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A biosocial cognitive model of cannabis use in emerging adulthood

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HIGHLIGHTS

- Impulsive personality traits predicted cannabis use via cognition.
- Reward sensitivity predicted cannabis use via positive expectancies.
- Rash impulsiveness predicted cannabis use via refusal self-efficacy.
- Punishment sensitivity was not associated with cannabis use.

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ABSTRACT

Objectives: The aim of this study was to test a new theoretical model of cannabis use incorporating biologically-based personality traits and social cognition. This biosocial cognitive theory (bSCT) has robust support in alcohol studies, but has not been applied to cannabis. The model proposes two pathways linking dimensions of impulsivity to cannabis use. The first predicts that the association between Reward Sensitivity (SR) and cannabis use is mediated by positive outcome expectancies. The second predicts that the relationship between Rash Impulsiveness (RI) and cannabis use is mediated by cannabis refusal self-efficacy. An extended version of this model was also tested and included a third pathway linking Punishment Sensitivity (SP) to cannabis use via higher negative outcome expectancies.

Method: Participants were 252 18-to-21-year-olds who completed questionnaires assessing cannabis use, personality and social cognition. Theoretical models were tested using structural equation modeling.

Results: The bSCT model provided a good fit to the data (CFI = 0.95; RMSEA = 0.07; SRMR = 0.06). Positive cannabis expectancies and refusal self-efficacy partially mediated the association between SR and cannabis use ($p < 0.05$). Cannabis refusal self-efficacy fully mediated the relationship between RI and cannabis use ($p < 0.05$). The addition of a third SP pathway did not improve model fit.

Conclusions: Consistent with alcohol studies, the association between impulsivity and cannabis use is largely mediated by social cognition. The bSCT may provide novel insights to inform prevention and treatment of problematic cannabis use.

1. Introduction

Emerging adults (18–25 years old) consume more cannabis than any other age group (Substance Abuse and Mental Health Services Administration, 2016). An established risk factor for cannabis use across the lifespan is impulsivity (e.g., Lyvers, Jamieson, & Thorberg, 2013). Longitudinal studies suggest that one mechanism through which impulsivity conveys risk is through its influence on social learning (e.g., Barnow et al., 2004). Evidence from alcohol studies indicate that impulsive individuals are predisposed towards learning about the positive effects of alcohol, and these positive expectancies then motivate alcohol use (e.g., Gullo, Dawe, Kambouropoulos, Staiger, & Jackson, 2010). However, limited research has examined these mechanisms in cannabis use. The current research seeks to integrate personality and social cognitive theories to further understand the processes influencing cannabis use among emerging adults.

1.1. Personality and substance use

Gray's (1970) Reinforcement Sensitivity Theory (RST) describes two

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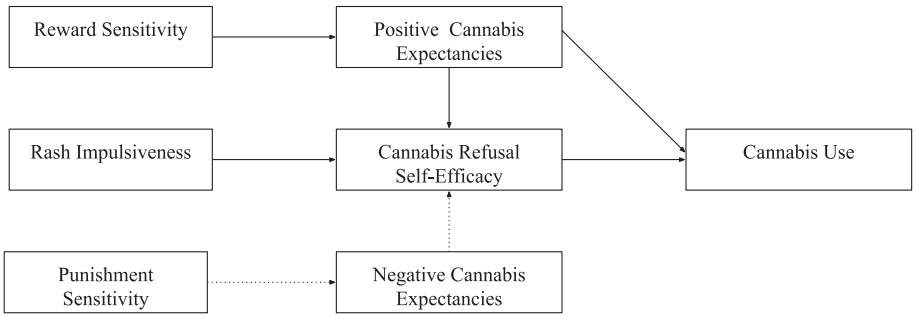

Fig. 1. Hypothesized models – the new pathways as proposed by the 3-CARS are depicted with dotted arrows.

independent, biologically-based, neural systems underlying personality. The Behavioural Inhibition System (BIS) is sensitive to learned signals of punishment. The BIS is associated with anxiety and behavioural inhibition during situations involving goal conflict (such as substance use) (Gray & McNaughton, 2000). An underactive BIS may result in hazardous substance use due to a *hypo*sensitivity towards potential future negative consequences and an inability to inhibit drug approach behaviours (Dawe, Gullo, & Loxton, 2004). The Behavioural Approach System (BAS) underlies sensitivity to reward, and is associated with approach behaviour and some forms of impulsivity (Pickering & Gray, 1999). An overactive BAS may lead to substance misuse due to enhanced reward conditioning and a hypersensitivity towards noticing and approaching drug cues (Dawe et al., 2004). Associations between the BAS and BIS and substance use outcomes have been observed in past research (e.g. Franken, 2002; Hasking, Boyes, & Mullan, 2015; Pardo, Aguilar, Molinuevo, & Torrubia, 2007; Simons & Arens, 2007).

Impulsivity has consistently been identified as a risk factor for substance use disorders (Loree, Lundahl, & Ledgerwood, 2015; Moeller & Dougherty, 2002). Within the hierarchical structure of personality, impulsivity traits have been conceptualized as higher-order factors arising from more fundamental, lower-order traits (Depue & Collins, 1999; Eysenck, 1993). High BAS and low BIS have been implicated in trait impulsivity (Barratt, 1972; Cloninger, 1987). There is an emerging consensus that impulsivity consists of two independent dimensions relevant to substance use: Reward Sensitivity and Rash Impulsiveness (Gullo, Loxton, & Dawe, 2014; Stautz, Dinc, & Cooper, 2017). *Reward Sensitivity* (SR) is related to the BAS. Individuals with a heightened SR are argued to be more attracted to drugs and may experience greater reward following drug use. *Rash Impulsiveness* (RI) is associated with disinhibition, and reflects a propensity to act without forethought or consideration of future consequences. RI is thought to be associated with a decreased ability to cease drug-taking behaviour once an approach response has commenced, despite the associated risks. In RST, high RI would be represented by high BAS and reduced sensitivity in BIS structures that process distal punishment (Dawe et al., 2004). Support for this 2-Component Approach to Reinforcing Substances Model (2-CARS) has been reported in a number of alcohol studies (e.g., Boog et al., 2014; Gullo et al., 2010; Stautz et al., 2017). The role of these two traits is yet to be examined in cannabis use.

1.2. Social cognition and substance use

Bandura's (1986) social cognitive theory (SCT) has been applied to understanding the initiation, maintenance and cessation of substance use (e.g. Connor, Gullo, Feeney, Kavanagh, & Young, 2014; Kadden & Litt, 2011). SCT describes the likelihood of an individual using substances as a result of their outcome expectancies and refusal self-efficacy beliefs. Importantly, these beliefs can develop through vicarious conditioning (e.g., modeling), even before substance use is initiated (Bandura, 1986).

Cannabis outcome expectancies are the beliefs a person holds regarding the positive and negative consequences of cannabis use. There is a body of evidence suggesting cannabis outcome expectancies impact whether an individual engages in cannabis use and the amount used (e.g., Alfonso & Dunn, 2007; Galen & Henderson, 1999). *Cannabis refusal self-efficacy* is the confidence that an individual has in their ability to resist or refuse cannabis in specific situations. Studies of cannabis users have found greater refusal self-efficacy to be associated with lower levels of cannabis use, less cannabis-related problems, and better treatment outcomes (e.g., Davis et al., 2014; Gullo, Matveeva, Feeney, Young, & Connor, 2016; Young, Gullo, Feeney, & Connor, 2012).

1.3. Integrating theories

Previous theoretical models have integrated impulsivity with components of SCT to understand substance use. One pathway that has been suggested is the association between impulsivity and outcome expectancies. According to the Acquired Preparedness Model (APM), impulsivity (conceptualized as disinhibition or RI) is thought to convey risk by creating a learning bias whereby positive expectancies are more likely to be encoded into memory following direct or indirect experiences with substances. These enhanced positive expectancies increase the likelihood of future substance use (McCarthy, Kroll, & Smith, 2001). To date, this model has mostly been applied to alcohol use and has received mixed empirical support (e.g. Anderson, Smith, & Fischer, 2003; Bolles, Earleywine, & Gordis, 2014; Hayaki et al., 2011; McCarthy et al., 2001; Settles, Cyders, & Smith, 2010). This may be due to the absence of refusal self-efficacy in the model or the conceptualisation of impulsivity employed. A *bio*social cognitive theory (bSCT) may address these limitations.

The bSCT (see Fig. 1) predicts that Reward Sensitivity (SR) and Rash Impulsiveness (RI) will lead to substance misuse through two distinct cognitive mechanisms. SR (rather than RI as proposed in the APM) is hypothesized to create a bias towards perceiving and remembering the positive effects of substances (positive outcome expectancies). Therefore, positive outcome expectancies are hypothesized to mediate the relationship between SR and substance use. In the second pathway, RI is hypothesized to lead to easier recollection of past experiences of poor inhibitory control because more experiences have accumulated compared to low RI individuals. This leads to the formation of a generalized belief that they will find future opportunities to consume rewards difficult to resist (e.g., substances of abuse). Thus, refusal self-efficacy is expected to mediate the association between RI and substance use (Gullo et al., 2010). This biosocial cognitive model has been supported in studies using emerging adult and alcohol use disorder samples, but is yet to be applied to cannabis (e.g., Gullo et al., 2010; Harnett, Lynch, Gullo, Dawe, & Loxton, 2013; Kabbani & Kambouropoulos, 2013).

A third pathway linking the BIS to substance use may also be indicated (e.g. Hasking et al., 2015; Pardo et al., 2007; Prince van Leeuwen, Creemers, Verhulst, Ormel, & Huizink, 2011). Individuals high in BIS functioning are higher in their *Punishment Sensitivity* (SP) (Gray, 1970). Past research linking SP to substance use has been mixed