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Research Plan Research Projects 2H

A. Rationale

The underlying mechanics of cognitive functions have eluded us until very recently. While general thought about cognition extend far back in intellectual history, formalized scientific research began in the 1950s (Thagard, 2018). Currently, cognitive science spans a wide range of fields and serves as a multidisciplinary culmination of methods and perspectives.

In the span of cognition, decision making plays a wide role in everyone's lives. Value based decision making (VBDM) refers to decision making based on the value of options rather than shape or color. Previous work has focused on two components, appraisal and choice which are crucial to the understanding of the underlying processes involved in decision making. Appraisal is associated with the valuation of options, while choice reflects the comparison between options. This comparison process can be investigated using computational models, such as the drift diffusion model (DDM), to understand what mechanisms drive changes in behavior, as measured by choices and response times.

Recent cognition studies show that visual attention plays an important role in decision making that can be captured with modified drift diffusion models that take attention into account (Krajbich et al., 2011, Cavanagh et al., 2014). These models predict that if participants have a bias in the way they look at the items during choice (e.g. systematically from left to right), then they should show a similar bias in their choices (e.g. Froemer & Shenhav, 2019a).

While attention is understood to affect VBDM, it is not understood to what extent attention these attention effects depend on value. There are two discrepant sets of previous

findings: On one hand additive effects have been found (Cavanagh et al., 2014), where attention increases the probability of choosing an item regardless of value. Alternatively, a multiplicative relationship has been proposed, such that attention amplifies an item's original value, low value items are less likely chosen and high value items are more likely chosen as attention to them increases (Krajbich et al., 2011). In previous studies, participants could shift their gaze and thereby their attention freely from one item to the other. It is therefore difficult to dissociate pure attention effects on choice from effects of value on attention and choice. To illustrate, if I am considering which ice cream flavor to buy, I will look more at flavors that I enjoy, and I will also be more likely to choose a flavor I enjoy. While there will be a relationship between my gaze and my choice, this relationship will be explained by my flavor preferences and potentially mask the additional effect of attention on choice that tipped my decision between chocolate and strawberry.

Understanding the link between attention and choice might help better understanding maladaptive decision making in clinical populations (e.g. impulsivity, OCD) and offer a starting point for targeted treatment. My research in decision making also will benefit the greater good as typical decision making can always be improved by the manipulation of one's attention.

B. Research Question(s)/Hypothesis(es)

In my research I hope to discover how value and attention interact on choice. When value is varied it is important to deeply understand the impact attention has on final choice. I hypothesize that attention will amplify the impact of value on choice and RT, implying a

multiplicative relationship in VBDM. This effect will be captured in variation of drift-rate (or signal) parameter in the hierarchical DDM (HDDM).

C. Detailed description of methods or procedures, Risk and Safety Analysis, Data Analysis

I will be using previously de-identified choice and reaction time data from a previous study investigating the role of order on choice. In this study, value, order, and attention are independently manipulated in a controlled sequential presentation paradigm, allowing for the investigation of pure attention effects (Fromer & Shenhav, 2019b). I will be using HDDM modeling to test how attention affects choice under these conditions. To that aim I will compare a model with additive effects of attention to a model with multiplicative effects of attention and value on choice. Based on previous work, I will specifically test how attention and value modulate the drift parameter in the HDDM which reflects the signal strength in Python. After discovering the model with the best fit of the original data (illuminated through Deviance information criterion), I will compare the posterior predictive statistics of the "winning" model and the original data in R.

Sources

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Post Summary

No changes were made to this research plan.