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Measuring Emotion at the Zoo

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Emotions – happiness, surprise, anger, fear, wonder – play an important role in human experience. The feeling of emotions can lead to changes in the way people think and feel and are also important in forming memories (Petty and Cacioppo 1986; Cahill and McGaugh 1995; McGaugh 2006). Many zoo educators intuitively know this and, as a result, often design experiences that evoke a range of emotional responses, with the hope of delivering memorable experiences that cause visitors to think and feel differently about wildlife. However, zoo researchers have yet to produce findings that can inform zoos on how to elicit and then harness emotional arousal to achieve their often-stated aims of influencing visitors' memories, thoughts and attitudes.

One reason for the lack of research success in this area is the difficulty in measuring and reconciling the many physiological and psychological responses that are associated with the experience of emotion. Findings from research in other contexts suggest that it is necessary to use multiple measures of emotion, including self-reports by the research subjects themselves. This paper outlines a multi-method approach to measuring emotions in a zoo context as well as presents some preliminary findings of the emotional responses of visitors at three zoos in and around Melbourne, Australia.

Self-report measures of emotion

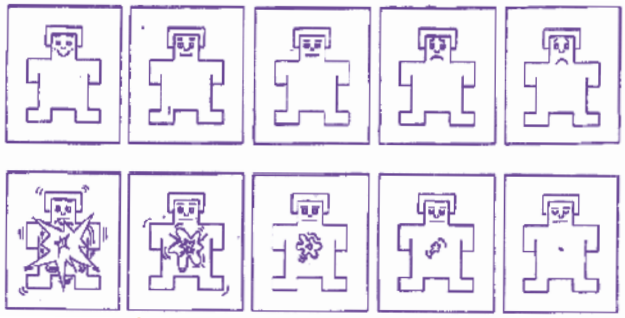
An obvious way of measuring emotion is to ask people how they feel or felt at a previous point in time, but this is not as straightforward as it sounds. According to Russell (1978) and many others, emotions are multi-dimensional, including the dimensions of pleasure (from pleasant to unpleasant), arousal (from sleepy to frenetic excitement) and dominance (from no to complete control over the emotion). As an example, anger would be an unpleasant emotion associated with high levels of arousal over which an individual has some degree of control. Conversely fear is also associated with unpleasantness and high arousal, but differs in that the individual has little control over its occurrence. Some zoo experiences may be designed to make visitors feel joy, awe and wonder while others may seek to evoke anger, despair and frustration at the state of animals in the wild. Thus the pleasantness dimension of the emotion may be of less importance to zoos than the amount it is felt, making the emotional arousal dimension of greater interest. Indeed, it could be argued that the worst outcome for zoo educators is if visitors felt little or no emotional arousal during their trip to the zoo.

As a result, the most appropriate framework to adopt when obtaining zoo visitors' self-reports of their emotions one that includes a direct measure of arousal. Thus, the pleasure-arousal-dominance (PAD) model proposed by Russell and colleagues is particularly suitable. Their instrument, which uses six items to measure each of the three dimensions (18 items in

total), has been refined by Eroglu, Machleit and Davis (2003) to three items for each dimension, making it quicker to fill out.

The Self-Assessment Manikin (SAM) (Bradley and Lang 1994 – see Figure 1) requires more explanation but is even faster to fill in. Participants are told what each end of the robots means. For example, an explanation for the SAM on the pleasantness dimension might use the following wording: "Put a mark at this end where the figure is smiling if you are feeling happy, contented or pleasant and place a mark down the other end if you are feeling sad, melancholic or unpleasant. Feel free to place a mark on or between any of the figures."

Figure 1. The pleasantness and arousal dimensions of the Self-Assessment Manikin (SAM) (Bradley and Lang, 1994).



These instructions are also given for the arousal and dominance dimension. When respondents are required to report on their emotions on more than one occasion, the SAM can be a really useful tool to use, since participants quickly learn the instructions and can report on current mood state with three simple X marks. This study used the pleasure and arousal dimensions of the three-item version of the PAD scale (6 items in total) together with the SAM for collecting self-report data on emotional states.

Physiological measures of emotion

As was suggested above, emotions lead to many changes, both psychological and physiological. When we emote, our endocrine system releases a range of different hormones, our nervous system sends messages throughout the body, our face changes, we sweat, our pupils dilate, our heart rate changes and we prepare for action. These changes and many others – Cacioppo *et al.* (2000) document 37 different physiological measures of emotion – happen very quickly and can sometimes occur without any conscious awareness of them. So, although emotional arousal can be retrospectively sought through self-report measures, it is wise to complement these with physiological measures.

Liam checking the physiological equipment after a birds prey show.

Photo © Annita Allman/Tourism Research Unit

Many researchers get frustrated by the fact that individual research subjects vary in how and where their emotions can be detected physiologically. For one person, being angry may result in dramatic changes to their heart, but not in their sweat. For another, the reverse may be true. Indeed, the manifestation of emotion not only changes from person to person, but also from event to event. Thus, the same person experiencing same emotion, but in a different situation, can yield different results.

Before outlining which physiological measures were used in this study, an explanation of how the nervous system works in relation to emotions is needed. At the broadest level, humans have two nervous systems, the somatic and the autonomic nervous system (ANS). The somatic nervous system is responsible for movement and conscious reception from external stimuli. The ANS on the other hand, is responsible for arousal and relaxation and has frequently been identified as the best place to look for physiological manifestation of emotions (Cacioppo *et al.* 2000). The two major divisions of the ANS are the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The SNS is responsible for arousal and results in heart rate increases, sweating, dilation of the pupils and rising blood pressure, among many other things. The PNS, on the other hand, is responsible for returning each of these changes back to normal. While many organs

receive messages from the SNS and PNS, the heart is one that can be measured relatively easily (Myrtek 2004).

A review of the literature on physiological measures of emotion reveals that there is a lack of non-cumbersome, real-time tools that can be used to measure arousal during real experiences. Certainly, physiological instruments with established validity can provide these real-time assessments and have been used for examining individuals' level of arousal. However, often these measurements have required bulky equipment and/or controlled settings and assessments have been confined to the laboratory. Recent technological innovations have led to a number of companies producing ambulatory monitors which can make assessments while subjects are in real settings, particularly in reference to psychophysiological measures of the heart.

Physiological measures in this study were taken using the Mindware MW1000A ambulatory impedance cardiac monitor and related software. The specific measures used to assess SNS were heart rate (HR) and the Pre-Ejection Period (PEP), and PNS was measured using Respiratory Sinus Arrhythmia (RSA).

Participant wearing the Mindware MW1000A ambulatory cardiac monitor.

Photo © Liam Smith/Tourism Research Unit

The Mindware MW1000A ambulatory cardiac monitor.

Experience: walking through a butterfly house.

Photo © Rob Doolaard/IZP, Rotterdam Zoo

In summary, two self-report measures (PAD and SAM) and three physiological measures (HR, PEP and RSA) were used to measure emotional arousal during zoo experiences.

Experiences tested

Eight zoo experiences were selected in consultation with zoo staff at three Australian zoos around Melbourne, and tested for the level of emotional arousal they elicited. These were:

Walking through a butterfly house

The Butterfly House at Melbourne Zoo contains numerous butterfly species which fly freely in a large glasshouse. The humidity and temperature of the Butterfly House are maintained at similar levels to tropical climates. Participants in this study walked through the Butterfly House and watched them and some participants had butterflies land on them.

Watching an orang-utan training session

A new orang-utan (*Pongo pygmaeus* spp.) exhibit was opened in October 2006. As part of the schedule of activities, keepers regularly conduct training sessions where a series of tasks are performed by the orang-utans at a close viewing point. Participants in this study watched one of these training sessions and were given some information about orang-utan husbandry during the session.

Attending a keeper presentation on elephants

This experience involved watching and listening to a scheduled public presentation at the Trail of the Elephants exhibit. Typically this involved training routines involving keepers and elephants that participants in this study watched through a glass viewing area.

A birds of prey show

Participants sat in a 600-seat amphitheatre and watched one of the free-flight birds of prey shows. During this experience, birds flew over the audience, sometimes in close proximity while a keeper talked about the birds.

A reptile presentation

This presentation was given by one of the keepers. During the presentation a number of different reptiles were brought out by the keepers and discussed. Participants in this study were invited to touch some of the different reptiles, including a carpet python.

Watching an operation on wildlife at the Australian Wildlife Health Centre

Everyday activities conducted by vets in the Australian Wildlife Health Centre are on display. Participants in this study watched operations, animal assessments and rehabilitation. The veterinary staff would talk about what they were doing either directly to the public during a pause in their work (e.g. while waiting for x-ray results) or during their work through a microphone.

A behind the scenes lion-feeding tour

The Rip Roaring Feed tour allowed participants in this study to go behind the scenes and watch the male lions being fed. Typically participants were able to approach within less than a metre of the lions and were given an introduction to the facility.

A bus tour around an open-range zoo

Werribee Open Range Zoo has a number of large exhibits and the only way to view these areas is on a 40-minute bus tour around the open-range section of the zoo. Visitors sit on a 72-seater bus and watch the animals while listening to a guide who drove the bus and provided commentary about the animals.

Preliminary findings

While the focus of this paper is on the measurement of emotion, some preliminary results are presented here.

Experience: a birds of prey show.

Photo © Rob Doolaard/IZP

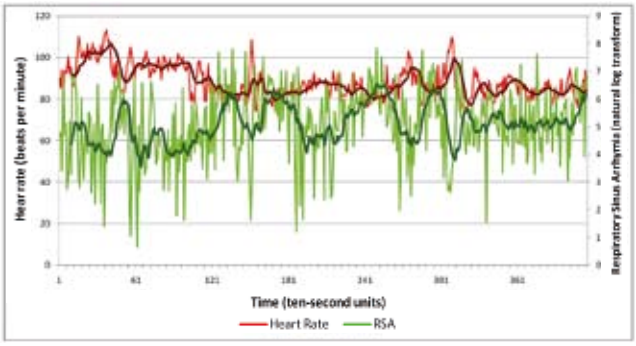
Table 1. Summary of SAM and PAD self-report arousal assessments.

Experience	SAM during-experience rank	SAM pre-during-experience rank	PAD during-experience rank	PAD pre-during-experience rank	TOTAL
Birds of prey show	1	1	2	1	5
Lion-feeding tour	1	2	1	3	7
Reptile show	3	5	3	5	16
Bus tour	5	4	7	2	18
Butterfly house	7	3	4	4	18
Elephant presentation	4	6	5	8	23
Orang-utan presentation	6	8	6	6	26
AWHC presentation	7	7	8	7	29

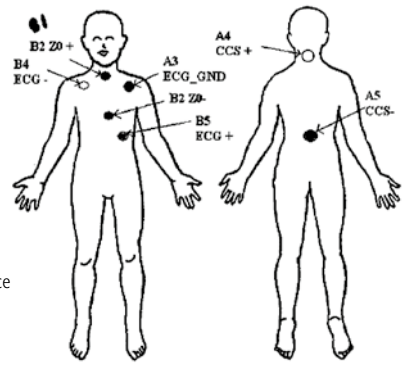
According to the results from the self-report measures (Table 1), the most emotionally arousing experiences were the lion-feeding tour and the birds of prey show.

Analysis of the heart data revealed that there was a lot of variation in HR, PEP and RSA during each of the experiences. Figure 1 gives an example of fluctuations in RSA and HR during one participant's visit to Melbourne Zoo. A key difference between self-report measures and physiological measures was that baseline measures were more difficult to obtain for the latter. Participants in the study were required to be in the movement mode of the experience itself (standing, sitting or walking) for at least one full minute prior to having the experience.

Figure 1. Graph of participant five's Heart Rate and Respiratory Sinus Arrhythmia at Melbourne Zoo including moving average trend line based on ten scores.



Also, participants needed to get used to wearing all the electrodes and be in the baseline position for several minutes before the baseline measurement was taken. Differences in HR, RSA and HR between the baseline and the experience were then calculated and ranked. Results showed that the same two experiences (the Birds of Prey show and the Rip Roaring Feed tour) were consistently identified as emotionally arousing on all three of the physiological measures.



Placement of electrodes for taking ECG and impedance measures of the heart.

Where to from here?

All the experiences led to higher levels of emotional arousal. However, as was stated at the beginning of the paper, zoo researchers have not investigated the impact of emotional arousal on visitors' memories, knowledge, attitudes and behaviours. The next stage of this research project is looking at the impact of high levels of emotional arousal on these visitor outcomes. It seems that it is pretty easy to wow visitors when they come to the zoo. After all, the animals are often spectacular. What is more important is the meaning that comes out of experiencing high levels of arousal and whether zoos can use this emotional state to achieve their aims.

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