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Promotionsverfahren von **Frau M.Sc. Hannah Kurtenbach**
Auslage der Dissertation und Gutachten sowie Termin der mündlichen Prüfung
Anlage: Einseitige Zusammenfassung der Dissertation

Sehr geehrte Damen und Herren,

in dem oben genannten Promotionsverfahren wird die Annahme der Dissertation

Mechanisms of reinforcement learning and decision making in different environments

von den Berichterstattenden Prof. Dr. G. Jocham und PD Dr. J. Hirschmann beantragt. Sie kann zusammen mit den Gutachten in der Zeit

vom 02.12.2024 bis 11.12.2024

eingesehen werden. Bitte wenden Sie sich zur Einsicht an das Promotionsbüro (promotionmnf@hhu.de).

Einsprüche gegen diese Dissertation können nur zwei Tage nach der vorgenannten Frist geltend gemacht werden. Erfolgt kein Einspruch, so gilt die Dissertation als angenommen (§ 7 Ziffer (5) PO).

Sofern die Dissertation angenommen wird, findet die mündliche Prüfung am

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im **Raum 25.32.03.21** statt. Als Prüferinnen bzw. Prüfer sind vorgesehen:
Prof. Dr. T. Kalenscher, Prof. Dr. S. Becker und Prof. Dr. A. Buchner.

Die Öffentlichkeit ist bei der Befragung zugelassen.

Mit freundlichen Grüßen
im Auftrag

Silke Krispin

Mechanisms of reinforcement learning and decision making in different environments

Hannah Kurtenbach

ABSTRACT

For centuries, the question of how humans make decisions has been a subject of scientific research. When addressing the question, however, a decision cannot be considered in isolation; the environment in which decisions are made must be taken into account. Depending on the environment, different decision strategies can be used and be advantageous. If, in addition, relevant information is lacking to form a decision, learning by trial and error also plays a key role in the decision-making process, as feedback must be integrated into future decisions. The decision-making process is a sensitive construct which, when out of balance, is often associated with psychiatric disorders. Neurotransmitters and neuromodulators are, among others, responsible for maintaining this balance. However, their exact role in learning and decision making is not fully understood. This dissertation focuses on the question of how behaviour is adapted depending on the reliability of information and the presence (or absence) of feedback. In addition to the behavioural mechanisms, we also investigated the role of the neuromodulator acetylcholine in decision-making and learning processes. To this end, two studies were conducted with healthy volunteers: In the first study, participants performed two tasks after administration of the muscarinic acetylcholine antagonist biperiden. Their goal was to maximise the gain by choosing one of two options with different reward magnitudes and probabilities. However, only in one task, all the relevant information was given, while in the other task, reward probabilities had to be learnt and these varied over the course of the task. In the second study, participants performed another task in which they learnt the association between visual stimuli and corresponding actions using feedback that was at times removed during the learning process. To analyse the data, we used different computational modelling approaches with the aim of uncovering the underlying strategies and their changes across conditions. Overall, our results show that decision strategies are adapted according to the environment. Participants relied less on information that was associated with uncertainty. Interestingly, biperiden impaired the estimation of uncertain option attributes resulting from maladaptively increased learning rates. In addition, we found that performance improved in the absence of feedback, but this effect only emerged because participants responded more cautiously, which happened to be beneficial in this specific context. This dissertation contributes to the general understanding of decision strategies and the state of knowledge about the effect of acetylcholine on behaviour.