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

ノハ，モフセン，アブデルアジズ，アブデルラフマン，ゾマラ

（様式６－２）

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論　文　名	Effect of Context and Exploration on Choice Optimization in Rat and Human（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　審　査　の　結　果　の　要　旨

This research uses behavioral analysis with rats and humans to examine the role of context and prior learning in decision-making, particularly in choice situations in which exploration can lead to optimizing the reward intake.

The present series of studies started from the general hypothesis that the choice optimization depends on information-oriented exploration and learning processes. As such, the basic idea is that information acts as an intrinsic reward, which can reinforce the behavioral choice beyond direct associations between primary rewarding outcomes such as food or aversive outcomes such as an electric foot-shock. This means that the research works from the hypothesis that the dominant theories such as classical conditioning and operant conditioning are incomplete, and must be changed to include cognitive processing and information-oriented attraction (i.e., the “information hypothesis”).

In the first set of experiments, in rats, this thesis provided evidence in favor of the information hypothesis by setting up a choice situation between an old option and a new option with a higher reward value. The question was how soon the rats would shift to the new option with a higher value. This measure captures the transition behavior. Critically, the study compared different reward and information contexts to examine the impact on transition behavior. It was found that rats in a more complex situation (with multiple stimulus-outcome associations) showed faster transition behavior than rats in a simpler situation (with only one stimulus-outcome association). This result could not be explained by classical or operant conditioning but was consistent with the information hypothesis.

In the second set of experiments, also with rats, this thesis further provided evidence in a similar paradigm that prior learning experience had an impact on the information-oriented exploration and transition behavior. Rats trained with multiple spatial mapping conditions showed faster transition than rats trained with only one spatial mapping conditioning. As in the previous set of experiments, the result was consistent with the information hypothesis but not the conventional behavioral theories of learning.

In the third and fourth sets of experiments, the thesis went on to examine the relation

between context, prior learning, and exploration in a gambling task for humans. In addition to the basic behavioral measures of response rates (choice probability and response time), these experiments also used an eye-tracking technique to measure the gaze bias in the subjects. Overall, these sets of experiments indicated some potential differences between rats and humans, in the sense that prior learning had a less noticeable impact in the humans' choice behavior. Several hypotheses for further investigation were raised in the light of this finding. On the other hand, the eye-tracking data and gaze bias analysis also showed a prominent role for information-oriented exploration during decision-making in humans. In this sense, the human study once more corroborated the information hypothesis.

Overall it was found that each of the sets of experiments provided valuable additions to the specialist literature on behavioral decision-making. It was also found that the jump in the studies, from rats to humans, was somewhat too large, or too ambitious, so that, overall, the thesis presented several disparate new findings rather than one tightly connected story. Nevertheless, overall we can certainly acknowledge that the findings are a valuable achievement, providing important new knowledge in the area of cognitive science through behavioral analysis.

Therefore, we conclude that this thesis deserves to be acknowledged as a doctor's thesis (Systems Life Sciences).