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VOCAL CUES TO DISCOMFORT IN MAMMALS: APPLICATION FOR ESTIMATING WELFARE IN CAPTIVITY

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Negative emotional arousal impairs animal welfare. Many mammals respond vocally to discomfort, so the acoustic variables can be measured in automated mode to create systems for real time estimating the degree of discomfort. This is an important problem for farms, shelters and zoos, as control of discomfort leads to decreased traumatism and improves welfare in captive animals. Creating of automated systems for welfare estimation needs in revealing integral acoustic variables, appropriate for measuring emotional arousal in calls of any structure. The acoustic variables for estimation of discomfort can be recommended based on meta-analysis of our own and literature data about discomfort-related shifts in the acoustics across species. Among these variables, the peak frequency and the power quartiles are most universal, as the indicative of discomfort energy shifts toward higher frequencies can be measured in calls of any structure, tonal or noisy. Another universal indicator of discomfort is time spent vocalizing. Modulation of fundamental frequency that can be measured only in tonal calls, represents a particular case of energy shift to higher frequencies. The increase in proportion of time spent vocalizing and the shift of call energy towards higher frequencies may be integral vocal characteristics of short-term welfare problems in captive mammals. For farm pigs, *Sus scrofa*,call-based automated monitoring of emotional arousal STREMODO has already proved to be useful. We have developed and tested a method for estimating discomfort *via* creating and measuring «joint» calls, that can be obtained by removal all silent spaces between calls within a time fragment and are equally appropriate for analysis of all calls independently on their structure, either tonal or noisy. We propose a vocal-based algorithm of automated discomfort estimating, that is applicable for all species of mammals, responding vocally to discomfort. 1. Splitting continuous recording to fragments. 2. Checking the start and end of each call. 3. Preparing a joint call by removal of silent spaces and strikes. 4. Measuring the duration of the joint call. 5. Measuring peak frequency and quartiles of the joint call. 6. Comparison with previous and following joint calls. All these procedures can be made automatically using already existing software.

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