Too much dopamine can be bad for you: I. Addiction

PSY/NEU338: Animal learning and decision making: Psychological, computational and neural perspectives

drugs addiction

- huge and diverse field of research (many different drugs)
- addiction (abuse) = continued making of maladaptive choices even in the face of explicitly stated desires to do otherwise (Redish et al. 2008)
- fundamental problem: relapse
- addictive drugs thought to access same neurophysiological mechanisms as natural rewards, just in an aberrant way
- e.g., drugs that increase availability of dopamine (directly: amphetamine, cocaine or indirectly: heroin, nicotine) are addictive
models of psychopathology

- Model = any experimental preparation developed for studying a condition in the same or a different species
- usually try to imitate a condition in humans
  - neuropathology
  - psychopathology
- Construct validity (similar etiology) examples?
- Face validity (the behavior in the model resembles the symptoms of the disorder) examples?
- Predictive validity (model with pharmacological similarity to the disorder; screening tests) examples?
- a good model will have predictive validity (otherwise we can’t do much with it); structural validity is good (but don’t always know cause); face validity is nice but not necessary

is there a good animal model of drug abuse?

- can give animals drugs and see effects
- …also need a model of an animal choosing to take the drug, relapsing, even at a cost
- at minimum: compare to natural rewards to study differences not commonalities

Model of relapse: Reinstatement (what types of validity does it have?)
how can we make our computational models ‘addicted’?

- goal: the model inappropriately selects to take the drug (in face of other rewards)
- explain some phenomena of addiction: likelihood to select drug is sensitive to length of exposure to drug, size of other non-drug rewards, and cost (but ultimately the demand is inelastic, or at least not as elastic as that for natural rewards)
- Redish (2004) - addiction as a computational process gone awry
- predictions?
- note: “A neuropharmacologically driven increase in dopamine is not the sole effect of these drugs, nor is it likely to be the sole reason that drugs of abuse are addictive.”

is drug abuse a habit?

- drugs: initially used voluntarily due to rewarding/hedonic value, slowly transition to habitual and compulsive behavior (loss of control over behavior)
- why are drugs compulsive? become S-R habits
- how does this explain elaborate, seemingly goal directed behavior?
- distinction between drug taking and drug seeking behaviors

**vulnerabilities in decision making**

| 1. disrupted planning (tree search) | 1. overestimate outcome value | 1. disrupted PEs 
| 2. incorrect state space (overgeneralize → perseveration, overclassify → illusion of control) | 2. too steep discounting | 2. altered learning process due to abnormal learning rate, attention |

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<th>goal-directed system</th>
<th>habit system</th>
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2. incorrect state space (overgeneralize → perseveration, overclassify → illusion of control)

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- Overestimate outcome value
- Too steep discounting
- Disrupted arbitration (goal-directed can’t override habits)