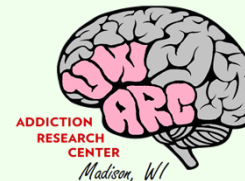


Risky or rational? Alcohol increases the subjective value of uncertain rewards in a reward decision-making task

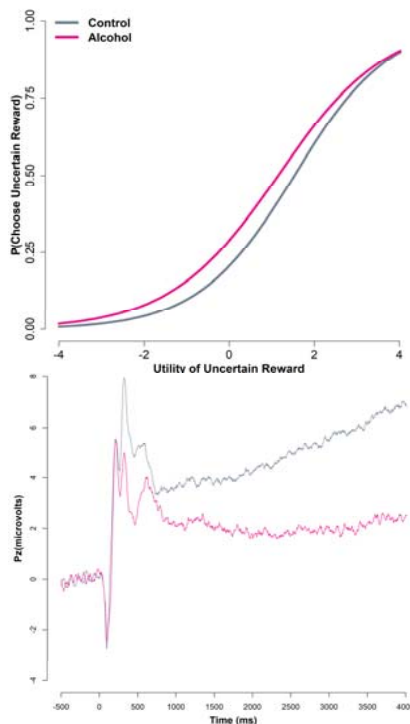
Sarah J. Sant'Ana, Daniel E. Bradford, Mark J. Starr, & John J. Curtin
University of Wisconsin-Madison



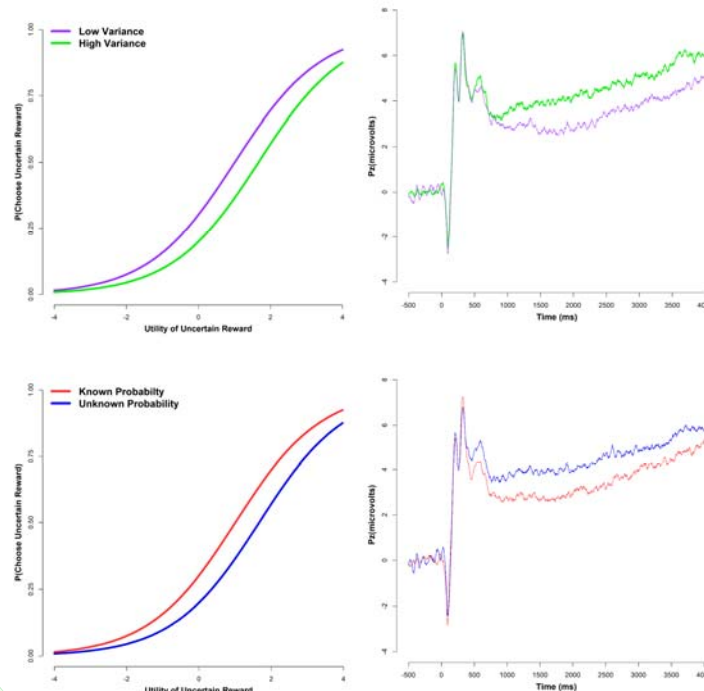
ABSTRACT

Individuals avoid uncertain rewards even when they are objectively better than certain ones (e.g., sticking with known, suboptimal partners, jobs, or locations when presented with uncertain but likely better options). However, the cognitive-affective mechanisms of these decision-making processes remain unclear for both sober and intoxicated individuals. We randomly assigned 122 participants into alcohol (target BAC = .08%), placebo, and no alcohol groups. They completed a reward decision-making task where each trial required a choice between a certain reward (known monetary value) and an uncertain reward (two possible monetary values). Across trials, we manipulated the uncertainty type (unknown vs known probability of receiving each of two uncertain reward options) and uncertain reward variance (high vs low difference between the two uncertain reward options). We measured ERPs and behavioral choices indicating participants' subjective valuation of uncertain vs. certain rewards. When sober, unknown (vs known) probability reduced P3, increased slow wave activity, and reduced the subjective value of uncertain rewards. High (vs low) variance increased slow wave activity and reduced the subjective value of uncertain rewards. Alcohol reduced P3 on all trials but increased the subjective value of uncertain rewards. These results begin to delineate mechanisms involved in sober and intoxicated decision-making. In particular, alcohol increases the subjective value of uncertain rewards which paradoxically may result in risky or rational decisions depending on the context.

ALCOHOL INCREASES PROBABILITY OF CHOOSING UNCERTAIN REWARDS, DECREASES P3, AND DECREASES SLOW WAVE ERP



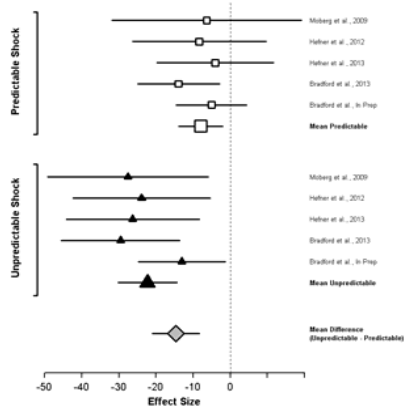
BEHAVIOR MANIPULATION CHECKS AND ASSOCIATED ERPS



High variance decreases the probability of choosing the uncertain reward and increases slow wave ERP

Unknown Probability decreases the probability of choosing the uncertain reward, decreases P3, and increases slow wave ERP

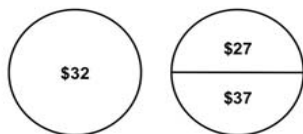
BACKGROUND



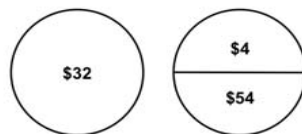
- Uncertain threats are generally more aversive than certain threats
- Alcohol has consistently lowered reactions to uncertain vs certain threat
- Does this effect generalize to uncertain rewards?

REWARD DECISION-MAKING TASK

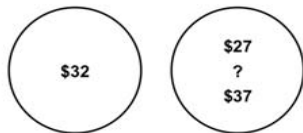
A. Known Probability, Low Variance



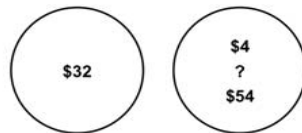
B. Known Probability, High Variance



C. Unknown Probability, Low Variance



D. Unknown Probability, High Variance



Between Subject Manipulation

Alcohol Beverage group: Collapsed to two groups: Alcohol (BAC = .08) and No Alcohol (BAC = 0.0)

Within Subject Manipulations

Uncertain Reward Probability: Known vs Unknown probability of receiving each of two uncertain reward types

Uncertain Reward Variance: High vs Low difference between the two uncertain reward options

Uncertain Reward Utility: Probability weighted sum of the two uncertain offers in a trial minus the value of the certain offer. (Displayed as the ordinal ranking of utility across variance conditions)

DISCUSSION

Behavioral Effects

- Uncertain rewards that are highly variable and of unknown probability are less desirable
- Alcohol behavior effect suggests that alcohol's dampening effect on uncertainty may generalize to reward contexts

ERP Effects

- Increases in slow wave ERP may be due to increased motivational relevancy of context
- Alcohol reduced P3 overall as usual, did not interact with uncertainty or variance
- Explore potential mechanisms for alcohol's effect on reward uncertainty