Instructional Set and Visual-Motor Performance

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1. Introduction

From a behavioral perspective, there has been minimal research concerning resistance to alcohol impairment; however, there has been an abundance of research on ethanol tolerance. This work has produced conflicting theories, with some individuals advocating exposure to ethanol as the only necessary factor for development of functional ethanol tolerance. Others have suggested a classical or instrumental learning paradigm as the underlying mechanism for the development of ethanol tolerance. These positions all implicate the development of new compensatory mechanisms. However, if resistance to alcohol impairment could be demonstrated in a single session these arguments would become less germane, while a motivational position would become more central. This motivational perspective would suggest that learning is unnecessary for resistance to alcohol impairment to manifest itself. What is necessary for resistance to alcohol impairment are cues from the environment that cause the individual to focus attention more intently on the task, resulting in less impaired performance.

Previous research with "instructional sets" suggests that compensatory mechanisms for resisting alcohol impairment already exist and that the development of new skills towards this end are unnecessary (George, Raynor, and Nochajski, 1990; 1992). The goal of this research was to evaluate the hypotheses that (1) behavioral resistance to alcohol impairment following a single drinking session can result from "instructional sets," (2) these "instructional sets" raise the level of mental concentration, which (3) then attenuate the pharmacological effects of alcohol. The current study considered the effects of instructional sets for both sober and intoxicated subjects.
2. Method

2.1. Sample

The sample consisted of 40 heavy drinking young men that were recruited from restaurants/bars in areas surrounding a state university. The subjects were paid $35 for the 4 hour session. The mean age of the sample was 23.18 ± 1.68, ranging from 21.17 to 28.99. The majority of the sample was white (97%), currently in college as an undergraduate (78.3%) or graduate student (15%), and single (97%). The average number of days drinking per week was 5 with an average of 6.24 drinks being consumed per occasion. Subjects had their driving license for an average of 5.9 years, drove an average of 178 miles per week, and had an average of 1.5 accidents and 1.7 traffic tickets over their driving history. The subjects reported driving after drinking 5 or more drinks an average of 17 times over the last year, with an expectation that they would do so at least twice in the next thirty days.

2.2. Alcohol Administration

Alcohol was administered in a ratio of 1.1 grams of ethanol/kg of bodyweight for a target blood alcohol concentration (BAC) level of .10. Tonic with lime juice was used as the mixer. Subjects were given 40 minutes to consume the beverage. Placebo subjects were given just tonic water and were treated in an identical fashion to the alcohol subjects. The Intoxilyzer 5000 was used to measure blood alcohol concentration when subjects first arrived and prior to every post-beverage trial.

2.3. Experimenter Ratings of Subject Intensity

Experimenter ratings of the intensity displayed by subjects while performing the tasks were used as an indication of mental concentration. This rating was based on the experimenter's evaluation of the subject's posture, facial expressions, gestures, reactions, and overall intensity during his performance. Reliability for the experimenter ratings of these feature ranged from .75 to .88. Percent of baseline concentration ratings for the 8 post-beverage trials were used as the dependent measures.

2.4. Visual-Motor Tasks

A modified pursuit rotor task was used as one of the measures of visual-motor performance. This task involved tracking a light target with a light-sensitive stylus attached to a plexiglass wheel that subjects had to turn to keep the
stylus on the light target. The light was programmed by computer to move in a fixed 8 cycle sequence which lasted 32 seconds. Four of the 8 cycle sequences made up one trial. An electronic timer was connected to the pursuit rotor apparatus to automatically register the amount of time the stylus remained in contact with the light target to the nearest 1/100th of a second. The subjects were not able to see the timer and were not informed of their scores. Percent of baseline time on target for the 8 post-beverage trials was used as the dependent measure.

The DORON L-225 Driver Simulator task used in the current research involved reactions to driving situations that simulated potential accidents. The individual was required to hit the brakes when confronted with a situation. The percent of the baseline reaction time was the dependent measure used in the repeated measures analyses of variance.

2.5. Instructional Set

Subjects in the instruction set condition were told the following for the pursuit rotor task: "Now concentrate as hard as you can on keeping the stylus on the target. Remember, concentrate as hard as you can on tracking the light with the light sensitive stylus."

For the driver simulator, the following was said: "Now concentrate as hard as you can on reacting to the scenes depicted in the film as quickly and correctly as possible. Remember, concentrate as hard as you can on reacting to the scenes depicted in the film."

3. Results

ANOVA performed on drinking characteristics, driving characteristics, and drinking-driving characteristics, revealed no significant effects for instructional set, or alcohol, and no significant interactions. A repeated measures ANOVA on BAC readings also showed no significant effects for instructional set, with a peak BAC of .098. This suggests that subjects were equivalent on these characteristics and that these factors could be ruled out as plausible alternative explanations for any group differences found in performance or concentration ratings. Additionally, alcohol significantly impaired performance for both the pursuit rotor tracking task ($F[1,18] = 18.02, p < .001$) and the driver simulator braking task ($F[1,18] = 6.93, p < .02$).
3.1. Pursuit Rotor Tracking Task

Repeated measures ANOVA for pursuit rotor performance, yielded significant instruction set by alcohol (F[1,36] = 4.46, p < .05) and instruction set by alcohol by trial interactions (multivariate F[7,30] = 2.74, p < .03). Simple effects tests performed within alcohol conditions yielded a significant effect for instructional set for both between- (F[1,36] = 8.12, p < .008) and within-subjects assessments (multivariate F[7,30] = 2.59, p < .04). The within-subjects effects indicate that performance was steady across the 8 trials for the group that received the instructional set and was consistently near baseline (Mean = 99.6% of baseline). In contrast, performance for the group that did not receive the instructional set showed a steady decline across trials and was consistently below baseline (Mean = 98%). Effects within the placebo condition for the between- and within-subjects effects were not significant.

Results for the analyses on concentration ratings yielded a significant interaction for instruction set by alcohol condition (F[1,36] = 4.84, p < .04). Simple effects tests within alcohol condition showed a significant effect for instruction set (F[1,36] = 13.85, p < .005). This parallels the effect found for performance. Figure 1 shows the comparison of means for performance and concentration for the alcohol conditions. As can be seen, there were increases in concentration across trials with stable performance for the instructional set condition, whereas for the group that did not receive the instructional set, performance declined as concentration ratings declined.

3.2. Driver Simulator Braking Task

Repeated measures ANOVA for the driver simulator braking task yielded a significant main effect for instructional set (F[1,36] = 5.86, p < .021). The individuals that received the instructional set performed significantly better than the individuals that did not receive the instructions to concentrate (102.17% of baseline vs. 98.49% of baseline). In contrast to the results for the pursuit rotor tracking task, the effects of the instructional set were not specific to the alcohol condition. Also, no significant trial effects were found.

Results for driver simulator concentration ratings yielded a significant effect for instructional set (F[1,36] = 8.40, p < .05) and a significant effect for instructional set by trials within the alcohol condition (multivariate F[7,30] = 2.76, p < .03). The latter effect showed concentration ratings increased across trials for the instructional set condition, while decreasing for the group that did not receive the instructional set. Figure 2 shows rising performance and concentration ratings for the instructional set condition and stable concentration ratings and below baseline performance for the non-instructional group.
Figure 1.

Figure 2.
4. Discussion

George et al. (1990; 1992) found that instruction sets allowed intoxicated individuals to perform at almost sober levels on a visual-motor tracking task. The current findings extend the previous work to heavy drinking young men and to BAC levels of up to .10%, as well as through the falling limb of the BAC curve. Instructional sets facilitated intoxicated performance for both tasks, while having no impact on sober performance. The results for the concentration ratings, as measured by the intensity displayed by the subject while performing the task, parallel the findings for performance. Thus, it suggests that the instructional sets were producing an increase in focus for the intoxicated subjects and this increased focus was allowing the subjects to maintain performance at sober levels.

The overall rate of performance on the visual-motor tasks by this group of heavy drinking young men would indicate some level of chronic behavioral tolerance. However, the effects of the instructional sets could not be attributed to chronic tolerance because of the lack of differences between groups on the drinking practices measure. The immediate impact of instruction sets also indicates that subjects were able to instantly resist the impairing effects of alcohol over and above the level of chronic tolerance. Also, there were no paired associations between drug administration and task performance and there were no instrumental pairings of consequences with responses prior to actual performance. Consequently, a classical or instrumental learning paradigm would not appear to be appropriate in explaining the immediate impact of the instruction sets. Rather, it would seem that the subjects were using an already existing capacity to resist alcohol impairment. This would support a motivational position for development of behavioral resistance to alcohol impairment.

The combined results suggest that attention to relevant cues is a critical factor for evaluation of intoxicated performance. Future research needs to determine how persistent the focus on relevant cues is and whether inattention to lower BAC levels is a critical factor in motor vehicle accidents.

5. References
