Development and application of an olfactory discrimination paradigm for Asian elephants

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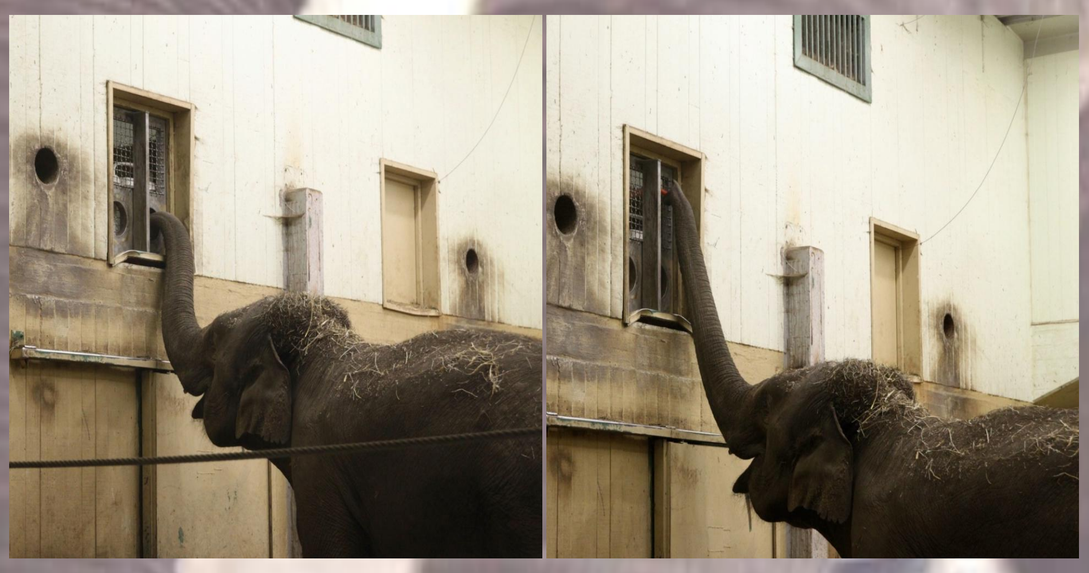
Introduction

Anatomical as well as behavioral evidence suggests that Asian elephants strongly rely on their sense of smell in a variety of contexts such as foraging and social communication. However, so far, no behavioral test to systematically assess the olfactory abilities in this species has existed.

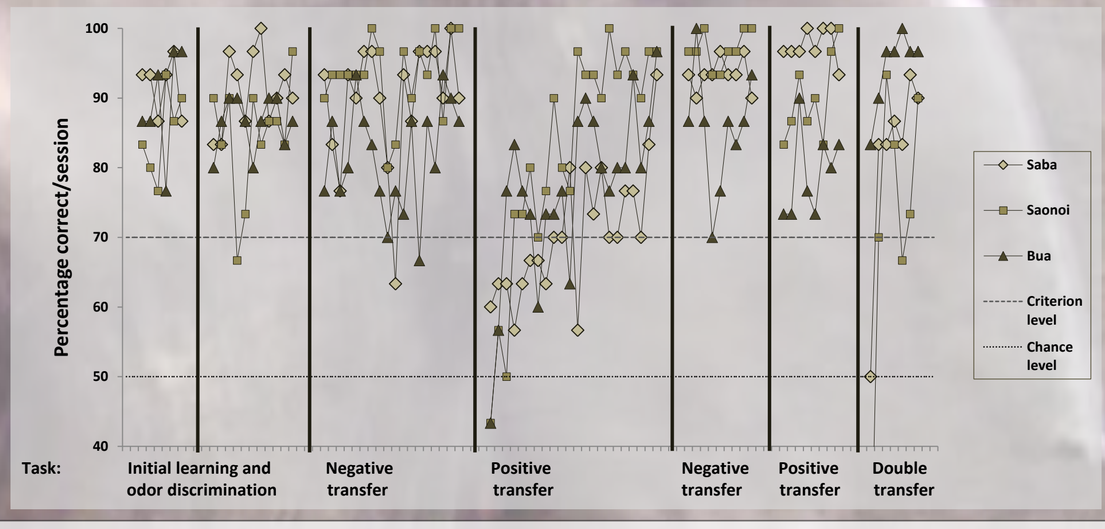
The aim of the study was therefore to train three female Asian elephants to cooperate in an olfactory discrimination paradigm and to collect first data on their olfactory learning speed, memory and discrimination performance and to compare their performance to that of other species.



Materials and methods

The behavioral test was based on a food-rewarded two-alternative instrumental conditioning paradigm. The animals were taught to sample two odor ports and were food-rewarded when they performed an operant response (putting the trunk at a certain position of the experimental set-up) upon correctly identifying the rewarded odor. The training method was based on a voluntary participation of the animals and only positive reinforcement was used as a tool to shape the desired behavior.

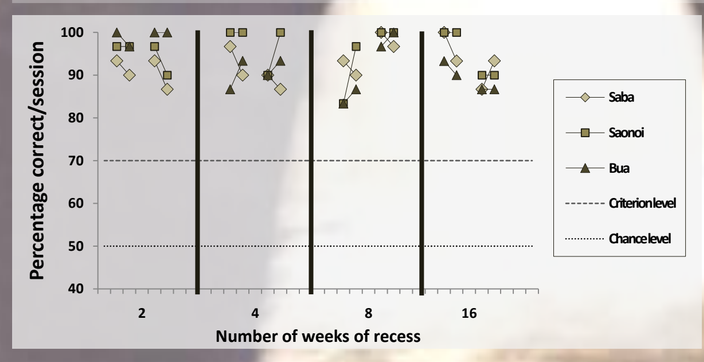
Results - Initial task acquisition

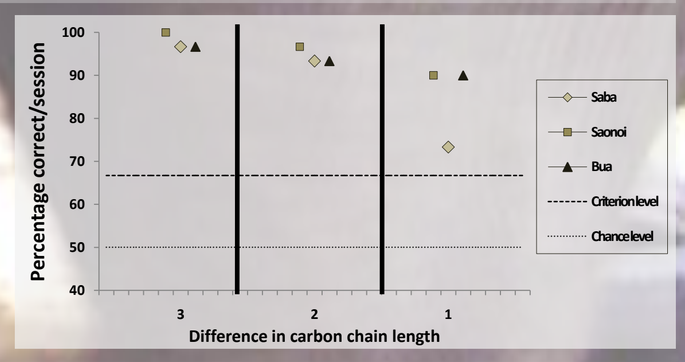


Conclusion 1

The elephants quickly learned to discriminate between odors and also succeeded in intramodal stimulus transfer tasks in which either the rewarded odor, or the unrewarded odor, or both odors were exchanged simultaneously for new odors. The animals readily mastered the initial task within only 120 stimulus contacts, demonstrating rapid olfactory learning and performing at least as good as rodents and dogs and even better than other species, including nonhuman primates, tested in similar studies before.

Results - Memory and discrimination performance





Conclusion 2

The elephants demonstrated an excellent long-term odor memory and successfully remembered the reward value of previously learned odor stimuli even after up to 16 weeks of recess in testing.

Conclusion 3

When presented with pairs of structurally related odorants, the discrimination performance of the elephants decreased with increasing structural similarity of the odorants, but the animals still significantly discriminated between aliphatic acetic esters even when the stimuli only differed by one carbon chain length.

Acknowledgements

I would like to thank my supervisor, Matthias Laska, and also Mats Amundin and the elephant keepers at Kolmården Wildlife Park, whose assistance and patience made this work possible.

For further information

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