

Effect of Context and Exploration on Choice Optimization in Rat and Human

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(ラットおよびヒトにおける選択最適化に対する文脈と探索の影響)

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論 文 内 容 の 要 旨

Behavior analysis has been established to develop a comprehensive approach to understand the behavioral principles of organisms. As such, experimentations and behavioral observations under laboratory conditions are expanding from animal to human experiments observed in various learning contexts. In learning theories, contextual behavioral control has been a topic of interest for many years. It's known that behavioral responses and action choices are driven by the reinforcement received in a context during learning the associations between stimuli and outcomes. Yet, little is known about which factors determine the strategy of choice behavior during decision-making, and how stimulus representation and type of information influence future choices. Animals tend to explore and resolve the ambiguity of the context by collecting information. Many studies have supported that animal's behavior and responses in a learning context involves more than a conditioned response to a simple stimulus-action association or to a simple behavioral reinforcement during learning process. As such, it involves more complex cognitive process and information seeking in order to allow for the organisms to disambiguate the information in a context and optimize their choices.

The current sets of studies aimed to consider the information and stimuli type in different learning contexts in order to examine to what extent contextual factors influence future responses towards optimal choice. Using animal and human subjects the effect of previous learning and experience on future choices were examined by offering a transition from familiar to novel option. The dissertation contains of four main studies divided into four chapters. The first two chapters, rats were used as experimental subjects in order to understand the influence of contextual factors and experience on optimization in behavior

responses. In chapter 1, I investigated the influence of multiple action-outcome association on choice behavior in the context of rewarding outcomes (food) and aversive outcomes (electric foot-shock). Groups of rats were trained to do nose-poke responses while their behavior associated with either a single action-outcome association (“Reward-Only”) or dual action-outcome associations (“Reward-Shock”; with the added opportunity to avoid an electric foot-shock) with different levels of threat (a low- or high-amplitude electric foot-shock). The data suggested that the strategy of choice behavior was modulated by the information complexity of the environment. In chapter 2, further investigations about the type of information and to what extent the spatial distribution of a stimulus will restrict or facilitate exploration and optimizing behavior was tested. The results revealed rats trained to give responses within the same spatial direction developed attention bias to the old choices and produced an inflexible form of behavior orienting when new choices were offered in the context. From chapter 1 and 2, as general implications, the data suggests that the basic behaviorism accounts alone, model-free, are not able to interpret the behavioral responses however; behavioral responses are more of a reflection of cognitive process and information abstraction, model-based.

In chapters 3 and 4, experimentation expands from animal to human subjects. It would be important to address in these chapters to what extent humans as well as rats share the same orienting mechanisms during learning and deliberation. In chapter 3, the studies examined how information and previous experience will modulate and affect the explorative behavior and curiosity towards the future choices. The data revealed transition dynamics to new options was clearly influenced by the context of the previous training. In chapter 4, the eye-movements were measured during decision to understand the cognitive process associated with the role of gaze. The results showed that the gaze is a predictive of choice in a task that requires learning and updating information in a context. Taken together, the current thesis provides a contribution to the literature of cognitive and behavioral science and emphasis on the role of cognition during decision-making process.