Exposure to parents' negative emotions in early life as a developmental pathway in the intergenerational transmission of depression and anxiety
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GENERAL DISCUSSION
General discussion

This thesis aimed to examine the links between exposure to parents’ depression and anxiety in the early years of life, and infants’ socio-emotional development. The dissertation first examined the associations between infants’ and parents’ emotional expressions, and between their reactions to novel stimuli in everyday interactions (Chapter 1, 2, 3, & 4), and next the associations between parents’ depression and anxiety, and infants’ attention to emotional stimuli (Chapter 1, 5 & 6). Infants’ temperamental dispositions were included as a vulnerability/susceptibility factor in the effects of exposure to parental depression and/or anxiety on infant outcomes (see Figure 1). In the next two sections of this final chapter, we first put the main findings reported in dyadic and in triadic contexts together, first in daily interactions and next in infants’ attention. A summary of key research findings is presented in Figure 2. The chapter continues with the integration of findings, followed by limitations, future directions, and it ends with clinical implications.

Exposure to Parents’ Depressed/Anxious Moods, and Infants’ Emotional Expressions/Reactions to Novelty in Daily Interactions

Dyadic parent-infant interactions

The findings of the current dissertation reveal that lifetime depression (and not anxiety) diagnosis interferes with mothers’ (but not fathers’) ability to provide a positive interpersonal environment to their infant in face-to-face interactions (Chapter 2). Mothers with lifetime depression diagnoses were less positive, and more flat during their interactions with the infant. Interestingly, lifetime depression did not influence the duration of fathers’ positive or neutral affect in the interaction. Infants’ positive affect during face-to-face interactions did not differ as a function of their mothers’ or fathers’ lifetime depression status. However, more depression symptoms (a continuous measure rather than the presence/absence of depressive diagnosis) in parents were linked to less positive and less negative affect from the infants in the interactions. Thus, more flat affect was observed in infants’ expressions when parents have higher levels of depression symptoms. Infants’ temperament did not moderate the effect of parents’ lifetime diagnoses on infants’ affect expressions. These findings on the effect of depression on parents’ and infants’ expressions of emotion in parent-infant face-to-face interactions are consistent with previous literature that consistently report a decrease in positive affect expressions of mothers with depression and their infants (reviewed in Chapter 1). This dissertation additionally reveals that depression-related alterations may not be salient in fathers’ expressions of affect in early face-to-face interactions.

Depression-related alterations in mothers’ facial expressions of emotions in parent-infant face-to-face interactions held with depressed mothers with and without anxiety disorders. However, anxiety disorders alone did not alter the duration of mothers’ or fathers’ expressions of positive or neutral affect during the parent-infant face-to-face interactions. Neither did infants’ positive or negative affect differ during
face-to-face interactions as a function of their mothers’ or fathers’ lifetime anxiety status. The findings revealing no alterations in the positive and negative expressions of affect in parents with lifetime anxiety disorders without depression are consistent with the limited number of previous studies (Kaitz, Maytal, Devor, Bergman, & Mankuta, 2010; Murray, Cooper, Creswell, Schofield, and Sack, 2007; Weinberg, Beeghly, Olson, & Tronick, 2008; reviewed in Chapter 1) that addressed the effects of parental anxiety disorder without comorbid depression on parents’ and infants’ expressions of emotion.

However, higher levels of anxiety symptoms in parents (a continuous measure rather than the presence/absence of anxiety diagnosis) predicted more positive and more negative affect, thus less emotional stability/more emotional variability in infants. But as the duration of parents’ expressions of positive and neutral affect does not seem to change directly during the interaction as a function of parents’ anxiety diagnosis or symptoms (Chapter 2), the decrease in infants’ emotional stability may be related to earlier repeated exposure to parents’ depressed moods, or to inherited alterations in physiological reactions rather than direct environmental transmission of facial affect via exposure in the interaction. Alternatively, the increase in infants’ positive and negative affect can be a reaction to higher levels of exaggerated behavior in parents with (vs. without) anxiety disorders. Exaggerated behavior is defined by an irregularly high frequency or intensity in the occurrence of certain aspects of parents’ interactive behavior including acknowledgements, vocalizations and gaze in addition to positive affect expressions, and it was previously found to be higher in interactions of mothers with (vs. without) anxiety disorders (Kaitz et al., 2010).

Figure 1. An overview of the scope of this thesis.
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Key Findings

Dyadic parent-infant interactions

- Parental lifetime depression diagnosis interferes with mothers’ (but not fathers’ or infants’) positive affect expressions.
- Parental lifetime anxiety diagnoses alone do not influence mothers’, fathers’ or infants’ expressions of positive or neutral affect.

Triadic parent-infant-object interactions

- Mothers and fathers with lifetime social anxiety disorder express more anxiety than reference parents during confrontations with unfamiliar stimuli in infancy and toddlerhood.
- More expressed anxiety (rather than the presence of a lifetime anxiety disorder) in mothers and fathers is linked to more avoidance of the stimuli in temperamentally reactive children in infancy, whereas the presence of a lifetime anxiety disorder in parents (rather than expressed anxiety) is linked to more fear/avoidance of the stimuli in toddlerhood.
- More expressed anxiety in infancy from mothers and fathers with comorbid lifetime social and non-social anxiety disorders prospectively predicts more avoidance in toddlerhood.

Attention to Emotional Stimuli in Dyadic Person-Infant Contexts

- Mothers’ and fathers’ anxiety, but not depression is associated with infants’ attention to emotional facial expressions.
- More anxiety in mothers and fathers is linked to more attention to emotional facial expressions in infants with high levels of fearful temperament, but to less attention to emotional facial expressions in infants with low levels of fearful temperament.

Attention to Emotional Stimuli in Triadic Person-Infant-Object Contexts

- Depression, but not anxiety in mothers and fathers is associated with infants’ attention to novel objects paired with emotional facial expressions in the following ways: More depression in fathers is linked to more attention to objects following emotion-object pairing.
- More depression in mothers is linked to more attention to objects following emotion-object pairing in infants with low levels of sad temperament, but to less attention to objects following the pairing in infants with high levels of sad temperament.

Box 1. An overview of the key findings of this thesis.

Triadic parent-infant-object interactions

In contrast to the lack of alterations in anxious parents’ expressions of emotion in parent-infant face-to-face interactions, this dissertation found evidence that mothers and fathers with lifetime social anxiety diagnoses express more anxiety than parents without diagnosis in parent-child-object interactions where their children were confronted with unfamiliar stimuli (i.e., social referencing situations with female strangers and robot toys, Chapter 3 & 4). This was true for parents who have lifetime social anxiety diagnoses only, but also for those who have comorbid social and other types anxiety disorders, and the effect held across social versus nonsocial stimuli, and when children are 12 and 30 months. However, lifetime diagnoses of other -nonsocial-
anxiety disorders alone do not seem to alter parents’ expressions of anxiety in these social referencing situations. Thus, the increase in parents’ expressed anxiety was specifically related to the presence of lifetime social anxiety disorder. It seems that anxiety expressions were triggered by the experience of being videotaped with one’s infant in the lab, and were similar with strangers vs. robot toys as unfamiliar stimuli in social referencing situations.

As regards infants’ reactions to unfamiliar stimuli in social referencing situations at 12 months, infants’ fear and avoidance of unfamiliar stimuli did not differ as a function of their mothers’ or fathers’ lifetime anxiety status. On the other hand, higher levels of expressed anxiety by mothers and fathers predicted increased avoidance of stimuli, an effect that held for infants who had temperamental dispositions for anxiety (i.e., moderate and high levels of behavioral inhibition). Thus, when it comes to 12-month-old infants’ avoidance, how parents behaved in the presence of the stimuli in social referencing situations mattered more than their lifetime anxiety diagnoses. The findings showing a larger influence of parents’ anxiety expressions on temperamentally reactive infants’ avoidance in the social referencing situations are consistent with earlier findings by Murray and colleagues (2008), who reported a larger increase in stranger avoidance of temperamentally fearful infants of parents with social anxiety disorders from 10 to 14 months. Our findings show that higher vulnerability of temperamentally fearful infants of mothers with social anxiety disorder reported in this earlier study (Murray et al., 2008) may in fact be mediated by the temperamentally fearful infants’ exposure to parents’ expressions of anxiety. Findings of the current thesis revealing an effect of exposure to parents’ expressions of anxiety in the situation, rather than an effect of lifetime diagnoses are also consistent with earlier experimental findings on social referencing processes by De Rosnay and colleagues (De Rosnay, Cooper, Tsigaras, & Murray, 2006), that showed a stronger influence of maternal (trained) anxious reactions on stranger avoidance of temperamentally fearful than non-fearful infants of mothers without diagnosis.

A follow-up of the same sample in social referencing situations in toddlerhood (at 30 months of age, Chapter 4) revealed that neither children’s avoidance of unfamiliar stimuli in social referencing situations, nor the association between parents’ expressed anxiety and children’s avoidance of unfamiliar stimuli is stable from infancy to toddlerhood. In contrast to the findings at 12 months, toddlers’ avoidance of unfamiliar stimuli differed as a function of their mothers’ or fathers’ lifetime social anxiety status, but not of their parents’ expressed anxiety. Children of parents with lifetime social anxiety diagnoses were more avoidant of the unfamiliar stimuli at 30 months. On the other hand, despite a parallel increase in expressed anxiety in parents, and avoidant reactions in infants when the mother has a lifetime social anxiety diagnosis, there was no significant association between parents’ expressions of anxiety and toddlers’ avoidance of stimuli. Thus, when it comes to 30-month-old
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toddlers’ avoidance of unfamiliar stimuli, parents’ lifetime social anxiety diagnoses mattered more than how parents behaved in the presence of the stimuli in social referencing situations. Moreover, earlier temperamental dispositions (i.e., behavioral inhibition at 12 months) did no longer moderate the strength of the associations between parents’ expressed anxiety (or social anxiety status) and toddlers’ avoidance. Although heightened anxiety expressions of parents with social anxiety diagnoses characterized social referencing situations at both 12 and 30 months, it seems that the direct transmission of anxiety via exposure to parents’ anxiety expressions in social referencing situations is specific to the end of first year. Moreover, there were prospective associations of earlier exposure to parental expressions of anxiety in social referencing situations with later child avoidance. Children of parents with comorbid social and other anxiety disorders who had been exposed to more anxiety from their parents at 12 months were more avoidant of the stimuli in social referencing situations at 30 months. The fact that this prospective association only holds for infants of parents with comorbid social and nonsocial anxiety disorders may be explained by stronger deviations in earlier exposure, or other biological or genetic vulnerabilities in these children. These vulnerabilities may have strengthened the effects of earlier exposure on later child behavior, or may simply become more salient in child behavior at 30 months.

Contributions
In addition to including the first longitudinal investigation of social referencing processes from infancy to toddlerhood, this dissertation advanced our knowledge on the transmission of depressed and anxious/avoidant interactive styles from parents to children in the early years in several other respects. First, it addressed for the first time the effect of fathers’ depression and anxiety disorders in interactions, in addition to mothers’ depression and anxiety. In contrast to a differential influence of depression on mothers’ vs. fathers’ facial expressions of positive affect in parent-infant interactions, parallel associations were found in mothers’ and fathers’ anxiety with infants’ avoidance. Second, the thesis advanced our understanding on the effects of parental anxiety disorder without comorbid depression in dyadic parent-infant interactions. The decrease in positive affect was specific to mothers’ depression, while lifetime anxiety disorder(s) alone did not influence the duration of mothers’ or fathers’ expressions of affect. Third, the effect of infants’ temperamental dispositions on infants’ and parents’ expressions of emotion in dyadic parent-infant interactions were for the first time considered in the investigation of parental depression and anxiety. Infants’ temperament did not influence infants’ or parents’ expressions of emotion in face-to-face interactions. In contrast, it exacerbated the effects of exposure to parental anxiety expressions in social referencing situations on 12-month-olds’ avoidance. Fourth and finally, the thesis investigated the diagnosis and context specificity in early social referencing processes by including parents with
social and/or nonsocial of lifetime anxiety disorders, and social and nonsocial types of ambiguous stimuli (a stranger vs. a robot). The increases in mothers’ and toddlers’ reactions were specific to parents’ social anxiety disorder, while no context specificity was found in social referencing processes with social vs. nonsocial stimuli.

**Exposure to Parents’ Depressed/Anxious Moods, and Infants’ Attention to Others’ Emotional Expressions in Dyadic and Triadic Contexts**

To address how depression- and anxiety-related variations in infants’ exposure to emotion from non-clinical parents may affect infants’ emotion processing, this dissertation tested the links between infants’ attention to emotional (vs. neutral) stimuli and parents’ depression and anxiety. Infants’ attention to emotional stimuli was tested using facial expressions of emotion (in Chapter 5), and objects paired with emotional facial expressions (in Chapter 6). These were used to investigate infants’ attention in dyadic person-infant contexts and triadic person-infant contexts respectively.

**Dyadic person-infant contexts**

In the current dissertation no significant association was found between non-clinical depression in parents and infants’ attention to facial expressions (Chapter 4). In contrast, maternal and paternal anxiety predicted infants’ fixations to emotional (vs. neutral) expressions in interaction with infants’ fearful temperament (Chapter 5). More maternal and paternal anxiety was related to longer fixations to emotional (vs. neutral) facial expressions in infants with high levels of fearful temperament, whereas it was associated with shorter fixations to positive and negative (vs. neutral) emotional expressions in infants with low levels of fearful temperament. Thus, high levels of anxiety from mothers and fathers seem to be linked to decreased interest or an avoidant processing style in the processing of facial expression with infants low in temperamental dispositions for fear, whereas it is related to an increase in interest or hyper-vigilant processing style in infants high in temperamental dispositions for fear.

The findings reveal that exposure to parents’ expressions of anxiety may enhance temperamentally fearful infants’ interest to others’ emotional (vs. neutral) expressions of emotion. Considering that enhanced attention to negative stimuli is a defining feature of anxiety disorders in children and parents, infants’ fearful temperament needs to be further investigated as a vulnerability in the effects of exposure to parents’ anxiety on infants’ early attention to emotional facial expressions. In contrast to these findings, parents’ anxiety did not predict infants’ pupil responses. Thus, it seems that the effect of parental anxiety is specific to behavioral indices of attention (i.e., fixation durations), and may not be detectable in the pupil responses.

**Triadic person-infant-object contexts**

Mothers’ and fathers’ depression, but not anxiety predicted infants’ attention (Chapter 6) to novel objects, after these were paired with emotional vs. neutral expressions.
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More depression in fathers was linked to a larger increase in pupil responses (i.e., more attention) to objects following both positive and negative emotion-object pairing. More depression in mothers was also linked to a larger increase in pupil responses (i.e., more attention) to objects following both positive and negative emotion-object pairing, but only in infants with low levels of sad temperament. In contrast, maternal depression predicted a decrease in pupil responses (i.e., less attention) to objects after the pairing in infants with high levels of sad temperament. Thus, exposure to more depression from mothers and fathers was related to heightened physiological sensitivity to the objects paired with emotion when infants have low levels of sad temperament. However, for infants with high levels of sad temperament, exposure to maternal depression decreased infants’ sensitivity to objects, whereas paternal depression increased it.

Considering that infants with a sad temperament already show enhanced attention/vigilance to negative emotional expressions (presented without objects, Chapter 6), infants’ lower interest to positive and negative emotional stimuli when the mother is depressed, may be a protective mechanism that helps to reduce the effect of exposure to others’ negative moods on temperamentally sad infants’ interest to novel objects. However, a disadvantage coming from the decrease in attention to objects paired with both positive and negative expressions may be that temperamentally sad infants of depressed mothers have a smaller likelihood to attend to, and thus learn from others’ emotional signaling when confronted with unfamiliar stimuli. In contrast, the link of fathers’ depression to temperamentally sad infants’ attention was in the reverse direction, that is, fathers’ depression was linked to an increase in infants’ attention to objects that were paired with others’ positive and emotional expressions. This implies higher likelihood that infants make use of others’ positive and negative emotional signals towards unfamiliar stimuli when their father is depressed. To understand whether these differential alterations in infants’ attention constitute a risk or a buffer for later psychopathology, it is essential to establish the links of these with later functioning in future research.

Contributions
This dissertation advanced our knowledge on the links between exposure to depression and anxiety in parents and infants’ attention allocation to facial expressions in several respects. First, to the best of our knowledge, this thesis was the first to test and to show links between non-clinical levels of parental depression and anxiety and infants’ attention to emotional stimuli. The inclusion of both physiological and behavioral (Chapter 5) indices of attention was another innovative aspect of this dissertation. Second, this study included infants’ sad and fearful temperament as moderators of the link between parental depression and/or anxiety and infants’ attention. The findings (summarized above) illustrate the importance of considering infants’ temperament in infants’ emotion processing in the context of parental depression and anxiety. Third,
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this thesis extended the study of attention to person-infant-object contexts to discover how infants’ exposure to parents’ depression and anxiety may alter infants’ attention to unfamiliar objects paired by emotional (vs. neutral) facial expressions (Chapter 6). As summarized above, depression (but not anxiety) in mothers and fathers explain individual differences in infants’ attention to objects paired with others’ emotional expressions. Finally, to our knowledge the current dissertation was the first one to consider the variation in depression and anxiety levels from both fathers and mothers in the study of exposure effects on infants’ attention. This dissertation found parallel links between mothers’ and fathers’ depression, and anxiety and infants’ attention, except for the link between depression and temperamentally sad infants’ attention to objects paired with positive and negative emotional expressions (i.e., more depression in mothers was related to less attention, whereas more depression in fathers was linked to more attention).

Integration

Exposure to parental depression and anxiety, and infants’ socio-emotional development

Concerning the effects of infants’ exposure to parental depression, the findings of current dissertation suggests that lifetime depression diagnoses alter mothers’ but not fathers’ facial expressions of emotion during dyadic parent-infant interactions with their infant in the first half-year of life, contributing to a more flat, and less positive socio-emotional environment (Chapter 2). The potential associations of these early alterations in face-to-face interactions with later development of depression in the offspring is straightforward as they indicate early transmission of a less positive and more flat affective style characterizing depression from mothers to infants (Field, 1984). However, infants’ attention in dyadic contexts (thus to positive and negative [vs. neutral] facial expressions) was not explained by parents’ depression. In contrast, this thesis reveals that depression in parents may be linked to infants’ attention to objects paired with emotional expressions in triadic parent-infant-object contexts (Chapter 6). In the absence of evidence for a prospective link between early emotion processing and later depression, it is difficult to understand whether the depression-related changes found in this thesis in infants’ attention to objects constitute a risk or a buffer for later development of depression, or other psychopathology in children of depressed mothers.

Concerning the effects of infants’ exposure to parental anxiety, this thesis demonstrates a change in the effect of mothers’ and fathers’ lifetime anxiety on parents’ and infants’ emotional expressions and reactions from dyadic parent-infant interactions in the first half-year to triadic parent-infant-object interactions in the second half-year. Lifetime anxiety disorder in mothers and fathers does not alter parents’ or infants’ expressions of emotion in early face-to-face interactions, whereas exposure to parental anxiety in triadic parent-infant-object interactions predict
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avoidant responses to unfamiliar stimuli from temperamentally fearful infants at 12 months. In other words, anxiety-related alterations in exposure only become detectable as parent-infant interactions extend to ambiguous/unfamiliar objects in the environment at the end of first year (i.e., social referencing contexts).

Moreover, there seems to be a change in the effect of mothers’ and fathers’ lifetime anxiety diagnoses on infants’ avoidance in social referencing situations from infancy to toddlerhood. Higher levels of parental anxiety expressions in social referencing situations seem to directly influence temperamentally reactive children’s avoidance of novel stimuli only at 12, but not at 30 months, suggesting that the end of infancy may be a sensitive period in the environmental transmission of anxious/avoidant reactions from parents to temperamentally reactive children in social referencing situations. In line with this, infants’ exposure to parents’ expressions of anxiety seem to have prolonged effects on children’s avoidance of novel stimuli in toddlerhood in cases where parents have more severe comorbid instances of lifetime parental anxiety. In other words, exposure to parental anxiety expressions in this sensitive period may convey risk for the environmental transmission of anxious/avoidant reactions from parents with more severe forms of anxiety dispositions.

In contrast, infants’ attention in dyadic rather than triadic contexts (thus, to positive and negative [vs. neutral] facial expressions rather than to objects paired with these expressions) was explained by parents’ anxiety. Infants of more anxious mothers and fathers showed enhanced attention to positive and negative facial expressions. These alterations may be early forms of anxious responses that are defined by an increase in the avoidance of anxiety-provoking situations and enhanced attention/hyper-vigilance to negative emotions in childhood depression and anxiety.

Mothers’ vs. fathers’ depressed/anxious moods
Concerning the effects of exposure to mothers’ vs. fathers’ depression and anxiety, the results of this thesis suggests that lifetime depression diagnosis makes mothers but not fathers less positive and more flat in their facial affect than reference mothers in dyadic parent-infant interactions. Overall differences between mothers’ and fathers’ interactive styles may explain why lifetime depression diagnoses in mothers, but not in fathers was related to less positive affect durations. Evidence from the current dissertation (Chapter 2), and from earlier studies (reviewed in Chapter 1) suggest that fathers are overall less positive than mothers in their interaction with their infant. It seems that fathers construct infants’ socio-emotional environment by creating intense states of positive arousal via physical play in early interactions, rather than face-to-face exchange of positive affective states (Feldman, 2003; Forbes, Cohn, Allen, & Lewinsohn, 2004). In this sense, our investigation that exclusively focused on the duration of positive affect, rather than on the intensity of positive arousal or the amount of physical play in the father-infant dyad may not have captured depression-
and anxiety-related alterations in father’s interaction. In contrast, high levels of expressed anxiety from both mothers and fathers seem to make temperamentally fearful infants more avoidant of ambiguous stimuli in triadic parent-infant-object interactions (i.e., social referencing situations). Likewise, the presence of a lifetime social anxiety disorder in both mothers and fathers increased parents’ anxiety and toddlers’ avoidance of unfamiliar stimuli. Thus, depression is more salient in mothers’ than fathers’ facial expressions in face-to-face interactions, whereas fathers are as influential as mothers in the early modeling of anxious behavior in SR situations.

Moreover, the results of this thesis reveal similar links between mothers’ and fathers’ depression and anxiety, and infants’ attention to emotional stimuli (i.e., emotional vs. neutral facial expressions or objects paired with emotional vs. neutral facial expressions). The only exception was in the association between depression and attention to novel objects in infants with high levels of sad temperament. More depression in mothers was linked to less attention to objects paired with positive and negative expressions in infants, whereas more depression in fathers was linked to more attention to objects. Thus, it seems that mothers’ depression desensitizes infants to emotional stimuli while fathers’ depression sensitizes them to emotional stimuli in triadic contexts.

To summarize, the findings of this thesis are line with the idea that exposure to clinical and non-clinical parental depression and anxiety from both mothers and fathers influence infants’ interactive behavior and/or emotion processing. The findings illustrate the importance of fathers’ in addition to mothers’ depression and/or anxiety in exposure effects.

Temperament as a moderator of the exposure to mothers’ vs. fathers’ depressed/anxious moods

Concerning the effect of infants’ temperamental dispositions as a potential moderator of the link between exposure to parents’ depression and anxiety and infant outcomes, this dissertation reveals that infants’ temperament do not moderate the effect of parents’ lifetime diagnoses on infants’ expressions of affect in parent-infant face-to-face interactions. However, in line with the diathesis-stress (Zuckerman, 1999), vulnerability-stress (Ingram & Luxton, 2005; Nigg, 2006) and the differential susceptibility to environmental influences hypothesis (Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2007; Belsky & Pluess, 2009), fearful temperament seems to create a vulnerability for the exposure to parents’ expressions of anxiety in social referencing situations at 12 months.

Furthermore, findings from this thesis also suggest the associations between exposure to parental depression and anxiety and infants’ attention to emotional stimuli are moderated by infants’ own temperamental predispositions for negative emotion across parent-infant and parent-infant-object contexts (except for the positive...
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association between paternal depression and infants’ attention to objects). Taken together, the findings support a joint influence of exposure to parents’ depressed/anxious moods and of infants’ temperament on infants’ interactive behavior and emotion processing.

Limitations
The findings of this dissertation should be interpreted in the light if the following limitations: First, the non-experimental and correlational design of the studies in the current thesis precludes causal inferences on the effects of exposure to parental anxiety and/or depression and of infant temperament on infants’ behavior in early interactions, or on infants’ attention to emotional stimuli. Second, the majority of the studies in the current dissertation examined cross-sectional associations between exposure and infants’ behavior in early interactions or attention to emotional stimuli (except for Chapter 4), thus the thesis precludes any conclusions on the prospective links of depression- and anxiety-related alterations in infants’ exposure to parental emotions early interactions, and emotion processing to later emotional functioning. Third, infants’ early emotional behaviors and attention constituted the main infant outcome in the investigation of exposure effects, as alterations in these early processes has the potential to tap on the dysfunctional processes in interactive styles and attention of depressed and anxious children. However, the direct links between these aspects of early development and dysfunctional aspects of childhood depression and anxiety wait to be investigated in future studies. Fourth, although the current thesis included infants’ temperament as a behavioral index of biological and/or genetic vulnerability, the current dissertation did not consider purely genetic and biological indices in infants of parents with depression and anxiety. Delineating the mediating or moderating role of these non-environmental vulnerabilities together with prenatal influences remain essential in the investigation of environmental transmission of depression and anxiety. Finally, although the current dissertation is unique in bringing together the investigation of infants’ interactive behavior in early interactions and infants’ attention to emotional stimuli, the studies did separately consider these components of early socio-emotional development. Thus, the links between anxiety- and depression-related alterations in infants’ interactive behavior and infants’ attention remain to be investigated in future studies.

Future Directions
In the light of the limitations addressed above, we suggest that the first priority for future research on the effect of early exposure to parental negative emotions is the investigation of longitudinal links between exposure-related alterations in early emotional environment and later child functioning and psychopathology. The longitudinal link may help to identify which aspects of these alterations in infants’ early interactive behavior and attention is adaptive, that is, longitudinally linked to better outcomes. For example an earlier study by Creswell and colleagues (2008)
showed that 10-week-old infants of mothers with social anxiety disorders show less interest to high (vs. low) intensity fearful faces, whereas infants of control mothers showed more interest to high intensity fearful faces. A follow-up of this sample at 2-years revealed that less interest to high (vs. low) intensity facial expressions at 10-weeks is linked to better anxiety outcomes in the offspring of socially anxious mothers (Creswell et al., 2011). In contrast, more interest to high (vs. low) intensity facial expressions at 10-weeks was linked to better anxiety outcomes in the offspring of control mothers. This longitudinal study suggests that infants who show more interest to high intensity fearful faces may be at risk for later anxiety in children of socially anxious mothers. As illustrated by this study, the investigation of longitudinal links may help for understanding early vulnerability or resilience factors relating to infants' attention and interactive behavior.

The second priority is the consideration of non-environmental factors such as early neurophysiological or genetic influences that may mediate or moderate the associations of exposure to parental depression and anxiety with infants’ interactive behavior and attention in addition to subsequent functioning. For example, the s allele of the serotonin transporter (5-HTTLPR) gene, which is known to create vulnerability for depression and anxiety (Lesch et al., 1996) was found to be linked to 7-month-old infants' temperament and emotion processing in an ERP study (Grossmann et al., 2011). Genetic vulnerabilities are an important addition to future studies as they may provide further insight in individual differences in infants' early interactive behavior and emotion processing. Genetic and/or biological vulnerabilities may mediate or moderate (thus reduce or exacerbate) the links of early exposure to parental depression and anxiety to infants' socio-emotional development, and to later psychopathology.

The third priority is the simultaneous investigation of exposure effects in different aspects of infants' socio-emotional development across samples of infants of parents with clinical and non-clinical depression and anxiety. For a more complete picture of the early exposure effects on infants' development, it remains essential to examine the link between exposure to depression and anxiety in parents and infants' attention and reactions to others’ and parents’ facial expressions in early interactions or in computerized experiments.

**General Conclusion**

This dissertation shows that exposure to depression- and/or anxiety-related alterations in mothers' and fathers' emotional expressions in early life is linked to alterations in infants' affect and behavior in early interactions with parents, as well as in infants' emotion processing. The thesis additionally illustrates the importance of considering fathers' depression and/or anxiety and infants' temperamental dispositions in the study of early exposure effects.
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Clinical Implications
The findings of the current thesis reveal significant alterations in mothers’ and fathers’ emotional expressions in everyday interactions in the first postnatal year in case of lifetime anxiety and depression diagnoses. Moreover, these alterations were found to be linked to parallel alterations infants’ interactive behavior and to explain infants’ emotion processing. To identify which patterns of interactive behavior and of emotion processing convey risk for later problems, it remains essential to test the links between these early alterations and later adaptation and psychopathology in the offspring in future research. Still, the findings of this thesis demonstrate that exposure to parents’ depressed and anxious moods may constitute an early risk in the intergenerational transmission of depression and anxiety, highlighting the potential importance of protecting the offspring from these alterations in exposure by improving the screening, the prevention and the treatment of depression and anxiety disorders in mothers and fathers in the postnatal year. In the light of the findings demonstrating a joint influence of infants’ exposure to parents’ depression and anxiety, and infants’ temperamental dispositions, it is additionally important to detect early signs of negative temperament in infants, together with depression and anxiety symptoms in parents. Quick and easy-to-administer screening instruments addressing these dimensions in parents’ and newborn infants’ behavior would be extremely helpful in detecting which parents and infants require specific attention to minimize/eliminate early exposure effects.

Keeping in mind that the majority of parents who have depression and anxiety disorders in the first postnatal year also have it during pregnancy (Beck, 2001; Heron, O’Connor, Evans, Golding, & Glover, 2004) or earlier (Robertson, Grace, Wallington, & Stewart, 2004) it appears that an important risk group to target later depression/anxiety following the child’s birth is mothers and fathers with earlier or prenatal diagnoses of depression and anxiety. Moreover, findings from this thesis imply stronger deviations in the distribution of infants’ exposure to parental emotions in the case of comorbid forms of depression and anxiety disorders, and in cases where both the mother and the father have depression/anxiety. Considering that comorbid forms of depression and anxiety disorders in one parent, and the presence of depression/anxiety in both parents (vs. one parent only) at the same time contribute to a more pronounced genetic and biological risk for intergenerational transmission of depression and anxiety, these families should be prioritized in the interventions targeting parents’ depression/anxiety and interactive behavior with their infants.

In this thesis, the alterations reported in the interactions of depressed/anxious parents in the postnatal year were observed in the case of lifetime depression and anxiety disorders, revealing that depression- and anxiety-related alterations may extend to the periods where the parents do no longer satisfy criteria for a current diagnosis. This raises the possibility that the interventions that solely target current depression/
anxiety symptoms in parents are not enough to improve parent-infant interactions. Additional interventions specifically targeting parents’ interactive behavior (i.e., attention, emotional expressions and emotional reactions) should therefore be considered to more directly target depression- and anxiety-related alterations in infants’ early emotional environment in this period. The interventions focusing on attachment theory to target parent-child interactions in maternal depression revealed promising results (Gelfand, Teti, Seiner, & Jameson, 1996). However, these interventions address infants’ attachment rather than directly targeting attention and affect expressions in everyday interactions. Computerized training of attentional biases (often referred to as cognitive bias modification and cognitive control training, see Wiers, Gladwin, Hofmann, Salemink, & Ridderinkhof, 2013) in parents and infants (towards positive affect/away from threat) would be an interesting alternative to be considered in the interventions for parent-infant interactions in the case of depression and anxiety. An advantage of cognitive bias is that some of the tasks can be adapted to preverbal infants, for example by replacing verbal labels by visual/auditory and bi-modal stimuli, or by replacing verbal instructions with gradual training of infants’ attention to the target response (Wass, Porayska-Pomsta & Johnson, 2011). These techniques would thereby offer the unique possibility to intervene the interaction by training attention towards positive affect and away from threat in parents and infants. Another alternative is mindful parenting training (Bögels & Restifo, 2014) that has recently been adapted to new parents and infants. During mindful parenting sessions where one or both parents participate with the infant, parents’ early interactive behavior with the infant is directly addressed as parents are encouraged to provide sustained and undivided attention to their infants, to attend to the infants’ emotional signals of their infants, and to adopt a non-reactive parenting style in the face of parenting stress.