

Advances in Assessment of Emotional States and Cognitive Processes in Pigs

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Introduction

Improvements in modern pig welfare have largely focused on the environmental enrichment of housing, with the primary aim of promoting expression of natural behaviours (van de Weerd & Day, 2009). However, more recently there has been research into the underlying emotions and cognitive processes that welfare-friendly housing may influence, which, in turn, may affect the behaviours observed in the animals. This reflects a facet of animal welfare that not only moderates negative experiences, but promotes positive ones (Boissy *et al.*, 2007). Better understanding and recognition of emotional states has the potential to aid evaluation of housing design by allowing objective assessment of the welfare benefits that certain forms of environmental enrichment may provide. The studies discussed in this paper reveal insights into factors of emotional states and cognitive processes in pigs, and how these factors can be assessed.

Discussion

Emotions are generally described as having behavioural, cognitive, physiological and subjective components (Paul *et al.*, 2005). Classically, the physiological components, such as cortisol concentrations and heart rate, are those most studied, as these are easy to measure. The difficulty here is that though certain readings may suggest the animal is experiencing an emotion, it is difficult to determine the valence of this emotion (whether positive or negative) as the same physiological response may be indicative of two very different emotional states. Research into behavioural indicators has aimed to provide better discrimination between these states (Désiré *et al.*, 2002).

Reimart *et al.* (2013) performed a study to identify observable behaviours suggestive of either positive or negative emotions. This work also explored the phenomenon of emotional contagion, a simple form of empathy that is hypothesised, but not well documented in pigs. The pigs (n=24) in this experiment were trained to associate specific cues to either a positive reward or negative event. Their behaviour in anticipation of and during these events was observed, and the results suggested that tail and ear movements, though previously little tested, may be useful indicators of emotions in pigs. In addition, untrained pigs were housed and exposed to the cues along with their trained conspecifics, and also had their behaviour monitored. This showed some indication that pigs may be susceptible to emotional contagion, which is of particular importance in this commonly group-housed species.

A study by Rutherford *et al.* (2012) tested the use of a Qualitative Behavioural Assessment (QBA) approach to measure the emotional state of pigs (n=40) through observation of their behaviour in unfamiliar environments. To test the sensitivity of the approach, half the pigs were given an intra-muscular injection (1 mg/kg) of Azaperone (Stresnil), an anti-anxiety drug that would effectively make the subject indifferent to its surroundings. The experimenters found that observers (n=12) could successfully differentiate between the treated and untreated pigs just by using a QBA approach on one-minute video footage of the pigs' behaviour.

Both Rutherford *et al.* (2012) and Reimart *et al.* (2013) were able to demonstrate observed behaviours as indicators of emotional states. Where they differed was in their methodology. Reimart *et al.* (2013) noted specific behaviours, such as nosing or vocalising, and specific postures of the ears, tail and head. This allowed for objective scoring of the pigs, which would be consistent among any informed observers. Rutherford *et al.* (2013) used a QBA, which involved observers using descriptive terms to assess the pigs, such as "confident", "relaxed" or "frustrated". Although the study validated the accuracy of a QBA, the use of terms with strong links to human behaviour made this an inherently subjective approach.

In a study by Douglas *et al.* (2012) gilts (n=10) were tested for their capacity for cognitive bias when housed in either barren or enriched environments. Cognitive bias refers to the influence of emotional state on cognitive processing. It suggests that when given new or ambiguous cues, a positively

biased pig will expect a reward (optimism) and a negatively biased pig will expect punishment (pessimism).

As with the Reimart *et al.* (2012) study, the pigs were trained to hear auditory cues, corresponding to either a positive food reward or an aversive event. They were then given the opportunity to approach a hatch to receive the signalled outcome. Once the pigs were able to satisfactorily discriminate between the two cues and respond appropriately, a third ambiguous auditory cue, which had no consequences if the pig chose to approach the hatch, was introduced. Willingness to approach the hatch on hearing the ambiguous cue was considered optimistic cognitive bias, while reluctance to approach was considered negative cognitive bias. The effect of environment was also tested by alternating the pigs between enriched and barren housing. It was concluded that cognitive bias was more positive in pigs housed in enriched environments. Furthermore, cognitive bias was more negative in pigs housed in barren environments, even when they had not yet experienced the enriched environment.

The results of Douglas *et al.* (2012) and Reimart *et al.* (2012) provided insight into the effect of the environment on the psychological wellbeing of the pigs. The indication of emotional contagion in Reimart *et al.* (2012) suggests that a negative event that affects one individual, such as medical treatment, can have a continued effect on other animals housed in the same area. Douglas *et al.* (2012) emphasised the benefits that an enriched environment has on cognition in the pig and, importantly, the impact of removing that enrichment.

These studies help support the claim that a pig's physical and social environment will have a strong bearing on its emotional state. This may then influence the way pigs react to different situations, such as housing changes and routine handling procedures.

Conclusion

The determination of emotional valence, positive or negative, plays a vital role in understanding what an animal may experience in a given production system. The ability to gauge the effect surroundings have on a pig is a useful tool for improving welfare, especially regarding choice of housing design. Accurate interpretation of behavioural responses can allow observers to more effectively evaluate the welfare of pigs in commercial industries.

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