

A developmental neuroscience perspective on affect-biased attention



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ABSTRACT

There is growing interest regarding the impact of affect-biased attention on psychopathology. However, most of the research to date lacks a developmental approach. In the present review, we examine the role affect-biased attention plays in shaping socioemotional trajectories within a developmental neuroscience framework. We propose that affect-biased attention, particularly if stable and entrenched, acts as a developmental tether that helps sustain early socioemotional and behavioral profiles over time, placing some individuals on maladaptive developmental trajectories. Although most of the evidence is found in the anxiety literature, we suggest that these relations may operate across multiple domains of interest, including positive affect, externalizing behaviors, drug use, and eating behaviors. We also review the general mechanisms and neural correlates of affect-biased attention, as well as the current evidence for the co-development of attention and affect. Based on the reviewed literature, we propose a model that may help us better understand the nuances of affect-biased attention across development. The model may serve as a strong foundation for ongoing attempts to identify neurocognitive mechanisms and intervene with individuals at risk. Finally, we discuss open issues for future research that may help bridge existing gaps in the literature.

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1. Introduction

Attention mechanisms play an early and pervasive role in shaping behavior. Historically, much of the literature has focused on

cognitive or “cool” components of attention development and functioning. Thus we have a strong literature base examining, for example, the impact of attention on learning and memory (e.g., Amso and Scerif, 2015). Recently, there has been more direct examination of the role attention may play in eliciting and supporting broad profiles of socioemotional functioning. As will be noted below, a rapidly growing literature suggests that attention bias to threat may play a causal role in the emergence of anxiety and non-clinical social withdrawal. Indeed, laboratory manipulations using

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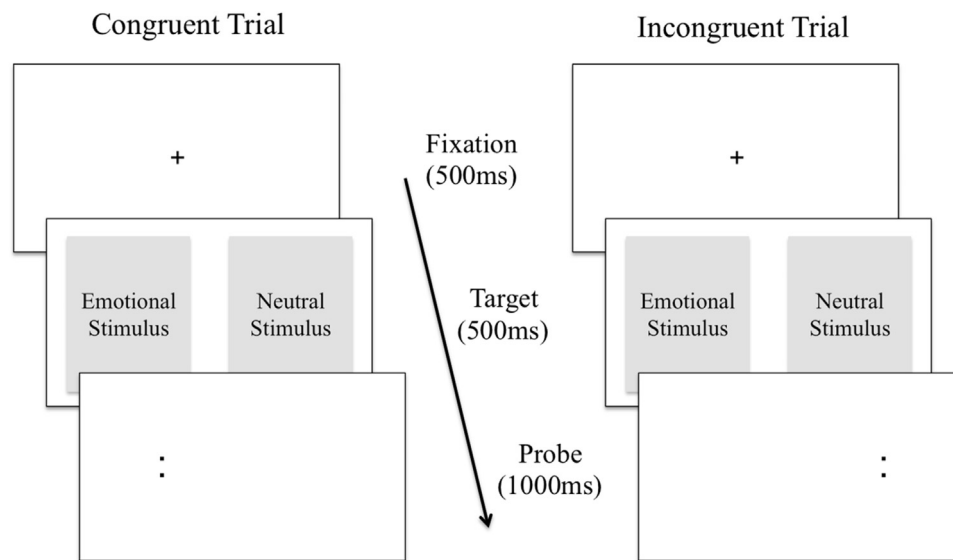


Fig. 1. An illustration of the dot-probe task. In the dot-probe task, participants see a pair of stimuli simultaneously, one emotionally salient (e.g., threatening) and one neutral (e.g., non-threatening), most often for 500 ms. A probe replaces one of the two stimuli. The individual is required to respond as accurately and as quickly as possible to the probe. An attentional bias towards emotional stimuli is inferred when participants preferentially attend to emotional cues, resulting in decreased reaction times to probes replacing the emotional stimuli compared to the neutral stimuli. A direct extension of the dot-probe task has been attention bias modification (ABM), which is used to reduce affect-biased attention. The training procedure only uses incongruent trials. The logic is that by having the probe replace the emotional or neutral stimuli in all the trials, the individual implicitly learns to attend towards the neutral stimuli/away from the emotional stimuli.

attention bias modification (ABM; explained in Fig. 1) appear to impact even entrenched patterns of anxious thought and behavior (Eldar et al., 2008; Hakamata et al., 2010). While this literature has garnered a great deal of recent interest, it represents only a small portion of the complex relations across time and levels of analysis between attention and socioemotional behavior. Given the pervasiveness of attention as a cognitive mechanism, the distributed neural networks supporting attention, and the early emergence of individual differences in attention in infancy and childhood, we suggest that attention plays a broad and sustained role in socioemotional development.

Affect-biased attention, as used by Todd et al. (2012), refers to “attentional biases that cause preferential perception of [any] particular category of stimulus based on its relative affective salience” (p. 365). In this review, we propose a developmental model of affect-biased attention, in which individual traits and characteristics help shape the specific components of the environment that are deemed salient. At the extreme, salience may track constructs highlighted by condition-specific psychiatric concerns (e.g., food in eating disorders or spiders in arachnophobia). Salience may also track developmental concerns, as seen in normative data indicating an attention bias to negative facial stimuli in infancy. In addition, environmental experience can help define salience. For example, children exposed to violence or maltreatment are especially sensitive to anger cues. As a rough analogy, one can point to language mechanisms that are both experience expectant and experience dependent (Greenough et al., 1987; Werker and Tees, 1992). In our model, affect-biased attention acts as a general mechanism that highlights cues that reflect past history and are relevant to concurrent motivational states, guiding the individual to meet his/her goals. In this way, a single processing mechanism may be responsible for both positive and negative attentional biases.

In this model, we also suggest that affect-biased attention influences cognitive and emotional development from infancy. For example, preferential attention allocation toward emotionally salient objects emerges early in development, likely due to specific perceptual markers (e.g., the curvilinear body of a snake; LoBue et al., 2010). In the competition for limited attentional

resources, infants prioritize objects that provide information about danger and reward (Peltola et al., 2008). No other object is as closely tied to survival, punishment, and reward as the human face (Hoehl and Striano, 2010). Due to the coupling of perceptual cues, rewarding daily events (e.g., feeding), and long hours of exposure, infants quickly begin to show preferential looking to human faces (Leppänen and Nelson, 2009). This preference is magnified when the face also conveys an emotional threat signal. Thus, this particular example of affect-biased attention is early appearing, likely rooted in evolutionary concerns, and has the potential to influence broad patterns of socioemotional behavior throughout life.

Expanding from this early foundation, our proposed model places the concept of affect-biased attention into a developmental framework. More specifically, it suggests that affect-biased attention, particularly if stable and entrenched, helps sustain early socioemotional and behavioral profiles over time, even in the face of internal and external forces that typically act to ameliorate early extreme tendencies. In order to account for normative developmental variations as well as for individual differences in attentional patterns, our model argues that affect-biased attention builds on the development of different attentional components proposed by the cognitive literature (Posner, 2012) and draws in the specific traits and characteristics of the individual. We use this model to make the following predictions: (I) Affect-biased attention is not a single construct; rather it emerges from the interaction of multiple attentional systems; (II) Affect-biased attention develops and its role in socioemotional functioning changes due to maturation and experience; (III) Affect-biased attention acts as a domain-general mechanism. This prediction suggests that affect-biased attention is not limited to attention bias towards threat and internalizing disorders, but that these relations may hold across multiple domains of interest (e.g., positive affect, externalizing behaviors, drug use, and eating behaviors); (IV) The relation between affect-biased attention and socioemotional functioning is reciprocal rather than unidirectional. In the following sections of the review, we examine the existing data that support each of these predictions. Finally, we discuss issues for future research that may help bridge existing gaps in the literature.

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