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How do adolescents regulate distress according to attachment style? A combined eye-tracking and neurophysiological approach

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ABSTRACT

According to attachment theory, attachment representations influence emotion regulation (ER) across the lifespan. However, research into attachment-related ER in adolescence is still scarce. The aim of this study was to assess attachment-related ER using a multimodal approach, relying on behavioral and neurophysiological parameters. Attachment styles in eighty-one adolescents were assessed with the Attachment Style Interview (ASI). A distress-then-comfort paradigm based on visual stimuli (the Besancon Affective Picture Set-Adolescents) was employed to "activate" then "deactivate" the attachment system. Gaze and neurophysiological parameters of ER strategies were assessed using eye-tracking synchronized with a physiological device.

During the first phase "distress exposure", attachment style was associated with the early stage of distress processing indexed by first fixation duration. Withdrawn adolescents fixated distress pictures less than other groups. Fearful adolescents showed a longer first fixation duration than withdrawn adolescents.

During the following phase, "comfort-seeking", all groups initially fixed joy-complicity and comfort pictures earlier than neutral pictures, except for withdrawn adolescents, who fixated comfort pictures later than neutral pictures. Additionally, withdrawn adolescents explored comfort pictures less than enmeshed adolescents. Enmeshed adolescents explored neutral pictures less than comfort and joy-complicity pictures.

Concerning neurophysiological parameters, first fixation duration correlated positively with Skin Conductance Response (SCR) rise time in fearful adolescents, while glance count correlated negatively with SCR latency in withdrawn adolescents. This study provides an innovative and objective evaluation of behavioral and neurophysiological parameters for attachment-related ER in adolescents, with a temporal resolution. These parameters constitute potential biomarkers that could contribute to our understanding of ER differences in insecure adolescents. This study was registered with the clinical trials database ClinicalTrials.gov on August 01, 2016, under the number NCT02851810.

1. Introduction

Studying emotion dysregulation in adolescence is of particular importance, as it is one of the risk processes for the development of psychopathology (Archibald et al. 2003; Baker et al. 2014; Blakemore and Mills 2014; Collins et al. 2002; Raphael 2013). Emotion regulation (ER) encompasses changes in the quality, intensity, duration, and latency of emotional reaction and expression in the service of adaptation (Thompson 1994), through the temporary synchronization of physiological, behavioral, and cognitive components (Cole et al. 2004).

Attachment is one of several factors influencing the effectiveness of ER (Mikulincer et al. 2005). Attachment is an innate psychobiological behavioral system, activated in times of perceived distress (Mikulincer et al. 2003), inciting a child to seek proximity and comfort from his/her

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attachment figures (Ainsworth 1985, 1991). The system is deactivated once a felt sense of security and safety is reestablished (Allen and Manning 2007). The quality of early attachment interactions with an attachment figure leaves an enduring mark on the developing person at different levels: (i) cognitive (representational models of self as worthy of care and of others as capable of providing care), (ii) behavior (comfort and proximity-seeking behaviors) and (iii) psychobiological (reaction to distress). Attachment representation (secure or insecure: withdrawn, fearful, or enmeshed) is likely to be associated with the way stress is perceived and dealt with across the lifespan (Kobak and Sceery 1988; Mikulincer et al. 2004; Parrigon et al. 2015). Research focusing on infancy found that attachment quality contributes to the regulation of infant stress reactivity, and that infants are likely to use information about the availability of an attachment figure to calibrate their threat response system at both behavioral and physiological levels (Cassidy et al. 2010). Children with insecure attachment present chronic activation of physiological stress response systems and higher elevated cortisol following exposure to novel stimuli (Gunnar and Quevedo 2007; Schieche and Spangler 2005; Spangler and Grossmann 1993). In adults, differences in physiological reactivity to attachment-related stress remain: insecure individuals show a higher increase in skin conductance and greater cortisol reactivity than secure individuals (Diamond 2001; Gross and Levenson 1997; Pietromonaco et al. 2013; Roisman et al. 2004; Silva et al. 2015). The capacity to represent a responsive attachment figure can diminish physiological responses associated with threatening experiences in times of both anticipated and actual threat (Eisenberger et al. 2011).

The literature proposes that ER in the context of attachment encompasses representational and physiological processes influencing each other. However, the use of attachment representations in adolescence to modulate stress reactivity during the different phases of ER (distress perception, self-regulation, and comfort-seeking strategies) has not been examined extensively. Previous studies have generally used non-attachment-related stimuli to assess ER, e.g., the dot probe task (Dewitte et al. 2007; Eisenberg and Spinrad 2004; Mogg and Bradley 2006), the emotional Stroop task (Bailey et al. 2012, Dewitte, De Houwer, 2007, Eisenberg and Spinrad 2004, Mogg and Bradley 2006), facial expressions (Bosmans et al. 2013, Zhang et al. 2008, Zhang et al., 2013), or positive and negative words (Debbane et al. 2017). Few studies have used multimodal assessments (cognitive, behavioral, and neurophysiological) that encompass the process of ER linked with attachment in adolescence (Beijersbergen et al. 2008; Borelli et al. 2014a; Borelli et al. 2014b; Zimmermann et al. 2001), and few have studied the different styles of insecurity, although their ER strategies differ (Dewitte, De Houwer, 2007, Escobar et al. 2013).

Empirical evidence has demonstrated that secure adolescents are characterized by their flexibility in integrating positive and negative emotions, and the increasing ability to experience, express, and tolerate temporally distressing events (Bowlby 1969, 1982). They are also more able to seek out aid from unfamiliar peers than insecure adolescents (Feeney et al. 2008). Insecure withdrawn adolescents tend to suppress their emotional expression and comfort-seeking strategies (Bifulco et al. 2002). They showed higher cardiac reactivity during conflictual interaction with parents, but presented no difference with secure adolescents while answering questions from the AAI (Beijersbergen, Bakermans-Kranenburg, 2008).

During a virtual game with peers that involved fair play, exclusion, and reunion phases, White and co-workers examined participants' neural responses to reunion with peers who had previously excluded them (White et al. 2013). Withdrawn adolescents appeared to expect peer rejection to continue even upon reunion, as indicated by their neural responses during reunion: increment in the N2, a neural marker commonly linked to expectancy violation (White et al. 2013). The authors suggest that attachment representations in adolescents influence their expectation of social reparation and their report of distress. Insecure adolescents indeed reported lower distress, while their neural response was higher than for secure adolescents (White et al. 2012). The literature is sparse concerning insecure enmeshed adolescents. One study found that enmeshed adolescent girls have higher cortisol levels on awakening (Oskis et al. 2011).

We need to address this burgeoning area of research to better understand the entire temporal dynamics of ER (from distress perception to felt security and comfort), based on synchronized neurophysiological and behavioral parameters. To assess moment-to-moment changes in behavior and physiological responses to attachment-related stressors, we chose to examine gaze parameter and Autonomous Nervous System (ANS) reactivity. Eye-tracking methodology is ideally suited for continuous assessment of the gaze, moment-to-moment.

In previous studies, gaze parameters such as first fixation duration, dwell time, and latency of first fixation have been used to investigate attention, exploration of threatening stimuli, and salience of visual cues. These gaze parameters were assessed by a free-view task, in which pairs of emotional facial stimuli were presented simultaneously. For example, in socially anxious participants, longer dwell time has been associated with difficulty of disengagement from disgust versus happy faces (Schofield et al. 2012). Individuals diagnosed with social phobia showed lower latency of first fixation on emotionally threatening versus neutral faces, a response consistent with the vigilant-avoidant pattern (Gamble and Rapee 2010; Singh et al. 2015). Finally, longer first fixation duration was associated with the maintenance of attention on negative pictures in dysphoric individuals (Caseras et al. 2007).

Few studies have used eye-tracking to investigate the impact of attachment representation on the modulation of perception and attention in emotionally demanding contexts that is one of the core capacities that support ER (Cole, Martin, 2004, Lewis et al. 2006). In the attachment context, Kirsh and Cassidy (1997) have observed in children (45 months) how different attachment expectancies modulate attention on drawings of mother-child positive, negative, and neutral interaction. Compared to secure children, both insecure-avoidant and insecure-ambivalent children processed less the positive attachment-relevant drawings. Vandevivere and colleagues proposed using eye-tracking on children (8–12 years old) in the context of attachment, to examine gaze parameters with pictures of the mother's face and unfamiliar faces (Vandevivere et al. 2014). They found that, compared to withdrawn children, secure children had a longer fixation time on their mother's face than on unfamiliar women's faces, and more visits. Consequently, the authors suggested that withdrawn children use defensive exclusion to process attachment-related information.

In this study, we provide a multimodal assessment of dynamic attachment-related ER, based on a distress-then-comfort-seeking paradigm in two phases, similar to the strange situation procedure used in infancy (Ainsworth et al. 1978). First, the adolescent's attachment system is activated by visualizing pictures of distress. Second, to determine how adolescents deactivate their attachment system, three pictures are presented simultaneously (comfort, joy-complicity, and neutral), corresponding to the phase of comfort-seeking. Gaze parameters will be used to determine which ER strategies are used (i.e., distress or comfort avoidance, comfort-seeking, or exploration of neutral pictures) to regulate distress and comfort, depending on attachment style. Synchronized measurement of cardiac activity and electrodermal response will indicate the physiological impact associated with these strategies.

We expected that behavioral and physiological reactions would differ depending on attachment style, with the following hypotheses. Secure adolescents should process distress pictures with a longer fixation duration, and should alleviate their distress by fixating comfort pictures first, which should produce a decrease in their physiological reactions. Withdrawn adolescents should avoid fixating distress pictures, while responding with a short-latency physiological reaction. Their comfort-seeking strategies should be directed to joy-complicity or neutral pictures. Enmeshed adolescents and fearful adolescents should fixate distress pictures for longer, with higher physiological reactions