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Love withdrawal is related to heightened processing of faces with emotional expressions and incongruent emotional feedback: Evidence from ERPs☆

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ABSTRACT

Parental use of love withdrawal is thought to affect children's later psychological functioning because it creates a link between children's performance and relational consequences. To investigate whether love withdrawal is also associated with the underlying level of basic information processing in the brain, we studied event-related potentials to feedback stimuli that combined performance feedback with emotional facial expressions. We focused on the VPP (face processing) and N400 (incongruence processing). More maternal use of love withdrawal was related to more positive VPP amplitudes, larger effects of the emotional facial expression on VPP amplitude, and more negative N400 responses to incongruent combinations of feedback and facial expressions. Our findings suggest a heightened processing of faces with emotional expressions and greater sensitivity to incongruence between feedback and facial expression in individuals who experienced more love withdrawal.

Love withdrawal is a disciplinary strategy that involves withholding love and affection when a child misbehaves or fails at a task. When used excessively, it is considered psychological maltreatment (Euser et al., 2010). By using love withdrawal the parent communicates to the child that his or her love and affection for the child are conditional upon the child's compliance and success. The formation of this link between compliance or performance on the one hand and relational consequences on the other is thought to underlie both the effectiveness and emotional costs of love withdrawal (Assor et al., 2004; Elliot and Thrash, 2004). Parental, and in particular maternal, use of love withdrawal has been associated with low self-esteem, low emotional well-being, feelings of resentment towards the parents, and fear of failure in adolescence and young adulthood (Assor et al., 2004; Elliot and Thrash, 2004; Goldstein and Heaven, 2000; Renk et al., 2006; Soenens et al., 2005b). It remains unclear, however, whether the use of love withdrawal also affects the deeper level of information processing in the brain. It remains to be studied whether the association of compliance and performance with relational consequences, formed through the experience of parental love withdrawal, affects the perception and processing of information relevant to this association. As a first step towards filling this gap we present a study on event-related potentials to one type of information that is especially relevant to this association, emotional facial expressions accompanying feedback.

Because parental use of love withdrawal is thought to affect psychological functioning through the establishment of a link between performance and compliance on the one hand and relational consequences, including intense emotional expressions, on the other, emotional information and expressions within the context of performance situations may be more relevant for, more attended by, and processed to a larger extent by persons who have experienced high levels of maternal love withdrawal compared to those who have experienced less love withdrawal. This would increase the amplitude of a component of the event-related potential (ERP) called the Vertex Positive Potential (VPP).

The VPP is a positive deflection in the ERP that peaks at frontocentral electrode sites, roughly between 140 and 180 ms after stimulus onset. Evidence suggests that the VPP and N170, a negative going occipito-temporal right hemisphere dominant component, represent two sides of the same generator dipoles in occipito-temporal cortex (Joyce and Rossion, 2005). Both components have been associated with the configural processing of faces, with larger amplitudes indicating more extensive processing, and show larger amplitudes in response to emotional compared to neutral expressions (Luo et al., 2010). VPP and N170 are often found to be sensitive to intensity, but not valence of emotional expressions (Luo

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et al., 2010; Sprengelmeyer and Jentzsch, 2006), although larger amplitudes in response to negative (often fearful) compared to positive (often happy) expressions have been observed in some studies (Ashley et al., 2004; Krombholz et al., 2007; Williams et al., 2006).

In addition to heightening the processing of facial expressions in performance situations, parental use of love withdrawal may also affect the processing of incongruence between performance feedback and emotional expressions. Because a link between performance and relational consequences is established through the experience of love withdrawal, the violation of this link may become an especially salient and unexpected event. Such a violation occurs when performance feedback is presented with an emotional expression that does not match the feedback (e.g., presenting positive feedback with a disgusted facial expression). One component of the event-related potential (ERP) that is particularly sensitive to incongruence (mismatch) is the N400. The N400 is a negative-going ERP component that peaks at parietal electrode sites, around 400 ms after the presentation of a stimulus that is incongruent with its context (e.g., the word 'knife' at the end of the sentence 'soup is eaten with a. . .'). The N400 is sensitive to the amount or salience of this discrepancy (Caldera et al., 2004).

Neural generators of the N400 effect may vary according to the demands of the task at hand, and include a network of areas involved in the processing of learned associations, including the anterior temporal lobes, superior temporal sulcus, parahippocampal gyri, superior parietal regions, inferior frontal gyrus, and insular regions (Frühholz et al., 2009; Silva-Pereyra et al., 2003). The N400 is typically studied in the context of language processing, but has also been observed following facial stimuli, often lateralized towards the right when emotional expressions are involved (Bobes et al., 2000; Caldera et al., 2004; Frühholz et al., 2009; Münte et al., 1998). Because incongruence between feedback and emotional expression violates the performance-relational consequence link, we expect this incongruence to be more salient and therefore N400 responses to be larger for persons who have experienced high maternal love withdrawal than for those who have experienced less maternal love withdrawal.

Some support for the idea that love withdrawal may be related to the processing of facial expressions and performance feedback comes from a recent study in which one characteristic associated with love withdrawal, fear of failure, has been associated with the amplitudes of the N400 and VPP (Tops and Wijers, submitted for publication). The participants in this study performed a flanker task, in which a picture of a happy or disgusted face was presented after every response. The pictures were presented in green after a correct response and in red after an error. Tops and Wijers (submitted for publication) found that the amplitude of the N400 to incongruent feedback stimuli (disgusted faces in green and happy faces in red) increased when participants reported higher levels of fear of failure. Also, when higher levels of fear of failure were reported the amplitude of the VPP in response to disgusted facial expressions was larger compared to VPP amplitude in response to happy expressions.

In the present study, we investigate the relations between maternal use of love withdrawal and the VPP and N400 using a similar design. Because it is particularly the use of love withdrawal by mothers with their daughters that has been linked to unfavorable outcomes in adolescence and young adulthood (e.g., Elliot and Thrash, 2004; Renk et al., 2006), we focus on maternal use of love withdrawal in females. We expect higher maternal use of love withdrawal to be related to larger N400 and VPP amplitudes. To evaluate the unique contribution of love withdrawal, we controlled for fear of failure in our analyses. In this manner, we aim to add to previous findings by investigating how parenting practices contribute to information processing biases.

1. Method

1.1. Participants

Data were acquired from 27 participants who participated in a larger study that additionally focused on the role of oxytocin. Data for the current study were derived from the placebo condition. All participants were female undergraduate students, aged 18–30 years ($M = 20.59$, $SD = 3.08$), and were paid 50 euros for participation. Exclusion criteria included colorblindness, smoking, alcohol and drug abuse, neurological and psychiatric disorders, pregnancy, breastfeeding, and use of medication (except oral contraceptives). The study was approved by the ethical committee of the Leiden University Medical Center.

1.2. Procedure

Participants completed questionnaires on maternal use of love withdrawal and fear of failure during an introductory course in child and family studies. The questionnaires were administered to 391 18–30-year old women who were willing to participate in an EEG experiment. Within this sample of 391 students, the distribution of scores on the love withdrawal questionnaire was skewed towards the right, indicating that in this pool of students high maternal love withdrawal is (relatively) underrepresented. To ensure an acceptable coverage of the full range of scores on the love withdrawal questionnaire within the sample of students taking part in the EEG experiment, participants for this experiment were selected stratified from the pool of 391 students: Half of the participants were selected randomly from the group scoring in the upper quartile of the questionnaire ($n = 13$ for the current sample), and half of the participants were selected randomly from the group scoring in the other three quartiles ($n = 14$ for the current sample). They were asked to come to our laboratory for two experimental sessions, separated by approximately four weeks.

Informed consent was obtained at the beginning of the first session. Concerning the administration of oxytocin, participants were told that they would receive oxytocin during one session and a placebo during the other, but that the order was not known even to the experimenter. This message was repeated at the beginning of the second session. When participants were asked, at the end of the second session, which substance they thought they had taken during that session their guesses were not significantly better than chance ($p > .05$). Participants were not informed about the effects of oxytocin under investigation, only about the possible side effects they might experience (which was required by the ethical committee). We therefore believe that influences of the procedure of nasal spray administration on overall performance, if any, have been negligible.

At the start of each session, a saliva sample was collected and participants completed a number of questionnaires. The participants then received nasal spray containing either 24 I.U. of oxytocin or a placebo (saline solution). All participants received both substances once, either the placebo during the first session and oxytocin during the second, or oxytocin during the first session and the placebo during the second. The order of administration was counterbalanced across participants and unknown to both the participant and the experimenter. Participants were then fitted with an electrode net after which they completed a flanker task (with a short break after the fourth block). Halfway through and after completion of the task saliva samples were collected and participants completed several questionnaires. Data regarding oxytocin, saliva samples, and questionnaires will be presented elsewhere.