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Are Alcohol Expectancies Associations? Comment on Moss and Albery (2009)

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Abstract

A. C. Moss and I. P. Albery (2009) presented a dual-process model of the alcohol-behavior link, integrating alcohol expectancy and alcohol myopia theory. Their integrative theory rests on a number of assumptions including, first, that alcohol expectancies are associations that can be activated automatically by an alcohol-relevant context, and second, that alcohol selectively reduces propositional reasoning. As a result, behavior comes under the control of associative processes after alcohol consumption. We agree with the second but not with the first assumption, based on theoretical and empirical arguments. Although in some cases expectancies may involve a simple association, they are propositional in nature. We demonstrate that this assertion is supported by existing literature cited in Moss and Albery. Moreover, six recent studies consistently demonstrated that under circumstances where executive control is impaired (either as a stable individual difference or under the acute influence of alcohol), associative processes, over and above expectancies, predict alcohol-related behavior. Taken together, the evidence strongly suggests a fundamental distinction between expectancies and associations in memory: effects of propositional expectancies and executive functions are impaired under the acute influence of alcohol but memory associations are not. This difference in perspective not only has theoretical implications, but also leads to different predictions regarding acute alcohol effects in society.

Keywords

Dual-Process Theories; Automatic and Controlled Processes; Acute Alcohol Effects

Moss and Albery (2009) presented an interesting integration of two influential theories about alcohol's inconsistent effects on behavior: alcohol-expectancy theory and alcohol myopia theory. We agree with the authors that alcohol has a differential effect on associative vs. controlled processes, as distinguished in general dual-process models (Gawronski & Bodenhausen, 2006; Smith & DeCoster, 2000; Strack & Deutsch, 2004). We also agree that there is ample evidence that controlled processes are negatively affected by alcohol whereas automatic processes remain unaffected or are primed (Field, Schoenmakers, & Wiers, 2008; Fillmore & Vogel-Sprott, 2006). We disagree, however, with the author's assumption that alcohol expectancies are to be conceived as associative processing rather than as propositional reasoning. As a consequence we have opposite predictions from those of Moss and Albery regarding the influence of many expectancies under the influence of alcohol. We present theoretical and empirical arguments in support of our contentions.

In a review of general dual-process models (Smith & DeCoster, 2000), central to the work of Moss and Albery (2009), associative processes are summarized to operate “essentially as a pattern completion system. After knowledge has been accumulated from a large number of experiences, this memory system uses that knowledge to fill in information, quickly and automatically, about the characteristics that previously have been observed or affective reactions that previously have been experienced, in situations that resemble the current one” (Smith & DeCoster, p. 110). In contrast, rule-based processing uses symbolically represented and culturally transmitted knowledge and rests on human linguistic abilities (Smith & DeCoster). Rule-based processing occurs optionally when capacity and motivation are present (p. 111). Rules can be learned through *social learning*, and *on a single occasion* (p. 112, italics added). “Our proposal emphasizes not only the relatively effortful nature of rule-based processing, but also that it draws on symbolically represented rules, which are structured by language and logic” (Smith & DeCoster, p. 125). “In our model, the two processing modes tap separate databases that represent knowledge in distinct formats. The associative mode draws solely on patterns of features built up over time in the slow learning memory system. Rule-based processing, although it also makes use of the slow learning memory system for the storage of long-term knowledge of word meanings and the like, uses the fast-binding memory holding symbolically encoded propositions and other linguistic material” (Smith & DeCoster, p. 127).

Additional dual process models (Gawronski & Bodenhausen, 2006; Strack & Deutsch, 2004) assert that associative relations are independent of the assignment of truth values, whereas propositional processes assign such values (Gawronski & Bodenhausen, 2006, p. 2). Another feature of propositional rule-based representation is that effects can be placed in the future (Strack & Deutsch, 2004, p. 228). Furthermore, associations are bi-directional, whereas propositions are not; indeed, propositions typically have an “if – then” format. All of these models emphasize that associative (or impulsive) and propositional (or reflective) systems jointly predict behavior, and in some cases can be in competition with each other. Dual process neurological models that are precise about behavioral relationships make further distinctions that are quite relevant here, such as distinctions between expectancies and habit associations that are implicated in distinct neural circuits (Berridge, 2001; Yin & Knowlton, 2006a, 2006b).

How should alcohol expectancies be viewed, from these general dual process frameworks? Expectancies are anticipated effects of behavior; in case of alcohol expectancies, they are anticipated effects of drinking alcohol. Expectancies refer to the anticipation of a systematic relationship between events or objects in some upcoming situation (Goldman, Brown, & Christiansen, 1987; Tolman, 1932). “The relationship is understood to be of an if-then variety; *if* a certain event or object is registered *then* a certain event is expected to follow” (Goldman et al., p. 183, italics in the original). If-then relationships are prototypical examples of propositions (Smith & DeCoster, 2000; Strack & Deutsch, 2004). For this reason it makes at least intuitive sense that recent dual process models of addiction (not referred to by Moss and Albery, 2009) consider expectancies as part of the propositional reflective system (Bechara, Noel, & Crone, 2006; Deutsch & Strack, 2006; Evans & Coventry, 2006; Wiers et al., 2007; Wiers & Stacy, 2006).

We argue that expectancies are generally propositional in nature but that some expectancy assessments can sometimes tap into simple associations. When the expected outcome strongly and routinely co-occurs with drinking, the expectancy and association will largely overlap. For example, many students associate alcohol with fun, and vice versa. In this case, the fun-alcohol association will largely overlap with the expectancy that drinking alcohol is fun. There are other instances, however, in which expectancies do not overlap with associations. For example, someone can learn a new fact about alcohol effects that is

compelling enough to foster a strong expectancy (in terms of subjective probability) yet a weak association. Consider a public health message to a pregnant woman who had thought that only large amounts of alcohol were harmful to her unborn child. The message states that even small quantities of alcohol may harm prenatal development. A single message is unlikely to result in a strong association, but the propositional contents may strongly influence behavior (Smith & DeCoster, 2000).

To the extent that outcomes are expected to occur later (e.g., if I drink now, I will not be able to drive home later), they are clearly propositional in nature (cf. Deutsch & Strack, 2006; Strack & Deutsch, 2004). Moreover, some expectancies cannot be represented as a single association. For example, expectancies of negative reinforcement require a rather complex propositional structure (e.g., when I am stressed and I drink alcohol, I become less tense). Whereas the first type of expectancy (fun, an example of positive reinforcement) can sometimes overlap with a single association, negative reinforcement expectancies are unlikely to be similar to a single association (see Wiers, 2008).

When we consider the other general characteristics of propositional and associative memory in general dual-process models, expectancies mostly follow the rules of propositional knowledge. For example, it has been demonstrated that negation can have the paradoxical effects of increasing the strength of associations (Deutsch, Gawronski, & Strack, 2006). Indeed, a similar finding has been reported for alcohol expectancies: explicitly negating the commonly endorsed expectancy that alcohol makes one sexy resulted in an *increased* association strength between alcohol and sexiness (Krank, Ames, Grenard, Schoenfeld, & Stacy, 2008). Interestingly, some of the existing literature cited by Moss and Albery (2009) appears to support the notion that expectancies behave like propositional knowledge, as defined by Smith and DeCoster (2000). For example, as Moss and Albery indicate, there is ample evidence that expectancies exist in children, even prior to personal experience. This is strongly suggestive of social learning, typical of propositional knowledge (Smith & DeCoster, 2000, p. 112). Moss and Albery also cite a series of studies by Fillmore and Vogel-Sprott, which showed that instruction can alter moderate impairment after acute alcohol. Specifically, Fillmore and Vogel-Sprott gave one group of participants "(...) information that contradicted their expectations of mild psychomotor impairment under alcohol. This was done by informing them that the alcohol dose used in this research produces strong impairing effects on task performance, and all participants display considerable impairment after drinking the alcohol." (Fillmore & Vogel-Sprott, 1996, p. 600). This group displayed significantly less impairment in psychomotor function than a group who received the same amount of alcohol without the expectancy-challenging information. Further analyses demonstrated that this effect was related to participants' history of social drinking: the compensating effect was carried by relatively novel drinkers. This effect is strongly reminiscent of rule-based learning on a single occasion, again typical for propositional learning (Smith & DeCoster, 2000). Hence, this brief analysis suggests that "expectancies" are a hybrid concept, with some expectancies (especially positive reinforcement) similar to, and possibly based on, simple associations and other expectancies failing to align with simple associations.

From this analysis we concur with Moss and Albery's (2009) predictions regarding the alcohol-behavior link in cases where expectancies are actually the product of simple associations, but not when expectancies are more complex or are the product of brief (hippocampal) learning that would not usually create associations within implicit systems (White, 1996). The hybrid nature of the expectancy concept can be conceptualized as a strength, with expectancies as a central unifying construct (Goldman, 2002; Goldman, Reich, & Darkes, 2006). Alternatively, it may be helpful to aim for a purer assessment of both associative and propositional knowledge in relation to drinking (Stacy & Wiers, 2006).

This alternative view is more consistent with major approaches to automatic priming in cognitive science, from which expectancy is viewed as a strategic decision process that sometimes occurs after automatic memory activation but is not part of the automatic memory process (Hutchison, 2003; Neely, 1991). It is also consistent with major movements in expectancy theory in social learning (Bandura, 2008) and with accounts of instrumental action, according to which expectancies form an integral part of goal-directed as opposed to automatic control over behavior (de Wit & Dickinson, 2009). This brings us to the final topics of our comment: assessment and evidence.

In line with Goldman and colleagues (2006), Moss and Albery (2009, p. 519) argue that implicit (or indirect) and explicit measures assess the same underlying construct—in this case, expectancies. Expectancies have traditionally been assessed with self-reflective questionnaires directly inquiring about the behavior. Memory associations have been assessed with two broad types of measures: association measures derived from basic memory research and reaction time (RT)-based measures derived from social cognition research. Regarding the first type of measure (not referred to in Moss & Albery), commonly used tests have used free word association, in which the participant lists the first word that comes to mind in response to a cue word or phrase, using “top of mind,” indirect instructions. If such tests do not directly inquire about the target concept (e.g., drinking alcohol), then the tests are indirect and may have the capability of assessing implicit processes; such tests are standard tests of associative strength in memory (Stacy, Ames, & Grenard, 2006). The second type of measure concerns RT-tests like the Implicit Association Test (IAT). In a recent comprehensive meta-analysis of over 89 effect sizes from studies sampling nearly 20,000 participants, both types of measures were found to predict alcohol or other drug use, even when explicit expectancies were controlled for (Rooke, Hine, & Thorsteinsson, 2008). Several investigations have also reported prospective prediction of alcohol and drug use by these implicit or indirect measures after controlling for explicit expectancies (Kelly, Masterman, & Marlatt, 2005; Stacy, 1997; Wiers, van Woerden, Smulders, & de Jong, 2002). It should be noted that we do not believe that implicit measures are “process pure” indicators of associative processes or that questionnaires are “process pure” indicators of explicit cognitive processes (Schwarz, 1999; Sherman et al., 2008). Still, these findings suggest that implicit measures of alcohol-related associations at least partly assess something different than explicit measures of expectancies.

This idea was strengthened by a recent series of studies investigating moderation effects on both types of measures in relation to alcohol and drug use and related impulsive behaviors (Grenard et al., 2008; Hofmann, Friese, & Roefs, 2009; Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008; Houben & Wiers, 2009; Thush et al., 2008; Wiers, Beckers, Houben, & Hofmann, 2009). In all of these studies it was found that a measure of executive control moderated the impact of associative processes on impulsive behavior as follows: for individuals with relatively poor executive control abilities, associative processes were predictive of behavior, whereas for individuals with relatively well developed executive control abilities, explicit expectancies or attitudes were the best predictor. Note that these findings were consistent over a wide range of behaviors, including alcohol consumption (Houben & Wiers, 2009; Thush et al., 2008); sexual interest, candy consumption, and aggression (Hofmann, Gschwendner et al., 2008), as well as aggression following alcohol (Wiers et al., 2009). Moreover, moderation of implicit memory processes was found both when assessed with indirect measures of spontaneous first associations (Grenard et al., 2008) and with RT-measures (all other investigations cited in this paragraph). Findings were also consistent across specific measures of executive control, including different measures of working memory (Grenard et al., 2008; Hofmann, Gschwendner et al., 2008; Thush et al., 2008), classical Stroop interference (Houben & Wiers, 2009; Wiers et al., 2009), or the Stop-task as a measure of motor inhibition (Hofmann et al., 2009).

Hence, there are well-replicated crossover interactions in the prediction of alcohol-related behaviors, supporting a distinction between associations and expectancies. That is, alcohol-related behavior is predicted relatively well by explicit expectancies in people with good executive control (Thush et al., 2008) and in people with good verbal abilities (Tapert, McCarthy, Aarons, Schweinsburg, & Brown, 2003); but in people with relatively poor executive control, alcohol-related behavior is better predicted by measures of implicit associations (Grenard et al., 2008; Houben & Wiers, 2009; Thush et al., 2008; Wiers et al., 2009). Finally, there is evidence that such disordinal interactions, documented *between*-subjects, are also found *within* subjects, under the acute influence of alcohol, whereby associative processes become more predictive of behavior compared with explicit measures (Hofmann & Friese, 2008). Similar findings have been reported for other manipulations that temporarily impair the reflective system (see for a review: Hofmann, Friese, & Wiers, 2008). These data support a dual-process model that highlights the differences between implicit associations and expectancies rather than a model that assumes they are identical.

Such a dual-process model yields additional predictions that diverge markedly from those of Moss and Albery (2009). Under circumstances in which executive control is weakened or is impaired through acute alcohol intoxication, we predict that many expectancies will have *weaker* rather than stronger predictive power. One particularly relevant example involves expectancies of long-term negative outcomes of drinking. We predict that the influence of these expectancies on behavior under the acute influence of alcohol becomes weaker, which is likely to be a contributing factor to alcohol misuse. Decreased predictive effects should extend to other impulsive or problematic behaviors. Most people know it is unhealthy to smoke, eat high caloric snacks, have unsafe sex, or act aggressively. “Knowing” in this context means that they have long term negative expectancies related to the target behavior. Yet, after a couple of drinks, all of these behaviors can become more likely, assuming a few enabling circumstances. This is exactly what is predicted from dual-process models of the class emphasized here, when applied to alcohol use and health behaviors (Field et al., 2008; Hofmann, Friese, et al., 2008; Hofmann & Friese, 2008; Wiers, Houben, Roefs, Hofmann, & Stacy, in press).

A final difference in approach concerns the necessity of the expectancy construct in Moss and Albery’s (2009) own theorizing about automatic or implicit cognitive effects. Aside from the arguments already raised, we do not see that the contentions about automatic activation of alcohol-related cognitions by Moss and Albery require the expectancy construct. Associative and connectionist memory frameworks provide a more general way to construe automatic memory effects that have been well documented in basic cognitive research. Such frameworks can readily address distinctions among many different types of associations in memory (e.g., cue-behavior, concept-concept, action-outcome, etc.), without a sole reliance on associations with outcomes. Furthermore, they can be readily applied to addiction within dual-process models that justifiably preserve the distinction between propositional and associative effects (such as Smith & DeCoster, 2000). Occam’s razor is well-implemented and consistency with basic cognitive research is preserved by reserving expectancy for propositional, explicit, or strategic processes. As we demonstrated, doing so provides more clear-cut predictions regarding the acute effects of alcohol on impulsive and reflective precursors of behavior.

In conclusion, we agree with the general idea in Moss and Albery (2009) that (a) associative processes are important in predicting the many varieties of behavior under the influence of alcohol; and (b) associative processes become more important when more alcohol is consumed, which may explain some alcohol-myopia effects (Hofmann, Friese et al., 2008; Wiers et al., in press). We do not agree with Moss and Albery, however, that expectancies should be conceptualized as associative processes. Rather, we view them as propositional

representations, at the same time recognizing that some measures of expectancies (particularly for positive reinforcement) may at times tap into the same underlying associative representation. This tendency is more likely for strong associations in memory that have become part of implicit or automatic memory systems than for newly formed relations that may be represented entirely in a propositional form (likely to be supported only by an explicit memory system). Future research on acute alcohol effects on cognition, and the perplexing and costly consequences for society of alcohol use, may benefit from a closer alignment with basic cognitive research.

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