

Effects of Bupropion on Sign-and Goal-Tracking

Megan Arth, Kiya Azure, Amanda Barbaro, Cassidy Bos, & John M. Holden (faculty sponsor)

Winona State University – Department of Psychology.



Introduction:

- **Sign-tracking:** The tendency of an organism to engage with a conditioned stimulus (CS) signaling a forthcoming appetitive unconditioned stimulus (US). Contrasted with **goal-tracking** (approaching location of US, if separate from the CS).
- Sign-tracking may be comparable to drug addicts impulsively approaching/interacting with drug-related cues, derailing rehabilitation efforts. Our lab is exploring the effects of drugs that could be used to reduce sign-tracking and thus aid in rehabilitation.
- **Bupropion**, also known as Wellbutrin, is a norepinephrine—dopamine reuptake inhibitor (NDRI) used to treat major depressive disorder and has been found to aid in smoking cessation. If successful in reducing sign-tracking, bupropion could be used to aid in drug addiction treatment generally.

Methods:

n= 48 male Sprague-Dawley rats
Operant chambers equipped with retractable levers and food receptacles (with infrared head detectors) were used.

3 Phases:

Habituation: 20 Min/day for 2 days
Introduced to banana pellets on day 2
Then, 48-hour break

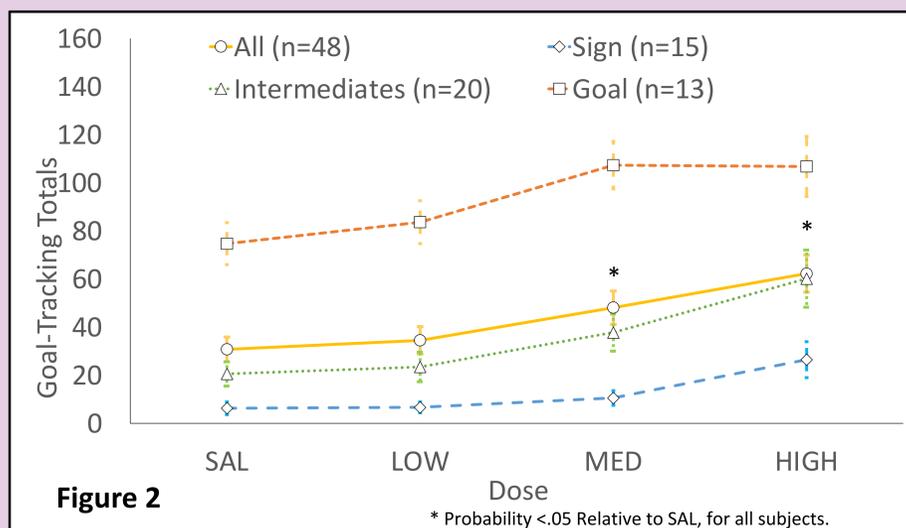
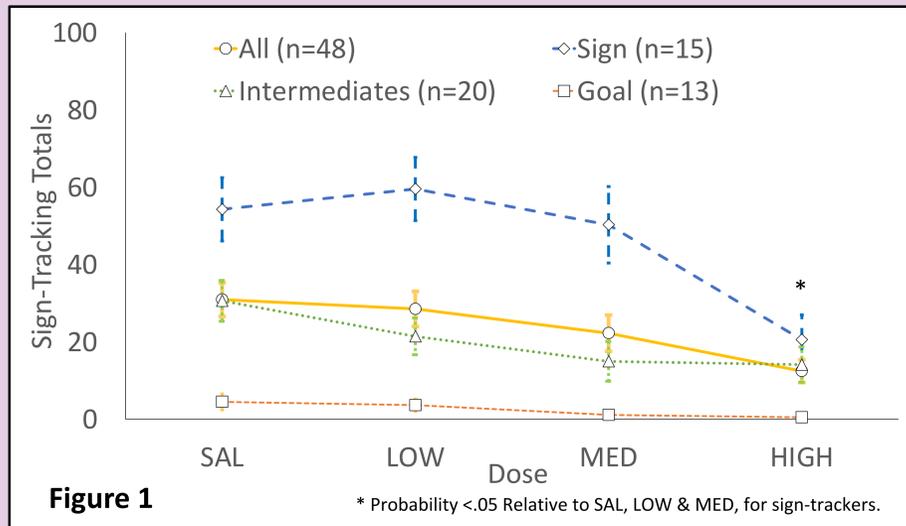
Training: 1 Session/day for 5 total days
25 trials in each session

Lever presented for 8 seconds, Banana pellets drop in food receptacle. **Sign-tracking** = interaction with lever during trial. (Note = lever-pressing is not reinforced; rather it is used as a measure of sign-tracking.) **Goal-tracking** = head entering food receptacle during trial. We then divided the subjects into their respective behavioral phenotypes (sign-trackers, goal-trackers, intermediates based on criteria of Meyer et al., 2012)

Drug Trials: 1 session per day/ 3 total days 48 hours apart
Saline, 20mg/kg (LOW), 40mg/kg (MED), 60mg/kg (HIGH)

Drug administered 30 Min before trial.

Hypothesis: Bupropion will reduce sign-tracking.



Discussion:

We confirmed our hypothesis that sign-tracking would be reduced under bupropion. We also found that goal-tracking was increased, suggesting that the two responses may have been competing with each other. In fact, we found effects on goal-tracking using both the medium and large doses. Since goal-tracking often reflects frontal lobe engagement, use of bupropion may contribute to inhibition of impulsive behavior. Our results suggest that bupropion may be an effective adjunct medication for patients attempting rehabilitation. Human trials would be necessary to see if we get the same effect as this work has just been done with animals.

Results:

Figure 1 represents sign-tracking as a function of dose and behavioral phenotype. A mixed model ANOVA using dose and behavioral phenotype as factors found a significant effect of sign-tracking between dose $F(3,132)=9.47, p<.001$, partial $\eta^2=0.177$ and dose by Behavioral Phenotype $F(6,132)=3.87, p=0.001$.

Post hoc testing using Tukey's HSD found a significant difference in sign-trackers between saline and the 60 mg dose, $t(44)=4.786, p=.001$, between 20mg and 60mg dose $t(44)=6.985, p<.001$, and between the 40mg and 60mg dose, $t(44)=4.204, p=.006$.

Figure 2 represents goal-tracking as a function of dose and behavioral phenotype. A mixed model ANOVA using dose and behavioral phenotype as factors found a significant effect of dose on goal-tracking $F(2.01, 90.24)=14.95, p<0.001$; We did not find a significant dose by behavioral phenotype interaction, $F(4.01, 90.24)=1.32, p=0.27$. Lastly, We found a significant effect of behavioral phenotype, $F(2,45)=43.5, p<0.001$.

Post hoc tests using Tukey's HSD found a significant difference between Saline and 40mg/kg, $t(45)= -4.09, p<0.001$, and a significant difference between saline and 60mg/kg, $t(45)= -4.72, p<0.001$. We also found a significant difference between 20 mg/kg and 40 mg/kg, $t(45)= -3.39, p=0.008$, as significant difference between 20 mg/kg and 60mg/kg, $t(45)= -4.18, p<0.001$, however, no other significant effects were found.

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