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Comparing the response modulation hypothesis and the integrated emotions system theory: The role of top-down attention in psychopathy

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ABSTRACT

Objective: Two major etiological theories on psychopathy propose different mechanisms as to how emotional facial expressions are processed by individuals with elevated psychopathic traits. The Response Modulation Hypothesis (RMH) proposes that psychopathic individuals show emotional deficits as a consequence of attentional deployment, suggesting that emotional deficits are situation-specific. The Integrated Emotions System theory (IES) suggests that psychopathic individuals have a fundamental amygdala dysfunction which precludes adequate responsiveness to the distress of others.
Methods: Participants performed a visual search task in which they had to find a male target face among two female distractor faces. Top-down attentional set was manipulated by having participants either respond to the face's orientation, or its emotional expression.
Results: When emotion was task-relevant, the low-scoring psychopathy group showed attentional capture by happy and fearful distractor faces, whereas the elevated group showed capture by fearful, but not happy distractor faces.
Conclusion: This study provides evidence for the RMH such that top-down attention influences the way emotional faces attract attention in individuals with elevated psychopathic traits. However, the different response patterns for happy and fearful faces suggest that top-down attention may not determine the processing of all types of emotional facial expressions in psychopathy.

1. Introduction

Psychopathy is a well-known personality disorder, characterized by aberrant emotionality and antisocial behavior. Particularly well-known are the unemotional and callous personality traits of psychopathic individuals, often accompanied by antisocial behavior (e.g., criminal behavior and poor behavioral control; Blair & Mitchell, 2009; Hare, 1991; Hoppenbrouwers, Bulten, & Brazil, 2016).

Recent work has shown an increased interest in how psychopathic individuals perceive and interpret emotional facial expressions. Previous studies have revealed a diverse pattern of results concerning the ability of psychopathic individuals to recognize, process and act upon varying emotional facial expressions such as happy, fearful and angry (Fairchild, Van Goozen, Calder, Stollery, & Goodyer, 2009; Fairchild, Stobbe, van Goozen, Calder, & Goodyer, 2010; but see

Glass & Newman, 2006). Diverse results notwithstanding, converging evidence has suggested that the manner in which emotional expressions are processed by psychopathic individuals is qualitatively different from those processes in healthy individuals (Dawel, O'Kearney, McKone, & Palermo, 2012; Marsh & Blair, 2008). However, the underlying mechanisms leading to differences in processing emotional expressions in psychopathic individuals are poorly understood. While deficits in affective functioning have been hypothesized to reflect the core of psychopathy, aberrations in cognitive factors such as attention have also been put forth as important etiological factors (Baskin-Sommers, Curtin, & Newman, 2011; Newman & Baskin-Sommers, 2012). These opposing views are reflected in two theories that aim to describe the mechanisms underlying psychopathy.

First, the Response Modulation Hypothesis (RMH) proposes a malfunction in information-processing abilities as an important contributor

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to psychopathic behavior. Specifically, psychopathic behavioral traits are suggested to originate from deficits in the ability to rapidly switch from goal-directed behavior to attending task-irrelevant information when processing this irrelevant information could lead to beneficial behavior or improved social interaction (Gorenstein & Newman, 1980; Newman & Wallace, 1993; Patterson & Newman, 1993). According to Newman and Wallace (1993) psychopathic individuals are deficient in detecting and redirecting top-down attention towards important or informative, yet task-irrelevant stimuli, resulting in the non-adaptive perseverance of behavioral patterns solely aimed at ongoing goals. Indeed, evidence for the RMH is observed in a host of studies emphasizing the presence of attentional abnormalities in psychopathy (e.g. Baskin-Sommers et al., 2011; Hoppenbrouwers, Van der Stigchel, Sergiou, & Theeuwes, 2016; Hoppenbrouwers, van der Stigchel, Slotboom, Dalmeijer, & Theeuwes, 2015; Newman, Curtin, Bertsch, & Baskin-Sommers, 2010). In short, the RMH states that psychopathic individuals have a rigid, inflexible mechanism of top-down attentional control, resulting in diminished attentional resources being allocated to information not fitting the psychopathic individual's top-down set.

A second theory on the etiological factors of psychopathy is the Integrated Emotions System theory (IES; Blair, 2005) which focuses on deficits in the processing of emotional and affective stimuli. At the focus of the IES lies a dysfunction in the amygdala (Blair et al., 2004), which may prevent the allocation of attention towards emotional expressions. Amygdala deficits are hypothesized to cause an impairment in the formation of aversive stimulus-reinforcement associations in psychopathic individuals, with aversive stimuli extending to emotional expressions such as fear and anger (Blair, 2005). As a consequence, emotions that signal distress in others are not processed effectively by psychopathic individuals, resulting in diminished social behavior.

The RMH and IES lead to a number of opposing hypotheses concerning how emotional facial expressions may influence attentional selection. First, the RMH's focus on attentional processes as the source of psychopathic behavior predicts that aberrant behavior by psychopathic individuals is situation specific rather than pan-situational: Only when threat-signaling stimuli or emotional expressions do not match the top-down goals of the psychopathic individual will these stimuli go unnoticed and unattended. In short, it is the relevance of a stimulus that matters. On the contrary, the IES makes no claims about the relevance of stimuli and predicts that psychopathic individuals are generally unresponsive to aversive emotional stimuli due to disrupted amygdala functioning. A consequence of the lack of emotional responsivity to aversive stimuli is that attention may not be automatically drawn to such emotional stimuli and as such this emotional information is not, or to a lesser extent processed. Second, according to the RMH, the deficiency in processing non-relevant information does not only pertain to threat-signaling or emotional stimuli, but to any type of stimulus that does not match the psychopathic individual's goals and as such remains unattended. Alternatively, the IES does not make such a broad claim by stating that attentional selection in psychopathic individuals is predominantly determined by the absence of a stimulus-reinforcement relation between an aversive stimulus and a behavioral response towards that stimulus. The IES therefore makes specific predictions that tailor to aversive stimuli such as facial expressions signaling distress, but does not make any claims regarding the relevance of such information. Regarding attention, the IES predicts differences between aversive emotional expressions such as fearful faces, as compared to neutral or positive expressions, regardless of whether processing these emotions is part of the psychopathic individual's top-down set.

To investigate how attention to emotional expressions is altered in psychopathy and to distinguish between the RMH and the IES, we employed a paradigm used by Hodsoll, Lavie, and Viding (2014). Hodsoll and colleagues investigated how emotional facial expressions affected the allocation of attention in children with high versus low callous-unemotional traits (CU-traits; a precursor for psychopathy:

Viding & McCrory, 2012) and healthy controls (for more information on the influence of emotion on attentional processes see Byrne & Eysenck, 1995; Yiend, 2010). In their paradigm, participants searched for a male target face among two female distractor faces and indicated whether the male face was tilted to the left or the right. On a subset of trials, one of the faces contained an emotional expression, either presented on the male target face or on one of the two female distractor faces. This manipulation allowed for testing the difference in attentional allocation to emotional facial expressions in a high CU group, a low CU group and healthy controls using both emotional distractor faces and emotional target faces. Results showed that children with increased callous-unemotional traits showed reduced attentional capture by irrelevant emotional faces; a finding in support of the IES.

In the current study, we added a critical condition in which participants had to judge the emotion of a male target face, rather than its orientation. Using both positive and negative emotional expressions under different task demands was done for multiple reasons: First, the IES predicts that individuals with elevated psychopathic traits will show an abnormality in the detection of a fearful facial expression, irrespective of the task set (i.e., whether the participant is responding to the emotion or the orientation). As such, it is expected that individuals with elevated psychopathic traits are slower than controls when the target face displays a fearful facial expression. However, when a distractor displays a fearful facial expression, the IES predicts that individuals with elevated psychopathic traits show better performance than controls because they are not influenced by the fearful expression on the distractor. Second, contrary to the IES, the RMH predicts that emotional differences between individuals with low versus elevated psychopathic traits arise as a function of task-relevance, independent of the emotion's valence. Therefore, during the emotion task, the RMH predicts no difference between healthy controls and psychopathic individuals as emotion is always part of an individual's top-down set. On the contrary, during the orientation task, emotion is task irrelevant. Emotional expressions may still automatically capture attention in healthy controls, but not in psychopathic individuals as their top-down set is focused on orientation, rather than the emotion of the presented stimuli. By manipulating top-down attentional set and using different emotional facial expressions we directly compare the RMH and the IES with the aim of reconciling earlier contrasting findings.

2. Methods

2.1. Participants

We tested a mixed community sample ($N = 100$) consisting of 80 undergraduate students and 20 non-students recruited from the community (36 males, mean age = 24.4, SD = 5.7; one participant did not provide age information). All participants had normal or corrected-to-normal vision and did not report any history of mental illness. All participants provided informed consent and course credits or a monetary reward was provided as compensation. Procedures were approved by the local ethics committee, and in accordance with the Declaration of Helsinki ("WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects," 2013).

2.2. Materials and design

2.2.1. Psychopathy questionnaire

Participants started the experiment by completing the Psychopathic Personality Inventory (PPI), a self-report questionnaire of 187 items that assesses psychopathic traits (Lilienfeld & Andrews, 1996). The overall PPI score can be split into two specific factors associated with psychopathy: PPI-I has been labeled 'Fearless Dominance' and represents social potency, fearlessness and stress immunity, whereas PPI-II is called 'Impulsive Antisociality' and refers to impulsivity, egocentricity and aggressiveness among the most dominant traits. These