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Review

Impulsivity and substance-related attentional bias: A meta-analytic review

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ABSTRACT

Background: Previous research demonstrates the role of attentional bias in addictive behaviors. Impulsivity is thought to affect the strength of attentional biases, and thus, attentional biases might be one mechanism by which impulsivity affects addictive behaviors. However, whether or not impulsivity is related to attentional biases across different conceptualizations of impulsivity and attentional biases has yet to be examined as an initial test of such causal models.
Methods: The authors completed a meta-analysis of 13 published research studies examining the relationship between substance-related attentional bias and different conceptualizations of impulsivity.
Results: There was a small and significant effect size between impulsivity and substance-related attentional bias ($r = 0.20$), which was moderated by impulsivity measurement type ($Q_b = 5.91$, $df = 1$, $p < 0.05$): there was a stronger relationship between behavioral impulsivity and substance-related attentional bias ($r = 0.22$) than trait impulsivity and substance-related attentional bias ($r = 0.10$). Different components of behavioral impulsivity and trait impulsivity did not affect the relationship.
Conclusions: This study is the first systematic and empirical demonstration of the relationship between substance-related attentional bias and impulsivity and suggests viability of future examinations of casual models relating these constructs. Since trait and behavioral conceptualizations differentially relate to substance-related attentional bias, the current review further supports research suggesting how disaggregation of multidimensional constructs can lead to more robust relationships.

Contents

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1. Introduction

Addictive behaviors are characterized by and frequently associated with reactivity to substance-related cues, also known as substance-related attentional bias (Field and Cox, 2008). The strength of both initial orientation to substance-related stimuli in the environment and the difficulty in disengaging one's attention from such stimuli is an important predictor of substance seeking and relapse risk (Cox et al., 2002, 2007; Marissen et al., 2006; Streeter et al., 2008). Recent research suggests that impulsivity, including multiple tendencies toward impulsive or ill-planned action (Cyders and Smith, 2007), affects the strength of attentional biases toward substance-related stimuli (Field and Cox, 2008). Our overarching theoretical model suggests that one way in which impulsivity affects addictive behaviors (e.g., Evenden, 1999; Smith et al., 2007) is through, in part, impulsivity's role in increasing attentional biases toward these substances (as suggested by Smith and Anderson, 2001). The current study is the first step in examining the viability of such a model using existing research across multiple research laboratories. If there is a relationship between impulsivity and attentional biases, this suggests potential viability of the role of attentional biases as a mechanism in how impulsivity affects addictive behaviors. The current study is a quantitative meta-analytic review of the relationship between impulsivity and substance-related attentional biases, and how different conceptualizations and components of attentional bias and impulsivity, the specific substance of abuse, and sample demographics might impact this relationship.

1.1. Measurement of attentional bias

Substance-related attentional bias measures can be classified into two main categories: direct and indirect (Field and Cox, 2008). In indirect measures (e.g., addiction Stroop, dot probe task; see Table 1), attentional bias is inferred through participants' reaction time performance on a primary task when a substance-related stimulus is presented (speed of color naming on substance-related trials). More direct methods of substance-related attentional bias measure visuospatial selective attention in the presence of substance cues through eye-movement monitoring. In direct assessments, substance-related attentional bias is measured through both participants' gaze time on substance-related stimuli as compared to control stimuli (disengagement), as well as the proportion of initial eye movements directed toward addiction-related cues (initial orientation; e.g., Field et al., 2005; Mogg et al., 2003). Some work has supported stronger relationships between direct measures of attentional bias and, for example, subjective craving, than with indirect measures (e.g., Field et al., 2009), although this has yet to be fully explored.

Attentional bias measures assess two related, though separate, components of attentional bias: initial orientation to stimuli and the inability or difficulty to disengage attention from the stimuli (Cisler et al., 2009). Although these components share approximately 25% of their variance (e.g., Field et al., 2006; Schoenmaker et al., 2008), they at times differentially relate to substance use outcomes (e.g., Field et al., 2004a; Noel et al., 2006). Separating these two components can be difficult, as they are often assessed using the same measures. Field et al. (2009) separated attentional bias measures into these components, as follows: initial orientation tasks included visual probe tasks with stimulus duration 50–200 ms, the attentional blink task, and direct eye movement measures examining initial or shifting eye orientation. Delayed disengagement tasks include the addiction Stroop, the emotional Stroop, dual task procedures, visual probe tasks with stimulus duration greater than or equal to 500 ms, event related potentials, and direct eye movement measures examining gaze duration (Field et al., 2009). When stimuli are presented for a short time interval (e.g., <200 ms), results are thought to reflect initial, automatic initial orientation, whereas when stimuli are presented for a longer time interval (e.g., at least 500 ms, but more appropriately >1000 ms), results are thought to reflect more conscious maintenance of or disengagement from the stimuli (Field and Cox, 2008).

Neither direct, nor indirect measurements of attentional bias provide a truly absolute measure of selective attention; therefore, we cannot assume a perfect relationship between task performance and one's attentional bias (Field et al., 2009). There are various other cognitive processes, such as working memory and cognitive avoidance strategies that likely influence the results obtained in measures of attentional bias, especially measures of delayed engagement, which could lead to overall smaller correlations between attentional bias and other constructs (Conrey et al., 2005). Moreover, there has not been a sufficient amount of research examining the reliability of these attentional bias tasks; however, Ataya et al. (2012) recently found that reliability varies widely across these tasks, such that the Stroop task appears to have preferable reliability over the visual probe task, although this should be examined further.

1.2. Attentional bias in addictive behaviors

Previous research suggests that both initial orientation and delayed disengagement play a role in substance use in several ways, such as increased craving (*see* Field et al., 2009), ongoing substance use (*see* Field and Cox, 2008), and relapse following treatment (Waters et al., 2003). In fact, it is theorized that attentional biases affect the risk for substance use and abuse through, in part, increasing subjective cravings for the substance, signaling availability of the substance, and thus, increasing the likelihood of substance-seeking behavior (*see* Field et al., 2009).

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