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Cognitive bias in pigs: Individual classification and consistency over time

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ABSTRACT

The aim of the study was to ascertain if the cognitive bias (CB) test can be used to assess pigs' emotional state and classify them individually. Moreover, the test was repeated over time to assess its consistency. Thirty-six male pigs were individually trained during 14 training sessions to discriminate between a bucket with (A) or without (NA) access to chopped apples depending on its position (left or right) in a test pen. Once pigs were able to discriminate between both positions, each animal was subjected to 2 A and 2 NA reminder sessions before performing the CB test session, where the bucket was placed on a central position with access to 2 pieces of apple. The trial was repeated after 5 weeks, reducing the number of training sessions to 4. Time to contact the bucket, time to eat (or try to eat in the case of NA sessions), number of vocalizations, number of times pigs were reluctant to move, number of escape attempts, and number of urination and defecation events were recorded. In the first trial, time to contact the bucket and time to eat was significantly lower in A than in NA from session 10 ($P < 0.0012$), indicating that pigs were able to discriminate between both positions. In the second trial, both variables were significantly lower in A compared to NA from session 2 ($P < 0.005$) onward, confirming the pigs' capacity to remember the task. Pigs were individually classified as having positive, negative, or neutral CB, according to the time to contact the bucket during the CB test session in comparison with the time taken during the remainder sessions. A large percentage of pigs were classified as positive CB in both trials (84.85% and 94.29%, respectively). However, there was no consistency between the results of both trials, suggesting that during the second CB test session animals were able to remember the content of the bucket of the first CB test session. Alternatively, other factors such as the time of the day that pigs were tested, the age of the animals, or their hunger state could have an effect on the results.

Introduction

Measures based on animal emotion are of increasing interest in animal welfare science (Panksepp, 1998; Mendl and Paul, 2004; Rolls, 2005; Lawrence, 2008). Because nonhuman animal cannot self-report their feelings, the assessment of an animal's emotional state has to rely on measures of physiology, neurology, and behavior, including cognitive bias (CB) tests.

The term "cognitive bias" refers to the influence that the emotional state has on cognitive processes such as attention, learning, memory, and decision making (Mendl et al., 2009). There is an extensive bibliography in human psychology that discusses how the affective state influences the cognitive function (e.g., Eysenck et al., 1991; Williams et al., 1997).

In recent years, several studies have explored CB in nonhuman animals. Harding et al. (2004) first designed a methodology to determine the emotional state of nonhuman animals by using a "judgment bias" task. The concept of judgment bias refers to the response of an individual to an ambiguous cue and is based on the premise that individuals in negative affective states make negative judgments about ambiguous cues more frequently than individuals

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in positive affective states. After this experiment, a large number of studies of CB have been carried out in different species (Gygax, 2014).

Most studies on CB have used the judgment bias task to compare 2 or more groups of animals subjected to different treatments, such as different housing (e.g., Douglas et al., 2012; Wichman et al., 2012) or management (e.g., Papciak et al., 2013; Düpjan et al., 2013) conditions. For instance, Douglas et al. (2012) showed that pigs kept in an enriched environment made more positive judgment in front of an ambiguous cue than pigs kept in a barren environment. Düpjan et al. (2013), however, did not find differences in judgment bias between pigs kept isolated and pigs kept in groups.

It is widely accepted that animal welfare indicators should have a high reliability, for example, they should be repeatable and consistent over time (Temple et al., 2013). The consistency has been assessed individually in several studies of different behavior test such as novel arena test (e.g., Jensen et al., 1995) or novel object test (e.g., Spoolder et al., 1996). To the best of our knowledge, consistency over time of CB has been assessed by using the mean value of a group of animals (e.g., Doyle et al., 2010 and Murphy et al., 2013), but has never been tested using individual values despite the fact that the CB is assessed individually.

The objective of the present study was to classify pigs individually and to assess the consistency over time of individual CB by using a go or no-go spatial judgment task (Burman et al., 2009; Mendl et al., 2009) in pigs from the same sex and genotype, exposed to the same housing and management conditions.

Material and methods

Animals and housing conditions

Thirty-six male pigs aged 8 weeks coming from a commercial farm were moved to the experimental facilities in IRTA (Monells, Spain) and randomly allocated to 4 groups of 9 animals each. The experimental pigs were crosses of Large White × Landrace halothane gene—*RYR1*—free (NN) sows with Pietrain heterozygous (Nn) boars.

Animals were housed in slatted pens (5 × 2.7 m) and under natural light conditions at a constant environmental temperature of 22°C ± 3°C. Each pen was provided with 1 steel drinker bowl (15 × 16 cm) connected to a nipple and a concrete feeder (58 × 34 cm) with 4 feeding places. Pigs had water and food *ad libitum*. The pigs were inspected daily and no health problems were observed during the experimental period.

Cognitive bias test

Pigs were subjected to the CB test twice, at the age of 10 (first trial) and 15 (second trial) weeks. Pigs were individually moved from the housing pen to a 31.5 m^2 test pen (4.7 length × 6.7 m width) separated from the housing pens by a corridor (6.4 × 2.2 m). The temperature of the test pen was kept at 22°C. The floor was partially slatted with a corridor of concrete (6.4 × 2.3 m) in the middle of the test pen. Pigs entered and left the test pen through the same door. A bucket (30 × 40 cm) was placed close to the wall opposite to the door, on the right or left side of the pen during the training sessions and in a central position during the test session (Figure 1).

One video camera was placed above the door and connected to a video recorder and a screen located outside the test facilities.

Each trial procedure included training, reminder, and test sessions. The procedure was the same in both trials except the number of training sessions (14 in the first trial and 4 in the second trial).

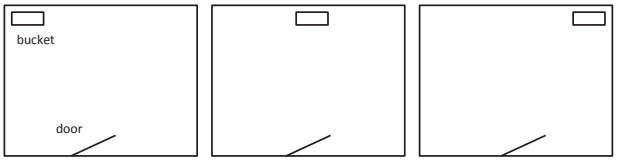

Figure 1. The test pen with the 3 positions of the bucket according to the session: right or left side for the training and reminder sessions and the central position for the cognitive bias test session.

Training sessions

Pigs were trained individually on a go or no-go discrimination task (Mendl et al., 2009). Pigs had to learn to discriminate between a bucket with or without free access to chopped apples according to its position in the test pen (left or right side). In each training session, only one bucket was presented as a cue either with free access (A) to the chopped apples (rewarded reinforcer) or with a wire mesh covering the apples to prevent the animals from eating them (NA) (unrewarded reinforcer). The wire mesh was placed inside the bucket to ensure that pigs could only see it when they were in contact with the bucket. To avoid a lateralization effect, half of the pigs had the rewarded reinforcer on the right side and the unrewarded reinforcer on the left side, and vice-versa. The training sessions finished 30 seconds after the pig ate or tried to eat the chopped apples, or 10 minutes after entering the test pen if the pig did not contacted the bucket. Afterward, the test pen door was opened, and the animals were taken back to the housing pen. In the first training session, all pigs had access to chopped apples for 10 minutes. If the pig did not eat the chopped apples during the first 2 A sessions, the apples were put half a meter in front of the bucket for 2 minutes to encourage the pig to eat them and learn the association between the bucket and the food.

In consecutive training sessions, the bucket was randomly placed (no more than 2 consecutive sessions on the same side) on one side of the test pen according to the accessibility of the apples. The animals were subjected to 2 training sessions per day for 7 days (from 08:00 to 14:00 hours randomly). Before the CB test, all pigs were exposed to a total of 7 A and 7 NA training sessions.

Reminder sessions and test session

After the 14 training sessions, pigs were subjected to 4 reminder sessions (2 A and 2 NA randomly placed as in training sessions), 2 sessions per day for 2 days. Pigs that did not learn to discriminate between the 2 cues during the reminder sessions were excluded from the study. The criterion used to exclude pigs from the CB trial was the time to contact the bucket during the reminder sessions: if the mean time during the 2 A sessions was higher or equal than in the 2 NA sessions, the pig was excluded from the study.

The day after the 4 reminder sessions, each pig was individually subjected to the CB test session, where the bucket was placed in a central position in contact with the wall opposite the door. The bucket contained 2 pieces of apple that were not visible until the animal contacted the bucket. The CB test session finished when the pig ate the chopped apples or 10 minutes after the pig had entered the pen. Afterward, the test pen door was opened, and the animal was returned to the housing pen. Both reminder and test sessions were conducted during the same time frame as in the training sessions.

After 5 weeks, pigs were subjected to a second trial which was conducted as the first trial, including training, reminder, and test sessions, but the number of training sessions were reduced to 4 (2 A and 2 NA).

Measures

Behavioral data were directly recorded by 4 observers, and video recordings were used to confirm the observations in case of doubt.