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Commentary - Understanding Gambling, Impulsivity, and Decision-Making: Self-Report and Behavioral Considerations

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COMMENTARY

UNDERSTANDING GAMBLING, IMPULSIVITY, AND DECISION-MAKING: SELF-REPORT AND BEHAVIORAL CONSIDERATIONS

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The manuscript by Fantino and Stolarz-Fantino raises multiple important points about the study of gambling and how findings from such investigations have both applied (e.g., clinical and societal) and basic implications. A main theme of the manuscript is that behavioral analysts are well suited to provide a structural framework for such studies and to inform future directions.

A focus on behavior is important in understanding many human processes, particularly gambling and excessive patterns of gambling exhibited by individuals with pathological gambling (American Psychiatric Association Committee on Nomenclature and Statistics, 2000). Behavioral assessments, as compared with self-report ones, have benefits. For example, they are often more easily modeled across species, facilitating translational research efforts that can provide significant insight into the biological factors contributing to human behaviors, including gambling and pathological gambling (Williams, Grant, Winstanley, & Potenza, 2008). Furthermore, behavioral assessments may provide unique information that differs from self-report measures, even when assessing the same domain. For example, in a study of adolescents seeking to quit smoking (Krishnan-Sarin et al., 2007), behavioral measures of delay discounting on an Experiential Discounting Task (Reynolds & Schiffbauer, 2004) did not correlate with delay discounting as estimated from a self-reported preference measure (Kirby, Petry, & Bickel, 1999). In this study, the adolescents able to maintain smoking abstinence at the end of the behavioral therapy trial were distinguished from those who relapsed by showing less steep discounting on the behavioral measure, and no significant relationship between self-reported discounting and treatment outcome was observed (Krishnan-Sarin et al.). These results suggest that what people say that they might do and what they actually do in specific situations might differ significantly (consider dieting resolutions and consummatory behaviors when offered a tempting dessert). The findings also echo those from other studies of drug dependence; e.g., performance on the Iowa Gambling Task, a behavioral measure of risk/reward decision-making, has been found to correlate with the ability to hold a job amongst cocaine dependent subjects (Bechara, 2003). Despite the importance of behavioral measures, it is also important to consider internal states not readily captured by behavioral assessments (e.g., feelings of depression, anxiety, or appetitive states like urges or craving). These states appear relevant to gambling behaviors,

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particularly clinically important phenomena like treatment outcome in pathological gambling (Grant, Kim, Hollander, & Potenza, 2008; Grant & Potenza, 2006).

When discussing impulsivity, Fantino and Stolarz-Fantino allude to the complexities of impulsivity and theoretically related phenomena like risk-taking. Multiple definitions for impulsivity have been proposed, with some focusing more narrowly on processes like temporal discounting and others covering more broad areas, such as the definition described by Fantino and Stolarz-Fantino that encompasses risk taking. Members of the International Society for Research on Impulsivity (www.impulisivity.org) have forwarded the following definition for impulsivity (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001; Potenza, 2007): "a predisposition toward rapid, unplanned reactions to internal or external stimuli [with diminished] regard to the negative consequences of these reactions to the impulsive individual or others." If one accepts this definition, there are several important points that can be noted. First, impulsivity is a complex, multifaceted construct. Consistently, factor analyses have typically identified two or more domains of impulsivity including ones related to risk/reward decision-making and response inhibition, respectively (de Wit, 2008; Reynolds, Ortengren, Richards, & de Wit, 2006; Verdejo-Garcıa, Lawrence, & Clark, 2008). Second, aspects of impulsivity overlap with proposed core components of addiction; e.g., continued engagement despite adverse consequences (Potenza, 2006). As pathological gambling has been described as a "behavioral" addiction (Grant, Brewer, & Potenza, 2006; Holden, 2001), an improved understanding of how specific aspects of impulsivity relate to specific patterns and features of gambling is important and clinically relevant. Consistent with this notion, individuals with pathological gambling have been shown to be impulsive on both self-report and behavioral measures of impulsivity in multiple domains (Blaszczynski, Steel, & McConaghy, 1997; Lawrence, Luty, Boggdan, Sahakian, & Clark, in press; Verdejo-Garcıa et al., 2008), and certain measures of impulsivity are related to treatment outcome in pathological gambling (Blanco et al., in press). Third, as gambling behaviors, particularly problem and pathological gambling, often co-occur with substance use behaviors and disorders (Desai & Potenza, 2008; Kessler et al., 2008; Petry, Stinson, & Grant, 2005) and as substance use may influence impulsivity in a complex fashion (with impulsivity predisposing to use and use promoting greater impulsivity (de Wit, 2008; Kreek, Nielsen, Butelman, & LaForge, 2005; Perry & Carroll, 2008), including with respect to decision-making in gambling (Kyngdon & Dickerson, 1999)), an improved understanding of the relationship between specific aspects of impulsivity, substance use and gambling is important. Fourth, given the complex nature of impulsivity, a battery of assessments (both behavioral and self-report) will be important in dissecting impulsivity and understanding the relationship of the components to specific aspects of gambling behaviors.

Behavioral tasks also have the benefit of being adaptable for use in neurobiological investigations, including brain imaging studies involving human subjects. Such studies have the promise to understand not only the neural mechanisms underlying gambling processes, but also how brain function is different in people with and without gambling problems. Functional magnetic resonance imaging (fMRI) techniques allow for the investigation of behavioral processes (e.g., tasks assessing aspects of impulsivity) to test hypotheses regarding the neural mechanisms underlying specific aspects of behaviors (e.g., gambling) or emotional or motivational processes (e.g., sadness or gambling urges) relevant to gambling behaviors. Such investigations (reviewed in Potenza, 2008) indicate that individuals with pathological gambling

differ from control subjects in showing relatively diminished activation of ventral cortico-striatal circuitry (involving the ventromedial prefrontal cortex and ventral striatum) during response inhibition, decision-making, simulated gambling, and gambling urge paradigms. These brain regions have been implicated in aspects of impulsivity. For example, consider delay discounting, in which a central element is the selection of small, immediate rewards over larger delayed ones. Among healthy volunteers, the selection of small, immediate rewards recruited ventral striatum and ventromedial prefrontal cortex, whereas the selection of larger, delayed rewards was associated with brain activations in more dorsal cortical regions (McClure, Laibson, Loewenstein, & Cohen, 2004). Moreover, the processing of small immediate monetary awards can be further parsed into anticipation and receipt phases, with the former more closely associated with activation of the ventral striatum and the latter with activation of the ventromedial prefrontal cortex (Knutson, Fong, Adams, Varner, & Hommer, 2001; Knutson, Fong, Bennett, Adams, & Hommer, 2003). Together, these data are beginning to provide an understanding of the brain mechanisms underlying specific aspects of engagement in impulsive behaviors, and what brain function might underlie excessive patterns of gambling. A future goal would be to translate this understanding to improved prevention and treatment strategies.

Towards the goal of advancing prevention and treatment strategies, an understanding of how individual difference measures (e.g., gender and specific genetic and environmental factors contributing to such constructs as emotional regulation and stress responsiveness) might contribute to impulsivity and gambling is important. For example, treatment trials for certain types of medication (e.g., serotonin reuptake inhibitors) in the treatment of pathological gambling have yielded mixed results, and it is likely that individual differences contribute to the variability in results (Brewer, Grant, & Potenza, 2008). Heritable contributions to pathological gambling are substantial, with studies of male twins estimating genetic contributions over 50% (Eisen et al., 1998) and suggesting overlaps in genetic contributions to alcohol dependence, antisocial behaviors and depression (Potenza, Xian, Shah, Scherrer, & Eisen, 2005; Shah, Eisen, Xian, & Potenza, 2005). Similar studies are needed to investigate these relationships in women, particularly as there exist significant gender-related differences in both problematic and recreational gambling behaviors (Potenza, Maciejewski, & Mazure, 2006; Potenza et al., 2001). Genetic and environmental factors have been reported to interact in a complex manner, with significant life experiences (e.g., stressors like childhood trauma) associated with and the development of specific pathologies (e.g., depression) in individuals with specific commonly occurring allelic variants (e.g., of the gene coding for the serotonin transporter) but not in those individuals with the other variant (Caspi et al., 2003). Such commonly occurring allelic variants (including the one coding for the serotonin transporter, the molecular target of serotonin reuptake inhibitors) have also been associated with specific patterns of brain activation (e.g., in the case of the allelic variants of the serotonin transporter gene, in regions associated with emotional reactivity) (Hariri et al., 2002). Together, these data suggest that there are complex interactions between genetic and environmental factors that contribute to brain function and behavior. The data also suggest that the technological advances to which we currently have access should allow for a more complete understanding of internal and behavioral phenomena related to gambling, and that this understanding should lead to improved prevention and treatment strategies for individuals with gambling problems.

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