

Psychophysiological Phenotyping of Reward Processing and its Modulation With Abstinence in Cocaine Addiction

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Disclosure Information

Muhammad A. Parvaz, PhD

- No Disclosures

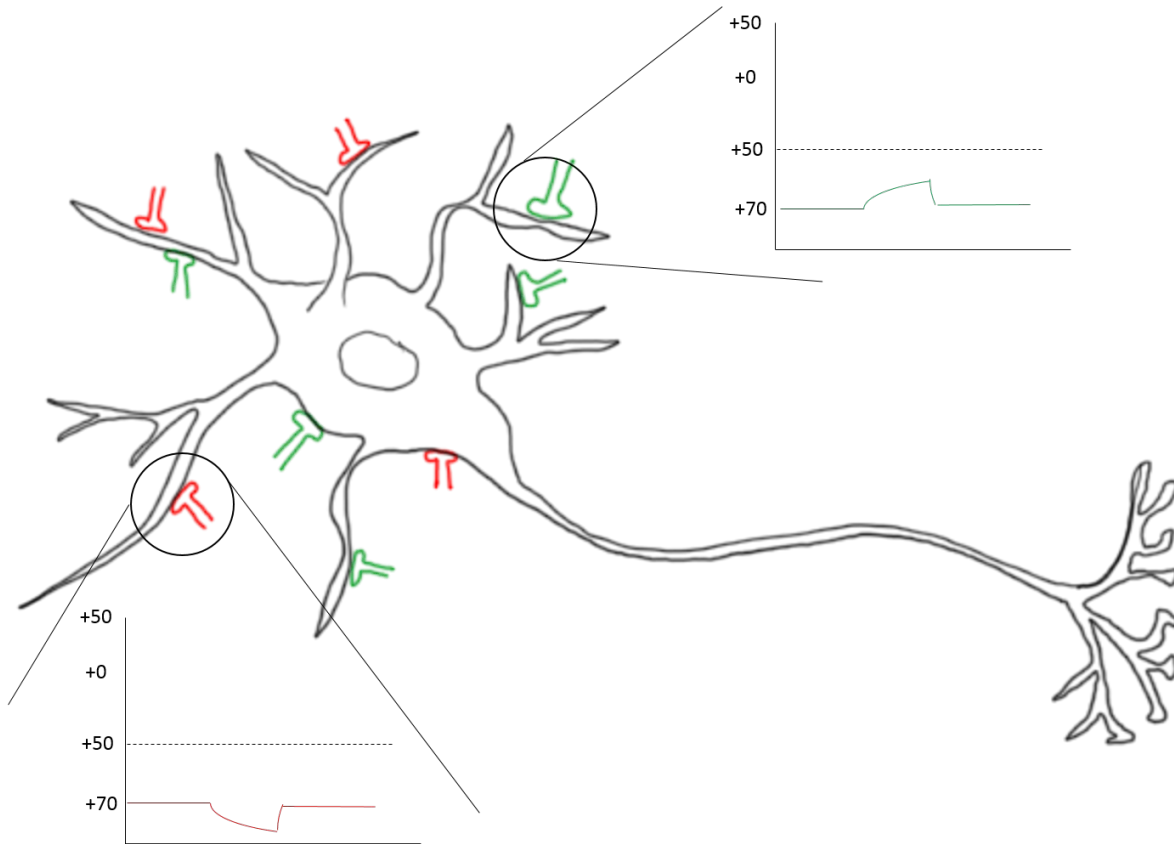


Session Learning Objectives

At the end of the session, you will be able to:

- Brief Intro to Electroencephalography (EEG)
- Event-Related Potentials (ERPs)
- ERPs to study sensitivity to non-drug reward
- ERPs to study sensitivity to drug-related reward (i.e., cue-reactivity)
- Tracking Changes in Cue-Reactivity with Abstinence
- Tracking Decrease in Cue-Reactivity with Reappraisal

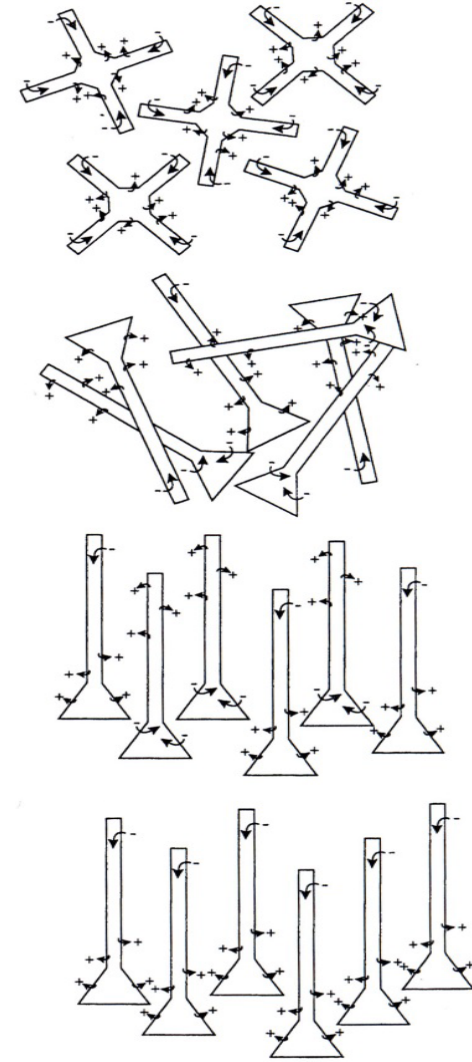
Intro to EEG



- Brain is a complex electrical circuit
- Neurons communicate via electrical signals
 - EPSP: Excitatory post-synaptic potentials
 - IPSP: Inhibitory post-synaptic potentials
- Pyramidal neuronal activity

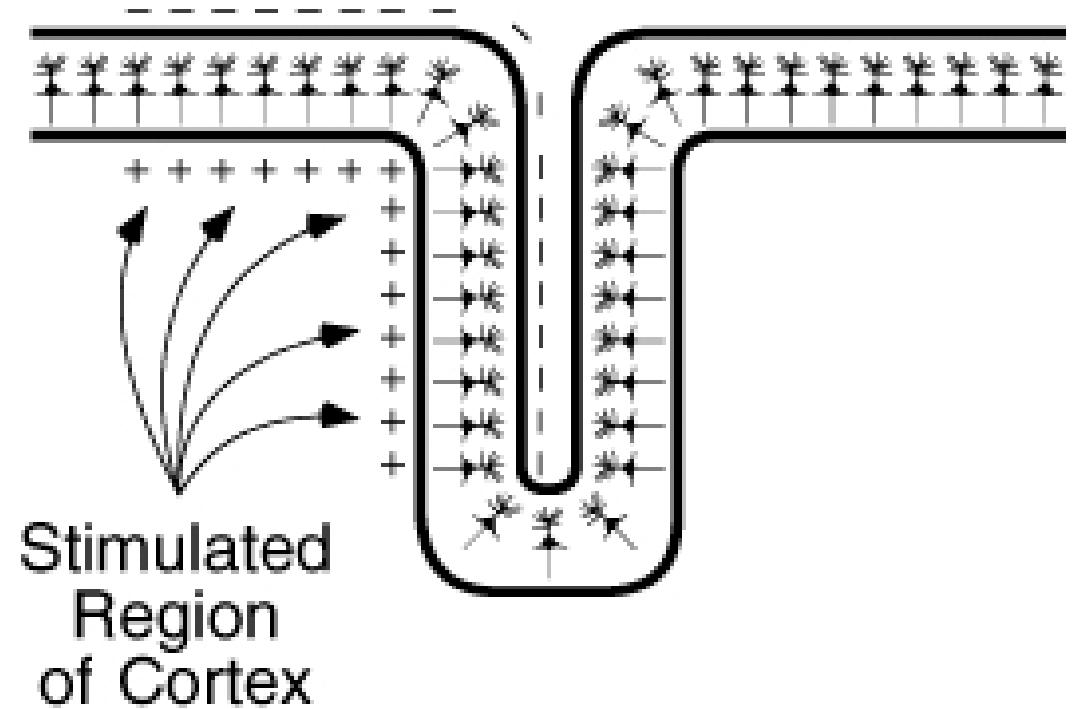
Intro to EEG

- Orientation of pyramidal neurons

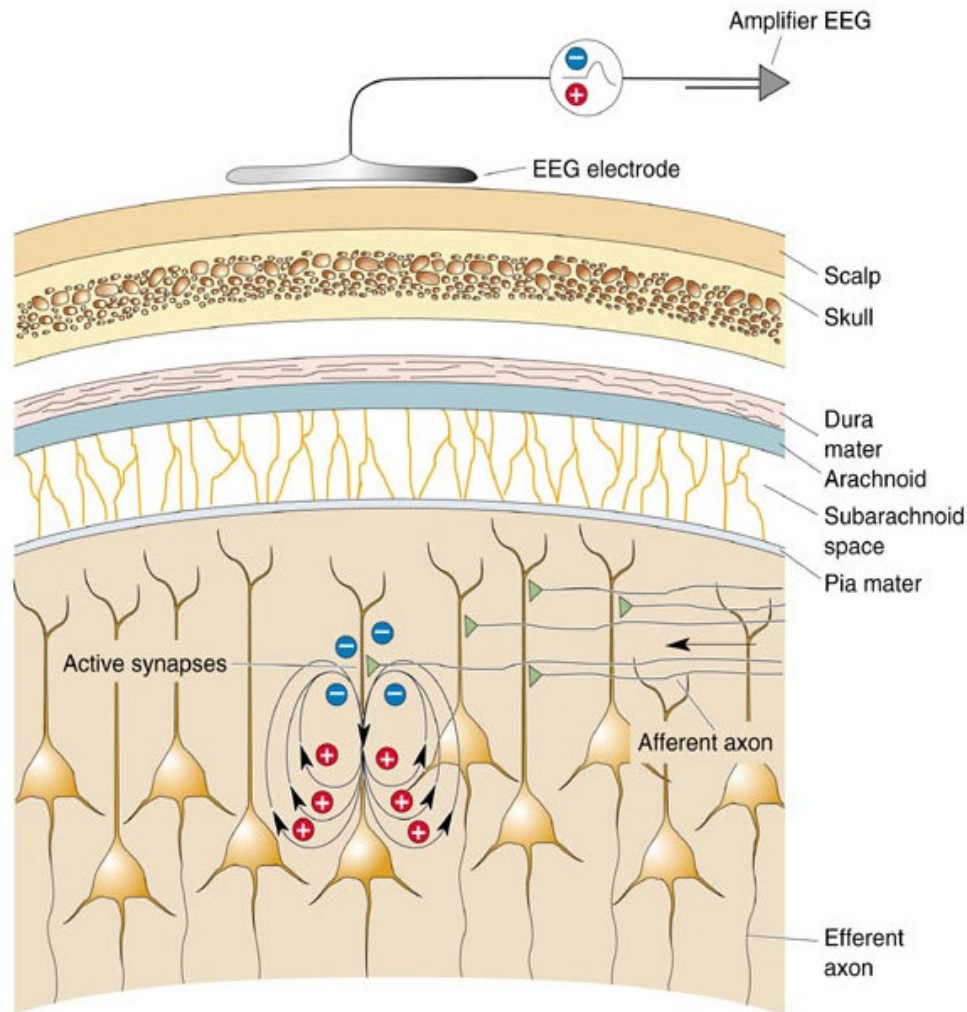


Intro to EEG

- Direction of electrical field (Gyri vs Sulci)



Intro to EEG



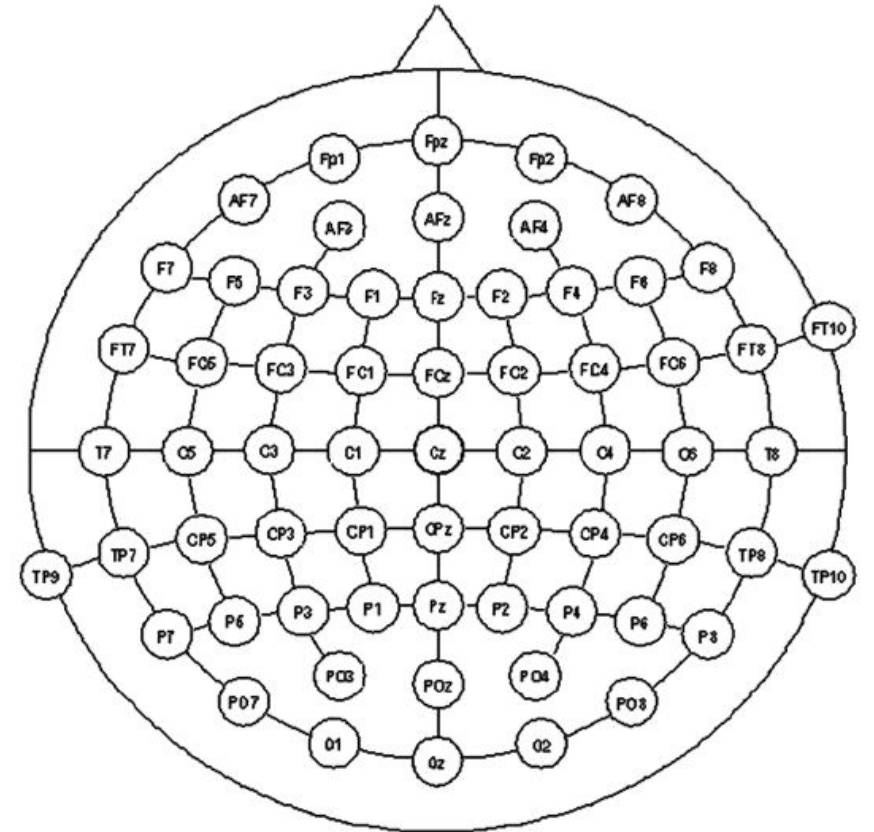
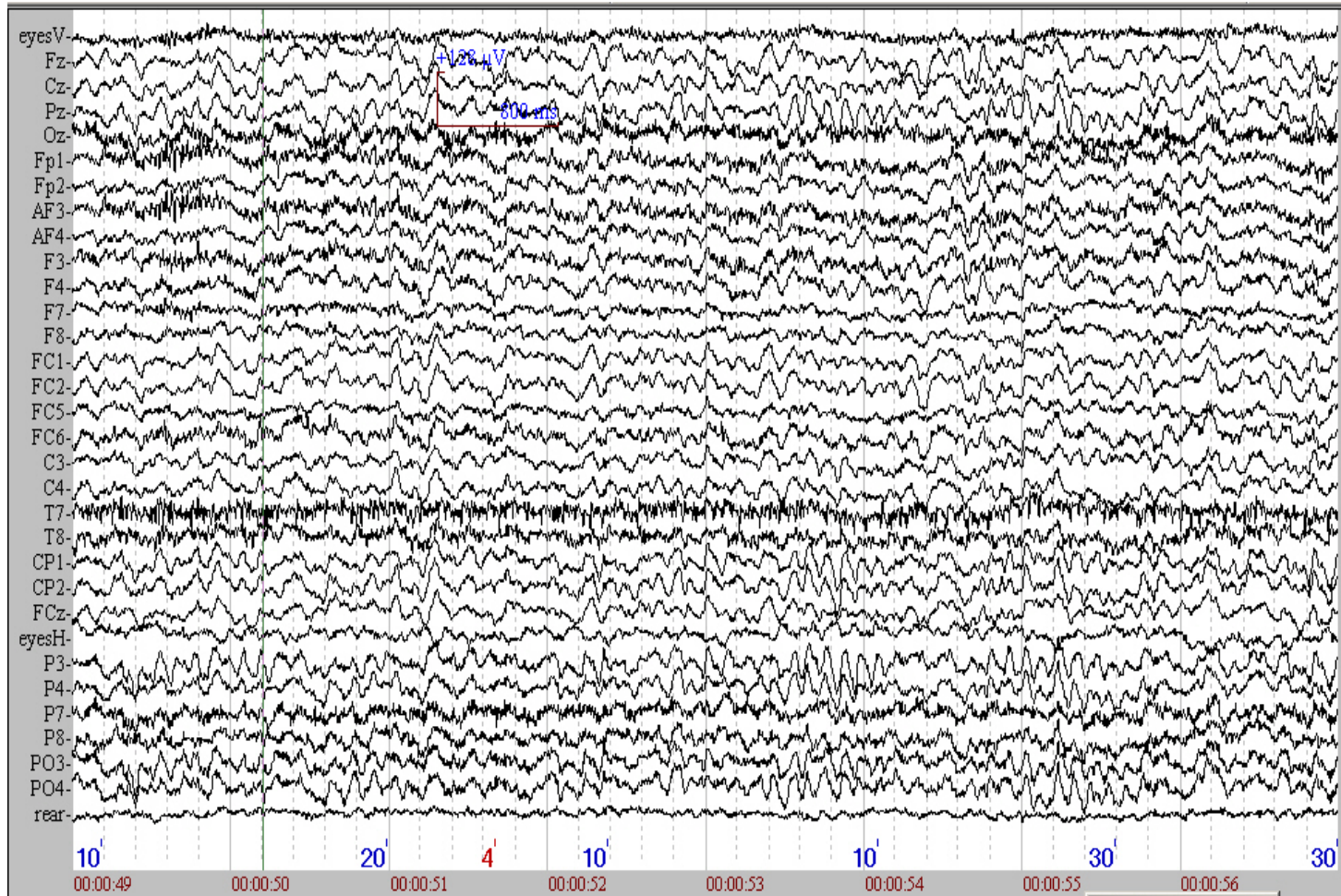
- Measures the activity of large numbers (populations) of neurons
- Measures voltage-difference at the scalp in the microvolt (μV)
- Advantages
 - Non-invasive
 - Painless
 - Low-cost
 - Ambulatory
- Millisecond resolution – advantage over other brain imaging techniques (fMRI or PET).

Intro to EEG

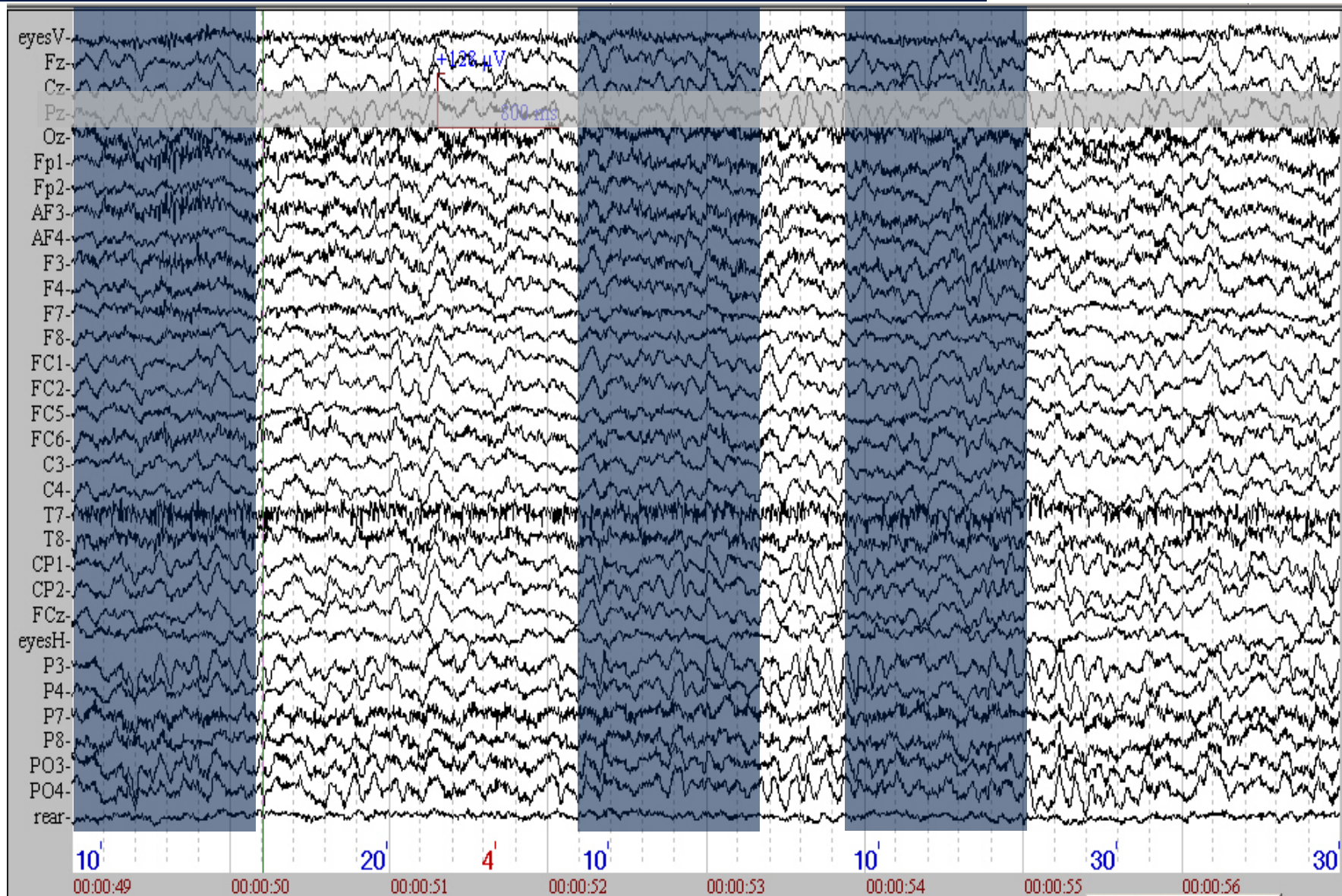


- Advantages of EEG
 - High temporal resolution (~1ms)
 - Clinically translatable
 - Already being used in neurology
 - Cost-effective (~\$50 per EEG, compared to ~1,000 per MRI)
 - Portable/Wearable
- Limitations of EEG
 - Estimated source localization
 - Signal to noise ratio

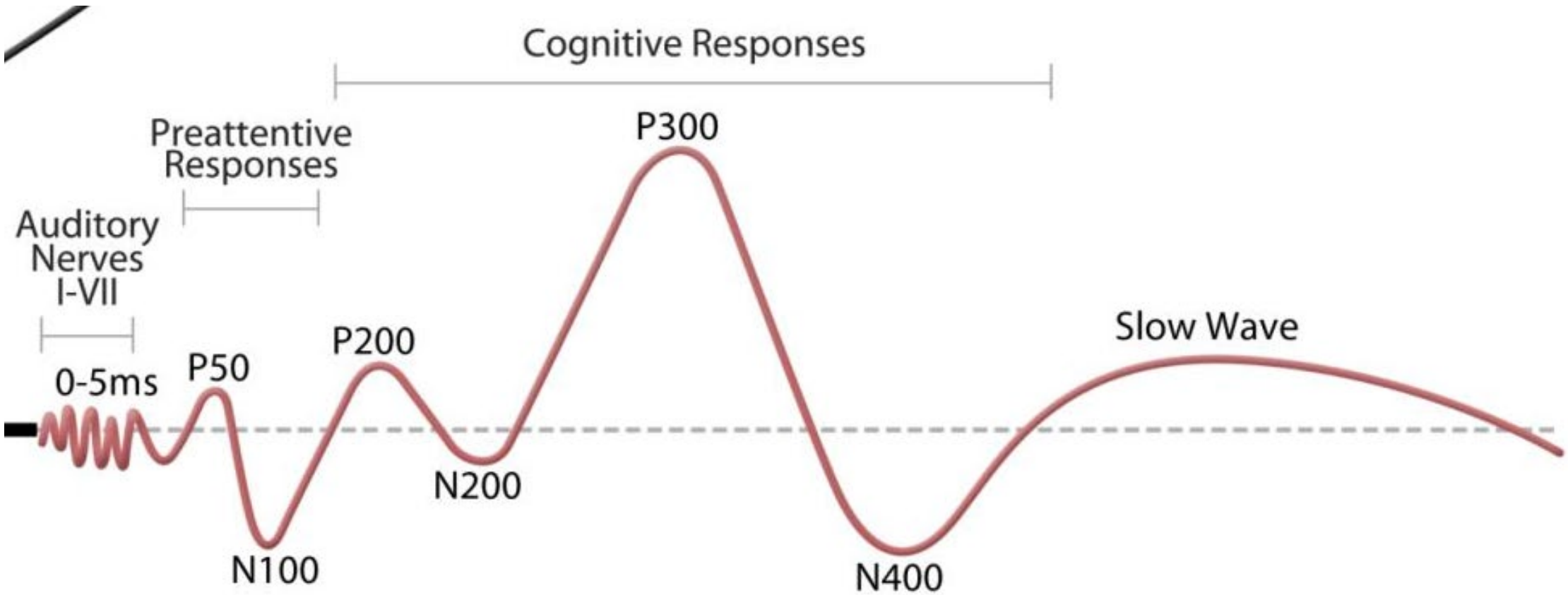
Intro to EEG



Event Related Potentials (ERPs)



Event Related Potentials (ERPs)

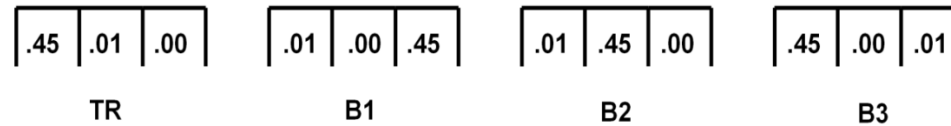


ERPs for Non-Drug Reward

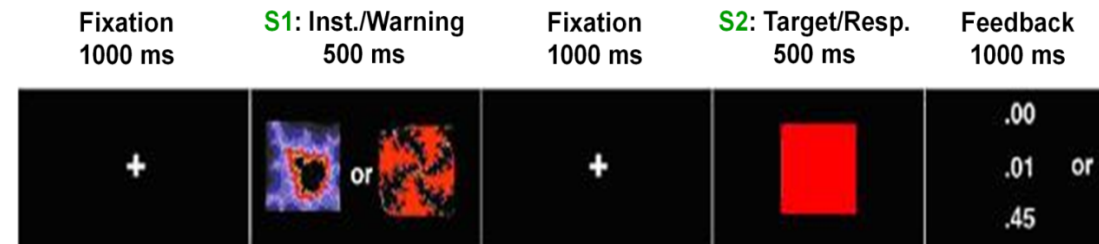
Task included training (TR) and 3 sequences/blocks (B):



Each block contains 3 monetary conditions:



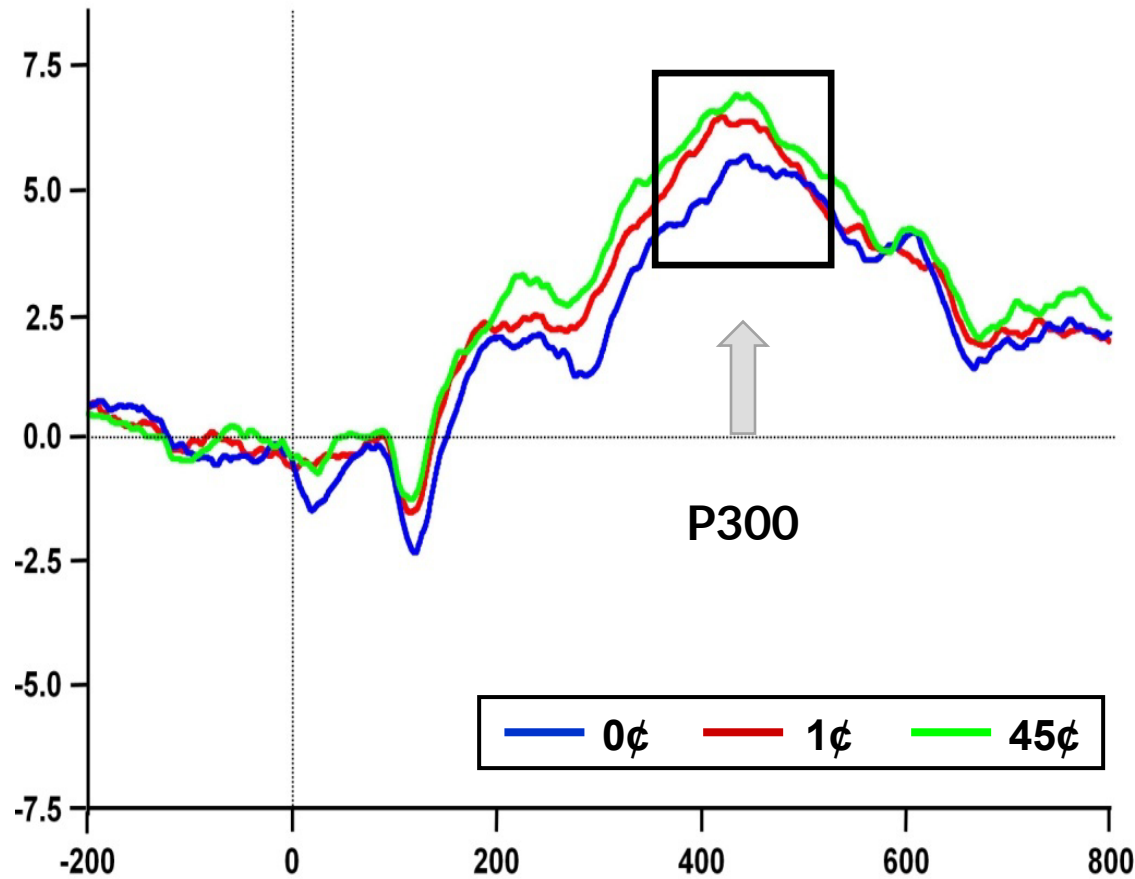
Each condition contains 18 3.5 sec trials (9 Go and 9 No-Go trials):



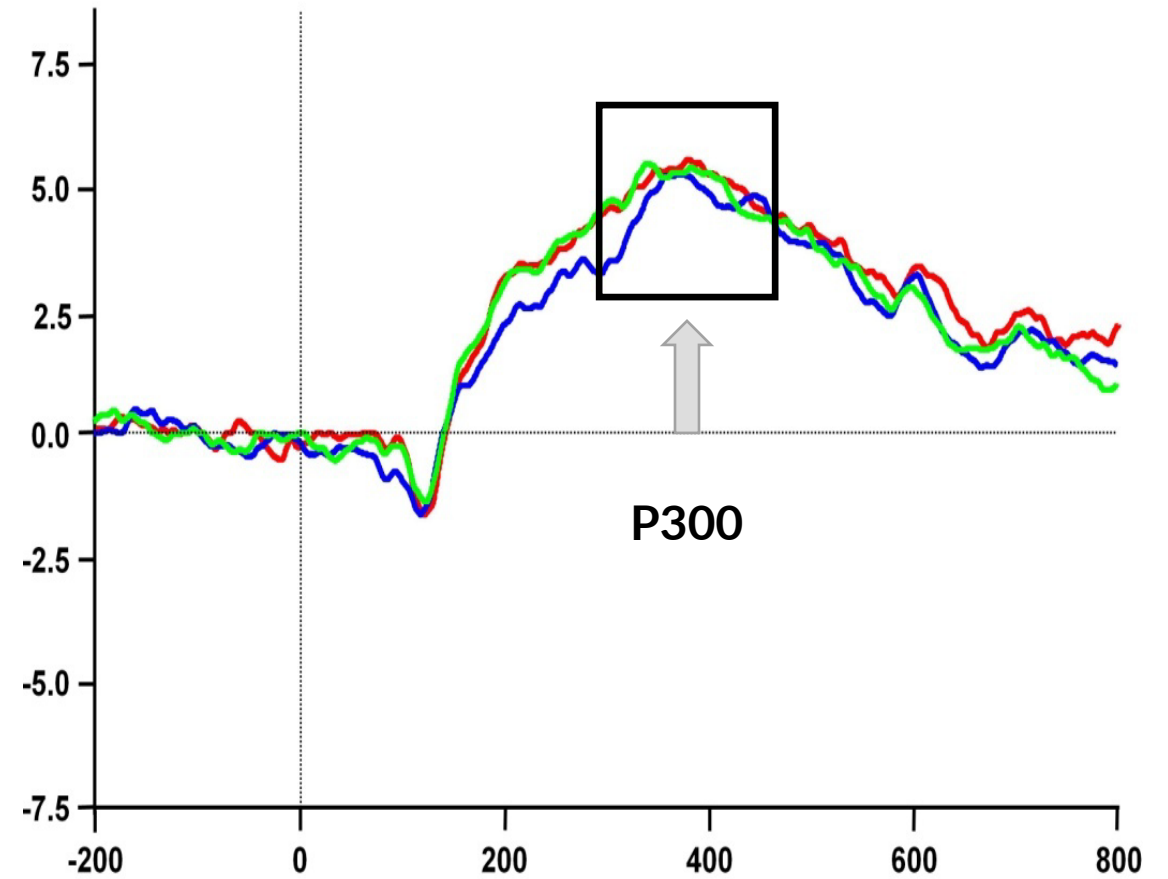
Instructions were to press a button (using the index finger of the dominant hand) on a response pad with speed and accuracy upon seeing the target (S2) after a “Go” but not after a “No-Go” stimulus (S1).

ERPs for Non-Drug Reward

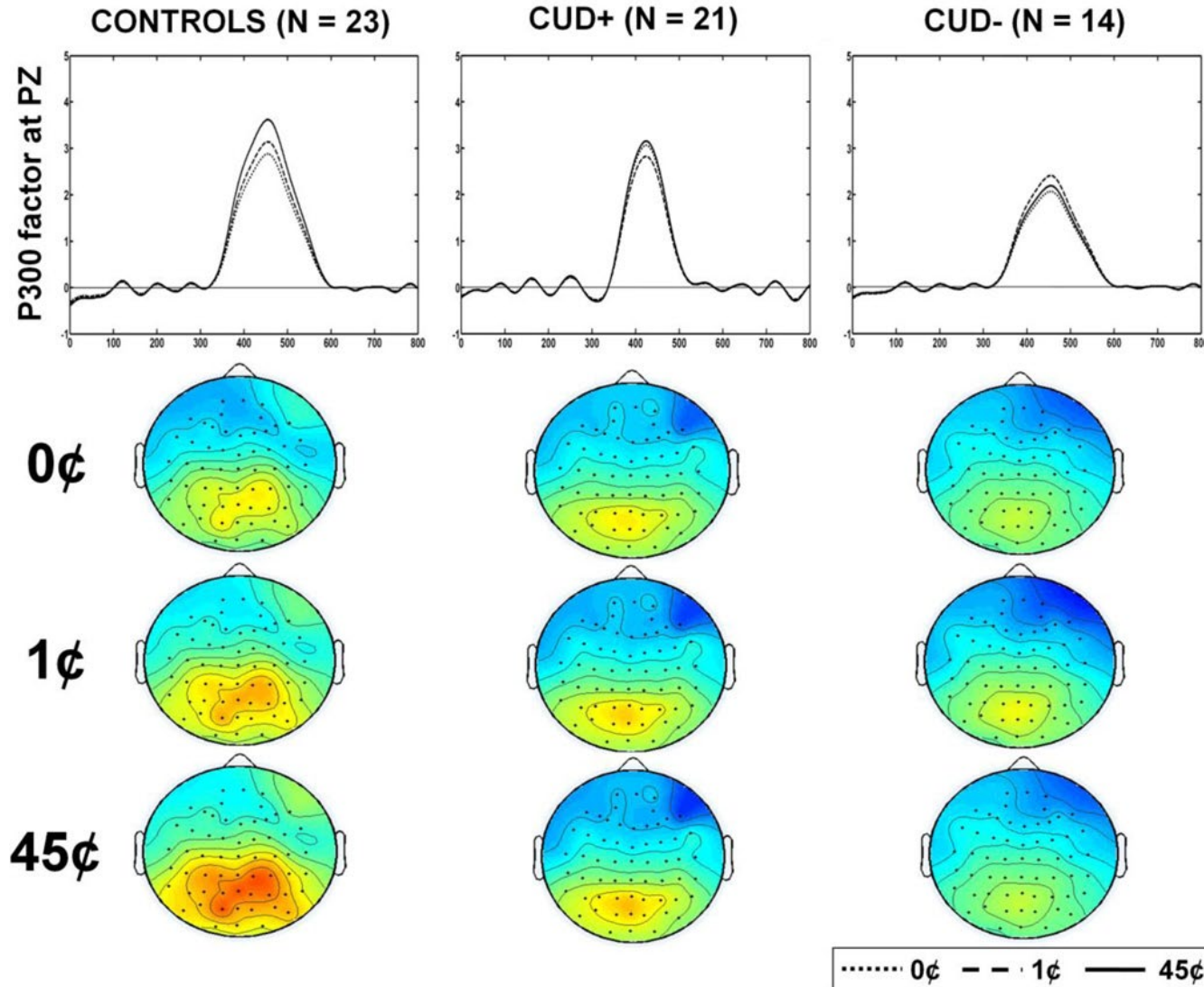
Controls (N = 18)



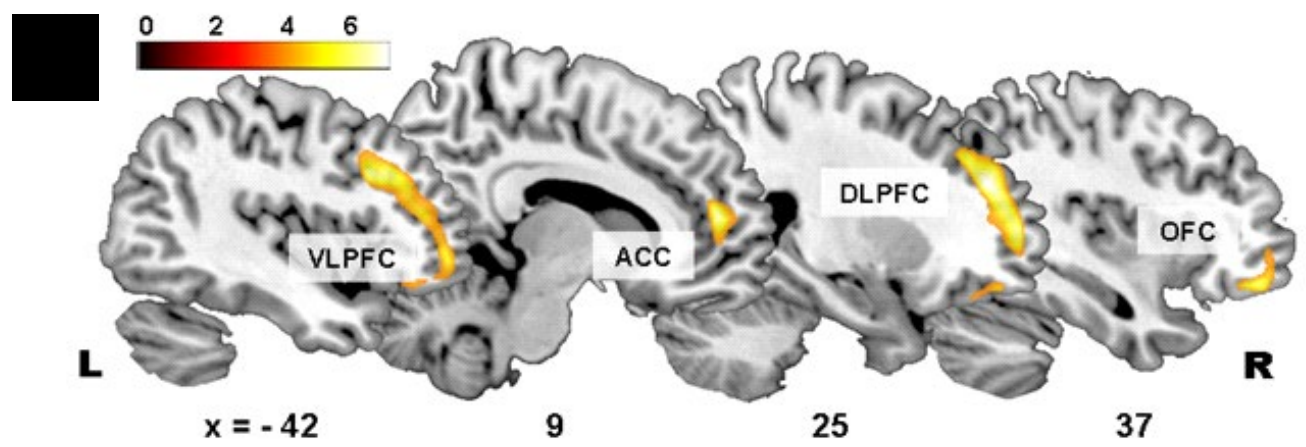
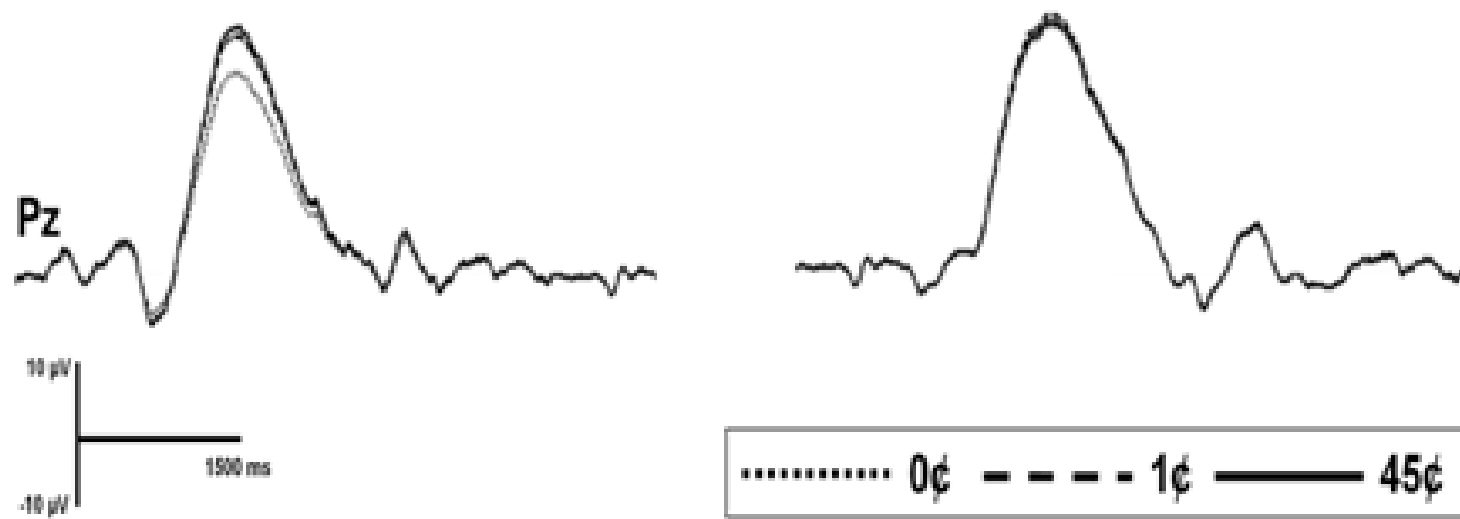
Cocaine (N = 18)



ERPs for Non-Drug Reward



ERPs for Non-Drug Reward

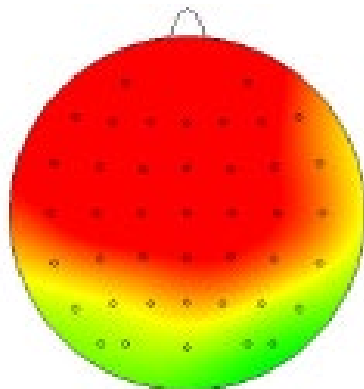


ERPs for Drug Cue Reactivity

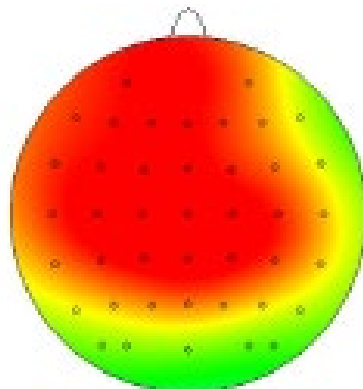


ERPs for Drug Cue Reactivity

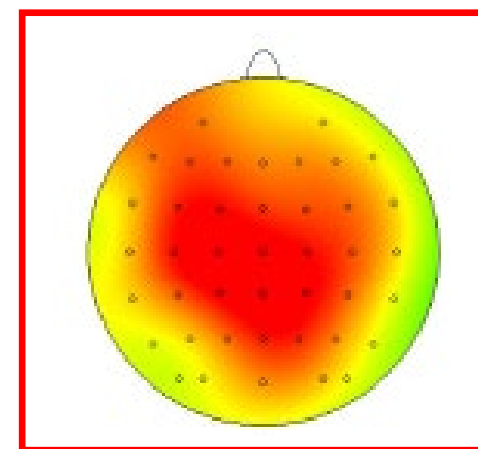
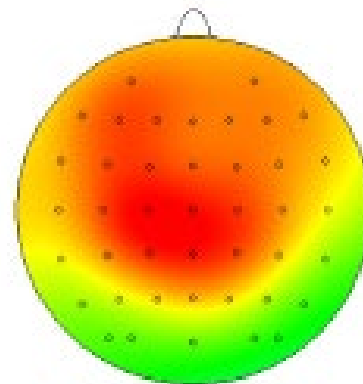
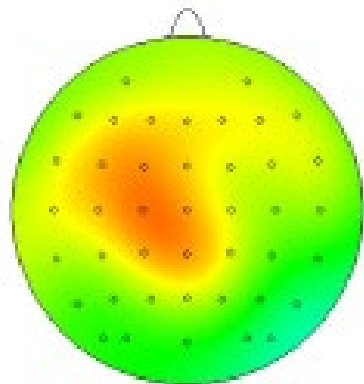
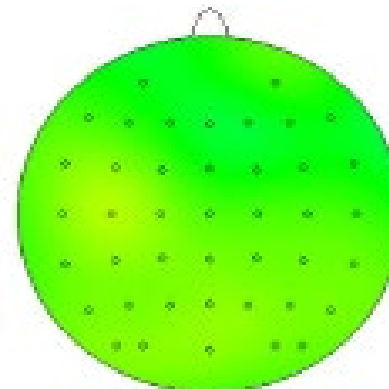
Pleasant - Neutral



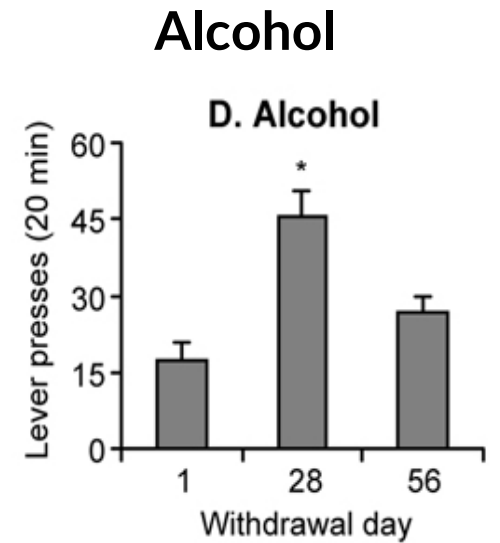
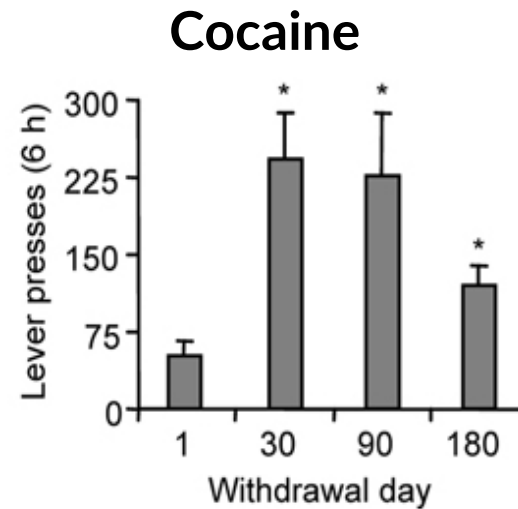
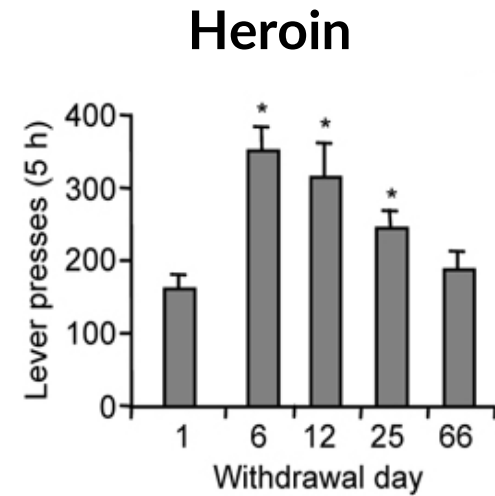
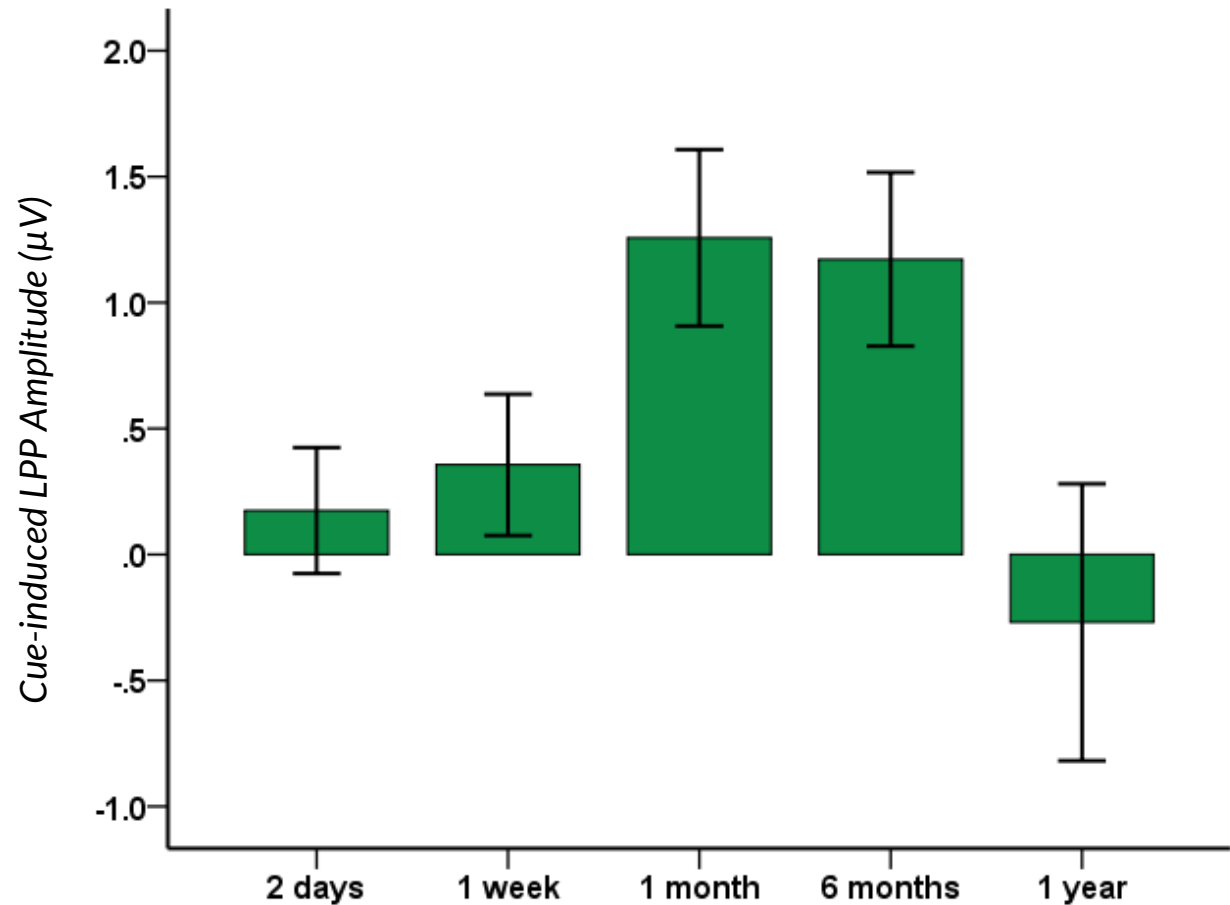
Unpleasant - Neutral



Drug - Neutral



Tracking Changes in Cue Reactivity with Abstinence

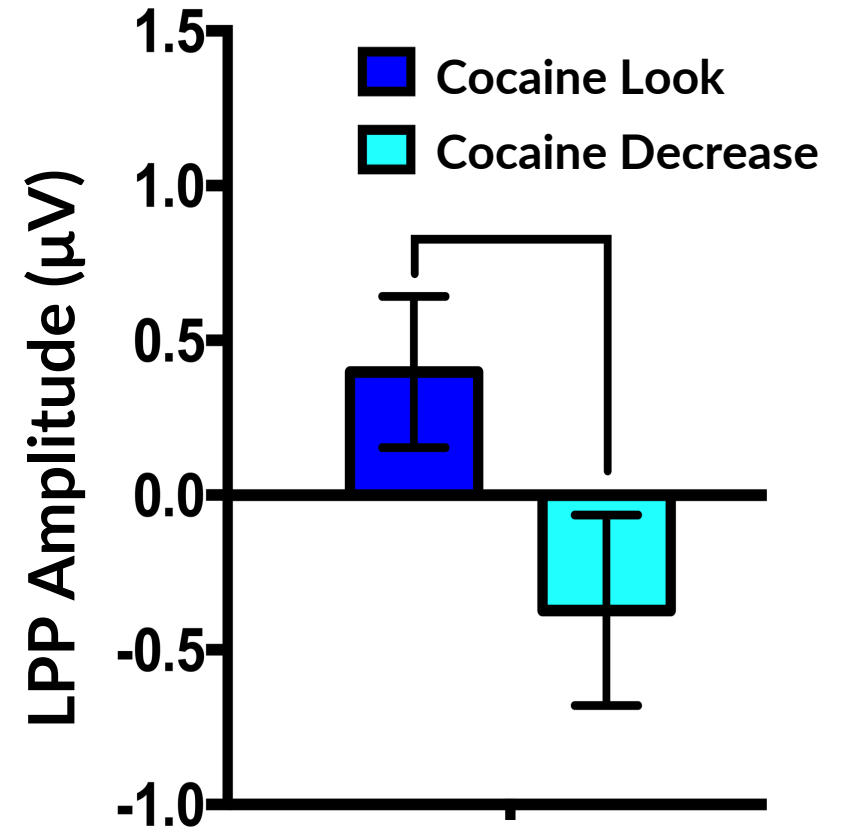
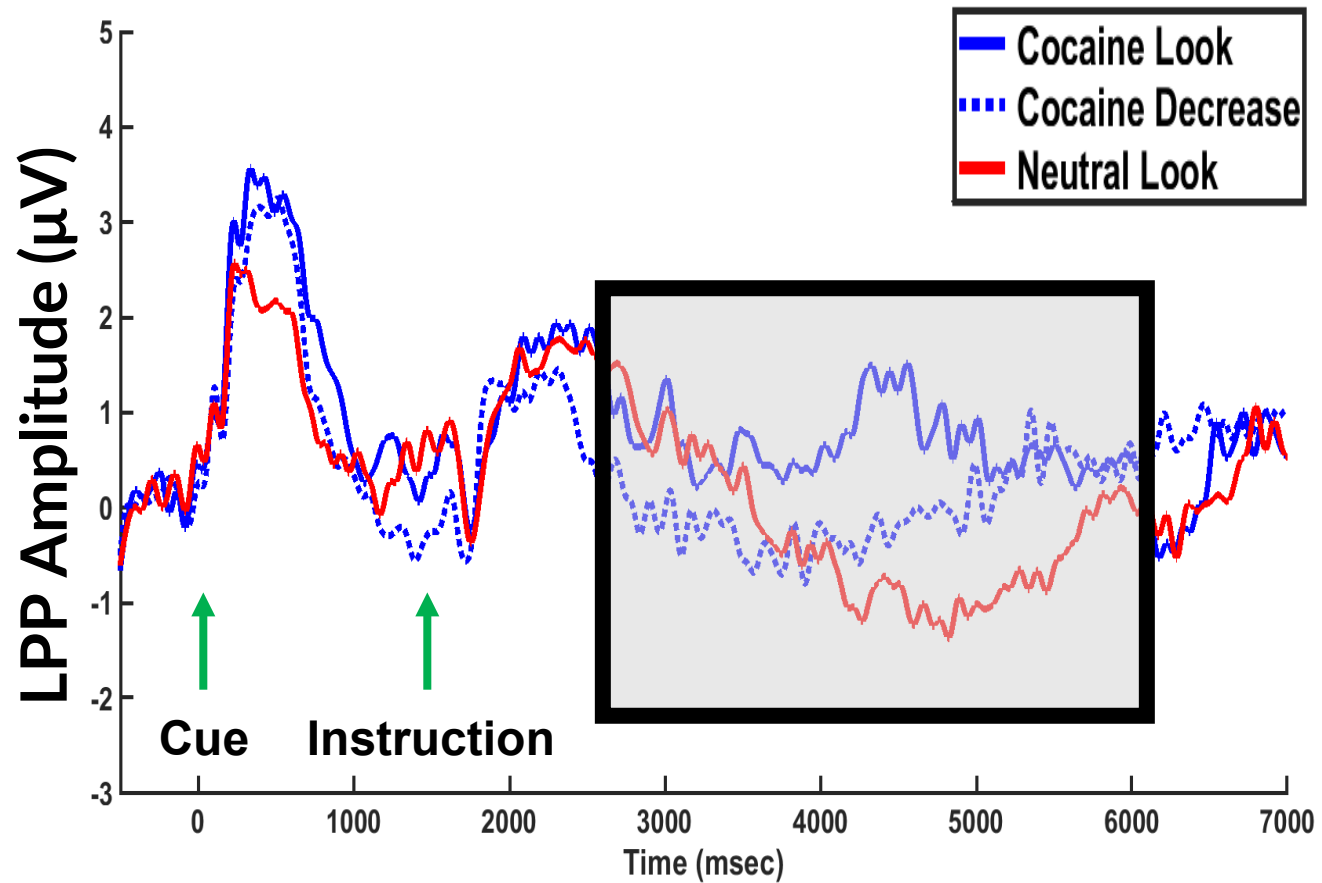


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Tracking Changes in Cue Reactivity with Reappraisal



Tracking Changes in Cue Reactivity with Reappraisal



Final Takeaways

- EEG is a neurophysiological technique to measure brain activity with high temporal resolution.
- ERPs are averaged brain activity elicited by a specific stimulus.
- ERPs can be used to study impairments in brain function, for example, sensitivity to non-drug and drug related reward.
- Each peak and trough of an ERP is a neurophysiological correlate of a specific brain function.
- P300 can be used to study impaired sensitivity to non-drug (monetary) reward magnitude in individuals with cocaine use disorder.
- LPP can be used to study heightened reactivity to drug reward (or cue-reactivity) in individuals with cocaine use disorder.
- Drug cue-reactivity increases (incubates) during the initial stages of abstinence, while self-reported craving decreases.
- Drug-cue reactivity can be decreased using emotion regulation techniques such as cognitive reappraisal.

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