Welfare by the ear: comparing relative durations and frequencies of ear postures by using an automated tracking system in sheep

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Abstract

Given the increased interest in animal emotional reactions for assessing welfare, indicators for such reactions are sought. Ear postures and movements have been found to be promising indicators of emotional states in sheep and other animals. The manual recording of ear postures, however, is very time consuming and possibly prone to a degree of inaccuracy due to the subtle and fast nature of ear movements that have to be identified. Therefore, a number of previous studies have analysed the frequency of certain ear postures relative to all ear posture changes rather than measuring the relative duration spent with different ear postures. Here, we present an automated, continuous tracking system that keeps track of small and lightweight marker balls attached to the head and ears of sheep. We measured ear postures and movements when the animals were confronted with three physical stimuli thought to differ in valence (from negative to intermediate to positive). We then compared new ear-posture definitions reflecting the real time spent with certain ear postures during stimulation with previous definitions used for video-based analyses that assessed ear-posture changes in relation to the total number of observed ear postures. In the analysis, we correlated new and previous measures both between and within experimental stimuli using residuals from mixed-effects models. We found that the new and previous definitions of ear postures and movements correlated highly. Given these high correlations and the discussed theoretical and practical advantages of the automated tracking, the new recording system can be recommended highly for assessing reactions in animals that may indicate emotional states.

Keywords: animal welfare, automated tracking, ear posture, emotion, sheep, video analysis

Introduction

The enhancement of positive as well as the reduction of negative emotions is thought to improve animal welfare (Boissy et al 2007). However, the assessment of short-term emotional states is difficult (Mendl et al 2009), and the development of objective indicators reflecting emotional states is therefore necessary. Non-invasive methods are especially valuable because their use only minimally disturbs the behaviour of the tested animals.

Ear postures and movements have been used as subtle indicators of animal emotion (dairy cows: Schmied et al 2008; pigs: Reimert et al 2013; sheep: Reefmann et al 2009a,b; Boissy et al 2011). All these studies included the definition of a set of specific ear postures, for example, measuring how far forward or backward both ears were positioned relative to the longitudinal axis of the head. For the actual measurements of the ear postures, the researchers used video observations. Video recordings have the advantage of being able to depict a general view of a situation, record several behaviours simultaneously, be relatively simple in handling, and be used widely. On the other hand, video analyses have a number of disadvantages, the main one being the very time consuming scoring after the experiments have been conducted, specifically when the video shots need to be slowed down for scoring. Also, a suitable camera array may be difficult to be determined a priori, and several cameras may be required to ensure that all ear movements are detectable for scoring from the video track (Tami & Gallagher 2009). This, in turn, causes additional effort in scoring pictures from each of the cameras. In the studies by Boissy et al (2011) and Greiveldinger et al (2009), for example, four cameras were used simultaneously. Another disadvantage of video analyses is the potential subjectivity of the experimenter in analysing the video data, specifically when small and fast movements of the ears are to be scored. This makes an inter-observer test of reliability advisable (Schmied et al 2008; Verbeek et al 2012) and implies an additional effort.