A Multivariate Behavior Genetic Investigation of Dual-Systems Models of Alcohol Involvement

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ABSTRACT. Objective: Dual-systems models hypothesize that individuals who tend to be drawn to risky behavior and are low in self-control are at greatest risk for alcohol use disorder (AUD). Importantly, these models assume that behavioral approach tendencies and self-control are distinct. This study investigated hypotheses and assumptions central to dual-systems models. **Method:** Participants were 3,509 members of a national twin registry (58% female). Structured interviews assessed alcohol use and AUD symptoms. Self-report questionnaires assessed individual differences in approach tendencies, namely for general risky behavior (sensation seeking) and substance use (positive expectancies), and behavioral control. Regression models tested nonadditive, interaction effects on alcohol involvement, as proposed by the dual-systems model. Multivariate behavior genetic models investigated the incremental validity of these interaction effects and whether approach tendencies and behavioral control explain distinct variance in alcohol involvement. **Results:** In regression models, we found interaction effects consistent with the dual-systems model for women but in the opposite direction for men. After accounting for additive main effects in behavior genetic models, however, these interaction effects played a negligible role phenotypically and genetically. Further, sensation seeking and positive expectancies explained phenotypic and genetic variance in alcohol involvement that was distinct from behavioral control. Behavioral control, however, did not explain distinct variance in alcohol involvement. **Conclusions:** Contrary to dual-systems models, this study suggests that all of the variance in alcohol involvement explained by behavioral control is also shared with the tendency to engage in risky behavior (sensation seeking) and substance use (positive expectancies). Further, interaction effects central to dual-systems models failed to explain additional variance beyond basic main effects. Thus, more parsimonious models may better explain AUD. (*J. Stud. Alcohol Drugs, 79,* 617–626, 2018)

WITHIN THE LAST DECADE, increasing attention has been devoted to investigating dual-systems models of broad constructs such as decision making (Kahneman, 2003, 2011; Metcalfe & Mischel, 1999) and risky behavior (Steinberg, 2010), and specific constructs such as alcohol use disorder (AUD) (Houben & Wiers, 2009; Magid et al., 2007; Stacy & Wiers, 2010; Thush et al., 2008). Dual-systems models attribute AUD to an interplay between two complementary systems, a bottom-up (e.g., mesolimbic; Koob & Le Moal, 2008) emotion-based system that is characterized by approach tendencies, and a top-down (e.g., prefrontal; Goldstein & Volkow, 2011) cognitive-based system that is characterized by behavioral control. Specifically, those who tend to be drawn to risky behavior and are low in behavioral control are hypothesized to be at greatest risk for alcohol problems. Thus, dual-systems models assume that interac-

tion effects capturing this interplay cannot be explained by additive, main effects of these constructs. Further, these models posit that each system serves as a distinct risk process for AUD, thus warranting the inclusion and delineation of both constructs. These fundamental assumptions are often overlooked, but it is important to clarify whether interaction models better explain AUD than simpler models and whether these are actually distinct risk processes. The current study used a twin sample to investigate assumptions and hypotheses of the dual-systems model of AUD.

The constructs represented in dual-systems models correspond to personality taxonomies (Harden & Tucker-Drob, 2011; Quinn & Harden, 2013; Shulman et al., 2015). Gray's behavioral approach system has informed many conceptualizations of approach-based tendencies (Gray, 1972, 1990), including sensation seeking, defined as the tendency to seek "varied, novel, complex, and intense sensations and experiences" (Zuckerman, 1994, p. 27). Further, the association between behavioral approach and alcohol use is mediated by domain-specific conceptualizations, namely alcohol expectancies (Wardell et al., 2012). Behavioral control has been measured by personality facets related to conscientiousness and can be defined by Tellegen's MPQ Control Scale, which closely resembles (lack of) planning from the UPPS impul-