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Bridging Species Divides: Affiliative Interactions between *Theropithecus gelada* and *Papio anubis* in an Unprotected Area in Ethiopia

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Most interspecies encounters in primates are aggressive (e.g., territorial defense, feeding competition), although they rarely involve physical contact. Affiliative interactions are less common and cannot be explained by ecological factors, such as territoriality or feeding, raising questions about the advantages of this behavior (Freyman et al., 2023). Tolerant behavior may help to reduce the probability of overt interspecies aggression. Understanding interspecies tolerance may shed light on the evolution of tolerant primate society and plasticity of communication, which is relevant in enlarging receiver networks.

Geladas (*Theropithecus gelada*), a terrestrial monkey endemic to Ethiopia, live in one-male, multifemale units (OMUs) well known for their intergroup tolerance (Palagi & Bergman, 2021). Such groups are organized in a multilayer society characterized by complex social and communicative systems (Bergman & Beehner, 2013). Geladas often coexist with olive baboons (*Papio anubis*) and grivet monkeys (*Chlorocebus aethiops*). The close phylogenetic relationship between geladas and olive baboons (Fig. 1) increases the risk of hybridization in sympatric populations.

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Fig. 1 Top left, the phylogenetic tree of extant Papionini (interpretation by Bergman & Beehner, 2013). ► The upper part of the figure shows the distribution of GPS points (red) collected by four observers at 15-min intervals throughout the entire data collection period at the Set Debir study site (Debre Libanos, Ethiopia, 9.711944°N, 38.8475°E). We generated the red area delineating the study site by connecting these GPS points. The blue GPS points indicate specific zones where geladas (*Theropithecus gelada*) and olive baboons (*Papio anubis*) were observed together. Bottom of figure, a graphical abstract summarizes the behaviors recorded between subjects of the two different species: ad=adult; sub-ad=sub-adult; l-inf=late infant; o.b.=olive baboons; g=geladas. ♂=male, ♀=female. Credits: Alice Galotti and Elisabetta Palagi

Putative gelada-baboon hybrids occur in the Bole Valley, where anthropogenic pressures may have increased interspecies mating opportunities (Jolly et al., 1997).

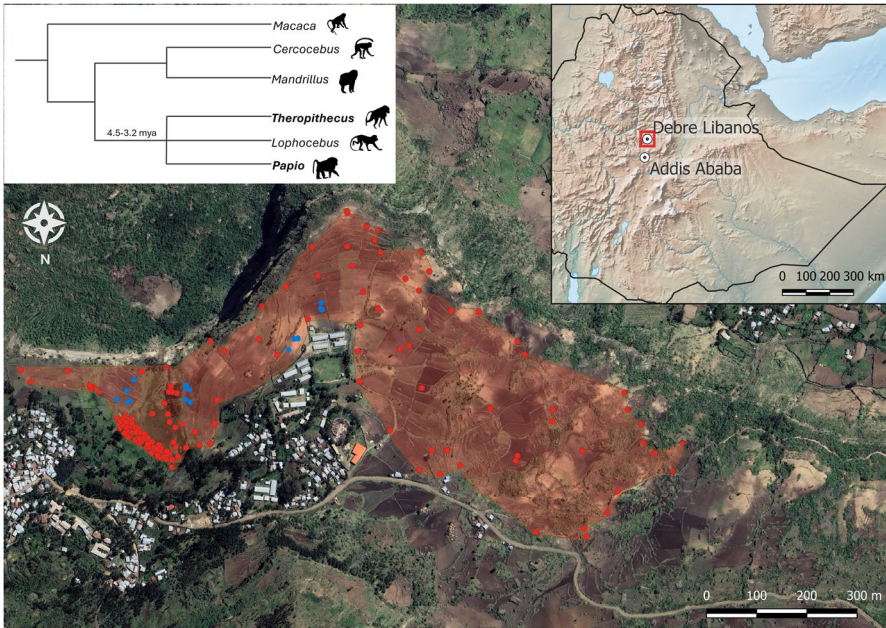
We report affiliative interactions between geladas and olive baboons in an unprotected, anthropized area rich in food for geladas (grass) (Debre Libanos, Oromia, Ethiopia, Fig. 1 and ESM_1). We followed 11 OMUs including 165 subjects from February to April 2024 (end of dry/start of wet season). We video-recorded all social interactions within and between OMUs and with other mammals. We used scan sampling at 15-min intervals (1564 scans) covering 391 h and recorded OMU identity, time of day, GPS position, and any other co-present primate species (within an area of 50 m) (ESM_1).

Geladas and olive baboons co-fed within 15 m in the same area for four hours (~ 16 scans). In addition to spatially tolerant co-feeding, we recorded interspecies affiliative interactions: lip smacking (N=1, an affiliative multimodal signal), reciprocal gazes (N=5), rear presenting (N=2), prolonged unidirectional grooming sessions (N=2), and a play invitation.

February 12 (03:03 pm): An adult male baboon followed the steps of male gelada PER (OMU_p) at 3 m. When PER sat down, the baboon passed him at less than 1 m, looking back at PER. PER turned, engaged in reciprocal gazing, and began lip-smacking. PER then followed the baboon for 5 s before sitting and self-scratching for 6 s. The male baboon continued walking, and a female baboon passed close (1 m) to PER without eliciting a visible reaction.

March 2 (12:25 pm): A group of olive baboons was feeding approximately 15 m from the subadult gelada DIN (OMU_D). DIN was feeding at the edge of his OMU when an adult female baboon gazed at him from 3 m away while walking in his direction. When the female baboon approached DIN to within 1 m, they gazed at each other for 1 s. This occurred again when she was 5 m away. When the baboon reached 0.5 m from DIN, she presented her back to him, a behavior that is usually followed by grooming in baboons. DIN continued to look at her but did not otherwise react. The baboon ran away while DIN continued looking at her. He did not follow her (Video ESM_3).

March 11 (02:00 pm): After sharing a feeding area for over 30 min, an adult female baboon ran towards two subadult gelada males (PER and PEA, OMU_p). After 2 s of reciprocal gazing with PER, the female groomed PEA's back for 65 s. When PER approached the pair, they stopped grooming, and the female presented her rear to him before leaving. PER immediately replaced the female, and the two geladas groomed one another. The female watched the new pair (8 s) while raising the eyebrows (a negative valence expression) and self-scratching (6 s).



March 11 (02:45 pm): Three late-infant (ESM₁ for age categories) geladas of the OMU_p (PIN, PEP, PON) and two late-infant baboons were within a 4 m² area. PIN gazed at one of the baboons for 6 s without any response. After 4 s, PIN and the second baboon gazed at one another for 1 s, during which time PIN scratched

himself. PIN approached to 20 cm of the baboon. They exchanged gazes again; then the baboon attempted to play slap PIN, who jumped away (Video ESM_4). PEP attempted to join the interaction by running toward PIN and the baboon, but the latter left the interaction while continuing to watch PIN and PEP for 2 s.

March 20 (12:39 pm): An adult female olive baboon approached a subadult male gelada (LOL, OMU₁) and stopped 1 m in front of him. After scratching himself twice, LOL approached the female to 0.5 m, who presented her rear to him. LOL showed her his flank, requesting grooming. She groomed LOL's rear/side with both hands and mouth (207 s, Video ESM_5). Three minutes later, the female presented her rear to LOL again, but he ignored her and continued feeding. She left him and rejoined her group.

Geladas and grivet monkeys also co-fed within 15 m for 28 scans (~7 h) (Fig. ESM_2), but all interactions were neutral (spatial co-presence). The two species never engaged in affiliative (body contact, grooming, rear presenting, play) or aggressive interactions (threatening, overt aggression).

Our observations provide further evidence of tolerance in geladas and show that adult female olive baboons are interested in initiating interspecies affiliative interactions. Interestingly, each interaction was preceded by a visual exchange, with subjects of both species gazing at each other before engaging in closer contact. Lip smacking seems to be effective in clarifying the affiliative intent of the signaler (Palagi & Mancini, 2011), promoting social alignment. The shared communication of these two phylogenetically close species seems sufficient to foster affiliative interactions. We hypothesize that, together with ecological factors (e.g., abundant resources) leading different species to converge towards anthropic areas, the high propensity for interspecies interaction underlies possible gelada and olive baboon hybridization (Jolly et al., 1997). In this light, comparing anthropized and nonanthropized areas can offer insights into the ecological pressures that promote these tolerant behaviors and communication strategies.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10764-024-00450-6>.

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Author Contributions AG, MF, LP, EP conceived the study; AG, MF, LP, SAG collected the data; BAB provided technical and logistic support for the data collection; AG and MF scored the videos; AG and EP drafted the manuscript; AG, MF, LP, SAG, AL, BAB, EP revised the final version of the manuscript.

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Data Availability All the relevant information and videos supporting the findings of the present study have been submitted as Supplementary Material.

Declarations

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Statement The research was entirely observational and did not involve any kind of manipulation. As a result, the Animal Care and Use Committee of the University of Pisa waived the requirement for approval. Research was also performed in accordance with the laws and approved guidelines of the Ethiopian Wildlife Conservation Authority (EWCA).

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