Chapter 9
Olfaction in the Gorilla

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Abstract It has been argued that the great apes have poor olfactory capabilities and that olfactory stimuli convey little useful information for them. Thus odours and scents have little functional significance for the great apes in guiding their behaviour. Part of this belief has been based on the observation that brain volume in those areas dealing with olfactory stimuli relative to other brain areas is greatly reduced in these apes. Moreover, naturalistic observations report little obvious olfactory guided behaviour. We have initiated a programme of work (Project SOAP) investigating the olfactory abilities, and the functions of smell, in the great apes. Here we report an initial study examining whether the western lowland gorilla (Gorilla gorilla gorilla) is able to detect and discriminate between different odours presented on cloths. The study revealed that gorillas can both detect the presence of an odour and discriminate between different odours. An incidental observation demonstrated one trial olfactory guided taste aversion learning which persisted for over 7 weeks. We conclude that gorillas have a functioning olfactory sense that they use in the investigation of their environment, and that olfaction may not be as irrelevant in great apes as has been suggested.

9.1 Introduction

There has been little study of the olfactory abilities of the great apes. Olfactory stimuli play an important role in guiding behaviour in many species (Stoddard 1980). In the great apes, however, the role of olfaction has been questioned due to the perceived primacy of vision and audition in influencing behaviour (King and Forbes 1974; Dominy, Ross and Smith 2004). This has led to the label of microsmatic being applied to the apes. For most vertebrates, e.g. the dog, there is much evidence of the importance of olfaction in behaviour, and these species are termed macrosmatic (Smith and Bhatnagar 2004).
The terms micro- and macro-smatic are not only restricted in their use to the role of olfaction in behaviour, but also refer to the anatomical structures involved in olfaction. For example, the relative size of brain areas dealing with olfactory stimuli when compared to overall brain size is greatly decreased in microsmatic species compared to macrosmatic species (0.01% in man, 0.07% in great apes, cf. prosimians 1.75% and insectivores 8.88%, Stephan, Bauchot and Andy 1970). This has led to the suggestion of poorer olfactory abilities in those animals with reduced relative size of brain structures associated with olfaction. However, whilst there is anatomical evidence of a reduction in relative size of olfactory structures in apes, it is unclear whether this is a good indicator of olfactory function and there has been little experimental study to examine whether this is the case (Smith and Bhatnagar 2004).

Further suggestions of poorer olfactory abilities in great apes have been derived from studies mapping olfactory receptor genes. These studies have revealed a progressive increase in the number of olfactory receptor pseudogenes in apes, including humans, resulting in a decrease in the number of functional olfactory receptor genes. Estimates indicate that humans have approximately 350 functional olfactory receptor genes, old world primates 700 and new world primates 1000 (e.g. Gilad, Wiebe, Przeworski, Lancet and Paabo 2004). This has also lead to a view that olfactory abilities will be consequently reduced in species with fewer olfactory receptor genes.

Much of the argument regarding the olfactory abilities of great apes has taken place in the absence of experimental evidence. However, studies on humans have challenged this. Whilst humans may have poorer acuity than macrosmatic species, they have good discriminatory abilities and excellent abilities to detect changes in concentration (e.g. Stoddart 1980). More recently, experimental techniques have been derived to examine olfactory abilities in monkeys and have revealed that these supposedly microsmatic primates have good olfactory abilities (e.g. squirrel monkeys: Laska, Seibt and Weber 2000; spider monkeys: Laska, Salazar and Luna 2003; pigtailed macaques: Laska, Wieser and Salazar 2005).

This raises the question of olfactory abilities in the great apes. We have found no experimental studies of olfactory abilities in the great apes other than two abstracts. Oeda, Ueno, Hasegawa and Tomonaga (2002) report a study which found that two infant chimps preferred strawberry and lavender odour and exhibited an aversion to pyridine. An increase in chimpanzee activity was reported when peppermint odour was added into the chimps’ enclosure by diffuser (Struthers and Campbell 1996). Naturalistic studies of great ape behaviour have observed apes touching an object with their fingers and then bringing these fingers to the nose (orangutans: Rijksen 1978; chimpanzees: Blackman 1947). Sniffing the genital region may be involved in pre-mating behaviour in gorillas (Dixon 1981). However reports of olfactory behaviour do not feature highly amongst naturalistic observations of the great apes. There are reports of silverback gorillas emitting a pungent odour, especially when stressed (Cousins 1990; Schaller 1963). Examination of the skin of great apes reveals the presence of apocrine glands and axillary organ (e.g. gorilla: Ellis and Montagna 1962; chimpanzee: Montagna and Yun 1963), both involved in scent production (Montagna and Parakkal 1974; Stoddart 1991). Thus, there may be a role for scent in the social behaviour of great apes.