

consistently in many primate species and has significant fitness consequences. Therefore, studies of social personality traits will shed light on the magnitude of personality variation in the social domain, allow the assessment of the interactions between social behaviour and other personality traits and enhance the understanding of the evolutionary significance of personality in a social environment.

In this study, I assessed personality in a large number ( $N=75$ ) of captive chimpanzees. Earlier behavioural research on chimpanzee personality has assessed only youngsters (Anestis 2005), few individuals (Uher et al. 2008) or males only (Foster et al. 2009; Anestis 2006). Much research has been done on great ape personality with a ‘psychological approach’ that relies upon human subjective evaluations of animal personality (King and Figueredo 1997; Weiss et al. 2002, 2007; Murray 1998). These studies yield no data on individual variation at the behavioural level (Uher 2008; Koski 2011). Thus, the present study is the first to provide basic data on personality differences in a large number of chimpanzees of both sexes and from multiple captive facilities.

I quantified within-individual consistency and between-individual variation in a range of ecologically and evolutionarily relevant social behavioural patterns (Table 1). The first aim was to test if the sampled behaviours were repeatable (Lessells and Boag 1987) and thus agreed with the definition of personality. Repeatability assesses the proportion of variation in behaviour that is due to inter-individual variation, as compared to intra-individual variation, and thus measures an individual's behavioural consistency. Second, I addressed the trait correlation structure to understand which social behavioural patterns are expressed as broader trait categories and whether social behaviours form syndromes with non-social behaviours, including general activity and self-directed behaviours (SDBs) that can be considered as indicators of anxiety (Leavens et al. 2001; Maestripieri et al. 1992; Schino et al. 1996). I expected to find personality traits in the realms of grooming and aggression (Anestis 2005; Foster et al. 2009; Uher et al. 2008) but refrained from predictions concerning other potential personality traits or their structural organisation. I further assessed sex differences in personality scores. Based on chimpanzee socioecology (Pepper et al. 1999; Gilby and Wrangham 2008), I predicted that males are more sociable than females. Finally, I assessed whether different captive groups differed regarding individual personality scores.

## Methods

### Study subjects and data collection

The study consists of observational data of 75 adult and adolescent individuals' behaviour. The data were collected

in 2002–2009 at three zoos: Burgers Zoo (AR) in Arnhem, The Netherlands, in 2002–2005; Chester Zoo (CH) in Chester, UK, in 2008; and Beekse Bergen Safaripark (BB) in Hilvarenbeek, The Netherlands in 2009.

The chimpanzee group of AR was established in 1971. During the study, the group had 5 adult or adolescent males, 17 adult or adolescent females and 7–9 infants and juveniles (not observed). All but four founding (wild-caught) individuals were born and reared in the group, and no new individuals were introduced during the study. Four individuals were transferred elsewhere before the end of the study but remained long enough to yield a sufficient amount of data (see below). The group lived in a combination of outdoor island (7,000 m<sup>2</sup>), indoor enclosure (378 m<sup>2</sup>) and adjacent off-exhibit feeding and sleeping cages.

The chimpanzee group of CH was established in 1956. The group had 5 adult and 1 adolescent male, 18 adult or adolescent females and 6 juveniles (not observed). All study subjects had been in the group since at least 1992 or born into the group later. The housing consisted of outdoor island (2,000 m<sup>2</sup>), indoor enclosure (143 m<sup>2</sup>) and adjacent off-exhibit feeding and sleeping cages.

The BB chimpanzee group was relatively newly established; the individuals were transferred from the Biomedical Primate Research Centre, Rijswijk, The Netherlands, to BB in 2006. The chimpanzees were divided into two groups, BBa and BBb. Both groups were formed by combining individuals from previously existing social groups; BBa was formed in 2003 and BBb in 2006. All individuals had been used in medical research until 2003, had varying rearing histories (i.e. mother or peer rearing) and past housing conditions (always socially but in varying group sizes). BBa had five adult males and 13 adult females and BBb had five adult males and six adult females. Neither group had infants or juveniles. Each group was housed in a combination of outdoor area (BBa, 2,786 m<sup>2</sup>; BBb, 2,240 m<sup>2</sup>), indoor enclosure (173 m<sup>2</sup>) and adjacent off-exhibit cages. The groups had visual and auditory but no physical contact with each other.

In all facilities, the chimpanzees were fed three to four times daily and water was always available. The chimpanzees had regular enrichment with various toys and hidden, extractable or frozen food items, and the living quarters were furnished with climbing structures, logs, tyres, nets and straw or wood wool as nesting material. All zoos are in the European Association of Zoos and Aquaria and comply fully with the regulations for animal keeping and welfare. The study was purely observational and adhered to the national and international ethical requirements for animal welfare (Animal Behaviour Society Guidelines 2006).

Data were collected by myself and several students under my supervision. Before starting the data collection, the students trained at least for a month, after which their