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Too happy to care: Alcohol, Affect and ERN amplitude

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Introduction:
Performance monitoring and adjustment is a critical component of the human information processing system whereby people assess the appropriateness of ongoing behavior and make changes when current actions fall short of intended goals. Research shows that performance monitoring is regulated by activity in the anterior cingulate cortex (ACC), which can be recorded at the scalp as the error-related negativity (ERN), as defined by a negative deflection that occurs following a perceived error. Studies have shown that the ERN is modulated by a variety of factors such as task difficulty, error costs, and response-valence relevance on the basis of their relation to the ACC (e.g., Bush et al., 2000).

The present study was designed to examine the relationship between the ERN and alcohol consumption. Participants were randomly assigned to consume one of three beverages: Alcohol (n = 23), Placebo (n = 22), or a control condition (n = 22). The control condition was chosen to control for the effects of alcohol on the ERN, as well as to control for the effects of carbonation on the ERN. Following consumption of the beverage, participants were asked to complete a range of cognitive and affective measures.

Method:
Participants
N = 67 moderate social drinkers, 21-35 years old, who qualified according to a telephone screening interview.

Self-reported Affect
Throughout the study, participants completed the Positive and Negative Affect Scale (PANAS), which contains two subscales measuring positive affect (e.g., interested, excited, enthusiastic; α = .80) and negative affect (e.g., distressed, upset, hostile; α = .81).

Beverage administration
Participants were randomly assigned to consume one of three beverages: Alcohol (n = 23): 0.80 g/kg ETOH (100 proof vodka and tonic); Placebo (n = 22): 0.4 g/kg ETOH (10-proof vodka and tonic); Control (n = 22): plain tonic.

Participants in the Alcohol and Placebo groups were told that their beverage contained alcohol. Alcohol group participants achieved a maximum BAC during or just after the priming task. Self-reported intoxication measures indicated that both Placebo (M = 2.26) and Alcohol subjects (M = 3.56) reported feeling at least moderate intoxication (where 1 = not at all and 5 = very much).

Weapon Identification Task
The task involved categorizing images of a gun or a face as a weapon or a non-weapon. The task was designed to elicit a post-error response, which is a decrease in performance following a judgment that is incorrect.

Results:
As is typical, Ps were more accurate in categorizing guns than tools. More importantly, the typical error bias effect was significant (i.e., participants were more accurate in categorizing guns following black faces than white faces). This pattern was larger following alcohol consumption (see Figure 1).

Consistent with Ridderinkhof et al. (2002), the ERN was smaller in the alcohol than the placebo condition. For participants in the control group, ERN amplitude was .06 smaller in the alcohol condition than in the placebo condition (see Figure 2). In fact, the pattern in the alcohol group was more accurate at detecting their errors than were participants in the control group. For participants in the control group, ERN amplitude was .06 smaller in the alcohol condition than in the placebo condition (see Figure 2).

Whereas placebo subjects showed significant increases in the interference effect in RT following error trials vs. correct trials, indicating post-error performance adjustment, both alcohol and control subjects failed to adjust their performance following errors, ERN amplitude was .06 smaller in the alcohol condition than in the placebo condition (see Figure 4). After consuming their beverage, participants in the alcohol group experienced a decrease in Negative Affect, while individuals in the placebo group exhibited a moderate increase in self-reported negative affect (see Figure 5).

Conclusions:
Consistent with Ridderinkhof et al. (2002), the ERN was smaller in the alcohol group than the placebo group. However, contrary to Ridderinkhof et al.'s conclusions, alcohol subjects were not less accurate in detecting when they had made errors -- just the opposite was true. Moreover, the effect of alcohol on the ERN was modulated by changes self-reported negative affect. These findings suggest that the extent to which alcohol decreases the ERN depends upon alcohol's dampening of negative affect, and not on impairment of ability to detect errors.

References: