IGN-Research Award 2021

Dr. Charlotte Goursot

„Laterality in pigs and its links with personality, emotions and animal welfare"

FBN in Dummerstorf
Institut für Nutztierbiologie
2019

Summary

Acknowledging that farm animals are individuals experiencing their own affective states is central to improve their welfare. Studying laterality (i.e. asymmetries of brain and behaviour, with each hemisphere controlling the contralateral part of the body) and especially emotional lateralization (i.e. one hemisphere of the brain is specialized to process specific emotions) is a potential non-invasive approach to gain more insight into the common neural basis of personality and emotion. The hypotheses underlying this thesis are that the left (or right) hemisphere of the brain controls approach or positive (or withdrawal or negative) emotions. This thesis represents the first theory-driven studies on behavioural lateralization in pigs with potential implications for their welfare. The goals of this work are specified by two main questions. First, is individual hemispheric dominance (i.e. an individual's "preferred" hemisphere) measurable through individual motor lateralized patterns and does it reflect personality in pigs? To this end, we investigated pig-specific motor functions (Study 1) and their interactions with personality (Study 2). Second, can the direct investigation of emotional lateralization in pigs improve understanding of the mechanisms of emotional valence? For this, we tested the effect of monocular vision on emotional responses (Study 3) in pigs.

The first study represents the first study investigating motor lateralization in domestic pigs. We investigated possible motor lateralization patterns in four different motor functions (snout use in a manipulative task, foot use in two stepping tasks, and tail curling) in eighty male piglets. A significant majority of our sample showed individual biases for manipulation with their snout and for curling their tail but not for stepping with their foot. Interestingly, the tail curling was lateralized towards the right at the population level and showed stronger lateralization patterns than snout use. Using a cluster analysis with combined tail and snout laterality, we identified groups of individuals with consistent lateralization patterns across motor functions that potentially reflect the individuals' hemispheric dominance. This new

classification system is hypothesized to reflect qualitative differences in brain organization and therefore differences in personality.

As a logical follow-up, investigating how individuals with supposed opposite hemispheric dominance differed in their personality was the aim of the second study. To analyze the relationships between personality and laterality we tested the same eighty male piglets from the first study in several personality tests and used the classification system integrating two motor functions (tail and snout) that was established in the first study. We found that the combined laterality classification showed both more, and more robust, significant associations with different personality traits compared with the single motor biases. Like in other species, the approach and withdrawal emotions were lateralized because right-biased pigs (i.e. pigs with a left hemispheric dominance) were bolder and more explorative in a context of novelty than left-biased pigs (i.e. pigs with a right hemispheric dominance). Additionally, right-biased pigs were more sociable (they vocalized more in a context of social isolation) than left-biased pigs. This study demonstrates the importance of taking into account the multidimensionality of both laterality and personality.

The third study aimed at giving insights into the mechanisms of emotional valence. We used a paradigm of monocular viewing which can be considered as a direct manipulation of the central nervous system, because covering one eye results in a reduced visual input to the contralateral hemisphere. Moreover, the use of emotional conditioning was supposed to allow a focus on emotional valence independently of emotional arousal. Our study tested the emotional valence hypothesis in the context of visual laterality for viewing positive or negative emotionally conditioned stimuli. Ninety male piglets were either positively (food-reward) or negatively (mild punishment) conditioned to an object (a ball). Afterwards, the object was presented without the reinforcer under three different treatments: patch was fixed on the left or right eye (reducing input to the contralateral hemisphere) or patch between the eyes (the control). Monocular viewing had no clear effects on the negatively conditioned subjects. In contrast, in the positively conditioned group, covering the right eye caused a longer interruption of vocalization, a longer latency to touch the object, a shorter duration of exploring the arena and an increased vagal activity compared to the control. This suggests that reduced processing in the left hemisphere leads to heightened attention that is accompanied by a general orienting response, possibly resulting from a reduced positive appraisal. These findings therefore suggest an important role of the left hemisphere in the quick recognition of a positive stimulus.

With these studies, we were able to partly validate hypotheses on emotional lateralization in the domestic pig for the first time. Considering those studies together shows that studying laterality provides a means to non-invasively elucidate mechanisms underpinning emotional reactions towards a positive stimulus, but also to identify individuals with different cerebral organizations and thus with different personality types. Thus, further investigations of emotional lateralization could be promising to give insight into individual appraisal in pigs. Another direct implication is that tail curling might be a complex behaviour that could be impaired if pigs' tails are docked. In conclusion, this dissertation indicates not only that pigs should have the freedom to choose how they perceive and react to their environment, but also that individual differences in appraisal and perhaps affective styles exist in pigs. Affective styles may help explain individual differences in appraisal in everyday situations. Understanding these processes could allow us to offer to farm animals living conditions that are in better accordance with what they want and what they like, and thus help heighten their psychological welfare.

Take Home Message

It is of interest to identify the individual emotional needs of our farm animals in order to implement individualized welfare into farm animal husbandry. For this, studying behavioural laterality (i.e. asymmetries of behaviour, where each brain hemisphere controls the contralateral part of the body) represents a promising approach. On the one hand, this work shows that pigs with different motor side preferences (and therefore with different brain organizations) differ in their personality. On the other hand, this work evidences that the eye with which pigs perceive a positive stimulus influences their emotional response to that stimulus. This work represents a milestone for research on "affective styles" in farm animals and contributes to more individualized welfare.

Vita

Since 2021: DFG Postdoctoral fellow, Institute of Animal Welfare Science, University of Veterinary Medicine Vienna
2020: Doctor in Ethology (Dr. agr.), Universisty of Rostock
2014-2019: PhD student at the Institute of Behavioural Physiology, FBN Dummerstorf
2014: Doctor in Veterinary Medicine (DVM), University Paris 12
2012-2013: Master (M.Sc.) in Ecophysiology & Ethology, University of Strasbourg
2008-2013: Veterinary Study Diploma, National Alfort Veterinary School

Sources

Dissertation: DOI: 10.18453/rosdok_id00002791

Studie 1: DOI: 10.1080/1357650X.2017.1410555

Studie 2: DOI: 10.1093/cz/zoy071

Studie 3: DOI: 10.1016/j.anbehav.2019.06.021