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Decision making about alcohol use: The case for scientific convergence

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HIGHLIGHTS

- Cognitive processes predict drinking as well or better than any other predictor.
- One theme may be shared by seemingly separate cognitive constructs: anticipation.
- Anticipatory processes are evident at many neurobiological and behavioral levels.
- Anticipatory processes seem to have a causal influence on drinking.
- Anticipatory processes should be considered as a target for prevention efforts.

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ABSTRACT

Research on cognitive processes related to the decision to drink alcohol has yielded assessment tools that predict drinking as well or better than any other predictor. Although largely overlapping in content, some of these tools have been issued from different theoretical perspectives and consequently have been named to reflect separate cognitive constructs. This article describes a single theme that may be shared by what now appear to be separate constructs: anticipatory information processing. These anticipatory processes are reviewed at multiple levels of analysis, from neurobiology, to learning and memory, and finally to behavioral choice. Evidence supporting anticipatory processing as a causal influence on drinking also is reviewed, along with evidence that these ideas may be usefully applied to prevention/treatment efforts.

For over three decades the decision to drink alcohol has been studied in the context of cognition (see Brown, Goldman, Inn, & Anderson, 1980; Donovan & Marlatt, 1980). Since then, indices of alcohol-related cognition have been as predictive of drinking patterns as any variables researched. Numerous terms have been used to describe these "thought processes" involved in drinking including "expectancies," "beliefs," "reasons," "attitudes," "motives," "associations," "evaluations," or the generic "cognitions," among others. Using statistical techniques that can parse out variance explained by different variables, researchers have demonstrated that they all predict drinking to some extent, and that when included within the same models, they may show some degree of independence in predicting drinking outcomes such as frequency, quantity, or alcohol problems. For example, regression models predicting drinking may have both "expectancies" and "motives" contributing unique explanatory variance (Read, Wood, Kahler, Maddock, & Palfai, 2003). Despite the incremental variance explained, and their potentially distinct theoretical origins, however, considerable quantitative and qualitative overlap in content exists between seemingly different cognitive constructs. Quantitatively, measures of these constructs tend to have statistically significant correlations with one another (as high as .56; Cooper, Frone, Russell, & Mudar, 1995). Qualitatively, items including words reflecting a behavioral or affective sentiment such as "sociable," "pleasant," "fun," "bad," or "relaxed," may be found on many measures of what have been offered as indicators of *different* alcohol-related thought processes. The array of approaches to this domain have advanced our understanding of how alcohol behavior is influenced, while the quantitative and qualitative overlap presents a number of empirical and theoretical questions that have yet to be resolved. Some of these issues will be discussed later in this review. We start with a brief review of exemplars of these measures.

Conventional paper and pencil self-report measures have yielded a great deal of information about how humans conceive of drinking behavior. They include measures such as the Alcohol Expectancy Questionnaire (Brown, Christiansen, & Goldman, 1987), the Drinking Motives Questionnaire (Cooper, 1994), and the Reasons for Drinking Questionnaire (Westerberg, Miller, & Heather, 1996). Using measures such as these, alcohol-related cognitions have demonstrated strong correlations with drinking, predicting up to half of the drinking variance in error attenuated models, prediction of the onset and level of drinking in children/adolescents, mediation of the relationship between known

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antecedents of drinking (e.g., family, peer, or cultural factors) and drinking, and increases and decreases that parallel drinking in experimental designs (see Goldman, Reich, & Darkes, 2006, for a more detailed summary of this research).

It is important to keep in mind that although the phrase "thought processes" (used above) implies a degree of conscious deliberation, dozens of studies have shown that alcohol-related behavior can be influenced by cognitive stimuli in the absence of awareness of the governing processes (i.e., implicitly). These studies have used tasks developed by cognitive psychologists to test memory activation following implicit primes. Because initiation and pursuit of goals may be largely non-conscious (Custers & Aarts, 2010), approaches that tap these non-conscious processes are quite applicable to the investigation of alcohol-related goals. In addition, the use of implicit methods reduces demand characteristics associated with explicit assessment (which may indirectly encourage participants to provide the results that the experimenter "wants"). A final advantage of using implicit measures is their sensitivity to very subtle contextual shifts. Similar words to those used in the paper and pencil measures mentioned above often have been used in these measures, including the Implicit Association Test (e.g., McCarthy & Thompsen, 2006; Wiers, van Woerden, Smulders, & de Jong, 2002), the Stroop Task (Kramer & Goldman, 2003), primed recall tasks (Reich, Noll, & Goldman, 2005), and free association tasks (e.g., Palfai & Wood, 2001; Stacy, 1997), among several others. Consistent with responses to the explicit tasks, in each of these studies, responses to implicit tasks were contingent on the typical drinking level of the participants. In other words, alcohol-related cognitions measured implicitly repeatedly have been correlated with drinking.

A view that, in part, drove the use of implicit measures in all of these studies was that implicit measures accessed psychological processes that were somehow more central to decision-making, or at least provided additional statistical explanation for the decision to drink, than those processes that could be accessed by explicit measurement approaches. To examine these suppositions, Reich, Below, and Goldman (2010) conducted a meta-analysis of studies that included both kinds of measures within a single study. Results of this meta-analysis provided support for the notion that implicit measures offered added statistical information, but were not necessarily more central to the decision to drink: in 13 of the 16 studies that met the inclusion criteria, explicit measures accounted for more drinking variance than did implicit measures (in 12 out of 13 studies accounting for unique variance). Meta-analysis of the relative mean effect sizes confirmed the observed differences. Notably, one study of participants with cognitive impairment (not included in the meta-analysis) did show an advantage of using an implicit measure over an explicit measure (Grenard et al., 2008). In summary, therefore, these results showed that explicit techniques typically predicted more outcome variance than did implicit techniques, but that thoroughgoing approaches to prediction might best use both explicit and implicit measures of alcohol-related cognition to predict drinking.

To summarize the current state of science in alcohol-related cognition: whether they are called expectancies, motives, cognitions, or reasons for drinking (or other characterizations), and whether they are measured explicitly or implicitly, alcohol-related cognitions have been empirically shown to play a role in the decision-making processes that influence drinking. To advance this field in the direction of scientific explanation, however, it would be useful to go beyond just having an array of measures with different names, which are presented as though they represent different constructs/mechanisms that drive drinking, and which are rarely considered in concert. That is, it may be useful to consider the possibility that common psychological processes underlie all the measures in this domain. We will consider these possible common processes below. Clear consideration of the possibility that common processes are in play necessitates that we first address a few of the (primarily) methodological issues that may obscure our capacity to see the psychological processes common to all these measures/theoretical approaches.

Although space considerations do not allow a thorough review of all the issues involved, a few central points are worth noting. First, psychological/decision-making processes rooted in the neurobiology of the brain can be only imperfectly accessed by psychometric approaches to instrument development, and analyzed by regression/structural equation approaches aimed at evaluating operational/causal pathways. For example, when instruments include items that are highly overlapping, but also have instructional sets that differ to some degree, it should come as no surprise that they might demonstrate both overlapping and unique predictive variance. Statistical non-overlap can, in fact, be useful in prediction models; uniqueness suggests that scales could be used together to maximize prediction (increased accounted for variance in the outcome measures). Statistical uniqueness is less informative with regard to process, however; in deciphering the underlying processes/mechanisms that actually drive behavior. Uniqueness can derive from method variance and not from distinct psychological processes; i.e., from somewhat differing sets of items included in a scale, differing instructions, differing wording or ordering of items, differing scoring systems based on different factor solutions, etc. While it is true that some configurations of items, scales, etc., may predict uniquely, it is not necessarily true that these item arrangements are more informative about controlling processes.

Given the substantial overlap among all these scales in variances accounted for, it also should come as no surprise that statistical models can be constructed that purport to show that the variance accounted for by one instrument might mediate the influence of the other; in fact, in the absence of competing models, it remains likely that in any pairing of these measures (or scales) either could mediate the influence of the other. A quintessential example is the case of "expectancies" and "motivations." Previous reports have indicated that "motivations" mediate the influence of "expectancies" (Cooper et al., 1995). These reports, however, should not be considered a definitive representation of the operation of underlying processes. For example, given the overlap of variances accounted for in the case above, it remains possible that expectancies could have been shown to mediate motivations. Other than theoretical preference, there is no reason at the process level to regard either construct as more proximal to drinking decisions. Although it has been argued to the contrary, it could easily be argued that expectancies, conceived as information (memory) networks are more proximal. Following experimental manipulation, expectancies have been shown to activate in-the-moment in certain contexts and to influence behavior immediately (e.g., Carter, McNair, Corbin, & Black, 1998; Roehrich & Goldman, 1995). These findings readily support expectancies as a very proximal influence on behavior. In fact, outside the alcohol/substance abuse field, motivation explanations have often relied on expectancy formulations as the actual operational components that drive behavior (Bolles, 1967; 1972).

Second, all methods based on administration of questionnaires or on verbal reports may possibly be assessing epiphenomena. It is without question that (as with all behavioral outputs), behavior predicts behavior. Alcohol use is no exception. If scores on assessment instruments are correlated with the target behaviors, it may just be that these scores are useful for prediction because of their correlations with the behaviors in question, but not necessarily because what the instruments purport to assess are the actual drivers of the behavior. Unlike some of the approaches noted above, evidence for expectancies as real causal processes is available. Expectancies measured in children before drinking begins have been shown to predict later drinking (precluding their interpretation as an epiphenomenon; Christiansen, Smith, Roehling, & Goldman, 1989), and the experimental manipulation of expectancies through "expectancy challenge" has been shown to alter drinking behavior (Scott-Sheldon, Terry, Carey, Garey, & Carey, 2012). Evidence of this kind for other constructs in this domain is less available.

Lastly, we would argue for parsimony and consilience as guideposts toward better understanding of actual controlling forces in the highly important domain of alcohol and drug use. Rather than making ever-