Neural Mechanisms Mediating Perceived Need for Drug Abuse Treatment

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The Neuroeconomics of Cocaine Use

Neuroeconomics is an interdisciplinary field that explores human decision making with neuroscience, economics, and cognitive psychology.

Two cognitions that may explain cocaine user’s lack of perceived need for treatment: *delay discounting* and *motivated reasoning*.
Neuroimaging of Perceived Need

• Inclusion criteria
  • Cocaine dependence
  • 18-45 years of age
  • must have used cocaine within past 30 days
  • cannot have been in treatment in past 30 days

• Exclusion criteria
  • MRI contraindications; pregnancy; claustrophobia

• Participant Demographics
  • n=11; age (mean±sd) = 37±6.3 years; 8 male/3 female
  10 African-American / 1 Caucasian
Delay Discounting

• Also known as intertemporal choice behavior
• We devalue delayed rewards relative to immediate rewards
  – $100 now vs. $200 now
  – $100 now vs. $200 in 5 years
• Cocaine users’ belief that they do not need treatment may stem from devaluing the long-term benefits of cocaine abstinence in favor of immediate reinforcers
• Sets of 25 decision making trials, divided into 2 runs
• Randomized delay intervals
• 1 month, 6 months, 1 year, 5 years, and Today (control)
• Smaller amount adjusted during task based on previous choice
Decision Making Trials vs. Control Trials
Adolescent (n=30)

- Amygdala (reward processing)
- Ventromedial prefrontal cortex (reward processing)
- Hippocampus (memory formation and retrieval)

Decision Making Trials vs. Control Trials
Cocaine Adults (n=5)

- Insula (processing interoceptive stimuli)

Kilts & Stanger (R21 DA029442)
Valuation network activity correlates with impulsivity in delay discounting

Kilts & Stanger (R21 DA029442)
Increasing impulsivity correlates with increasing belief in ability to make change in behavior.

\[ R^2 = 0.1744 \]
Motivated Reasoning

- People bias their decision making process to arrive at preferred outcomes

- *Example*: Perception of Political Party candidates
  Westen, Blagov, Harenski, Kilts and Hamann, 2006

- Cocaine users may overly engage in these “mental gymnastics” to justify cocaine use despite its negative consequences
Cocaine-related Motivated Reasoning Paradigm

- Participants view 2 conflicting statements
  - *Drug use* and *non-drug use* statement pairs
- Participants consider and rate how much these 2 statements conflict each other
- Participants view a third *exculpatory* statement
- Participants then reconsider and rate how much these statements conflict each other
Cocaine-related Motivated Reasoning

Sample Drug-use statement

Initial: “Why would I want to get treatment for my drug use when everyone knows that treatments don’t work?”

Contradictory: Last year over 300,000 people with drug use problems were able to stay clean from drug use following treatment.

(Participants rate conflict between statements)

Exculpatory: Most people with drug use problems start using drugs again within 6 months of receiving treatment.

(Participants rate conflict between statements)
Cocaine-related Motivated Reasoning

Sample Non-Drug Use statement

Initial: “I’m a hip hop artist and have never liked Country Western music.” – DJ Ice, 1980.

Contradictory: “I am excited about my new Country Western album. It will be fun to try a new kind of music.” – DJ Ice, 1990.

(Participants rate conflict between statements)


(Participants rate conflict between statements)
Neuroimaging Results

Political Partisans (n=13):
Contradictory vs. Exculpatory Statements for preferred candidate

Cocaine users (n=8):
Contradictory vs. Exculpatory Statements for Drug Use Statements

Cocaine users (n=8):
Contradictory vs. Exculpatory Statements for Non-Drug Use Statements
Why do cocaine users show orbitofrontal activity during both drug-use and nondrug-use statements?

Behavioral data shows comparable conflict for both conditions!

Westen 2006: Political partisans see more conflict in statements by other party than for their party.

Pilot Study: Participants saw conflict for both Drug use and Non-drug use statements.
But, Readiness for Treatment Ruler correlates with Perceived Conflict of Drug use Statements

$R^2 = 0.1935$

$R^2 = 0.0003$
Conclusions

• Both Delay Discounting and Motivated Reasoning may contribute to the inability of cocaine users to recognize a need for treatment
• The Perceived Need Rulers add additional behavioral insight by which neuroimaging data may be interpreted
• With a larger sample, we will better be able to tease apart the cognitions justifying substance dependence despite its debilitating consequences
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