Lecture 10.2 Exercises

1. Your misguided classmate publishes a prominent article containing a new theory of dopamine function. Your classmate argues that dopamine is actually not related to reward prediction error, but instead is a signal of attentional salience. In particular, your classmate argues, dopamine neurons will be excited by any surprising, salient (i.e., important or attention-grabbing) event, whether it be positive, negative or neutral.

   a. Give an example of a surprising event that is known not to activate dopamine neurons, contradicting your classmate's theory.

   b. You further point out that dopamine apparently plays a causal role in certain behaviors, which is well explained by a reward prediction error theory but not by an attention signal. Give an example of a behavior believed to be supported by dopamine, and explain why this function can be understood given a reward prediction error theory but not if dopamine signals surprise.

2.
   a. Just for laughs, your classmate secretly injects a drug into the globus pallidus, external segment (GPe) of another classmate. The drug causes neurons there to become less active, and causes your drugged classmate to exhibit misbehavior during the lecture. What sort of symptoms would you expect to see and why?

   b. Now suppose you tested the victim's cognitive abilities using the probabilistic selection task that Frank et al. (2004) used with Parkinson's patients. According to Frank et al.'s reasoning, would you expect her to do better learning to choose rewarded actions, or avoid unrewarded ones? Why?

   c. And how would you expect this behavior to change if she were treated with a dopamine antagonist, i.e. a drug that blocks the action of dopamine?