I like it like that: reward discounting and appetitive responses to amphetamine in a drug naïve sample of healthy adults

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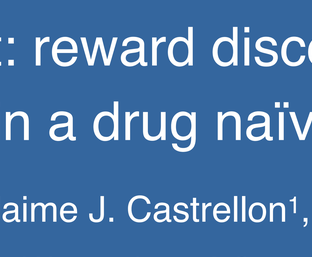
Introduction

Temporal discounting of monetary rewards has been shown to be increased in various forms of addiction. In particular, abuse of psychostimulants like cocaine and methamphetamine have been linked to higher discounting of delayed rewards and increased reward sensitivity. It has been speculated that the underlying neural circuitry that supports discounting behavior also supports appetitive responses to reinforcing drugs. We sought to identify whether individual differences in monetary reward discounting behavior in drug-naïve adults explained subjective responses to amphetamine—a dopamine agonist that has similar properties to cocaine and methamphetamine. **Goal: connect neural mechanisms underlying subjective drug experiences to delay discounting.**

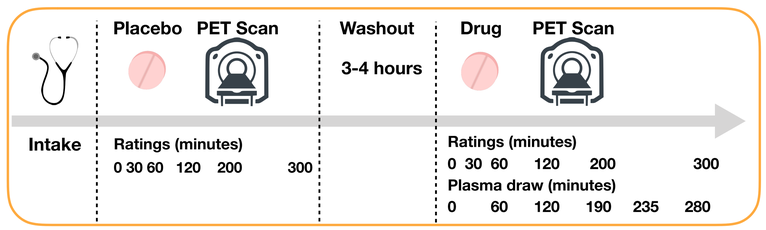
Methods

Healthy adults (N = 21, Mage = 35.7, SDage = 7.6) completed a **delay-discounting task** for monetary rewards (41 trials) in a behavioral lab. Choices were fit using a hyperbolic value function to estimate time discount rates (k). As usual, the distribution of k was skewed so the scores were transformed (ln(k)+1). One random trial from the task was selected for monetary payment (Amazon gift card).

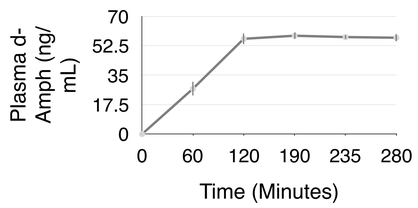
$$SV = R\left(\frac{1}{1+kC}\right)$$



On a separate visit several weeks later (Mdays = 43, SDdays = 26), the same participants received 0.4 mg/kg of **oral placebo and d-amphetamine** (Mdose= 29.8 mg, SDdose = 5.36 mg) prior to a PET scan. Subjective ratings after placebo and drug were collected using the **Drug Effects Questionnaire (DEQ)** in which participants identified how much they: **Feel High, Like,** Dislike, Feel, and Want more of the drug.



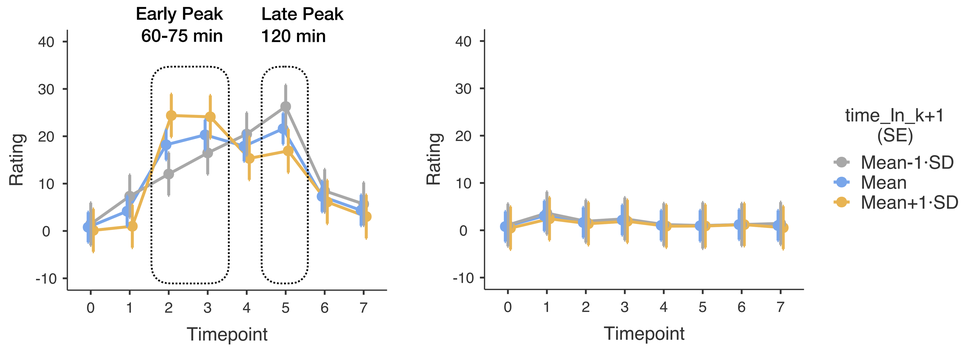
Plasma samples confirmed that the drug reached peak around 2 hours after ingesting and this peak was highly consistent across participants.



Results

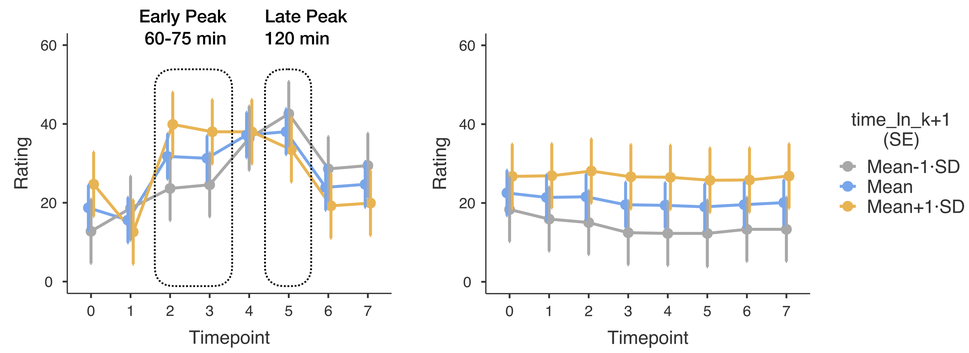
DEQ Feels High

Non-significant interaction between time, drug condition, and delay discounting (k), $F_{7, 266}$ = 0.755, p = .626, but simple effects analyses suggested that high discounters felt highest earlier and low discounters felt highest later.



DEQ Liking

Non-significant interaction between time, drug condition, and delay discounting (k), $F_{7, 266}$ = 1.30, p = .249, but simple effects analyses suggested that high discounters experienced peak drug liking earlier and low discounters experienced peak drug liking later.



Conclusions

High discounters felt higher and rated liking the drug more than low discounters sooner after drug administration. While high discounters peaked in feeling (and feeling high from) the drug approximately 60 minutes after drug administration, low discounters did not peak until 120 minutes after drug administration. This analysis is the first to identify a relationship between appetitive drug responses and a behavioral measure of reward sensitivity. Observed effects in this drug-naïve sample suggests the presence of underlying **individual differences in susceptibility to appetitive drug responses**. In this sample we also collected a neuroimaging measure (fMRI) of learning but not discounting. However, in a recent study that included self-reported effects during d-Amph administration we also collected fMRI data during a probabilistic effort-based decision task to examine generalizability and connect these effects with measures of brain function.

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