Cognitive bias in a non-human primate: husbandry procedures influence cognitive indicators of psychological well-being in captive rhesus macaques

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Abstract

The measurement of ‘cognitive bias’ has recently emerged as a powerful tool for assessing animal welfare. Cognitive bias was initially, and widely, studied in humans, and describes the way in which particular emotions are associated with biases in information processing. People suffering from clinical levels of anxiety or depression, for example, interpret ambiguous events more negatively than do non-anxious or non-depressed people. Development of methods for use with non-human animals has revealed similar biases in several species of mammals and birds, and one invertebrate. However, cognitive bias has not been previously explored in any species of non-human primate, despite specific concerns raised about the welfare of these animals in captivity. Here, we describe a touchscreen-based cognitive-bias task developed for use with captive rhesus macaques (Macaca mulatta). Monkeys were initially trained on a ‘Go/No-Go’ operant task, in which they learned to touch one of two lines that differed in size in order to receive a reward (food), and to desist from touching the other line to avoid a mildly aversive stimulus (delay to the next trial and white noise). In testing sessions, the monkeys were presented with lines of intermediate size. We measured whether touchscreen responses to these ambiguous stimuli were affected by husbandry procedures (environmental enrichment, and a statutory health check involving restraint and ketamine hydrochloride injection) presumed to induce positive and negative shifts in affective state, respectively. Monkeys made fewer responses to ambiguous stimuli post health check compared to during the phase of enrichment suggesting greater expectation of negative outcomes following the health check compared to during enrichment. Shifts in affective state following standard husbandry procedures may therefore be associated with changes in information processing similar to those demonstrated in anxious and depressed humans, and in a number of other taxa.

Keywords: animal welfare, capture, emotion, enrichment, husbandry procedures, rhesus macaque

Introduction

Improving methods used to assess the psychological well-being of animals in captivity is a key goal for animal welfare researchers (Dawkins 1990; Mendl & Paul 2004; Rennie & Buchanan-Smith 2006a,b; Veissier et al 2008; Broom 2010; Mason & Vasey 2010; Mendl et al 2010a; NC3Rs 2011). A particularly promising development in this area has been the emergence of ‘cognitive bias’ as an indicator of animal psychological well-being (Harding et al 2004; Mendl & Paul 2004; Paul et al 2005; Mendl et al 2009, 2010a). The cognitive-bias model draws on work with humans which demonstrates a strong link between trait and state affect and cognitive processes (including attention, appraisal, expectation and memory: Eysenck et al 1991, 2006; MacLeod & Byrne 1996; Mathews & MacLeod 2002; Richards et al 2002; Bar-Haim et al 2007; Miranda & Mennin 2007). For example, people high in anxiety demonstrate a bias to judge ambiguous information as more negative, and report a greater expectation of negative future events, than do people who are low in anxiety (Eysenck et al 1991, 2006; Richards et al 2002; Blanchette et al 2007). Anxious people with co-morbid depression additionally demonstrate a reduced expectation of future positive events (MacLeod & Byrne 1996; Miranda & Mennin 2007). These emotion-mediated biases in the appraisal of the valence of stimuli, events and future outcomes are implicated in the onset and maintenance of clinical affective disorders in modern-day human populations (Gray 1971; Mathews & MacLeod 2002). They are also reliable predictors of self-reported distress experienced during stressful life events, and considered to be important markers of human psychological well-being (Mathews & MacLeod 2002; Purdy 2002; Wilson et al 2006).

Recent work with rats (Rattus norvegicus) (Harding et al 2004; Burman et al 2008a, 2009; Brydges et al 2011), starlings (Sturnus vulgaris) (Bateson & Matheson 2007;