Influence of reward on attention selectivity in Parkinson's disease

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Background

- Executive function deficits are common in Parkinson's disease, even early in the course of disease[1]. Among these, **attention** impairments are common[2].
- **Dopamine-dependent reward processing** is also disrupted in Parkinson's disease[3] but if and how this *directly* contributes to early executive dysfunction is unknown.
- The allocation of attention, i.e. selective attention, is known to be guided by environmental reward signals [4].

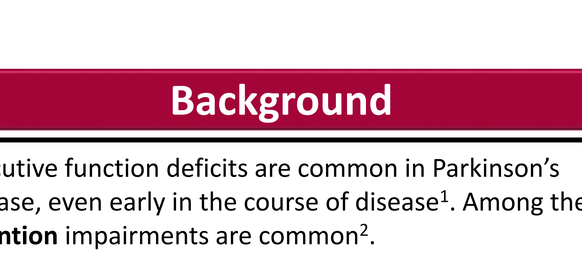
1. **Are Parkinson's patients impaired at using reward information to guide the allocation of attention?**
2. **Does dopamine replacement alter the selective allocation of attention?**

Methods

Task: A two-phase selective attention task. Patients (n=24) were twice: ON and OFF their dopamine medication, and compared to older controls (n=28).

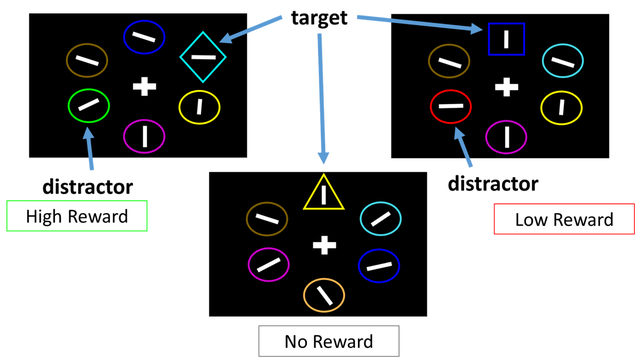
Phase 1: Reward Learning (240 trials)

- Report the orientation of a white bar in either a red or green target
- Trials are *differentially rewarded* for correct answers depending on the target color (1 vs. 10 points)
- **Participants learn to associate each color with either a low or high reward**



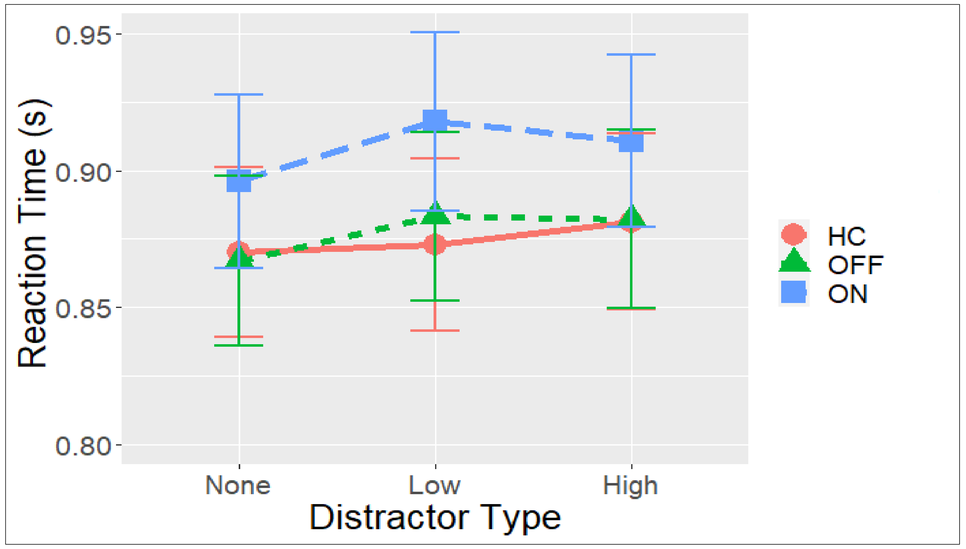
Phase 2: Attention Test (240 trials)

- Report the orientation of a white bar inside a target.
- Target = "The Unique Shape"
- On 2/3 trials either a Low or High reward distractor (i.e. a shape that is either red or green) is present. On 1/3 trials, no distractor is present.
- **Slowing of responses occurs when previously rewarded colors are present, and depends on reward level**



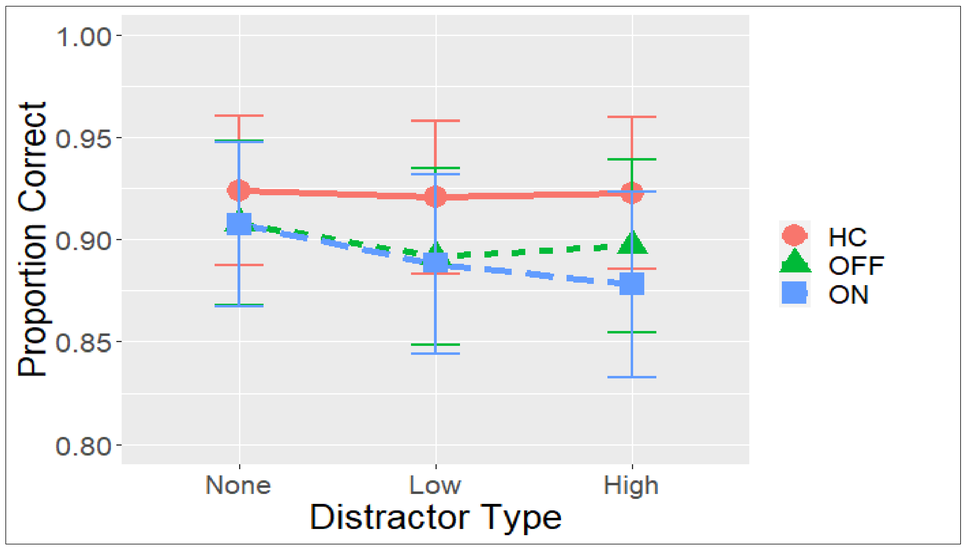
Results

Effect of reward and dopamine on attention: Reaction Time



- Healthy controls were sensitive to reward level: they were slowed by high (p=0.049) but not by low (p=0.58) reward distractors
- **Parkinson's patients were not sensitive to reward level**: responses were similarly slowed for both high (p=0.016) and low (p<0.001) reward distractors
- **Patients were not more 'distractible', overall, than controls**
- Though dopamine medication caused overall response slowing, **dopamine did not modulate the effect of reward on attention, nor did it modulate overall distractibility**

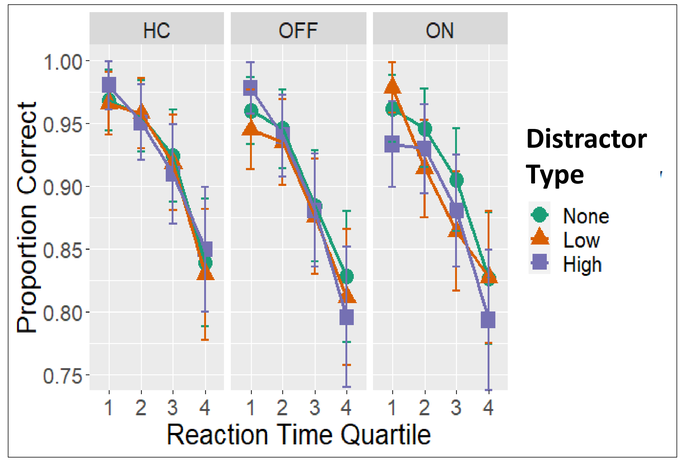
Effect of reward and dopamine on attention: Accuracy



- Reward did not influence accuracy in either patients (p = 0.130) or controls (p = 0.162)
- Dopamine medications did not modulate the effect of reward on accuracy

Results

Speed accuracy tradeoff



- In Control subjects, there was no effect of reward on the speed accuracy trade-off
- In Patients, regardless of medication state, reward did not influence the speed accuracy trade-off

Summary and Discussion

- **In older controls, reward influences the allocation of attention: higher value but not lower value distractors slow performance.**
- **In contrast, Parkinson's patients do not allocate their attention according to reward level: both the high and low value distractors caused similar slowing. Importantly, patients show the same overall attention capacity as controls.**
- **Surprisingly, dopamine medications did not modulate the influence of reward on attention.**
- **These results suggest that attention impairments in Parkinson's patients may be due to an inability to triage information for processing based on its reward association, rather than due to an overall reduction in attention capacity.**

References:

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