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The influence of Behavioural Inhibition and Parental Expression on Childhood Anxiety

by

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Thesis for the degree of Doctorate in Clinical Psychology

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Abstract

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Childhood anxiety disorders are one of the most prevalent and detrimental mental health conditions within young people worldwide. Understanding the risk factors and mechanisms that lead to the development of anxiety in young people can serve to inform practice and help with prevention. Some reviews and meta-analyses have explored the associations between the temperamental style of behavioural inhibition (BI) and anxiety, however had not yet explored the association when dependent of the conceptualisation of BI and anxiety or the type of study design used. We explored this in the first chapter of this thesis. Additionally, experimental, and observational studies had started to explore the mechanisms behind the development of anxiety in children, however the underlying mechanism by which children learn to be anxious remained unclear. The second chapter of this thesis encapsulates a pilot study examining the role of maternal gaze in a social referencing task on the anxious behaviours of infants aged 12-14 months.

The first chapter examines the association between BI and presentations of childhood anxiety. BI has been characterised by a categorical construct and is described as a temperamental style of sensitivity to novel and unfamiliar stimuli, accompanied by fear and wariness. More recent explorations of BI have used continuous measures to assess for temperament and the categorical characterisation has been contested. This systematic review and meta-analysis examined 70 studies that reported a quantitative outcome for the association between BI and childhood anxiety. We found no significant moderating effects of sex or age but did find significant effects for the type of assessment used for BI, anxiety and time delay between assessments of BI and anxiety. We provide novel findings in relation to the strength of association depending on the conceptualisation of both BI and anxiety as categories or on continuums and the type of study design used. We found a larger significant effect when anxiety was categorical, rather than assessed continuously, and found the opposite with BI, a larger significant effect when BI was measured continuously, rather than operationalised categorically. Finally, we also found a larger significant effect when using cross-sectional designs. We make recommendations for future research and ways further research could address limitations with this meta-analysis.

The second chapter presents an empirical study examining whether maternal gaze (gaze or no gaze) while behaving anxiously in a social referencing task affects the anxious behaviours of 12–14-month-old infants. We also examined the moderating effect of BI on anxious behaviours across both conditions (gaze or no gaze). We know that those who are behaviourally inhibited are more likely to be anxious and that infants can learn through both vicarious learning and social

referencing. Although research highlighted the effect of gaze on threat communication, we were unclear on the role of eye gaze on infant responses during a social referencing task. **Method:** Thirteen mother-infant dyads completed two experimental conditions whereby they met with a stranger. In both tasks, mothers acted anxiously while interacting with a stranger, however in one task mothers did not look at their infant at all and in the other, they gazed directly at their infant in 10 second intervals. The stranger then approached the infant for 60 seconds. Both tasks were video recorded, and infants' behaviours were coded for fearfulness and avoidance. **Results:** We did not find any significant results. Looking behaviour was greater in the condition infants were exposed to first. We also found gaze did not have an impact on infants expressed fear or avoidance. We did, however find a large effect of fear between conditions, showing greater fear in the no-gaze condition. We also found a medium effect size in the interaction between condition and BI on fear and a large effect size in the interaction between condition and BI on avoidance. **Conclusions:** we have identified possible preliminary findings into the role of maternal direct (gaze) and indirect (no gaze) expressions of anxiety on infants expressed emotion in a social referencing task. We have established feasibility of the study and identified pitfalls of the study design in this pilot phase.

Keywords: childhood anxiety, behavioural inhibition, parenting, eye gaze, infancy, risk factors

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Definitions and Abbreviations

BI ..... Behavioural Inhibition

APA..... American Psychiatric Association

ERGO..... Ethics and Research Governance Online

R ..... A language and environment for statistical computing and graphics

SAD..... Social Anxiety Disorder

GAD ..... Generalised Anxiety Disorder

PSWQ..... Penn State Worry Questionnaire

EPDS..... Edinburgh Postnatal Depression Scale

SIAS ..... Social Interaction Anxiety Scale

M..... Mean

N..... Number of participants

n ..... number of studies

OR ..... Odds ratio

PRISMA ..... Preferred reporting items for systematic reviews and meta-analyses

PROSPERO ..... International prospective register of systematic reviews

CI ..... confidence interval

d ..... Cohen's d (Effect size)

z..... Fisher's Z transformation

SR ..... social referencing

BIS ..... Behavioural inhibition system

r..... Pearson's r (effect size)

Q..... Test of heterogeneity

I^2 ..... Test of heterogeneity

SD ..... Standard Deviation

Chapter 1 What is the Association Between Behavioural Inhibition and Childhood Anxiety? A Systematic Review and Meta-Analysis

1.1 Introduction

Anxiety disorders are the most common psychiatric disorders in adults (Stein et al., 2017) and children (Polanczyk et al., 2015) worldwide. A recent meta-analysis estimated the earliest peak of development is around five and a half years for anxiety and fear related disorders, and that most anxiety disorders typically emerged by the age of 14 in 38% of individuals (Solmi et al., 2022). Anxiety disorders precede detrimental long-term outcomes for children, their families, and wider communities (Carpenter et al., 2011; Neubauer et al., 2013). Untreated anxiety disorders run a chronic course, with Social Anxiety Disorder (SAD) disrupting the social, emotional, and academic development in children and young people (Beesdo et al., 2007; Halldorsson et al., 2019; Schutters et al., 2011). In turn, these predict adverse adult outcomes, including disruption to employment (Ambusaidi et al., 2022), increased cost to health and social services (Creswell et al., 2015) and risk of further psychiatric disorder (Essau et al., 2018).

Behaviourally inhibited (BI) temperament is one of the most robust risk factors for development of anxiety disorders and symptoms (Perez-Edgar & Fox, 2018). Kagan et al. (1984) state BI is characterised by sensitivity to novel and unfamiliar stimuli, accompanied by fear and/or avoidance of novel situations and/or people. The temperamental style of BI was initially described as a categorical construct (Garcia Coll et al., et al., 1984), not 'simply' as at the end of a severity continuum. BI as a category, compared to its absence, has been found to be linked with rates of anxiety disorders; specifically, in a cross-sectional study, rates of social anxiety disorder were significantly higher in those who were categorized with BI, than those who were not (OR=3.7, 95% CI=1.4–9.9; Biederman et al., 2001). Since then, however, longitudinal studies have used continuous measures of BI

(e.g., Muris et al., 2011) and have demonstrated similar findings to Kagan, specifically childhood BI measured continuously predicts later symptoms of social anxiety. As BI has been found to develop over the first few years of an infant's life (e.g., Clauss et al., 2011; Degnan & Fox, 2007; Goldsmith & Lemery, 2000), rather than being categorically present or not present and also measured using continuous scales, the categorical characterisation of BI can be contested, with multi-methods of assessment proving useful (e.g., Hwang & Rothbart, 2003).

BI can be assessed from the end of the first year of an infant's life typically by laboratory observation and/or parent-report measures. Laboratory and parent-report measures yield similar results (e.g., Olino et al., 2013) and significant modest correlations (r=0.35) have been found between laboratory observations and parent-report of temperament (Kochanska et al., 1997). Parent report measures are beneficial because parents can observe and report information across a variety of situations and time points, however parent ratings may be influenced by a comparison of their child and external factors (e.g., societal, and general expectations of child behaviour) (Kagan & Fox, 2006; Olino et al., 2013; Zenter & Shiner, 2012). Comparatively, laboratory observations are likely to be standardised across all children (Rothbart & Bates, 2006) and have been endorsed by several authors (Durbin et al., 2007; Gagne et al., 2011; Rothbart & Goldsmith, 1985; Seifer et al., 1994). However, they can be time consuming (Bishop et al., 2003) and the novel nature of a laboratory setting may influence the child's behaviour, resulting in data unrepresentative of the child's true presentation (Gartstein & Marmion, 2007).

Three meta-analyses have demonstrated importance of BI as a risk for later anxiety (Kostyrka-Allchorne et al., 2020; Clauss & Blackford, 2012; Sandstrom et al., 2019). Kostyrka-Allchorne et al. (2020) examined BI as a prospective risk for parent-rated internalizing symptoms and found a small significant association (r=.09, 95% CI=.03- .16).

Clauss and Blackford (2012) and Sandstrom et al. (2019) quantified the prospective risk posed by BI, compared to its absence, for particular subtypes of anxiety disorders with the largest risk being for Social Anxiety Disorder (OR=7.59, 95% CI=3.09-19.00, Clauss & Blackford, 2012; OR=5.84, 95% CI=3.38–10.09; Sandstrom et al., 2019), and smaller but significant risks for Generalized Anxiety Disorder (OR=2.04, 95% CI=1.43-2.91) and specific phobias (OR=1.49, 95% CI=1.03-2.14). Despite all three meta-analyses demonstrating BI poses a risk for the later development of anxiety, there are inconsistent findings between them. Both Kostyrka-Allchorne et al. (2020) and Sandstrom et al. (2019) found no significant moderation of the relationship between BI and anxiety, by sex, tools used for assessing BI and anxiety, age, and time delay between assessments of BI and anxiety. Clauss and Blackford (2012) did, however, find the time between assessment of BI and SAD was significantly negatively correlated with the rate of SAD (slope= −0.16; CI= −0.32 – −0.002; z= −1.99; *p*=.05). Here, we will clarify and update our understanding of the risks examined in the previous meta-analyses. Furthermore, we will address issues not addressed in previous meta-analyses regarding conceptualization of anxiety disorders, BI, and study design.

First, the literature is missing an understanding of the risk BI poses for anxiety disorders ascertained from diagnostic interviews, not inferred solely from measures of symptom frequency or severity. In both Clauss and Blackford (2012) and Sandstrom et al. (2019) anxiety disorders were operationalised based on anxiety symptom severity measure (regardless of whether a diagnostic interview was used). Kostyrka-Allchorne et al. (2020) did not examine anxiety disorders. This is an important limitation because, although symptom measures capture frequency and/or severity of symptoms, they fail to account for the *impact and impairment* of anxiety on a child's life. Diagnoses require evidence of functional interference or impairment (5th ed.; DSM–5; American Psychiatric Association, 2013; Kutash et al., 2008). Furthermore, although evidence suggests multidimensional

measures can accurately identify clinically anxious individuals compared to some traditional measures (Rey et al., 2013), they are not sufficient for use as clinical diagnostic instruments without the accompaniment of a diagnostic interview (Spence, 2018). Hence, from previous meta-analyses, we do not know whether BI is a predictor of the impairment that accompanies symptoms of anxiety, and therefore we ask Research Question One: whether the association between BI and anxiety is stronger when anxiety is operationalized as a category / disorder and ascertained using diagnostic interviews, or as a continuum, using only symptom measures.

Our second novel question focuses on a similar conceptual issue - whether conceptualising BI as a category (Garcia Coll et al., 1984) or continuum moderates the associations between BI and anxiety outcomes. Kagan et al. (1989) assert that BI is a categorical construct. However, much of the literature does not observe these constraints, with many using continuous measures that conceptualise BI on a continuum (e.g., Fu et al., 2017; Hudson et al., 2011; Muris et al., 2011). Thus, we will ask Research Question two: whether the association between BI and anxiety is stronger when BI is operationalized as a category or as a continuum.

Finally, we will examine whether associations between BI and anxiety (symptoms and disorders) are moderated by child age and sex, time elapsed between assessment of BI and anxiety, and study design (cross-sectional, prospective, or retrospective). This final moderator analysis will address whether associations are stronger cross-sectionally than prospectively or retrospectively. This could appear theoretically redundant, but we have chosen to test this exactly because all three previous meta-analyses have excluded cross-sectional studies, so there is an empirical gap in the literature. The literature is lacking consistency and clarity around these moderating variables in the association between BI and anxiety, (e.g., Kostyrka-Allchorne et al., 2020; Clauss & Blackford, 2012; Sandstrom

et al., 2019). Thus, this meta-analysis aims to clarify the role of these moderators in the associations between BI and anxiety.

1.1.1 Aims of this review

In summary, this is the first meta-analysis that aims to quantify the strength of the association between BI and diagnosed childhood anxiety disorders. Furthermore, it will examine whether the associations between BI and anxiety differ depending on the conceptualization of BI as a category or continuum. The review aims to update findings from previous meta-analyses and clarify inconsistencies between them by examining whether the time between the assessment of BI and anxiety moderates the strength of the association (Clauss & Blackford, 2012; Sandstrom et al., 2019).

1.2 Method

1.2.1 Protocol

This systematic review and meta-analysis are registered on the International prospective register of systematic reviews (PROSPERO; registration number: CRD42019153829). The protocol was written in 2019 by LR for a DClinPsych Research Thesis and searches were initially run at this point. Searches were re-run in October 2022 by RW to update the work of the analysis completed in 2019.

1.2.2 Eligibility criteria

Inclusion criteria

1. Studies including behavioural inhibition and childhood anxiety as variables.
2. Reported in a peer-reviewed journal, written in English.
3. Human participants, aged between 0 and 18 years.

4. Report a validated assessment of Behavioural Inhibition (BI), conducted via an observation or parent-report (but not self-report). These studies must also report a validated assessment of anxiety in childhood (0-18 years old) for the same children, measured from clinical interview or report from clinician, parent or teacher or child self-report.

Exclusion criteria

1. Studies that do not include a validated quantitative measure of both BI and childhood anxiety for the same child.
2. Any intervention study that does not include a baseline (i.e., pre-intervention) measure of BI and childhood anxiety symptoms, for the same child.
3. Papers without extractable quantitative data (e.g., review papers, conference abstracts, theoretical discussions).
4. Any study with a participant sample recruited in light of a specific health condition (e.g., children with neurodevelopmental conditions such as Autistic Spectrum Condition or Attention Deficit Hyperactivity Disorder, intellectual disabilities, specific health conditions or diagnosed mental health conditions).
5. Studies that do not include childhood anxiety or behavioural inhibition as variables.

BI is defined as the expression of fear, wariness, or reticence in unfamiliar situations or with unfamiliar people, observed in young children. Studies that used Gray's sensitivity to reinforcement model - the Behavioural Inhibition System (Gray, 1970) were not included.

1.2.3 Searches

The searches were run in October 2019 by LR and updated by RW in October 2022 on the electronic databases CINAHL (via EBSCO), Embase (Version 1974 to 2022 October 14 via Ovid), MEDLINE (via EBSCO) and PsycINFO (via EBSCO). The following search terms were used:

anxi* OR phobi* OR wariness OR internalizing OR internalising

AND

((behavioral OR behavioural OR temperament*) N3 inhibit*) OR BI

AND

‘longitudinal’ OR ‘prospective’ OR ‘follow up’ OR ‘follow-up’ OR ‘followup’ OR ‘cohort’ OR 'retrospect*' OR ‘associat*’ OR ‘trajector*’ OR ‘predict*’ OR “relations* between” OR “link* between”

AND

infan* OR toddler* OR child* OR youth* OR young OR teen* OR adolescen* OR paediatric* OR pediatric*

The review process and number of records identified at each stage is illustrated in the PRISMA flow diagram (Figure 1). From initial search in 2019, 744 records were identified (after removal of duplicates) and nine further records were identified through hand searching reference lists of previous relevant reviews. In October 2022, 445 records across all databases were identified, after removal of duplicates. Hand-searching reference lists of relevant previously conducted reviews identified an additional 11 records.

1.2.4 Study selection

In 2019, reviewer (LR) and second reviewer (PL) screened the abstracts of all 753 records. LR and PL assessed the 234 articles selected for full text review. Seventy articles met eligibility criteria for inclusion; however, data was unavailable for 15 articles (five authors did not respond to email requests for data, ten did not produce appropriate data) and therefore 55 papers were retained.

In October 2022, the main reviewer (RW) screened the abstracts and titles of all 445 articles from the searches covering November 2019 - October 2022. PL double-screened 10% of the 445 abstracts and titles. Seventeen discrepancies were discussed between the reviewers. Discrepancies pertained to ambiguity in the abstracts and therefore, a decision was reached to screen the full texts of these articles. Forty-three articles were selected for full text review. Both RW and PL examined the full texts of all 43 articles. Disagreements were identified for four articles, due to ambiguity in the methods of assessing anxiety. Any disagreements were resolved between RW and PL. Twenty articles were identified as eligible. Hand-searching reference lists of the eligible 20 full texts identified an additional 11 records. Of these 11, the full text of five were screened and one was retained. Data were unavailable for six of the 21 included articles (two authors did not respond to email requests for required data and four did not supply the required data). Thus, as a result of the 2022 searches, we retained 15 more records for inclusion in analyses.

Included articles from both searches (2019 and 2022) were retained in the analysis, with a total number of 70 records for data extraction.

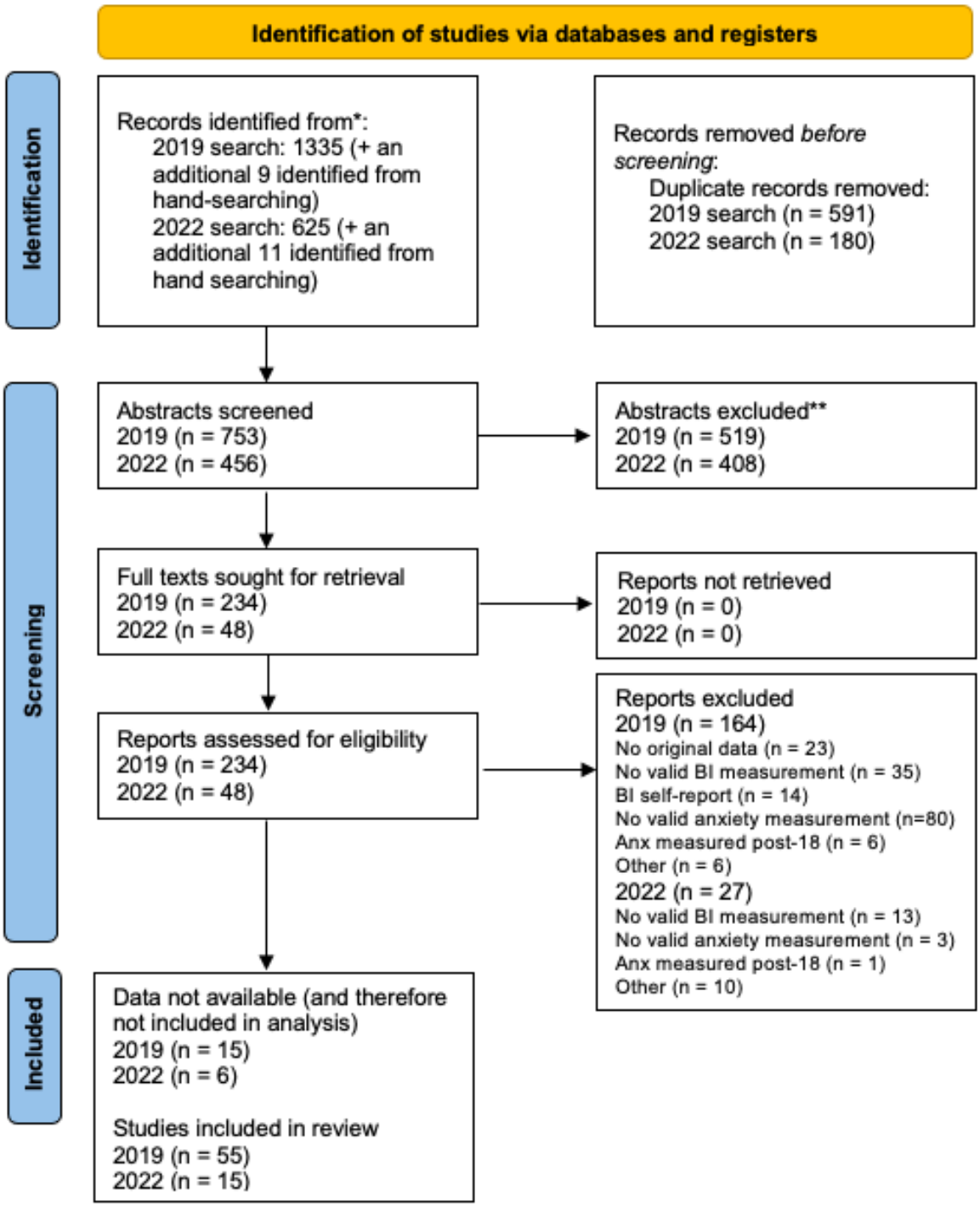
1.2.5 Data extraction

RW and LR extracted the following data from each included article: first author, year of publication, citation, sample size, study design, age of child when BI was measured (mean, SD, Range), age of child when anxiety was measured (mean, SD, range), gender percentage of infants/children, all outcome measures of BI and all outcome measures of childhood anxiety symptoms (including type of measure, e.g. parent-report, clinical observation and whether BI and anxiety were measured categorically or continuously) and anxiety outcome (e.g., any anxiety, social anxiety, specific phobia). Regarding the conceptualisation of anxiety, studies that used diagnostic interviews were operationalised as diagnostic (categorical) and those that did not use diagnostic interviews were operationalised as measuring anxiety symptoms (continuous). As BI is not a diagnosis but

a description of a temperamental style, the conceptualisation cannot be diagnostic. Thus, regarding the conceptualisation of Behavioural Inhibition, studies that used laboratory observation for the assessment of BI were operationalised as categorical BI and those that used only parent- or other informant- report scales were operationalised as continuous BI.

Figure 1.

PRISMA Flowchart



1.2.6 Analysis strategy

We used R Software environment to conduct our meta-analyses (weighted, using random effects modelling). Some articles reported multiple effect sizes (e.g., two different measures of anxiety), which, in meta-analysis, violates the assumption of independence. Considering this, we used three-level meta-analyses to examine all reported effects. By correcting standard errors to account for associations between effects within the studies, this allows for dependent effect sizes (Hedges et al., 2010). We used three-level meta-analyses (Van den Noortgate et al., 2015) because some studies reported multiple effect sizes, creating dependencies in the data. We used Akaike information Criterion (AIC), Bayesian Information Criterion (BIC) and likelihood ratio test to assess whether the three-level model was superior (i.e., explained significantly more variance) to a 'reduced' two-level model for each outcome.

For primary and moderator analyses, we used the 'metafor' package in R (Viechtbauer, 2010). All outcomes were transformed into a common metric (Pearson's *r*) for them to be used in the data synthesis. Using the effect size calculator from the Campbell Collaboration (Wilson 2001), studies that used categorical data for BI and anxiety (i.e., number of children classified as BI/non-BI, and number of children diagnosed/not diagnosed with an anxiety disorder) were converted into odds ratios. This data was then converted into Pearson's *r* using the same effect size calculator from the Campbell Collaboration. For analyses, it is recommended *r* scores are converted to Fisher's z scores (Borenstein et al., 2011) and therefore we used the transformed r-to-z scores (via the 'compute.es' function in the metafor package; Viechtbaur, 2010). To present our findings in the most interpretable format, Fisher's Z scores were converted back to Pearson's *r* scores.

We assessed heterogeneity with Q and I^2 statistics. Both tests assess the variation across studies that can be attributed to heterogeneity as opposed to chance. However, when interpreting the Q statistic, care must be taken as when the number of included studies are low, it has low power as a comprehensive test of heterogeneity (Gavaghan et al., 2000) and when the number of studies is large, the test can have too much power (Higgins et al., 2003). For three-level meta-analyses, the I^2 is broken into components one attributable to the true effect size differences *within* studies, the other to *between*-study variation.

Meta-regressions were used to examine the impact of moderators on the association between BI and child anxiety. The meta-regression analyses included assessment of moderation by continuous variables (e.g., years between BI and anxiety assessments) and by categorical variables (e.g., method of BI assessment: observation, parent report or a combination; conceptualization of anxiety: symptom frequency or disorder; and study design: cross-sectional, retrospective, or prospective).

1.2.7 Study Quality and Publication Bias

RW and SM assessed each article for study quality using the QualSyst tool (Kmet, 2004). The tool assesses quality of quantitative research across domains, including clarity of research questions/objectives, measures used to minimise bias such as random allocation and blinding, and reporting of variance. Domains are rated on a 0-2 scale, (0 = not met, 1 = partially met and 2 = met fully). An overall score was calculated for each study (sum of the total scores, divided by the total possible score), to allow for quality comparisons between studies (see Table 1, Appendix A).

Publication bias was assessed via visual inspection of funnel plots and using a proxy for Egger's test (Egger et al., 1997) by conducting a three-level meta-analysis with each effect size's standard error as a moderator (Rodgers & Pustejovsky, 2021).

1.3 Results

1.3.1 Sample

Seventy articles published between 1993 and 2022 were retained for analyses. For study characteristics, see Table 2 (Appendix B).

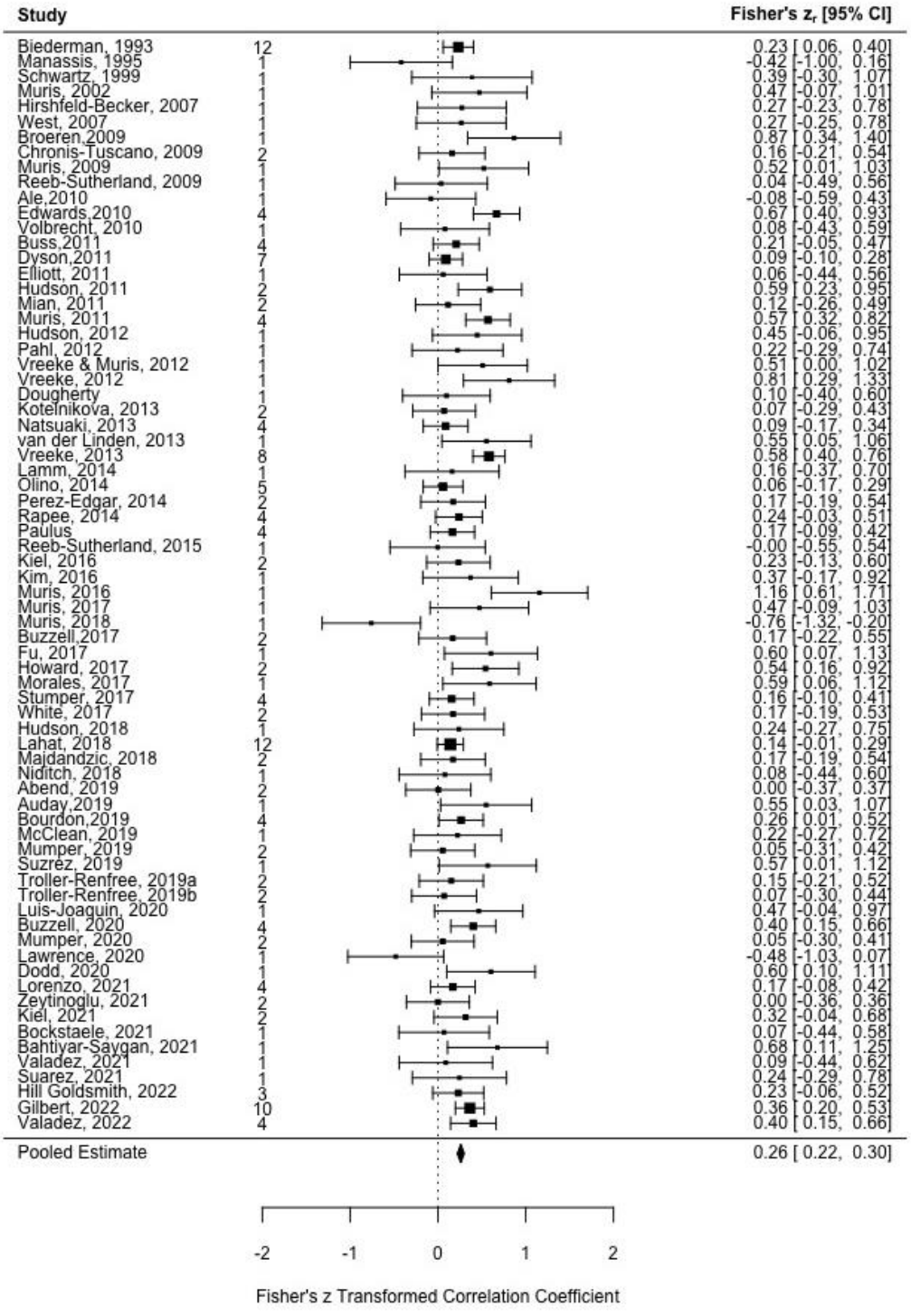
1.3.2 Update of previous meta-analyses

First, we conducted analyses to update our understanding of the risks examined in previous meta-analyses (Clauss and Blackford, 2012; Korstyrka-Allchorne et al., 2020; Sandstrom et al., 2019).

From our three-level meta-analytic model, the pooled correlation was r =0.255, (n=70, es= 172, 95% CI=0.217–0.292, Q=2501.28, p<.001). The estimated variance components were $tau^2_{level\ 3}$ =0.03, $tau^2_{level\ 2}$ =0.04. This means $I^2_{level\ 3}$ =55.11% of the total variation can be attributed to between study heterogeneity, and $I^2_{level\ 2}$ =40.01% to within study heterogeneity. The three-level model provided a significantly better fit than the two-level model (when we constrained level 3 heterogeneity to zero) (chi^2 =28.66, p< .0001). (see Figure 2).

Figure 2.

Forest plot showing full three level meta-analytic model.

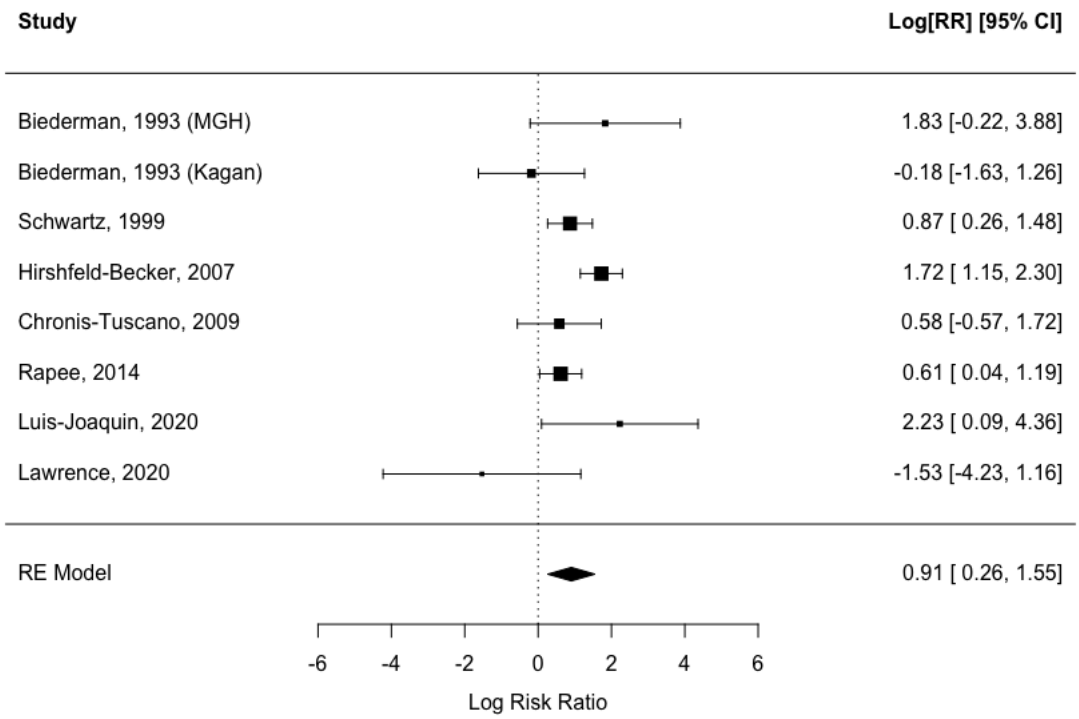


Regarding sub-types of anxiety disorder, we were only able to examine Social Anxiety Disorder (SAD; *n*=7), because there were too few studies reporting diagnoses of other sub-types of anxiety disorder (generalized anxiety disorder, *n*=1; separation anxiety

disorder, *n*=1; specific phobia, *n*=2). In our three-level model (see Figure 3), BI children, compared to non-BI children, were at significantly greater risk of having SAD (n=7, es= 8, OR=2.47, 95% CI=1.30-4.71, Q=16.42, *p*=.022).

Figure 3.

Forest plot showing three-level meta-analytic model for SAD.



Previous meta-analyses examined moderators in the relationship between BI and anxiety, including sex, tools used for assessing BI and anxiety, age, and time between assessments of BI and anxiety. In this meta-analysis, sex was not a significant moderator, F(1, 137)=0.00, *p*=.998, nor was age, F(89, 82)=0.422, *p*=1.00. However, type of assessment used for BI was significant, F(2, 169)=11.66, *p*<.0001 (see Table 3), as was the time delay between assessments of BI and anxiety: F(1,160) =6.60, *p*=.011 (see Figure 4) and the type of anxiety measurement, F(4, 131) =9.77, *p*< .0001 (see Table 4).

Table 3.

Type of assessment used for BI.

	Intercept (r)	95% CI	*t*	*p*
Lab observation	.126	.038 - .216	2.82	.006 **
Parent report	.388	.331 - .488	4.72	< .0001 ***
Combined lab observation and parent report	.216	.134 - .305	1.619	.107

CCBL - Child Behaviour Checklist[a]

Preschool Age Psychiatric Assessment[b]

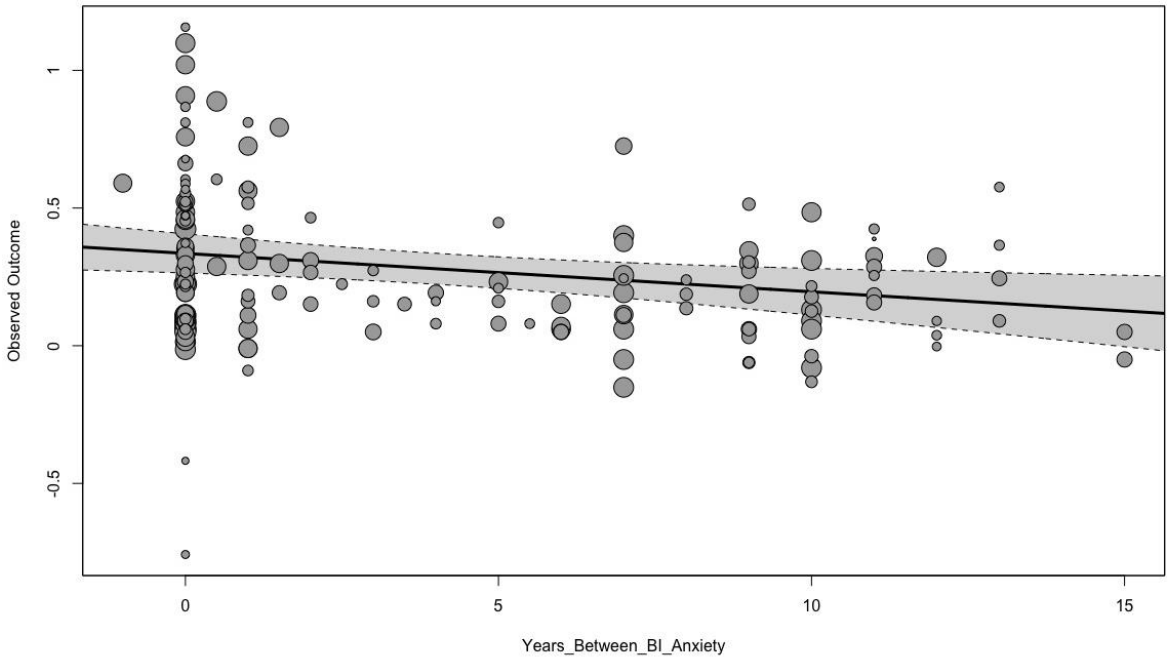
Preschool Anxiety Scale[a]

Screen for Child Anxiety Related Disorders[b]

[a] Symptom Measure, [b] Diagnostic tool

Figure 4.

Bubble plot showing moderation by time delay between assessments of BI and anxiety.



1.3.3 Research Question One.

We aimed to understand whether the association between BI and anxiety is stronger when anxiety is assessed using diagnostic interview, or only using symptom measures. A larger, significant effect was found when participants were diagnosed with an anxiety disorder, rather than when assessed only with anxiety symptom measures, F(1, 158)= 9.42, p< .0001 (see Table 5).

Table 5.

Type of assessment for anxiety

	Intercept (r)	95% CI	*t*	*p*
Diagnosis	.458	.336 - .654	6.15	< .0001 ***
Symptom measure	.305	.247 - .383	3.08	< .0001**

1.3.4 Research Question Two:

We also aimed to understand whether the association between BI and anxiety is stronger when BI is operationalised as a category or a continuum. A larger, significant effect was found when BI is measured continuously, F(1, 170) =22.99, $p< .0001$ (see Table 6).

Table 6.

Type of BI measurement

	Intercept (r)	95% CI	*t*	*p*
Categorical	.391	.335 - .4911	2.967	< .0001 ***
Continuous measure	.568	.480 - .801	7.76	< .0001**

Additional moderation analyses

We examined whether the associations between BI and anxiety (both symptoms and disorders) were moderated by study design (cross-sectional, retrospective, or prospective). There was a larger, significant effect for studies using a cross-sectional design, F(2, 169) =4.5542, p=.012 when compared to prospective or retrospective designs (see Table 7).

Table 7.

Type of study design

	Intercept (r)	95% CI	*t*	*p*
Cross-sectional	.335	.266 - .431	8.39	< .0001 ***
Prospective	.212	.146 - .284	5.706	.007 **
Retrospective	.167	.009 - .345	6.4005	.048 *

1.3.5 Publication Bias

Visual inspection of funnel plots (see Figure 5) and a proxy for Egger's test (see Table 8; Egger et al., 1997) analysed by conducting a three-level meta-analysis with each effect size's standard error as a moderator (Rodgers & Pustejovsky, 2021) were run to test for publication bias. There was little evidence of publication bias, F(1, 170)=.599, *p*=.44.

Table 8.

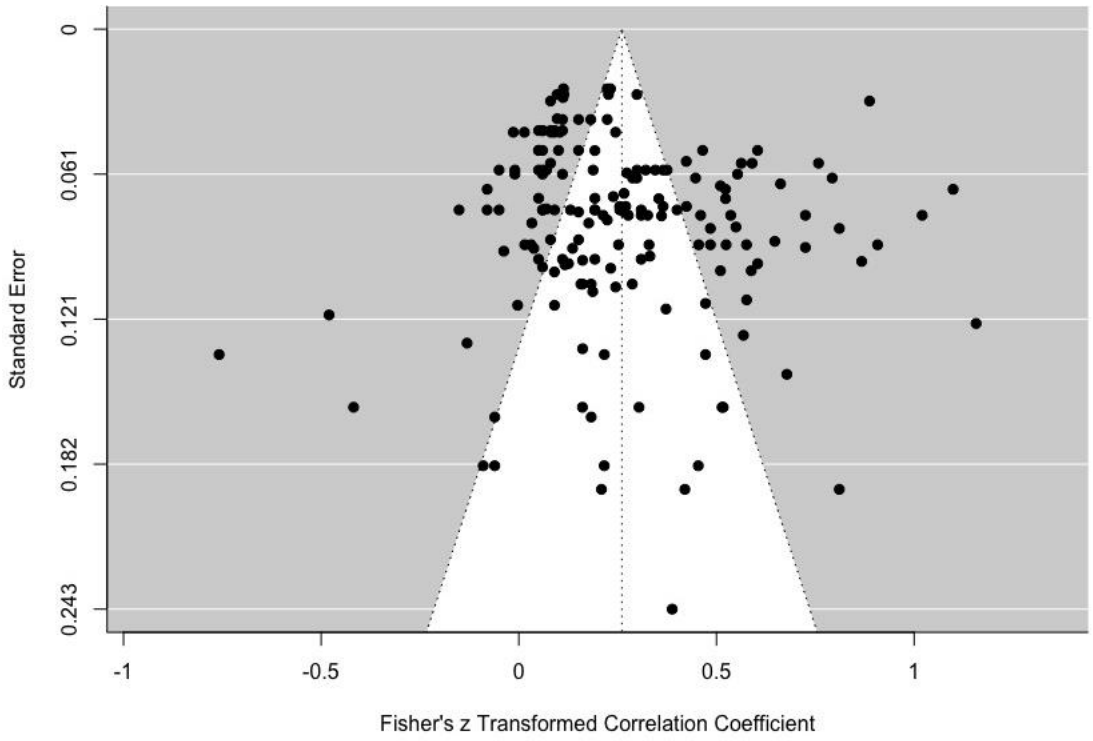
Results of Pseudo Egger Test

	Estimate (r)	95% CI	*t*	*p*	*p* SEz
Risk of bias					.44
Intercept	.219	.107 to .339	3.79	<.001	
Sez*	.613	-.439 to 1.867	.774		

*Sez = Standard error of Z

Figure 5.

Funnel plot



1.4 Discussion

The literature was lacking an understanding of the risk BI posed for anxiety disorders, ascertained from a diagnostic interview. We found the association between BI and diagnosed childhood anxiety disorders was (r =.46), which was a significantly stronger association (F (1, 158) =9.42, p <.0001) than between BI and undiagnosed anxiety assessed using symptom measures (r =.31). Although multi-dimensional symptom measures can identify clinical anxiety (Rey et al., 2013), they typically do not sufficiently or accurately account for clinical impairment (Spence, 2018). Our findings suggest that by using diagnostic interview to assess for anxiety disorders, BI may also predict the impairment that accompanies symptoms of anxiety.

Our second novel question considered whether conceptualising BI as a category or a continuum moderated the strength of the association between BI and anxiety. We found a larger, significant effect when BI was measured continuously (r =.57), compared to as a category (r =.39). Interestingly, this was the opposite pattern to the one we found for the

conceptualisation of anxiety, where the association of anxiety was stronger when measured as a category (diagnostically) than on a continuum (symptom measures). This is theoretically and clinically important. Kostyrka-Allchorne et al., (2020) examined the predictive power of parent-report questionnaires in measures of infant temperament for psychopathology in childhood and later adolescence. They comparably found questionnaire-measured infant temperament had a weak predictive power for later psychopathology, however they did find BI measures were stronger at predicting later psychopathology than measures of other temperaments. Our finding supports use of continuous measures of BI and suggests BI perhaps lies on a continuum rather than being present or not present. This, therefore, supports the use of multi-methods for assessment which may boast different benefits. Chronis-Tuscano et al., (2009) integrated a multimethod approach to assessing BI and only found a significant association between parent report and later social anxiety. These authors identified strengths to using continuous measures of Behavioural Inhibition, such as the low-cost, accessibility, lack of need for training and representation of real-world settings. We did still, however, find a smaller, yet significant association when Behavioural Inhibition was assessed in the laboratory (that is, categorical conceptualisation), which still credits the use of observation methods (e.g., LAB-TAB; Planalp et al., 2017).

To our knowledge, three other meta-analyses demonstrated the importance of BI as a risk factor for later anxiety (Kostyrka-Allchorne et al., 2020; Clauss & Blackford, 2012; Sandstrom et al., 2019). We tested the strength of association between BI and childhood anxiety disorders. Overall, we found similar results (r =0.255), in line with previous meta-analyses (r =0.273, Sandstrom et al., 2019). We also found a greater prospective risk of developing SAD when children were behaviourally inhibited (OR=2.47), compared to not, which was also in line with previous meta-analyses (OR=7.59, Clauss & Blackford, 2012; OR=5.84, Sandstrom et al., 2019).

This is the first meta-analysis to examine the influence of different study designs (cross-sectional, retrospective, prospective) on the strength of association between BI and anxiety. We found a larger effect size for cross-sectional studies (r =.36), when compared to prospective (r=.21) and retrospective designs (r=.17). Cross-sectional studies were found to have a larger association regardless of the conceptualisation of anxiety and BI. This perhaps provides evidence for the conceptual overlap between BI and anxiety, which could be due to the similarities between what is being measured contemporaneously, with many items on BI and psychopathology measures overlapping (Nigg, 2006). It is suggested this may inflate the estimations of associations between BI and anxiety (Sanson, 1990). Furthermore, Lahay (2004) highlighted that the literature is lacking a clear distinction between the behaviours that form temperament and those that contribute to psychopathology. There is a substantial overlap in the constructs being measured, such as fear and avoidance (Klein & Mumper, 2018; Perez-Edgar & Fox, 2098; Reeb-Sutherland et al., 2009) and prevalence rates of SAD are similar to the prevalence estimation of BI in adolescents (Gladstone & Parker, 2005; Reznick et al., 1992). However, not all children with BI develop SAD or any type of anxiety disorder. Furthermore, Clauss and Blackford (2012) suggest there may be multifinality, whereby the same developmental starting point for BI and SAD may lead to divergent developmental pathways and the two constructs may be distinguished by symptoms and impairment later in development. Therefore, there may still be value to examining BI as a prospective risk factor for anxiety, as has been done in previous meta-analyses (e.g., Clauss & Blackford, 2012; Kostyrka-Allchorne et al., 2020).

As children grow older, it is possible their abilities to self-report symptoms may improve. When BI and anxiety are measured in toddlerhood or early childhood, the measurement is reliant on behavioural observation by parent/carer/researcher. This type of observation relies on the parent/carer/researcher reliably reporting on what they see. If we

draw on models of human behaviour and consider that as children therefore get older, they become better able to articulate their experiences of anxiety and/or aspects of their temperament, which may result in greater measurement and reporting accuracy. Interestingly, some research into self-report measures found low agreement between parent and child reports when measuring symptoms using the Multidimensional Anxiety Scale for Children in all anxiety dimensions except for social anxiety in their older, clinical sample (Baldwin & Dadds, 2007). This finding suggests the level of dysfunction that accompanies social anxiety may be more evident and possibly enables more reliable reporting of their child's symptoms. Additionally, the development of greater cognitive skills and strategies for articulating fears and worries as children become older may contribute to more consistency across parent and child reports. However, there was greater divergence of child and parent reports over a 12-month period (Baldwin & Dadds, 2007), possibly reflecting maturation effects and differences in the level of openness about symptoms as young people get older.

Similar to Kostyrka-Allchorne et al., (2020) and Sandstrom et al., (2019), our moderation analyses found no effects of age or sex on the associations between BI and anxiety. We did, however, find a significant effect of time elapsed between assessment of BI and anxiety, which is in line with Clauss and Blackford (2012) who found time between assessments was significantly negatively correlated with the rate of SAD. However, Clauss and Blackford only found this significant result for SAD, whereas our findings demonstrated the moderating effect of time for all types of anxiety disorders and symptoms. These findings may suggest the possible conceptual overlap in characteristics of BI and anxiety deviate over time.

1.4.1 Limitations

First, we did not assess participant racial or ethnic characteristics and therefore we do not know how the findings can be generalised across groups and cultures. For example, in Eastern cultures, parents encourage parent-child proximity and physical contact during the early years (Ho, 1986), with autonomous behaviours and less inhibition being considered selfish (Ho, 1986). Furthermore, Chinese children are regarded as well-behaved and socially competent when they are behaviourally inhibited (e.g., Chen & French, 2008; Chen et al., 2006). Chen et al., (2009) also found early childhood BI prospectively predicted better social and school adjustment in Chinese children, showing more socially desirable behaviours than those less inhibited. As other studies with samples from Asian samples found similar results (e.g., Chen et al., 1999; Eisenberg et al., 2001), it would be important to consider race and ethnicity as moderators in future research or to consider a cross-cultural study of this kind.

Second, we did not account for comorbidity, and were unable to assess subtypes of anxiety disorders, other than SAD. In the literature, comorbidity has been consistently linked with greater symptom severity, chronicity and disability and impairment (Belzer & Schneier, 2004; Brown et al., 1996; Olfson et al., 1997), with evidence from a meta-analysis also showing symptoms of depression and anxiety predicted each other (Jacobson & Newman, 2017). Therefore, accounting for comorbidity may help us pick apart other factors that may moderate the relationship between BI and childhood anxiety. Third, we used simple linear models, with BI as a sole predictor of anxiety. Other factors, such as parenting behaviours (Möller et al., 2015) and parent anxiety disorders (Lawrence et al., 2019) have also been implicated in the development of child anxiety and therefore future research would benefit from accounting for other factors in the model. Finally, unpublished data was not included, which may have excluded studies that had important findings. We

accounted for this by conducting tests to examine publication bias and we did not find any evidence for this.

In summary, this is the first meta-analysis to test the strength of the association between BI and diagnosed childhood anxiety disorders, including addressing the theoretical issue of whether this differs depending on study design and the operationalization of BI and anxiety. We found a small, but significant correlation between BI and later childhood anxiety disorders. We also found BI children were more likely to develop SAD than non-BI children. Although we did not find sex and age moderated the association between BI and anxiety, we did find the type of assessment for both BI and anxiety and the time delay between assessments of BI and anxiety were significant moderators. We identified that when children were diagnosed with anxiety disorders, as opposed to using symptom measures, the association between BI and anxiety was stronger. Contrasting to Kagan et al's., (1984) initial categorization of BI, we found the association between BI and anxiety was stronger when assessed continuously. Finally, we identified all study designs were significant moderators in the association between BI and anxiety, however the largest, most significant effect was found for cross-sectional studies.

Chapter 2 The effect of parental indirect and direct expressions of anxiety on infant reactions

2.1 Introduction

2.1.1 Anxiety Disorders

Anxiety disorders are one of the most common mental health disorders in children and young people (Stein et al., 2017), with a worldwide prevalence of 6.5% ((Polanczyk et al., 2015; Rapee et al., 2009). Specifically, Social Anxiety Disorder (SAD) is among the most prevalent mental health diagnoses (e.g., Stein et al., 2017) and has a prevalence of 1-13% in young people (Abbo et al., 2013; Bener et al., 2011; Canino et al., 2004; Canals et al., 2019; Farshidfar et al., 2019; Knappe et al., 2011). SAD is characterised by excessive fear and avoidance of social situations and fear of negative scrutiny from others (American Psychiatric Association, 2013; Heimberg et al., 2014). A recent meta-analysis showed that symptoms of anxiety and fear-related disorders have a peak onset at age five and a half years, and 51.8% of individuals have an onset before the age of 18-years-old (Solmi et al., 2022). However, symptoms of SAD lie on a continuum and can worsen over time (Conway et al., 2019; Craske et al., 2017; Katzelnick et al., 2001; Kessler, 2003; Lipsitz and Schneier, 2000; Krueger et al., 2018; Rapee and Spence, 2004; Ruscio, 2019; Stein et al., 2017). Often reported in the literature as challenging to treat (e.g., Neubauer et al., 2013; Craske et al., 2017), rates of relapse in SAD are high (Batelaan et al., 2017; Bruce et al., 2005; Gordon and Redish, 2016; Rhebergen et al., 2011; Scholten et al., 2013, 2016; Spinhoven et al., 2016) and have substantial consequences for individuals experiencing symptoms. Hur et al., (2019) investigated the real-world consequences of 228 young people with SAD and found that higher levels of SAD were associated with worsening of

mood (including negative affect, anxiety, and depression), fewer close relationships and less time spent with close companions.

The development of anxiety disorders has been explained by a set of risk factors. It is well established in the literature that a combination of environmental factors (Eley et al., 2015) and genetic markers (Hettema et al., 2001) can increase the risk of developing SAD (Crozier & Alden, 2001; Wood, McLeod, Sigman, Hwang & Chu, 2003, Wong & Rapee, 2016). In particular, the two key environmentally mediated risk factors for the development of SAD are behavioural inhibition (Lahat et al., 2011) and parenting behaviours (Askew & Field, 2008).

2.1.2 What do we know about how infants learn to be anxious?

2.1.2.1 Behavioural inhibition

Behavioural inhibition (BI) is a term coined to describe a biologically driven temperament of fear, avoidance, and withdrawal in novel situations or with unfamiliar people or objects (Kagan et al., 1987). The way in which BI manifests changes across the developmental period, and typical characteristics of the manifestation include distress, clinging to the caregiver, hesitancy, reticence, and social withdrawal (Ollendick & Benoit, 2012). Although BI shares characteristics of SAD, such as shyness and social withdrawal, BI also presents in relation to unfamiliar non-social stimuli as well as unfamiliar social stimuli (Ollendick & Benoit, 2012). BI is known to precede anxiety disorders in infants and children (Rapee et al., 2009) and has been identified as increasing the risk for subsequent SAD (Sandstrom et al., 2020; Schwartz et al., 1999). Biederman et al., (2001) conducted a study with 216 inhibited and noninhibited children and found that those with BI had significantly higher rates of SAD than non-inhibited (OR = 3.7, 95% CI = 1.4-9.9). This was corroborated at five-year follow up, where children with BI were more likely to

develop SAD during the follow up ($p < 0.001$). Several additional studies also using a longitudinal design have identified that those who were behaviourally inhibited were more at risk of developing SAD than those who were not (e.g., Chronis-Tuscano et al., 2009; Hirshfeld et al., 1992; Kagan & Snidman, 1999).

Despite the strong associations found in the literature between BI and SAD, not all children with BI are diagnosed with an anxiety disorder, which raises questions as to what else contributes to how children learn to be anxious. Extrinsic factors, including parenting behaviours, have been identified in the variability of anxiety outcomes (Degnan & Fox, 2007).

2.1.2.2 Parenting behaviours

The relationship between parent and child has been identified as contributing to the development of social anxiety in children and young people. Parenting styles are an important factor in the development of children's psychological and behavioural development (Brennan et al., 2013). Negative parenting styles have been consistently linked with internalising symptoms in children and young people (e.g., Rose et al., 2017). Repeatedly, parenting styles including over-control, high criticism and low warmth have been found to be related to anxiety in children and young people (Ginsburg & Schlossberg, 2002; McLeod et al., 2007; Rapee, 1997; Van der Bruggen et al., 2008). These parenting styles have been investigated in samples of clinically diagnosed children with social anxiety, specifically focusing on expressed emotion (Garcia-Lopez et al., 2014).

Such parenting dimensions can have consequences on the child. Overcontrolling styles have been linked to an inability to develop and learn social competence due to the lack of opportunity for the child to be autonomous (Ballash et al., 2006). Furthermore, parental control in unfamiliar situations may lead the child to perceive unfamiliar environments as threatening and therefore present in a fearful/anxious manner (Bgoels &

Brechman-Toussaint, 2006). Meta-analyses examining the role of overcontrolling parenting has found positive associations with child anxiety, with effect sizes ranging from 0.25 (McLeod et al., 2007) to 0.58 (Van der Bruggen et al., 2008). High levels of parental criticism has been found to be linked with parental anxiety and evidence demonstrates that anxious parents are more likely to criticise or doubt their child's performance, which may lead to anxiety in the child or the child doubting their social competence (Crosby Budinger et al., 2013). It is evident that parenting that is characterised by warm and responsive behaviours are associated with greater social competence and adaptability in children (Hane et al., 2008; Park et al., 1997). However, some researchers have identified that the warm style of parenting may not always create a confident and socially adapted child. Degnan et al., (2008) and Kagan et al., (1993) both found that higher levels of warmth and sensitivity from parents could inadvertently reinforce avoidance and beliefs that the child cannot cope with threats in the environment.

2.1.2.3 Interaction between BI and parenting

The influential model by Murray et al., (2009) demonstrates the interaction between BI and parenting. Murray et al., (2009) suggest that behaviourally inhibited temperament can trigger some parenting dimensions that are associated with childhood anxiety disorders. Murray et al., (2009) also reported on evidence to suggest that BI is a predictor of childhood SAD only when accompanied by aversive parenting styles. For example, Murray et al's (2008) study found that when mothers did not encourage social responsiveness, inhibited infants of mothers with social phobia also avoided strangers when they had observed their parents exhibit anxiety with the stranger.

One model suggested that the way in which parents believe they should socialise their child is dependent on their child's disposition and character (e.g., Rubin et al., 1999). It has been proposed that the inhibited temperament of a child elicits negative parenting

styles, such as overcontrol and overprotection (e.g., Rubin et al., 1995), which would in turn influence and reinforce the child's social wariness. This appears to be the case among anxious parents, with Hirshfeld et al., (1997) demonstrating that maternal criticism was identified as a result of the interaction between the child's behavioural inhibition and maternal anxiety, specifically that anxious mothers of inhibited children were more likely to be critical than those with non-inhibited children. Murray et al., (2008) later produced similar findings, showing that mothers with SAD showed less encouragement of their infant when engaging with a stranger only when their child was behaviourally inhibited, which was not the case for mothers without SAD.

Some models suggest that BI might cause vulnerability to adverse child rearing environments (e.g., Ingram & Luxton, 2005; Nigg, 2005). One hypothesis is that inhibited children are more likely to be susceptible to the effects of adverse rearing and are also more likely to benefit from adaptive and encouraging parenting environments (Belsky & Pluess, 2009).

2.1.2.4 Transmission of parental expressions of anxiety (social referencing and observational learning)

While parenting behaviours and BI are clearly important factors in the development of later SAD, the mechanisms by which infants learn to be anxious remain unclear. Although Murray et al., (2008) and Aktar (2014) demonstrate the importance of these mechanisms within samples of clinically anxious parents, we cannot make causal inferences to tease apart the relationship and identify what might lead the infant to develop anxiety themselves. de Rosnay et al., (2006) attempted to investigate this and studied whether the social responsiveness of infants was influenced by indirect maternal messages in relation to a stranger when the infant observed the mother interacting with the stranger. They found that following an interaction between the mother and stranger that

demonstrated social anxiety, the infants were more fearful and avoidant with the stranger themselves. Although this attempted to clarify some of the mechanisms in the relationship between parenting, BI and SAD, this study left gaps in understanding how the infant learned to be anxious. Two possible accounts to explain how infants learned to be anxious have been proposed by Murray, specifically whether observation or social referencing have a role.

With parents identified as models for their children's learning, it is unknown whether infants acquire anxious behaviours directly (via social referencing) or indirectly (via observational learning).

Infants may develop a socially fearful disposition vicariously, through observing their parents show fear in social situations, something the literature refers to as modelling (Bandura, 1977). Dunne and Askew (2013) paired a photo of an unfamiliar animal with an image of either a happy or a fearful facial expression in one of two conditions (facial expression of the mother or of a stranger). They found higher levels of child self-reported fear when the animal was paired with a fearful face, regardless of which condition they were in. Furthermore, when children are frequently exposed to parental expressions of anxiety, they may adopt anxious responses and also become anxious (Muris et al., 1996). Vicarious learning has been identified in infants as young as 12-20 months old (Dubi et al., 2008; Egliston & Rapee, 2007; Gerull & Rapee, 2002).

Between the ages of nine and 12 months, infants begin to develop increasing awareness of the agency of others in relation to objects/people/places of reference (Carpenter et al., 1998). Around a similar time, infants begin to become wary around strangers (Sroufe, 1977). Social referencing theory suggests that infants modify their emotional responses to such referents based on how other people around them respond to it (Feinman et al., 1992), with infants social referencing behaviour at its most salient at 10-14

months old (Emde, 1992). In a social referencing task whereby a female stranger engaged parents in a two-minute long conversation while their infant watched and was then approached, it was found that infants aged 10-14 months with high BI who also had a mother with SAD displayed greater levels of avoidance (Murray et al., 2008) Similarly, Aktar et al., (2014) found that levels of BI and parental expressed anxiety interacted during social referencing tasks and predict avoidance in infants aged 12-months old.

Despite the evidence supporting both observational learning and social referencing, the mechanism underpinning the transmission of parental anxiety remains unclear. De Rosnay et al., (2006) manipulated expressions of parents to be anxious or non-anxious and found that infants who observed their mother behave anxiously when interacting with a stranger were subsequently more anxious themselves when interacting with the stranger compared to infants who observed their mother interact neutrally. This paper is consistent with findings in line with both observational and social referencing literature, however, leaves a gap in the literature to understand the effects of direct or indirect parental expressions of anxiety on infants' reactions during a social referencing task. Therefore, this study will aim to examine the underlying mechanism of anxiety transmission between parent and infant.

2.1.2.5 What do we know about how gaze impacts learning of anxiety?

A crucial feature of parent-child interactions is parental gaze towards the infant. Gaze is a direct social signal that fosters social connectedness between parent and infant (Brooks & Meltzoff, 2014) and humans spend substantial amounts of time during interactions fixating on eyes (Grossmann, 2017; Haith et al., 1977; Haxby et al., 2002). Direct gaze, usually referred to as eye contact, has been found to be crucial in the exchange of social signals, aligning adults and infants' brain during the learning process (Leong et al., 2017). When infants are learning about behaviour and emotion regulation, they use

social cues such as gaze to infer meaning and intentions that can then guide their interactions (Brooks & Meltzoff, 2008; Csibra & Gergely, 2009; Senju & Csibra, 2008). When a face communicates threat, humans spend more time holding gaze (Green et al., 2003; Ohman et al., 2000). It has been found that anxious individuals are more likely to view eye gaze as a source of threat (Ohman, 1986) and therefore it is unsurprising that anxious individuals tend to avoid holding eye contact (Baker & Edelmann, 2002; Farabee et al. ,1993; Weeks et al., 2013). Michalska et al., (2017) examined eye-gaze using a face-based fear conditioning task and found that during fear acquisition, children looked more often and for longer to the eye region of the positive conditioned stimulus (fearful face), rather than the negative conditioned stimulus (fearful face, accompanied by loud, aversive scream), which is consistent with findings that found anxiety was associated with eye gaze avoidance.

Gaze from the mother is something infants are highly attuned to, and early evidence shows that infants can join in with mutual direct gaze from three months old (Stern, 1974). Through gaze, parents communicate availability, engagement and can help to initiate self-regulation (Beebe & Steele, 2013; Slee, 1984) and adaptive responses (Belsky et al., 1984; Bornstein & Manian, 2013). From around six months old, infants begin to explore objects and people with their eyes and by interacting with social partners (Lock & Zukow-Goldring, 2010). Frank et al., (2012) measured visual fixations of infants aged between three and 30 months. They found that the youngest infants looked primarily at faces and eyes, and older infants distributed their gaze more flexibly and looked mostly at hands. Elsabbagh et al., (2014) found similar results with infants aged seven to 15 months and found that they looked at the eyes of their interaction partner more than the mouth. What the literature does not tell us is whether direct or averted gaze has an impact on how an infant responds when they are observing a parent-stranger interaction. Additionally, we do

not know how the infant would respond to the stranger themselves when approached after being in a gaze or no gaze condition.

2.1.3 Aim, Research Questions and Hypotheses

We know that children who are behaviourally inhibited are more likely to be anxious (Sandstrom et al., 2020). What we also know is that parenting behaviours can have an impact on how socially adapted a child is (Brennan et al., 2013). Evidence has suggested that children learn vicariously and also by acquiring cues through social referencing (de Rosnay et al., 2006). The literature highlights the importance of eye gaze in social communication between parent-child and has started to demonstrate that infants can learn about threat based on facial expression (e.g., Green et al., 2003), however we do not yet know whether eye gaze has an impact on infant response during a social referencing task.

Therefore, we aim to examine whether maternal gaze (direct gaze at infant or without gaze at the infant) while behaving in a socially anxious manner in a social referencing task affects 12- to 14-month-old infants' anxious behaviours.

Our hypotheses are:

1. When infants see their mother interacting in a socially anxious manner with an adult stranger in a social referencing paradigm, they will behave more anxiously when interacting with the stranger if their mother has gazed at the infant while she behaved anxiously, than if she did not gaze at her infant while she behaved anxiously with the stranger.
2. Infant behavioural inhibition will significantly moderate the relationship between mothers' socially anxious behaviours and infants' anxious behaviour when interacting with an adult stranger. Specifically, compared to infants who are not behaviourally inhibited, infants who are behaviourally inhibited will show more

anxious behaviour in response to each of parental direct and indirect expressions of anxiety.

2.2 Method

This study is the pilot phase to the larger study examining the role of maternal gaze while behaving in a socially anxious manner in a social referencing task and how this affects 12- to 14-month-old infants' anxious behaviours. The larger study will replicate the methods used in this pilot, with amendments made to features of the design, measures and procedures that appear unfeasible. The effect sizes obtained from the analyses used in this pilot phase will be used to estimate effects for the larger study.

2.2.1 Ethical approval

Prior to conducting this study, ethical approval was granted by the University of Southampton's Research Integrity and Governance Committee (ERGO: 53477) on the 16th November 2022.

2.2.2 Participants

18 eligible participants completed the online screening. Five mothers scored above the cut-offs on the GAD-7 and therefore were ineligible to take part in the study. Two participants did not attend the lab after booking in a session at the University due to illness or alternative commitments and one participant did not reply to emails to book a session. Two participant dyads completed phase one and then completed one of the conditions during phase two. These infants became distressed and therefore were unable to complete the second condition and thus provided too little data to be included in analyses.

The final sample included seven boys and six girls, aged between 12 and 14 months, seven days (M = 12 months, one day, SD = 25.72) and their mothers (n = 13), aged

between 25 and 42 (M = 31.46, SD = 5.64). Mother-infant dyads were recruited from the South of England through social media, poster advertisements in local libraries, supermarkets, nurseries, churches and mother and baby groups. Mothers were all over 18, White and English speaking and without a diagnosis of anxiety in the past year. All infants were born full term (37+ weeks) and were typically developing with no additional needs.

2.2.3 Study design and conditions

The study used a within-subjects laboratory experimental design, consisting of two conditions:

- Condition A: direct gaze towards the infant. The infant observed their mother interacting with a stranger for 90 seconds in a socially anxious manner. During this interaction, the mother was given a cue by the researcher to look in a congruent (anxious/worried) way towards the infant every 10 seconds. The stranger then interacted with the infant for 60 seconds while the mother ignored the infant (instead told to focus on a magazine or tablet screen).
- Condition B: no gaze towards the infant. The infant observed the mother interacting with a different stranger for 90 seconds in a socially anxious manner. The mother was instructed to not look towards the infant during this interaction. The stranger then interacted with the infant for 60 seconds while the mother ignored the infant (instead told to focus on a magazine or tablet screen).

2.2.4 Measures

Infant measures

The *Fear Subscale of the Infant Behaviour Questionnaire* (IBQ; Rothbart, 1981), assesses the fear domain of infant temperament (α = .87, Parade & Leerkes, 2008). The questionnaire asks parents to rate the frequency of different temperament-related

behaviours. Items on this measure are rated on a 7-point Likert scale, ranging from 1 (never) to 7 (always), with an additional option to select "does not apply". We did not use a cut-off score for this measure, rather scores were calculated, and a median split was conducted to classify infants as having either low BI or high BI (Lahat et al., 2014).

Parent measures

The *Penn State Worry Questionnaire* (PSWQ; Meyer et al., 1990) is a 16-item self-report scale measuring the trait of worry in adults (α = .87, Zhong et al., 2009). The scale measures three dimensions of worry, including excessiveness, generality, and lack of control. Items are rated on a 5-point Likert scale ranging from 1 (not at all typical of me) to 5 (very typical of me). Higher scores indicate greater levels of worry. A cut-off score of 63 was in place for the PSWQ. Rodríguez-Biglieri and Vetere (2011) found the highest level of correctly classified anxious patients were identified when sensitivity and specificity were optimised at a cut-off score of 63.

The *Generalised Anxiety Disorder Assessment* (GAD-7; Spitzer et al., 2006) is a 7-item self-report measure of anxiety across the previous two weeks, (α = .89, Dhira et al., 2021). Participants are asked to rate how often they have been bothered by different problems over the last two weeks. Items are rated on a 4-point Likert scale, ranging from 0 (not at all) to 3 (nearly every day). A cut-off score of 8 was used on the GAD-7. Plummer et al., (2016) identified that a cut-off score of 8 maintained the highest sensitivity, without compromising specificity.

The *Social Interaction Anxiety Scale* (SIAS; Mattick & Clarke, 1998) is a 20-item scale measuring anxiety pertaining to social interactions (α = .89, Olivares et al., 2001). The scale asks participants to rate how true each statement is on a 5-point Likert scale ranging from 0 (not at all) to 4 (extremely). A cut-off score of 36 was used for the SIAS.

Peters (2000) analysed the sensitivity and specificity of the scale, finding the classification of social phobia was most probable with a cut-off score of 36.

The *Edinburgh Postnatal Depression Scale* (EPDS; Cox et al., 1987) is a 10-item scale used to detect depressive symptoms in pre and postnatal women (α = .79, Kheirabadi et al., 2012). Participants are asked to rate on a 4-point scale how they have felt during the past week. Higher scores indicate a greater likelihood that a mother is experiencing symptoms of depression. As the measure is not a diagnostic tool, we included the measure to assist with identifying mothers who required possible follow-up support. Therefore, the risk question was checked immediately after completion to identify mothers presenting with risk to self/others. A cut-off score of >12 was used (O'Connor et al., 2016).

2.2.5 Procedure

Phase 1

Participants who showed interest in the study accessed Qualtrics online to complete the screening phase, which comprised the Fear Subscale of the Infant Behaviour Questionnaire (Rothbart, 1981), the Penn State Worry Questionnaire (Meyer et al., 1990), The Generalised Anxiety Disorder Assessment (Spitzer et al., 2006) and the Social Interaction Anxiety Scale (Mattick & Clarke, 1998).

If participants were eligible and scored below the cut offs (see measures section for more information) on the anxiety scales, they were contacted by the researcher and booked in for a lab session at the University of Southampton.

Phase 2

Mothers and their infants attended the lab at the University of Southampton. Each mother was read the same instructions for the lab session and was then asked to read the Participant Information Sheet for a second time and to provide their informed consent.

Once participants had given their consent, they completed the Edinburgh Postnatal Depression Scale.

The mothers were then shown a training video with two actors demonstrating how to act during the two interactions with the strangers. They were shown the video twice, first without sound so the participant could focus on the behaviours, and second with sound so the mothers could focus on verbal nuances in the way the actor was responding. Mothers were then given the opportunity to practise acting anxiously.

The mothers were informed which condition they were in first (gaze or no gaze) and then they were asked to sit their baby in the highchair provided. If the baby was distressed by the highchair, the mothers were given the option to sit them in their own pushchair. Once sat in the highchair, the camera was set to record the baby's behaviours. This camera was controlled from an adjoining laboratory room.

Participants then took part in both condition A and B separately with a different adult male stranger in each condition. The conditions were counterbalanced to control for order effects. Time to settle the infant was provided between the conditions, if needed.

Once both conditions were completed, participants were debriefed and thanked for their participation. They were informed of how to claim back their travel expenses. Participants received their £20 Amazon voucher by email later that day.

2.2.6 Ethical considerations

All the stooges used as "strangers" in this study were checked by the Disclosure and Barring Service (DBS). This ensured the safety of the children taking part in the study. Participants were told that all researchers and stooges involved were DBS checked to remain transparent about safety.

Due to the nature of the study, some infants became distressed. In the first instance, the mothers attempted to soothe their infant through physical touch, play or food. The mothers were then given the option to discontinue the experiment if their child was too distressed and if the mother was also concerned when observing their child in distress. If the participants discontinued the study, they still received the Amazon voucher as a thank you for attending.

The final question on the EPDS pertains to risk of harm to oneself. The researcher checked the answer to this item as soon as possible while the mother was still present in the lab. A protocol was in place for a qualified clinician, with experience in risk management, to be on hand if the participant answered that they had been having thoughts of harming themselves. No mothers endorsed this item.

All mothers were debriefed at the end of the lab phase of the study. They were given the opportunity to ask any questions and to discuss any concerns they had about the study.

2.2.7 Analysis plan

Video coding. The video recordings of the interactions were coded using the "*Scoring Protocol for Infant and Maternal Behaviour in The Presence of a Stranger at 10 and 14 Months"* (de Rosnay et al., 2003). The protocol provided detailed descriptions for the observed behaviour of the mother and their infant, with rating scales for observed behaviours on 1–5-point scales. The behavioural observation of the mother included maternal expressed emotion, which was observed in part one, when the mother was interacting with the stranger. The behavioural observations for the infant included: fearfulness and avoidance, which were observed in part two of each condition, when the stranger was interacting with the infant. An overall count of the number of times the infant looked towards their mother in both part one and part two of each condition were taken separately from the recordings.

Infants' behaviour during part two (infants interacting with the stranger) were coded on five-point scales for: infant fear (e.g., facial expressions of wariness and fear, postural behaviours such as freezing), ii) avoidance of stranger (e.g., attempts to avoid contact with the stranger through gaze avoidance, physically withdrawing or turning away).

The recruitment team consisted of the main researcher (RW; DClinPsych student) and two MSc students (LB and LG). Two members of the research team were present for each participant. The member of the recruitment team who was not present, and was therefore blind to the experimental condition, completed the coding. There were 26 observations to be coded (two conditions for each of the 13 participants) A second member of the recruitment team second-coded 40% (eight observations) of the recordings to monitor inter-rater reliability. Agreement was 87.5% for the number of looks (k = .69, 95% CI = .35 – 1.02, $p < .01$), 87.5% for fearfulness scores (k = .83, 95% CI = .42 – 1.24, $p < .01$) and 75% for avoidance scores (k = .82, 95% CI = .40 – 1.25, $p < .01$). Disagreements were discussed and it was agreed that where an agreement could not be reached, the third member of the research team blind would be responsible for blind coding the recording. This was not needed, as no disagreements were found within the coding pairs.

2.2.8 Statistical analysis

Measures of maternal mental health. Mothers' scores on the EPDS, SIAS, GAD-7 and PSWQ were calculated and means, standard deviations and clinical ranges were calculated.

Infant temperament on the fearfulness subscale. Means and standard deviations were calculated for each infant. A median split was conducted to group participants into higher BI or lower BI groups.

We are aware that our sample size makes our data statistically underpowered. Therefore, I have outlined the analytic plan for the intended sample size (n = 34) that we planned for to demonstrate how the analysis will be run for the subsequent larger scale study that this pilot is for. For the sample size reported in this pilot study, non-parametric tests will be conducted to account for the assumptions of the parametric tests not being met.

The mean number of looks from infant to mother were calculated for each condition. To investigate infant looking behaviour and whether order of conditions influenced the number of looks from infant to mother during the mother-stranger interaction, a repeated measures ANOVA was conducted, with condition (gaze or no gaze) as the within subject's factor and order (gaze first or no gaze first) as the between subject's factor.

Hypothesis one. When infants see their mother interacting in a socially anxious manner with an adult stranger in a social referencing paradigm, they will behave more anxiously when interacting with the stranger if their mother has gazed at them while she behaved anxiously, than if she did not gaze at them while she behaved anxiously with the stranger.

Mean scores were calculated for infant fearfulness and infant avoidance for each condition – A (direct gaze) and condition B (no gaze). To examine the effect of gaze on infant fearfulness and infant avoidance, a mixed model ANOVA will be conducted, with condition as the within subjects' factor.

Wilcoxon Signed Rank Test was conducted as the non-parametric equivalent test for this hypothesis.

***Hypothesis two*.** Infant behavioural inhibition will significantly moderate the relationship between mothers' socially anxious behaviours and infants' anxious behaviour when interacting with an adult stranger. Specifically, compared to infants who are not

behaviourally inhibited, infants who are behaviourally inhibited will show more anxious behaviour in each condition (direct gaze and no gaze).

To determine whether there is a moderating effect of infant BI on infant fearfulness in each condition, a mixed model ANOVA will be conducted. The ANOVA will have condition as the within subjects' factor and level of BI (high or low) as the between subjects factor.

To determine whether there is a moderating effect of infant BI on infant avoidance in each condition, a mixed model ANOVA will be conducted. The ANOVA will have condition as the within subject's factor and level of BI (High or low) as the between subject's factor.

2.3 Results

2.3.1 Demographics

All data analysis was conducted in SPSS (version 14).

We had a total of 13 mothers and their infants, mothers were aged between 25 and 42 (M = 31.46, SD = 5.64). Table 1 depicts the full demographic characteristics of the mothers.

Table 1.

Participant characteristics

Demographic characteristic		N
Ethnicity	Caucasian	13
Sexual Orientation	Heterosexual	12
	Bisexual	1
Household	Two-parent household	13

Marital status	In a domestic partnership	6
	Married	7
Religion	Atheist	5
	Agnostic	2
	Prefer not to say	1
	Protestant	1
	Roman catholic	2
	Buddhist	1
	Other (Church of England)	1
Education level	High school/college	2
	Bachelors	2
	Masters	3
	Other university/junior high qualification	1
	Trade/technical/vocational training	2
	Doctorate	3
Employment	Part-time	2
	Full-time	8
	Student	1
	Homemaker	2
Income	0 – 10,000	1
	11,000-20,000	3
	21,000-30,000	4
	31,000-40,000	3
	41,000-50,000	1
	51,000-60,000	1
Time spent with baby per day	3-6 hours	6
	>6 hours	7
Primary carer	Mum	9

Mother questionnaire scores

Prior to the laboratory phase of the study, mothers completed online screening questionnaires. Mothers who scored above any clinical cut off score (64 on the PSWQ, 36 on the SIAS and 8 on the GAD-7) were ineligible to take part in the second phase of the experiment. Table 2 displays the mean scores of eligible mothers who participated in the study.

Table 2.

Mothers' mean scores on anxiety and mood measures

	Mean	SD	Range	N*
PSWQ	41.00	6.56	28 – 51	13
SIAS	11.92	4.09	6 – 21	13
GAD-7	1.69	2.36	0 – 7	13
EPDS	3.00	3.29	0-12	13

* Total number of participants in the study

PSWQ: Penn State Worry Questionnaire

SIAS: Social Interaction Anxiety Scale

GAD-7: Generalised Anxiety Disorder-7

EDPS: Edinburgh Postnatal Depression Scale

In total, 13 infants participated in this study, with six female infants and seven male infants. Infants were aged between 12 months and one day and 14 months and seven days (M = 12 months, one day, SD = 25.72) on the day of the experimental task.

Parents completed the IBQ during the screening phase. The scores on this questionnaire informed a median split, whereby those who scored above 42 were labelled as "high behavioural inhibition" and those below 42 were labelled "low behavioural inhibition". Table 3 depicts the means and standard deviations.

Table 3.

*Parent-report scores on the Fear Subscale of the IBQ**

	Mean	SD	Range	N**
Fear subscale	41.62	7.04	31 - 56	13

*Infant Behaviour Questionnaire

** Total number of participants in the sample

2.3.2 Infant looks to mother

Infant looks were calculated for part 1 of the experiment. In the gaze condition, all infants looked towards the mother at least three times (M = 8.31, SD = 3.38). In the no gaze condition, all infants looked towards the mother at least four number of times (M = 8.38, SD = 3.33).

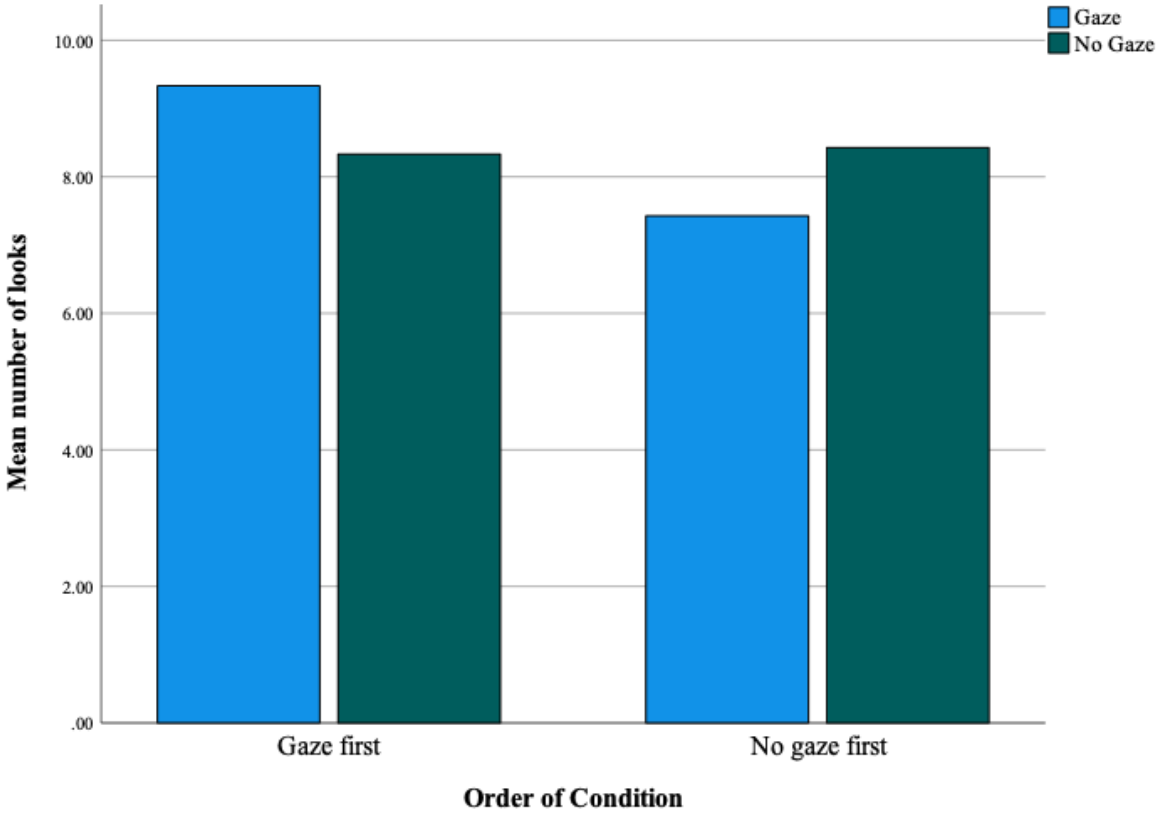
The parametric assumptions of an ANOVA were checked. The number of looks in the gaze condition was normally distributed ($p > .05$, see table 4 and figure 1, Appendix D), as was the number of looks in the no-gaze condition ($p > .05$, see table 4 and figure 2, Appendix D). There were no significant outliers and as there were only two repeated samples, we could not account for sphericity.

The repeated measures ANOVA showed that there was not a statistically significant main effect of condition (gaze or no gaze) on the number of looks, F (1, 11) = .00, $p > .05$, $\eta_p^2 = .000$. There was also a non-significant interaction between condition and order of

condition (gaze first or no gaze first) on the number of infant looks, F (1, 11) = 1.55, $p > .05$, $\eta_p^2 = .12$. Although there was a large effect size in the interaction, this was non-significant, which is likely a function of the sample size. Despite the counterbalancing of conditions, we can suggest from figure 3 that there was a large effect for the number of looks in the condition that infants were exposed to first.

Figure 3.

Number of looks across condition and order.



2.3.3 Hypothesis 1.

When infants see their mother interacting in a socially anxious manner with an adult stranger in a social referencing paradigm, they will behave more anxiously when interacting with the stranger if their mother has gazed at the infant while she behaved anxiously, than if she did not gaze at her infant while she behaved anxiously with the stranger.

In condition A (gaze), the mean score for infant fearfulness was 2.61 (*SD* = 1.66) and for avoidance was 2.62 (*SD* = 0.77). In condition B (no gaze), the mean score for infant fearfulness was 3.08 (*SD* = 1.25) and for avoidance was 2.69 (*SD* = 1.31).

To investigate this hypothesis, two repeated measures, mixed model ANOVAs were most appropriate to firstly examine the effect of gaze on infant fearfulness and then to examine the effect of gaze on infant avoidance. In both ANOVAs, condition was the within subject's factor.

We checked the parametric assumptions of an ANOVA. There were no significant outliers in the fear scores in the gaze condition, however this dependent variable was not normally distributed ($p < .005$, see Figure 4, Appendix D). There were no significant outliers in the fear scores in the no-gaze condition, and this dependent variable was normally distributed ($p > .05$, see Figure 5, Appendix D). In avoidance scores in the gaze condition, the data was non-normally distributed ($p < .05$, see figure 6, Appendix D) however in the no-gaze condition, avoidance scores were normally distributed ($p > .05$, see figure 7, Appendix D). As the data partly violated the assumptions of normality, the non-parametric equivalent of two repeated measures ANOVAs were conducted using Wilcoxon Signed Rank Test.

There was not a statistically significant difference in fear scores in the gaze condition (*Mdn* = 2.00) compared to the no-gaze condition (*Mdn* = 3.00), $T = 37.00$, $p > .05$, $r = .27$. Despite there being no significant difference, there was a medium effect of fear between the conditions.

There was not a statistically significant difference in avoidance scores in the gaze condition (*Mdn* = 3.00), compared to the no-gaze condition (*Mdn* = 3.00), $T = 24.5$, $p > .05$, $r = .07$, showing a small effect size of avoidance between the conditions.

2.3.4 Hypothesis 2.

Infant behavioural inhibition will significantly moderate the relationship between mothers' socially anxious behaviours and infants' anxious behaviour when interacting with an adult stranger. Specifically, compared to infants who are not behaviourally inhibited, infants who are behaviourally inhibited will show more anxious behaviour in response to each of parental direct and indirect expressions of anxiety.

In order to examine the moderating effect of BI on the dependent variables (infant fearfulness and infant avoidance), we planned to run ANOVAs with condition as the within subjects' factor and level of BI (high or low) as the between subjects factor.

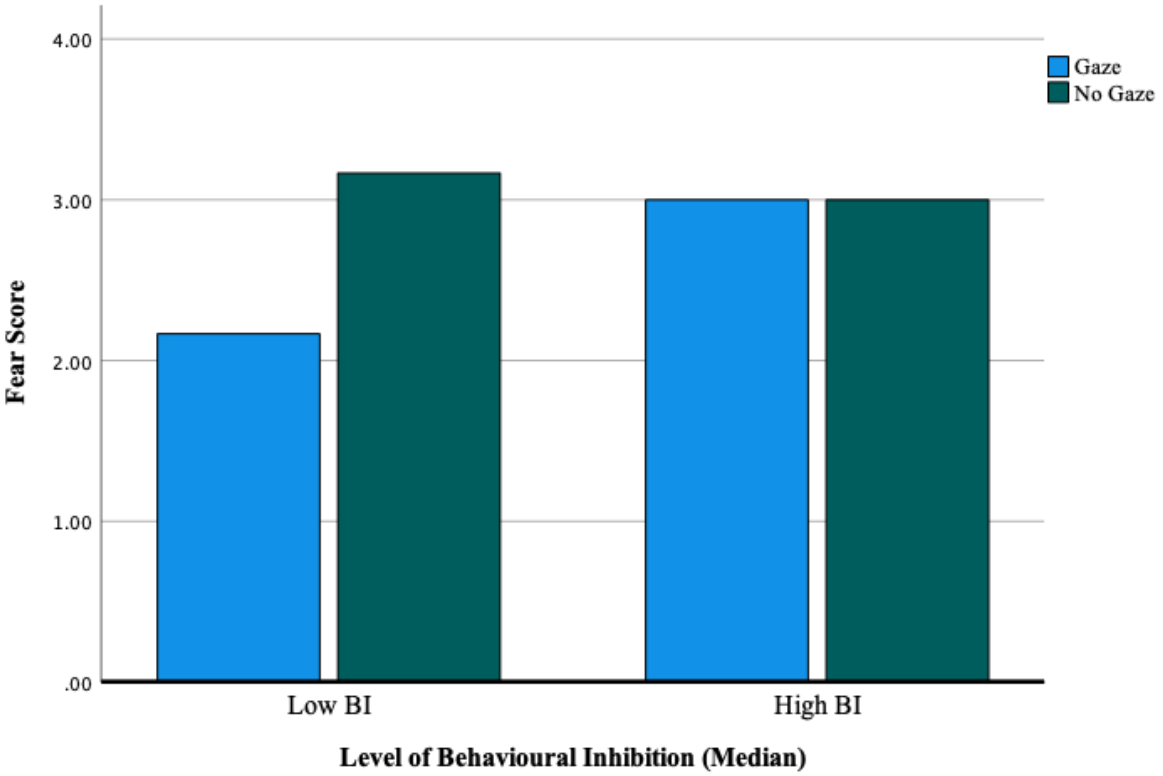
As discussed in hypothesis one, the data partly violated the assumptions of normality. We could not test for sphericity as there were only two levels of the repeated measures. However, in order to demonstrate how the data will be analysed for moderation in the subsequent, main study, we conducted the repeated measures ANOVAs.

Fear

The repeated measures ANOVA shows that there was a non-significant, main effect of condition (gaze or no gaze) on fear scores of infants, $F\,(1, 11) = 1.48$, $p > .05$, $\eta_p^2 = .12$. Despite the absence of statistical significance, the large effect size suggests that, with a larger sample, the no-gaze condition produces greater levels of fear than the gaze condition. There was also a non-significant interaction between condition and behavioural inhibition (low or high), $F\,(1, 11) = 1.48$, $p > .05$, $\eta_p^2 = .12$. The graph in figure 8 and the large effect size suggests that, with a larger sample, when infants are low on behavioural inhibition, they may be more fearful in the no gaze condition. This is compared to the gaze condition and those who were high inhibited who demonstrated no difference in fear scores. Although possibly statistically underpowered, these results suggest that, with a larger sample size, the no-gaze condition may produce more anxious behaviours in infants than the gaze condition, which is not in line with our hypothesis.

Figure 8.

Fear scores across conditions and behavioural inhibition levels

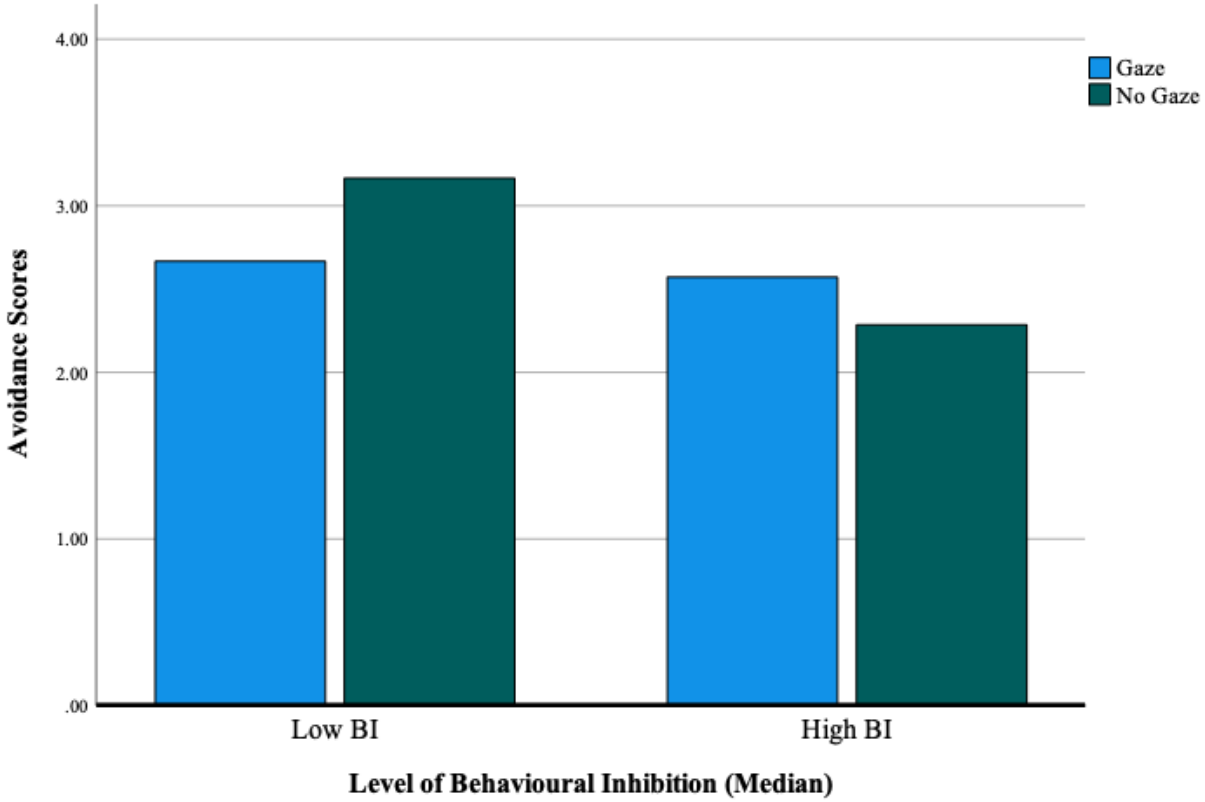


Avoidance

The repeated measures ANOVA showed that there was a non-significant main effect of condition (gaze or no gaze) on infant's avoidance scores, F (1, 11) = .11, p > .05, η_p^2 = .01. There was also a non-significant main interaction between condition and level of behavioural inhibition (low or high) on infant's avoidance scores, F (1, 11) = 1.70, p > .05, η_p^2 = .13. The graph in figure 9, alongside the large effect size of interaction suggests that, with a larger sample size, those with low BI scores may be generally more avoidant than those who are more highly inhibited.

Figure 9.

Avoidance scores across conditions and behavioural inhibition levels.



2.4 Discussion

This study was the first to examine the role of parents' eye gaze in a social referencing task on infants' anxious behaviours. This study was the pilot phase of the larger planned piece of research and was conducted to identify any issues with study design and feasibility (Lancaster et al., 2004). We set out to examine, first; whether maternal gaze to their infant (direct or indirect) while acting anxiously with a stranger impacts on infants anxious behaviours (fearfulness and avoidance) with that stranger, and second; whether infant behavioural inhibition moderated the relationship between maternal eye gaze and infant anxious behaviours (fearfulness and avoidance).

Infants use eye gaze as a social cue to infer meaning and to guide their subsequent actions with interaction partners (Brooks & Meltzoff, 2008; Csibra & Gergely, 2009; Senju & Csibra, 2008). To date, no research has investigated whether direct or averted gaze had an impact on infants' anxious behaviours during a social refencing task. We manipulated

maternal gaze so that each infant observed their mother interacting with a stranger while their mother either did not look at them or while their mother glanced towards them with direct gaze every 10 seconds. We found no main effect of condition (gaze or no gaze) on infant looking behaviour. We did, however, find a large effect size in the interaction between the order of conditions and condition on infant looking behaviour. We counterbalanced the conditions in order to control for confounding variables and to attempt to enhance internal validity of the study (Allen, 2017). Despite this, the findings showed that infant looking behaviour was more prevalent in the condition that infants were exposed to first. As it is likely the analyses are statistically underpowered due to the sample size, we can only draw some possible preliminary findings from the results. However, if similar results are found in the larger, subsequent study, it may suggest that there may be a primacy effect.

Co-regulation accounts of social referencing theories suggest that infants may refer to their mothers during unfamiliar situations in a way to downregulate their emotional and physiological arousal (e.g., Ainsworth, 1992; Kopp, 1989). This may account for the novelty effect found in this pilot, whereby infants in our study demonstrated more looking behaviour in the first condition they were exposed to. This may have been due to not yet having a reference on how to act in such an unfamiliar task. Social-cognitive accounts of social referencing paradigms found that typically infants exhibit more looking behaviour in the direction of the unfamiliar person in order to gather information (Carver & Vaccaro, 2007), rather than looking to the mother (Kim & Kwak, 2011; Schieler et al., 2018; Stenberg, 2009; Stenberg & Hagekull, 2007; Walden & Kim, 2005). In this pilot, we only accounted for the looking behaviour of the infant towards the mother and not towards the stranger, therefore we cannot make comparisons about where infants looked more. The larger, subsequent study may benefit from including this variable in their analysis to further add to the literature about looking behaviour.

In this study, we manipulated the mother's behaviour during the mother-stranger interaction so that mothers acted anxiously across both conditions (gaze and no gaze). De Rosnay et al., (2006) identified that infants who observed their mothers behaving anxiously with their interaction partner were subsequently more anxious themselves during the interaction, compared to infants who observed their mother interacting neutrally. Previous research identified that infants aged between nine and 12 months begin to become wary around strangers (Sroufe, 1977) and that they may adopt anxious responses following parental expressions of anxiety (Muris et al., 1996). While these studies highlighted that vicarious learning may be taking place, or that infants are engaging in social referencing behaviour (e.g., Walle et al., 2017), our study attempted to parse the underlying mechanisms of direct (that is, with gaze) and indirect (without gaze) expressions of anxiety. Although we did not find that gaze had a direct impact on infants expressed emotion (fear or avoidance), we unexpectedly found that there was a large effect size of fear between the conditions. We identified that despite being non-significant, there were greater levels of fear in the no-gaze condition, compared to the gaze condition. However, these results are based on non-parametric analyses and are possibly statistically underpowered, therefore we should interpret them with caution. Our results are not in line with our hypothesis that infants would behave more anxiously in the gaze condition, than the no-gaze condition. Previous research highlights that from birth, babies demonstrate a preference for mother's direct gaze over averted gaze (e.g., Farroni et al., 2002; Senju & Csibra, 2008) and Hietanen et al., (2008) found a heightened level of arousal in participants who were exposed to direct eye gaze, compared to averted gaze. We know that anxious individuals are more likely to view eye gaze as a source of threat (e.g., Ohman, 1986) and therefore we conducted moderation analyses to further explore this.

We explored the moderating effect of behavioural inhibition on infants' expressed emotion (fearfulness and avoidance) in relation to direct and indirect expressions of

maternal anxiety (gaze or no gaze). Although non-significant, we found a medium effect size in the interaction between condition (gaze or no gaze) and level of behavioural inhibition (low or high) on infant fear and a non-significant large effect size in the interaction between condition and level of BI on infant avoidance. Quite possibly, our analyses are again likely to be statistically underpowered and are therefore interpreted with caution. However, interestingly, our findings are opposite to our hypothesis that those who are more behaviourally inhibited would show more anxious behaviour in the gaze condition than those who are not. What we actually found was that those who were low on behavioural inhibition demonstrated more fear in the no-gaze condition and were generally more avoidant across both conditions than those who were highly inhibited. Those who were low on inhibition also demonstrated greater levels of avoidance in the no-gaze condition compared to the gaze condition, which was the opposite finding to those who were high on inhibition (greater avoidance in the gaze condition). These findings are in stark contrast to the research on behavioural inhibition, which highlights that the temperamental style is characterised by fear and avoidance in unfamiliar situations (Niditch & Varela, 2018).

Although in the opposite direction to our hypothesis and possibly due to the underpowered sample, our analyses infer possible preliminary findings into the underlying mechanism of gaze. It is possible that in this study, the direct gaze had the opposite effect to the desired result and rather served to capture the attention of the infant (e.g., Rato et al., 2019) which may have enabled self-referential processing (Senju & Johnson, 2009), leading to encouragement of affiliation (e.g., Georgescu et al., 2013; Stephenson & Rutter, 1970). As mutual gaze facilitates social coordination (e.g., Frädrich et al., 2018; Freeth et al., 2013; Lachat et al., 2012), and research found that eye gaze is expressive (Kendon, 1967) in that individuals are more likely to avert gaze in moments of high emotion, it is possible that the no-gaze condition communicated aversive information and possibly more

threat in the way we anticipated gaze to. These findings may be similar to Murray et al., (2008) who found that BI predicted childhood social anxiety when there was a presence of aversive parenting styles that did not encourage social responsiveness, which may be in line with what the no-gaze condition found.

2.4.1 Limitations

First, due to various recruitment and experimental difficulties (e.g., mothers scoring above the clinical cut off on screening questionnaires, babies being too distressed to complete the study or mothers not attending the laboratory phase), we had a sample size significantly smaller than our power analysis recommended. We used word of mouth to recruit, approached 50 venues that host mothers and their babies (e.g., nurseries, church groups, mother-and-baby groups) and the research team posted weekly on approximately 10 social media groups and forums. Some research has identified the difficulties with recruiting research participants, with Campbell et al., (2007) finding that less than one third of trials met their a priori power analysis for sample size. Pilot studies should aim to identify and address issues that arise in relation to sample size and data collection (Jairath et al., 2000; Prescott & Soeken, 1989) and can inform feasibility of a study. Conducting this pilot has identified clear difficulties with recruiting this population. For example, we have identified that mothers returned to work before 12 months, which was the minimum age for our research participants, with research showing that mothers typically return to work when the infant is eight months old (Burgess et al., 2008). As a result of the difficulties with recruiting, we aimed to follow the "rule of 12" participants for pilot studies (Julious, 2005; van Belle, 2002), using the results to estimate average effect sizes for planning the larger subsequent study. Using the effect sizes found in this pilot study we identified that, to achieve at least a medium effect size of $\eta_p^2 = .06$, a significance value of .05 and a power of .8 using two groups and two measurements, the larger subsequent study should aim for a total of 40 participants. The sample size in this pilot increases the chance of type two errors

(Columb & Atkinson, 2016). As a result, there is a likelihood of unreliable estimates of effect (Arnold et al., 2009) and therefore we must interpret the results with caution. We are unable to make assumptions about the data we have collected and therefore, we are using the data to inform the feasibility of this project on a larger scale. We are aware of the statistical tests we should conduct with a larger sample, and we used the appropriate tests to demonstrate how we plan to analyse the results.

Second, our sample was 100% Caucasian and therefore, we are unable to generalise beyond a Caucasian sample. It is possible that there may have been a bias towards Caucasian groups having more access to the online study advertisement, as evidence suggests that one of the most common ways to share parenting knowledge and connect with other mothers in Western societies is online (Crosby, 2011; Lupton et al., 2019). Contrastingly, within African American communities, it is shown that support and advice tend to be sought directly from extended family and fictive kin (very close friends, who are considered family) (Boyd-Franklin, 2005; Jarrett et al., 2010). This may therefore have prevented the advertisement reaching non-White groups and is a reflection on where recruitment may need to adapt for the larger study. The larger subsequent study and other future research should aim to run Patient and Public Involvement (PPI) groups to account for such cultural differences.

Third, the generalisability of participants is considered in light of the education of the mother. All mothers were educated to at least high school/college level and most made qualitative reference to the fact that they had studied elements of psychology in some capacity. It is possible that the educational backgrounds that some participants have had may have had an impact on their parenting, for example the way they communicate or socialise their child. This possibly may have resulted in less anxiety in the infants when interacting with strangers.

Finally, this pilot used a non-clinical sample. We trained mothers to be socially anxious during the interactions with stooges from our laboratory. Although mothers acting anxiously is less realistic than genuine anxiety, there is research to support the use of video training for parents in experimental tasks (e.g., Ewing et al., 2020). Additionally, after being trained by the researchers and asked if they were happy to continue, the participants provided qualitative information that they had become anxious about doing the study correctly and therefore, there may have been a genuine element of anxiety to some of the participants acting.

2.4.2 Implications and future research

Despite the limitations, this is the first study to examine the effect of eye gaze in a social referencing task. We are able to draw on some possible preliminary findings about the impact of gaze, and when conducted on a larger scale, this research will help to clarify how fear is communicated between generations in terms of the mechanisms of how infants learn to be anxious.

As this is a pilot study, the implications pertain largely to the feasibility of the larger scale study. The larger study must allow for more time to recruit the desired sample (Hulley et al., 1989). Additionally, employing a multicentre design would enable a larger sample size and would provide opportunity for sharing resources and generalisability across communities (Hunniford et al., 2019; Payne et al., 2011).

Prior to undertaking the larger study, a PPI group should be run to consider recruitment and mothers' expertise. The larger subsequent study may benefit from including infant looking behaviour in the direction of the stranger in the data analysis. This would act as a comparison to infant looking behaviour in the direction of the mother and would further explore where infants attend to during social referencing paradigms. Some of the infants who participated in the study had already begun to attend nursery. As we did

not control for whether infants were in nursery or other settings without their caregivers, it would be interesting to consider whether this level of socialisation moderated the infant's fearfulness and avoidance in relation to the stranger interaction.

2.4.3 Conclusion

In conclusion, this pilot study identified some preliminary findings in relation to direct and indirect maternal expressions of anxiety (direct gaze or no gaze) on infant expressed emotion (fear and avoidance) in a social referencing paradigm. Our findings, although interpreted with caution due to the likelihood that our sample is statistically underpowered, were not in line with our hypotheses and suggest that a lack of eye gaze may be communicating more threat than direct gaze. Additionally, we found that those who were low on behavioural inhibition demonstrated greater levels of fear and avoidance, which contrasts to previous work on understanding the temperament. A larger sample size may find dissimilar results and while we were unable to draw assumptions from the findings due to the small sample size, we have determined feasibility of the study and have been able to estimate effect sizes for the larger, subsequent study. We have identified pitfalls in the research design and are aware of the recruitment difficulties that may arise.

Appendix A - Standard Quality Assessment Criteria

Table 1.

Assessment of Study Quality for the 55 Included Studies using the 11 Relevant Criteria from Kmet et al (2004) Standard Quality Assessment Criteria for Quantitative Studies.

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Abend (2019)	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Ale (2010)	2	2	2	2	2	0	2	0	2	2	2	18	0.82

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Auday (2019)	2	2	2	2	2	2	2	0	2	2	2	20	0.91
Biederman (1993)	2	2	2	2	2	2	2	0	2	2	2	20	0.91
Bourdon (2019)	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Broeren (2009)	2	2	2	2	2	2	2	2	2	2	2	22	1.00

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	described/justified and appropriate?	10. Analytic methods reported for the main results?	11. Some estimate of variance is	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Buss (2011)	2	2	2	2	2	2	2	2	2	2	2	22	1.00	
Buzzell (2017)	2	2	2	2	2	2	2	2	2	2	2	22	1.00	
Chronis-Tuscano (2009)	2	2	2	2	2	2	2	2	2	2	2	22	1.00	

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Dougherty (2013)	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Dyson (2011)	2	2	2	2	2	2	2	2	2	1	2	21	0.95
Edwards (2010)	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Elliott (2011)	2	2	2	2	2	1	2	2	2	2	2	21	0.95

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Fu (2017)	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Hirshfeld-Becker (2007)	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Howard (2017)	2	2	2	2	2	1	2	2	2	2	2	21	0.95
Hudson (2011)	2	2	2	2	2	2	2	2	2	2	2	22	1.00

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Hudson (2012)	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Hudson (2018)	2	2	2	2	2	1	2	0	2	2	2	19	0.86
Kiel (2016)	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Kim (2016)	2	2	2	2	2	1	2	0	2	2	2	19	0.86

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Kotelnikova (2013)	2	2	2	2	2	1	2	0	2	1	2	18	0.82
Lahat (2018)	2	2	2	2	2	1	2	0	2	2	2	19	0.86
Lamm (2014)	2	2	2	2	2	2	2	0	1	2	2	19	0.86
Majdandzic (2018)	2	2	2	2	2	2	2	1	2	2	2	21	0.95

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Manassis (1995)	2	2	2	2	2	0	2	0	2	2	2	18	0.82
McLean (2019)	2	2	2	2	2	1	2	2	2	2	2	21	0.95
Mian (2011)	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Morales (2017)	2	2	2	2	2	2	2	2	2	2	2	22	1.00

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Mumper (2019)	2	2	2	2	2	1	2	2	1	2	2	20	0.91
Muris (2002)	2	2	2	2	2	2	2	1	0	2	2	19	0.86
Muris (2009)	2	2	2	2	2	2	2	1	2	2	2	21	0.95
Muris (2011)	2	2	2	2	2	2	2	2	0	2	2	20	0.91

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Muris (2016)	2	2	1	2	2	1	2	2	2	2	2	20	0.91
Natsuaki (2013)	2	2	2	2	2	0	2	0	2	2	2	18	0.82
Niditch (2018)	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Olino (2014)	2	2	2	2	2	2	2	0	0	2	2	18	0.82

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Pahl (2012)	2	2	2	2	2	2	2	2	0	2	2	20	0.91
Paulus (2015)	2	2	2	2	2	2	2	2	0	2	2	20	0.91
Perez-Edgar (2014)	2	2	2	2	2	0	2	2	2	2	2	20	0.91

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Rapee (2014)	2	2	2	2	2	1	2	0	2	2	2	19	0.86
Reeb-Sutherland (2009)	2	2	2	2	2	1	2	2	0	2	2	19	0.86
Reeb-Sutherland (2015)	2	2	2	2	2	1	2	0	2	2	2	19	0.86

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Schwartz (1999)	2	2	2	2	2	1	2	0	0	2	2	17	0.77
Stumper (2017)	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Suarez (2019)	2	2	2	2	2	2	2	2	0	2	2	20	0.91

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Troller-Renfree (2019 [a])	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Troller-Renfree (2019)	2	2	2	2	2	2	2	2	2	2	2	22	1.00

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	selection or source of information/input 3. Method of subject/comparison group	applicable) characteristics sufficiently 4. Subject (and comparison group, if	exposure measure(s) well defined and 8. Outcome and (if applicable)	described/justified and appropriate? 9. Sample size appropriate?	reported for the main results? 10. Analytic methods	11. Some estimate of variance is	12. Controlled for confounding?	13. Results reported in sufficient detail?	results? 14. Conclusions supported by the	Total score	Summary Score
van der Linden (2013)	2	2	2	2	2	2	2	0	0	2	2	18	0.82
Volbrecht (2010)	2	2	2	2	2	2	2	2	2	2	2	22	1.00
Vreek and Muris (2012)	2	2	2	2	2	2	2	2	2	2	2	22	1.00

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Vreeke (2012)	2	2	2	2	2	2	2	0	1	2	2	19	0.86
Vreeke (2013)	2	2	2	2	2	1	2	1	2	2	2	20	0.91
West (2007)	2	2	2	2	2	1	2	2	2	2	2	21	0.95
White (2017)	2	2	2	2	2	2	2	2	2	2	2	22	1.00

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Luis-Joaquin (2020)	2	2	2	2	2	2	2	2	0	2	2	20	0.91
Lorenzo (2021)	2	1	1	2	2	1	2	1	0	2	2	16	0.73
Zeytinoglu (2021)	2	1	2	2	2	2	2	1	0	2	2	18	0.82

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Buzzell (2020	2	1	2	2	2	2	2	2	0	2	2	19	0.86
Kiel (2021	2	2	2	2	2	2	2	2	1	2	2	21	0.95
Bockstael e (2021)	2	2	1	2	2	1	2	1	0	2	2	18	0.82
Mumper (2020)	2	1	1	2	2	2	2	2	1	2	2	19	0.86

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Bahtiyar-Saygan (2021)	2	2	2	2	2	2	2	2	0	2	1	19	0.86
Valadez (2021)	2	2	2	2	2	2	2	2	0	2	2	20	0.91
Suarez (2021)	2	2	2	2	2	2	2	2	1	2	2	21	0.95

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Lawrence (2020)	2	2	2	1	2	2	2	0	0	2	2	17	0.77
Hill Goldsmith (2022)	2	2	2	2	2	2	2	2	0	2	2	20	0.91
Gilbert (2022)	2	1	2	2	2	2	2	1	1	2	2	19	0.86

Study	1. Question / objective sufficiently described?	2. Study design evident and appropriate?	3. Method of subject/comparison group selection or source of information/input	4. Subject (and comparison group, if applicable) characteristics sufficiently	8. Outcome and (if applicable) exposure measure(s) well defined and	9. Sample size appropriate?	10. Analytic methods described/justified and appropriate?	11. Some estimate of variance is reported for the main results?	12. Controlled for confounding?	13. Results reported in sufficient detail?	14. Conclusions supported by the results?	Total score	Summary Score
Valadez (2022)	2	2	2	2	2	2	2	2	0	2	2	20	0.91
Dodd (2020)	2	2	2	1	2	2	2	2	2	2	2	21	0.95

Appendix B. Summary of the 70 Studies Included in The Meta-Analysis

Table 2.

Summary of the 75 studies included in the meta-analysis

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
Abend	2019	Prospective	Observational and parent-report	2.62	Categorical	Child and parent combined report	10.51, 13.04	Categorical	Any Anxiety
Ale	2010	Cross-sectional	Parent-report	4.42	Continuous	Parent-report	4.42	Continuous	Social Anxiety
Auday	2019	Cross-sectional	Parent-report	10.81	Continuous	Parent-report	10.81	Continuous	Any Anxiety
Bahtiyar-Saygan	2021	Cross sectional	Parent report	2.28	Continuous	Child behaviour checklist and brief version of infant-toddler social and emotional	0.72	Continuous	Any anxiety

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
Biederman	1993	Prospective	Observational	1.75, 5.12	Categorical	Clinical Interview	7.45, 11.25, 5.12, 6.38	Categorical	Any Anxiety, Separation Anxiety, Social Anxiety, Phobia, Panic
Bockstaele	2021	Cross sectional	Parent report	0.01	Continuous	Picture anxiety test, SCARED	0	Categorical	Social anxiety
Bourdon	2019	Prospective	Parent-report	N/A	Continuous	SCID-Junior Child and parent combined report	11.22	Continuous	Social Anxiety, Generalised Anxiety, Separation Anxiety, Panic
Broeren	2009	Cross-sectional	Parent-report	6.09	Continuous	Parent-report	6.09	Continuous	Any Anxiety
Buss	2011	Prospective and Cross-sectional	Observational	2	Continuous	Parent-report	2, 3, 4, 5	Continuous	Any Anxiety

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
Buzzell	2017	Prospective	Observational and parent-report	2.62	Continuous	Parent-report	13.58	Continuous	Social Anxiety, Generalised Anxiety
Buzzell	2020	Prospective	Observation	-.005	Continuous	SCARED parent	4.003, 3.82, 5.44, 4.94	Continuous	Social anxiety
Chronis-Tuscano	2009	Prospective	Observational and parent-report	1.2 – 7*	Categorical	Clinical interview	15.05	Categorical	Any Anxiety Social Anxiety
Chronis-Tuscano	2021	Prospective	Parent report	5.135	Continuous	ADIS-V-CP	6.797	Categorical	Any anxiety
Dodd	2020	Prospective	Observation and parent report	-.01	Continuous	PAS	22.43	Continuous	Any anxiety
Dougherty	2013	Cross-sectional	Observational	3.6	Continuous	Clinical interview	3.6	Categorical	Any Anxiety
Dyson	2011	Cross-sectional	Observational and parent-report	3.5	Categorical	Clinical interview	3.5	Categorical	Social Anxiety, Phobia,

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
Edwards	2010	Prospective, Cross-sectional, Retrospective	Parent-report	3.95, 5	Continuous	Parent-report	3.95, 5	Continuous	Separation Anxiety, Generalised Anxiety Any Anxiety
Elliott	2011	Cross-sectional	Parent-report	5.61	Categorical	Parent-report	5.61	Continuous	Any Anxiety
Fernandes	2022	Cross sectional	Parent report	3.366	Continuous	Parental anxiety scale	1.129	Continuous	Any anxiety
Fu	2017	Cross-sectional	Parent-report	6.06	Categorical	Observational	6.06	Continuous	Any Anxiety
Gilbert	2022	Cross sectional	Parent report	5.95	Continuous	Preschool Anxiety Scale (PAS) and KSADS-EC	129.67, 149.4, 117.92, 98.5, 11.31	Continuous	Separation, social, generalised, specific phobia, OCD

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
Hill Goldsmith	2022	Prospective	Observation and parent report	-.006, .002, -.002	Continuous	Multidimensional Anxiety Scale for Children, HBQ and DISC-IV	0, -.002, -.009	Continuous	Social anxiety
Hirshfeld-Becker	2007	Prospective	Observational	4.19	Categorical	Clinical interview	9.28	Categorical	Social Anxiety
Howard	2017	Cross-sectional, Prospective	Parent-report	4	Continuous	Parent-report	4, 5	Continuous	Any Anxiety
Hudson	2011	Cross-sectional, Prospective	Observational and parent-report	4	Categorical	Clinical interview	4, 6.03	Categorical	Any Anxiety
Hudson	2012	Prospective	Observational and parent-report	4	Categorical	Clinical interview	8.9	Categorical	Any Anxiety
Hudson	2018	Prospective	Observational and parent-report	4	Categorical	Clinical interview	11.8	Categorical	Any Anxiety

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
Kiel	2016	Cross-sectional, Prospective	Observational	2.1	Continuous	Parent-report	2.1	Continuous	Separation Anxiety
Kiel	2021	Prospective, cross sectional, retrospective	Observation	-.02	Categorical	Infant-toddler social emotional assessment	0.62, 0.62, 0.67	Continuous	Any anxiety
Kim	2016	Cross-sectional	Parent-report	13.4	Continuous	Parent-report	13.4	Continuous	Any Anxiety
Kotelnikova	2013	Cross-sectional	Observational	7.41	Continuous	Parent-report	7.41	Continuous	Any Anxiety
Lahat	2018	Prospective	Observational and parent-report	2.62	Continuous	Parent-report, Self-report, Child and parent combined reports	10-13*	Continuous	Social Anxiety
Lamm	2014	Prospective	Observational and parent-report	2.62	Continuous	Parent-report	7.64	Continuous	Any Anxiety

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
Lorenzo	2021	Prospective	Observation	-.01	Continuous	CBCL	2.86	Continuous	Social anxiety
Luis-Joaquin	2020	Prospective	Parent and teacher report	21.7	Continuous	Clinical interview	N/A	Categorical	Social anxiety
Majdandzic	2018	Prospective	Observational	1.05	Continuous	Parent-report	2.55, 4.56	Continuous	Any Anxiety
Manassis	1995	Cross-sectional	Observational	3	Categorical	Clinical interview	36.3m	Categorical	Any Anxiety
McClean	2019	Prospective	Parent-report	1.4	Continuous	Parent-report	48.8m	Continuous	Any Anxiety
Mian	2011	Prospective	Parent-report	3	Continuous	Parent-report	6.03, 8.01	Continuous	Any Anxiety
Morales	2017	Cross-sectional	Parent-report	10.19	Categorical	Clinical interview	10.19	Continuous	Social Anxiety

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
Mumper	2019	Prospective	Observational	3.55, 3.56	Continuous	Self-report	9.17, 12.67	Continuous	Any Anxiety
Mumper	2020	Prospective	Observation	0.64	Continuous	SCARED	19, 16	Continuous	Any anxiety
Muris	2002	Cross-sectional	Parent-report	12.7	Continuous	Parent-report	12.7	Continuous	Any Anxiety
Muris	2009	Cross-sectional	Parent-report	10.54	Continuous	Parent-report	10.54	Continuous	Any Anxiety
Muris	2011	Prospective	Parent-report	6.6	Continuous	Clinical interview, Parent-report	5-11*	Continuous	Social Anxiety, Any (Non-Social) Anxiety
Muris	2016	Cross-sectional	Parent-report	4.10, 4.98, 4.99	Continuous	Parent-report	4.98	Continuous	Social Anxiety, Any (Non-Social) Anxiety, Selective Mutism

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
Natsuaki	2013	Prospective, Cross-sectional, Retrospective	Observational	1.17, 2.25	Continuous	Parent-report	1.17, 2.25	Continuous	Social Anxiety
Niditch	2018	Prospective	Parent-report	0.5	Continuous	Parent-report	6	Continuous	Any Anxiety
Olino	2014	Cross-sectional	Observational	3.56	Continuous	Clinical interview	3.56	Categorical	Generalised Anxiety, Separation Anxiety, Panic, Social Anxiety, Phobia
Pahl	2012	Cross-sectional	Parent-report	4.45	Continuous	Parent-report	4.45	Continuous	Any Anxiety
Paulus	2015	Retrospective	Parent-report	59m**	Categorical	Parent-report	6.1	Categorical	Any Anxiety, Social Anxiety, Separation Anxiety, Phobia

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
Perez-Edgar	2014	Prospective	Observational and parent-report	2.62	Continuous	Parent-report, self-report	16.33	Continuous	Any Anxiety
Rapee	2014	Prospective	Observational and parent-report	3.8	Categorical	Clinical interview	15.4	Categorical	Any Anxiety, Separation Anxiety, Generalised Anxiety, Social Anxiety, Phobia, OCD
Reeb-Sutherland	2009	Prospective	Observational and parent-report	2.62	Continuous	Clinical interview	15.1	Categorical	Any Anxiety
Reeb-Sutherland	2015	Prospective	Observational and parent-report	2.62	Continuous	Clinical interview	15.06	Categorical	Any Anxiety
Schwartz	1999	Prospective	Observational	1-2*	Categorical	Clinical interview	13	Categorical	Social Anxiety

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
Stumper	2017	Prospective, Cross-sectional	Observational, parent-report	3	Continuous	Clinical interview	3, 9	Continuous	Any Anxiety
Suarez	2021	Prospective	Observation and parent report	-.01	Continuous	SCARED (parent and child), GTKY and KSADS	-.03	Continuous	Any anxiety
Suzrez	2019	Cross-sectional	Parent-report	9.97	Continuous	Clinical interview	9.97	Continuous	Social Anxiety
Troller-Renfree	2019a	Prospective	Observational and parent-report	2.62	Continuous	Parent-report, Self-report	12	Continuous	Any Anxiety
Troller-Renfree	2019b	Prospective	Observational and parent-report	2.62	Continuous	Parent-report, Self-report	13	Continuous	Any Anxiety
Valadez	2021	Prospective	Observation and parent report	-.01	Continuous	SCARED	-.02	Continuous	Any anxiety

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
Valadez	2022	Prospective	Observation and parent report	0	Continuous	SCARED parent and child	10.3 17.9, 11.1, 20.5	Continuous	Any anxiety
van der Linden	2013	Cross-sectional	Parent-report	10.54	Continuous	Parent-report	10.54	Continuous	Any Anxiety
Volbrecht	2010	Prospective	Observational and parent-report	3.04	Continuous	Parent-report	7.51	Continuous	Separation and Generalised Anxiety
Vreeke	2012	Prospective	Parent-report	3.59	Continuous	Parent-report	4.47	Continuous	Any Anxiety
Vreeke	2013	Prospective, Cross-sectional, Retrospective	Parent-report	4.54	Continuous	Parent-report	4.54	Continuous	Social Anxiety, Any (Non-Social) Anxiety
Vreeke & Muris	2012	Cross-sectional	Parent-report	9.07	Continuous	Parent-report	9.07	Continuous	Any Anxiety

Author	Year	Design	BI measure	Mean age of BI measure	BI Type	Anxiety measure	Mean age of anxiety measure	Anxiety type	Anxiety outcome
West	2007	Cross-sectional	Parent-report	13.5	Continuous	Self-report	13.5	Continuous	Social Anxiety
White	2017	Prospective	Observational and parent-report	2.61	Continuous	Parent-report	5.26, 7.64	Continuous	Any Anxiety
Zeytinoglu	2021	Prospective	Observation	-.01	Continuous	GAD-7	5.57, 5.07	Continuous	Generalised anxiety

Note. * = mean age range not reported, age range reported instead. ** = mean age or age range not reported, age of recruitment reported instead.

Appendix C – Coding Scales from Murray et al., (2008) Manual

Infant-stranger avoidance (ISAv)

Epochs:2

Infant-stranger avoidance is meant to capture the infant's attempts to avoid contact and interaction with the stranger. Avoidance, as defined here, is meant to reflect the same behavioural dispositions as the avoidance scales articulated by Ainsworth et al. (1978). The relevant behaviours are, "increasing distance between self and the person [stranger], whether by locomotion or by leaning away from; turning the back on the person; turning the head away; averting the gaze; avoidance of meeting the person's eyes; hiding the face; or simply ignoring the person" (Aisnworth et al., 1978; p. 353).[i]

Avoidance usually takes on an obvious quality and is observed in many infants. During the stranger's approach, the infant may look away or avert gaze but again this is not to be scored as avoidance if he or she looks at the mother. Common avoidant behaviours include those listed above. Generally during close contact—between the stranger and the infant—looking away or averting gaze is scored as avoidant behaviour. However, if the infant is distracted by/making contact with, the stranger's jewellery or clothing then avoidance is not scored. Some infants may first establish contact with the stranger and then engage in active communication whilst not looking at the stranger. During these kinds of interactions the emotional tone of the infants should be relatively high and they may produce positive vocalisations. In these cases avoidance should not be scored. However, a small number of infants will have a high emotional tone and may even seem happy but nonetheless avoid visual contact with the stranger. Looking away and averting gaze in this context should be scored as avoidance until the infant makes face-to-face contact with the stranger. This contact must be more than merely a passing look and the infants' subsequent emotional tone should stay high if avoidance is not to be scored beyond this point.

A final note is required on the distinction between infant-stranger avoidance (ISAv) and fearfulness (ISF). Fearfulness is commonly displayed while looking in the direction of the stranger or in the absence of any obvious avoidance. Occasionally an infant will have a passive 'sunken-in' appearance in the presence of the stranger. This is generally scored as fearfulness. If, however, the infant also averts gaze then the postural elements should be considered indicative of fear and the gaze aversion indicative of avoidance.

(1) No stranger avoidance: This infant generally meets stranger openly or fearfully without turning away or avoiding gaze.

(2) Occasional stranger avoidance: During the interaction with the stranger, this infant shows only one or two brief instances of avoidance that are relatively passive (i.e. looking away without strong physical movements). If there is a sustained instance (lasting approximately two seconds) of avoidance then a score of '2' cannot be given even if this avoidance is passive.

(3) Moderate stranger avoidance: This infant shows at least two instances of avoidance which are not brief (see above) or one sustained instance lasting between three and four seconds or more active brief episodes of avoidance (i.e. pushing away with the arm, squirming out the stranger's arms, arching backwards, or avoidance + fearfulness)

(4) Frequent stranger avoidance: Frequent avoidance can only be given if the infant's behaviour in a given epoch is strongly characterised by avoidant behaviour; this can be passive or active. That is to say, avoidance must be more frequent than positive behaviours and will probably also be more frequent than fearful behaviours.

(5) Very frequent stranger avoidance: Very frequent avoidance can only be given if the infant's behaviour in a given epoch is predominantly avoidant. This infant spends most of his or her time avoiding eye contact, turning away from or ignoring the stranger as best he or she can. It is important to note that infants can achieve a '5' for avoidance without being visibly fearful.

From published paper: **Avoidance covered infant attempts to increase distance from or avoid contact with the stranger; this included leaning or pulling away, turning or looking away, averting gaze or avoiding eye contact, pushing the stranger away, and placing an arm between the self and the stranger.**

Infant-stranger fearfulness (ISF)

Epoch: 2

Infant-stranger fearfulness is designed to capture a fairly broad range of behaviours variously defined as fearfulness and wariness (see for example Goldsmith & Rothbart, 1999; Schafer, Greenwood & Parry; 1972; Stevenson-Hinde & Shouldice, 1990; Waters, Matas & Sroufe, 1975). Indications of fearfulness included a fearful or wary expression (including wary brow and characteristic mouth movements), a cry face, fretting, crying, a sudden decrease in activity often associated with a passive 'sunken-in' posture with or without averted gaze (often with arms and head drawn into body)[1], tense or frozen posture and possibly trembling at the extreme. Sometimes infants also bring their hands quite passively to the side of their head or their face. If there is a clear fearful expression on the face of the infant in response to the stranger, a score of at least 3 must be given.

Fearfulness can occur with or without avoidance (ISAv) and coders should be careful to distinguish when avoidance is present. As a general guideline, avoidance removes the child from interaction with the stranger. This can happen in the presence of a fearful expression. With fearfulness, the infant may look at the stranger first, but it is not always the case that the fearful expression must follow attention to the stranger to be scored as fearfulness.

For the purpose of this scale fear can be viewed as a function of two constructs: persistence of fear during an epoch, and intensity of a given expression of fear. In the ensuing five-point scale a balance has been struck between these two constructs and scorers must ensure that they give consideration to both. For example, a persistent low level of fearfulness would not achieve a score of over 2 or 3. By contrast, isolated intense expressions of fear (e.g. a fearful face) should achieve a high score.

> Care should be taken during the transition from epoch 1 to epoch 2. If the infant is already crying, fussing or whimpering and then the stranger comes to the infant's attention and he or she continues to cry, fuss or whimper then this expression of disquiet should not be scored as fearfulness. However, if an infant who has previously been crying, fussing or whimpering ceases to do so and then starts again in epoch II ~~or III~~ this should be scored as fearfulness. If the intensity of the crying, fussing or whimpering increases as a function of the stranger's approach then this should also be scored as fearfulness.

[1] This is also described as bodily 'sadness'. See Goldsmith and Rothbart (1999).

(1) No fearfulness: This infant generally meets stranger openly or possibly with avoidance, turning away or averting gaze. During the transitional epochs [2a and 3a] expressions of fearfulness can be quite subtle and may occur even with infants who greet the stranger with smiles.

(2) Occasional fearfulness: A single brief instance of fearfulness earns a score of '2'. If there are any additional expressions of fearfulness a higher score must be given. Level 2 aims to capture fleeting rather than persistent fear, or the sudden dampening of movement in response to the stranger. If there are any clear signs of facial fearfulness or a depressed demeanour occurring alongside this dampening of movement then the infant should score at least a 3.

(3) Moderate fearfulness: Only a single more persistent expression of fearfulness or two discrete examples are required for a score of '3'. An infant earning a score of '3' is not predominantly fearful. Rather, there should be instances of fearfulness mixed with other positive or avoidant responses. Alternatively, very persistent but mild fearfulness in the form of a wary expression or cry face, or a generally depressed demeanour throughout an epoch should earn a score of '3'.

(4) Frequent fearfulness: Frequent fearfulness can only be given if the infant's behaviour in a given epoch is strongly characterised by fearful behaviour. That is to say, the infant is more fearful than positive. Usually, this infant will also be more fearful than avoidant although this is not necessarily the case. With frequent fearfulness more pronounced fearful behaviours are noticed. Stronger fearful expressions and crying in response to the stranger may be seen. The infant may remain in a 'sunken-in' pose or whimper and fret persistently. Also, the infant may become tense or 'frozen'.

(5) Very frequent fearfulness: This can only be given if the infant's behaviour in a given epoch is predominantly fearful. There are various manifestations of very frequent fearfulness. First, the infant may cry strongly in response to the stranger. Second, he or she may remain frozen with a cry face or a fearful face. Mild trembling may also be noticed. Finally, there may be a combination of more active crying or screaming and more passive frozen posture. In epoch III (b) this infant may well cry continuously and may have to be returned to his or her mother. It is important to note that infants can achieve a '5' for fearfulness without being visibly avoidant. Their attention may remain 'locked' on the stranger during passive episodes of strong fear.

From published paper: Fearfulness covered a broad range of behaviors variously defined as fearfulness or wariness (Goldsmith & Rothbart, 1999; Schaffer, Greenwood, & Parry, 1972; Sroufe, 1977; Stevenson-Hinde & Shouldice, 1990). It included a fearful or wary expression, a cry face, fretting, crying, sudden stilling of activity, tense or frozen posture.

Appendix D – Chapter 2 Figures and Tables

Table 4.

Shaprio-Wilk Test of normality

	Statistic	df	Sig.
Total looks gaze	.948	13	.564
Total Looks no-gaze	.907	13	.165
Total Fear gaze	.825	13	.014
Total Fear no-gaze	.901	13	.137
Total Avoid gaze	.856	13	.035
Total Avoid no-gaze	.919	13	.246

Figure 1.

Normal Q-Q plot for total looks in gaze condition

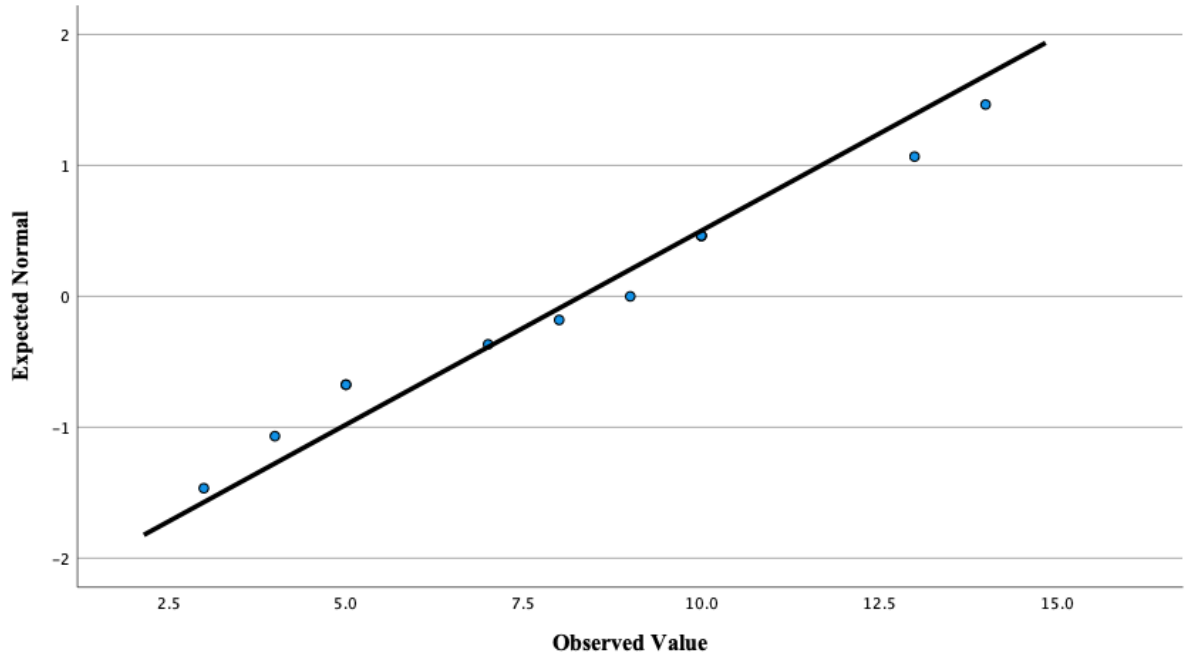


Figure 2.

Normal Q-Q plot for total looks in no-gaze condition

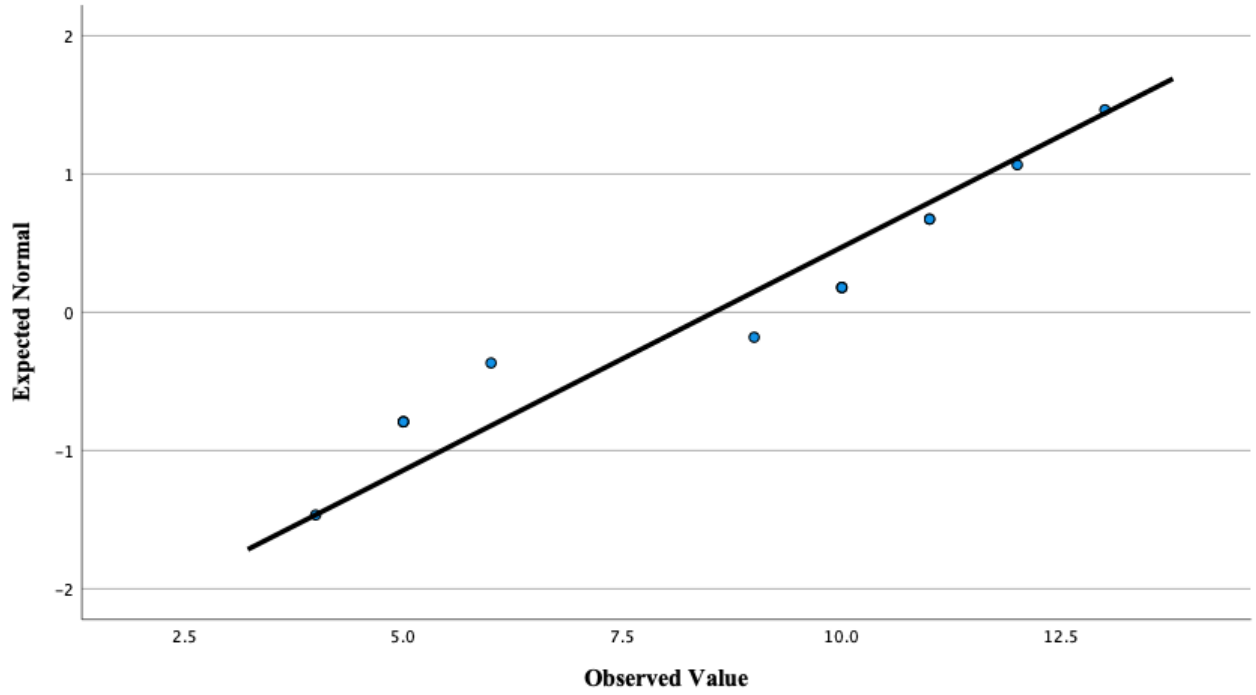


Figure 4.

Normal Q-Q plot for fear scores in gaze condition

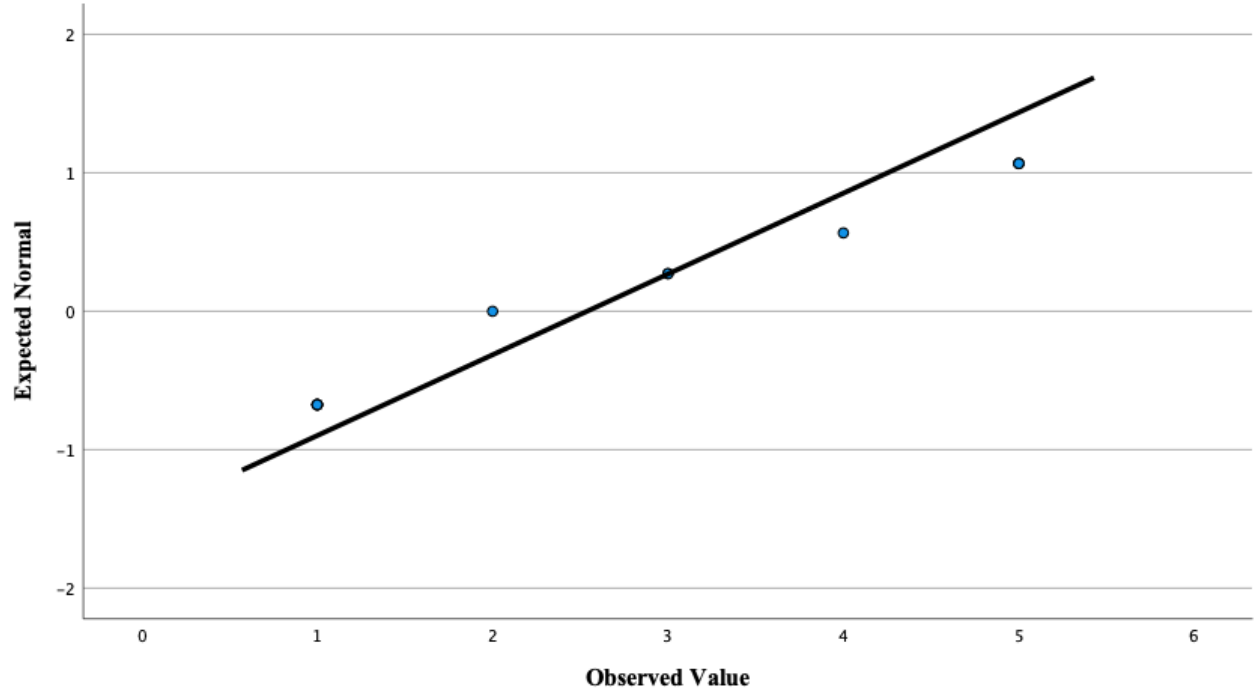


Figure 5.

Normal Q-Q plot for fear scores in no-gaze condition

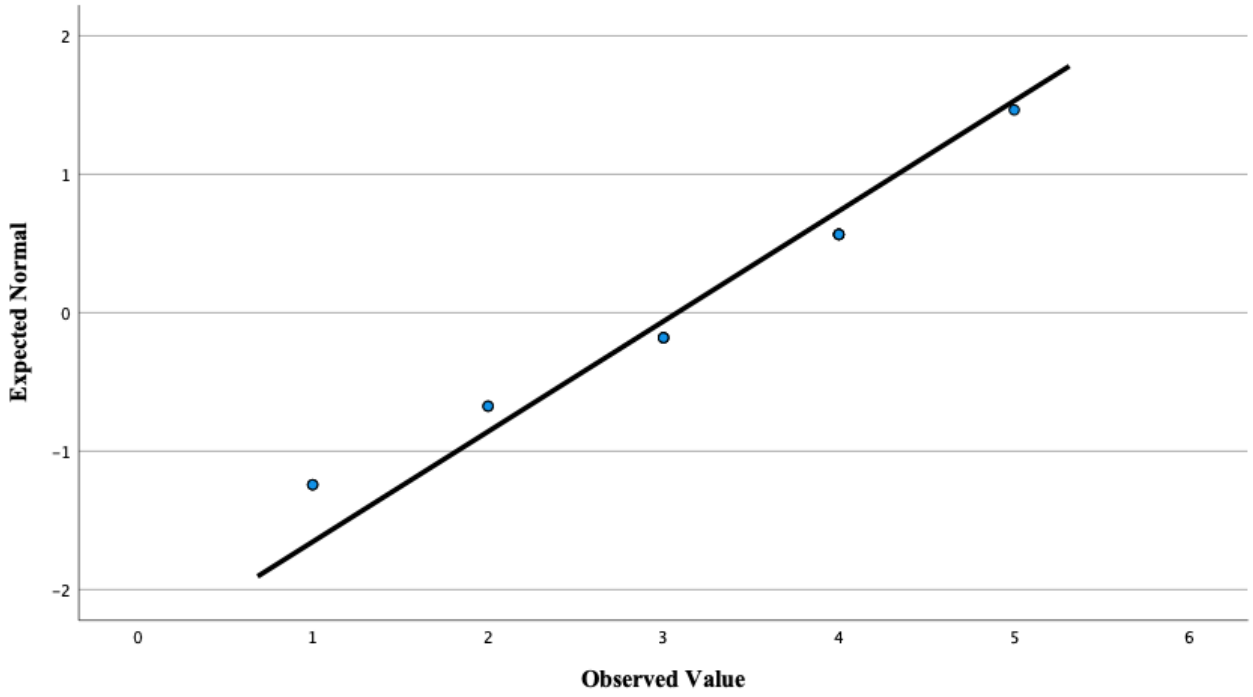


Figure 6.

Normal Q-Q plot for avoidance scores in gaze condition

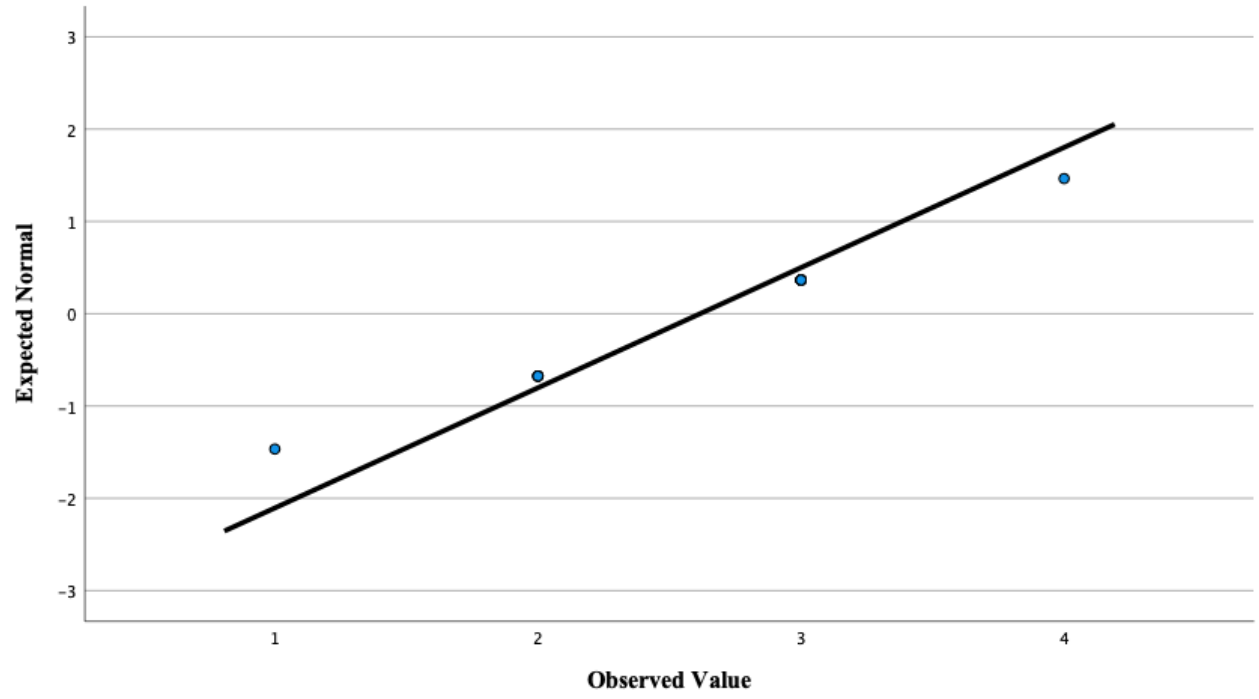
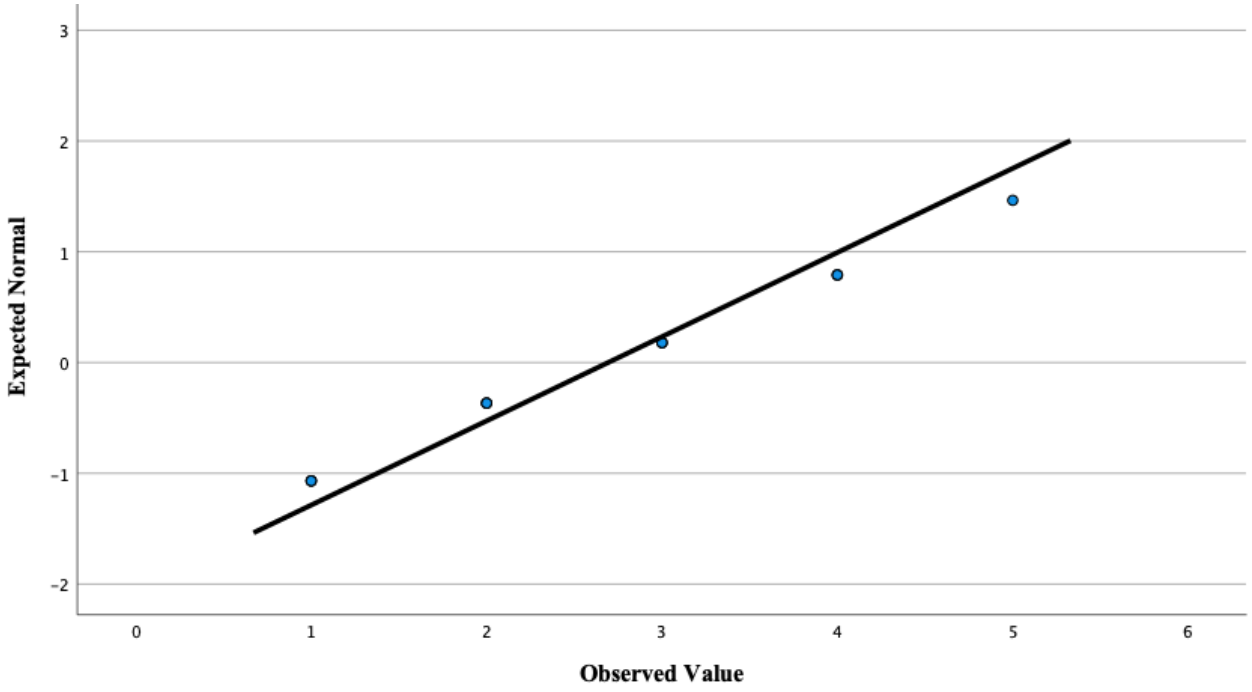


Figure 7.

Normal Q-Q plot for avoidance scores in no-gaze condition



Appendix E – Journal of Child Psychiatry and Psychology Author Guidelines

General

Contributions from any discipline that further knowledge of the mental health and behaviour of children and adolescents are welcomed. Papers are published in English, but submissions are welcomed from any country. Contributions should be of a standard that merits presentation before an international readership.

Papers may assume either of the following forms:

- *Original articles*
  These should make an original contribution to empirical knowledge, to the theoretical understanding of the subject, or to the development of clinical research and practice. Adult data are not usually accepted for publication unless they bear directly on developmental issues in childhood and adolescence or the transition from adolescence to adulthood. Original articles should not exceed 5000 words, (including title page and abstract, not including references and tables); the total word count should be given on the title page of the manuscript. There is a limit of 5 tables and 5 figures in the manuscript. It is possible to submit additional tables or figures as an Appendix for an online-only version. We strongly encourage you to keep the length of the manuscript within the word limit. As a guideline, we recommend 500 words for the introduction and 750 words for the discussion and using the rest of the allowance for methods and results. If you would like to make an exceptional request to extend the length of your submission contact the editorial office. (publications@acamh.org).
- *Review articles*
  Papers for this section can include systematic reviews, meta-analysis or theoretical formulations. There are three types of reviews: Annual Research Reviews, Research Reviews and Practitioners Reviews. These papers are usually commissioned. However, we also welcome proposals for Research Reviews from authors which our specialist editors will review before inviting a submission. The papers should survey an important area of interest within a general field and, where appropriate, closely follow PRISMA guidelines. Given the limitations in assessing the potential of the paper based on just the abstract, we cannot guarantee upon submission that the paper will be sent out for peer review. Practitioner Reviews and Research Reviews should normally be no more than 5000 words long (as original articles). Annual Research Reviews can be considerably longer with the length negotiated at the time of commission.

Systematic Reviews

Systematic reviews should conform to the PRISMA guidelines. The journal strongly encourages the pre-registration of review protocols on publicly accessible platforms. From 2021 this will be mandatory.

Other submissions

Pre-registration of studies with all other types of designs on publicly available platforms is encouraged. All pre-registered studies accepted for publication will be flagged following publication.

At this time the JCPP does not publish study protocols itself but actively encourages the practice to increase transparency and reproducibility of findings. This situation is under active review. Please **click here** for more details on our position.

CrossCheck

The journal employs a plagiarism detection system. By submitting your manuscript to this journal you accept that your manuscript may be screened for plagiarism against previously published works.

Manuscript preparation and submission

Papers should be submitted online. For detailed instructions please go to: **http://mc.manuscriptcentral.com/jcpp_journal**. Previous users can check for an existing account. New users should create a new account. Help with submitting online can be obtained from the Editorial Office at **publications@acamh.org**

1. The manuscript should be double spaced throughout, including references and tables. Pages should be numbered consecutively. The preferred file formats are MS Word or WordPerfect, and should be PC compatible. If using other packages the file should be saved as Rich Text Format or Text only.

2. Papers should be concise and written in English in a readily understandable style. Care should be taken to avoid racist or sexist language, and statistical presentation should be clear and unambiguous. The Journal follows the style recommendations given in the *Publication manual of the American Psychological Association* (5th edn., 2001).

3. The Journal is not able to offer a translation service, but, authors for whom English is a second language may choose to have their manuscript professionally edited before submission to improve the English. A list of independent suppliers of editing services can

be found **here**. All services are paid for and arranged by the author, and use of one of these services does not guarantee acceptance or preference for publication.

Layout

Title: The first page of the manuscript should give the title, name(s) and short address(es) of author(s), and an abbreviated title (for use as a running head) of up to 60 characters.

Abstract

The abstract should not exceed 300 words and should be structured in the following way with bold marked headings: Background; Methods; Results; Conclusions; Keywords; Abbreviations. The abbreviations will apply where authors are using acronyms for tests or abbreviations not in common usage.

Key points and relevance

All papers should include a text box at the end of the manuscript outlining the four or five key (bullet) points of the paper. These should briefly (80-120 words) outline what's known, what's new, and what's relevant.

Under the 'what's relevant' section we ask authors to describe the relevance of their work in one or more of the following domains - policy, clinical practice, educational practice, service development/delivery or recommendations for further science.

Headings

Articles and research reports should be set out in the conventional format: Methods, Results, Discussion and Conclusion. Descriptions of techniques and methods should only be given in detail when they are unfamiliar. There should be no more than three (clearly marked) levels of subheadings used in the text.

Acknowledgements

These should appear at the end of the main text, before the References.

Correspondence to

Full name, address, phone, fax and email details of the corresponding author should

appear at the end of the main text, before the References.

References

The *JCPP* follows the text referencing style and reference list style detailed in the *Publication manual of the American Psychological Association* (5th edn.)i.

References in text

References in running text should be quoted as follows:
Smith and Brown (1990), or (Smith, 1990), or (Smith, 1980, 1981a, b), or (Smith & Brown, 1982), or (Brown & Green, 1983; Smith, 1982).

For up to five authors, all surnames should be cited in the first instance, with subsequent occurrences cited as et al., e.g. Smith et al. (1981) or (Smith et al., 1981). For six or more authors, cite only the surname of the first author followed by et al. However, all authors should be listed in the Reference List. Join the names in a multiple author citation in running text by the word 'and'. In parenthetical material, in tables, and in the References List, join the names by an ampersand (&). References to unpublished material should be avoided.

Reference list

Full references should be given at the end of the article in alphabetical order, and not in footnotes. Double spacing must be used.

References to journals should include the authors' surnames and initials, the year of publication, the full title of the paper, the full name of the journal, the volume number, and inclusive page numbers. Titles of journals must not be abbreviated and should be italicised.

References to books should include the authors' surnames and initials, the year of publication, the full title of the book, the place of publication, and the publisher's name.

References to articles, chapters and symposia contributions should be cited as per the examples below:

Kiernan, C. (1981). Sign language in autistic children. *Journal of Child Psychology and Psychiatry*, *22*, 215-220.

Thompson, A. (1981). *Early experience: The new evidence*. Oxford: Pergamon Press.

Jones, C.C., & Brown, A. (1981). Disorders of perception. In K. Thompson (Ed.), *Problems in early childhood* (pp. 23-84). Oxford: Pergamon Press.

Use Ed.(s) for Editor(s); edn. for edition; p.(pp.) for page(s); Vol. 2 for Volume 2.

Tables and Figures

All Tables and Figures should appear at the end of main text and references, but have their intended position clearly indicated in the manuscript. They should be constructed so as to be intelligible without reference to the text. Any lettering or line work should be able to sustain reduction to the final size of reproduction. Tints and complex shading should be avoided and colour should not be used unless essential. Authors are encouraged to use patterns as opposed to tints in graphs. Authors will be able to access their proofs via Wiley Online Library. Figures should be originated in a drawing package and saved as TIFF, EPS, or PDF files. Further information about supplying electronic artwork can be found in the Wiley electronic artwork guidelines **here**.

Nomenclature and symbols

Each paper should be consistent within itself as to nomenclature, symbols and units. When referring to drugs, give generic names, not trade names. Greek characters should be clearly indicated.

Supporting Information

Examples of possible supporting material include intervention manuals, statistical analysis syntax, and experimental materials and qualitative transcripts.

1. If uploading with your manuscript please call the file 'Supporting Information' and reference it in the manuscript.
2. Include only those items that are relevant and ensure that all appendices, figures, tables etc included are referenced in the manuscript in chronological order.
3. Label and cite the items presented in the Supporting Information as – Appendix S1,

Figure S1, and Table S1 etc in the order of their appearance.
4. Please note supporting files are uploaded with the final published manuscript as supplied, they are not typeset and not copy edited for style etc. Make sure you submit the most updated and corrected files after revision.
5. On publication, your Supporting Information will be available alongside the final version of the manuscript online.
6. If uploading to a public repository, please provide a link to the Supporting Information and reference it in the manuscript. The materials must be original and not previously published. If previously published, please provide the necessary permissions. You may also display your Supporting Information on your own or an institutional website. Such posting is not subject to the journal's embargo data as specified in the copyright agreement. Supporting Information is made free to access on publication.

Full guidance on Supporting Information including file types, size and format is available on the **Wiley Author Service** website.

For information on Sharing and Citing your Research Data see the **Author Services website here**.

Appendix F – Journal of Behaviour Research and Therapy Author guidelines

Preparation

While full-length articles have no explicit limits in terms of numbers of words, tables/figures, and references, an article's length must be justified by its empirical strength and the significance of its contribution to the literature

Article structure

Subdivision - unnumbered sections

Divide your article into clearly defined sections. Each subsection is given a brief heading. Each heading should appear on its own separate line. Subsections should be used as much as possible when cross-referencing text: refer to the subsection by heading as opposed to simply 'the text'.

Appendices

If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

Essential title page information

• ***Title.*** Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.

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Acknowledgements

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Funding: This work was supported by the National Institutes of Health [grant numbers xxxx, yyyy]; the Bill & Melinda Gates Foundation, Seattle, WA [grant number zzzz]; and the United States Institutes of Peace [grant number aaaa].

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Examples:

Reference to a journal publication:

Van der Geer, J., Hanraads, J. A. J., & Lupton, R. A. (2010). The art of writing a scientific article. *Journal of Scientific Communications, 163*, 51–59.

https://doi.org/10.1016/j.sc.2010.00372.

Reference to a journal publication with an article number:

Van der Geer, J., Hanraads, J. A. J., & Lupton, R. A. (2018). The art of writing a scientific article. *Heliyon*, *19*, Article e00205. https://doi.org/10.1016/j.heliyon.2018.e00205.

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Reference to a website:

Powertech Systems. (2015). *Lithium-ion vs lead-acid cost analysis*. Retrieved from http://www.powertechsystems.eu/home/tech-corner/lithium-ion-vs-lead-acid-cost-analysis/. Accessed January 6, 2016

Reference to a dataset:

[dataset] Oguro, M., Imahiro, S., Saito, S., & Nakashizuka, T. (2015). *Mortality data for Japanese oak wilt disease and surrounding forest compositions*. Mendeley Data, v1. https://doi.org/10.17632/xwj98nb39r.1.

Reference to a conference paper or poster presentation:

Engle, E.K., Cash, T.F., & Jarry, J.L. (2009, November). *The Body Image Behaviours Inventory-3: Development and validation of the Body Image Compulsive Actions and Body Image Avoidance Scales*. Poster session presentation at the meeting of the Association for Behavioural and Cognitive Therapies, New York, NY.

Reference to software:

Coon, E., Berndt, M., Jan, A., Svyatsky, D., Atchley, A., Kikinzon, E., Harp, D., Manzini, G., Shelef, E., Lipnikov, K., Garimella, R., Xu, C., Moulton, D., Karra, S., Painter, S., Jafarov, E., & Molins, S. (2020, March 25). *Advanced Terrestrial Simulator (ATS) v0.88 (Version 0.88)*. Zenodo. https://doi.org/10.5281/zenodo.3727209.

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Appendix G – ERGO ethics application

ERGO II Ethics application form – Psychology Committee

1. Applicant Details

1.1 Applicant name	**Francesca Zecchinato**
1.2 Supervisor	**Pete Lawrence (P.J.Lawrence@soton.ac.uk)** **Jana Kreppner (J.Kreppner@soton.ac.uk)**
1.3 Other researchers / collaborators (if applicable): *Name, address, email*	**Ruth Webster (DClinPsych student at the University of Southampton)**

2. Study Details

2.1 Title of study	**The effect of parental indirect and direct expressions of anxiety on infant behavioural, emotional and physiological reactions**
2.2 Type of project (e.g. undergraduate, Masters, Doctorate, staff)	**Doctorate (plus DClinPsych, MSc and BSc students).**

2.3 Briefly describe the rationale for carrying out this project and its specific aims and objectives.
Anxiety Disorders (AD) are the most common class of mental disorders in children and young people, with an estimated 6.5% prevalence worldwide (Polanczyk et al., 2015; Rapee et al., 2009). More specifically, Social Anxiety Disorder (SAD) is one of the most common childhood anxiety disorders. Lifetime prevalence is estimated between 7% - 13% (Furmark, 2002) and, crucially, onset is typically before 13 years (Kessler et al., 2005). It has been well established within the literature that SAD can arise from a

combination of both genetic vulnerability and environmental factors (Crozier & Alden, 2001; Wood, McLeod, Sigman, Hwang & Chu, 2003, Wong & Rapee, 2016). In particular, two key risk factors for the development of SAD are infant behavioural inhibition and certain types of parenting behaviours.

Behavioural Inhibition (BI). BI refers to the biologically driven temperamental characteristics of fear, avoidance, and withdrawal in novel situations or with unfamiliar people and/or objects (Kagan, Reznick, & Snidman, 1987). It has been documented that infant BI increases the risk for subsequent ADs in general, and SAD specifically (Sandstrom, Uher, & Pavlova, 2020; Schwartz, Snidman & Kagan, 1999). In a large meta-analytic study, Clauss and Blackford (2012) concluded that infant BI was associated with a sevenfold increase in risk for the later development of SAD.

Parenting behaviours. A second set of potential risk factors included in theoretical accounts of the development of SAD is represented by parenting practices that increase children's sense of threat in social situations and limit their opportunities to develop and exercise their sense of control over their social environment (Murray, Creswell, & Cooper, 2009). In particular, it appears that a high frequency of parental expressed anxiety in social situations is a significant predictor of child social anxiety symptoms. For example, Murray et al. (2008) found that, compared to mothers without anxiety disorders, mothers with SAD expressed more anxiety in a social referencing task with their 10-month old infants, and these parental differences predicted increased infant social avoidant behaviours at 14-months, even after accounting for concurrent maternal behaviour.

Interaction between BI and parenting behaviours. Murray et al. (2008) found that, following a social referencing task at 10 months, the association between maternal anxiety disorder and infant avoidance of an adult stranger was moderated by infant BI. Aktar et al. (2013), using a very similar social referencing task with 10-month infants, reported a positive association between expressed parental anxiety and infant avoidance only among infants with moderate-to-high BI. Interactive effects of child (BI) and parental behaviours were also found by Rubin, Burgess and Hastings (2002), who

reported that mothers' intrusive behaviours with their two-year olds moderated the association between toddler inhibition and child social anxiety symptoms at age four. Specifically, toddler temperamental inhibition predicted social anxiety symptoms at 4 years where mothers behaved in anxious ways, but not where mothers did not behave intrusively. Taken together, these studies suggest that parental expressed anxiety is involved in the development of early social anxiety, particularly in infants high in BI (de Rosnay et al., 2006; Murray et al., 2008; Aktar et al., 2013; Aktar et al., 2014; Rubin et al., 2002).

Transmission of parental expressions of anxiety. The mechanism underpinning the transmission of parental expressed anxiety remains unclear. De Rosnay et al. (2006) found that infants who observed their mothers interact with a stranger in an anxious way were consequently themselves more anxious with the stranger, compared to when infants observed their mothers behave neutrally with the stranger. Crucially, these findings are consistent with both observational learning (Bandura, 1977) and social referencing (Baldwin & Moses, 1996) accounts of transmission.

According to the observational learning explanation, infants model their behaviours on the basis of what they see when their parents interact with strangers (an indirect, observational learning pathway). According to the social referencing theory, infants gather information from their parents' direct communication with them and use it to inform their own responses to the stranger.

Crucially, to our knowledge no studies to date have experimentally tested which of these accounts is accurate and whether parental indirect and direct expressions of expressed anxiety have differential effects on infant reactions during a social referencing task. Therefore, the current study will aim to fill this gap in the literature, by examining the underlying mechanism of anxiety transmission from parent to infant.

Physiological response. To date, it is not clear how infants respond physiologically in a social referencing paradigm. Physiological measures of arousal and anxiety in children include heart rate variability (HRV) (Jovanovic et al., 2011), which is often chosen due to the non-invasive nature of the assessment. HRV measures assess the autonomic

nervous systems control of the heart and cardiac functions. Measures of HRV highlight cardiovascular reactivity to stress. HRV has been widely used in studies examining anxiety in children and infants (Arai et al., 2009; Hannesdottir, et al., 2010; Monk et al., 2001). Parent gaze has been identified as an important moderator of the impact of parent behaviour on infant anxiety (e.g., Leong et al., 2017; Stenberg & Hagekull, 2007). However, we do not know whether parent use of gaze in anxiety provoking situations has an impact on infants' physiological markers of anxiety, and whether infant BI acts as a moderator of infant physiological arousal/reactivity in a social referencing paradigm.

Aim. With this experimental study, we aim to examine whether indirect and direct expressions of parental anxiety in a social referencing task differentially affect the behaviour and emotion of 12 to 14-month old infants. Moreover, we want to know how infant physiological responses differ in the two different scenarios (i.e., with and without direct gaze from the parent during the interaction with a stranger).

2.4 Provide a brief outline of the basic study design. Outline what approach is being used and why.

We will conduct a within-subjects laboratory experiment to answer the research questions. Each parent (i.e., mother or father of the infant) will behave in a socially anxious manner in two conditions. In condition A (indirect), the infant will observe their parent interact with the stranger with expressed social anxiety (and neither the parent nor the stranger will interact with the infant) and then the infant will interact with the stranger themselves. In condition B (direct), the infant will observe their parent interact with a different stranger and, during that interaction, the parent will gaze towards the infant, before the infant interacts with the stranger themselves.

The two independent variables will be experimental condition (direct gaze towards the infant vs averted gaze) and infant behavioural inhibition (high or low). We will counterbalance the order of each condition to minimise the impact of order effects. The dependent variables are infant behaviour (i.e. positive emotional tone, fearfulness and

avoidance) and infant physiological activation (specifically, heart rate and heart rate variability).

Heart rate (HR) and Heart Rate Variability (HRV) will be recorded via a Biopac MP150 amp recording at 2000 Hz (see here for more details https://www.biopac.com/product-category/research/systems/mp150-starter-systems/?fwp_product_category=research%2Csystems%2Cmp150-starter-systems&fwp_compatible_platforms=mp150-research-systems) using the BioNomadix RSP and ECG amplifier for wireless recording (https://www.biopac.com/product/bionomadix-rsp-with-ecg-amplifier/). Three electrodes will be applied in the infant chest for this assessment. The device is safe, unobtrusive and well established for physiological assessments in lab settings, and has been successfully used in previous studies (e.g., Smith et al., 2021; Wass et al., 2019). The device is designed so that an experimenter or a parent can apply the device easily and with no training. AcqKnowledge 5.0.7 software, supported by Biopac, will be used for data acquisition and analysis (see here for more details https://www.biopac.com/product-category/research/software/). The data will be processed automatically and the ECG signal will not be visually inspected by expert eyes.

The research team will be trained in setting up and using the equipment, as well as in analysing the signal, via the training offered in the Biopac website (https://www.biopac.com/webinars/), via the support offered by the Biopac UK support team and via the established collaboration with professor Sam Wass and his lab, who has relevant experience in using Biopac devices in experimental studies.

2.5 What are the key research question(s)? Specify hypotheses if applicable.

Research questions:

1. In a social referencing task, do parental direct and indirect expressions of anxiety (i.e., direct vs. averted gaze) differentially affect infant behaviour and emotion in a social referencing paradigm?

2. Does infant BI moderate the relationship between parental direct and indirect expressions of anxiety and infant behaviour and emotion?

3. Does heart rate variability in infants differ depending on whether parents behave in a socially anxious manner when interacting with a stranger and they gaze directly at the infant compared to when the parent behaves in a socially anxious manner when interacting with a stranger and does not gaze at the infant?

4. Does infant BI act as a moderator of infant physiological arousal/reactivity in a social referencing paradigm?

Hypotheses:

Infants will show more anxious behaviour, negative emotion, and physiological activation in response to parental direct, rather than indirect, expressions of anxiety in a social referencing paradigm. It is hypothesised that there will be a significant difference between the effect of parental direct expressions of anxiety compared to parental indirect expressions of anxiety, on the infant behaviour, emotion, and physiological arousal.

Infant behavioural inhibition will significantly moderate the relationship between parental direct and indirect expressions of anxiety and infant anxious behaviour, emotion, and physiological activation. Specifically, compared to infants who are not behaviourally inhibited, infants who are behaviourally inhibited will show more anxious behaviour and emotion, and more physiological activation, in response to each of parental direct and indirect expressions of anxiety.

3. Sample and setting

3.1 Who are the proposed participants and where are they from (e.g. fellow students, club members)? List inclusion / exclusion criteria if applicable.

Infants between 12-14 months old, with parents aged 18 years or older.

The inclusion criteria will be: infants between 12-14 months old with a mother or father aged 18 years or older; infants that are typically developing (i.e. birth weight > 2500g and born at 37+ weeks' gestation), with no complex medical conditions, skin allergies and heart conditions; parents with no current anxiety diagnosis and who have not been

clinically anxious in the past 12-14 months (i.e., since the baby was born); parents who are fluent in English.

These criteria will be checked during the online Qualtrics survey, whereby mothers/fathers will be shown the following, before the questionnaire measures:

Requirements for the study

- You are the parent of a 12 – 14 month old baby
- You are aged 18 years or over
- You have no current anxiety diagnosis and you have not been clinically anxious in the past 12-14 months (i.e., since your baby was born)
- You are fluent in English
- Your baby was born full-term (i.e. birth weight > 2500g and born at 37+ weeks' gestation) and without additional needs (such as congenital health difficulties or developmental delays)
- You baby does not have any complex medical conditions, skin allergies or heart conditions
- You are willing to travel to the University of Southampton to take part in the study (note that we can cover 40p per mile, or public transport costs, up to £30)

[ ] Please tick (check) this box to indicate that you meet the requirements for the study.

3.2. How will the participants be identified and approached? Provide an indication of your sample size. If participants are under the responsibility of others (e.g., parents/carers, teachers) state if you have permission or how you will obtain permission from the third party).

We aim to recruit 68 participant dyads (34 mother-infant dyads and 34 father-infant dyads). Parents will be recruited through poster advertisements (see 'AdvertPaper_v1') across the University of Southampton, at parent and baby toddler groups and nurseries in Southampton, as well as the surrounding area. We will circulate the study advertisement on social media (e.g., Twitter, Facebook; see 'AdvertOnline_v1'). Based

on our experience of recruiting mother infant dyads to a similar study, word-of-mouth and snowballing will be essential.

We plan to run a small pilot of the study to determine whether the equipment works in the way we need it to work, to familiarise with the experimental procedure, to evidence any potential issues in terms of acceptance of the physiological device and timing and to identify any technical problems. For the pilot study, we plan to recruit 2 parent-infant dyads. In case we identify any issues, we will act to fix them (e.g., getting in touch with the Biopac support team or adjusting our experimental procedure). We plan to pilot the study as soon as we have ethical approval and the research team has received appropriate training (expected to be by mid September 2022).

3.3 Describe the relationship between researcher and sample. Describe any relationship e.g., teacher, friend, boss, clinician, etc.

None expected, the sample will be recruited by advert.

3.4 How will you obtain the consent of participants? (*please upload a copy of the consent form if obtaining written consent***) NB. A separate consent form is not needed for online surveys where consent can be indicated by ticking/checking a consent box (normally at the end of the PIS). Other online study designs may still require a consent form or alternative procedure (for example, recorded verbal consent for online interviews).**

1. Parents will express interest by emailing the research team or scanning the QR code included in the study advert. Potential participants will see slightly different text, depending on whether they e-mail us (see 'E-mail template to potential participants expressing interest_v2'), or use the QR code (see 'Text to be shown to potential participants who use the QR code_v1').
2. Parents will be sent an email detailing information about the study ('E-mail template to potential participants expressing interest_v2') or will be directed to the 'text to be shown to potential participants who use the QR code_v1' if they click on the QR code. Parents who, in principle, choose to take part in the study will be given instructions to click on the Qualtrics link included in the email and: (1) Carefully read the 'Participant Information Sheet_v7' (2) provide informed consent (see 'Consent Form Screening Phase_v3'); (3) Confirm that they meet the

requirements for the study and complete the questionnaire measures using the Qualtrics weblink (please see uploaded attachment of 'Questionnaire Template for Qualtrics_v2'); (4) Provide their contact information (email) to arrange the session at the University. NB At the end of the questionnaires, all participants are debriefed - advice is given for the parent to contact their GP if completing the questionnaires raised any concerns for them regarding their own wellbeing or the wellbeing of their infant. They are also given the option to contact the researchers if they require any support in contacting the relevant support services.

3. Following the eligibility screening (i.e., that their scores on the measures completed at 2. meet our inclusion criteria), participants are contacted to arrange a suitable time to attend the University of Southampton with their infant to complete the social referencing tasks (see the uploaded document 'Follow up email and Qualtrics link for eligible participants_v2'). Additionally, participants are informed about the COVID-related guidance adopted by the University (IF APPROPRIATE). If participants do not meet our inclusion criteria, they will be notified via e-mail (please see 'Follow up email for non eligible participants_v1')
4. Parent-infant dyads attend the University of Southampton. Please see the uploaded document 'Lab Session Instructions_v1', which provides the script of the instructions participants will receive during the Lab visit at the University of Southampton and the detailed procedure of the social referencing paradigm. (This document represents a guide for the researchers, and will not be shown to participants.)

   Fathers/mothers will have the opportunity to read through the Participant Information Sheet again and will complete an online consent form regarding the laboratory visit ('Consent Form Lab Phase_v4') and the Edinburgh Postnatal Depression Scale (EPDS; see the uploaded document 'Edinburgh Postnatal Depression Scale_v2'). After the EPDS, participants will be provided with a brief overview of the experimental procedure (see 'Experimental Procedure Overview for Participants_v1'). The researcher will then instruct the parent on how to apply the electrodes to the baby, guide the parent through the study procedure and show the training video (see 'Instructional video_v2'); meanwhile, a VRA will attend on/play with the baby (see 'Lab Session Instructions_v1' for a detailed overview of the procedure). The dyad will then complete the social referencing tasks in the research laboratory. After the removal of the physiological kit, parents will receive full debriefing at the end of the session. Finally, participants are contacted via email (see 'Email post lab session') and asked to confirm their consent to the storage of video footages for 10 years (see 'Consent form post lab session'). Participants are also informed that they have one month to withdraw this consent.

   NB. The EPDS will be completed in person at the University to ensure risk issues are appropriately managed; thus, if risks concerns are apparent from the EPDS, the researcher will be able to follow this up with the participant.

E-mail addresses will be stored on a university networked drive, within a limited access and password protected folder, kept securely and separate to any questionnaire data. E-mail addresses will be destroyed after the data is no longer needed (e.g., after participants have completed all parts of the study and we no longer need to contact them; and after we have sent participants a summary of the study results). Only if participants consent to be contacted for future opportunities, we will store their contact information for 3 years on the university server. Participants in the study will also be assigned a unique ID number (formed of a random string of letters and numbers). A list assigning email addresses to unique ID numbers will be stored securely on the university server, separate from questionnaire data. The e-mail addresses of those **not** eligible to attend the lab session will be destroyed as soon as we have informed them about their ineligibility. Questionnaire responses will be stored on a university networked drive, within a limited access and password protected folder. The questionnaires of those who are **not** eligible to take part in the lab session will be destroyed from Qualtrics once we have informed the participants about their ineligibility; their data will be processed, pseudo-anonymised and kept for the duration of the study to allow us to report it in the manuscript for publication (we need to report how many people completed the screening phase, the reasons for exclusion etc.). The data will be destroyed once the project is complete. The video footages recorded during the visit at the University of Southampton will be stored securely for 10 years on the University server with a password-protected access limited to the research team. We will ask for participants consent to securely store the video footages for 10 years via an electronic form before the lab session (see 'Consent form lab phase' doc) and again after the lab session (see 'email post lab session' and 'Consent form post lab session' docs), and participants will have the opportunity to retrospectively withdraw their consent within a month from the lab visit. If participants withdraw their consent, the video footages will be coded and kept only for 3 years (the duration of Francesca Zecchinato's PhD).

We will consider parent-infant dyads only if infants are 12 to 14 months old (and up to 7 days beyond the 14 months, especially in relation to the in-person session). If infants are older that 14 months and 7 days at the time of the in-person session, the dyad would become ineligible. We will make sure to take these time requirements into consideration when booking participants for the in-person session. Participants are informed about this requirement in the Participant Information Sheet; moreover, in the 'Follow up email and Qualtrics link for eligible participants_v2' we will include a personalised note to inform participants regarding the last possible date to keep their infants withing the required time window.

3.5 Is there any reason to believe participants may not be able to give full informed consent? If yes, what steps do you propose to take to safeguard their interests?
No, participants will give full informed consent prior to taking part in each part of the study (please refer to 'Consent form Screening phase' for the online screening session and 'Consent form Lab phase' for the in-person session at the University). Clear information about the study aims and what participation involves will be in the Participant Information Sheet, so that participants can make an informed decision to participate.

4. Research procedures, interventions and measurements

4.1 Give a brief account of the procedure as experienced by the participant. Make it clear who does what, how many times and in what order. Make clear the role of all assistants and collaborators. Make clear the total demands made on participants, including time and travel. *Upload copies of questionnaires and interview schedules to ERGO.*
The experiment will take place at the University of Southampton and parent-infant dyads will be required to attend a ~45-minute session. Dr Pete Lawrence and either an undergraduate Voluntary Research Assistant (VRA) or male member of staff (all with full DBS checks in place) will act as stooges, to provide a 'stranger' that the parent-infant dyads will interact with. 1. Parents respond to the study advertisement expressing their interest in participation by contacting the researcher via e-mail or scanning the QR code included in the study advert (which will direct the potential participants to the content of the 'Text to be shown to potential participants who use the QR code_v1'). 2. Researcher responds to email (see 'E-mail template to potential participants expressing interest_v2' document) providing more detailed information about the study; potential participants who scan the QR code are directed to the 'text to be shown to potential participants who use the QR code_v1'. Parents wishing, in principle, to participate in the study are required to click on the Qualtrics weblink provided in the email. This takes them to the Participant Information Sheet hosted on Qualtrics. After reading the Participant Information Sheet, if willing to proceed, participants are instructed to: (1) give informed consent (see 'Consent Form Screening Phase_v3', (2) confirm that they meet the requirements for the study and complete the questionnaire measures using the Qualtrics weblink (please see uploaded attachment 'Questionnaire Template for Qualtrics_v2'). The online survey includes the following questionnaires: Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990); The Social Interaction

Anxiety Scale (SIAS; Mattick & Clarke 2000); Generalized Anxiety Disorder Assessment (GAD-7); Revised Infant Behaviour Questionnaire (IBQ; Putnam & Rothbart, 2006); (4) Provide their contact information (email) to arrange a time for them and their infant to take part in the study tasks at the University of Southampton.

3. Consenting eligible parents (that is, those who scores on measures completed at 2. meet our inclusion criteria) are contacted via email and are asked to book their session at the University (see the uploaded attachment 'Follow up email and Qualtrics link for eligible participants_v2'). Additionally, they are informed about the COVID-related guidance adopted by the University [IF APPROPRIATE].
4. Parent-infant dyads attend the University of Southampton to complete the social referencing tasks in research laboratory. Please refer to the uploaded document 'Lab Session Instructions_v1', which provides the script of the instructions participants will receive during the Lab visit at the University of Southampton and the detailed procedure of the social referencing paradigm. This document represents a guide for the researchers, and will not be shown to participants.
5. Fathers/mothers have the opportunity to read through the electronic Participant Information Sheet again, complete an electronic consent form to participate in the social referencing part of the study ('Consent Form Lab Phase_v4') and the Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987; see uploaded document 'Edinburgh Post Natal Depression Scale_v2'). Finally, participants are provided with a brief overview of the experimental procedure (see 'Experimental Procedure Overview for Participants_v1').
6. The researcher assists the parent while they apply three small electrodes to the baby for the for the recording of HR and HRV (via the Biopac MP150 amp recording at 2000 Hz using the BioNomadix RSP and ECG amplifier for wireless recording). There researcher allows some time for acclimatisation so that participants can settle.
7. While a VRA attends to/plays with the baby, the researcher gives verbal instructions (see 'Lab Session Instructions_v1') regarding the procedure and social referencing tasks and shows parents the instructional video (see 'Instructional video_v2' attachment) to inform them on how they should act throughout the experiment. The social referencing tasks will all be video recorded - the video recordings will be coded using the attached 'Coding Scales from Murray et al._v1', which provides scales to assess infants' avoidance, fearfulness and positive emotional tone during the infant-stranger interactions. Video recordings will be anonymously stored for 10 years on the University server as per University of Southampton and British Psychological Society policies.
8. Parents will be advised which condition of the social referencing task they will participate in first (direct gaze towards infant or averted gaze).
9. Three-minute social referencing task commences: For 30 seconds, the mother or father and infant will be in the room together with the infant strapped in a highchair and with the three electrodes for the assessment of HR, and the parent seated. The stranger (stooge) will knock and enter the room and will engage the parent in a conversation for 90 seconds. For these 90 seconds, in condition A (indirect), the parent will behave in a socially anxious manner with the stranger (stooge) but will not gaze towards their infant. The stranger (stooge) will then turn to the infant and gradually engage (by offering a toy and extending arms at

the end) with the infant for 60 seconds before leaving the room. For these 90 seconds, in condition B (direct), the parent will behave in a socially anxious manner with the stranger (stooge) and will gaze towards their infant. The stranger (stooge) will then turn to the infant and gradually engage (by offering a toy and extending arms at the end) the infant for 60 seconds before leaving the room.

10. The conditions will be counterbalanced, whereby half the participants will complete condition A first and the other half will complete condition B first.
11. The physiology kit is removed from the infant.
12. Debrief will be completed with the parent (see 'Debrief Form_v4') and we will explain exactly what we expect we might find. The parent will also be given the opportunity to ask any questions.
13. Participants are contacted via email (see 'Email post lab session_v1') and asked to give their consent to the storage of video footages for 10 years (see 'Consent form post lab session_v1'). Participants are also informed that they have one month to withdraw their consent.

NB. Throughout the in-person session we will allow some time so that the baby can familiarise with the new environment and settle. Moreover, we will allow time/space for feeding and/or nappy changes if necessary. If the baby does not settle or is particularly distressed, participants are free to terminate the study and will be compensated for their time with a £20 Amazon Voucher and travel.

Contact information of those not eligible to attend the lab session will be destroyed as soon as we have informed them about their ineligibility. The questionnaires of those who are not eligible to take part in the lab session will be destroyed from Qualtrics once we have informed the participants about their ineligibility; their data will be processed, pseudo-anonymised and kept for the duration of the study to allow us to report it in the manuscript for publication (we need to report how many people completed the screening phase, the reasons for exclusion etc.). The data will be destroyed once the project is complete. Anonymised and pseudo-anonymised data of the included participants will be kept in a University laptop with password-protection and then stored in the University repository and/or Open Science Framework for a minimum of 10 years (as per University of Southampton RDM policy) in line with best research practice, so that it can be used by other scholars. GP surgery details on the EPDS will be kept separate from identifiable information, stored on a university password-protected computer for the duration of the study and destroyed after the completion of the project. The video footages recorded during the visit at the University of Southampton will be stored securely for 10 years on the University server with a password-protected access limited to the research team. We will ask for participants consent to securely store the video footages for 10 years via an electronic form before the lab session (see 'Consent

form lab phase' doc) and again after the lab session (see 'email post lab session' and 'Consent form post lab session' docs), and participants will have the opportunity to retrospectively withdraw their consent within a month from the lab visit. If participants withdraw their consent, the video footages will be coded and kept only for 3 years (the duration of Francesca Zecchinato's PhD).

4.2 Will the procedure involve deception of any sort? If yes, what is your justification?

No deception will be used within this study. Clear information about the study aims and what participation will involve will be in the Participant Information Sheet.

4.3. Detail any possible (psychological or physical) discomfort, inconvenience, or distress that participants may experience, including after the study, and what precautions will be taken to minimise these risks.

Parents may experience some psychological distress due to the sensitive nature of the questions being asked about their own mental health and about their infant during the online Qualtrics questionnaires (PSWQ, SIAS, GAD-7, IBQ) and EPDS. The Participant Information Sheet explains the nature of the questions in these measures and participants will be advised to contact their GP or Health Visitor should they have any concerns regarding their own and/or infant's wellbeing after the study.

Parents will complete the EPDS when visiting the university, prior to completing the social referencing tasks with their infant. Again, the sensitive nature of the questions could cause some distress. At the end of the questionnaires, advice is given for the parent to contact their GP or Health Visitor if competing the questionnaires raised any concerns for them regarding their own wellbeing or the wellbeing of their infant or if the 'risk item' on is present (i.e., they indicate that they have recently experienced thoughts of harming themselves). They are also given the option to advise the researchers if they require any support in contacting the relevant support services. Participants will still be able to continue with the experiment.

The Participant Information Sheet also outlines the limitations of confidentiality and explains that if we (the research team) have serious concerns about the wellbeing of the parent and / or the infant, that we will have a duty to disclose this information to their GP to ensure their safety if the parent is unable to contact the GP himself. Parents will have provided their name and their GP surgery on the electronic EPDS form ('Edinburgh Post Natal Depression Scale_v2') and thus the researchers will have access to this information should it be required.

For clarity, this information (parent's name and GP surgery), will be stored securely in a separate location to the study data.

Parents may experience some psychological distress within both experimental conditions because it is expected that their infants may experience anxiety, as a result of the parental expressed anxiety. However, the social referencing task will only last six minutes in total (three minutes per condition) so it is expected that the duration of the experiment should minimise the effect of this psychological distress. Before the experiment, we will explain to the parents that, if they wish to stop the experiment at any point, for example if their infant is distressed, then they may do so without having to provide any explanation.

Participants will also be provided with a debrief after the study and will be advised to contact their GP or Health Visitor should they have any concerns regarding their infant's wellbeing after the study.

It is not possible to debrief the infant after completion of the tasks. However, at the end of the tasks, the strangers will return to the room and behave in a calm way with the infants and their parents so that the infants appear to be comfortable and relaxed in the strangers' presence.

4.4 Detail any possible (psychological or physical) discomfort, inconvenience, or distress that YOU as a researcher may experience, including after the study, and what precautions will be taken to minimise these risks. If the study involves lone working please state the risks and the procedures put in place to minimise these risks (please refer to the lone working policy).
It is unlikely that this experiment will provoke discomfort or distress in the research team and the experimental procedure will not involve any lone working. The project supervisors will be available and students will be supported in every stage of the project. There will also be regular meetings to discuss the experience of the research team. The main supervisor (PJL) is an experienced researcher and clinical psychologist and will be available to discuss any discomfort, distress or inconvenience that the members of the research team might experience.

4.5 Explain how you will care for any participants in 'special groups' e.g., those in a dependent relationship, are vulnerable or are lacking mental capacity), if applicable:
The participants are not from special groups. Infants will remain with their mothers/fathers throughout the duration of the experiment.

4.6 Please give details of any payments or incentives being used to recruit participants, if applicable:
Participants attending the University of Southampton to participate in the study will be reimbursed for travel expenses (40p per mile, or public transport costs, up to £30) and each parent-infant dyad will be given a £20 Amazon voucher. In the case of early withdrawal from the study, travel expenses will still be reimbursed but the £20 Amazon voucher will only be provided when there is complete participation in the study (i.e., questionnaires and laboratory tasks completed).

5. Access and storage of data

5.1 How will participant confidentiality be maintained? Confidentiality is defined as non-disclosure of research information except to another authorised person. Confidential information can be shared with those already party to it and may also be disclosed where the person providing the information provides explicit consent. Consider whether it is truly possible to maintain a participant's involvement in the study confidential, e.g. can people observe the participant taking part in the study? How will data be anonymised to ensure participants' confidentiality?
Only one parent-infant dyad will participate in the study at a time so participants will not be aware of the identity of other participants. Participation will occur in the laboratory and unauthorised persons won't access or view the experimental procedure. Videos will only be accessed and coded by members of the research team at the university in a confidential environment. Participants will be informed both in the Participant Information Sheet and consent form that they will be video recorded. In order to preserve confidentiality, participants will be randomly assigned a participant ID when we download their data from Qualtrics. This will allow us to keep participants' data separate from their name and contact email, but linkable. Only the research team will be able to link the data to a participant's name. As noted in 4.3, any participants who endorse the 'risk item' on the Edinburgh Postnatal Depression Scale (i.e., they indicate that they have recently experienced thoughts of harming themselves), will be offered support to contact their GP. We will at all times behave in keeping with the BPS Code of Ethics and Conduct (2021).

5.2 How will personal data and study results be stored securely during and after the study. Who will have access to these data?
Data from the research study (from Qualtrics and video recordings) will be exclusively stored in password-protected files on Southampton university-networked drives (or, as the School of Psychology shifts from the network drive system to Sharepoint and OneDrive, all data will be stored under password protection within the University Sharepoint site or OneDrive).

To ensure personal information remains confidential and anonymous, research codes will be given to each participant and used to identify non-identifiable participant data, such as the video recordings. The research code key will be stored separately to identifiable and non-identifiable participant data on a university password protected computer. As recruitment and attendance at the laboratory will be arranged via email, the researcher will keep contact details for each participant for the duration of the study. These details will be destroyed once the project is complete and we have sent you a summary of what we find. Contact information of those not eligible to attend the lab session will be destroyed as soon as we have informed them about their ineligibility. The questionnaires of those who are not eligible to take part in the lab session will be destroyed from Qualtrics once we have informed the participants about their ineligibility; their data will be processed, pseudo-anonymised and kept for the duration of the study to allow us to report it in the manuscript for publication (we need to report how many people completed the screening phase, the reasons for exclusion etc.). The data will be destroyed once the project is complete. Only if participants consent to be contacted for future opportunities, we will store their contact information for 3 years on the university server.

I will store digital data on a University laptop with password-protection, on a personal folder in filestore and a backup in OneDrive. Once the project is complete, all of my anonymised and pseudo-anonymised data will be stored in the University repository and/or Open Science Framework for a minimum of 10 years (University of Southampton Research Data Management Policy) so that it can be used by other scholars.

Video recordings will be stored separately from the data coded from the videos. Video recordings will also be stored for 10 years on the University server with a password-protected access limited to the research team. We will ask for participants consent to securely store the video footages for 10 years via an electronic form before the lab session and again after the lab, and participants will have the opportunity to retrospectively withdraw their consent within a month from the lab visit. If participants withdraw their consent, the video footages will be coded and kept only for 3 years (the duration of Francesca Zecchinato's PhD).

The data will be stored in accordance with University of Southampton policies on research data storage and retention. PJL and FZ will maintain responsibility for the storage of the data once the project is completed.

5.3 How will it be made clear to participants that they may withdraw consent to participate? Please note that anonymous data (e.g. anonymous questionnaires) cannot be withdrawn after they have been submitted. If there is a point up to which data can be withdrawn/destroyed e.g., up to interview data being transcribed please state this here.
Participants' right to withdraw consent to participate in the study will be outlined in the Participant Information Sheet provided at the start of the process. Participants' right to withdraw from the study will also be stated when completing the on-line questionnaires prior to participating in the social referencing task, where information from the Participant Information Sheet is restated. When attending the University of Southampton to complete the social referencing task participants will complete an additional consent form, which will include information about their right to withdraw consent to participate at any time throughout the social referencing tasks, or afterwards. The Participant Information Sheet also advises on the latest date that participants can withdraw their data, after which time the data will have been analysed and prepared for submission for peer review.

6. Additional Ethical considerations

6.1 Are there any additional ethical considerations or other information you feel may be relevant to this study?
All researchers involved in the study, including stooges in the social referencing tasks, will have DBS clearance.

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2.5 Chapter 1

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