Beyond group size effects: vigilance and social monitoring in Nepal gray langurs

KATHERINE J. KLING1 AND ANDREAS KOENIG1,2

1Stony Brook University, Interdepartmental Doctoral Program in Anthropological Sciences (IDPAS), Stony Brook, NY
2Stony Brook University, Department of Anthropology, Stony Brook, NY

Introduction

- Vigilance, the monitoring of the surrounding environment, may serve different functions:
  - non-social vigilance (vigilance directed at targets not located within the individual’s social group) may serve to detect threats from both predators (Caro 2005) and conspecifics (e.g. outside competitors; Cowlishaw 1998).
  - social monitoring within an individual’s group can detect threats from group mates, e.g., food competition, mate competition, infanticide (Steenbeck et al. 1999; Treves 1999).
- Vigilance directed at predators should decrease with group size, because ‘de dilution’ and ‘many eyes’ effects (Pulliam 1973). This group size effect, though common in many species, is largely absent in primates (Treves 2000; Caro 2005; Allan and Hill 2018).
- The lack of a group size effect may be explained by:
  - not distinguishing between targets of vigilance; i.e., increased group size can increase pressures for social monitoring (Caro 2005), potentially masking male-male in non-social vigilance.
  - greater biological relevance of perceived, rather than actual, group size and thus of the presence of individuals in proximity (Metcalfe 1984).
- Distinguishing between targets of vigilance and neighbor density may help to solve this issue.

Study Objective and Predictions

- We investigated the functions of non-social vigilance (NSV) and social monitoring (SM) in Nepal gray langurs (Semnopithecus schistaceus), predicting that:
  - NSV may serve antipredator and extra-group functions
  - Social monitoring may serve within-group functions
- See Table 1 for specific predictions

Study Site and Study Species

- Study site: Ramnagar, Nepal (300 m a.s.l., 27°44′N, 84°27′E)
- Population: Langurs live in a range of group sizes displaying varied degrees of group spread (Koenig et al. 1998) and can have both multi- and unimale groups (Koenig and Boorjes 2001).
- Mating seasonality: Conceptions occur from July to November (Boorjes et al. 2001)
- Male immigration: mainly during the mating season (Boorjes 2000)
- Predation: 21.4% of all adult females and immature known to have died/disappeared due to predation (de Vries et al. 2016)
- Possible predators: leopards and domestic dogs (confirmed), jackals, jungle and leopard cats, tigers, 4 species of birds of prey
- Infanticide: Risk of infanticide amounting to about 1/3 of infant mortality (Boorjes and Koenig 2000)

Methods

- Focal instantaneous sampling data of NSV and SM collected in two groups of wild Nepal gray langurs (Semnopithecus schistaceus) from January 1994 to January 1995:
  - 30 s intervals over a half hour period each, i.e., 60 sample points (59,551 total)
  - Group A (‘small group’): 1-3 adult males and 2-3 adult females (9-10 individuals total)
  - Group O (‘big group’): 3-5 adult males, 14-15 adult females (26-34 individuals total)
- Proximity to group members (≤ 3 m) also recorded at sample point
- Social monitoring with group size and proximity exhibited contrasting effects for NSV and SM.
- The lack of a group size effect for SM may be due to unexplored factors including position within the group (Gaynor and Cords 2012) or having ‘trusted neighbors’ (Fraser et al. 2008).
- Males displayed higher NSV than females:
  - Males may provide a service to mates and potential offspring (Baldeilou and Henzi 1992)
  - Male NSV could also serve the dual function of being vigilant for both potential predators (Caro 2005)
- An increased need to monitor within-group competitors and receptive females during the mating season may lead to a trade-off between NSV and SM (Treves 2000)
- Females exhibited higher NSV and SM when dependent
- We found evidence for antipredator, but not extra-group, functions of non-social vigilance (NSV) and within-group functions of social monitoring (SM) in Nepal gray langurs.

Results

- Individuals (N = 27) non-socially vigilant for 24.0 ± 9.1% of sample points and socially monitoring for 4.6 ± 2.5%.
- Possible predators: leopards and domestic dogs (confirmed), jackals, jungle and feeding competition (females) or both with larger groups
- The lack of a group size effect for SM may be due to unexplored factors including position within the group (Gaynor and Cords 2012) or having ‘trusted neighbors’ (Fraser et al. 2008).
- Males displayed higher NSV than females:
  - Males may provide a service to mates and potential offspring (Baldeilou and Henzi 1992).
  - Male NSV could also serve the dual function of being vigilant for both predators (Caro 2005)
  - An increased need to monitor within-group competitors and receptive females during the mating season may lead to a trade-off between NSV and SM (Treves 2000).
- Females displayed both higher NSV and SM when dependent

Summary and Conclusions

- We found evidence for antipredator, but not extra-group, functions of non-social vigilance (NSV) and within-group functions of social monitoring (SM) in Nepal gray langurs.
- Group size and proximity exhibited contrasting effects for NSV and SM:
  - A proximity effect for NSV suggests that neighbor density is a more important factor in perceived predation risk than overall group size (Metcalfe 1984).
  - The general use of group size instead of neighbor density might explain the absence of a group size effect in non-social vigilance (Cowlishaw 1998).
  - A group size effect for SM could indicate increased mating competition (males) or feeding competition (females) or both with larger groups.
- The lack of a group size effect for SM may be due to unexplored factors including position within the group (Gaynor and Cords 2012) or having ‘trusted neighbors’ (Fraser et al. 2008).

Acknowledgements

Supported by the Alexander von Humboldt Foundation Feodor-Lynen Fellowship (V-3-FLF-1014527), a Graduate Council Fellowship (Graduate School of Stony Brook University), and an NSF Graduate Research Fellowship (2016203971).

All research was approved by the Research Division of the Tribhuvan University, Kathmandu, Nepal, and the Ministry of Education, Culture and Social Welfare (His Majesty’s Government) and was in compliance with Nepalese law. All research was non-invasive and adhered to the ASAB/ABS Guidelines for the Use of Animals in Research (1992).