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Farm animal cognition: Physico- and socio-cognitive capabilities
of ungulate livestock

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Summary

The welfare of an animal includes its physical and mental state, and all animals must at least be protected from unnecessary suffering. To accomplish this, a detailed understanding of the perceptive and cognitive abilities of non-human animals is necessary for understanding their normal behavioural expressions and for avoiding to expose them to mental distress. Studies on the cognitive capacities of farm animals have the potential to build a bridge between applied ethology and the basic research in behavioural biology, as a lack of knowledge about the behavioural repertoire of farm animals can lead to misguided handling practices and designs of husbandry conditions.

The thesis presented here aimed to investigate physico- and socio-cognitive capabilities of ungulate livestock species, in particular those of domestic pigs (*Sus scrofa domestica*), goats (*Capra aegagrus hircus*) and sheep (*Ovis orientalis aries*), to gain a better understanding of how these animals mentally represent their physical and social environment. In a total of five studies, test paradigms from recent comparative psychological research in primates and dogs were used and modified to the behavioural needs and constraints of the tested species.

The objective of **Study 1** was to compare dwarf goats and sheep in their ability to choose a hidden reward by means of absent and therefore indirect information (i.e. to choose by exclusion). The results show that goats performed better than sheep when only indirect information was available. These results may be explained best by the different feeding ecologies of the two species. Sheep are non-specialised high-fiber feeders (dietary grazers) and are less selective in their food intake. Goats, on the other hand, prefer low-fiber food (dietary browsers) and forage more selectively than sheep. It is speculated that this higher selectivity may have led to the avoidance of a potential, but empty, food location in goats but not in sheep.

Study 2 presents a series of experiments investigating the ability to choose by exclusion within two perceptual modalities (visual and auditory) in domestic pigs. The results showed that pigs were able to use indirect visual and, to some degree, indirect auditory cues to infer the location of a hidden reward. The results are in line with the hypothesis that a higher selectivity in foraging behavior predicts the potential use of indirect information in a food-related context.

Study 3 presents investigations on the socio-cognitive abilities of dwarf goats. The objectives of this study were to investigate the ability of dwarf goats to differentiate between attentive states of humans using a food-anticipation paradigm and to investigate which human-given cues these goats are able to use in an object choice task. The results indicated that subjects changed their anticipatory behaviour depending on the presence and absence of an experimenter in general and his attentive state in particular as a means for reward delivery. In addition, goats were able to use cues like pointing and

touching from the experimenter to find a hidden reward, but failed to use his head direction as a cue in a food-related context.

Study 4 presents research on the ability of domestic pigs to differentiate between attentive states of humans in a choice task. An impulsive approach style with short response times and a non-impulsive approach style where response times were relatively long could be distinguished. Pigs applying the non-impulsive approach style chose the attentive person above chance level, which was not the case when subjects chose impulsively.

Using an object choice task, **Study 5** provides knowledge on the use of human-given cues by juvenile domestic pigs in a series of experiments. The results showed that pigs are able to use a wide variety of pointing cues as well as the head orientation of an experimenter to find a hidden food reward.

Gaining a detailed knowledge about the cognitive capacities of livestock species is of importance for improving their husbandry and welfare. To achieve this, we have to shift away from an anthropocentric point of view and to focus on the animal's view of its environment and its interaction with it and other individuals. This results of in this thesis show that paradigms previously used with primates and dogs can be adapted to livestock species. Moreover, the results obtained indicate that ungulate livestock species have sophisticated cognitive capabilities in dealing with their physical and social environment. The better understanding of how livestock species comprehend their environment will ultimately lead to an improvement in animal welfare in the long term.