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Thesis abstract

Extending and testing the components of evidence accumulation models of decision-making

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Past decades of research within the area of decision-making have had a large focus on advancing process models, which contain theoretically meaningful parameters, in order to better understand the processes that underlie decision-making. One of the most popular types of process models in decision-making research have been evidence accumulation models (EAMs), which propose that decision-making is made up of some process where evidence for the various alternatives accumulates over the course of a decision, until it reaches some threshold value, where the decision is triggered. Importantly, EAMs have enjoyed a great deal of success in being fitted to empirical data, being able to successfully account for a wide range of phenomena and helping to answer theoretical questions that would have been nearly impossible to answer without the use of a process model. This thesis aims to accomplish three main goals: to extend EAMs to new research areas to help solve novel empirical questions, to test newly proposed components that could potentially be added to existing EAMs, and to propose a new method of how to test between models in the EAM framework to answer empirical research questions. The first goal is addressed in Chapters 2 and 3, which apply the linear ballistic accumulator (LBA) to personality and genetics research, respectively, which are two areas previously unexplored with EAMs. The second goal is addressed in Chapters 4 and 5, which assess whether a newly proposed component of EAMs, a threshold that decreases over the course of a trial (collapsing threshold; or a mathematically similar urgency signal) can be justified in empirical data. The final goal is addressed in Chapter 6, which presents a new method of calculating Bayes factors — a method of selecting between competing models — for the LBA using Monte-Carlo integration and general-purpose graphics processing unit computing. Generally speaking, the findings indicate: that EAMs are capable of extending to the fields of personality and genetics, that the proposed component of a collapsing threshold is not necessarily justified within the EAM framework, and that the use of Bayes factors through Monte-Carlo integration improves upon previous methods of model selection.

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