18 [†]	.16	.41***	.83**	.42**	.89**	.32**					
11. Happy Face T1	.02	-.04	.11	-.04	.71***	.34**	.76**	.27*	.79**	.37**				
12. Happy Face T2	.23*	.19 [†]	.20 [†]	.18 [†]	.40***	.73**	.39**	.79**	.26*	.80**	.31**			
13. Surgency T2	-.06	-.04	-.12	-.03	-.05	-.06	-.10	-.07	-.10	-.03	-.20 [†]	-.08		
14. Effortful Control T2	.13	.08	.06	.10	-.07	.03	-.00	-.08	.05	-.02	-.04	-.10	-.09	
15. Gender ^a	.09	.09	.13	.20	-.13	-.13	-.05	-.13	-.12	-.07	-.09	.01	-.10	.08

Note. ^aSpearman-Rho with dummy coding 0 = male and 1 = female.

** $p < .01$, * $p < .05$, [†] $p < .10$, two-tailed.

TABLE 3 Path coefficients (β) for cross-lagged panel models of relations between maternal EA and child attention to emotional faces

Regressions	Neutral	Fearful	Sad	Happy
Sensitivity T1 – Sensitivity T2	.44**	.44**	.44**	.44**
Sensitivity T1 – Attention T2	.14	.14	.27*	.22*
Attention T1 – Attention T2	.44**	.40**	.33*	.30*
Attention T1 – Sensitivity T2	–.07	–.06	–.12	–.04
Sensitivity T1 – Attention T1	.01	.09	–.02	.03
Sensitivity T2 – Attention T2	.11	.11	.06	.12
Non-intrusiveness T1 – Non-intrusiveness T2	.36**	.37**	.35**	.35**
Non-intrusiveness T1 – Attention T2	.11	.12	.21*	.19†
Attention T1 – Attention T2	.45**	.40**	.33*	.30*
Attention T1 – Non-intrusiveness T2	–.18†	–.14	–.14	–.05
Non-intrusiveness T1 – Attention T1	.04	.14	.03	.12
Non-intrusiveness T2 – Attention T2	.16	.12	.16	.13

* $p < 0.05$, ** $p < 0.01$, † $p < .10$.

siveness at 12 months was associated with longer attention duration of children to the sad expression at 24 months ($\beta = .21, p = .037$), indicating a small effect. In contrast, attention duration to the sad expression at 12 months did not predict maternal non-intrusiveness significantly at 24 months ($\beta = -.14, p = .152$).

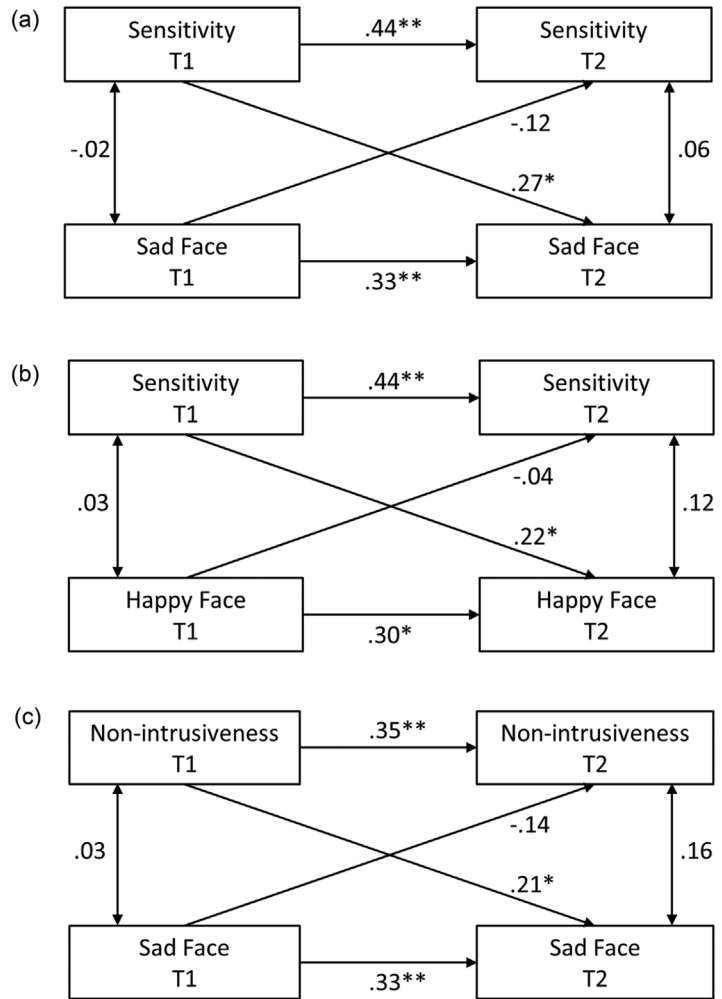
3.4 | Additional analyses

We conducted all analyses also with gender and temperament included as covariates. All models provided good fit statistics and significant cross-lagged associations emerged in the same models as in the analyses without covariates, that is, for models of relations between sensitivity and the sad expression, between sensitivity and the happy expression, and between non-intrusiveness and the sad expression. In all models, autoregressive effects were significant but no significant concurrent associations between parenting behavior and attention emerged.

Moreover, we tested for coefficient equality of the cross-lagged paths from caregiver behavior at 12 months on attention at 24 months pairwise across models. We estimated models that included respective paths for two emotional expressions (e.g., sad and fearful) and for which the residuals for the two cross-lagged regressions were allowed to covary. For sensitivity models, the coefficients for attention to the neutral face and the sad face ($p = 0.025$), as well as for attention to the fearful face and the sad face ($p = 0.014$) were significantly different. For non-intrusiveness models, the coefficients for attention to the neutral face and the sad face ($p = 0.048$) were significantly different, whereas the result for the coefficients for attention to the fearful face and the sad face showed the same pattern but was not significant ($p = 0.064$). A comprehensive table with comparison of the respective cross-lagged paths is provided in the online [supplementary material](#).

Based on recommendations of one reviewer, we calculated an EA sum score including all four maternal EA Scales and conducted cross-lagged panel analysis for each facial expression. Results for the fearful, sad, and happy expressions were the same as for the models with sensitivity (i.e., significant cross-lagged associations for the sad and happy expressions). For the neutral expression, a significant cross-lagged association of EA sum at 12 months and attention at 24 months ($\beta = .18, p = .047$) emerged. Yet, when adding the covariates, this effect vanished.

FIGURE 2 Final cross-lagged models of (a) maternal sensitivity and child attention to the sad expression from 12 to 24 months, (b) maternal sensitivity and child attention to the happy expression from 12 to 24 months, and (c) maternal non-intrusiveness and child attention to the sad expression from 12 to 24 months. * $p < 0.05$, ** $p < 0.01$



4 | DISCUSSION

The current study used cross-lagged panel models to investigate reciprocal relations of maternal caregiving behavior and children’s visual attention to emotional facial expressions in a longitudinal design. To this end, we assessed mothers’ sensitivity and non-intrusiveness in free play interactions at the age of 12 and 24 months. Moreover, at each time point we measured children’s attention duration to neutral, negative and positive facial expressions via eye tracking. Results demonstrated that more sensitive and less intrusive maternal behavior at 12 months predicted longer attention duration to the sad facial expression at 24 months. In addition, more sensitive caregiving at 12 months predicted longer attention duration to the happy facial expression at 24 months. The pattern of results supports key theoretical claims from the attachment and the emotional availability frameworks proposing that experiences with sensitive caregivers in early years lead to a more open and unbiased processing of emotional information (Bowlby, 1980; Dykas & Cassidy, 2011). The results add to this line of research by demonstrating the pervasive impact of caregiver sensitivity on attentional regulation as an early stage of emotion processing in the first years of life.

A considerable body of literature suggests that experiences in personal relationships impact children’s socio-emotional development, possibly by influencing how emotion stimuli are processed, that is, perceived, attended to,

interpreted or remembered (e.g., Hadwin et al., 2006; Pollak & Tolley-Schell, 2003). From a theoretical perspective, our study expands this knowledge as it examined effects of caregiver behavior on toddlers' attention to emotions as an early stage of emotion processing. Although previous research has provided evidence for associations between caregiving and processing of emotional facial expressions in infancy, middle childhood, and adolescence (Connell et al., 2013; de Haan et al., 2004; Gibb et al., 2009), the present study adds to this research by demonstrating that sensitive and non-intrusive maternal behavior affects attention to emotional faces in toddlerhood. Importantly, our study goes beyond correlational studies as cross-lagged panel analyses allow for clarification of the direction of effects. Our results thereby extend work by Northrup et al. (2019) who used cross-lagged models to investigate bidirectional associations between positive and negative parenting and infant responses in the still face procedure (i.e., affect and social gaze). They found predictive effects in one direction, that is, effects of changes in infant affect and social gaze on parenting behavior. Overall, our study provides new evidence regarding the relevance of caregiver behavior for attentional processes in child emotion regulation (Cassidy, 1994; Tronick, 1989).

Our findings on effects of sensitivity and non-intrusiveness on children's attention to the sad expression are consistent with theoretical claims that children with more sensitive and less controlling parents are more open and unbiased in their processing of emotion information (Bowlby, 1973; Cassidy, 1994). From an attachment theoretical perspective sensitive parenting behavior is assumed to be especially important for children's processing of negative emotions as those are potentially hurtful (Bowlby, 1980). This idea can be explained by the more adequate and effective external regulation that sensitive and non-intrusive mothers provide in their responses to children's negative affective states, so that children might perceive negative emotions as less hurtful and are able to attend more openly (i.e., longer) to negative emotional information (Cassidy, 1994).

Our hypothesis that caregiver behavior is a predictor of children's attention to positive expressions was partly supported. Although maternal non-intrusiveness was not associated with attention to the happy expression, maternal sensitivity was a significant predictor of children's attention to the happy expression. This result might be due to the different ways in which caregiving behaviors influence children's experiences with responding to emotional states. Non-intrusiveness might have a greater effect on children's attentional processing of negative emotions because children might have experienced that their caregivers are more likely to intervene in an intrusive way when they show negative affect than when they show positive affect. Sensitivity to child signals, on the other hand, might be important in attentional processing of both negative and positive emotions. This idea is supported by findings that mothers are more controlling when their children are more easily frustrated (i.e., showed more negative affect) (e.g., Spinrad & Stifter, 2002). Moreover, sensitivity as conceptualized in the EA Scales is about appropriate responsiveness to both negative and positive emotional expressions of the child (Biringen et al., 2014), which might foster children's more open and unbiased attentional processing of positive as well as negative emotion stimuli. It should be noted that the effects of the two EA dimensions on attention were overall small and that the analyses for effects of non-intrusiveness on attention to happy faces showed the same pattern as for effects of sensitivity on attention to happy faces, although the effect of non-intrusiveness was not significant. The possibility of a false negative finding may not justify strong conclusions regarding differential effects for sensitivity and non-intrusiveness on children's attention.

Previous studies investigating infants' behaviors in the still face paradigm have described infants' gaze avoidance (i.e., attentional disengagement) as an adaptive way to regulate their emotional distress in response to maternal affective unavailability (Tronick & Weinberg, 1997). However, this situationally adaptive gaze avoidance can be maladaptive when it becomes a generalized attention regulation strategy in response to others' emotions. As the direction of attention toward or away from others' emotional expressions is a regulatory process, it affects subsequent processes such as cognitive appraisal or emotion expression (Taylor & Amir, 2010). In this sense, the more open and unbiased attentional regulation of children with more sensitive and less intrusive mothers provides children with more opportunities for developing a repertoire of optimal regulation strategies. This claim is supported by research that showed effects of caregiving and relationship quality (i.e., attachment) on children's use of adaptive emotion regulation strategies (Calkins & Johnson, 1998; cf. Cooke et al., 2019). Our study adds to this research by focusing on the effects of caregiver behavior on attention as a process involved in emotion regulation.

Contrary to our hypothesis, there was no significant effect of maternal sensitivity on attention to the fearful expression. Although research suggests a general bias in infants' attention to fearful expressions in comparison to happy or neutral stimuli (Peltola et al., 2009), it is possible that when confronted with a fearful expression individually and not with positive or neutral expressions simultaneously, infants and toddlers cannot fully decipher the emotion information that is conveyed by this expression (Ruba & Repacholi, 2020). This lack of ability to decode fearful expressions might be due to the fact that in the first 2 years of life children have little experience with the expression of fear as this emotional expression occurs rather infrequently in everyday social interactions (e.g., Calvo et al., 2014; Grossmann, 2010; Malatesta & Haviland, 1982). That is, unless in contexts of attachment disorganization (Granqvist et al., 2017), children might be less likely to see really fearful faces. Indeed, it has been suggested that children's expression of fear has to be learned, which requires greater experiences with worrying or threatening situations and depends on cognitive abilities (e.g., memory) and appraisal processes (Sullivan & Lewis, 2003). It is an intriguing question whether effects of caregiver behavior on child attention to fearful expressions might be relevant when specifically exploring young children with a disorganized attachment.

Moreover, a fearful face is a rather ambiguous expression that indicates a potential threat in the environment, which might require searching for the source of the frightening stimulus. Children of more sensitive mothers might disengage their attention from a fearful face because they are searching for the potential source of threat, whereas children of less sensitive mothers might disengage, because they can no longer tolerate looking at the fearful expression. Notably, the additional analyses of cross-lagged path coefficients suggest differences in processing of fearful and sad facial expressions. One could argue that this is due to toddlers' different experiences with the expressions of fear and sadness. Compared to the rather limited experience with fearful expressions, sad expressions are experienced frequently and very early in development. Thus, fear and sadness might play different roles in toddlers' experience of their social environment and attention to these two emotions might not be influenced equally by parental caregiving. More research is needed to examine potential differences between discrete negative emotion expressions.

Likewise, regarding the attention to neutral facial expression, we did not have a clear hypothesis. Our results indicate that there is no predictive effect of maternal caregiving on children's attention to neutral facial expressions. As neutral facial expressions do not convey emotionally relevant information, attentional regulation processes might not play a role here. Moreover, due to their ambiguous nature neutral expressions might be perceived as fearful or frightened and thereby processed in a similar way as actual fearful expressions.

One might wonder why our study showed longitudinal associations of maternal caregiving on children's attentional regulation but did not support cross-sectional associations. This research relates to theoretical claims that early experiences with caregivers have stronger effects on children's later developmental functioning than on concurrent emotional development (Bowlby, 1969/1982). The attachment theoretical framework proposes that during the first year of life social experiences with the central caregiver become integrated and mentally represented in internal working models (Bowlby, 1969/1982; Main et al., 1985). The same applies to the development of emotion regulation, which becomes organized into patterns or strategies around the same time (Diener et al., 2002). If we assume attentional regulation to be a mechanism in emotion regulation, it is possible that the association of caregiver behavior and attention to emotions is not yet developed at the age of 12 months as these mental representations and strategies are only beginning to emerge at this age. Furthermore, during toddlerhood children become more self-regulated and independent from their caregivers, so that concurrent caregiver behavior might be less influential. Thus, the specific effects of sensitive caregiving behavior on young children's attentional processing of emotions can be assessed more reliably by exploring longitudinal relations and might be overlooked when assessing cross-sectional relations. Importantly, the cross-lagged panel design in our study allowed us to identify the direction of longitudinal effects. From an attachment theoretical perspective, we hypothesized longitudinal effects of maternal behavior on toddlers' later attentional regulation. However, studies focusing on associations between caregiving and attention to facial expressions early in infancy indicate effects in the opposite direction. Peltola and colleagues (Peltola et al., 2015, 2020) reported longitudinal effects of infant attention to fearful faces on later attachment security. Moreover, Northrup et al. (2019) found effects of changes in infant affect and social gaze from interaction to still face episodes on parenting behavior (i.e.,

more positive, less negative parenting and more mental state talk) but no effects in the other direction. However, the study did not investigate infants' attention to emotion expressions in general and results were only cross-sectional. Nevertheless, these results indicate that early in infancy, that is, prior to development of organized attachment and emotion regulation strategies, effects of infant emotion and social behavior on caregiver-child relationship patterns are already established, whereas influences in the other direction might be observed later in toddlerhood. Although these age-specific relations cannot be examined with the present study data, future research including assessments earlier in infancy, would help to understand bidirectional effects of child and maternal behavior from early infancy to late toddlerhood. In sum, by showing longitudinal but not concurrent relations of sensitive and non-intrusive parenting on child attentional regulation, our study adds to theoretical claims that experiences in interaction with caregivers in early years are most relevant predictors of children's later attentional regulation in emotion processing.

The findings of our study may have implications for clinical practice and interventions. Biases in attentional processing of emotion information can have negative impacts on subsequent regulation processes, which also might lead to problems in social interactions and relationships. For instance, research on the development of anxiety in childhood and adolescence shows the moderating role of attention biases to threat for the relation of early temperamental characteristics such as behavioral inhibition and later anxiety or social withdrawal (Pérez-Edgar et al., 2011, 2014). Furthermore, it is well established that relationship-based caregiver-infant interventions that focus on aspects of caregiver behavior can foster development of effective and adaptive emotion regulation strategies in children (cf. Bosmans, 2016). The effectiveness of such interventions can be enhanced through a greater understanding that attentional regulation in emotion processing is influenced by sensitive and non-intrusive caregiver behaviors.

Although our study adds to an important research gap, some limitations should be noted. First, the current study focused on an important but nonetheless limited age period. It would be interesting to examine whether the longitudinal effect of maternal sensitivity and non-intrusiveness on children's attentional regulation is also present at later time points during preschool age. Second, although our study provides evidence for the predictive association between maternal sensitivity, non-intrusiveness and child attentional regulation, other factors of maternal behavior also might be predictive of child attentional regulation. For instance, mothers' own emotion regulation abilities (Morelen et al., 2016) or specific maternal strategies for regulating their children's emotions and attention (Spinrad et al., 2004) are interesting factors to consider in future research. Third, although attentional regulation is considered an important process in emotion regulation, it might be interesting to examine other aspects in addition to attention and how the different aspects of emotion regulation are related to each other and to maternal behavior. Moreover, although the use of modern eye tracking technique is a strength of the study, it might be interesting to assess children's attentional regulation with more naturalistic materials and situations. A last limitation is the limited cultural generalizability due to the WEIRD (Western, Educated, Industrialized, Rich and Democratic) sample (Henrich et al., 2010). Research has shown that there are cultural differences in levels and effects of sensitivity and non-intrusiveness (e.g., Carlson & Harwood, 2003) as well as cultural differences in attention to emotional information (e.g., Masuda et al., 2012; Senzaki et al., 2016). These cultural differences in attention to emotional faces might be accounted for partly by different experiences with caregivers. Thus, it is important for future studies to consider possible cultural differences when investigating the relation between maternal caregiving behavior and children's attentional regulation in processing of emotions.

In sum, our study supports the important role of caregiver behavior for child attentional regulation in processing of emotion information. We provide evidence that sensitive and non-intrusive parenting is an important predictor of an open and unbiased attentional processing of others' negative and positive emotional expressions. This relation between experiences in parent-child interactions and attentional processing of emotions has important implication for children's socio-emotional development (e.g., Gross, 2014).

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CONFLICT OF INTEREST

The Author(s) declare(s) that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

Data and analyses scripts are available on the Open Science Framework (OSF) at https://osf.io/bau79/?view_only=9ac586c7ce324ed08fd52caa169f5421

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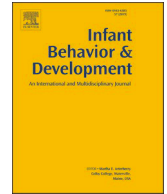
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Maternal emotional availability relates to two-year-olds' behavior in a challenging cooperative interaction

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ABSTRACT

Cooperative interactions are an essential aspect of human life, which children start to engage in the course of toddlerhood. Cooperation can often be challenging and requires repair and realignment. So far, little effort has been made to investigate how young children deal with emotionally challenging cooperative interactions. Therefore, we examined which factors explain 24-month-old toddlers' ($n = 90$) behavior to interruptions in two frustrating cooperative interactions, that is, their disengagement from the task, approach to the mother, active help seeking, and reengagement. We focused on child temperament (i.e., shyness) and child cognitive skills (i.e., language and self-control), and were especially interested whether mother-child interaction quality (i.e., sensitivity and non-intrusiveness) contributes beyond child characteristics. Results indicated that maternal intrusiveness significantly predicted more child disengagement and more approach to the mother. Furthermore, toddler self-control was positively associated with approach to mother, while toddler language skills were positively related to active help seeking. Reengagement was neither predicted by child characteristics nor by maternal emotional availability. We discuss how the findings of the current study expand our knowledge of the factors that impact toddlers' social competencies and coping strategies in emotionally challenging cooperative interactions with others.

1. Introduction

The ability to cooperate with others is an important human trait. Research suggests associations of cooperative behavior with less problematic behavior in pre-school and primary school age (Webster-Stratton & Lindsay, 1999), more positive social relationships (Smith, Boulton, & Cowie, 1993) and better academic performance (Caprara, Barbaranelli, Pastorelli, Bandura & Zimbardo, 2000; Kyndt, Raes, Lismont, Timmers, Cascallar & Dochy, 2013). Moreover, cooperation is an essential aspect of prosocial activities like sharing or helping (Tomasello, 2007). Thus, the ability to cooperate plays an important role in children's social and cognitive development.

Although cooperation is associated with positive outcomes such as prosocial behavior, nevertheless, cooperative interactions can be fraught with frustrations and become challenging once interruptions and distortions occur. Yet, little is known on how young children deal with emotionally challenging cooperative interactions and even less is known about potential correlates that might

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influence children's behavior in such interactions. Children's success in coping with these challenges may depend in part on developmental histories of interaction with parents, next to children's temperament and cognitive abilities. Thus, the current study aimed to investigate to what extent these factors contribute to children's coping behavior in frustrating cooperative interactions.

While in the first year of life, cooperative activities in dyadic and triadic interactions are strongly structured and scaffolded by parents (e.g., Hammond, Al-Jbouri, Edwards & Feltham, 2017), children become more independent in their participation in cooperative activities during the second year of life (Brownell, Ramani, & Zerwas, 2006; Brownell, & Carriger, 2004; Dahl, 2015; Rheingold, 1982). Moreover, in their second year of life children start to understand the interdependency of actions toward a joint goal in cooperative games (Warneken, Chen, & Tomasello, 2006, 2012; Warneken & Tomasello, 2007). In these studies, children and an adult partner played cooperative games in which two complementary roles had to be performed in order to pursue a joint goal. When the adult partner suddenly interrupted the cooperative game, 14- to 27-month-old children tried to reengage the adult partner and 27-month-olds protested when the adult partner indicated that he/she was unwilling to continue. This indicated that children perceived the partner's interruption as a violation against the cooperative nature of the interaction. Notably, as frustration and lack of coordination are rather the normal case in human interaction, this study nicely demonstrates how children deal with emotionally challenging interactive situations. In addition, children start to become able to coordinate their actions with others (Meyer, Bekkering, Haartsen, Stapel & Hunnius, 2015; Yu & Myowa, 2021; for review see Meyer & Hunnius, 2020). Thus, the toddler period is an important period for the development of cooperation, as children become progressively more independent and autonomous in their own actions and their initiation and coordination of joint activities with others (for review see Brownell, 2011). Moreover, they start to re-establish coordination with others in case the cooperative activity is interrupted.

The ability to regulate emotions and behavior in interactions in which the cooperation partner stops to pursue the joint goal of a cooperative activity, enables the child to repair such interactions and allows for continuation of cooperative activities. Thus, it is important to investigate which factors influence how toddlers cope with frustration evoked by interrupted cooperative interactions. Next to the necessary cognitive prerequisites (e.g. Gauvain & Rogoff, 1989; Meyer, Bekkering, Haartsen, Stapel & Hunnius, 2015), influential developmental theories suggest that experiences in interaction with caregivers play an important role for development of children's socioemotional competences (Gauvain, 2001; Hammond & Carpendale, 2015; Sroufe, 1979). Most notably, attachment theory has suggested that based on their expectations regarding their caregivers' responsiveness in stressful situations, young children develop behavioral strategies that are activated in emotionally challenging contexts (Bowlby, 1982; Main, Kaplan & Cassidy, 1985). This theoretical assumption is supported by studies that showed relations of attachment security with toddlers' behavior in challenging problem-solving tasks, that is, toddlers' enthusiasm, persistence, and cooperation (Matas, Arend, & Sroufe, 1978), competent problem-solving behavior (Frankel & Bates, 1990), dealing with frustration (Deichmann & Ahnert, 2021), task orientation and exploration, and help seeking behavior (Schieche & Spangler, 2005). Given that attachment is mainly a consequence of caregiver sensitivity (Ainsworth, Blehar, Waters & Wall, 1978), it relates to the view that experiences in interaction with caregivers might play a role in young children's ability to cope with frustrating cooperative interactions.

Interestingly, recent frameworks provide expanded conceptualizations of caregiving that vary in their definition of sensitivity and inclusion of other aspects of caregiving (see (Mesman & Emmen, 2013) for review of observational measures). The Emotional Availability (EA) framework (Biringen, 2008; Biringen, Derscheid, Vliegen, Closson & Easterbrooks, 2014) has its foundations in attachment theory and the original conceptualization of sensitivity, while placing greater emphasis on emotional and dyadic aspects of the interaction. More precisely, the EA framework assesses the overall affective quality of the caregiver-child relationship beyond caregiver-child attachment and assumes mutual influences and individual contributions of parent and child to the relationship quality. Thus, the EA framework seems most suitable for our research question as it indicates how well a parent-child dyad is able to cooperate and coordinate behavior and emotions in interaction. As the EA caregiver and the EA child dimensions are interrelated (e.g., Biringen, Brown, Donaldson, Green, Krcmarik & Lovas, 2000; Licata, Kristen, & Sodian, 2016), and as we were specifically interested in how maternal interactive behavior in the mother-child relationship contributes to child coping behavior, we decided to focus on caregiver EA in our study. Of the four caregiver dimensions distinguished in the EA framework (i.e., sensitivity, structuring, non-intrusiveness, and non-hostility), the two aspects that seem most relevant regarding children's coping behavior in frustrating cooperative interactions are sensitivity and non-intrusiveness.

Although it may be interesting to investigate relations of all EA caregiver scales with child coping behavior, research has reported that the EA dimensions are highly interrelated (Biringen, Derscheid, Vliegen, Closson, & Easterbrooks, 2014; Oppenheim, 2012), which can cause problems of multicollinearity. In order to minimize the number of interrelated predictors, we decided to focus on the EA dimensions sensitivity and non-intrusiveness as these EA dimensions are most relevant for our research question and particularly suitable to start investigating effects of maternal caregiving on child coping behavior in frustrating cooperative activities.

Sensitivity in the EA framework refers to the caregiver's behavioral and emotional responsiveness to the child. A sensitive caregiver creates a positive emotional atmosphere and is able to read and respond to child signals appropriately (Biringen, Derscheid, Vliegen, Closson, & Easterbrooks, 2014; Saunders, Kraus, Barone & Biringen, 2015). The sensitive caregiver's supportive presence promotes child competencies and autonomy in context of child exploration and provides a secure base for the child in challenging situations. Most importantly for our research question, the sensitive caregiver's appropriate responses support the child's ability to coordinate and regulate own emotions and behavior in social interactions (Brownell, 2011). Thus, children with sensitive caregivers are proposed to be competent, autonomous and persistent in their participation in cooperative activities, adapt their behavior to the interaction partner and are able to use the caregiver's assistance in case of frustration (Sroufe, 1979). In contrast, children with less sensitive mothers who are ignoring or rejecting their children's needs, might act autonomously in less stressful social situations but might not stay involved or seek maternal support when a cooperative activity becomes frustrating and too difficult for the child to resolve alone.

A second relevant EA dimension is non-intrusiveness, which refers to the caregiver's ability to follow the child's lead in play and to

avoid interfering with child's ongoing activities. A non-intrusive caregiver refrains from over-stimulation or interference and respects the child as an autonomous person (Biringen, Derscheid, Vliegen, Closson, & Easterbrooks; 2014; Saunders, Kraus, Barone, & Biringen; 2015). Thus, a non-intrusive caregiver is available for the child if needed and accepts when the child seeks age-appropriate levels of independence, thereby supporting the child's autonomy. In contrast, the intrusive caregiver's interruption of child actions likely undermines the child's attempts of age-appropriate autonomous exploration and independence as frequent maternal interference of the child's exploratory activities forces the child to redirect the attention to the mother (Cassidy, & Berlin, 1994). Thus, children with intrusive mothers might act less competently and autonomously in frustrating cooperative interactions, whereas children with less intrusive mothers might be able to cope with their frustration more competently and independently, while also being able to use their mother's support. Whereas higher intrusiveness is likely associated with less sensitive caregiving, the conceptualization of non-intrusiveness as a separate dimension allows exploring unique contributions of non-intrusiveness to child autonomy and exploration in frustrating cooperative interactions.

In sum, theoretical considerations suggest that sensitivity and non-intrusiveness influence how competent and autonomous children act in frustrating cooperative contexts and which behavioral coping strategies they use when cooperative interactions become emotionally challenging. Yet, only few studies have addressed this question empirically and those who did primarily focused on child behavior in challenging problem-solving tasks. For instance, in a longitudinal study Frankel and Bates (1990) found that maternal positive involvement measured at home predicted dyadic effective problem solving indicated by toddlers' engagement in the task and responsiveness to maternal suggestions. A more recent study by Schieche and Spangler (2005) found that in a difficult problem-solving task maternal support was related to more on-task behavior and more help seeking behavior, but not to toddlers' proximity seeking of the mother. Interestingly, insecure-ambivalent toddlers showed high task orientation only in close proximity to the mother and inhibited insecurely attached children showed increased proximity seeking and less task involvement. These findings suggest that proximity seeking might not always be the most adaptive strategy in contexts that are not attachment relevant, but require a more adaptive and solution-oriented response. As high dependence on the mother likely undermines child development of autonomous, coping and problem-solving competencies, proximity seeking without further exploration or active help seeking will not promote successful solution of an emotionally challenging task (Schieche & Spangler, 2005). Moreover, Borelli et al. (2021) found that maternal reflective functioning (RF) – a construct related to maternal sensitivity – moderated the relation between toddler distress and coping behavior, that is, for higher levels of maternal RF, the relation between toddler distress and mother-oriented behavior increased, whereas the relation between toddler distress and child aggression decreased. Indirect support comes from research on attachment security and children's coping behavior, which showed that securely attached toddlers use more help seeking and social support seeking strategies, whereas avoidantly attached toddlers use more self-soothing and distraction strategies and less socially oriented strategies, and ambivalently attached toddlers use less self-distracting strategies, sought out others for soothing and were overall less adaptable in coping with distress (for review see Zimmer-Gembeck et al., 2017). In sum, previous studies provide important findings for the relation of maternal caregiving behavior and child coping behavior in emotionally challenging situations. Yet, although the tasks and situations were manipulated to be too difficult and emotionally challenging for children, they were not cooperative in the sense that two persons had to work together simultaneously to achieve a goal together – which is a key aspect of cooperation (Tomasello & Hamann, 2012).

Our study aimed at filling this research gap by examining the relation between caregiver behavior, measured in terms of maternal emotional availability, and children's responses in frustrating cooperative tasks at the age of 24 months. To this end, we adapted the design and procedure of the study by (Warneken, Grafenhain, & Tomasello; 2012). More precisely, we created cooperation games in which a child and an experimenter had to perform one of two complementary roles simultaneously in order to reach the goal of the game. During the game, the experimenter interrupted the cooperative interaction because she was either unwilling or unable to perform her role. This enabled us to study how children cope with frustration in cooperative contexts and how this relates to caregiver characteristics (see also Deichmann & Ahnert, 2021). Based on previous research (Schieche & Spangler, 2005; Warneken, Chen, & Tomasello; 2006), we decided to assess children's disengagement from the task, approach to the mother, active help seeking addressed to the mother, and reengagement attempts addressed to the experimenter during interruption periods.

While we propose that maternal sensitivity and non-intrusiveness are very relevant for children's coping behavior in emotionally challenging cooperative interactions, other important factors such as child temperament and child cognitive skills are likely associated with toddlers' behavior in cooperative contexts. For instance, temperament, such as children's shyness level, that is, their tendency to approach new situations or persons. For instance, surgency (i.e., a temperamental dimension that measures children's sociability and shyness) and behavioral inhibition (i.e., a measure of approach versus withdrawal in response to new stimuli) were related to toddlers' affiliative behavior in cooperation tasks with peers (Endedijk, Cillessen, Cox, Bekkering & Hunnius, 2015) and to competent behavior in a problem-solving contexts (Schieche & Spangler, 2005). Thus, less shy children might be socially more competent and might withdraw less from challenging social situations (Schuhmacher & Kartner, 2015). Second, child language competencies as a possible indicator of cognitive development might be important to understand the collaborative nature of cooperative interactions and that interruptions initiated by one partner interfere with the intention to pursue a joint goal. As a third factor, self-control might be especially important for children's adaptation of their own behavior in face of frustration during interrupted cooperative interactions and might support children's tolerance to stay in such challenging situations. Taken together, it can be expected that lower levels of shyness as well as better language skills and better self-control are related to toddlers' coping behavior in frustrating cooperative situations. We were not only interested in exploring whether maternal emotional availability relates to child coping behavior in emotionally challenging cooperative interactions at all, but in particular whether it predicts children's coping behavior above and beyond the before mentioned temperamental and cognitive aspects.

In summary, the aim of the current study was to examine predictors of toddler coping behavior in frustrating cooperative

interactions and to investigate to what extent two dimensions of maternal EA – maternal sensitivity and maternal non-intrusiveness – play a special role. Emotionally challenging cooperative interactions are interesting exploratory contexts that might challenge toddlers' emerging autonomy and give insight in toddlers' individual coping strategies (Sroufe, 1979). In our study, we focused on four possible behavioral strategies children might use in order to cope with the interruption of a cooperative game by the interaction partner: disengagement, approach to the mother, active help seeking, and reengagement. In order to examine potential predictors of these four child behaviors, we first examined predictive contributions of child gender, child temperament and child cognitive skills. In a second step, we examined to what extent the maternal sensitivity and maternal non-intrusiveness explained additional variance.

Based on theoretical considerations, we expected that sensitive and nonintrusive parenting behavior are predictors of child coping behavior in frustrating cooperative interactions (Schieche & Spangler, 2005; Sroufe, 1979). We expected that maternal sensitivity and non-intrusiveness influences children's tendency to stay task-oriented or to use maternal support. More precisely, we expected that sensitive and non-intrusive maternal behavior would predict less disengagement, more help seeking and more reengagement during interruption periods. Regarding children's tendency to go to the mother without further request of support, predictions were less clear. From an attachment perspective, more sensitive and less intrusive caregiving might be related to more proximity seeking in children, as establishing contact to the mother is an adaptive regulation strategy in attachment-relevant contexts. Thus, more sensitive and less intrusive maternal caregiving might relate to increased approaches to the mother. However, while interrupted cooperative interactions might be frustrating for children, merely going to the mother without asking for further maternal help is not an adaptive response to deal with a challenging cooperative interaction. From that perspective, more sensitive and less intrusive maternal behavior might predict a reduced tendency to merely approach the mother. Overall, to investigate to which extent maternal emotional availability relates to toddlers' coping behavior beyond the cognitive and temperamental variables, we relied on a strict test and used generalized linear mixed models that allowed us to hierarchically enter the variables of interest. Given that an appreciation of cooperative behavior develops in toddlerhood (Warneken, Chen, & Tomasello; 2006), our study focused on 24-month-old children.

2. Methods

2.1. Sample

The final sample consisted of 90 mothers and their 24-month-old children ($M = 24.9$ months, $SD = 0.38$; 52% female). All children but two were white and children came predominantly from middle to upper middle class. Children took part in a longitudinal study on social development from infancy to childhood. Initially, we recruited mother–infant dyads from public birth records of a large city in Southern Germany at the age of 12 months (T1). All children were typically developing and had German-speaking mothers. The 90 families whose data we considered in this report were those who participated at the second measurement point when children were 24 months old. Eight participants who were additionally tested at T2 were excluded from the analysis because children did not want to participate in the cooperation task ($n = 6$), the child was too tired for the play situation ($n = 1$) and the mother had a visual impairment ($n = 1$). All children were healthy, typically developed, and full-term. In the final sample, 63% of mothers had a university degree, 19% had a high school diploma, and 18% had lower secondary school diploma. Seventy percent of mothers were currently working, of which 90% were working part-time, and 10% were working full-time. The majority of mothers (89%) were married to or living with the child's father, 8% were single, and 3% were divorced or widowed. Fifty-six percent of mothers reported that they are the primary caregiver, while 42% reported that both parents take care of the child equally, and for two families we did not obtain this information. Seventy-seven percent of children were regularly cared for in an institution, by a childminder or by relatives. For 3 we did not obtain this information. Thirty-six percent of children had at least one sibling. Thirty-two percent of children were bilingual. Mothers were informed about the content and procedure of the study and gave informed written consent. The university ethics committee approved the study. A priori power analyses focusing on correlational relations resulted in a required sample size for a medium effect (0.30) of at least 83 children.

2.2. Procedure and Measures

Data collection took place at the between March and December 2017 in the laboratory. All children were tested individually in one session with two female experimenters (E1 and E2) present. Of the measures relevant for this study the Shyness task was administered first. After a further warm-up phase with the two experimenters, children's language skills were assessed. Afterwards, three cooperation tasks were conducted. Next, mother–child interaction quality was assessed in a free play situation. The gift delay task was conducted last.

2.2.1. Shyness

2.2.1.1. Procedure. The shyness assessment took place in a testing room in which a second experimenter who was unfamiliar to the child was sitting on the floor in approximately 4 m distance to the door. In front of the experimenter were three toys (i.e., a car, a sorting task, and a small motor skills toy). Before the shyness task started, experimenter 1 instructed the mother on the procedure. The mothers and her child then entered the testing room, while E1 was waiting outside. Mother and child stopped entering the room at a sign on the floor approximately 1 m from the door. Experimenter 2 gave the first prompt by saying "Hello [child's name], I am [name of Exp. 2]. After a short pause, the experimenter looked friendly at the child and said, "Look, I have some great toys here", while

pointing at the toys. The mother was instructed to briefly encourage the child to look at the toys, but not to accompany the child. Experimenter 1 started a timer after the mother's verbal encouragement and gave a knocking sign after 20 s. If the child went to experimenter 2 and was close enough to reach the toys (i.e., less than 20–30 cm away) within the 20 s, the task was finished. If the child was further away or still standing next to the mother, experimenter 2 gave a second prompt by saying "Come over here, [child's name], and look at the great toys I have here." The mother was instructed to stay where she was and to not say anything. In case the child, looked at her, the mother should encourage the child by smiling and nodding. After the second prompt, Experimenter 1 again started a timer and entered the room after 20 s in order to stop the task.

2.2.1.2. Coding. Child behavior was coded on a 7-point scale, ranging from 0 to 6 (0 = does not attempt to approach experimenter; 1 = shows desire to approach experimenter, but asks mother to come along; 2 = starts approaching experimenter and returns to mother before child is close enough to reach the toys; 3 = starts approaching experimenter slowly after the second prompt, but takes longer than 20 s; 4 = approaches experimenter after second prompt and arrives there within 20 s; 5 = approaches experimenter after first prompt and arrives there within 20 s; 6 = approaches experimenter before first prompt and arrives there within 20 s). A second coder coded 24% ($n = 24$) of the cases. Interrater reliability was excellent (ICC = 0.96). As children with a score of 6 as well as those with a score of 5 approached the experimenter quite quickly, we decided to recode both scale points into one scale point. This resulted in a 6-point scale. The sample size for child shyness resulted in $N = 87$, because three experimenter errors occurred.

2.2.2. Language

Child language skills were assessed using a German language development test (SETK-2, Grimm, Aktas, Frevert; 2016), which can be applied from 2 years and 0 months to 2 years and 11 months. For pragmatic reasons, only the subtest *word comprehension*, containing 9 items, and the subtest *sentence comprehension*, containing 8 items, were used. For each item, the experimenter asked the child to point to one out of four drawings that were presented on a laminated sheet. Example items were "Show me the cheese" for the word comprehension subtest and "Show me 'The dog carries the shoe'" for the sentence comprehension subtest. We summed up the number of correct responses in both subtests and used this a measure of language skills in our analyses. Data on child language comprehension were obtained on 84 children, as five children did not want to participate and one child did not speak enough German.

2.2.3. Cooperation Tasks

The design and procedure of the cooperation tasks was based on studies by (Warneken, Chen, & Tomasello; 2006, Warneken, Gräfenhain, & Tomasello; 2012). Initially, we conducted three tasks in our study, but due to the high proportion of missing or invalid data for the third task (cases with missing or invalid data $N = 43$), we decided to focus on the first two tasks (see Fig. 1). In both tasks, two cooperation partners (the child and an experimenter) had to perform one of two complementary actions at the same time in order to reach the goal of the task. Both tasks were administered in each of two conditions (unwilling and unable). Each child was tested in both tasks and both conditions, resulting in a 2×2 design with Task and Condition as within-subject factors. Due to the correlational approach of the study, the order of tasks and conditions was the same for every child: Task 1 (Tube Task) was administered first, starting with the Unable condition (UA) and followed by the Unwilling condition (UW). Task 2 (Elevator Task) was administered second, starting with the UW and followed by the UA condition.

2.2.3.1. Task 1 (Tube Task). The goal of this task was to ring a small bell that was attached inside a tube by throwing a block into the top side of the tube. The experimenter had to hold the tube with one hand in an angle that made it possible for the block to slide down the tube, while at the same time she had to open a lid at the top of the tube. As both her hands were already occupied, it was not possible for her to throw in the block herself. Thus, it was the child's task to throw the block into the tube, in order to ring the bell.

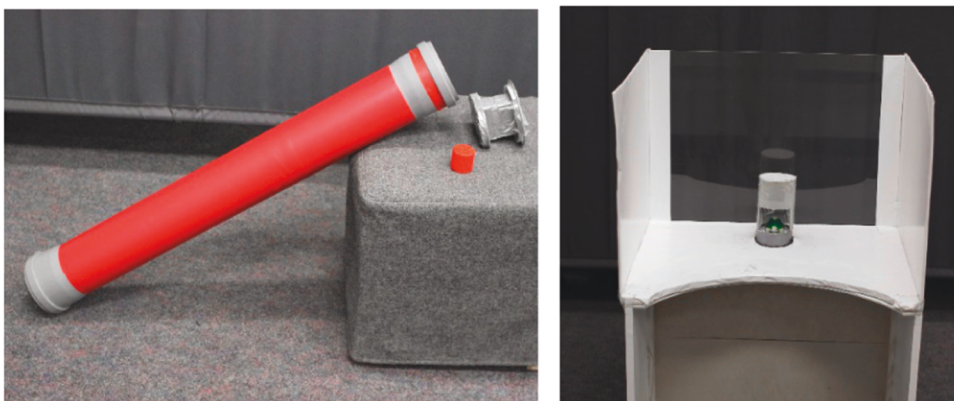


Fig. 1. Apparatus used for cooperation tasks 1 (tube task) and task 2 (elevator task).

2.2.3.2. Task 2 (Elevator Task). The goal of this task was to take a small toy out of a cylinder that could be moved up and down in the apparatus. The experimenter had to push up the cylinder from one side of the apparatus, in order for the child to receive the toy through the opening of the cylinder from the other side. As there was transparent plexiglass between the experimenter's and the opening of the cylinder, it was not possible for the experimenter to reach the toy while pushing the cylinder up. Thus, it was the child's task to take out the toy, while the experimenter was pushing and holding up the cylinder. In order to make the task interesting enough for children, three different toys were used: toy 1 was used in the first demonstration phase and the first practice phase, toy 2 was used in the first test phase and the second practice phase, and toy 3 was used in the second test phase.

2.2.3.3. Procedure. The procedure was based on studies by (Warneken, Chen, & Tomasello; 2006, Warneken, Grafenhain, & Tomasello; 2012) and was modified to fit the aims of our study. Each task started with a demonstration phase in which both experimenters performed the task together. For task 1, E1 held the tube in one hand and opened the lid on top of the tube with the other hand, while E2 showed a block to the child and threw it into the tube. For task 2, E1 pushed up the cylinder from one side of the apparatus, while E2 took out a small toy from the opening on the other side and showed it to the child. In each task, E2 demonstrated her role in the task twice and then offered the child to try it her/himself. If the child did not want to participate, E2 demonstrated the task another two times and tried to encourage the child again. When the child joined the task, a practice phase consisting of two subsequent trials started (P1 and P2) in which E1 performed her role properly and invited the child nonverbally to perform the other role of the task by looking back and forth with alternating looks between the child and the apparatus. If children performed unsuccessfully in the first practice trials, E1 and E2 repeated the demonstration of the respective task and E1 again invited the child to try to perform the role. If a child still failed, another demonstration was given in which E2 directly described the action of her role to the child and both experimenters encouraged the child to try again. For both cooperation tasks, all children who participated in a given task performed successfully after this direct demonstration. If children performed successfully in two practice trials, an interruption phase consisting of two test trials (T1 and T2) of the same condition (UW or UA, respectively) followed. In these test trials, E1 started to perform her role, but then stopped to participate in the task, that is, she did no longer perform the required action. Depending on condition, she either expressed that she was unable (UA) or unwilling (UW) to continue the task. In the unable condition of task 1, E1 effortfully tried to open the lid by pulling it three times but without success because it was stuck. In the unwilling condition of task 1, E1 three times opened the lid just a little bit and closed it again, immediately before the child could throw the block into the tube. For both conditions in task 1, the lid was manipulated in a way that made it too difficult for the child to open it alone in the test trials. In the unable condition of task 2, E1 effortfully tried to push up the cylinder a few centimeters but dropped it three times because it was stuck. In the unwilling condition of task 1, E1 three times playfully lifted and dropped the cylinder as soon as the child reached for the toy. Subsequently, in both conditions the experimenter was inactive for 10 s (timed by E2) and did not interact with the child. In the unable condition, she just looked down at the apparatus with a disappointed expression on her face. In the unwilling condition, she just looked around the room and away from the apparatus with a disinterested expression on her face. After two test trials of the same condition, another two practice trials (P3 and P4) followed, in which E1 restarted to perform her role. If the child was successful in these practice trials, another two test trials (T3 and T4) of the other condition followed. Thus, each child was tested in the following order: for task 1 2 x practice, 2 x UA, 2x practice, 2 x UW, and for task 2 2 x practice, 2 x UW, 2x practice, 2 x UA, resulting in 4 test trials for each condition across the two tasks.

Mothers were instructed to sit in an armchair in the testing room and to behave passively, e.g., by reading a magazine. In case a child approached the mother, the mother encouraged the child to return to the task without giving specific instructions to the child on what exactly the child should do in the task. E2 was only active in the demonstration phases and otherwise sat down next to the mother and stopped the time during the test trials in the interruption phase.

2.2.3.4. Coding. For each test trial of the interruption phases, we coded whether children showed a specific behavior (coded as 1) or not (codes as 0). The behaviors coded were selected based on studies by Schieche & Spangler (2005) and Warneken and colleagues (2006, 2012): *Disengagement* was coded when the child left the task apparatus or performed actions on the apparatus that were irrelevant to the goal of the task (e.g., climbing on the elevator). Disengagement was also coded if the child first individually attempted to pursue the goal or tried to reengage the experimenter and then left the apparatus without a recognizable goal. *Approach to Mother* was coded when the child directly approached the mother by seeking physical/bodily contact or standing close/next to the mother. *Help Seeking* was coded when the child directly approached the mother and actively asked her to help with the task (e.g., by giving her the block for the tube and asking "You do it." or by pulling on mother's arm to get her to the apparatus). The child's approach of the mother had to be clearly purposeful in order to be coded as approach to the mother or help seeking. Both categories were also coded if the child started to approach the mother purposefully but needed longer than 10 s to arrive there (i.e., after the coding interval of a test trial). Aimless walking around that accidentally ended at the mother was coded as disengagement. *Reengagement* was coded when the child was ready to perform her role and tried to reengage the experimenter with gestures (e.g., by pointing at the object) or verbally (e.g., by saying "Again!") to continue with the game. To code this category the child had to clearly address the experimenter (e.g., via eye contact by touching experimenter's arm). In contrast to the coding of Warneken and colleagues (2006, 2012), who selected the behavior that occurred for the majority of time, we selected all behaviors that occurred in a test trial. This was done as duration of behavior was usually different for the three behavioral categories and selecting the behavior that occurred the longest would lead to unequal weighting of the occurrence of a behavior. Thus, if a child displayed multiple behaviors in a given interruption phase, we

included all behaviors in our analyses.

Two trained undergraduate students coded all sessions with student one coding task 1 and student two coding task 2. In order to ensure interrater reliability both coders also coded 26% ($n = 24$ for task 1 and $n = 23$ for task 2) of the respective other task. Cohen's k was calculated for each behavior category and resulted in k s of .63 for disengagement (93%), .84 for approach to mother (97%), .88 for help seeking (98%), and .70 (89.3%) for reengagement.

2.2.4. Mother-Child Interaction Quality

2.2.4.1. Procedure. We assessed mother-child interaction during two situations lasting 14 min in total: a free play situation and a puzzle task, each lasting 7 min. Following previous studies (e.g., Bornstein, 2009; Taylor-Colls & Pasco Fearon, 2015), in the free play situation mother and child were seated on a blanket on the floor and provided with a box with different age-appropriate toys (e.g., a xylophone, picture books, and wooden building blocks). Mothers were instructed to play with their child as they usually would do at home for 7 min. In an additional puzzle task, which provided a more age-appropriate challenging context for assessing differences in EA at 24 months, mother and child were asked to put together a puzzle that was too difficult for the child (cf. Kluczniok et al., 2016). Mothers were instructed to solve the puzzle together with their child within 7 min. Interaction quality was rated across the two situations (i.e., free play and puzzle task).

2.2.4.2. Coding. Emotional availability of the mother-child dyads was rated as a measure of relationship quality. The EA Scales (Biringen, 2008) assess caregiver EA on four dimensions (sensitivity, structuring, non-intrusiveness, and non-hostility). All dimensions are rated on a scale from one to seven. Sensitivity assesses a variety of adult qualities related to the ability to be genuinely warm and emotionally connected with the child as well as to be responsive to the child's signals. Non-intrusiveness refers to the adult's ability to be available to the child and follow the child's lead without being intrusive or undermining the child's autonomy. Due to our hypotheses, we did not consider structuring and non-hostility for this study.

Two coders who had completed training and obtained reliability by Zeynep Biringen did coding of the mother-child interactions. The first coder rated all cases. In order to assure interrater reliability 31% ($n = 30$) sample were rated by the second. The ICC was .84 for sensitivity and .87 for non-intrusiveness. Therefore, interrater reliability was good to excellent.

2.2.5. Self-control (Gift Delay Task)

2.2.5.1. Procedure. For the gift delay task (Kochanska, Murray, Harlan; 2000), a small wrapped gift was put in a colorful gift bag. The experimenter asked the child to take a seat at the table, praised the child for his/her participation and said that she had a present for the child. She showed the gift bag to the child, and said: "Oh no, I forgot the bow!". She asked the child to wait and not to touch the gift bag until she was back with a bow. The experimenter then put the gift bag on the table in a reachable distance to the child and left the room. After 3 min the experimenter came back with a bow. If the child had not unwrapped the gift, the experimenter invited the child to open the gift. If the child had already unwrapped the gift, the experimenter just commented: "Ah, did you already unwrap the gift?". During the task, mothers took a seat a few meters behind the child and filled out a questionnaire. Before the task, mothers got written instructions which explained the task and asked them not to intervene.

2.2.5.2. Coding. Child behavior during the 3 min was coded on a 7-point scale, ranging from 0 to 6: 0 Unpacks present completely, 1 Takes present out of bag, 2 Puts hand in bag, 3 Looks inside bag, 4 Touches bag, 5 Shows tendency to touch bag, 6 Does not touch bag. A second coder coded 26% ($n = 24$) of the cases. Interrater reliability was excellent (ICC = 0.99). As some behaviors (i.e., 2 child shows tendency to touch bag and 5 child puts hand in bag) were only shown by few children, we recoded the scale by combining the scores 1 and 2, and the scores 5 and 6. This resulted in a 5-point scale ranging from 0 Unpacks present completely to 4 Does not touch bag. Sample size for the Gift Delay task resulted in $N = 84$, because three children were already too tired for the task, one child started to cry before the task, and two experimenter errors (e.g., different instructions) occurred.

2.3. Data Preparation and Preliminary Analyses

All children participated successfully in at least two test trials of the cooperation tasks and were all included in analyses. Due to missing values in some test trials, the number of valid test trials per child differed depending on the individual performance. To adjust for this difference, mean proportions of behaviors were calculated as dependent measures for each child (i.e., the number of trials with a given behavior divided by the number of valid test trials). Mean proportions were calculated separately for each combination of task and condition, resulting in four mean proportions (i.e., Task 1 UA, Task 1 UW, Task 2 UA, Task 2 UW) for each behavior. As there were two trials conducted in each task-condition-combination, mean proportions could take the values 0, 0.5, or 1. The number of valid mean proportions was $N = 88$ for UA Task 1, $N = 85$ for UW Task 1, $N = 81$ for UA Task 2, and $N = 88$ for UW Task 2.

2.4. Statistical Analyses

We first used correlational analyses to examine the associations between maternal EA and child behavior as well as child gender, temperament, and cognitive skills. As the correlational analyses served to give a first descriptive overview of associations between the

assessed variables, p-values are two-sided and uncorrected.

In our main analyses, we investigated which factors predicted child behavior in both cooperation task and both conditions and to what extent maternal EA plays a special role. In a first step, we examined predictive contributions of child gender, child temperament, and child cognitive skills. In a second step, we examined to what extent the maternal characteristics explained additional variance. To address this question, we used the lme4 package (Bates et al., 2018) for R (R Core Team, 2020) to construct separate generalized linear mixed models (GLMM) for each behavioral category (i.e., disengagement, approach to mother, help seeking, and reengagement). The dependent variable was mean proportion of trials in which the respective behavior was displayed. As these mean proportions represented ratios of discrete count variables, we specified the GLMMs as mixed Poisson (count) models.

As fixed effects, we included Task (Task 1 vs Task 2) and Condition (UA vs UW) as repeated factors as well as gender, shyness, language skills, self-control, maternal sensitivity, maternal non-intrusiveness and two-way-interactions of Condition with each EA dimension as predictors. In order to account for the repeated measurement structure in our data, we entered a random intercept for subjects allowing intercepts to vary across participants in all models. Note, that the specified random takes correlations between observations into account regardless of whether the value of the random intercept is significant or not. Thus, we do not report significance tests for the random effect.

To see whether adding maternal sensitivity and non-intrusiveness as predictors significantly improved the model's ability to predict child behavior above and beyond the influence of child characteristics, we tested for the significance of the hypothesized predictors by performing likelihood ratio tests of several models. This procedure was similar to hierarchical linear regression analyses in which variables are added to a model in separate steps to test whether the addition of each predictor explains additional variance in the outcome variable compared to the previous model. Specifically, we tested five theoretically derived models with increasing complexity for each outcome variable. Model 1 (baseline model) contained gender, shyness, language skills, self-control, task and condition. The maternal EA predictors (sensitivity, non-intrusiveness and the respective interaction terms with condition) were then placed in the baseline model in a step-wise fashion. That is, the subsequent models all included the predictors of Model 1, while with each subsequent model a new predictor was added to expand the previous model. In Model 2 we added sensitivity. In Model 3 we added a condition*sensitivity interaction. In Model 4 we added non-intrusiveness. And in Model 5 we added a condition*non-intrusiveness interaction. As each model was nested within the subsequent model, we used the deviance statistic to compare the addition of each predictor into a model to the previous model. A model with a significantly smaller deviance fits the data better than the previous model. As final model for each outcome variable, we selected the model that showed a significantly better fit than the respective previous model and after which subsequent models did not further improve model fit.

Regarding the issue of missing data, the lme4 package handles missing values with listwise deletion, that is, observations with at least one missing value in the variables considered were removed from the estimation.

3. Results

3.1. Descriptive Statistics

Table 1 shows the mean proportion of trials with a certain behavioral response in the cooperation tasks. Reengagement and approach to mother were shown most, ranging from 12% (UA Task 1) to 32% (UA Task 2) of trials and from 18% (UA Task 1) to 22% (UW Task 1) of trials, respectively. Help seeking was shown in 5% (UW T1) to 19% (UA T2) of trials, and disengagement was shown in 6% (UA Task 2) to 16% (UW Task 1) of trials. Table 2 depicts the descriptive statistics of maternal EA predictors, child shyness and child cognitive variables.

3.2. Associations between Maternal EA, Child Variables, and Child Behavior

Table 3 presents the correlations between all variables of interest. Sensitivity and non-intrusiveness were moderately related, indicating that the two EA dimensions are associated but at the same time distinct concepts. Regarding relations of maternal EA and child behavior, higher sensitivity was associated only with more help seeking in UW task 2. Higher non-intrusiveness was marginally related to less disengagement in UW of both tasks and significantly related to less approach to the mother in UW task 1. Moreover, less intrusiveness was marginally related to more help seeking in UW in both tasks. Regarding relations of child variables and child behavior, lower shyness was marginally related to less disengagement in UA task 1 (Note the inverse coding of the shyness score). Moreover, better language skills were marginally related to more help seeking in UW of both tasks. Better self-control was significantly related to more approach to mother in UA in both task and more help seeking in UA task 2, and marginally related to more approach in UW task 2 and less reengagement UA task 2. Correlations with gender showed that boys showed more reengagement in UA T1 and more approach to the mother in UW T1, while girls showed more help seeking in UW task (marginally) and in UA task 2. Furthermore, higher sensitivity was significantly associated with better language skills and better self-control, while non-intrusiveness was significantly related to better self-control.

Table 1

Mean Proportions and Standard Deviations for Child Behaviors in the two Cooperation Tasks (separated for Conditions) and ANOVA results.

Category	Task 1				Task 2				ANOVA					
	UA (n = 88)		UW (n = 81)		UA (n = 85)		UW (n = 88)		Task		Condition		Task*Cond	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>
Disengagement	0.09	0.23	0.16	0.27	0.06	0.18	0.16	0.29	0.049	.82	9.896	.002	.082	.77
Approach	0.18	0.33	0.22	0.34	0.21	0.36	0.19	0.34	0.208	.650	1.043	.310	2.218	.140
Help seeking	0.10	0.24	0.05	0.19	0.19	0.32	0.09	0.24	4.215	.043	8.257	.005	0.447	.506
Reengagement	0.12	0.26	0.17	0.30	0.36	0.40	0.23	0.34	24.133	< 0.001	1.127	.292	9.198	.003

Note. UA = Unable, UW = Unwilling

Table 2

Means, Standard Deviations and Range of Maternal EA and Child Variables.

Variable	<i>N</i>	<i>M</i>	<i>SD</i>	Range
Sensitivity	90	5.42	0.79	4.00–7.00
Non-intrusiveness	90	5.22	0.97	3.00–7.00
Shyness	87	2.68	2.23	0–5
Language skills	84	9.19	3.70	1–16
Self-control	84	1.64	1.51	0–4

3.3. Predicting Child Behavior

For each child behavior, Table 4 presents model fit indices and model parameters for the final models, that is, the models with the best fit.¹

3.3.1. Predicting Child Disengagement

For Disengagement, Model 4 fitted the data best. Compared to Model 3, the reduction in deviance due to the addition of non-intrusiveness in Model 4 was statistically significant ($\chi^2(1) = 305.27$, 300.04 , 5.23 , $p = .022$). Non-intrusiveness, $b = 0.389$, $p = .020$, OR = 0.678 (95% CI: 0.488, 0.941), significantly contributed to the prediction of child disengagement. More specifically, the more intrusive mothers were, the more often children disengaged from the task.

3.3.2. Predicting Child Approach to Mother

For approach to mother, Model 4 fitted the data best. Compared to Model 3, the reduction in deviance due to the addition of non-intrusiveness in Model 4 was statistically significant ($\chi^2(1) = 437.49$, 432.19 , 5.30 , $p = .021$). Non-intrusiveness, $b = 0.361$, $p = .026$, OR = 0.697 (95% CI: 0.508, 0.957) as well as self-control, $b = 0.312$, $p < .001$, OR = 1.366 (95% CI: 1.132, 1.647) emerged as significant predictors of child approach to mother. More specifically, the more intrusive mothers were, the more often children approached the mother. Moreover, the higher children's self-control was, the more often they approached the mother.

3.3.3. Predicting Child Help Seeking

For help seeking, the addition of predictors to the predictors of Model 1 did not result in significant better fit ($ps > 0.05$). This means that the addition of the maternal EA did not contribute to the prediction of child help seeking. However, gender, $b = 1.124$, $p = .002$, OR = 3.076 (95% CI: 1.532, 6.175), language skills, $b = 0.096$, $p = .047$, OR = 1.101 (95% CI: 1.001, 1.210), as well as condition, $b = 0.980$, $p = .001$, OR = 0.375 (95% CI: 0.208, 0.678) emerged as significant predictors of child help seeking. More specifically, the better children's language comprehension was, the more help seeking they showed. Moreover, girls showed more help seeking than boys did, and children showed more help seeking in the unable condition than in the unwilling condition.

3.3.4. Predicting Child Reengagement

For reengagement, the addition of predictors to the predictors of Model 1 did not result in significant better fit ($ps > 0.05$). This means that the addition of the maternal EA did not contribute to the prediction of child reengagement. However, task, $b = 0.747$, $p < .001$, OR = 2.110 (95% CI: 1.462, 3.044) emerged as a significant predictor of child reengagement. More specifically, children showed more reengagement in task 2 than in task 1.

¹ In the online supplementary material, we provide separate tables for each child behavior, reporting model fit indices and model parameters for all calculated models. Based on recommendations of one reviewer, each table includes two additional models that were specified to examine effects of maternal structuring on child behavior. In Model 6 Structuring was added and in Model 7 the interaction term Structuring*Condition was added. Model 6 and Model 7 did not significantly improve the model fit for any of the child behavior categories.

Table 3
Correlations of Variables Included in Analyses.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
1. Sensitivity																								
2. Non-intrusiveness	.49**																							
3. Responsiveness	.37**	.44**																						
4. Involvement	.32**	.72**																						
5. T1 UA Diseng	.07	.04	.04	.01																				
6. T1 UA Appr	.03	-0.18	.00	-0.02	.10																			
7. T1 UA Help	.01	.03	-0.14	-0.18	-0.10	-0.11																		
8. T1 UA Rec	.01	.03	.02	.01	-0.12	-0.21*	.04																	
9. T1 UW Diseng	.10	-0.21	-.13	.03	.29**	.09	.07	.07																
10. T1 UW Appr	-0.01	-0.03	.07	.07	.13	.46**	-0.20	.04	.08															
11. T1 UW Help	.07	.20	.12	.07	-0.09	-0.03	.29**	-0.12	-0.03	-0.12														
12. T1 UW Rec	-0.13	.01	.03	.04	-0.11	-0.03	.18	.08	-0.19	-.20	.07													
13. T2 UA Diseng	.05	.00	.00	-0.02	-0.04	-0.02	-0.06	-0.10	-0.14	-0.01	-0.10	-0.04												
14. T2 UA Appr	.05	-0.16	-0.05	-0.05	.03	.23*	-0.09	.05	.05	.48**	-0.10	-0.17	-0.15											
15. T2 UA Help	.13	-0.01	.08	.14	-0.02	-0.05	-0.02	-0.01	.06	-0.17	.07	.04	-0.14	-0.09										
16. T2 UA Rec	.04	-0.08	-0.01	-0.11	-0.22*	-0.14	.19	.35**	-0.06	-0.17	-0.10	.10	-0.01	-0.32**	-0.12									
17. T2 UW Diseng	.01	-0.22*	-0.21*	-0.04	.06	-0.02	-0.07	-0.04	.23*	-0.03	-0.05	-0.10	.14	-0.10	.25*	.09								
18. T2 UW Appr	-0.01	-0.22*	-0.09	.02	-0.02	.28**	-0.10	-0.11	.01	.13	-0.09	-0.02	-0.18	.52**	.09	-0.26*	-0.01							
19. T2 UW Help	.32**	.20	-.03	.04	.11	-0.14	.24*	.09	.09	.02	.05	.02	-0.05	-0.01	.09	.06	-0.12	-0.20						
20. T2 UW Rec	.06	.05	-0.12	-0.14	-0.21*	.06	.10	.10	-0.11	.12	-0.05	.05	.20	-.11	-0.09	.31**	-0.19	-.24*	.11					
21. Shyness	-0.08	-0.01	-0.03	-0.06	-0.18	-.09	-0.06	-0.05	-0.02	-0.01	-0.08	.08	-0.02	.12	-0.08	-0.04	.03	.02	-0.09	.14				
22. Language	.34**	.28**	.28**	.29**	.03	-0.13	.13	-0.04	.07	-0.17	.21	.03	-0.14	-0.13	.10	.12	-0.04	-0.04	.20	-0.07	-0.12			
23. Self-control	.35**	.18	.29**	.21	.15	.37**	.04	-0.04	.15	.08	.14	.08	-0.14	.24*	.25*	-.22	.05	.21	-.01	-0.15	-0.07	.16		
24. Gender ^a	-.10	.16	.05	-0.01	.00	-0.08	.06	-0.21*	.01	-0.30**	.19	.14	-0.05	-0.08	-.32**	-0.14	.04	.02	.16	-0.07	.18	.10	.10	

Note. a Spearman-Rho with dummy coding 0 male and 1 female.

T1 Task 1; T2 Task 2; UA Unable; UW Unwilling; Diseng Disengagement; Appr Approach to mother; Help Help Seeking; Rec Reengagement.
p < .10; * p < .05; ** p < .01; twotailed.

4. Discussion

Human interaction is of cooperative nature (Tomasello, 2014). Yet, interactions are challenging and we are often faced with interruptions and distortions in interactions nonetheless we are able to repair these interactions, allowing for continuation of interactions (e.g., Müller, Zietlow, Tronick & Reck, 2015; Riek & Mania, 2012). Little is known on how young children deal with emotionally challenging cooperative interactions. The main purpose of the current study was to investigate which factors predict toddlers' coping behavior in frustrating cooperative interactions. We focused on child cognitive skills and temperament, and were especially interested whether mother-child interaction quality contributes beyond child characteristics. To this end, we assessed mothers' sensitivity and non-intrusiveness in a play interaction and a task context with their 24-month-old children as well as child shyness, language skills, and self-control. Moreover, we assessed children's behavioral responses to interruption in two cooperation tasks, that is, their disengagement from the task, approach to the mother, active help seeking, and reengagement. Results showed that higher maternal intrusiveness was related to more child disengagement and more approach to the mother. Moreover, child self-control was positively associated with approach to mother, while child language skills were positively related to help seeking. Overall, results of the current study show some relations between particular child characteristics (self-control, language abilities) as well as maternal characteristics (maternal intrusiveness), and toddlers' behavior in frustrating cooperative activities. They further our understanding of the factors that impact how competent and autonomous toddlers act in emotionally challenging cooperative interactions (Brownell, 2011; Sroufe, 1979).

Our finding that intrusive maternal caregiving was related to more child disengagement is consistent with theoretical claims that intrusive caregiving might undermine the development of children's autonomous exploration in emotionally challenging situations and interactions (Cassidy, & Berlin, 1994). Children with intrusive mothers might be less skillful in coping with the interruption of the task because maternal interferences with child autonomous activities reduce children's opportunities to work persistently on a task. Moreover, it might undermine children's possibilities to learn themselves how to deal with frustrating social situations. This relates to findings from attachment research regarding the relation of avoidant attachment, intrusive parenting and child exploration. While one group of caregivers of avoidantly attached children were likely rejecting their children's needs, a second group was rather intrusive (Ainsworth, Blehar, Waters, & Wall; 1978). Although avoidant children may seem quite autonomous, as they do not seek much contact to the caregiver in frustrating situations, they are at the same time less likely to try actively to solve a difficult task (Matas, Arend, & Sroufe; 1978; Schieche & Spangler, 2005). This indicates that intrusive caregivers might have limited children's opportunities to develop effective coping strategies for such situations. Our study adds to findings on relations between caregiver behavior and emotional competence (Volling, McElwain, Notaro & Herrera, 2002) by showing that intrusiveness relates to children's disengagement from frustrating social tasks.

Regarding children's approach to the mother, we stated two contrasting hypotheses. Our results show that more intrusive maternal caregiving was related to an increased tendency to approach the mother. By consistently interrupting child activities to get the child's attention, the child might learn to focus on the mother even in mildly stressful situations instead of exploring a difficult task or situation autonomously. Our findings add to empirical findings that approaching the mother—importantly, without further active help seeking (as this was a separate scale in our study)—is not the most useful strategy in emotionally challenging situations (Schieche & Spangler, 2005). Attachment literature has shown links between maternal intrusiveness and child ambivalent attachment, indicating that the relatively high dependence on the mother is associated with less exploratory competencies in both attachment-relevant and exploratory contexts (Ainsworth, Blehar, Waters, & Wall; 1978; Cassidy, & Berlin, 1994). In sum, intrusive parenting might increase children's tendencies to approach the caregiver in frustrating cooperative interactions, thereby promoting the development of a behavioral strategy that might not be adaptive in mainly exploratory contexts (Schieche & Spangler, 2005).

Interestingly, higher self-control was also related to increased approaches to the mother. This may seem counterintuitive as one could expect that children with better self-control will be more persistent and better able to tolerate frustrating situations, thus showing less approach to the mother. This can be explained by characteristics of the gift-delay task we used in our study as a measure of self-control. During the 3 min of the task, in which children had to wait, they could show various behavioral strategies to distract themselves from the gift bag. One possible strategy was to leave the table and go to the mother, which increased the likelihood that the child did not touch the present and thus get a higher self-control score. We checked for this possibility in our data and indeed found a significant positive correlation ($r = 0.25$) between the gift-delay score and approach to the mother as a strategy during the gift delay task. Thus, the relation between self-control and approach to the mother in the cooperation tasks might reflect a form of disengagement in the sense of social distraction from the task as a potential coping strategy.

Overall, our findings regarding child disengagement and approach to mother are in line with the theoretical view that maternal caregiving is associated with children's competencies and behavior in cooperative interactions (Brownell, 2011; Lehman, Steier, Guidash & Wanna, 2002; Sroufe, 1979). From a theoretical perspective, our results support specific relations of maternal non-intrusiveness and children's disengagement and approach to mother. Non-intrusive caregiving might foster children's acquisition of skills that enable them to actively participate in and contribute autonomously to cooperative interactions, even when these interactions become a challenging for the children.

The findings of our study relate to literature on coping, that is, a goal-oriented processes of cognitive and behavioral efforts in order to manage responses to stressors or to eliminate the source of stress (Lazarus, 1993; Lazarus & Folkman, 1984). Attempts to resolve or change a challenging situation are referred to as problem-focused coping, whereas expressing emotions to get support from others and thereby dampening one's emotional arousal are referred to as emotion-focused coping (Lazarus, 1993; Lazarus & Folkman, 1984). Most interesting for our study are avoidance or disengagement coping strategies, such as orienting away or withdrawing from the stressor or from internal cognitive or emotional states triggered by the stressor (Compas, Connor-Smith, Saltzman, Thomsen &

Table 4
Fixed Effects Estimates and Fit Indices of Generalized Linear Mixed Models (GLMMs) Predicting Child Disengagement, Approach to Mother, Help Seeking, and Reengagement.

Parameter	Disengagement				Approach to mother				Help seeking		Reengagement
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 1	
Intercept	-2.57 *** (0.74)	-4.34 *** (1.26)	-1.28 (3.55)	-0.46 (3.63)	-0.84 (0.58)	-0.18 (1.10)	-1.42 (2.25)	-0.71 (2.27)	-2.59 * (0.84)	-1.97 *** (0.52)	
Gender	0.06 (0.29)	0.07 (0.29)	0.07 (0.29)	0.10 (0.28)	-0.23 (0.29)	-0.23 (0.29)	-0.23 (0.29)	-0.23 (0.28)	1.12 * (0.36)	-0.12 (0.21)	
Shyness	-0.05 (0.07)	-0.06 (0.07)	-0.06 (0.07)	-0.05 (0.06)	0.00 (0.07)	0.00 (0.07)	0.00 (0.07)	0.00 (0.06)	-0.07 (0.07)	0.02 (0.05)	
Language	-0.01 (0.04)	-0.03 (0.04)	-0.03 (0.04)	-0.02 (0.04)	-0.07 * (0.04)	-0.07 (0.04)	-0.07 (0.04)	-0.06 (0.04)	0.10 * (0.05)	0.02 (0.03)	
Self-Control	0.12 (0.10)	0.08 (0.10)	0.08 (0.10)	0.08 (0.10)	0.30 * (0.09)	0.32 * (0.10)	0.32 * (0.10)	0.31 * (0.10)	0.07 (0.11)	-0.12 (0.07)	
Task	-0.07 (0.26)	-0.05 (0.26)	-0.04 (0.26)	-0.04 (0.26)	-0.08 (0.19)	-0.09 (0.19)	-0.10 (0.19)	-0.10 (0.19)	0.41 (0.27)	0.75 *** (0.19)	
Condition	0.68 * (0.27)	0.67 * (0.27)	-1.22 (2.10)	-1.38 (2.14)	0.09 (0.19)	0.09 (0.19)	0.93 (1.33)	0.91 (1.34)	-0.98 * (0.30)	-0.05 (0.17)	
Sensitivity	0.37 (0.21)	0.37 (0.21)	-0.17 (0.64)	0.02 (0.65)	0.09 (0.19)	-0.14 (0.20)	0.09 (0.42)	0.30 (0.43)			
Sensitivity*Condition			0.33 (0.37)	0.36 (0.38)			-0.15 (0.24)	-0.36 * (0.16)			
Non-intrusiveness											
Goodness-of-fit											
LL	-154.63	-153.04	-152.64	-150.02	-219.22	-218.94	-218.74	-216.10	-135.45	-243.53	
AIC	325.26	324.09	325.27	322.04	454.43	455.89	457.49	454.19	286.91	503.05	
BIC	354.54	357.02	361.87	362.30	483.71	488.83	494.08	494.45	316.18	532.33	

Notes. Regression coefficients are unstandardized. Standard errors are within parentheses. LL, log likelihood; AIC, Akaike information criterion; BIC, Bayesian information criterion. $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Wadsworth, 2001). The current study suggests that intrusive caregiving may promote the development of avoidance coping strategies and impede the development of problem-focused coping strategies. Children with intrusive caregivers might over rely on their caregiver as a provider of external regulation and quickly approach the caregiver in challenging situations. This might prevent children from developing problem-focused strategies and competencies. Moreover, as caregivers' interferences with child ongoing activities are likely frustrating for children, experiences with intrusive caregivers might lead to the development of avoidance coping strategies. Those avoidance strategies may manifest as withdrawal from frustrating situations and at the same time as avoidance of caregivers as children might expect an increasing level of frustration in contact with an intrusive caregiver. In sum, our study suggests that toddlers' coping strategies might emerge from experiences in interactions with their caregivers.

Contrary to our expectation, maternal EA was not related to child help seeking. Instead, children's language skills, gender (female) and condition (UA) predicted more help seeking. It is possible that these effects already explained a large portion of variance and thus the addition of maternal EA did not further improve the prediction of help seeking. Children with better language skills, and thus further developed cognitive skills, might better understand that help is needed to continue with the cooperation game and that the mother can provide this help. Indeed, as the correlational analyses revealed that maternal sensitivity was strongly related to child language, using of child language as a first step in the model might have obscured the impact of maternal sensitivity (that was, on the correlational level, at least present for one of the tasks). Furthermore, as language comprehension (measured in this study) is related to language production (Fenson et al., 1994), children with better language comprehension skills are likely more capable to verbally request their mother's help than children with lower language comprehension skills. A second factor related to help seeking was gender. More specifically, girls showed more help seeking than boys. This is in line with empirical research with preschoolers that has shown that girls are more likely to seek help in challenging tasks than boys (Thompson, Arsenault, & Williams; 2006; Thompson, Cothran, & McCall; 2012). Our study, though not directly examining this, might fit to the idea that gender-based socialization of help seeking is already present in toddlerhood. Lastly, children showed more help seeking in the UA condition than in the UW condition. Given that in the UA condition the experimenter is still trying to continue the game but seems to have trouble to perform her role, it seems reasonable for children to get their mother's help more often in the UA than in the UW condition. This supports the view that children understand the cooperative intent of the experimenter (Warneken, Grafenhain, & Tomasello; 2012) and aim to continue the cooperation (Brownell, 2011).

For child reengagement, only the factor task was associated with reengagement, that is, children showed more reengagement in task 2 than in task 1. Even though we had a warm-up phase at the beginning of the testing session, children might have needed some time to get familiar with the experimenter and the cooperative interaction. Thus, children might have needed some time for getting involved into the games and the interaction with the experimenter before feeling comfortable enough to reengage the experimenter. Unexpected for us, maternal EA did not explain variance in child reengagement of the experimenter, but rather their behavior towards their mother. It would be interesting to explore whether this relation is different in case the cooperation partner is not a stranger, but another familiar person to the child.

Across the different measures, sensitivity did not relate to child behavior in the cooperation tasks when added as a predictor and controlling for child characteristics. This was contrary to our expectations. From a theoretical perspective, sensitive caregiver behavior is especially important in stressful or threatening attachment-relevant situations (Ainsworth, Blehar, Waters, & Wall; 1978; Bowlby, 1982). However, in mildly stressful exploratory situations, which primarily require children to cope autonomously with an emotionally challenging task or interaction, non-intrusiveness might be the more important caregiver behavior as it contributes more strongly to children's development of self-regulation. Notably, a first descriptive overview on correlational analyses showed a positive association of sensitivity with help seeking in the UW condition of task 2. Thus, in line with theoretical considerations correlational analyses indicate a potential influence of maternal sensitivity on children's competent behavior in cooperative situation, which we could probably not find with the more conservative approach of the GLMM analyses. Interestingly, correlation analyses also showed positive relations of sensitivity with language skills and self-control indicating that sensitivity might especially influence children's cognitive development. It is possible that sensitivity indirectly affects how children act in frustrating cooperative interaction by promoting children's language skills and self-control.

While our study adds to an important research gap, future research should address some limitations of our study. First, although the present study provides empirical support for a relation between maternal EA, as a measure of caregiving behavior, and child coping behavior in frustrating cooperative activities, the cross-sectional and correlational design precludes conclusions regarding the causal direction of these relations. Future research should employ a longitudinal design with several time points in infancy and the toddler period to examine whether effects and relations of caregiving on child cooperation and coping behavior differ depending on the time in development maternal EA and child behavior are observed. Moreover, future research could investigate other aspects of child behavior during cooperation tasks in addition to child coping during interruption. For instance, it would be interesting to examine individual differences in the quality of children's cooperation in interaction with the adult (e.g., see Warneken, Chen, & Tomasello, 2006) in relation to subsequent coping behavior in the interruption period. Second, our study did not include fathers, but focused only on mothers. Inclusion of fathers is important given research suggesting that parenting behavior and respective effects on child emotion regulation and coping as well as cooperative competencies are different for mothers and fathers (e.g., Deichmann & Ahnert, 2021; Gülseven et al., 2021; Volling, McElwain, Notaro, & Herrera; 2002). Future research should recruit both fathers and mothers to investigate how paternal and maternal EA contribute to the development of children's coping behavior, and cooperative competencies. A third limitation is the limited cultural generalizability due to the WEIRD (Western, Educated, Industrialized, Rich and Democratic) sample (Henrich, Heine, & Norenzayan; 2010). As there are cultural differences in levels and effects of sensitivity and non-intrusiveness (e.g., Carlson & Harwood, 2003) it is important for future studies to consider possible cultural influences on the relation between caregiver behavior and children's coping strategies in emotionally challenging cooperative interactions. In addition,

as attachment theory is part of the theoretical foundation of the EA framework and the concept of sensitivity, we suggest that future studies could include children's attachment security. Previous research has shown associations of attachment, maternal support and child behavior in problem-solving tasks (Matas, Arend, & Sroufe; 1978; Schieche & Spangler, 2005), but did not focus on emotionally challenging cooperative tasks that required children to work together with another person simultaneously to achieve a joint goal. Thus, it might be interesting for future research to examine how attachment security and caregiver EA uniquely contribute to the development of child cooperative competencies and coping behavior in emotionally challenging interactions.

In sum, the current study adds to our knowledge of the influence of caregiving on the development of child cooperative competencies in terms of coping behavior in frustrating cooperative interactions. We provide evidence that maternal non-intrusiveness is related to children's disengagement from a frustrating cooperative interaction and children's approach to the mother. These findings shed light on potential predictors of child cooperation in toddlerhood and emphasize the role of maternal EA for children's coping in emotionally challenging cooperative interactions with others.

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CRedit authorship contribution statement

Marina Kammermeier: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Visualization, Markus Paulus: Conceptualization, Methodology, Writing – review & editing.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.infbeh.2022.101696](https://doi.org/10.1016/j.infbeh.2022.101696).

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