Do fathers matter? The relative influence of fathers versus mothers on the development of infant and child anxiety
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CHAPTER 4

Fathers’ versus mothers’ social referencing signals in relation to infant anxiety and avoidance: A visual cliff experiment

Abstract

Infants use signals from others to guide their behavior when confronted with novel situations, a process called ‘social referencing’ (SR). Via SR, signs of parental anxiety can lead to infant anxiety. Little is known about differences in the effect of paternal and maternal SR signals on child anxiety. Using a visual cliff paradigm, we studied whether SR processes between fathers and their infants differed from mothers and their infants. Eighty-one infants aged 10-15 months were randomly assigned to conduct the visual cliff task with their father ($n = 41$) or mother ($n = 40$). The infant was placed on the shallow side of the cliff and the parent, standing at the deep side, was instructed to encourage the infant to cross. Results showed that although mothers showed more intense facial expressions of encouragement than fathers, no differences occurred in how fast, and with how much anxiety, infants crossed the cliff with fathers and mothers. However, path analyses showed that paternal, but not maternal, expressed anxiety was positively associated with infant expressed anxiety and avoidance. For infants who participated with their mother, infants’ anxious temperament was negatively associated with infant avoidance of the cliff. Infant anxious temperament moderated the link between paternal expressed anxiety and infant avoidance: the higher the level of infant anxious temperament the stronger the positive association between paternal expressed anxiety and infant’s avoidance of the cliff. Lastly, parental encouragement was unrelated to infant expressed anxiety and avoidance. Our results suggest that SR processes between fathers and their infants differ from those between mothers and their infants.
Introduction

Anxiety disorders run in families (Hettema et al., 2001). Children of parents with an anxiety disorder are at a much greater risk (OR = 7.2) for having an anxiety disorder themselves than children of parents without an anxiety disorder (Turner et al., 1987). Parents of children with anxiety disorders are also much more likely (OR = 6.3) to have an anxiety disorder as well (Cooper, Fearn, Willetts, Seabrook, & Parkinson, 2006). Heritability plays only a modest role in explaining individual differences in levels of anxiety (e.g., Hettema et al., 2001), and this leaves room for environmental factors in the intergenerational transmission of anxiety (Bögels & Brechman-Toussaint, 2006; Murray et al., 2009). One of these factors is social referencing (SR; Feinman, 1982), a communication process whereby children actively seek information from experienced others, mostly their parents, to guide their interpretation and behavior when facing the unknown or the uncertain, and which emerges around the age of 10 months (Feinman et al., 1992). Specific fears can already be learned early in life through anxious parental social referencing signals (Aktar et al., 2013b, 2014; De Rosnay et al., 2006; Gerull & Rapee, 2002; Murray et al., 2008). On the other hand, it is hypothesized that parental encouragement may decrease children’s anxiety as they experience mastery over situations (e.g., Chorpita & Barlow, 1998; Wood, McLeod, Sigman, Hwang, & Chu, 2003). Indeed, McLeod and colleagues (2007) found in their meta-analysis that parental encouragement (labeled autonomy-granting) predicted less childhood anxiety. However, evidence from SR studies on the effects of parental encouragement on infant avoidance of anxiety-provoking stimuli is mixed. That is, Murray et al. (2008) found that maternal encouraging signals were associated with less infant avoidance, whereas Aktar et al. (2013b) found that maternal encouragement and infant avoidance were unrelated, and paternal encouragement was even associated with more infant avoidance.

Infant temperament may influence the SR process. According to diathesis-stress (Zuckerman, 1999) and vulnerability-stress models (Ingram & Luxton, 2005; Nigg, 2006), children with behavioral inhibition (BI), defined as a constitutionally based tendency to react with avoidance, fear, and withdrawal to novelty (Kagan, 1999), and a developmental precursor of child anxiety disorders (e.g., Clauss & Blackford, 2012; Hirshfeld et al., 1992), are more vulnerable to negative parenting environments. In SR studies, it has indeed been found that BI moderates the effects of parental anxiety on infant avoidance. For example, De Rosnay et al. (2006) showed that 12-14-month-old infants were more fearful and avoidant with a stranger when mothers acted anxiously in interaction with a stranger than when mothers acted non-anxiously. Infant-stranger avoidance was moderated by infant temperament:
temperamentally high-fearful infants were more avoidant when mothers displayed stranger anxiety than temperamentally low-fearful infants. Murray et al. (2008) investigated SR in a group of mothers with and without social anxiety disorder. It was found that, compared to infants of mothers without social anxiety disorder, infants of mothers with social anxiety disorder showed increased avoidance of a stranger between 10 and 14 months and this increase in avoidance was even larger for infants high in BI. This effect was mediated by maternal encouragement: that is, mothers with social anxiety disorder who had infants high in BI encouraged their infants the least to approach the stranger, whereas mothers without social anxiety disorder who had infants high in BI encouraged their infants the most. Two recent studies of Aktar et al. (2013b, 2014) also found that BI constitutes a temperamental vulnerability for the effects of parental anxiety. Aktar et al. (2013b), using two SR tasks, found a positive association between avoidance of 1-year-olds towards novelty (a robot dinosaur and a stranger) and expressed parental anxiety. Expressed parental anxiety and BI interacted to predict infant avoidance, in the direction that moderate-to-highly inhibited infants with parents who expressed moderate-to-high levels of anxiety during SR were more avoidant. Moreover, infant fear was predicted by infant BI, but not by expressed parental anxiety. Aktar et al. (2014) investigated the same group of children at 2.5 years of age. In contrast to their previous findings, parental expressed anxiety did not predict child fear/avoidance, but parental trait anxiety (lifetime anxiety disorders measured before the birth of the child) did, suggesting that in toddlerhood anxiety may not be transmitted via SR anymore. The interplay of BI at 1 year with parental (state and trait) anxiety did not predict fear and avoidance at 2.5 years, as opposed to their findings at 1 year. Notably, BI at 1 year predicted toddlers’ fear and avoidance only with mothers, but not with fathers, suggesting that 2.5-year-olds act relatively free of their early temperament in SR situations with fathers. Thus, children’s temperamental predispositions seem to play an important role in the link between parental anxiety and child anxiety.

A behaviorally inhibited temperament may also benefit children. That is, according to the differential susceptibility hypothesis, children vary in their susceptibility to parental rearing influences, for both the worse and the better (Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2007; Belsky & Pluess, 2009). Belsky observed that young children who are high in negative emotion (or with a difficult temperament) appeared to benefit disproportionately from supportive parenting (Belsky, 2005) and studies have confirmed this observation (e.g., Feldman et al., 1999; Klein Velderman et al., 2006; Van den Boom, 1994). Connecting this to SR, it can be hypothesized that behaviorally inhibited infants may profit more than other children from parental encouragement signals, and may be more negatively affected by parental anxious signals.
Hardly any studies have looked at the effect of paternal SR signals on child anxiety. The few studies that have, have shown that fathers are just as important SR figures as mothers. For example, Möller, Majdandžić, Vriends, and Bögels (2013b) presented children aged 8–13 years scripts of ambiguous situations in which the mother or father signaled anxious/confident behavior. Children had to indicate how anxious they would feel. Children were not differently affected by signals of mothers and fathers. Aktar et al. (2013b, 2014) found that the positive association between child avoidance towards novelty and parental anxiety did not differ for mothers and fathers. These studies suggest that fathers play an equally important role. In only one study a differential effect of paternal and maternal SR signals on child anxiety was found. Bögels and colleagues (2011) presented children aged 8 to 12 years with scripts of ambiguous social situations in which either the father or the mother acted socially anxious or confident. Children were more influenced by maternal anxious signals than by paternal anxious signals. For maternal and paternal confident signals, no differences occurred. However, high socially anxious children gave more weight to paternal signals, whereas low socially anxious children gave more weight to maternal signals. This led the authors to conclude that it may be fathers’ role to boost the social confidence of socially anxious children, whereas mothers’ role may be to teach social wariness to children with little social anxiety.

There is considerable evidence showing that fathers and mothers differ in their parenting behavior towards and their interaction with their children (see the review of Möller et al., 2013a). For example, fathers play more often with their children than mothers (e.g., Lewis & Lamb, 2003; Russell & Russell, 1987), and their play is of a more physical nature than that of mothers (e.g., Carson et al., 1993; Lindsey & Mize, 2001). Furthermore, males are in general more risk taking than females (e.g., Byrnes et al., 1999; Eckel & Grossman, 2008) and it has been found that fathers are more likely to adopt challenge-orientated parenting choices than mothers (Ishak, Tamis-LeMonda, & Adolph, 2007). Mothers, on the other hand, engage more in pretend play with their offspring (e.g., Lindsey & Mize, 2001; Lindsey et al., 1997). With respect to interaction and communication with their children, mothers display more positive affect than fathers (Forbes, Cohn, Allen, & Lewinsohn, 2004), use more perspective taking (Lundy, 2003), and talk more with their child about emotional aspects of past experiences (Fivush et al., 2000).

Several researchers posit that fathers and mothers play a different role in the upbringing of their offspring. Paquette (2004) theorized that the mother-child relationship is primarily an attachment relationship, focused at calming and comforting the child, whereas the father-child relationship is more an activation
relationship, aimed at stimulating children to take chances, challenge them to overcome limits, and to open them to the outside world. According to Paquette (2004), this father-child activation relationship is characterized by surprising, destabilizing, and encouraging children, ‘enabling children to learn to be brave in unfamiliar situations and to stand up for themselves’ (p. 212). Bögels et al. (Bögels & Perotti, 2011; Bögels & Phares, 2008) propose that this challenging behavior of fathers may buffer the development of anxiety in children. However, Bögels and Phares (2008) hypothesize that fathers’ challenging role is more affected by their own anxiety than mothers’ caring role. That is, anxious fathers may not be capable of challenging, encouraging, and stimulating the child to take risks, whereas anxious mothers might still be able to care for and comfort the child. Moreover, as fathers’ assumed role is to open infants to the outside world, anxious fathers may signal to their child the world is a dangerous place, thereby increasing children’s anxiety. Thus, it is hypothesized that anxious fathers, more than anxious mothers, will transmit their anxiety to their children (Bögels & Perotti, 2011).

In SR studies, children are exposed to novel or ambiguous stimuli, such as strangers (e.g., De Rosnay et al., 2006; Murray et al., 2008) or novel toys (e.g., Aktar et al., 2013b, 2014; Gerull & Rapee, 2002). The most well-known SR paradigm is the visual cliff, a glass covered table divided into a shallow side under which a checkered pattern is placed right beneath the glass, and a deep side under which a similar pattern is placed some distance below the glass (Sorce et al., 1985; Walk, 1966), creating an apparent ‘drop’. Sorce et al. (1985) showed the powerful effect of maternal SR signals on visual cliff behavior of 1-year-olds in a series of four studies, of which two are important to mention here. In one study, infant responses to the visual cliff were compared when mothers showed either a happy \( (n = 19) \) or fearful \( (n = 17) \) facial expression. When mothers posed a happy expression, almost all infants crossed the cliff, whereas none of the infants who observed mothers’ fearful expression crossed. Moreover, more infants in the fear condition than in the joy condition retreated back onto the shallow side of the cliff. Finally, infants who observed a fearful maternal expression responded with a more negative hedonic tone compared to infants observing a happy maternal expression. In another study of Sorce et al. (1985), the deep side of the visual cliff was removed and replaced by a second shallow side. In the absence of any depth, almost no SR occurred, and the few infants who referenced, did cross the ‘cliff’ despite mothers’ fear signal. Thus, infants may only look for information when they are experiencing ambiguity in a particular situation. However, later studies showed that maternal facial expression alone might be insufficient as a source of information in SR to influence infants’ willingness to cross the visual cliff (Bradshaw, Goldsmith, & Campos, 1987; Vaish
& Striano, 2004). In the study of Bradshaw et al. (1987), 63% of the infants did not venture onto the deep side of the cliff despite mothers’ positive facial expression. In addition, Vaish and Striano (2004) manipulated the information that mothers provided to their 1-year-old infants (positive facial and vocal cues, facial-only cues, or vocal-only cues) and found that infants crossed the cliff faster with facial and vocal cues and with vocal cues only than with facial cues only.

The main goal of the present study was to investigate whether social referencing processes between fathers and their infants differ from those of mothers and their infants. Since there are to our knowledge at present no studies including fathers in a visual cliff paradigm, this is the first study investigating the differential associations between paternal and maternal behavior and infant behavior on the visual cliff. In addition to parental expressed anxiety, parental encouragement, infant time to cross the cliff, infant expressed anxiety, and infant avoidance in the visual cliff situation, we assessed parental trait anxiety and infant anxious temperament using questionnaires. Connecting the above-mentioned theories and findings to infants crossing the visual cliff we formulated the following hypotheses. With regard to differences in parental encouragement, we hypothesized that fathers would display more encouragement. As females express more anxiety than males (e.g., Rotter & Rotter, 1988; Wagner, Buck, & Winterbotham, 1993), we hypothesized that females would express more anxiety than fathers during the visual cliff experiment. Our main hypothesis was that there would be a stronger positive association between fathers’ expressed anxiety and infants’ expressed anxiety/avoidance than between the expressed anxiety of mothers and infants. Likewise, we expected that fathers’ encouraging signals would be more strongly associated with less infant expressed anxiety and avoidance than mothers’ encouraging signals. With respect to the role of temperament, we hypothesized that infants with a more anxious temperament would be more affected by parental rearing, for better or worse. Thus, they would respond with more anxiety and avoidance to parental anxious signals and with less anxiety and avoidance to parental encouraging signals than infants with a less anxious temperament. We tested the possible moderating effect of infant anxious temperament on SR separately for maternal and paternal signals. Lastly, because infant time to cross the cliff is a main outcome measure in a number of visual cliff studies (e.g., Bolten & Schneider, 2010; Striano, Vaish, & Benigno, 2006; Vaish & Striano, 2004), we also explored how infant time to cross the cliff was related to infant expressed anxiety. A shorter time to cross the cliff could indicate both less (i.e., infant does not hesitate to cross because s/he is not afraid) and more (i.e., anxious infant wants to go to parent as soon as possible) infant expressed anxiety.
Method

Participants
Participants were 81 infants (41 girls and 40 boys) and their parents (40 mothers and 41 fathers). Participants were recruited through an information letter distributed by the municipality of Amsterdam and by leaflets provided by child care centers. Parents received information about the study beforehand and had to sign informed consent. The study was approved by the ethical committee of the University of Amsterdam. Fewer mothers than fathers were working full-time, \( \chi^2(1) = 22.22, p < .001 \), and mothers spent more time with their children than fathers, \( t(75) = 4.76, p < .001 \), which is indicative for the Dutch situation. Characteristics of the participating infants and parents are depicted in Table 1.

Table 1. Characteristics of the participants

<table>
<thead>
<tr>
<th>Infant</th>
<th>Total  ( N = 81 )</th>
<th>Infants with mother  ( N = 40 )</th>
<th>Infants with father  ( N = 41 )</th>
<th>( t (df) ) or ( \chi^2 (df) )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys (n, %)</td>
<td>40 (49%)</td>
<td>20 (50%)</td>
<td>20 (49%)</td>
<td>.01 (1)</td>
<td>.913</td>
</tr>
<tr>
<td>Age in months (M, SD)</td>
<td>11.88 (1.25)</td>
<td>11.88 (1.30)</td>
<td>11.87 (1.21)</td>
<td>.03 (79)</td>
<td>.973</td>
</tr>
<tr>
<td>Level of motor development</td>
<td>3.00 (2)</td>
<td>4.11 (1.45)</td>
<td>2.63 (1.28)</td>
<td>4.76 (75)</td>
<td>.000</td>
</tr>
<tr>
<td>Able to shuffle on bottom/crawl on hands-knees</td>
<td>6 (7%)</td>
<td>4 (10%)</td>
<td>2 (5%)</td>
<td>.01 (1)</td>
<td>.913</td>
</tr>
<tr>
<td>Able to walk with support/pull him/herself up</td>
<td>73 (90%)</td>
<td>34 (85%)</td>
<td>39 (95%)</td>
<td>.03 (79)</td>
<td>.973</td>
</tr>
<tr>
<td>Able to walk independently</td>
<td>2 (2%)</td>
<td>2 (5%)</td>
<td>0 (0%)</td>
<td>.03 (79)</td>
<td>.973</td>
</tr>
<tr>
<td>Infant anxious temperament (M, SD)</td>
<td>( a ) 2.34 (.74)</td>
<td>2.33 (.79)</td>
<td>2.36 (.70)</td>
<td>-.14 (76)</td>
<td>.891</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parent</th>
<th>Total  ( N = 81 )</th>
<th>Mother  ( N = 40 )</th>
<th>Father  ( N = 41 )</th>
<th>( t (df) ) or ( \chi^2 (df) )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (M, SD)</td>
<td>35.62 (4.82)</td>
<td>34.84 (3.96)</td>
<td>36.39 (5.49)</td>
<td>-1.42 (76)</td>
<td>.158</td>
</tr>
<tr>
<td>Born in the Netherlands (n, %)</td>
<td>61 (75%)</td>
<td>29 (73%)</td>
<td>32 (78%)</td>
<td>.34 (1)</td>
<td>.563</td>
</tr>
<tr>
<td>Working fulltime (n, %)</td>
<td>31 (38%)</td>
<td>5 (13%)</td>
<td>26 (63%)</td>
<td>22.22 (1)</td>
<td>.000</td>
</tr>
<tr>
<td>Time spent with parent (M, SD)</td>
<td>( b ) 3.38 (1.55)</td>
<td>4.11 (1.45)</td>
<td>2.63 (1.28)</td>
<td>4.76 (75)</td>
<td>.000</td>
</tr>
<tr>
<td>Married/living together (n, %)</td>
<td>75 (93%)</td>
<td>37 (93%)</td>
<td>38 (93%)</td>
<td>.00 (1)</td>
<td>.975</td>
</tr>
<tr>
<td>Number of children (M, SD)</td>
<td>1.45 (.77)</td>
<td>1.36 (.67)</td>
<td>1.54 (.85)</td>
<td>-1.03 (76)</td>
<td>.304</td>
</tr>
<tr>
<td>Educational level (M, SD)</td>
<td>( c ) 7.23 (1.08)</td>
<td>7.23 (1.20)</td>
<td>7.23 (.96)</td>
<td>.00 (76)</td>
<td>1.000</td>
</tr>
<tr>
<td>Parental trait anxiety (M, SD)</td>
<td>( d ) .32 (.19)</td>
<td>.36 (.20)</td>
<td>.29 (.19)</td>
<td>1.44 (69)</td>
<td>.153</td>
</tr>
</tbody>
</table>

Note. For proportions, chi square tests were performed, for means independent samples t-tests.
\( a \) Mean item score, measured with the IBQ completed by both parents. \( b \) Number of days per week.
\( c \) On a scale from 0 (primary education) to 8 (university). \( d \) Mean item score, measured with the SCARED-A.
**Procedure**
A week before the visit to our laboratory, a set of questionnaires, including demographic information, was sent by mail to both parents and were to be completed individually and returned at the day of the visit. One of the parents was selected at random to visit our laboratory to participate in three experimental tasks. Note that we first piloted whether we could use a within-subject design (having each of the parents in random order guide the infant over a different visual cliff), but it turned out that every infant ($n = 5$) crossed the cliff without referencing to the parent the second time, so a within-subject design was not feasible.

The experimental tasks lasted approximately 30 minutes and consisted of two free play tasks (with and without toys, not used in the present study), measuring parenting behavior, and the visual cliff task. The parent and the infant were filmed during the tasks with three video cameras. After the laboratory visit, the parent received a second set of questionnaires for both parents to be filled out at home separately from their partner. Completing each set of questionnaires lasted approximately one hour. Afterwards, infants received a small gift and the parent received a refund of travel expenses. Parents also received a copy of the video recordings that were made of the parent and the infant, and a compensation of 10 euro that they could keep themselves or could donate to Orange Babies, a foundation established to help pregnant women with HIV and their babies in Africa.

**Measurements**

**The visual cliff**

**Procedure.** Assessment of paternal and maternal expressed anxiety and encouragement, and infant expressed anxiety and avoidance, was done using the visual cliff task. The visual cliff (Walk, 1966) is a plexiglass-covered table, which is divided into a shallow side ($94 \times 97.5$ cm) under which a checkered pattern is placed right beneath the glass, and a deep side ($94 \times 97.5$ cm) under which a similar pattern is placed some distance beneath the glass, creating an apparent ‘drop’. An upright plexiglass border of 20 cm prevented the infants from falling down. The depth of the cliff was set at 30 cm, as the study by Sorce et al. (1985) revealed that this depth elicited infant pauses at the edge and frequent looks to the mother but no clear avoidance of the depth. In contrast to Sorce et al. (1985), we did not place an attractive toy on the deep side, as this could hinder the pure SR process.

During the instruction, the visual cliff was placed in a corner of the room and was covered with sheets to ensure that the infant would experience an entirely novel situation when s/he was placed on the cliff, and also that the parent could not give
any cues to the infant about the cliff before the actual start of task. The parent was
told that s/he had to place the infant on a high table with his/her feet to the back
of the table and that s/he had to encourage the infant to crawl to the other side.
Parents were instructed to stay silent while placing the infant on the visual cliff,
because we were interested in the infant’s first reaction to the visual cliff without
receiving any parental information. The parent placed the infant on the shallow
side of the cliff, walked to the other side, and positioned her/ himself on the far
deep) side of the cliff. The parent could start encouraging when the infant had
first looked to the parent, and thus the SR process had started, indicated by the
experimenter raising her hand. While encouraging, the parent was not allowed to
reach over the cliff or touch the plexiglass, to ensure that all infants had to crawl
the same distance and that children would not see that glass was covering the
drop-off. During the task, the experimenter stayed behind a pillar, making no eye
contact with either the child or the parent, but keeping an eye on the safety of the
infant. The task was terminated when (1) the infant crossed the deep side touching
the end wall; (2) the infant was picked up by the parent at the end of the cliff;
(3) 10 minutes had elapsed and the infant had still not reached the end wall of the
cliff, as the study by Vaish and Striano (2004) indicated that this may be the time
that some infants need to cross the cliff; (4) the child became too upset or if the
parent indicated that s/he thought the infant was becoming too upset to continue.

Coding. Our coding scheme was based on two well-known coding schemes:
the Laboratory Temperament Assessment Battery (Lab-TAB Prelocomotor
version; Goldsmith, & Rothbart, 1999), an often used observational battery
to assess temperament (e.g., Buss & Kiel, 2004; Olino, Klein, Durbin, Hayden,
& Buckley, 2005; Majdandžić, Van den Boom, & Heesbeen, 2008), and the AFFEX
system for the coding of facial expressions (Izard, Dougherty, & Hembree, 1983).
Infant crossing time was coded in number of seconds. For the coding of all other
variables, the task was divided into 10 second time intervals and variables were
coded on a 4-point scale ranging from 0 to 3. Higher scores indicated a higher
frequency or intensity of that behavior (0 = absence of that behavior; 1 = light
expression of that behavior; 2 = clear expression of that behavior; 3 = clear and
intense expression of that behavior). For example, for infants’ vocal expression
of anxiety, coders made the 0–3 judgments based on the following scale: 0 = no
vocalizations that point to distress/anxiety or vocalizations that may be difficult to
identify as hedonically negative; 1 = mild and short vocalizations of anxiety, that
is, little sighs, groans, or coughs, with a negative hedonic tone; 2 = clear crying
of short duration (1–2 seconds) or mild vocalizations of anxiety of longer duration
(minimum 3 seconds); 3 = clear crying of longer duration (minimum 3 seconds),
or short but very intense crying. Final scores of each variable were obtained by averaging the scores across time intervals.

Infant expressed anxiety and infant avoidance constituted the primary outcome measures. Infant expressed anxiety during the visual cliff task was based on separate codings of: (1) bodily expressions of anxiety (e.g., muscle tension, freezing, trembling); (2) facial expressions of anxiety (e.g., wide eyes, stiff mouth); and (3) vocal expressions of anxiety (e.g., crying, whining). Cronbach’s alpha of the three infant expressed anxiety variables was .85, indicating a high level of internal consistency. A mean score of infant expressed anxiety was created by averaging the bodily, facial, and vocal ratings. Infant avoidance involved behaviors such as looking away from the cliff, turning around, crawling back, and sitting still for a long period of time. Infant crossing time was used as a secondary outcome measure and was coded as the number of seconds between the placing of the child on the cliff and the moment the child grabbed the glass border at the end of the cliff or when the parent picked up the child. Children who did not cross the cliff after 10 minutes or who were so upset that the task was ended were given the maximum score of 600 seconds.

Parental expressed anxiety was based on separate codings of bodily (e.g., standing still, muscle tension, nervous movements), facial (e.g., big eyes, stiff mouth), and verbal (both content and tone of verbal messages, such as ‘this is scary, right?’ or ‘be careful!’) expressions of anxiety during the visual cliff task. Cronbach’s alpha of the three parental expressed anxiety variables was .72, indicating a sufficient level of internal consistency. A mean score of parental expressed anxiety was created by averaging the bodily, facial, and verbal ratings. Parental encouragement was based on separate codings of bodily (e.g., waving, clapping, hand gesturing), facial (e.g., smiling), and verbal (e.g., ‘come here!’ or ‘you’re doing great!’) expressions of encouragement. Cronbach’s alpha of the three parental encouragement variables was .38, indicating a modest level of internal consistency. This can be partly explained by the combination of only three variables, but it is also understandable that the three modalities of encouragement (bodily, facial, and verbal) do not cohere very highly. That is, it is for example possible to be very encouraging by the use of smiles and verbal comments, without the use of bodily encouragements. The finding that parental encouragement was not highly coherent across modalities has been reported previously (see Karasik, Tamis-LeMonda, Adolph, & Dimitropoulou, 2008). To obtain a robust measure of parental encouragement, we therefore chose to average the three modalities into a single encouragement score for the parent. Coding of infant behavior was carried out by two groups of two
observers, trained by the first author. Twenty percent of the infants were double coded to determine interobserver reliability. Parent behavior was coded by one different group of two observers, also trained by the first author. Again, 20% of the parents were double coded by the two observers to determine interobserver reliability. The final scores for the double coded data were obtained by averaging the ratings of the observers. Mean interobserver reliability (intraclass correlations; ICC) was .88 (range .79–1.00) for the parent variables and .87 (range .84–.93) for the infant variables.

**SCARED-A**

To assess parental trait anxiety, parents completed the Screen for Child Anxiety Related Emotional Disorders-Adult version (SCARED-A; Bögels & Van Melick, 2004; Van Steensel & Bögels, 2014), a screening tool for identifying symptoms of anxiety disorders. The SCARED-A assesses a range of DSM-IV-based anxiety symptoms that can be divided into symptoms of panic disorder (13 items), generalized anxiety disorder (9 items), social anxiety disorder (9 items), separation anxiety disorder (12 items), obsessive-compulsive disorder (9 items), posttraumatic stress disorder (4 items), and specific phobia (15 items). Participants indicated how frequently they experienced each of the 71 anxiety symptoms using a 3-point Likert scale with almost never = 0, sometimes = 1, and often = 2. The SCARED-A possesses good reliability and discriminant validity to detect anxiety disorders (Bögels & Van Melick, 2004; Van Steensel & Bögels, 2014). A mean item SCARED score per parent was created by averaging the 71 item scores. Cronbach’s alpha of the SCARED total score in our study was high: .91 for mothers and .93 for fathers. Only the SCARED scores of the parent that visited our lab were used.

**IBQ**

Infant’s anxious temperament was measured using the Infant Behaviour Questionnaire-Revised (IBQ-R; Gartstein & Rothbart, 2003), a parent-report measure of temperament in infants between 3 and 12 months. The IBQ-R consists of 191 items, organized into 14 subscales. Parents rated the frequency of infant behaviors during the past week on a 7-point Likert-scale ranging from 1 (never) to 7 (always). For the present study, we used the Fear scale (16 items) that assesses the infant’s startle or distress to sudden changes in stimulation, novel physical objects or social stimuli. An example of an item is: ‘When visiting a new place, how often did the baby show distress for the first few minutes?’ Cronbach’s alpha of the Fear scale was high: .89 for mothers, and .85 for fathers. As fathers’ and mothers’ ratings of their child’s anxious temperament were substantially associated ($r = .55, p < .001$) a mean item score across parents was calculated.
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Results

Preliminary analyses and descriptive statistics

All outcome measures were checked for univariate outliers, using \( z < -3.29 \) or \( z > 3.29 \) as the criterion (Tabachnick & Fidell, 2001), and no outliers were present. Variables were checked for normality, and skewness and kurtosis were \(< |2|\) for all variables. Pearson correlations between all parental and infant variables are depicted in Table 2 for mothers and fathers separately. Associations between our two main outcome variables, infant expressed anxiety and infant avoidance, were moderate. As some studies found different patterns of results for infant expressed anxiety and avoidance (e.g., Murray et al., 2008; Aktar et al., 2013b), these variables were treated as separate outcome variables, despite their positive association. Participating mothers and fathers did not differ in their level of trait anxiety, \( t(69) = 1.44, p = .153 \), and infants participating with their mother or father did not differ in their level of anxious temperament, \( t(76) = .14, p = .891 \), suggesting that randomization was successful.

Of the 81 infants, four did not cross the cliff within 10 minutes. Another four were so upset that the task was ended. These four infants were not excluded from the analyses,¹ as (1) this would mean removing children from the high end of the distribution of anxious behavior, which is a threat to the validity of the experiment; (2) the task was only ended after a considerable amount of time (\( M = 237.25 \) seconds, \( SD = 169.98 \), range 69–456 seconds), leaving enough useable data; (3) these children started the experiment in a neutral mood, so it is likely that it was the cliff that caused their distress, which is the focus of interest of our study; and (4) it is customary in the Lab-TaB (Goldsmith & Rothbart, 1999) to include children with extreme scores for which a certain task ends prematurely, since their reaction is extreme but valid, and because these (for instance extremely anxious) children are often the focus of interest. Thus, for the variable ‘infant crossing time’ all these eight infants were given the maximum score of 600 seconds.

The level of parental expressed anxiety was quite low (\( M = .25, SD = .23 \) for mothers; \( M = .26, SD = .26 \) for fathers; range 0-1 for both parents on a scale of 0-3). However, scatterplots for the association between maternal/paternal expressed anxiety and infant expressed anxiety/infant avoidance showed that there was enough variance in the level of both maternal and paternal expressed anxiety to use it in our analyses (see Figures 1 to 4).²

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¹ Analyses were repeated excluding the four children who were so upset that the task was ended prematurely, and results were similar.
² As can be seen in Figures 1 and 3, there is one mother that had a somewhat extreme score of 1.0 on expressed anxiety. Analyses on the relation between maternal expressed anxiety and infant avoidance and infant expressed anxiety were repeated without this data point, and results were similar.
To test whether boys and girls reacted differently to their mother or father, and whether fathers and mothers behaved differently with their sons or daughters, univariate general linear models were conducted with parent sex and infant sex as between-subject factors and parental encouragement, parental expressed anxiety, parental trait anxiety, infant expressed anxiety, infant avoidance, infant anxious temperament, and infant crossing time as outcome variables. Results revealed no significant main effects for infant sex and no interactions between parent sex and infant sex for all outcome variables. Therefore, infant sex was excluded from further analyses.

### Differences in paternal and maternal behavior

Independent sample t-tests were carried out to investigate differences between paternal and maternal behavior. The sequential Bonferroni-Holm correction (Holm, 1979) was applied to the eight independent sample t-tests to control for Type 1 error. Results are shown in Table 3. Mothers had somewhat higher encouragement levels than fathers, $t(79) = 2.62, p = .010, d = .60$ (but not statistically significant after the Bonferroni-Holm correction). Mothers showed significantly more intense facial expressions of encouragement than fathers, $t(79) = 3.03, p = .003, d = .66$, whereas no significant differences were found for bodily and verbal expressions of encouragement. Mothers and fathers did not differ in level of expressed anxiety, $t(79) = .21, p = .836, d = .04$.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parental expressed anxiety</th>
<th>Parental encouragement</th>
<th>Parental trait anxiety</th>
<th>Infant expressed anxiety</th>
<th>Infant avoidance</th>
<th>Infant anxious temperament</th>
<th>Infant crossing time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental expressed anxiety</td>
<td>-.36*</td>
<td>-.21</td>
<td>.30†</td>
<td>.41**</td>
<td>-.14</td>
<td>.27†</td>
<td></td>
</tr>
<tr>
<td>Parental encouragement</td>
<td>-.13</td>
<td>-.20</td>
<td>.03</td>
<td>-.18</td>
<td>.06</td>
<td>-.17</td>
<td></td>
</tr>
<tr>
<td>Parental trait anxiety</td>
<td>.12</td>
<td>-.02</td>
<td>-.06</td>
<td>-.24</td>
<td>.04</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>Infant expressed anxiety</td>
<td>-.11</td>
<td>-.18</td>
<td>.04</td>
<td>-.49**</td>
<td>.04</td>
<td>.48**</td>
<td></td>
</tr>
<tr>
<td>Infant avoidance</td>
<td>.26</td>
<td>-.16</td>
<td>.20</td>
<td>.39*</td>
<td>-.07</td>
<td>.42**</td>
<td></td>
</tr>
<tr>
<td>Infant anxious temperament</td>
<td>.02</td>
<td>.01</td>
<td>.13</td>
<td>-.03</td>
<td>-.40*</td>
<td>.05</td>
<td></td>
</tr>
<tr>
<td>Infant crossing time</td>
<td>-.08</td>
<td>-.18</td>
<td>.25</td>
<td>.41**</td>
<td>.66**</td>
<td>-.34*</td>
<td></td>
</tr>
</tbody>
</table>

Note. Correlations for the mother and her infant below the diagonal, for the father and his infant above the diagonal. N’s ranged from 34 to 41. ** $p < .01$, * $p < .05$, † $p < .10$.
Figure 1. Scatterplot for the association between maternal expressed anxiety and infant avoidance

Figure 2. Scatterplot for the association between paternal expressed anxiety and infant avoidance
Figure 3. Scatterplot for the association between maternal expressed anxiety and infant expressed anxiety

Figure 4. Scatterplot for the association between paternal expressed anxiety and infant expressed anxiety
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Table 3. Differences between maternal and paternal behavior

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mothers M (SD)</th>
<th>Fathers M (SD)</th>
<th>t (df)</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental encouragement</td>
<td>1.75 (.28)</td>
<td>1.58 (.29)</td>
<td>2.62 (79)</td>
<td>.010</td>
<td>.60</td>
</tr>
<tr>
<td>Facial expression of encouragement</td>
<td>1.93 (.54)</td>
<td>1.60 (.45)</td>
<td>3.03 (79)</td>
<td>.003</td>
<td>.66</td>
</tr>
<tr>
<td>Bodily expression of encouragement</td>
<td>1.47 (.43)</td>
<td>1.43 (.42)</td>
<td>.39 (79)</td>
<td>.698</td>
<td>.09</td>
</tr>
<tr>
<td>Verbal expression of encouragement</td>
<td>1.83 (.32)</td>
<td>1.70 (.43)</td>
<td>1.58 (79)</td>
<td>.117</td>
<td>.34</td>
</tr>
<tr>
<td>Parental expressed anxiety</td>
<td>.25 (.23)</td>
<td>.26 (.26)</td>
<td>-.21 (79)</td>
<td>.836</td>
<td>.04</td>
</tr>
<tr>
<td>Facial expression of anxiety</td>
<td>.38 (.32)</td>
<td>.41 (.37)</td>
<td>-.32 (79)</td>
<td>.750</td>
<td>.09</td>
</tr>
<tr>
<td>Bodily expression of anxiety</td>
<td>.16 (.23)</td>
<td>.21 (.32)</td>
<td>-.71 (79)</td>
<td>.481</td>
<td>.18</td>
</tr>
<tr>
<td>Verbal expression of anxiety</td>
<td>.20 (.33)</td>
<td>.16 (.25)</td>
<td>.53 (79)</td>
<td>.597</td>
<td>.14</td>
</tr>
</tbody>
</table>

Note. After the Bonferroni-Holm correction, fathers and mothers only significantly differ in their level of facial expressions of encouragement.

Differences in infant behavior with fathers and mothers

To assess whether the behavior of infants who participated in the visual cliff experiment with their mother differed from the behavior of infants who participated with their father, independent sample t-tests were performed (Table 4). The sequential Bonferroni-Holm correction (Holm, 1979) was applied. Infants who participated with their mother did not differ from infants who participated with their father in their level of expressed anxiety, avoidance, and crossing time. Thus, no differences occurred in how fast, and with how much anxiety or avoidance, infants crossed the cliff with their father versus their mother.

Table 4. Differences in behavior between infants who participated with their mother and father

<table>
<thead>
<tr>
<th>Variable</th>
<th>Infants with mother M (SD)</th>
<th>Infants with father M (SD)</th>
<th>t (df)</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant expressed anxiety</td>
<td>.57 (.41)</td>
<td>.70 (.50)</td>
<td>-1.32 (79)</td>
<td>.191</td>
<td>.28</td>
</tr>
<tr>
<td>Facial expressions of anxiety</td>
<td>.62 (.53)</td>
<td>.74 (.67)</td>
<td>-.89 (78)</td>
<td>.389</td>
<td>.20</td>
</tr>
<tr>
<td>Bodily expressions of anxiety</td>
<td>.72 (.38)</td>
<td>.86 (.38)</td>
<td>-1.56 (79)</td>
<td>.124</td>
<td>.37</td>
</tr>
<tr>
<td>Vocal expressions of anxiety</td>
<td>.38 (.52)</td>
<td>.51 (.59)</td>
<td>-1.12 (79)</td>
<td>.286</td>
<td>.23</td>
</tr>
<tr>
<td>Infant avoidance</td>
<td>.74 (.34)</td>
<td>.83 (.31)</td>
<td>-1.20 (79)</td>
<td>.236</td>
<td>.28</td>
</tr>
<tr>
<td>Crossing time (in sec.)</td>
<td>179.11 (167.20)</td>
<td>185.84 (184.55)</td>
<td>-.17 (79)</td>
<td>.864</td>
<td>.04</td>
</tr>
</tbody>
</table>

Differential effects of maternal and paternal encouragement on infant expressed anxiety and avoidance and the moderating role of infant anxious temperament

To assess whether fathers’ encouraging signals would be more strongly associated with less infant expressed anxiety and avoidance than mothers’ encouraging signals, and whether infant anxious temperament moderated these associations, two path
analyses were performed (separately for mothers and fathers) in Mplus 5 (Muthén & Muthén, 2007). The model consisted of parental encouragement and infant anxious temperament as predictors, and infant avoidance and expressed anxiety as outcome variables. Also, we included the interaction between parental encouragement and infant anxious temperament. We statistically controlled for associations between the interaction and the predictors. The use of path models made it possible to account for the association between infant expressed anxiety and avoidance. Full Information Maximum Likelihood estimation was used, as the variables were normally distributed and the Little’s MCAR test (Little, 1988) produced a normed and nonsignificant $\chi^2 (\chi^2/df)$ of 1.05, revealing a good fit between sample scores with and without imputations (Bollen, 1989). Standardized parameter estimates for the link between parental encouragement and infant avoidance and infant expressed anxiety, and the moderating effect of infant anxious temperament, are depicted in Figure 5 (for mothers) and Figure 6 (for fathers). Both models provided an excellent fit to the data: $\chi^2 (7) = 16.71, p = .019$; CFI = 1.00; RMSEA = .00, range .00-.00 (for mothers), and $\chi^2 (7) = 17.09, p = .017$; CFI = 1.00; RMSEA = .00, range .00-.00 (for fathers). Because we had no specific hypotheses on associations between the interaction and the predictors, they are not presented in Figures 5 and 6.

For mothers (Figure 5), both infant avoidance and infant expressed anxiety were not significantly associated with maternal encouragement. Infant avoidance was negatively related to infant anxious temperament, indicating that for infants participating with their mother, those who had a more anxious temperament showed less avoidance during the visual cliff experiment. Infant expressed anxiety was not significantly associated with infant anxious temperament. The interaction between maternal encouragement and infant anxious temperament was not significantly associated with infant avoidance or infant expressed anxiety, meaning that the level of infant anxious temperament did not influence the association between maternal encouragement and infant avoidance or infant expressed anxiety.

For fathers (Figure 6), neither infant avoidance nor infant expressed anxiety was significantly associated with paternal encouragement. Both infant avoidance and infant expressed anxiety were also not significantly associated with infant anxious temperament. The interaction between paternal encouragement and infant anxious temperament was not significantly associated with infant avoidance or infant expressed anxiety, indicating that infants’ level of anxious temperament did not influence the association between paternal encouragement and infant avoidance or infant expressed anxiety.
Figure 5. Standardized parameter estimates for the link between maternal encouragement and infant avoidance and infant expressed anxiety and the moderating effect of infant anxious temperament. **p < .01

Figure 6. Standardized parameter estimates for the link between paternal encouragement and infant avoidance and infant expressed anxiety and the moderating effect of infant anxious temperament. **p < .01
Differential effects of maternal and paternal expressed anxiety on infant expressed anxiety and avoidance and the moderating role of infant anxious temperament

To examine whether the association between parents’ expressed anxiety and infant expressed anxiety and avoidance would be stronger for fathers than for mothers, and whether infant anxious temperament moderated these associations, we again performed two path analyses separately for mothers and fathers in Mplus 5 (Muthén & Muthén, 2007). The model consisted now of parental expressed anxiety and infant anxious temperament as predictors, and infant avoidance and infant expressed anxiety as outcome variables. The interaction between parental expressed anxiety and infant anxious temperament was also included. We statistically controlled for associations between the interaction and the predictors. The variables were normally distributed and the Little’s MCAR test (Little, 1988) produced a normed and nonsignificant $\chi^2$ ($\chi^2/df$) of .36, revealing a good fit between sample scores with and without imputations (Bollen, 1989). Therefore, Full Information Maximum Likelihood estimation was used. Standardized parameter estimates for the link between parental expressed anxiety and infant avoidance and infant expressed anxiety, and the moderating effect of infant anxious temperament, are depicted in Figure 7 (for mothers) and Figure 8 (for fathers). Both models provided an excellent fit to the data: $\chi^2 (7) = 20.48, p = .005; \text{CFI} = 1.00; \text{RMSEA} = .00, \text{range} .00-.00$ (for mothers), and $\chi^2 (7) = 25.67, p < .001; \text{CFI} = 1.00; \text{RMSEA} = .00, \text{range} .00-.00$ (for fathers). Again, associations between the interaction and the predictors are not presented in Figures 7 and 8, as we had no hypotheses on them.

For mothers (Figure 7), neither infant avoidance nor infant expressed anxiety was significantly associated with maternal expressed anxiety. Infant avoidance was negatively related to infant anxious temperament, indicating that for infants participating with their mother, those who had a more anxious temperament showed less avoidance during the visual cliff experiment. Infant expressed anxiety was not significantly associated with infant anxious temperament. The interaction between maternal expressed anxiety and infant anxious temperament was not significantly associated with infant avoidance or infant expressed anxiety, meaning that the level of infant anxious temperament did not influence the association between maternal expressed anxiety and infant avoidance or infant expressed anxiety.

For fathers (Figure 8), both infant avoidance and infant expressed anxiety were positively associated with paternal expressed anxiety, indicating that when fathers expressed more anxiety during the visual cliff experiment, their infants showed more avoidance and expressed more anxiety. Neither infant avoidance nor infant
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Figure 7. Standardized parameter estimates for the link between maternal expressed anxiety and infant avoidance and infant expressed anxiety and the moderating effect of infant anxious temperament. ** $p < .01$

Figure 8. Standardized parameter estimates for the link between paternal expressed anxiety and infant avoidance and infant expressed anxiety and the moderating effect of infant anxious temperament. ** $p < .01$, * $p < .05$
expressed anxiety was significantly associated with infant anxious temperament. The interaction between paternal expressed anxiety and infant anxious temperament was positively associated with infant avoidance, indicating that infants with a higher level of anxious temperament whose fathers expressed more anxiety, showed an extra increase in avoidance of the visual cliff. Thus, infant anxious temperament moderated the association between paternal expressed anxiety and infant avoidance. The interaction between paternal expressed anxiety and infant anxious temperament was not significantly related to infant expressed anxiety, meaning that the level of anxious temperament of the infant did not influence the association between paternal expressed anxiety and infant expressed anxiety.

**Association between infant time to cross the cliff and infant expressed anxiety**

A scatterplot (Figure 9) was made to explore how infant crossing time was related to infant expressed anxiety. Inspection of the scatterplot showed that there were fast crossers who are on the high end of the expressed anxiety distribution, but also fast crossers who were on the low end of the expressed anxiety distribution. Moreover, there were infants who crossed the cliff slowly, but did not express much anxiety. This suggests that the association between infant expressed anxiety and infant crossing time is of a nonlinear nature.

![Figure 9. Scatterplot displaying the association between infant expressed anxiety and infant crossing time](image-url)
Discussion

This study investigated whether social referencing processes between fathers and their infants differed from those between mothers and their infants. The main findings were that (1) mothers displayed more intense facial expressions of encouragement, but were not more anxious, than fathers; (2) no differences occurred in how fast, and with how much anxiety or avoidance infants crossed the cliff with their father versus their mother; (3) for infants who participated with their mother, infants’ anxious temperament was associated with lower infant avoidance; (4) parental encouragement was unrelated to infant expressed anxiety and avoidance; (5) more paternal, but not maternal, expressed anxiety was positively associated with infant expressed anxiety and avoidance; and (6) infant anxious temperament moderated the link between fathers’ expressed anxiety and infant avoidance.

This was the first visual cliff study including both fathers and mothers, and the finding that paternal, but not maternal, expressed anxiety was associated with more infant expressed anxiety and avoidance, is noteworthy. It may indicate that (1) fathers’ anxiety has more impact on infants’ anxiety than mothers’, and/or (2) anxious child behavior has more impact on fathers’ anxiety than on mothers’. The father-infant direction of effects supports the proposed different roles of mothers and fathers in the development of child anxiety, namely that children are more negatively influenced by paternal anxiety signals than by maternal anxiety signals (Bögels & Phares, 2008; Bögels & Perotti, 2011). Bögels argues that the different roles of mothers and fathers have an evolutionary basis; fathers specialized in ‘external protection’ (approaching potentially dangerous animals and unfamiliar humans, exploring new territory), whereas mothers specialized in ‘internal protection’ (feeding, soothing, comforting the child). These different roles are assumed to be reflected in mothers’ and fathers’ parenting behavior (Bögels & Perotti, 2011). Indeed, evidence from parenting studies confirms that fathers and mothers differ in their parenting behavior towards their offspring (see the review of Möller et al., 2013a). As an example, fathers encourage risk-taking and social competition more than mothers, whereas mothers are more protective and stimulate caring for others and intimate bonding more than fathers (Möller et al., 2013a). From this different specialization of men and women, it can be hypothesized that fathers and mothers have a comparative advantage over their partner in their domains of expertise. That is, children may instinctively be more influenced by paternal signals in external situations and by maternal behavior in internal situations (Bögels & Perotti, 2011). As a result, Bögels and Perotti (2011) argue, if the parent specialized in a certain situation exhibits anxiety in that situation, children interpret it as a more strong
negative signal, and become more fearful or stressed than when the other non-specialized parent shows fear in that situation. Applying this theory to our study, the visual cliff would represent an external threat, as it evokes fear of high places or falling, and thus corresponds with fathers’ evolutionary-based specialization. Following their reasoning, the impact of anxious signals of the father on fearful behavior of the child would then be larger than that of mothers, as indeed was found in our study. This is a very interesting theory that requires further testing.

On the other hand, infants’ anxiety and avoidance may also have evoked more anxiety in the father than in the mother. This may be because fathers are more insecure in the interaction with their young children than mothers, as they know the child less at that young age, likely because of spending less time with him/her (Geary, 2010; Möller et al., 2013a). Indeed, we found that fathers in our study spent on average two days a week less with their child than mothers (see Table 1). Moreover, fathers’ emotions seem to be influenced more by the emotion of the infant than mothers’ emotions. For example, recent face-to-face interaction research with infants has shown that mothers are more positive than fathers when the infant displays a positive, negative, or neutral facial expression, whereas fathers tend to be more neutral than mothers when the infant is neutral or negative (Aktar, Colonnesi, Majdandžić, De Vente, & Bögels, 2013a). Thus, it seems that fathers are more affected by infants’ negative emotions than mothers.

Fathers’ anxious behavior thus was more strongly related to infant anxious and avoidant behavior on the visual cliff than mothers’ anxious behavior. However, the larger association between paternal behavior on child anxiety and avoidance seems to be restricted to the parent’s anxious behavior. That is, for both mothers and fathers, parental encouragement was unrelated to infants’ level of expressed anxiety and avoidance. Thus, there was no difference between fathers and mothers in the association between encouragement signals about the visual cliff and infants’ expressed anxiety and avoidance. Our findings conflict with the findings of the meta-analysis of McLeod et al. (2007) in which parental encouragement predicted less child anxiety and the study of Murray et al. (2008) in which more maternal encouragement was associated with less infant avoidance. However, the positive association between paternal expressed anxiety and infant expressed anxiety and avoidance in our study also means that when fathers displayed low levels of anxiety (and thus appeared confident), their child was less anxious and avoidant during the visual cliff experiment. The absence of paternal anxiety may thus also signal to the child that the situation is safe and that the child should not feel anxious, independent of the presence of encouraging signals. The absence of an association
between parental encouragement and infant expressed anxiety and avoidance may also be due to the fact that parental encouragement is a heterogeneous construct. That is, the encouragement variable was an average of three variables (bodily, facial, and verbal expressions of encouragement) that did not cohere very highly. As was already mentioned in the methods section, a previous study by Karasik et al. (2008) also reported that different modalities of parental encouragement do not cohere very highly. To obtain a robust construct, and as infants also see the combination of parental encouraging behavior, we chose to average the bodily, facial, and verbal encouragement variables into a single construct. Nonetheless, our results add to the growing evidence showing that we tend to overestimate the direct ‘on the spot’ effects of parenting on child anxiety (e.g., Aktar et al., 2013b, 2014; Murray et al., 2008). That is, in our study paternal expressed anxiety was related to infants’ anxiety and avoidance, but maternal anxiety and both maternal and paternal encouragement were unrelated to infants’ anxious and avoidant responses to the visual cliff. It may be that when exploring a novel situation such as the visual cliff, infants rely more on their own observations than on signals from their parents.

Concerning the differential susceptibility theory (Belsky & Pluess, 2009), infants with an anxious temperament did not respond with less anxiety and avoidance to maternal and paternal encouraging signals than infants with a less anxious temperament. Thus, the results of our study do not confirm that infants with a high level of anxious temperament would benefit more from encouraging parenting signals than infants low in anxious temperament, as the differential susceptibility theory (Belsky & Pluess, 2009) predicts. Our results do partly support the diathesis-stress (Zuckerman, 1999) and vulnerability-stress (Ingram & Luxton, 2005; Nigg, 2006) models, stating that children high in BI would be especially vulnerable to adverse rearing environments. That is, for infants participating with their father, infant anxious temperament was a moderator in the association between paternal expressed anxiety and infant avoidance. The more anxious the temperament of the infant, the stronger the positive association between expressed anxiety of the father and infant’s avoidance of the cliff. However, this effect was not found for mothers and their infants. As anxious children display an attentional bias toward threat-related information (e.g., Puliafico & Kendall, 2006), they may interpret parental anxious signals more strongly than less anxious children, and as a result react with more avoidance of the cliff. The fact that this moderating effect was only found for infants and their fathers, and not for infants and their mothers, may be explained by the evolutionary-based role that fathers are assumed to play in helping their children overcome anxiety (Bögels & Perotti, 2011; Möller et al., 2013a) and was
supported by the study of Bögels et al. (2011). That is, especially when children have a predisposition for anxiety, they may benefit from a confident father, and are confirmed in their anxiety by an anxious father. A different explanation is that because of the generally lower expression of anxiety in males than in females (e.g., Rotter & Rotter, 1988; Wagner et al., 1993), it may have an increased frightening effect on children when fathers do show anxious behavior, as children do not expect their fathers to show anxiety, resulting in an increased avoidance of the anxious stimulus by the child.

For infants participating with their mother, it was found that infants with a more anxious temperament avoided the cliff less. This finding can be connected with the finding that the more anxious the temperament of an infant, the faster s/he crossed the cliff in the presence of her/his mother (see Table 2). Both these findings may be explained by the fact that infants with a high fearful temperament were ‘running’ to be with the mother. One could speculate that for infants who have an inhibited approach to novelty, being close to the mother is very important, pointing to an important role of the mother in calming anxious children. Proximity to the mother is an important indicator in the measurement of child behavioral inhibition (Kagan, Reznick, & Snidman, 1987). The calming role of mothers corresponds with the assumed different roles that fathers and mothers may have for their children (Möller et al., 2013a; Paquette, 2004). Mothers may be central in comforting and reassuring their children, and infants have indeed been found to seek their mother, more than their father, to be reassured in stressful situations (see Paquette, 2004). We know very little about possible differences in the relationship of the child with the mother versus the father in the face of novelty, and even less about the role of child temperament herein, and the results of the current study provide a valuable starting point.

Unexpectedly, although mothers and fathers did not differ significantly in their general level of encouragement, mothers displayed more intense facial expressions of encouragement than fathers during the visual cliff experiment. This finding conflicts with our hypothesis and the findings of a study of Ishak et al. (2007). These authors investigated mothers’ and fathers’ expectations and parenting choices about their infants’ crawling behaviors on different slopes and found that fathers were more likely to adopt challenge-orientated parenting choices than mothers. However, the fact that mothers smiled more than fathers is in line with the findings that women are in general more emotionally expressive than men (Kring & Gordon, 1998), and that mothers smile more at their infants than fathers (Aktar et al., 2013a). The larger amount of facial expressions of encouragement of mothers
in our study did, however, not affect infants’ crossing time and level of anxiety and avoidance. Infants did not cross the cliff faster or with less anxiety or avoidance with their mother than with their father.

Parental trait anxiety was not significantly associated with infants’ expressed anxiety and avoidance, which is in concordance with the study of Aktar et al. (2013b), in which parental anxiety disorders were also unrelated to infants’ expressed anxiety and avoidance during two social referencing tasks. Thus, it appears to be parental expressed anxiety (note: only paternal expressed anxiety, as maternal expressed anxiety was unrelated to infant expressed anxiety and avoidance in our study) in a specific situation in which parents have to guide their infant to approach novelty or overcome fear that is correlated with infants’ anxiety and avoidance, and not parents’ anxiety symptoms in their own lives. This suggests that if anxious or anxiety-disordered parents do not let their own fears interfere with their parenting, they thus do not transmit their anxiety to their child on the spot. Note in this regard that parents’ trait anxiety and expressed anxiety were uncorrelated. In general, there is very little evidence of parental trait anxiety being related to their parenting when interacting with their child. Van der Bruggen et al. (2008) found a meta-analytic effect size of only .08 between parents’ trait anxiety and parental control versus autonomy-encouragement, assumed to be an important form of an anxiety-enhancing parenting style. Clearly, we need to gain much more knowledge about if, when, and how parents’ own anxiety affects their behavior when guiding their child in novel situations.

Most visual cliff studies (e.g., Bolten & Schneider, 2010; Striano et al., 2006; Vaish & Striano, 2004) use crossing time as main outcome measure, with a longer crossing time indicating more anxiety of the infant. However, our results showed that although most infants with a high level of expressed anxiety indeed crossed the cliff slowly, a substantial number of infants high in expressed anxiety crossed the cliff quickly. Moreover, some infants who did not express much anxiety crossed the cliff slowly nonetheless. Thus, it seems that the association between infant expressed anxiety and time to cross the visual cliff is nonlinear. If this result is replicated, time to cross the cliff may not be the best measure to grasp infants’ level of anxiety and avoidance, in the presence of a parent standing on the other side of the cliff.

The results of this study should be interpreted with the following limitations taken into account. First, our sample was highly educated, possibly limiting the generalizability of our findings. For example, it might be that in lower educated samples, role differences between fathers and mothers are more pronounced.
Second, this study relied on a community sample of children and parents. Therefore, we do not know whether the results can be generalized to clinical groups of children and parents with anxiety disorders. Third, coders were not blind to the experimental condition (mother versus father encouraging), as coders were able to see or hear that a male or female was encouraging the child. However, coders were blind to the hypotheses of our study. Note also that interobserver reliability was high for both the parent and infant variables, and that different observers coded parent and infant behaviors, in order to ensure maximum objectivity in coding. Fourth, the level of parental expressed anxiety was quite low (parents scored between 0 and 1 on a 4-point scale ranging from 0 to 3). Although the level of parental expressed anxiety during the visual cliff experiment was low, parents who did not express any anxiety (scoring 0) and parents who expressed some anxiety (scoring 1) are clearly distinguishable. Regarding bodily expressions of anxiety, the posture of parents who did not express any anxiety (0) was relaxed, whereas the posture of parents who expressed some anxiety (1) was moderately tense. Concerning the facial expressions of anxiety, parents who did not express any anxiety (0) did not express any anxiety on their face, while parents who expressed some anxiety (1) showed mild signs of anxiety (for example, mildly dilated eyes, raising the eyebrows). With regard to verbal expressions of anxiety, parents who did not express any anxiety (0) used no verbal expressions of anxiety, whereas parents who expressed some anxiety (1) used mild forms of verbally anxious statements, that is: they spoke with a worried tone of voice. Thus, there was enough variance in the anxious behavior of the parents, which was also confirmed by the scatterplots showing the associations between maternal/paternal expressed anxiety and infant expressed anxiety and infant avoidance. Fifth, causality cannot be inferred from our results, as this was a cross-sectional correlational study in which parental behavior was not manipulated. The study was designed as such because this was the first visual cliff study with fathers and little is known about the effect of parents’ natural encouragement and anxiety on infants’ expressed anxiety and avoidance of the visual cliff. Future research should compare clinically anxious fathers and mothers with normal control fathers and mothers. In future visual cliff studies, parental behavior could be manipulated to compare whether happy/fearful expressions of fathers have a different effect on infant behavior during the visual cliff experiment than those of mothers.

Thus, reasoning from a father–infant direction of effects, it seems that fathers play a more important role than mothers in the transmission of anxiety in infants’ exploring of the visual cliff, particularly in infants with an anxious temperament. The clinical implication of this finding is that anxious signals from the father can maintain or
exacerbate fearful behavior of the child, whereas with non-anxious and confident behavior a father can teach his child that the world is safe. In this sense, fathers can act as a buffer against child anxiety. Reasoning from an infant-father direction of effects, it appears that infants evoke more anxiety in fathers than in mothers. Thus, it might be useful to guide fathers in how to cope with their child’s anxiety. In conclusion, the present study showed that social referencing processes between fathers and their infants differ from those between mothers and their infants.