DOCTORATE IN CLINICAL PSYCHOLOGY

Major Research Project

The Association Between Maternal Responsiveness and Child Social and Emotional Development

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Declaration:

“I certify that the all the material in this manuscript which is not my own work has been identified and properly attributed. I have conducted the work in line with the BPS DCP Professional Practice guidelines”.

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# Table of Contents

Cover Sheet 1  
Research Paper 3  
  Abstract 3  
  Introduction 4  
  Method 10  
  Results 17  
  Discussion 32  
  Conclusion 41  
  Acknowledgments 42  
References 43  

## Appendices

Appendix A: Ethical approval email from University of Exeter 58  
Appendix B  
  B1. Instructions to Authors (Literature Review) 59  
  B2. Instructions to Authors (Research Manuscript) 63  
Appendix C  
  C1: Social and Communication Disorders Checklist (SCDC) 66  
  C2: The Strength and Difficulties Questionnaire (SDQ) 67  
  C3: The Diagnostic Analysis for nonverbal Accuracy 2 (DANVA2) 68  
  C4: Carey Temperament Scales 70  
  C5: Edinburgh Postnatal Depression Scale (EDPS) 75  
Appendix D: Test of confounder and outcome associations 76  
Appendix E: Regression analyses results for MR and additional SDQ subscales 77  
Appendix F: Regression analyses results for maternal emotional recognition and additional SDQ subscales 78  
Appendix G: Dissemination Strategy 79
Abstract

Introduction. A mother’s verbal and non-verbal behaviour towards her infant is known as maternal responsiveness (MR). Positive MR is associated with better child social and emotional development (SED). A mother’s ability to accurately recognise emotions is thought to enhance MR.

Method. Data from 1,122 mother-infant interactions from a longitudinal birth cohort study, was used firstly to examine whether positive MR at 12 months was associated with better child and adolescent SED, and secondly to explore whether better maternal facial and vocal expression recognition at 151 months was associated with positive MR and child SED. MR was measured using the Thorpe Interaction Measure (TIM) from observed mother-infant interactions and SED from questionnaire data adjusting for potential confounding variables. A test of facial expression recognition was used with vocal expression recognition additionally used in mothers.

Results. Logistic regression revealed that positive MR was associated with positive SED outcomes in childhood but there was little effect in adolescence. Positive MR was associated with mothers having better facial and vocal expression recognition at 151 months and these recognition skills were associated with children showing less emotional problems at 158 months independent of MR. Adjustments for confounding variables had no effect on these results.

Conclusion: These findings support the benefit of positive MR on a child’s SED in middle childhood. Further, the findings suggest that a mother’s facial and vocal expression recognition skills are important to both MR and a child’s SED. Limitations include subjective reporting of SED.

Keywords: Maternal Sensitivity, Maternal Responsiveness, Social and Emotional Development, Social Competence, Emotional Recognition
The association between maternal responsiveness, emotion recognition and child social and emotional development²

Mother-infant interactions and Maternal Responsiveness

Maternal Sensitivity (MS) can be defined as warm and appropriate responses towards an infant’s communications and emotional cues (Ainsworth, Blehar, Waters & Wall, 1978). MS is considered to be stable over time and the most important dimension of the early mother-child interaction (National Institute of Child Health & Human Development [NICHD] Early Child Care Research Network [ECCRN], 1997; 1999a; Lamb, Thompson, Gardner & Charnov, 1984). A core feature within MS is maternal responsiveness (MR); defined by the observation of a mother’s positive verbal and non-verbal behaviour towards her infant. More positive MR is indicative of greater MS and is positively associated with and considered to be the most important precursor of mother-infant attachment security (Bigelow, MacLean, Proctor, Myatt, Gillis & Power, 2010; Bakermans-Kranenburg, van Ijzendoom, & Juffer, 2003).

The quality of an infant’s attachment relationship with their mother has lifelong consequences (Ainsworth, et al, 1978) with the mother’s sensitive and responsive approach being internalised as a secure base further promoting the child’s social and emotional development (SED; Bowlby, 1969; Feldman & Eidelman, 2009).

Children’s social and emotional development

The core features of a child’s SED includes the ability to identify, understand, express and manage their own emotions constructively and to accurately interpret and recognise others’ emotional states, cues and intentions (e.g. facial expressions), and so develop the

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² This manuscript is formatted in accordance with the nominated journal, the Journal of Family Psychology. Instructions to authors are included in Appendix B2
Maternal Responsiveness and Child Social and Emotional Development

capacity for empathy to help maintain positive social relationships (Cohen, Onunaku, Clothier & Poppe, 2005; National Scientific Council on the Developing Child, 2004).

Significant delays in SED can lead to elevated levels of conduct and peer problems, hyperactivity and emotional difficulties (Gilmour, Hill, Place & Skuse, 2004; Goldstein & Schwebach, 2004; Kim, Szatmari, Bryson, Streiner & Wilson, 2000), which can persist into adolescence with subsequent social withdrawal, peer rejection and antisocial behaviour (Rubin, Coplan, & Bowker, 2009; Boyd, Barnett, Bodrova, Leong, & Gomby, 2005). Consequently, it is important to identify children at risk of poor SED and to develop interventions to enhance it.

**The relationship between MR and child SED**

The positive effects of MR on a child’s SED can be derived from established research on MS and specific studies measuring MR (within the first 12 months), and are found in a number of small sample longitudinal (Jaffari-Bimmel, Juffer, van IJzendoorn, Bakermans-Kranenburg & Mooijaart, 2006; Stams, Juffer & van Ijzendoorn, 2002; Davidov & Grusec, 2006; Feldman & Eidelman, 2009) and cross-sectional designs (Page, Wilhelm, Gamble & Card, 2010) as well as studies using high risk and clinical samples (Jaffari-Bimmel et al, 2006; Niccols & Feldman, 2006). A number of studies have found that positive MS is significantly correlated with a child’s concurrent emotional understanding, which includes their facial expression recognition ability, which itself may be critical for good SED (Denham, Renwick-DeBardi & Hewes, 1994; Denham, Mitchell-Copeland, Strandberg, Auerbach, & Blair, 1997).

In contrast, a less responsive mother is more at risk of having an infant who develops emotional and behavioural problems during childhood and may go on to have more problematic relationships in later life (Kaczynski, Lindahl, Malik & Laurenceau, 2006; Shaw, Keenan & Vondra, 1994; Berlin, Cassidy & Appleyard, 2008; Fraley &
Maternal Responsiveness and Child Social and Emotional Development

Longitudinal studies have confirmed the association between low MR and poor child SED (e.g. Brophy-Herb et al, 2010, Whittaker, Jones-Harden, See, Meisch, & Westbrook, 2010). There are, however, some studies that fail to find such strong associations (Mäntymaa, Puura, Luoma, Salmelin & Tamminen, 2004) and several studies have found that selective and greater MS to distress but not to non-distress was associated with an increased likelihood of being more securely attached (Leerkes, Blank & O'Brien, 2009; McElwain & Booth-LaForce, 2006).

In many large longitudinal studies (e.g. Mensah & Kiernan, 2010) positive MS at 6 to 36 month period is positively associated with a child’s SED but most use US samples and focus on child behaviour outcomes with positive MS being associated with a child showing fewer externalizing problems (Haltigan, Roisman & Fraley, 2012; NICHD ECCRN, 2004; 2003; 1999b; Leerkes et al, 2009; Campbell, Maticic, von Stauffenberg, Mohan & Kirchner, 2007). Some studies find positive effects of MS on social and relational competence, peer acceptance and child loneliness in middle childhood (Fraley, Roisman & Haltigan, 2012; Mintz, Hamre, & Hatfield, 2011; Raikes & Thompson, 2008; Spinrad et al, 2007; Roisman, Booth-LaForce, Cauffman, Spieker & NICHD ECCRN, 2009) but there are fewer studies looking at adolescence (Fraley et al, 2012; Roisman, et al, 2009; Haltigan et al, 2012) and so fail to fully investigate the potential enduring effects of early MS. Finally in an RCT of intervention to improve early MR, gains in child SED were seen from 6-13 months in a sample of low-income mothers (Landry, Smith & Swank, 2006).

While the beneficial effect of early MS and MR on early SED is well established it remains unclear whether it has an enduring role in shaping later SED when other factors maybe influential (Fraley et al, 2012).

MR and a mother’s emotional recognition
Certain skills would seem critical for the development of MR and identifying these should inform intervention strategies. Facial expressions are known to be one of the principal non-verbal channels for communicating emotional information (Collier, 1985). Consequently, emotional recognition skills in mothers would seem to play a crucial role in the development of good MR and a child’s SED. The ability to recognise basic emotions is conceptualised as part of an emotional intelligence stable trait (Petrides, Furnham, & Mavroveli, 2007; Mayer, DiPaolo & Salovey, 1990). These skills are important in enhancing a child’s early SED through the use of strategies such as modeling emotional expressions (Nicely, Tamis-LeMonda & Bornstein, 1999), coaching (using verbal language) and contingent responding to enable the child to interpret emotional cues and read social situations so benefiting their SED (McClure, 2000).

Mothers with maternal depression have been shown to have difficulty processing positive facial and vocal expressions in infants, so this may lead to less sensitive MR in response to positive affect in the child and so diminish the beneficial quality of the mother–child interactions (Arteche et al, 2010; Stein et al, 2010, Young, Parson, Stein & Kringelbach, 2012).

Given the importance of accurately recognising an infant’s cues to better interpret their emotional state in order to respond sensitively, consistently and promptly, investigation of the relationship between a mother’s emotional recognition skills and her MR and their contribution to a child’s SED would seem prudent but little research has been done in this area.

**Factors associated with disruption to MR and a child’s SED**

Important confounding variables in the association have been identified in previous literature. Maternal factors that have been shown to influence MR and SED include; social class, maternal age and education, duration of breastfeeding and parity.
Maternal Responsiveness and Child Social and Emotional Development (Whittaker et al, 2010; Landry, Smith, Swank, Assel & Vellet, 2001; Tharner et al, 2012; Pearson et al, 2011; Fish & Stifter, 1993; Herrera, Zajonc, Wieczorkowska, & Cichomski 2003; Sulloway 2007) and most notably maternal depression (Campbell et al, 2007; Cummings, Davies, & Campbell, 2000; Arteche et al, 2010; Stein et al, 2010, Young et al, 2012; NICHD ECCRN, 1999). The reciprocal nature of the mother-infant interaction means that infant factors such as prematurity, a ‘difficult’ temperament (easily distressed, hard to soothe, trouble adapting to change) and gender have been found to affect MR and SED (Davidov & Grusec, 2006; Raikes and Thompson, 2008; Beckwith, Rofga & Sigman, 2002; NICHD ECCRN, 2004; Rothbart & Bates, 1998; Calkins & Degnan, 2006).

In summary, there is only one large UK population based study, with no measure of early (within first 12 months) observed MR (Mensah & Kiernan, 2010) and there are few studies looking at SED into adolescence, which investigate the potential influence of confounding variables. It is also unclear from the literature which individual aspects of child SED are associated with MR as most studies use global measures such as the Child Behaviour Checklist (Achenbach, 1992; Mäntymaa et al, 2004). The influence of MR on particular aspects of a child’s SED such as social communication, social competence and emotional recognition is less established but children with delays in SED may exhibit behaviours such as impulsivity, inattention, and aggression (Feldman & Masalha, 2010). Further, children who have difficulty recognising social cues such as facial expressions may find friendships problematic and experience problem behaviour, as they do not always interpret social situations accurately (Boyd et al, 2005).

More research is needed to understand the interplay between mother and child factors (such as maternal depression and child temperament) and how they impact on the observed relationships between MR and child SED into adolescence in a large UK
longitudinal sample. It would be important to see how a mother’s emotional recognition skills relate to MR with consideration of confounding variables; something which has been focused on in clinical (e.g. maternal depression, Arteche et al, 2010) but not in non-clinical samples. Further, the relationship between a mother’s emotional recognition and a child’s emotional recognition and SED should be explored.

**Current study**

The current study, based on a large contemporary birth cohort, firstly examined the relationship between observed MR at 12 months and a child’s SED between 81 and 198 months, which includes a measure of social communication at 91 and 128 months, facial expression recognition at 103 months and emotional, conduct and peer problems, hyperactivity/inattention and pro-social behaviour at 81, 115, 140, 158 and 198 months. Secondly, the relationships between MR at 12 months and a mother’s facial and vocal expression recognition at 151 months will be explored. Finally, the relationship between a mother’s facial and vocal expression recognition at 151 months and a child’s facial expression recognition at 103 months and SED at 158 months will also be explored, with adjustment for MR at 12 months, to see if these skills are associated with SED independently of MR.

In addition, this study considered potential maternal and child confounding variables in the associations. These included maternal age, education and depression, child temperament, parity, breastfeeding duration, infant gender and gestation. Adjusting for these variables meant that the associations could be explored further to see whether any effects were independent, or might be partially or fully explained by these variables.

The following hypotheses were tested: 1) that positive MR at 12 months would be associated with more positive SED across all later child measures and time-points. 2) that positive MR at 12 months would be associated with a mother showing better facial
and vocal emotion recognition at 151 months. 3) that both associations in hypotheses one and two would remain after controlling for multiple confounders. 4) that better facial and vocal expression recognition at 151 months in mothers would be associated with more positive child SED at 158 months and better child facial expression recognition at 103 months. 5) that these associations in hypothesis four would remain after controlling for MR at 12 months.

Method

Sample

The sample comprised participants from the Avon Longitudinal Study of Parents And Children (ALSPAC): an ongoing longitudinal cohort study following the health and development of children born between April 1991 and December 1992 who were resident in the Avon area of South West England. The ‘core’ cohort consists of 14,541 pregnancies with 13,988 singletons/twins alive at 12 months. The ALSPAC sample had a slightly greater proportion of mothers who were married or cohabiting, were home owners and who had a car in the household when compared to the 1991 National Census data for mothers with infants under one who lived in the Avon area. Ethical approval for the study was obtained through the ALSPAC Law and Ethics Committee, the Local Research Ethics Committees and the School of Psychology Ethics Committee (University of Exeter; Appendix A).

The current study uses a 10% random sub-sample of parent-infant pairs, selected from the last 6 months of ALSPAC births. At a ‘Children in Focus’ clinic when the child was 12 months, 1,213 parent-infant pairs attended and 1,144 mothers of singleton infants completed an observed and videotaped mother-infant interaction from which a measure of MR was derived. Twins were excluded from the sample due to
maternal responses being thought to differ towards them, which could make the ratings unreliable.

Measures

Maternal responsiveness. The non-verbal communication subscale of The Thorpe Interaction Measure (TIM; Thorpe, Greenwood & Rutter, 2003) was used by independent trained researchers to rate MR during mother-infant interactions, when the infants were 12 months (mean infant age 54 weeks, standard deviation 1.1 weeks). The TIM involves asking mothers to engage their child in sharing a picture book as they would at home (approximately 5 minutes duration) in a living room style setting.

The current study focused on the non–verbal rather than verbal aspects of maternal responses as they are thought to reflect the more automatic and subtle aspects of MS that are not consciously controlled and subject to biases by the situation and social desirability. The responses coded in the non-verbal scale also compare to maternal responses used in MS scales from the literature (Murray, Fiori-Cowley, Hooper & Cooper, 1996; Page et al, 2010). Additionally, there was little variance in verbal responses (80% of mothers showed positive responses) and previous research has considered verbal responses as separate from the responses used to categorise MR (Page et al, 2010).

Mother’s non-verbal responses towards their infant were categorised according to a coding system (see table 1), which has good inter-rater reliability (0.73) and predictive validity demonstrated by ALSPAC (Pearson et al, 2011). Concurrent validity of the TIM has been evidenced by scores being associated with scores on the Mellow Parenting Scale (Puckering, 2004), a well-validated and more in-depth measure of MR.

Negative responses (see table 1) were not included in statistical analyses due to a low number (n=22) of cases and as they are thought to be qualitatively different from
neutral responses the categories could not be combined. Scores were coded as neutral = 0 and positive = 1.

Table 1
Coding system for observation of mothers’ responses in the TIM

<table>
<thead>
<tr>
<th>Non-verbal communication:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Negative</strong>: Observation of pushing, distracting, non-response to positive initiation, gaze aversion.</td>
</tr>
<tr>
<td><strong>Neutral</strong>: No clear examples of either negative or positive communication, defined as non-responsive behaviour.</td>
</tr>
<tr>
<td><strong>Positive</strong>: Observation of stroking, caressing, positive eye contact, smiling.</td>
</tr>
</tbody>
</table>

Social and Communication Disorders Checklist\(^3\). A child’s social interaction and communication competence was measured using the Social and Communication Disorders Checklist (SCDC; Skuse, Mandy & Scourfield, 2005). The SCDC is a 12-item (scale: 0 = not true, 1 = quite or sometimes true and 2 = very or often true) parent/carer report questionnaire, designed to measure social reciprocity and verbal/non-verbal characteristics of social communication in the last six months with a maximum score of 24. The SCDC is a validated research and clinical tool with good internal consistency (0.93) and high test retest reliability (0.81; Skuse et al, 2005). The total score was dichotomised using a cut-off of ≥8 as presence of clinically significant social communication difficulties (Skuse et al, 2009) and coded as 1 = presence of social communication difficulties and 0 = not present.

Mothers completed the SCDC at two time-points: when the study child was 91 months (mean and standard deviation [SD] 1 month) and 128 months (1.5 months).

\(^3\) See Appendix C1 for SCDC measure
**Strengths and Difficulties Questionnaire**

The Strength and Difficulties Questionnaire (SDQ) is a 25 item emotional and behavioural screening questionnaire from 3-16 years old (Goodman, 1997). There are five scales of five items: emotional symptoms, conduct problems, hyperactivity-inattention, peer problems, and pro-social behaviour. Mothers rated whether the item was ‘Not True’, ‘Somewhat True’ or ‘Certainly True’ in describing the study child. For all five scales the score can range from 0 to 10; if all five are attempted with at least three items completed a scale score can be prorated. Except for the pro-social scale, a higher score reflects greater difficulties. The pro-social scale indicates the amount of pro-social characteristics a child shows and was reversed for our analyses so the outcome was always detrimental. The test-retest reliability (0.70 to 0.85), internal consistency (0.51 to 0.76) and the criterion validity was found to be acceptable for the five sub-scales (Goodman, 1999).

Results were categorised according to established bandings (Normal, Borderline, Abnormal) to identify those children with clinically relevant difficulties (Goodman et al, 2000). However, due to the small number of abnormal cases for the mothers with neutral (range= 10–49, 1-6%) and positive (range= 5-48, 1-6%) maternal non-verbal responses the borderline and abnormal categories were collapsed. Therefore, for all subscales a higher score indicated more problems and coded accordingly (1= abnormal/borderline, 0= normal).

In ALSPAC mothers completed an SDQ at five time-points when children were 81 months (mean and SD 1 month), 115 months (1 month), 140 months (1 month), 158 months (2 months) and 198 months (1 month).

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4 See Appendix C2 for SDQ measure
The Diagnostic Analysis for nonverbal Accuracy\(^5\). The Diagnostic Analysis for non-verbal Accuracy 2 (DANVA2; Nowicki, 2006) is designed to assess people’s ability to accurately send and receive emotional information through non-verbal means (Nowicki & Duke, 1994). The child facial expression subtest was used to assess a child’s emotion expression recognition accuracy. The test has acceptable internal consistency (.69 to .81) and test-retest reliability \((r=.74; \text{Nowicki & Carton, 1993})\). In terms of criterion validity, lower accuracy scores correlate with lower social competence in school children (Goonan, 1995; Nowicki & Mitchell, 1998; Maxim & Nowicki, 1996).

In ALSPAC participants viewed 24 pictures of child actors posing a facial expression, and rated the emotion expressed as happiness, sadness, anger or fear. Responses are scored for accuracy against correct answers and higher scores indicate a greater number of errors.

The DANVA2 was completed when a child was 103 months (mean and SD 2 months). It is more clinically relevant to use a cut-off to decipher a level at which social functioning is likely to be affected by emotional recognition difficulties and clinical services needed. In addition, if the variable was left as continuous, the difference between DANVA2 scores was likely to be clinically meaningless. Consequently, a cut-off of \(\geq 7\) errors was used (the 15\% worst performing participants) to identify those with clinically relevant difficulties. This cut-off was also previously established in a population sample (S. Jr. Nowicki, personal communication, November 30, 2012). The scores were then coded as 1= \(\geq 7\) errors and 0= <7 errors.

An opportunistic sample of mothers also completed the child version DANVA2 facial and vocal expression recognition subtests when children were 151

\(^5\) See Appendix C3 for DANVA2
months (mean and SD 2 months). The mothers did not complete the adult versions because the child versions were thought to better reflect the dynamics within the mother-child relationship (S. Jr. Nowicki, personal communication, November 30, 2012).

The child vocal expression recognition subtest involved mothers listening to 24 clips of child actors reading a sentence and rating the emotion expressed as happiness, sadness, anger or fear. The test has acceptable internal consistency (.74 to .76) and test-retest reliability (r=.88; Nowicki, 2006). There is no data on reliability and validity for adults completing the child version DANVA2. A cut-off of ≥7 errors was also used to dichotomise the facial and vocal expression recognition subtests and was coded in the same way; consistent with the child scores.

**Confounding variables**

In ALSPAC questionnaire data on several confounding variables was collected during the antenatal period and the first year of the study child’s life. Continuous variables included maternal age (in years), gestation (in weeks) and infant temperament at 6 months using The Carey Temperament Scale (score of 0-44 on the mood subscale; Carey & McDevitt, 1978), with a higher score reflecting a more difficult temperament. Categorical variables included child gender, highest maternal education (2= degree, 1= O or A level, 0= CSE or vocational), social class (2= high social class, 1= middle social class, 0= low social class), parity (0= multiparous, 1= primiparous), birth-weight (0= normal range, 1= low birth-weight; ≤ 2500 grams), duration of breastfeeding in the first year (0= none, 1=<3 months, 2= 3-5 months, 3= 6 months+) and maternal depression at 8 months (0= non depressed, 1= depressed) measured using the Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden & Sagovsky, 1987).

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6 See Appendix C4 for Carey Temperament Scales
7 See Appendix C5 for EPDS measure
Statistical Analyses

Separate analyses were carried out using logistic regression to investigate firstly, the association between MR at 12 months (non-verbal behaviour: 1= positive, 0= neutral) and child SED across each outcome measure at each time-point (hypotheses one) with adjustment for confounding variables (hypothesis two). Secondly, the association between mother’s facial and vocal expression recognition at 151 months (hypotheses three) and thirdly, the association between a mother’s facial and vocal expression recognition scores at 151 months (1= ≥7 errors and 0= <7 errors) and a child’s facial expression recognition at 103 months and scores on the SDQ at 158 months (hypothesis four). In order to address any effect of mother’s facial and vocal expression recognition and MR on child SED were independent of each other, both were entered into a final regression model (hypothesis five).

Missing data and confounding variables

Invalid scores were coded to missing to prevent them being included in analyses. Missing data varied across the data set. Therefore analyses were performed for all available data for the exposure and confounding variables (n=965) and then limited to each outcome measure (see figure 1). The separate logistic regression analyses were repeated with adjustment for confounding variables, which had been identified in previous literature as influencing MR and child SED. The separate regression models meant that the order the confounding variables were entered did not matter. The variables were grouped according to theoretically relevant combinations (e.g. maternal age and education entered together) and to account for gaps identified in the literature (e.g. infant temperament entered individually). For each hypothesis a complete model was run including all potential confounding variables (see results tables for confounder combinations).
Results

Sample demographics

The 1,144 mother-infant dyads with TIM non-verbal communication scores reduced to 1,122 with the exclusion of mothers with negative non-verbal responses (n=22). Table 2 shows the characteristics of this sample compared to those that did not attend the clinic.

The sample reduced to 965 when restricted to those who also had data on confounding variables and reduced further with complete case samples for each outcome measure; 624 for the SCDC at 91 and 128 months, 442 for the SDQ at all time-points, 363 for mother and child DANVA2 scores and 233 for mother DANVA2 scores and child SDQ at 158 months (See figure 1, flow diagram).

As the sample reduces the demographics become less representative (see table 2). The mothers are older, more likely to be married, have breastfed, be of higher education and social class and less likely to be depressed or very anxious at 8 months. The children are less likely to be born at a low birth-weight and more likely to be a girl and the first-born.

Of the 1,122 mothers, 499 showed neutral and 623 showed positive non-verbal responses. Mothers with positive non-verbal responses were more likely to be of high social class, have a higher level of educational attainment, were more likely to have breastfed and be married (see table 3). Complete case samples for each outcome measure showed similar results, which became less representative as measures taken at older time-points were included.

The children of mothers who completed the TIM were less likely to make \( \geq 7 \) errors on the DANVA2 facial expression recognition subtest at 103 months compared to
the rest of ALSPAC. There were no other significant differences between the groups on the outcome measures (see table 4).

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**Figure 1.** Flow diagram of sample sizes to complete cases.