

The Impact of Alcohol Hangover on Reward Processing within the Medial-Frontal Cortex

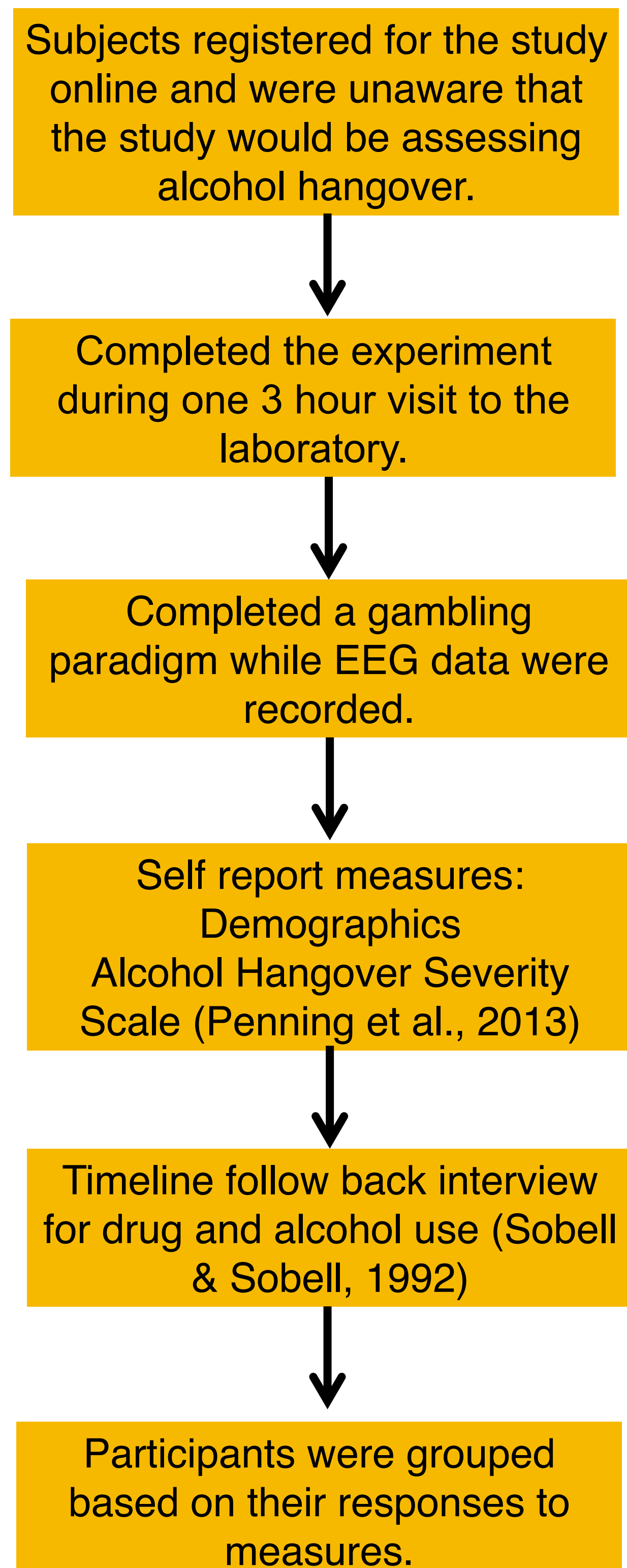
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INTRODUCTION

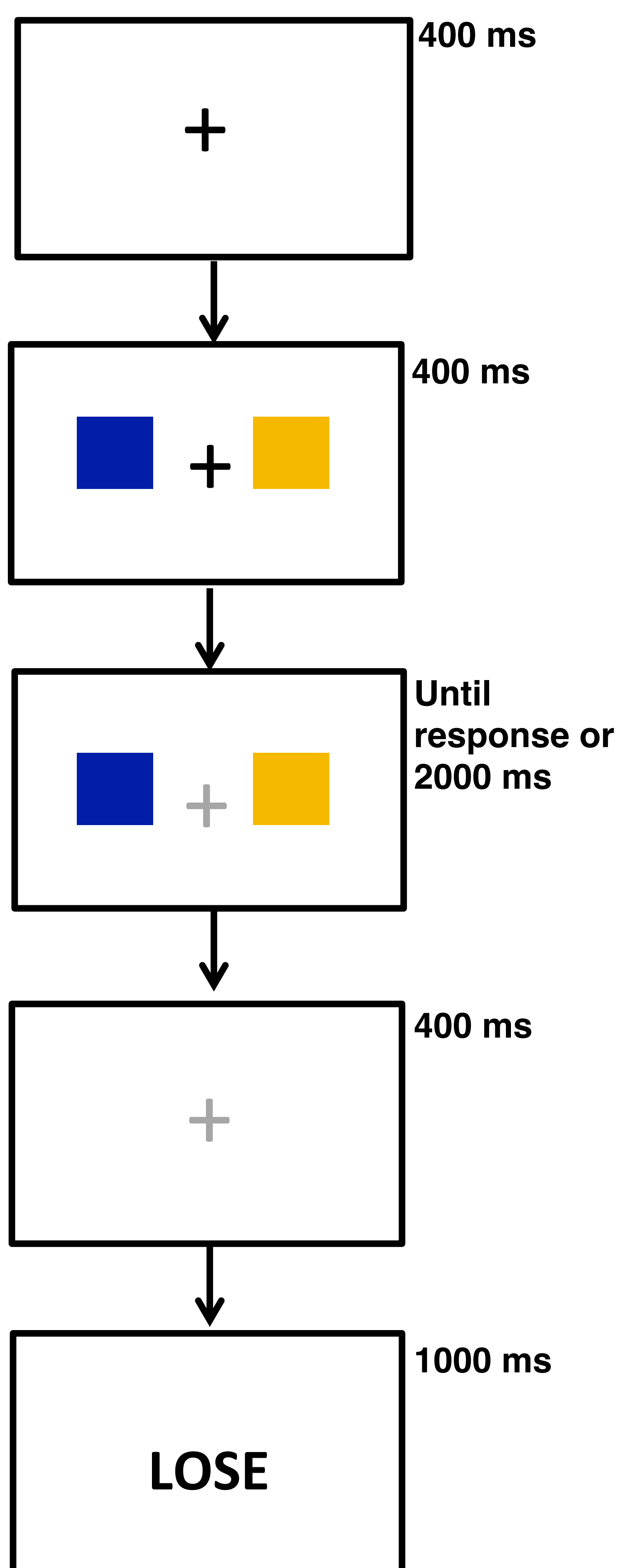
There is strong evidence for a reward processing system within the human medial-frontal cortex that plays a key role in reinforcement learning (Krigolson et al., 2014; Holroyd and Coles, 2002). Indeed, over the past two decades studies using electroencephalography have provided key evidence that the neural responses evoked by rewards and punishments respond in a pattern that would be predicted by computational theory (e.g., Sutton and Barto, 1998). Having said that, a lot remains unclear about the factors that influence the functional efficacy of the medial-frontal learning system. For example, behavioural evidence suggests that alcohol hangover impacts motor control and cognitive functioning (Cherpitel et al., 1998; Verster, 2007) and thus alcohol hangover may be one of the factors that would impair the medial-frontal system. In the present study, we aimed to provide the first electroencephalographic evidence of an impairment to the reward processing system of the human medial frontal cortex during alcohol hangover.

METHOD



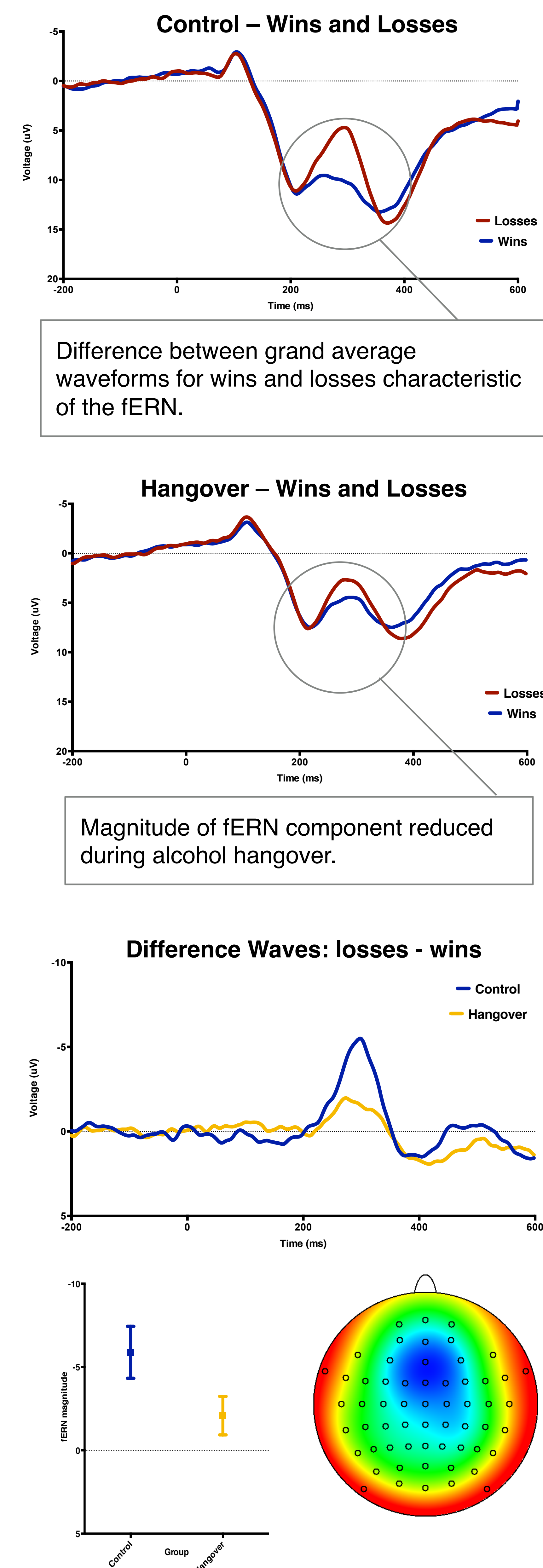
PARADIGM

Computerized Gambling Task



Paradigm Design. Participants took part in a two-choice gambling task. Each coloured square represented a casino. Participants were instructed to learn which casinos demonstrated greater probabilities of wins in order to maximize their rewards. Following casino selection, feedback was provided to indicate the outcome of the trial.

RESULTS



Difference between grand average waveforms for wins and losses characteristic of the fERN.

Magnitude of fERN component reduced during alcohol hangover.

Left: Differences in fERN Magnitude between groups. Right: scalp topography of control sample in line with that of the fERN component.

CONCLUSIONS

In line with previous work, we found that the feedback error-related negativity (fERN; Miltner et al., 1997), a component of the human event-related brain potential (ERP), was elicited by wins and losses during the gambling paradigm. Further, and importantly, a reduction in fERN amplitude was observed for hangover relative to control participants. Additionally, we also observed a moderate correlation between fERN magnitude and hangover severity. Our data indicate the magnitude of impairment to the medial-frontal system increases with hangover severity. The results of the present study are important for public education and safety, as an impairment of the reward processing system within the medial-frontal cortex may implicate individuals' ability to execute corrective behaviours—processes necessary for successfully executing potentially dangerous tasks such as driving a motor vehicle.

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