

# NICOTINE DEPRIVATION INDUCES NEGATIVE AFFECT TO ACTUAL CIGARETTES BUT NOT PICTURES OF CIGARETTES

Jesse T. Kaye, Fang Ying Shi, Timothy B. Baker, & John J. Curtin  
University of Wisconsin – Madison

## BACKGROUND AND SIGNIFICANCE

- Responses to drug cues have long played a prominent role in theories of addiction, yet cue-reactivity continues to prove difficult to manipulate and measure in the lab.
- Pictures of drugs and drug use are amenable to precise control in experimental designs that employ psychophysiological measures. However, the motivational properties of these visual cues may differ in magnitude and salience relative to actual (*in vivo*) multisensory drug exposure.
- Nicotine deprivation does not affect the startle response, a measure of negative affect, to unpleasant or smoking-related pictures.
- Perceived availability or opportunity to use drugs can influence motivationally relevant responses to drug cues (e.g., craving and affect).

## AIMS AND HYPOTHESES

- Examine whether nicotine deprivation alters the startle response during exposure to actual lit cigarettes that are either available or unavailable to smoke.
- Confirm that nicotine deprivation does not alter the startle response to pictures of either unpleasant or smoking-relevant content.

## METHOD

### Participants

Forty-three cigarette smokers from the community completed two lab sessions:

Inclusion criteria:

21 – 65 years old

≥15 cigarettes/day for >1 year

≥10ppm expired carbon monoxide (CO)

Exclusion criteria:

Current smoking cessation treatment

Strong desire to quit smoking

Both laboratory sessions were identical except all participants smoked one cigarette at the start of the screening session. At the screening session participants were randomly assigned to a smoking group for the experimental session:

*Deprived Smokers* (N = 21): 24 hours nicotine & tobacco abstinence

*Non-Deprived Smokers* (N = 22): Normal ad libitum smoking prior to the session.  
Smoked one cigarette upon arrival at the lab.

## DATA ANALYSIS

The startle response from the picture viewing task and cigarette exposure were analyzed in separate General Linear Models for each session. In all models smoking group (centered) and task time (1<sup>st</sup> vs. 2<sup>nd</sup>) were included as interactive between- and within-subject variables, respectively. Picture type was also included as an interactive within-subject variable in the picture viewing task and follow up testing separately compared smoking and negative to neutral pictures. General startle reactivity from the screening session was included as a covariate in analyses of experimental session data in order to account for individual differences in startle response.

### Picture Viewing Task

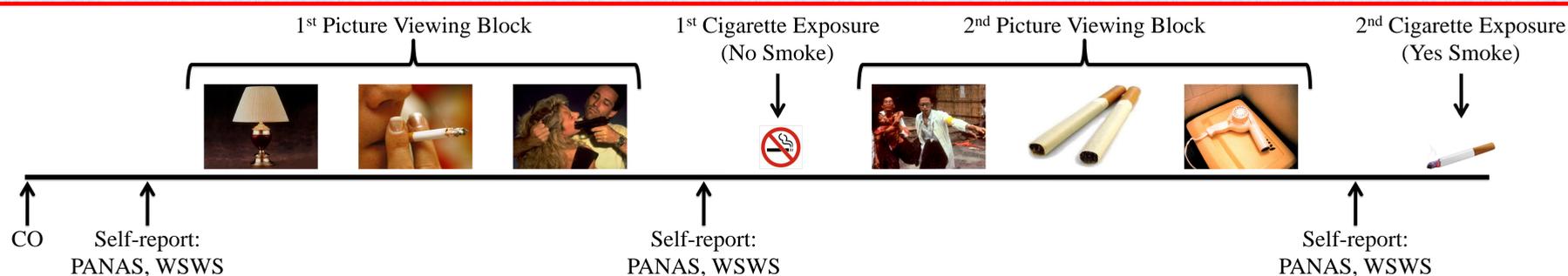
- At both laboratory sessions participants viewed 2 blocks of 27 different pictures comprising 9 negative, 9 neutral, and 9 smoking pictures.
- Pictures were displayed for 6s and separated by an inter-trial interval of 16-24s.
- No picture was presented more than once to each participant.
- Picture content type was counterbalanced within participants and picture order was counter balanced across participants.
- IAPS and smoking pictures were selected from independent pretesting with smokers to include average valence ratings of 2.42 negative, 5.00 neutral, and 4.78 smoking.
- Arousal ratings were 6.11 negative, 3.81 neutral and 4.72 smoking pictures.

### Cigarette Exposure

- Participants viewed a lit cigarette sitting on an ashtray approximately 50cm from them for 2-minute exposure periods in the middle and end of each laboratory session.
- Participants were told that they *would not* be allowed to smoke the first cigarette, but they *would* be allowed to smoke the cigarette after the second cigarette exposure.

### Startle Response Measurement

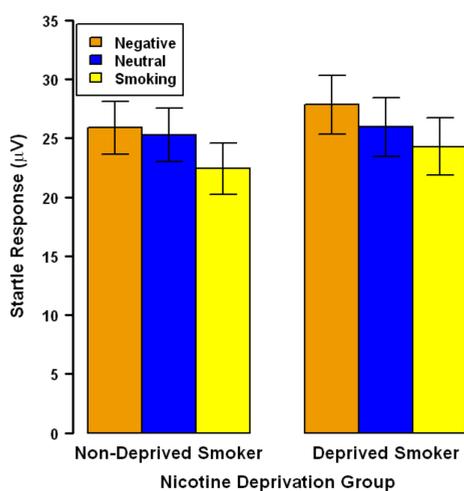
- The startle response is a sensitive measure of defensive reactivity and negative affective state.
- Eighteen acoustic startle probes were presented at 2.5 to 5s post picture onset (6 per picture type per block) and at 4 random times during the lit cigarette exposure periods.
- The eyeblink startle response was measured with Ag/AgCl EMG sensors below the eye on the orbicularis oculi muscle.
- Startle response was quantified as the peak magnitude 20-120ms post-probe onset.



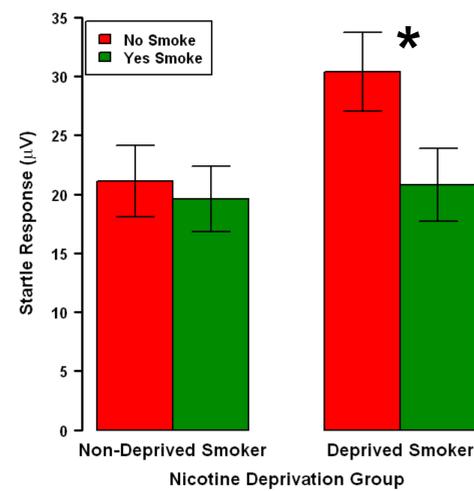
## RESULTS

### Experimental Session

Nicotine deprivation does not alter startle response to unpleasant or smoking pictures



Nicotine deprivation increases startle response to lit cigarettes that can not be smoked



	Non-Deprived Smokers M (SD)	Deprived Smokers M (SD)
Age	26.80 (7.93)	27.80 (10.24)
Years Smoking	9.37 (3.60)	11.15 (1.68)
Cigarettes Per Day	21.67 (4.31)	19.62 (3.01)
Session 1 CO Level (ppm)	20.77 (10.32)	21.10 (7.04)
Session 2 CO Level (ppm)*	19.41 (10.02)	6.62 (2.75)
PANAS Negative Affect	1.51 (.51)	1.94 (.60)
PANAS Positive Affect*	2.32 (.58)	2.22 (.65)
WSWS Craving Score*	2.18 (.79)	2.91 (.52)

\*Nicotine deprivation group main effect,  $p < .05$

### Screening Session

- Startle response during cigarette exposure was not affected by cigarette availability or smoking group.
- During the picture viewing task there was a main effect of picture type  $F(2,7) = 6.17, p = .003$ , but no main effect of nicotine deprivation group,  $p = .55$ , nor an interaction with smoking group,  $p = .94$ .

- Picture type showed a significant main effect,  $t(37) = 3.51, p = .001$ .
- Nicotine deprivation group showed no main effect,  $t(37) = 0.49, p = .62$ , interaction with picture type,  $t(37) = 0.79, p = .43$ , or interaction with smoking vs. neutral picture contrast,  $t(37) = 0.50, p = .62$ .

- Nicotine deprivation moderates the effect of cigarette availability on the startle response during cigarette exposure,  $t(37) = 3.51, p = .001$ .
- Nicotine deprived smokers display elevated startle during cigarette exposure when they can not smoke the cigarette,  $t(37) = 5.63, p < .001$ .

## CONCLUSIONS

- Exposure to lit cigarettes increases negative affective responses as measured by the startle response among nicotine-deprived smokers selectively when the cigarettes are unable to be smoked.
- Nicotine deprivation does not alter the startle response to pictures related to smoking cigarettes, replicating null effects from previous studies.
- Nicotine deprivation does not alter the startle response to unpleasant IAPS pictures, replicating null effects from previous studies.
- The motivational properties of distinct classes of drug cues (pictures vs. actual drug exposure) should be carefully considered in selecting relevant stimuli in experimental research and have important implications for the ability to detect theoretically meaningful effects of drug deprivation and availability.