

Development of a Human Pavlovian Conditioned Approach Paradigm

*Lora M. Cope, Ali Gheidi, Tyler I. Allerton, Andrew Drumheller,
Huzefa H. Khalil, & Jonathan D. Morrow*

Using a paradigm called Pavlovian conditioned approach (PCA), animal researchers have demonstrated that there are individual differences in the extent to which drug-associated cues acquire incentive motivational properties: “Sign-trackers” tend to approach and engage the reward-associated cue, whereas “goal-trackers” tend to approach and engage the site of reward delivery. Animals that are more reactive to the reward-associated cue also show greater drug-seeking reinstatement, increased preference for drugs over food, and faster acquisition of drug self-administration relative to goal-trackers. This paradigm has not been applied extensively in humans, however. Here we present preliminary data from an adapted PCA paradigm involving eye-tracking to measure sign- and goal-tracking in humans.

Methods: Thirty-six healthy young adults (mean age=22.3 years, SD=2.3; 56% female) completed a mechanical PCA task while wearing an eye-tracking device. On each of 61 trials, a lever appeared for 3 seconds on a variable-time 20-second schedule. After lever retraction, a token was delivered into the reward magazine on one-third of trials. Eye gaze location during lever presentation on the last four trials was used to categorize participants as sign-trackers, goal-trackers, or intermediate responders following the formula [(lever gaze – magazine gaze) / 100]. The Barratt Impulsiveness Scale-11 was used to assess impulsivity.

Results: The mean number of lever presses per trial was 1.96 (SD=2.51, min=0.00, max=8.33). The mean percent time of eye gaze directed at the magazine was 22.08% (SD=20.49, min=1.12, max=89.87). The mean percent time of eye gaze directed at the lever was 49.33% (SD=22.33, min=3.50, max=96.35). Twenty-one participants were categorized as sign-trackers, nine as goal-trackers, and six as intermediate responders. Consistent with hypotheses, there were significant correlations between behavioral impulsivity and lever gaze ($r=.24$, $p=.048$) and between behavioral impulsivity and lever presses ($r=.26$, $p=.030$). There was also a trend-level correlation between cognitive impulsivity and gaze directed at neither the lever nor the magazine ($r=.22$, $p=.078$).

Conclusion: This is one of the first demonstrations of an adapted animal PCA task in humans. Results showed expected correlations with behavioral impulsivity. There was also adequate variance in the sign- and goal-tracking responses for further testing of personality, behavioral, and substance use variables. This novel human paradigm has the potential to inform investigations of alcohol and other substance use disorders from a behavioral perspective.

This research was supported by the National Institute on Drug Abuse (K01 DA044270; P50 DA037844; T32 DA007268) and the University of Michigan (Mcubed, Third Century Initiative).