

# **Behavioural flexibility in wild mountain gorillas and implications for its conservation: Anthropogenic impacts on species-specific behaviours**

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## **Introduction**

Behavioural plasticity is the ability to adapt conventional behavioural strategies to respond to novel conditions or challenges. Information on individual behaviour and social plasticity provide the framework to understand behavioural variations in population dynamics (i.e. survival and reproduction) as a reaction to environmental changes. Fully adaptive behaviours may also show faulty adaptation or disfunction if the environment changes, so we expect individuals to swift their behavioural strategies to adapt to the new conditions, through learning and explorative processes. It is suggested that the potential limits of behavioural plasticity are mandatory factors to take into account when developing wild population management plans, by aiming to the conservation of species-typical behaviours. In this thesis, I investigated key elements of habituated mountain gorillas' flexible behavioural responses including individual innovative traits, individual stress responses, and social plasticity:

- 1) I first explored mountain gorillas tension reduction strategies in response to the Tourism via social interactions and individual behaviour (Chapter 2) and the group's social plasticity (Chapter 3), contending for the urgent need for the enforcement of the current tourism rules, which may mitigate the stress levels observed in the wild gorillas.
- 2) I reported for the species, the first case of water play behaviour, discussing the enhanced behavioural flexibility of novel resources use (Chapter 4).
- 3) I provide evidence of infanticide in the Bwindi population, where this reproductive strategy is rare in comparison with the other mountain gorilla population, adding to the literature a complete description of infant corpse epimeletic behaviour in the species (Chapter 5), in addition to the discussion of the species' reproductive and dispersal strategies.
- 4) I explored the consistency of residents' relationships and the integration of new members, providing insights on the architecture of mountain gorillas' stable social networks upon demographic changes that allow for the preservation of social stability (Chapter 6).

## **Methods**

I collected data over a 9-month period (between December 2017-February 2019), subsequent to a 2-month pilot study (September-October 2017), on one group of mountain gorillas (N=15) living in Bwindi Impenetrable National Park, Uganda. I used continuous focal sampling to collect behavioural data before, during, and after the tourist visit, including social interactions, activity budgets, displacement behaviours, and human-directed behaviours. I collected also the number and identity of individuals within arm's reach of the focal. Regarding the tourists, I collected data on distance between gorillas and the closest tourist within the group, providing a proportion of time spent in each distance category per focal animal: a) < 3 meters,

b) 3-7 meters, and c) > 7 meters. I divided the tourist group size into two categories [a]  $\leq 8$  people per and b] > 8 people] to reflect the current rule of a maximum of 8 people per group, including park staff assisting the tourists.

## **Results**

In Chapter 2, at the first level of analysis, I found that 99 out of 199 tourist parties exceeded 8 people (including park staff) and spent 60% of the viewing time within 3 meters from the gorillas. Behavioural data showed that gorillas adopted social buffering to respond to tourist presence and close proximity, and increased scratching as a probable sign of stress reaction. Gorillas never charged tourists when tourists respected the 7 meters rule.

In Chapter 3, I found that increased tourist proximity was associated with an increase in time spent in a close association between individuals, but not to a change in the number of associates.

In Chapter 4, I reported in detail the movements and interaction with water in a playful manner by young adult individuals, described here as the first observed vigorous display of splashing water reported for Bwindi gorillas.

In Chapter 5, I reported an infanticide event, followed by epimeletic behaviour of the corpse I found that the mother carried the corpse for a day (June 5th, 2018), that other gorillas groomed both mother and dead infant, and I describe mother's stress coping mechanisms immediately after the loss of her infant.

In Chapter 6, I found no change in social partners and close neighbours and a similar time spent in proximity of others, following a natural demographic change in the studied group.

## **Discussion**

Considering the growing human pressure, and how it has challenged and confronted management measures for wildlife conservation, conservationists demand better scientific consultation to increase the efficiency of such plans. Taken together with the findings of the chapters of this thesis, I argue that mountain gorillas have evolved behavioural plasticity that enables them to adjust to changes in the environment, including anthropogenic disturbance, but is nonetheless at risk of zoonosis spillover, considering the short distances to tourists. I found a disruption of gorillas' behavioural patterns and social networks, but gorillas employ stress tension mitigation strategies to accommodate the presence or proximity of ecotourists. Gorillas also seem to adjust quite readily to changes into the social structure, preserving social stability while integrating new members into the group. On the other hand, individual flexible coping strategies may also yield risk, as the tendency to explore new objects may extend to snares and traps. In this thesis, I argue for better conservation of species-typical behaviours, in the wake of the previous major management efforts aiming to increase population numbers as the main goal for species conservation. Put together, the results in this thesis support the utmost importance of considering behavioural flexibility into conservation plans and contributes to the overall understanding of mountain gorillas' complex behaviour and social structure.