

Parental social anxiety disorder prospectively predicts toddlers' fear/avoidance in a social referencing paradigm

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Background: Anxiety runs in families. Observational learning of anxious behavior from parents with anxiety disorders plays an important role in the intergenerational transmission of anxiety. We investigated the link between parental anxiety (parental lifetime anxiety disorders and expressed parental anxiety) and toddler fear/avoidance during social referencing (SR) situations. **Method:** Toddlers ($N = 117$) participated with both parents (with lifetime social anxiety disorder, other nonsocial anxiety disorders, lifetime comorbid social and other anxiety disorders, or without anxiety disorders) in a longitudinal study. Behavioral inhibition (BI) was measured at 12 months via observational tasks. At 30 months, children were confronted with a stranger and a remote-control robot in SR situations, separately with each parent. Children's fear and avoidance, and parents' expressions of anxiety, encouragement, and overcontrol were observed. **Results:** Toddlers of parents with lifetime social anxiety disorder (alone and comorbid with other anxiety disorders) showed more fear/avoidance in SR situations than toddlers of parents without anxiety disorders, while the effect of other anxiety disorders alone was not significant. Although expressed parental anxiety at 30 months in SR situations did not significantly predict toddlers' fear/avoidance, higher levels of expressed anxiety at 12 months in SR situations by parents with comorbid social and other anxiety disorders predicted higher levels of fear/avoidance. BI at 12 months predicted toddlers' fear/avoidance only with mothers, but not with fathers. **Conclusions:** Parental lifetime social anxiety disorders may be a stronger predictor of children's fear/avoidance than parents' expressions of anxiety in SR situations in toddlerhood. End of infancy may be a sensitive time for learning of anxiety from parents with comorbid lifetime social and nonsocial anxiety disorders in SR situations. Fathers are as important as mothers in the transmission of anxiety via SR. Furthermore, children may act relatively free of their early temperament in SR situations with fathers. **Keywords:** Social referencing, parental anxiety, father's role, behavioral inhibition.

Introduction

Anxiety aggregates in families, passing from generation to generation and putting children of anxious parents at risk for the development of anxiety disorders (Beidel & Turner, 1997; Turner, Beidel, & Costello, 1987). Genetic factors partially explain the intergenerational transmission of anxiety with moderate effect sizes (Eley, 2001; Hette- ma, Neale, & Kendler, 2001). Environmental factors also play an important role, both alone and in interaction with genetic predispositions (Fisak & Grills-Taquechel, 2007). In this study, we investigated the role of social referencing (SR) as an early mechanism for the transmission of anxiety from parents (with and without anxiety disorders) to toddlers.

Given the family aggregation of anxiety disorders and the prominent role of parents in the construction of the child's environment in early years, it is important to understand how children learn from parents who have anxiety disorders and who are highly likely to experience irrational fear in the presence of their child. From a learning perspective,

modeling (observational learning) of parental behavior may contribute to children's learning of anxiety from parents (Fisak & Grills-Taquechel, 2007; Murray, Creswell, & Cooper, 2009). Children of parents with anxiety disorders may adopt anxious responses and become fearful/avoidant, because they are frequently exposed to parental expressions of anxiety (Muris, Steerneman, Merckelback, & Meesters, 1996) and to avoidant coping strategies (Barrett, Rapee, Dadds, & Ryan, 1996). Furthermore, parental anxiety may impair parents' ability to positively reinforce (encourage) their child's attempts to approach novelty (Fisak & Grills-Taquechel, 2007; Murray et al., 2009) and is assumed to give rise to parental overcontrol, which increases child anxiety (Rapee, 2001). Meta-analytic studies report a medium effect size association between parental control and child anxiety (van der Bruggen, Stams, & Bögels, 2008; McLeod, Wood, & Weisz, 2007) and a low effect size association between parental anxiety disorder and parental control (van der Bruggen et al., 2008).

Considerable attention has been given to the role of child temperamental predispositions in the link between parental and child anxiety. Behavioral inhibition (BI) is a biologically based temperamental

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characteristic defined by fearful, withdrawn and avoidant responses to ambiguity (Fox, Henderson, Marshall, Nichols, & Ghera, 2005; Kagan & Snidman, 1999). Highly inhibited children are more likely to develop anxiety disorders (Rosenbaum et al., 1993), especially social anxiety (Clauss & Blackford, 2012) than those with low BI, and are more likely to have parents with anxiety disorders (Rosenbaum et al., 1991). Furthermore, as stated by diathesis stress (Zuckerman, 1999) and vulnerability-stress models (Ingram & Luxton, 2005; Nigg, 2006), temperamental traits may constitute a predisposition to the effects of adverse rearing environments, and thereby to the development of psychopathology. Thus, infant BI may moderate the link between child and parental anxiety, rendering highly inhibited infants more vulnerable to the effects of anxious modeling and thereby to the development of anxiety disorders (Degnan, Almas, & Fox, 2010).

As infants begin to use SR at the end of the first year, they start to utilize adults' emotional signals and behaviors to determine how to behaviorally and emotionally respond in ambiguous/novel situations (Feinman, 1982; Feinman, Roberts, Hsieh, Sawyer, & Swanson, 1992). In early experimental studies of SR, affective messages provided by adults (most often mothers) in the face of ambiguity in SR situations have been manipulated to investigate its effect on infant behavior (Feinman et al., 1992). The novel stimuli utilized in these studies, were most often a robot toy (e.g. Blackford & Walden, 1998; Walden & Ogan, 1988); a stranger (e.g. Feinman & Lewis, 1983), or visual cliff (e.g. Sorce, Emde, Campos, & Klinnert, 1985). The findings from these studies support the idea that infant behavioral and affective reactions change in line with the affective and behavioral state expressed by parents (for a review see Feinman et al., 1992). More recently, scientific interest has grown on how parents with anxiety disorders may contribute to infants' learning of anxiety and avoidance via social referencing in daily life. At around the same time as SR, infants start to show increased wariness to unfamiliar people (Sroufe, 1977). The coemergence of stranger wariness and SR at the end of infancy, has raised the question of whether this time is a sensitive period for the learning of social anxiety, especially for children of parents with social anxiety disorder and/or highly inhibited children (Murray et al., 2008; de Rosnay, Cooper, Tsigaras, & Murray, 2006).

Studies investigating learning of anxiety from parents via SR at the end of infancy consistently reveal an important role of the interplay between infants' BI and parental anxiety in determining infant avoidance in response to novelty. However, the precise learning mechanism for how these factors work together is unclear. Murray et al. (2008) found that highly inhibited infants who had a mother with social anxiety disorder (SAD) became more avoidant from 10 to 14 months in a social SR

task. In this task, a female stranger engaged the parent in a 2-min conversation while the infant was watching, and subsequently approached the infant, and picked him/her up. The effect was accounted for by less encouragement from mothers with SAD to highly inhibited infants. Additionally, it has recently been shown that 12-months-old infants' level of BI and their parents' expressed anxiety during SR tasks interact to predict infants' avoidance behavior in SR situations (Aktar, Majdanžić, de Vente, & Bögels, 2013). This link is such that moderate-to-highly inhibited infants with parents who expressed moderate-to-high levels of anxiety during SR were more avoidant. Contrary to Murray et al. (2008), parental encouragement did not account for this interaction. Notably, parental anxiety diagnoses did not predict infants' fear or avoidance behavior, indicating that at 12 months, parents' expressions of anxiety in the situation are more influential than their lifetime anxiety diagnoses. This finding is complemented by an experimental SR study (de Rosnay et al., 2006) where the expressions of parental anxiety were manipulated to be anxious or nonanxious. The interplay between 12-to-14 month-old infants' BI and maternal expressions of anxiety was found to predict increased infant avoidance in the anxious condition. This finding provides strong confirmation of a causal role for mothers' anxious messages about strangers on children's avoidance behavior in infancy, an effect moderated by an infant's level of BI.

The studies investigating how children learn from parents with anxiety disorders via SR have been conducted at an age where infants' SR behavior is assumed to be most 'salient' (i.e., 10–14 months; Emde, 1992). According to Feinman et al. (1992), children's reactions in SR situations closely match parental reactions in this period, indicating that parental appraisals of the situation have a direct influence on infants' reactions to novelty. Much less is known about how parental anxiety links to children's fear/avoidance in SR situations later in development, for example in toddlerhood. Early studies with toddlers of healthy mothers have revealed that as children gain more experience in dealing with novelty in the environment, the effect of parental reactions on children's reactions in SR situations becomes more complex and indirect (see Feinman et al., 1992). Although parents' influence may change as children grow older and build confidence in approaching novel situations, it is likely that parents still have a pronounced role in constructing toddlers' environment, particularly for behaviorally inhibited children who have more difficulty in approaching novel situations.

Moreover, the role of fathers in SR has been rarely studied. Nevertheless, recent models on the development of anxiety (e.g., Bögels & Perotti, 2011; Bögels & Phares, 2008) assign fathers a unique and essential role in the development of anxiety

based on their greater evolutionary experience in exploring the external world. It was recently found that fathers' expressed anxiety in SR situations is as influential as mothers' at 12 months (Aktar et al., 2013). In view of an increasing number of encounters with the external world from infancy to toddlerhood, it may be hypothesized that father's role becomes more influential as children grow older (Bögels & Perotti, 2011; Bögels & Phares, 2008).

The majority of SR studies on anxiety have been conducted with parents with and without SAD in social SR paradigms (e.g., Murray et al., 2008; de Rosnay et al., 2006), whereas the effect of other types of parental anxiety disorders or of other contexts is not well understood. Thus, it is not clear whether the transmission of anxiety is diagnosis or context specific. That is, does it only occur when a parent has SAD, or also when the parent has another anxiety disorder or no anxiety disorder? Additionally, is the transmission specific to social situations, or does it also occur in nonsocial SR situations? The inclusion of a nonsocial SR situation in addition to a social SR situation, enables the assessment of child reactions and parental dynamics via SR in a more comprehensive manner in typical SR contexts, and allows the investigation of context-specificity in the transmission of anxiety. In a recent study addressing these questions with social and nonsocial SR tasks at 12 months, we found that parental expressions of anxiety may influence infant reactions in response to both social and nonsocial types of novelty, and from parents with and without lifetime anxiety diagnoses indicating that the transmission occurs similarly in social and nonsocial contexts, and independent of parental anxiety disorders (Aktar et al., 2013).

In the present study, we observed toddlers' reactions to ambiguous stimuli in SR situations at 30 months, to address the following issues: First, based on previous findings (Aktar et al., 2013; Murray et al., 2008) we expected toddlers to be more fearful/avoidant if their parents had an anxiety disorder (parental trait anxiety), and/or if their parents expressed higher levels of anxiety in SR situations (parental state anxiety). Second, we investigated the role of both parents by having toddlers participate to both SR tasks once with their mother and once with their father, thus with both their parents separately. Based on theories about the importance of father's role in the prevention or maintenance of child anxiety (e.g. Bögels & Perotti, 2011; Bögels & Phares, 2008; Möller, Majdandžić, de Vente, & Bögels, 2013), and on previous evidence (Aktar et al., 2013), we hypothesized that fathers are at least as important referees as mothers in SR situations. Third, we included an early measure of child temperament to explore whether children who showed high BI at 12 months (trait anxiety) were more fearful/avoidant in SR situations at 30 months.

Furthermore, based on vulnerability models, we explored the effect of the interplay between parents' expressed anxiety and children's early BI on their fear/avoidance at 30 months. Fourth, we explored anxiety subtype and context specificity in the transmission of anxiety by confronting toddlers of parents without anxiety disorders, with social anxiety disorder, with other types of nonsocial anxiety disorders and with comorbid social and nonsocial types of anxiety disorders in one social and one nonsocial SR context.

Method

Participants

The present sample consisted of 117 couples with their 30 month-old toddler (64 girls, 53 boys). The families are participants of an ongoing longitudinal study on social development. Testing phases have included a prenatal (see below), a 4-month (not used in this study), a 12-month (Aktar et al., 2013), and a 30-month measurement. Sociodemographic characteristics of the parents are presented in Table 1. The study was approved by the ethics committee of the University of Amsterdam. Parents provided informed consents for participation.

Materials and procedure

At 30 months, toddlers visited the lab twice, once with their father ($n = 115$), and once with their mother ($n = 117$) (53% of toddlers visited with mother first and 47% with father first.) and completed both the social and the nonsocial SR tasks at each visit. Thus, each toddler completed the social and the nonsocial SR task once with each of his/her parents. The order of the visits was included in the analyses to control for learning effects. BI tasks were

Table 1 Sociodemographic characteristics of the sample

	Mothers	Fathers
Age <i>M (SD)</i>	33.98 (4.34)	34.02 (4.18)
Dutch origin	90.60%	94.02%
Educational level ^a <i>M (SD)</i>	7.07 (1.12)	6.63 (1.57)
Professional level ^b <i>M (SD)</i>	8.69 (2.14)	8.24 (2.67)
Current working status (%)		
HK	2.56	0.86
PT	76.06	23.93
FT	5.98	64.10

M, mother; F, father; HK, house keeper; PT, part-time; FT, full time.

^aParental educational level was assessed with an 8-point scale (1 = primary education, 4 = higher secondary education, 8 = university).

^bParental professional level was assessed with an 11-point scale (1 = manual labor for which no education is required, 5 = white-collar work at primary or secondary professional education level and not in an executive function, 11 = labor for which a university degree is required).

administered at the 12-month measurement occasion.

Parental anxiety status

Parents' current and lifetime anxiety disorder status was measured via the Anxiety Disorder Interview Schedule (ADIS; Di Nardo, Brown, & Barlow, 1994) at the prenatal measurement by four experienced interviewers. A trained psychologist recoded 10% of the interviews. Inter-interviewer agreement for all ADIS diagnoses (based on the presence/absence of each anxiety disorder) ranged from 90% to 100% for each anxiety disorder with a mean of 97.55% ($SD = 2.95$).

Each parent was assigned to the following four groups based on his/her current and lifetime anxiety diagnoses: 'SAD' ($n = 43$, 21 mothers and 22 fathers), 'other types of nonsocial anxiety disorders' ($n = 34$, 20 mothers and 14 fathers), 'comorbid social and other nonsocial type(s) of anxiety disorders' ($n = 53$, 32 mothers and 21 fathers) and 'no anxiety disorder' ($n = 104$, 44 mothers, and 60 fathers).

BI tasks

The toddler's level of BI was assessed at the 12-month measurement occasion via 11 well-known BI laboratory tasks (Calkins, Fox, & Marshall, 1996; Goldsmith & Rothbart, 1996; Kochanska, Coy, Tjebkes, & Husarek, 1998; Rothbart, 1988). Details on procedures and coding can be found in Aktar et al., 2013. For each BI task, several indices of infant behavior were coded such as facial, bodily and vocal fear, escape, and latency until the first fear reaction (see Goldsmith & Rothbart, 1996). The BI score was a standardized average across these behaviors (see Aktar et al., 2013). Average interobserver reliability of BI tasks was .83, $SD = .11$.

SR tasks

Social SR task. The parent and toddler were seated at a low table in a way that enabled the toddler to see the parent–stranger interaction. In phase I, a female stranger entered the room, sat on a sofa 2 m away from the table, and engaged the parent in a 2-min conversation about his/her daily activities with his/her child. In phase II, the stranger explained to the parent that she would like to read a book with the toddler on the sofa and asked the parent to inform the toddler. In phase III, the parent asked the toddler to join the stranger on the sofa. This phase terminated when the child sat next to the stranger. If the toddler was unwilling to approach the stranger, the parent and the stranger encouraged the child. If the toddler did not approach the stranger, the stranger moved to be next to the toddler to read the story. In phase 4, the stranger read stories to the child for 2 min from a colorful book. The stranger maintained

a neutral but friendly attitude towards the toddler and the parent. Different strangers conducted the task during the mother and father visits.

Nonsocial SR task. A remote-control robot dog was placed 2 m from the toddler and displayed a pattern of movements and noises. Parents were instructed to remain neutral in phase I, to talk about the robot in phase II, and to actively encourage the toddler to approach the robot in phase III. Two different robot dogs were counterbalanced between the mother and father visits. We expected the nonsocial SR task to inherently evoke more intense negative reactions from toddlers than the social task due to differences in previous exposure. By 30 months, children would have already gained some experience in interacting with strangers in daily life. The robot dog however, was less likely to be familiar, and therefore more likely to trigger negative reactions. To minimize potential dropouts due to intense negative reactions to the robot, the order of SR tasks was kept fixed, with the social task first and then the nonsocial task.

A previously used coding scheme was adapted and used to code the toddler and parent behavior (see Aktar et al., 2013; Murray et al., 2008). All the behaviors were coded on 5-points scales unless stated otherwise.

Parent behavior during SR tasks.

1. Expressed parental anxiety was based on facial (e.g. anxious, frozen faces), bodily (e.g. fidgeting, rigid posture) and verbal expressions of anxiety.
2. Parental encouragement (3-point scale) involved encouragement of toddler's positive engagement with the stranger and of approach to the robot through smiles, looks or simple comments.
3. Parental overcontrol involved attempts to control or intervene (e.g. interfering in the stranger-toddler interaction during the social task, or controlling toddler's attempts to explore the robot in the nonsocial task).

Toddler behavior during SR tasks.

1. Toddler fear was based on facial (e.g. wide eyes, cry face), bodily (e.g. sunken-in posture, decrease in activity) and vocal (nonverbal e.g. whining, crying, and verbal, e.g. 'go away!') expressions of fear.
2. Toddler avoidance involved behaviors such as looking/turning away, hiding behind the parent or refusing to approach the stimulus.
3. Toddler baseline negativity was based on facial, bodily, and vocal expressions of negative emotional tone. It was rated in the last minute before the task started and used as a control variable.
4. Toddlers' looks at the parent were counted and served as a preliminary measure of the extent to which social referencing occurs during the tasks.

For the coding, each phase was divided into time intervals and final scores of each behavior were obtained by averaging scores across intervals. Two pairs of observers were trained to code either the toddler's or the parent's behavior. Observers were blind to parents' diagnostic status and toddlers' BI.

Inter-observer reliability for parent and toddler variables was good (intraclass correlations: parental anxiety .88, parental encouragement .85, parental overcontrol .95, toddler fear .93, toddler avoidance .93, toddler baseline negativity .99, and looks at the parent .97).

Preliminary analyses

The families in the present sample had participated in similar social and nonsocial SR tasks previously at the 12-months measurement occasion (reported in Aktar et al., 2013). First, the correlations between the scores at 12 and 30 months were computed separately per task and parent. The two-tailed significance of the associations was inspected at $p \leq .05$. The associations of child fear and avoidance scores between 12 and 30 months were not significant, implying that children's behavior in SR situations at 30 months could not be predicted by their behavior at 12 months. Therefore, we separately analyzed the data for 30 months, and excluded infants' fear and avoidance at 12 months from further analysis. On the other hand, parental expressions of anxiety showed some stability from 12 to 30 months: there were modest but significant positive associations between expressions of parental anxiety at 12 and 30 months, with the exception of mothers in the social SR task (Pearson correlations for the significant effects, were: $r = .20$, $p = .045$ for mothers in the nonsocial SR task, and $r = .30$, $p = .001$ and $r = .24$, $p = .014$ for fathers in the social and the nonsocial SR tasks, respectively). None of the associations between parenting at 12 and 30 months were significant, with the exception of maternal overcontrol in the social SR task ($r = .30$, $p = .001$). The lack of associations in parenting variables between 12 and 30 months suggests that parenting dynamics may change over time as child capabilities change and as parents gain more experience in adapting to their child's behavior in the toddlerhood years.

Correlations between child fear and avoidance were highly positive at 30 months ($r = .59$ and $.73$ for measurement with the mother and $.62$ and $.81$ for measurement with the father in the social and nonsocial tasks, respectively, all $p < .001$), indicating that expressions of fear and avoidance co-occur frequently at 30 months. Therefore, fear and avoidance were aggregated into a single variable.

The raw associations between observed parental expressions of anxiety and parenting variables at 30 months revealed that the correlations of expressed parental anxiety with parental encourage-

ment were only significant and negative in the nonsocial SR task: ($r = -.20$, $p = .037$, for mothers and $r = -.37$, $p < .001$, for fathers, respectively), whereas none of the associations between expressed parental anxiety and parental overcontrol were significant. The negative association between parents' encouragement and expressed parental anxiety supports the idea that parental anxiety can impair parents' ability to encourage their child to approach the robot, while parental overcontrol seems to be unrelated to the expressions of parental anxiety.

Statistical analyses

Hypotheses were tested with fixed-effects multilevel regression models consisting of the toddler, and the observations (repeated in *social and nonsocial* SR tasks and with *mothers and fathers*) as levels. The significance of the effects was inspected at $p \leq .05$. Scores on continuous outcome and predictor variables were standardized. Parental anxiety disorders were dummy coded with parents without anxiety disorders as the reference group. Expressed parental anxiety, parental encouragement, parental overcontrol as well as toddler's BI and looks at the parent at 30 months were entered as continuous variables. As toddlers were neutral in the majority of the cases, baseline negativity was dichotomized (0: neutral, 1: negative).

Predicting expressed parental anxiety at 30 months. Expressed parental anxiety was analyzed with a main effects model that included parental lifetime anxiety disorders (i.e. lifetime parental social, nonsocial, and comorbid social and nonsocial anxiety disorders), parent gender, and task.

Predicting toddler fear/avoidance at 30 months. Toddler fear/avoidance was analyzed first with a main effects model including order of the visits (first visiting parent vs. second visiting parent), toddler baseline negativity, parent gender, task, toddler gender, parental lifetime anxiety disorders, expressed parental anxiety, parental encouragement and BI as predictors. Theoretically relevant interactions were then added one-by-one. Interaction terms were kept in the model or removed based on likelihood ratio tests and *t*-tests.

First, the interaction between parent gender and toddler gender was tested to investigate whether toddler expressions of fear/avoidance differed between mother and father visits and between boys and girls. Second, the interaction between parent gender and children's BI was tested to investigate whether fear/avoidance differed across mothers and fathers based on the infants' level of BI. Third, the interactions between parent gender and expressed parental anxiety, between parent gender and parental encouragement, and between parent gender and

parental overcontrol were tested to investigate whether the associations of toddler fear/avoidance with parental behavior differ between mothers and fathers. Fourth, the interaction between expressed parental anxiety and BI at 12 months was included to test the vulnerability models predicting a larger influence of parental anxiety on highly inhibited children. Next, we tested the interactions of parenting variables with BI to explore whether the associations of parental overcontrol and of parental encouragement with child fear/avoidance differ across BI levels. Finally, the interaction between expressed parental anxiety and type of task was included to test the context specificity in the transmission of anxiety.

Results

Main analyses

Predicting expressed parental anxiety at 30 months. The main effects model explained 18% of the variance in expressed parental anxiety and revealed that parents with lifetime social ($\beta = .33$, $SE = .14$, $p = .021$) and comorbid social and nonsocial anxiety disorders ($\beta = .36$, $SE = .13$, $p = .007$) expressed more anxiety during SR situations than parents without anxiety disorders. Parents expressed more anxiety in the social SR task than in the nonsocial SR task ($\beta = -.78$, $SE = .06$, $p < .001$). Mothers and fathers expressed similar levels of anxiety in the SR situations.

Predicting toddler fear/avoidance at 30 months with parental behavior at 30 months. The standardized parameter estimates, standard errors and p -values for the toddler fear/avoidance model are shown in Table 2. Looks at the parent and parental overcontrol, were initially included in the models but neither the main effects of these variables, nor their interactions with parent gender and with early BI

reached significance. As these variables did not predict child fear/avoidance in any of the models, they were not considered further.

Among theoretically relevant interactions that were tested, only the interaction between parent gender and infant BI improved the fit of the model and was included. In view of the main effects of lifetime parental social, and comorbid social and nonsocial anxiety diagnoses, we additionally explored the two-way interactions of parental anxiety diagnoses with parent gender, and with BI in subsequent steps. None of these effects were significant.

The final model explained 19% of the variance in toddler fear/avoidance, and revealed that toddlers of parents with SAD [alone ($\beta = .22$, $SE = .10$, $p = .025$) or comorbid social and nonsocial anxiety disorders ($\beta = .21$, $SE = .10$, $p = .039$)] showed higher levels of fear/avoidance than toddlers of parents without anxiety disorders. Parental diagnoses of other nonsocial anxiety disorders alone did not significantly predict toddlers' fear/avoidance. Expressed parental anxiety did not significantly predict toddlers' fear/avoidance -also when parental lifetime anxiety diagnoses were excluded from the model-. Toddlers were more fearful/avoidant in the nonsocial SR task than in the social SR task ($\beta = .65$, $SE = .11$, $p < .001$). Higher levels of parental encouragement were marginally associated with *higher* levels of toddlers' fear/avoidance ($\beta = .08$, $SE = .04$, $p = .054$). The plot of the significant interaction between parent gender and BI ($\beta = -.13$, $SE = .06$, $p = .015$) revealed that higher levels of BI at 12 months predicted higher levels of fear/avoidance at 30 months in the mother's visit, whereas early BI had a negligible impact on toddler fear/avoidance in the father's visit. Inspection of confidence bands (continuously plotted confidence intervals) for the simple outcome slope across levels of BI at 12 months revealed that this effect was more pronounced for children with low-to-moderate levels of BI.

Post-hoc analyses

Predicting toddler fear/avoidance at 30 months with parental behavior at 12 months. To investigate early learning mechanisms that may explain the current findings in the model, we additionally explored the longitudinal effects of parental behavior in SR tasks at 12 months on toddlers' fear/avoidance at 30 months. We included the standardized average scores of expressed parental anxiety and parental encouragement (observed at 12 months in similar SR situations with a similar protocol, see Aktar et al., 2013) as predictors in the fear/avoidance model (Table 2). Parental overcontrol showed little variance at 12 months, therefore we excluded this variable from further analysis.

First, to investigate the prospective associations of parental encouragement at 12 months with child fear/avoidance at 30 months, we included the main

Table 2 Parameter estimates for the multilevel model of toddler fear/avoidance

Parameter	β	SE	p
Intercept	-.39	.11	<.001
Order of the visits (0: first visiting parent, 1: second visiting parent)	-.18	.06	.001
Toddler baseline negativity (0: no, 1: yes)	.31	.14	.025
Parent gender (0: mother, 1: father)	.14	.06	.017
Task (0: social, 1: nonsocial)	.65	.11	<.001
Toddler gender (0: girl, 1: boy)	-.06	.12	.635
Parent lifetime social anxiety disorder	.22	.10	.025
Parent lifetime other anxiety disorder(s)	-.06	.11	.613
Parent lifetime comorbid social and other anxiety disorder(s)	.21	.10	.039
Expressed parental anxiety	.01	.04	.813
Parental encouragement	.08	.04	.054
Behavioral inhibition (BI)	.12	.06	.055
Parent gender \times Infant BI	-.13	.06	.015

effect of parental encouragement at 12 months in the final toddler fear/avoidance model. This association was not significant. Second, to see whether the association between parental encouragement at 12 months and toddlers' fear/avoidance at 30 months differs between mothers and fathers, and across levels of BI, two-way the interactions of parent gender and of infant BI with parental encouragement were subsequently entered one-by-one in the model. None of these interactions were significant, indicating that toddlers' fear/avoidance at 30 months was not predicted by parental encouragement at 12 months, neither alone nor as a function BI or parent gender.

Furthermore, the association between expressed parental anxiety at 12 months and toddlers' fear/avoidance at 30 months was tested to investigate whether parents' anxious behavior at this potentially sensitive time for learning via SR has an effect on child fear/avoidance in similar SR situations at 30 months. First, the main effect of expressed parental anxiety at 12 months was included in the final fear/avoidance model at 30 months. The effect was not significant. Second, to test whether the association between expressed parental anxiety at 12 months and child fear/avoidance at 30 months changes as a function of task, we included the interaction of expressed parental anxiety at 12 months with task, this effect was also not significant. Third, based on vulnerability models, we tested whether the association between expressed parental anxiety at 12 months and child fear/avoidance at 30 months changes as a function of BI by including the interaction of expressed parental anxiety at 12 months with BI in the model; this effect was also not significant. Finally, to test whether the associations between expressed parental anxiety at 12 months and child fear/avoidance at 30 months change as a function of parental lifetime anxiety disorder, we included the two-way interactions of expressed parental anxiety at 12 months with parental lifetime diagnoses of social, nonsocial, and comorbid social and nonsocial anxiety disorders in the final fear/avoidance model. Only the interaction between parental lifetime comorbid social and other anxiety disorders, and expressed parental anxiety at 12 months ($\beta = .20$, $SE = .09$, $p = .026$) revealed a significant association. Inspection of the interaction plot revealed that higher levels of expressed anxiety by parents with comorbid social and other anxiety disorders at 12 months predicted higher levels of child fear/avoidance at 30 months, while this association was not significant for toddlers of parents without anxiety diagnoses. Inspection of confidence bands (continuously plotted confidence intervals) for the simple outcome slope across levels of expressed parental anxiety revealed that the effect of comorbid lifetime parental anxiety disorders was more pronounced for toddlers of parents who expressed moderate-to-high levels of anxiety in SR situations at 12 months.

The model after the inclusion of this interaction ($N = 112$) is presented in Table 3. The interaction between parent gender and infant BI was marginally significant ($\beta = -.11$, $SE = .06$, $p = .057$) and the association between parental encouragement and fear/avoidance was significant ($\beta = .10$, $SE = .04$, $p = .026$) after the inclusion of the interaction between comorbid social and other nonsocial anxiety diagnoses and expressed parental anxiety at 12 months in the model, and the remaining effects were similar to the model presented in Table 2.

Finally, we further explored the possibility that the positive association between the expressions of parental anxiety by parents with comorbid social and other anxiety disorders at 12 months and toddlers' fear/avoidance at 30 months is explained by higher severity of lifetime parental anxiety disorders in the comorbid social and other anxiety disorders group (than lifetime other anxiety disorder(s) only, and than social lifetime anxiety disorder only groups). As an index of severity, we used the sum of parents' interference scores for each anxiety diagnosis. First, we compared severity across the three parental anxiety disorder groups (i.e. parental lifetime social anxiety disorders, parental other nonsocial anxiety disorder(s) and parental comorbid social and nonsocial anxiety disorders) with a one way between-subjects ANOVA which revealed a significant effect of parental anxiety disorder group on severity $F(2, 125) = 43.97$, $p < .001$, $\eta^2_p = .41$. Pairwise comparisons revealed that the severity was significantly higher in comorbid social and other nonsocial anxiety disorders group ($M = 14.92$, $SD = 5.50$), while there was no significant difference

Table 3 Parameter estimates for the multilevel model of toddler fear/avoidance after the inclusion of the interaction between parental lifetime comorbid anxiety disorders and expressed parental anxiety in SR at 12 months

Parameter	β	SE	p
Intercept	-.40	.11	<.001
Order of the visits (0: first visiting parent, 1: second visiting parent)	-.20	.06	.001
Toddler baseline negativity (0: no, 1: yes)	.30	.15	.043
Parent gender (0: mother, 1: father)	.15	.06	.018
Task (0: social, 1: nonsocial)	.60	.11	<.001
Toddler gender (0: girl, 1: boy)	.00	.11	.982
Parent lifetime social anxiety disorder	.21	.10	.045
Parent lifetime other anxiety disorder(s)	-.05	.12	.685
Parent lifetime comorbid anxiety disorders	.20	.10	.061
Expressed parental anxiety at 12 months	-.02	.06	.749
Expressed parental anxiety at 30 months	-.01	.04	.910
Parent lifetime social anxiety disorder x Expressed parental anxiety at 12 months	.01	.10	.943
Parent lifetime other anxiety disorder(s) x Expressed parental anxiety at 12 months	-.13	.12	.283
Parent lifetime comorbid anxiety disorders x Expressed parental anxiety at 12 months	.20	.09	.026
Parental encouragement at 30 months	.10	.04	.026
Behavioral Inhibition (BI)	.09	.06	.158
Parent gender x Infant BI	-.11	.06	.057

in severity between social anxiety disorder group ($M = 5.74$, $SD = 2.34$), and other anxiety disorder(s) group ($M = 7.53$, $SD = 6.52$). Second, we included the severity scores in the multilevel model (presented in Table 2) as a predictor of toddlers' fear/avoidance at 30 months in SR situations, after removing parental anxiety diagnoses. There was a positive association between parents' anxiety disorder severity and toddlers' fear/avoidance ($\beta = .09$, $SE = .04$, $p = .040$). The association between parental encouragement and of toddlers' fear/avoidance was not significant in this model, while the remaining effects were similar to the model presented in Table 2.

Discussion

This study investigated the links between parental trait anxiety (lifetime anxiety disorders), parental state anxiety (observed expressed anxiety at 12 and 30 months in SR situations) and toddlers' fear/avoidance in SR situations at 30 months, and explored the influence of early temperamental dispositions of child trait anxiety (i.e. BI measured with observational tasks at 12 months) as well as of current and previous parenting behavior in SR tasks (i.e. parental encouragement at 12 and 30 months and parental overcontrol at 30 months).

The central finding is that toddlers' fear/avoidance in SR situations was predicted by parental anxiety disorder rather than by expressed parental anxiety in the SR situations at 30 months. Note that this was specifically the case for social anxiety disorder, as children of parents with SAD diagnoses (with and without other nonsocial comorbid anxiety diagnoses) were more fearful/avoidant than children of parents without anxiety diagnosis, whereas children of parents with other nonsocial anxiety diagnoses alone expressed similar levels of anxiety as children of parents without anxiety diagnosis. Parental diagnosis of SAD (with and without other nonsocial comorbid anxiety diagnoses) also predicted higher levels of expressed parental anxiety compared to parents without anxiety diagnosis in the SR situations. These findings suggest that parental lifetime social anxiety diagnosis increased both the parents' and the toddlers' anxiety in novel situations.

Although at 30 months, expressed parental anxiety did not significantly predict child fear/avoidance in the SR tasks, higher levels of expressed parental anxiety at 12 months by parents with lifetime comorbid social and other anxiety diagnoses, predicted higher levels of child fear/avoidance at 30 months. The positive association implies that these children may have already learned to be anxious in SR situations from their parents at 12 months. That is, children of parents with comorbid social and other anxiety disorders may have already internalized parental responses to novel stimuli at 12 months, and, as a result, they may rely on their own judgment (that seems to include parents' previ-

ously expressed anxiety) rather than on their parent's current behavior. Additional checks on the predictive role of severity of parental lifetime anxiety disorder(s) revealed that this longitudinal effect of expressed parental anxiety by comorbid parents may be explained by a significantly higher severity of anxiety disorders in parents with comorbid social and other anxiety disorders. These findings provide preliminary support for the idea that the end of first year may be a sensitive period for learning of anxiety via SR from parents with comorbid social and nonsocial lifetime anxiety diagnoses.

The finding that expressed parental anxiety at 12 months did not significantly predict toddler fear/avoidance for toddlers of parents with lifetime social anxiety disorder only or with nonsocial anxiety disorder(s) only, has raised the question of whether the transmission of anxiety at 12 months is only happening from parents with relatively more severe forms of parental anxiety disorders. The severity analyses revealing significantly higher severity in parents with comorbid social and other nonsocial anxiety disorders confirmed this idea in the current sample. The longitudinal effects of learning via SR at 12 months on children's fear/avoidance at later ages remain to be studied.

In contrast to the hypothesized vulnerability of highly inhibited infants (e.g. Ingram & Luxton, 2005; Nigg, 2006; Zuckerman, 1999), the interplay of infants' BI with parental (trait and state) anxiety, did not predict toddler fear/avoidance at 30 months. Interestingly, BI at 12 months prospectively predicted toddler fear/avoidance in SR situations at 30 months with mothers but not with fathers, indicating a differential influence of early temperamental predispositions on fear/avoidance in the presence of mother versus father. It seems that with their mother, toddler's reactions to novelty were more consistent with their early temperamental predispositions, whereas with their father, toddlers seemed to respond relatively free of their early temperamental predispositions. Thus, it can be speculated that fathers' presence stimulates their toddlers to approach novel, ambiguous situations without a priori hesitance, consistent with their hypothesized role of stimulating exploration (Bögels & Perotti, 2011; Bögels & Phares, 2008).

With respect to the influence of mothers versus fathers in SR at 30 months, no other difference was observed between mothers' and fathers' effects during SR situations. The associations of child fear/avoidance with parental state and trait anxiety did not significantly differ across parents, indicating that in toddlerhood (like in infancy, Aktar et al., 2013), fathers are as important as mothers. No support was found for the idea that fathers' expressed anxiety may be *more* influential than mothers' as children get older (Bögels & Perotti, 2011; Bögels & Phares, 2008) in toddlerhood. The lack of gender differences in toddlers' expressions of

fear/avoidance and in parents' anxiety indicate that SR processes operate similarly across parent and child gender at this age, in line with our previous findings at 12 months (Aktar et al., 2013).

The present findings suggest that the transmission of anxiety in SR situations is not context specific. The interplay of expressed parental anxiety at 12 and 30 months with task (social vs. nonsocial) did not significantly predict child fear/avoidance indicating a lack of differential effects of expressed parental anxiety on children's fear/avoidance across SR tasks.

Higher levels of parental encouragement were associated with *more* fear/avoidance in the SR situations in the regression models. This is inconsistent with previous evidence on maternal encouragement predicting lower avoidance at 14 months (Murray et al., 2008), but consistent with the negative association we found at 12 months between child avoidance and parental encouragement (Aktar et al., 2013). Because parents were asked to actively encourage their child to approach the stimuli, the likely explanation is that fearful/avoidant children needed – and received – more encouragement. Note that although parental encouragement is associated with more child fear/avoidance on the spot, it may help children overcome fears of novelty in the long term. In contrast with previously reported meta-analytic associations between overcontrolling parenting and child anxiety (van der Bruggen et al., 2008; McLeod et al., 2007), in the present study parental overcontrol at 30 months was unrelated to toddlers' fear/avoidance. However, keep in mind that very few studies have examined this association at this age. The lack of association between parental state anxiety and overcontrol is, however, in accordance with the low meta-analytic effect size reported by van der Bruggen et al. (2008). Post-hoc analyses on the prospective effect of parents' encouraging behavior at 12 months on child fear/avoidance at 30 months did not reveal any significant associations, indicating that child reactions at 30 months were unrelated to previous parental encouragement in SR contexts. To conclude, our findings do not support the generally held idea that parents transmit their anxiety to their children through overprotective or lack of encouraging parenting, neither cross-sectionally nor longitudinally. However, higher levels of previously expressed anxiety during SR tasks by parents with lifetime comorbid social and other anxiety disorders did predict higher levels of anxiety/avoidance at 30 months, suggesting that social referencing in infancy, contributes to the intergenerational transmission of anxiety in children of parents with comorbid social and other anxiety disorders.

The findings should be interpreted with consideration of the following limitations. First, measures of parental anxiety diagnoses were obtained in the prenatal assessment, thus information on parents' current diagnostic status was not available. Still, the

findings revealed that prenatal diagnostic anxiety status prospectively predicts child behavior in SR situations. Second, a concurrent measure of BI was not available at 30 months. The existing literature on the stability of temperament suggests that BI may be relatively less stable from infancy to toddlerhood (e.g. Lemery, Goldsmith, Klinnert, & Mrazek, 1999), and more stable from toddlerhood onwards (Fox et al., 2005). Still, higher levels of BI at 12 months predicted higher levels of fear/avoidance with mothers, suggesting that with mothers, toddlers rely on their early temperamental predisposition in approaching novel situations. Third, because the order of SR tasks was fixed, potential carryover effects couldn't be excluded. Fourth, families were from a relatively higher socioeconomic background than the general population, limiting the generalizability of the findings.

Conclusions

The findings of the present study investigating toddlers' and parents' behavior in SR situations provide evidence that social anxiety aggregates in families. Children of parents with lifetime SAD (both alone and comorbid with other anxiety disorders) showed higher levels of fear/avoidance in response to novelty in SR situations than children of parents without anxiety disorder. Although parents with lifetime SAD expressed more anxiety during the SR situations, expressed parental anxiety at 30 months was not associated with child fear/avoidance, indicating that in toddlerhood, anxiety may not be (any longer) transmitted via SR. Expressed parental anxiety at 12 months by parents with comorbid lifetime social and other nonsocial anxiety diagnoses did predict children's fear/avoidance significantly at 30 months, indicating that end of first year may be an especially sensitive period for learning of anxiety from parents with comorbid social and other anxiety disorders. No evidence was found for an increased vulnerability of highly inhibited infants to the effects of parental state or trait anxiety.

The association between parental state and trait anxiety and toddler fear/avoidance did not significantly differ between mothers and fathers, indicating that at this young age, fathers are as important as mothers in the intergenerational transmission of anxiety. Interestingly, early BI predicted fear/avoidance only with mothers, suggesting that toddlers may act relatively free from their early temperamental predispositions in SR situations with fathers.

This study found evidence in favor of a specific link between parental *social* anxiety diagnosis and higher levels of child fear/avoidance, which did not hold for parental diagnoses of other anxiety disorders alone. No evidence was found supporting context specificity: the association between expressed parental anxiety and toddler fear/avoidance did not significantly differ across social and nonsocial contexts.

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Key points

- Previous evidence revealed that highly inhibited infants of mothers with SAD learn from maternal anxious signals via SR and become progressively avoidant towards strangers. This study extended previous research by comparing SR effects in toddlerhood with fathers and mothers, and by investigating context and diagnosis specificity of SR processes.
- At 30 months, children of parents with lifetime social anxiety disorders (with and without other nonsocial comorbid anxiety disorders) showed higher levels of fear/avoidance, than children of parents without anxiety disorders, while the effect of other anxiety disorders alone was not significant.
- While expressed parental anxiety in the SR situations at 30 months did not significantly predict toddlers fear/avoidance, higher levels of expressed parental anxiety in SR tasks at 12 months predicted higher levels of fear/avoidance among toddlers of parents with lifetime comorbid social and other anxiety diagnoses.
- The link between toddler fear/avoidance and parental anxiety did not differ between mothers and fathers, pointing to an equally important role of fathers in the transmission of anxiety in toddlerhood.
- BI measured at 12 months predicted toddlers' fear/avoidance in mothers' but not in fathers' visit, suggesting that toddlers respond relatively free of their early temperamental predispositions with fathers in SR situations.
- The association between parental anxiety diagnoses and child fear/avoidance of novelty was specific to social anxiety diagnoses, and did not hold for other nonsocial anxiety diagnoses.
- No evidence was found for an increased vulnerability of highly inhibited children to the effects of parental anxiety.

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