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Using technology to monitor and improve zoo animal welfare

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Abstract

While the international zoological community is committed to enhancing the welfare of individual animals, researchers have yet to take full advantage of the tools available for non-invasively tracking behavioural and physiological indicators of welfare. We review technology currently being applied in studies of zoo, farm and laboratory animals to regularly monitor welfare status, as well as to evaluate responses to particular stimuli and situations. In terms of behavioural measures, we focus on automated assessments that offer insight into how animals — even those that are nocturnal or elusive — behave when humans are not present. Specifically, we provide an overview of how animal-attached technology (accelerometers, global positioning systems, radio frequency identification systems) can be implemented to generate activity budgets, examine use of space, conduct gait assessments, determine rates of movement and study social dynamics. We also emphasise the value of bioacoustics, as the rate and acoustic structure of certain vocalisations may vary across contexts and reflect an animal's internal state. While it can be challenging to identify non-invasive methods for investigating physiological welfare indicators, we discuss approaches (thermography, tracking measures of heart rate) that may be especially useful for monitoring affective states and psychophysiological functioning. Finally, we make a concerted effort to highlight tools that allow welfare scientists to consider measures of positive welfare. Ultimately, zoos can ensure that each animal has the opportunity to thrive by employing technology to create baseline behavioural and physiological profiles, conduct ongoing monitoring schemes and assess responses to specific conditions, events and stimuli.

Keywords: *animal welfare, automated monitoring, behaviour, physiology, positive welfare, technology*