



Contents lists available at ScienceDirect

## Applied Animal Behaviour Science

journal homepage: [www.elsevier.com/locate/applanim](http://www.elsevier.com/locate/applanim)



# Chimpanzees with positive welfare are happier, extraverted, and emotionally stable

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### ARTICLE INFO

#### Article history:

Received 12 November 2016

Received in revised form 31 January 2017

Accepted 5 February 2017

Available online xxx

#### Keywords:

Behaviour

Chimpanzee

Happiness

*Pan troglodytes*

Personality

Welfare

### ABSTRACT

Facilities housing captive animals are full of staff who, every day, interact with the animals under their care. The expertise and familiarity of staff can be used to monitor animal welfare by means of questionnaires. It was the goal of our study to examine the association between chimpanzee (*Pan troglodytes*) welfare, happiness, and personality. To these ends we collected two waves of welfare and subjective well-being ratings of 18 chimpanzees housed at the Edinburgh Zoo and one set of ratings of 13 chimpanzees housed at Fundació Mona. Ratings were made on a welfare questionnaire that included 12 items related to stress, psychological stimulation, and behavioural indicators of negative and positive welfare states, and a 4-item subjective well-being questionnaire. In addition, ratings were made on the 54-item Hominoid Personality Questionnaire and an abbreviated version of this scale consisting of 37 antonym pairs. We used generalizability theory to test whether welfare ratings generalized across items, raters, chimpanzees, and time. We then assessed the validity of the welfare and subjective well-being questionnaires by examining their associations with behaviour. Finally, we tested whether the welfare and subjective well-being ratings were associated with personality. Welfare ratings generalized across items, raters, chimpanzees, and time. Principal components analysis and regularized exploratory factor analysis indicated that ten welfare items and all four subjective well-being items formed a single dimension (welfareSWB). LASSO regression found that lower welfareSWB was associated with regurgitation, coprophagy, urophagy, and decreased proximity to nearest neighbour. A linear model that adjusted for age, sex, and facility, indicated that higher Extraversion and lower Neuroticism were related to higher welfareSWB. Welfare ratings were reliable and associated with subjective well-being and personality, demonstrating that staff ratings are a valid and potentially valuable tool for chimpanzee welfare assessment.

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## 1. Introduction

The chimpanzee fear grimace, which indicates panic but looks like a smile to humans, is a classic example of how humans can misinterpret animal behaviour and emotion in that, what appears to be the same behaviour in animals and humans, reflects different emotional states (Parr and Waller, 2006). This mismatch between animal signals and human interpretations of these signals may

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explain why some researchers find that observer ratings of welfare are not always associated with behaviours, including abnormal behaviours (Lesimple and Hausberger, 2014). However, animal care staff and researchers with years of education, training, and experience with their charges appear to be able to assess the personalities of these animals (Gosling, 2001; Vazire et al., 2007) and also the animals' well-being (Diener and Chan, 2011; Gartner and Weiss, 2013). However, there is still debate about whether members of staff or other observers can reliably assess animal welfare (Meagher, 2009; Whitham and Wielebnowski, 2009).

Welfare is traditionally measured by coding behaviours believed to indicate negative or positive welfare, or by collecting physiological measures, such as blood cortisol. These approaches are, however, time consuming and/or expensive. Welfare questionnaires, on the other hand, can cover a broad set of states, and can be designed to be brief (Clarke et al., 2016). These questionnaires can thus be used to rapidly and inexpensively assess welfare (Whitham and Wielebnowski, 2009). Ratings are also based on staff knowledge (Meagher, 2009), which is an underused resource. When welfare ratings are studied in combination with traits, such as personality, they can help further our understanding of why some animals do better in captivity than others.

In previous study (Robinson et al., 2016), we designed a 12-item welfare questionnaire for use in brown capuchins (*Sapajus apella*). For that study we collected observer ratings of personality and happiness, the latter being measured using the subjective well-being questionnaire (King and Landau, 2003), which was based on measure of human happiness (Sandvik et al., 1993). Observers agreed on their ratings of welfare and that welfare and happiness were measuring the same construct in brown capuchins. Welfare and happiness were positively associated with brown capuchin Sociability, Assertiveness, and Attentiveness, and negatively associated with Neuroticism.

To extend these findings across primates, we sought to conduct a similar study with another nonhuman primate species. To these ends, chimpanzees (*Pan troglodytes*) are an ideal study species due to the high number that reside in zoos, sanctuaries, and research facilities, and the welfare challenges captivity may pose for them (Hosey, 2005). We also tested whether observer ratings of welfare are valid by examining their association with behavioural indicators of welfare states. Behaviours commonly associated with positive welfare in chimpanzees include prosocial grooming (Martin, 2005) and play behaviour (Held and Špinková, 2011); those commonly associated with negative welfare include rocking and pacing (Jacobson et al., 2016).

Previous research has shown that ratings of chimpanzee happiness and behavioural indicators of chimpanzee welfare are associated with personality. Chimpanzees with higher Dominance, Extraversion, Agreeableness, and Openness and lower Neuroticism have higher subjective well-being (King and Landau, 2003; Weiss et al., 2009). Chimpanzees higher in Neuroticism also perform more self-directed behaviours, such as scratching (Herrelko et al., 2012). However, we do not yet know whether chimpanzee subjective well-being and welfare states, such as stress frequency and physical health, are related. Moreover, research is needed to determine whether and how chimpanzee personality is related to a more extensive set of welfare indicators.

To address these questions we collected ratings of welfare, subjective well-being, and personality in chimpanzees. Our first aim was to test the degree to which staff agreed in their ratings on an existing welfare questionnaire. Our second aim was to test whether there were associations between ratings on the welfare scale and ratings on the subjective well-being questionnaire. Our third aim was to test for associations between the ratings and observed

behaviours. Our fourth aim was to test for associations between welfare, subjective well-being, and personality.

## 2. Methods

### 2.1. Ethical approval

Our study was observational and non-invasive. Approval was sought and gained from the Edinburgh Zoo's Budongo Trail Research Committee on 3 July 2014, by the Edinburgh Biological Services Unit on 11 March 2014 (AWERB No: OS04-14), and by Fundació Mona's head researcher, Dr. Miquel Llorente, on 10 March 2015.

### 2.2. Subjects

We studied 31 chimpanzees, of whom 17 were males that ranged in age from 12.32 to 51.05 years (mean = 27.04 years  $\pm$  SD = 10.06 years). Of these chimpanzees, 8 males and 11 females were housed at the Royal Zoological Society of Scotland's Edinburgh Zoo and 9 males and 4 females were housed at Fundació Mona in Girona, Spain. The Edinburgh Zoo chimpanzees lived in 1832m<sup>2</sup> enclosure with outdoor and indoor areas, each with complex climbing structures, and ropes (Schel et al., 2013). The Fundació Mona chimpanzees lived in a 5640m<sup>2</sup> naturalistic outdoor enclosure. The enclosure is divided in two areas (2420m<sup>2</sup> and 3220m<sup>2</sup>) and contained natural grasses, wooden platforms, towers and ropes. Additional details on the Edinburgh Zoo chimpanzees and Fundació Mona are available in Schel et al. (2013) and Úbeda and Llorente (2015), respectively.

### 2.3. Instruments and observations

We used four questionnaires: the welfare questionnaire (Robinson et al., 2016), the subjective well-being questionnaire (King and Landau, 2003), the Five Factor Model Questionnaire (Úbeda and Llorente, 2015), and the Hominoid Personality Questionnaire (Weiss et al., 2009). Úbeda and Llorente translated the welfare and subjective well-being questionnaires into Spanish<sup>3</sup> and put them into an Excel spreadsheet. We also used existing behavioural data.

#### 2.3.1. Welfare questionnaire

The welfare questionnaire is comprised of three sections. In the first section, raters are instructed to answer questions about themselves and to explain the signs they use as indicators of positive and negative welfare, for example, "What signs (both physically and behaviourally) do you use as an indication that an animal has positive welfare?" The second section consists of a 12-item welfare questionnaire that is based on the factors—social relationships, mental stimulation, physical health, stress, and control—that McMillan (2005) identified as important welfare domains. The questionnaire design was also influenced by descriptions of animal stress, coping, and physical health (see Broom and Johnson, 1993; Broom, 1991, 2007). The wording of the ninth and tenth question was influenced by the quality of life scale (Table 3 in Green and Mellor, 2011). Printed instructions asked raters to answer each question using a five-point scale, which includes answers that range from "very bad" to "very good" (e.g. Boissy et al., 2007; Yeates and Main, 2008). The third section asks for demographic details on animals, including their date of birth and sex.

<sup>3</sup> The English version of the welfare questionnaire can be found in the supplementary materials and the original questionnaire can be found in Robinson et al. (2016).

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