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Play behaviour as an indicator of positive welfare:
Effects of milk allowance and social environment on locomotor play and motivation to play in calves

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Summary

Play behaviour increases with improved housing conditions and reacts sensitively to restrictions on animal welfare. It is also assumed that there is a connection with positive emotions. In addition, play is considered to be "contagious", i.e. an animal at play can stimulate play in others and induce positive affective states. Thereby, a playing animal could increase the well-being of its group members. However, the use of play behaviour as an indicator of positive welfare is still the subject to current research. The relationship between play behaviour and positive affective states is known insufficiently and the strength of the 'play contagion effect' remains to be investigated. This dissertation is divided into three parts, dealing with an automatic method for eliciting play, the contagion effect of play and the motivation to play.

(I) Automatic recording of locomotor play: Calves play only sporadically and for short durations, making reliable recording very time-consuming. To facilitate the measurement of play behaviour, a method for automatic recording was validated. For this purpose, accelerometers were attached to the calves' hind legs to measure their vertical acceleration. These measurements were compared to behaviours recorded continuously from video. Discriminant analysis was used to classify periods of ten seconds each as "locomotor play" (= running, turning, bucking) or as "non-play". 79% of these periods were correctly classified as locomotor play. The number of classified play periods from accelerometer recordings correlated with the number of observed periods with locomotor play ($r = 0.87$), thus making this sensor-based recording a reliable method to record locomotor play.

(II) The play contagion effect: The frequency of play behaviour is dependent on the calves' dietary energy intake, among other influences. This characteristic was utilised by giving calves high or low milk allowances to stimulate or inhibit their play behaviour. A total of 72 calves were housed in groups of three. The contagion effect of play behaviour was tested in different group compositions. Using the recording method described above, the locomotor play of calves was estimated at four and eight weeks of age. As expected, groups in which all three calves received high milk allowances performed more play than groups in which all three calves received low milk allowances. In mixed groups, two calves with high milk allowances were housed with one calf with a low milk allowance to stimulate it to play. Surprisingly, the play of the two penmates with high milk allowance was reduced. The calf with a low milk allowance probably experienced a negative affective state due to hunger and depressed the locomotor play of its penmates. Thus, for the first time, a negative play contagion effect was observed. Furthermore, these results may suggest that negative contagion has a stronger effect on play behaviour than positive contagion.

(III) Calves' motivation to play: The 72 calves used to test the contagion effect were also used to test whether calves with different levels of play based on milk quantity and social environment show motivation for a play opportunity. In motivation tests, one focal animal per group was trained to wait in

a holding pen before joining its' penmates in a play arena as the reward. In the anticipation phase indicating "wanting" or the value of a reward, calves did not differ in their anticipatory behaviour between treatments. In the reward phase, which indicates the "liking" of a reward, calves also showed no differences between treatments in locomotor play. However, their locomotor play was temporarily increased immediately after entering the arena, compared to later times in the arena. The lack of treatment differences in the anticipation phase as well as the increased locomotor play during the reward phase could originate from the motivation to participate in play overriding influences of milk allowance and social environment.

This dissertation project illustrated that play behaviour may be more strongly influenced by the social environment than by physical development and available energy. Thus, when using play behaviour to assess the welfare state of group-housed calves, the average play level may not reflect the average welfare state but the welfare state of the calf experiencing the lowest welfare. Further, these findings imply that play behaviour may primarily reflect the affective state and may not be a reliable indicator of the physical wellbeing of calves. Looking at the previous and current studies together, the findings highlight that there is a high potential to use play as an indicator of positive welfare in calves, however the quantitative relationship of play behaviour with positive affective states as well as physical wellbeing and their interaction requires further research.