

# Reduced Face Preference in Infancy: A Developmental Precursor to Callous- Unemotional Traits?

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## ABSTRACT

**BACKGROUND:** Children with callous-unemotional (CU) traits, a proposed precursor to adult psychopathy, are characterized by impaired emotion recognition, reduced responsiveness to others' distress, and a lack of guilt or empathy. Reduced attention to faces, and more specifically to the eye region, has been proposed to underlie these difficulties, although this has never been tested longitudinally from infancy. Attention to faces occurs within the context of dyadic caregiver interactions, and early environment including parenting characteristics has been associated with CU traits. The present study tested whether infants' preferential tracking of a face with direct gaze and levels of maternal sensitivity predict later CU traits.

**METHODS:** Data were analyzed from a stratified random sample of 213 participants drawn from a population-based sample of 1233 first-time mothers. Infants' preferential face tracking at 5 weeks and maternal sensitivity at 29 weeks were entered into a weighted linear regression as predictors of CU traits at 2.5 years.

**RESULTS:** Controlling for a range of confounders (e.g., deprivation), lower preferential face tracking predicted higher CU traits ( $p = .001$ ). Higher maternal sensitivity predicted lower CU traits in girls ( $p = .009$ ), but not boys. No significant interaction between face tracking and maternal sensitivity was found.

**CONCLUSIONS:** This is the first study to show that attention to social features during infancy as well as early sensitive parenting predict the subsequent development of CU traits. Identifying such early atypicalities offers the potential for developing parent-mediated interventions in children at risk for developing CU traits.

**Keywords:** Callous-unemotional traits, Face preference, Maternal sensitivity, Infant development, Precursor, Psychopathy  
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Among antisocial adults, psychopathy is associated with more severe and enduring violence and offending (1,2). The proposed childhood equivalent, callous-unemotional (CU) traits, evidenced by a lack of responsiveness to, or concern for, others' distress, is also associated with severity and persistence of offending and aggression as well as increased burden on families (3–5). Despite the clear need to understand the developmental origins of CU traits, few studies have examined infant predictors.

In children with CU traits, core impairments such as responsiveness to others' distress cues have been associated with a lack of attention to the eye region. Eye contact occurs during interaction with a parent or caregiver and forms a critical component of an infant's early social communication, influencing the development of the social brain (6). The early environment also plays an important role with factors such as positive parenting associated with lower CU traits, offering a target for potential interventions. The present study examines the role of infants' preferential attention to a face with direct gaze and maternal sensitivity as predictors of subsequent CU traits.

## Attention to the Face

In typical development, early social interaction (e.g., attention to faces, reciprocal smiling) facilitates bonding with (and learning from) the caregiver during the protracted period of postnatal development (7,8). In typical development, sensitivity to another person's face and eye gaze appears to be present from immediately after birth (8,9). In the first few months of life, faces are processed by a subcortical route, via the superior colliculus, pulvinar, and amygdala (10). Infant face preference is thought to be driven by the configuration of the eyes within the face, which maximally activates this low spatial frequency subcortical pathway (11). More recently, this route has been proposed to modulate activation and influence the development of the social brain network [i.e., fusiform gyrus, prefrontal cortex, and superior temporal sulcus regions (6)] specialized in adults for the processing of social stimuli. It is plausible that atypical face preferences early in infancy contribute to later impairments in socioemotional behavior (12).

A decreased recognition of, and amygdala activation in response to, fearful faces, which may underpin failures to

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regulate aggression in the face of others' distress, is associated with CU traits (13). There is also evidence that elevated CU traits and reduced fear recognition are associated with reduced attention to the eyes (14–17). Could early difficulties in orienting toward a person's face underlie the social and emotional impairments characteristic of children with CU traits? Dadds *et al.* (16) hypothesized that a failure to attend to emotionally salient stimuli such as another person's eyes might be present very early in the development of CU traits, with direct effects on responsiveness to others' distress and indirect effects through a reduced ability to benefit from parental sensitivity. However, to date, no studies have examined whether reduced face preference in infancy could represent a developmental precursor to CU traits.

### Role of Parenting in CU Traits

A child's early environment is known to play a role in the development of CU traits (18). Research into the effects of early parent characteristics on subsequent CU traits has yielded mixed results; several studies failed to show associations for measures such as parental involvement, monitoring/supervision, discipline, and poor parental practices (19–21). However, associations have been found between early positive parenting characteristics (i.e., parental warmth) and decreased CU traits (22–24) [Waller *et al.* (25)]. Low maternal warmth and affection predict higher adolescent CU traits even after controlling for risk factors such as childhood abuse and neglect (26). Interactions with parents over the first months of life provide numerous opportunities to attune with others' emotions and intentions, provided that parents are responsive to infant cues (27,28). Sensitive parenting may promote the development of empathy and social understanding and reduce risk of CU traits.

### Dyadic Interaction

There may be limits to the effect of parental sensitivity in the presence of reduced looking toward the caregiver's face. Dadds *et al.* (16) specifically hypothesized that an early lack of attention to the eyes of an attachment figure reduces the beneficial effects of sensitive parenting and, over the course of development, results in the social and empathy deficits characteristic of children with CU traits. In line with this hypothesis, they found reduced eye contact in boys with high CU traits (age range, 5–16 years; mean, 8.9 years) in interactions with both of their parents, despite the fact that the mothers of the children with high CU traits did not themselves show impairments, a finding replicated in a later study by Dadds *et al.* (17).

### Gender Differences in CU Traits

Most studies of CU traits have focused predominately on male participants, likely because of increased prevalence of CU traits in boys (29). However, several studies have found gender differences relating to the relative contribution of genetic and shared environmental influences suggesting that CU traits in boys are more highly heritable than CU traits in girls (30,31). Gender differences have been found for parenting, with positive parenting measures negatively associated with CU

traits only in girls (22,23). Exploring the role of gender in the developmental pathway leading to CU traits is an important next step.

This is one of the first studies to examine prospectively early developmental processes in CU traits. Based on available evidence from cross-sectional studies in children, we hypothesized that reduced preferential tracking of a face with direct gaze in infancy represents an early vulnerability for CU traits. In addition, early parental sensitivity may lead to reductions in CU traits by increasing opportunities to respond to others' emotions and intentions. However, the beneficial effect of parental sensitivity on the development of CU traits may be reduced by lower eye contact and may be less evident in boys than in girls. We tested the following specific predictions: 1) reduced preferential tracking of the human face at 5 weeks will be associated with higher CU traits at 2.5 years, 2) elevated maternal sensitivity assessed at 29 weeks will predict lower CU traits, 3) there will be an interaction between maternal sensitivity and face tracking in the prediction of CU traits, and 4) there will be an interaction between maternal sensitivity and sex of infant in the prediction of CU traits.

## METHODS AND MATERIALS

### Participants

Mothers and children participated in the Wirral Child Health and Development Study, a consecutive cohort of 1233 women (mean age, 26.8 years; SD, 5.8 years) recruited at 20 weeks of pregnancy with their first child [Sharp *et al.* (32)]. An intensive subsample of 316 women, stratified by partner psychological abuse, was identified at 32 weeks' gestation. The extensive general population sample consisted of all participants. For the current study, data were analyzed from 213 (105 male; 108 female) participants in the intensive sample who had data at "32 weeks prenatal" (mean weeks of pregnancy, 32.1; SD, 2.1) and at postnatal assessment points, as follows: "5 weeks" (mean, 5.2; SD, 1.1 weeks), "29 weeks" (mean, 29.1; SD, 3.1 weeks), and "2.5 years" (mean, 31.4; SD, 2.5 months) (Figure S1 in Supplement 1).

### Procedure and Measures

**Neonatal Behavioral Assessment Scale.** The Neonatal Behavioral Assessment Scale (NBAS), a standardized measure designed to assess orienting, motor, and emotion regulatory processes (33,34), was administered to the intensive sample at 5 weeks after birth in the laboratory. It was conducted by a trained administrator who carried out, in a prescribed sequence, a range of maneuvers designed to elicit the infant's optimal orienting and motor performance and emotional responses to mildly aversive procedures. There are six orienting procedures during which the infant is positioned on the administrator's lap at 45 degrees, with the infant's head supported by the administrator. However, because the focus of this study was face preference, we used only two subscales: 1) orientation to the human face, assessed as the extent to which the infant moves eyes and head to track the administrator's face over a 180-degree horizontal arc and 30 degrees vertically and 2) orientation to an inanimate visual

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