



# Cognitive enrichment affects behavioural reactivity in domestic pigs

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## Abstract

Cognitive challenges presented in connexion with the foraging behaviour of animals may have the potential to enrich the housing environment of captive animals, and thus can have beneficial effects on their behaviour and welfare. Therefore, we have developed a food-rewarded learning system based on a combination of classical and operant conditioning for groups of domestic pigs using acoustic cues ('call-feeding station'). The present study investigated the characteristics of learning behaviour in seven experimental groups ( $n = 8$  individuals each) of growing pigs in postnatal weeks 7–20. The behavioural budget of each group was observed weekly within the housing environment and compared to seven conventionally fed control groups ( $n = 8$ ) which were supplied with an equal food amount. The alterations of individual behavioural responses after 6 and 12 weeks of cognitive enrichment were analysed in combined open-field/novel-object tests and compared to controls. All experimental pigs were able to discriminate reliably an individual tone that was associated with a locally changing feeding site. Generally, the animals were also willing to work for food (push a button with increasing fixed ratio, FR) but this motivation varied considerably between the groups ranging from FR 1 to 10. Sustained cognitive enrichment also affected other behavioural patterns within the housing environment as indicated by an increased locomotor behaviour and less belly nosing. Behavioural test responses were altered towards a greater reduction in open-field activity as well as a reduced excitement and fear behaviour compared to control pigs. Behavioural differences seem to be more pronounced the longer pigs were faced with the cognitive challenge. However, with equal food intake, the weight gain of the experimental pigs was not different compared to the controls. The present study suggests that, in domestic pigs, the presented cognitive enrichment may induce repeated positive appraisals in pigs by the association of successful coping with a demanding behavioural task rewarded by several small portions of food during the day. This

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appears to agree very well with pigs' motivational needs and may also be applicable for animal welfare enhancing management of feeding.

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## 1. Introduction

Environmental enrichment can be defined as an increase of the biological relevance of captive environments by appropriate modifications resulting in an improvement of the biological functioning of captive animals (Newberry, 1995). In general, enrichment should present objects or situations to act with a rewarding outcome. In applied ethology improved animal welfare and health as well as an adequate coping with stress are major indicators for assessing the relationship between farm animals and their housing environment. Although the important role of cognitive and emotional processes in farm animals has been widely neglected for a long time, in recent years much effort was made to develop scientific theoretical frameworks and practical applications in this field. Animals interpret their interactions with the environment in an emotional way on the basis of present and previous experience (Wiepkema and Koolhaas, 1992). Hence, the possibility to control the environment and to cope successfully with challenges may be a source of positive emotions increasing welfare in farm animals (Dantzer, 2002). This will be the case especially if an animal can expect a rewarding result (Spruijt et al., 2001). Despite many differences in the existing concepts, most agree that cognitive processes, especially appraisal of stimuli, events and situations are linked with emotional states which again may affect positively or negatively other behavioural and physiological parameters of welfare and health (Mendl, 1999; Spruijt et al., 2001; Dantzer, 2002; Désiré et al., 2002; Puppe, 2003; Mendl and Paul, 2004; Paul et al., 2005). In this context, Milgram (2003) used the term 'cognitive enrichment' in a study analysing the effects of a prolonged learning program on cognitive plasticity in dogs. The mentioned study provides some evidence that cognitive enrichment slows the development of age-dependent decline. Up to now, the development of cognitive tasks to study emotional or hedonic states in animals is rather rare and predominantly restricted to laboratory animals (e.g. Harding et al., 2004; Van der Harst et al., 2005). Therefore, there is an urgent need for increasing experimental research on this field which should necessarily include farm animals.

For this purpose we have recently developed a food-rewarded learning system for pigs using acoustic cues in a combination of classical and operant conditioning techniques (Ernst et al., 2005). This system enables to study if and how cognitive enrichment affects other parameters which are usually linked to welfare and health. Our experimental approach meets well-known postulates as rewarded activity, controllability, predictability, positive experiences, reduced boredom, or successful coping with challenges which all are known to contribute positively to emotional judgements, and thus, have the potential to improve welfare of animals. Moreover, the system can be used to study learning behaviour of animals in a more 'realistic' design which includes a familiar environment with normal social setting as also demonstrated by Langbein et al. (2006) for dwarf goats. From a more practical point of view, it also offers the opportunity to develop useful tools for an improved behavioural management in automatic feeding systems using the cognitive abilities of pigs. We have shown that an exemplary pig group was able to

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