GfP 2019

16th Conference of the Gesellschaft für Primatologie

Göttingen
February 13-15, 2019

Programme

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17.10-18.10	**Amanda Melin** (Calgary): The Sensory Ecology of Fruit Selection by Wild Capuchin Monkeys
18.10-19.30	Welcome Reception

Thursday, February 14th, 2019

Morning session

Chair: *Julia Fischer (Göttingen)*

9.00-10.00 **Christoph J Völter** (St. Andrews): Comparative psychometrics: Establishing what differs is central to understanding what evolves

Chair: *Tobias Deschner (Leipzig)*

10.00-10.15 **Sofia IF Forss** (Tübingen), A Motes Rodrigo, C Hrubesch, C Tennie: Differences in novel food response between solitary and social great ape species

10.15-10.30 **Alba Motes Rodrigo (Tübingen),** A Hernandez Aguilar, C Tennie: Captive task-naïve chimpanzees use different tool materials to obtain buried food

10.30-10.45 **Johanna Henke-von der Malsburg** (Göttingen), C Fichtel: Innovation in two sympatric mouse lemurs (*Microcebus murinus, M. berthae)*

10.45-11.15 ***Coffee break***

Chair *Jorg JM Massen (Leiden)*

11.15-11.30 **Damien Farine** (Konstanz), M Somveille, J Firth, L Aplin, B Sheldon, R Thompson: Movement and conformity interact to establish local behavioural traditions in animal populations

11.30-11.45 **Kai R Caspar** (Duisburg-Essen), S Begall: Mirror-induced behavior in gibbons (*Hylobatidae*) – A review

11.45-12.00 **Rahel K Brügger** (Zurich), JM Burkart: Third-party social evaluation in cooperatively breeding common marmosets: Do they understand call combinations?

12.00-12.15 **Zina Morbach** (Roehampton), S Semple, A MacLarnon: Dealing with stress: stress reactivity and its link to (social) behaviour in wild chacma baboons

12.15-12.30 **Nadine Müller-Klein** (Göttingen), M Heistermann, C Strube, M Franz, O Schülke, J Ostner: Social and environmental transmission of gastrointestinal parasites in semi free-ranging Barbary macaques

12.30-12.45 **Katja Rudolph** (Göttingen), C Fichtel, M Heistermann, D Schneider, R Daniel, PM Kappeler: On the relationship among group size, health, and ecology in a wild lemur population

12.45-13.00 **Annette Klein** (Hannover), C Strube, U Radespiel, A Springer, E Zimmermann: Differences in microfilarial infection patterns in sympatric mouse lemur species

13.00-13.15 **Charlotte Defolie** (Göttingen), M Heistermann, C Fichtel: Caring is sharing: determinants of parasite richness at the individual, group and population level in wild redfronted lemurs (*Eulemur rufifrons*)

13.15-14.15 ***Lunch break***

Thursday, February 14th, 2019

Afternoon session

Chair: *Claudia Fichtel (Göttingen)*

14.15-14.30 **Yvonne Zürcher** (Zurich), EP Willems, JM Burkart: Increased similarity or individual recognition – common marmosets accommodate to their partners depending on call function

14.30-14.45 **Lauriane Faraut** (Göttingen), H Siviter, F Dal Pesco, J Fischer: How life in a tolerant society affects the use of affiliative vocalizations: evidence from male and female Guinea baboons

14.45-15.00 **Liza R Moscovice** (Emory), B Fruth, G Hohmann, A Jaeggi: Close Encounters: Causes and consequences of prolonged inter-group interactions for bonobos at LuiKotale

15.00-15.15 **Sylvain Lemoine** (Leipzig), C Boesch, C Crockford, RM Wittig: Effects of between-group competition on fitness in wild chimpanzees

15.15-15.30 **Robin E Morrison** (Cambridge), M Bermejo, JC Dunn, PD Walsh: Western gorilla inter-group dynamics: how neighbouring groups influence movement patterns

15.30-15.45 **Yoonjung Yi** (Ewha), C Fichtel, S Ham, H Jang, JC Choe: Participation in and outcome of inter-group aggression in a pair-living and territorial lesser ape, the Javan gibbon (*Hylobates moloch*)

15.45-16.00 **Alison M Ashbury** (Zurich), EP Willems, SS Utami-Atmoko, CP van Schaik, MA van Noordwijk: The socio-spatial dynamics of home range establishment among female Bornean orangutans at Tuanan

16.00-16.15 **Miguel de Guinea** (Oxford Brookes), S Van Belle, KAI Nekaris, A Estrada: Route Selection on Black Howler monkeys (*Alouatta pigra*): energetic implications associated with landscape structure and tree monitoring

16.15-16.45 ***Coffee break***

16.45-18.15 **Poster session with wine and snacks**

Friday, February 15th, 2019

Morning session

Chair: *Julia Ostner (Göttingen)*

9.00-10.00 **Andrea Migliano** (Zurich): From humans foraging niche to the emergence of cumulative culture

10.00-10.15 **Mirjam MI Minkner** (Leipzig), S Winters, CJ Young, BM Weiß, A Ganswindt, L Barrett, SP Henzi, JP Higham, A Widdig: What predicts genital colour variation in male vervet monkeys?

10.15-10.30 **Federica Spani** (Roma Tre), G Gentile, M Scalici, M Carosi: Primate penile bone symplesiomorphy disclosed: why a critical literature review is crucial?

10.30-11.00 ***Coffee break***

Chair *Claudio Tennie (Tübingen)*

11.00-11.15 **Julia A Kunz** (Zurich), GJ Duvot, MA van Noordwijk, SS Utami Atmoko, CP van Schaik: Orangutan males force copulations when they perceive mating competition

11.15-11.30 **Lavinia Germani** (Roma Tre), M Heistermann, PO Ngakan, M Carosi: The sexual "play all out" strategy of female moor macaque (*Macaca maura*)

11.30-11.45 **Delphine De Moor** (Göttingen), C Roos, J Ostner, O Schülke: Paternal and maternal kin biases in female Assamese macaques

11.45-12.00 **Joshua Reukauf** (Zurich), JA Kunz, O Wassmer, T Weingrill: Male bonding in Sumatran orang-utans – Why do unflanged males form temporary associations?

12.00-12.15 **Andreas Berghänel** (New Mexico), M Emery Thompson, MN Muller, ZP Machanda, RW Wrangham: Skewed birth sex ratios in wild chimpanzees: The role of prenatal maternal glucocorticoids and maternal age

12.15-12.30 **Astrid Rox** (Rijswijk), EHM Sterck, AH van Vliet, H de Vries, JAM Langermans, AL Louwerse: The road to success: Factors determining male introduction success in captive rhesus macaques

12.30-12.45 **Lynn Lewis-Bevan** (Oxford), D Biro, S Carvalho: Baboon habitat use in a complex environment, Gorongosa National Park, Mozambique

12.45-13.00 **Mareike C Janiak** (Calgary), KL Chiou, A Lu, TJ Bergman, JC Beehner, N Snyder-Mackler, AD Melin: Genomic adaptations for digestion, taste, and olfaction in the graminivorous gelada (*Theropithecus gelada*)

13.00-14.00 ***Lunch break***

Friday, February 15th, 2019

Afternoon session

Chair	*Oliver Schülke (Göttingen)*
14.00-15.00	**Margaret Crofoot** (Davis): Science of the Sociome: Tracking how individual interactions scale to complex societies
Chair:	*Gisela Kopp (Konstanz)*
15.00-15.15	**Helena Teixeira** (Hannover), J Salmone U Radespiel: Genomic signals of natural hybridization between *Microcebus murinus* and *M. ravelobensis* in northwestern Madagascar
15.15-15.30	**Bertrand Andriatsitohaina** (Hannover), MS Ramsay, F Kiene, ML Ramilison, SM Lehman, S Rasoloharijaona, R Rakotondravony, U Radespiel: Fragmentation effects in sympatric mouse lemurs (*Microcebus spp.*) in northwestern Madagascar
15.30-15.45	**Lauren C White** (Leipzig), C Fontserè, E Lizano, DA Hughes, M Arandjelovic, A-C Granjon, JB Hans, JD Lester, MT Rbanus-Wallace, C Rowney, V Städele, T Marques-Bonet, KE Langergraber, L Vigilant: A roadmap for high-throughput sequencing of wild animal populations using hybridization capture
15.45-16.00	**Irene Alida F Hasiniaina** (Hannover), MR Evasoa, M Scheumann, B Randrianambinina, S Rasoloharijaona, E Zimmermann: Agonistic calls: non invasive suitable tools for cryptic species in the smallest-bodied primate radiation, the mouse lemurs
16.00-16.30	***Coffee break***
Chair	*Ute Radespiel (Hannover)*
16.30-16.45	**Laura Hagemann** (Leipzig), C Boesch, MM Robbins, M Arandjelovic, T Deschner, M Lewis, G Froese, L Vigilant: Similar population size estimates over a twelve year period for a socially dynamic population of wild western lowland gorillas
16.45-17.00	**Filipa Franco da Silva Borges** (Lisbon), IA Pais, RM Sá, MW Bruford, C Casanova, L Chikhi, T Minhós, MJ Ferreira da Silva: The Genetics of Conservation – a case study on West African primates
17.00-17.15	**Alexander Mielke** (Leipzig), C Crockford, RM Wittig: Impact of interactional data density on results of primatological studies
17.15-17.30	**Erica S Dunayer** (SUNY), KN Balasubramaniam, CM Berman: Time matching between grooming partners: Do methodological distinctions between short vs. long term reciprocation matter?
17.30-17.40	**Oliver Schülke** (Göttingen): Closing Remarks and Award Ceremony
17.40-18.40	***GfP General Assembly***
19.00	**Farewell Party**

Poster session

The poster session will take place on Thursday, February 14th, from 16.45-18.15. The session will be split in two blocks; a number is assigned to each poster and we ask the presenters of even-numbered posters to be at their poster from 16.45-17.30; the presenters of odd-numbered posters are asked to be at their posters from 17.30-18.15.

16.45-17.30: Block 1 - Even-numbered posters

02 **Nilofer Begum** (LTM Research and Conservation Gleichen/Mysore), W Kaumanns, M Singh, H Hofer, A Sliwa: 100 years and 2400 Lion-tailed macaques (*Macaca silenus*) worldwide in zoos: Demography and conservation potential

04 **Monica Carosi** (Roma Tre), B Simeoni, C Sagnotti, P Ciaccia, M Ricotta, I Orlando: Space and time: dimensions of captive apes well-being

06 **Francisco E de Oliveira Terceiro** (Zurich), DL da C Silva, AS Araújo, JM Burkart: Comparing social tolerance between wild and captive common marmosets (*Callithrix jacchus*)

08 **João d'Oliveira Coelho** (Oxford), RL Anemone, S Carvalho: Fossil sites as landscape outliers: the potential of the dbscan clustering algorithm for detecting fossiliferous outcrops in forests

10 **Anja Ebenau** (Göttingen), C von Borell, L Penke, J Ostner, O Schülke: Personality homophily influences social bonds in wild Assamese macaques

12 **Claudia Fichtel** (Göttingen), ManyPrimates: ManyPrimates: Establishing an infrastructure for collaboration in primate cognition research

14 **Sol Gennuso** (Corrientes), M. Raño, B Natalini, V Romero, C Valeggia, M Kowalewski: Seasonality in cortisol levels in *Alouatta caraya* juveniles

16 **Philippa Hammond** (Oxford), L Lewis-Bevan, D Biro, S Carvalho: Vocalisations and vigilance: Vocalisations and Vigilance: Monitoring habituation and indicators of risk perception in baboons (*Papio ursinus*) in Gorongosa, Mozambique

18 **Eckhard W Heymann** (Göttingen), L Culot, ER Tirado Herrera, J Hambuckers, B Ziegenhagen, R Bialozyt, C Mengel, K Heer: Tamarin seed dispersal contributes to the natural regeneration of anthropogenically disturbed forest

20 **Haneul Jang** (Leipzig), C Boesch, R Mundry, KRL Janmaat: How does spatial movement pattern of human foragers and chimpanzees compare when they travel to food locations in the forest?

22 **Ammie K Kalan** (Leipzig), E Carmignani, R Kronland-Martinet, S Ystad, J Chatron, M Aramaki: Is chimpanzee accumulative stone throwing adapted for communication?

24 **Yena Kim** (Leiden), JC Choe, M Tomonaga: Familiar and unfamiliar human face recognition by chimpanzees: The role of mouth

26 **Annika Kollikowski** (Hannover), E Zimmermann, U Radespiel: The use of operant conditioning to study olfactory species discrimination in two mouse lemur species (*Microcebus lehilahytsara* and *M. murinus*)

28 **Kelly Ray Mannion** (Zurich), C Schuppli, A Marzec, C Fryns, M van Noordwijk: Achieving Independence in Bornean Orangutans: A Mother's Push or self-interests' Pull?

30 **Michaela Másílková** (South Bohemia), A Weiss, T Bugnyar, M Konečná: Cross-species comparison of personality structures based on everyday behaviours in callitrichids

32 **Fabia Miss** (Zurich), H Meunier, J Burkart: Auditory Simon Effect in an Old World monkey, *Macaca tonkeana*

34 **Bako Rasolofoniaina** (Göttingen), PM Kappeler, C Fichtel: Variation of cognitive style is driven by level of neophobia and social enhancement in free-ranging narrow-striped mongooses

36 **Laureen Seex** (Groningen), PM Kappeler, C Fichtel, CK Hemelrijk: The relation between undecided fights and social style in group living lemurs

38 **Lluis Socias Martínez** (Göttingen), PM Kappeler: Catalyzing Sociality: Ecology Builds on Parental Care

40 **James Stranks** (Göttingen), C Roos, M Heistermann, O Schülke, J Ostner: Ontogenetic changes in social relationship patterns and social buffering of the stress response in juvenile male Assamese macaques

42 **Sonia Touitou** (Göttingen), M Heistermann, O Schülke, J Ostner: Energetics of reproduction in wild female Assamese macaques (*Macaca assamensis*)

17.30-18.15: Block 2 - Odd-numbered posters

01 **Lucy Baehren** (Oxford), A Piel, T Matszawa, S Carvalho: Do wild chimpanzees say "goodbye"? A study on leave-taking in *Pan troglodytes* of the Bossou outdoor laboratory

03 **Mélissa Berthet** (Paris), G Dezecache: General alarm calls in primates: what do they mean?

05 **Fotang Chefor** (Cottbus-Senftenberg), U Bröring, K Birkhofer: The population size of the Nigeria-Cameroon chimpanzee in Kom-Wum Forest Reserve, Cameroon

07 **Ivo Colmonero Costeira** (CIBIO/Cardiff), T Minhós, M Ferreira da Silva: Protecting the last populations of the western spot-nosed guenon in Guinea-Bissau using genetic tools

09 **Sarah E De Troy** (Leipzig), EJC van Leeuwen, B Dietrich, KA Cronin, DBM Haun: The times they are a-changin': The development of social tolerance in four chimpanzee groups over eight years

11 **Sofya Dolotovskaya** (Göttingen), C Roos, EW Heymann: Social monogamy and pair bonds in red titi monkeys (*Callicebus cupreus*)

13 **CANCELLED** P Tralma, **Maria Joana Ferreira da Silva** (CIBIO/Cardiff), C Capelli, FI Martinez, Paleo Primate Project Team: High genetic diversity and subtle population structure of the grayfooted chacma baboons at Gorongosa National Park

15 **Johanna Henke-von der Malsburg** (Göttingen), PM Kappeler, C Fichtel: Interspecific differences in cognitive abilities in wild mouse lemurs

17 **Anna Holzner** (Leipzig), N Ruppert, A Widdig: Rat feeding behavior of Southern pig-tailed macaques in oil palm plantations – implications for conservation

19 **Lena Jeanson** (Göttingen), N Ghasemi Nejad, S Boretius, J Fischer: Age-dependent influences of general anaesthesia on the cognitive abilities in long-tailed macaques (*Macaca fascicularis*)

21 **Niels Kil** (Göttingen), C Roos, J Ostner, O Schülke: Social and genetic drivers of dispersal decisions in male Assamese macaques

23 **Kayla Kolff** (Utrecht), C Webb, F de Waal: Bystander jealousy-driven behaviour in zoo-housed chimpanzees, *Pan troglodytes*

25 **Barbora Kubenová** (Kyoto), J Ostner, O Schülke, B Majolo, P Šmilauer, J Waterman, P Tkaczynski, M M Konečná: Male infant handling in Barbary macaques (*Macaca sylvanus*): paternal care or mating effort?

27 **Anna Marzec** (Zurich) P Amodio, S U Atmoko, M van Noordwijk, CP van Schaik (Zurich): Within-population variation in nest building behaviours of Bornean orangutans

29 **Jorg JM Massen** (Leiden), SE Koski, T Bugnyar, AV Jaeggi, JS Martin: Prosocial motivations and similarity in personality increase cooperative success in common marmosets (*Callithrix jacchus*)

31 **Louise Peckre** (Göttingen), PM Kappeler, C Fichtel: Social determinants of scent-marking behaviours in red-fronted lemurs

33 **Alan V Rincon** (Göttingen), O Schülke, T Deschner, J Ostner: Oxytocin and affiliation in male Barbary macaques

35 **Sandro Sehner** (Zurich), RK Brügger, JM Burkart: Comparing methods of vigilance observation in captive common marmosets (*Callithrix jacchus*)

37 M Brindle, R Thomsen, G Cowlishaw, **Volker Sommer** (London): Masturbation in Primates: Phylogeny and Functions

39 **Rowan Titchener** (Göttingen), S Keupp, T Bugnyar, T Mussweiler, J Fischer: Social comparison in long-tailed macaques – competition is key

41 **Madita Zetzsche** (Leipzig), BM Weiß, C Birkemeyer, A Widdig: The role of chemical cues for indicating female fertility in primates

Talk abstracts

The Sensory Ecology of Fruit Selection by Wild Capuchin Monkeys

Amanda D Melin

Department of Anthropology and Archaeology & Department of Medical Genetics, University of Calgary, Calgary, AB, Canada T2N 1N4

Sensory systems are our interface with the external world. Longstanding hypotheses concerning primate origins hinge on the relationships among sensory systems, diet, and activity pattern. Understanding these interactions is key to interpreting primate adaptive radiation. I ask how primates use their senses to find and select foods, and how diet and habitat have shaped vision, olfaction, taste, touch and hearing over the course of primate evolution. Here, I will discuss my collaborative research on the sensory ecology of wild capuchin monkeys (*Cebus imitator*) in the tropical dry forests of northwestern Costa Rica over the past 15 years. Data from behavioral, genetic, life history, and visual modelling approaches provide compelling evidence that color vision polymorphism is maintained by balancing selection, and that monkeys with different sensory phenotypes have distinct ecological advantages and disadvantages. Trichromatic (color "normal" relative to human) capuchins have higher foraging efficiency on many ripe fruits, while dichromats (red-green colorblind) are more efficient at capturing surface-dwelling insects. Capuchins also integrate their senses of vision, olfaction, touch and taste in complex ways during foraging, and their sensory gene repertoire is diverse. Additionally, I will discuss how plant properties shape primate behavior - variation in the frequency of fruit sniffing and tasting can be linked to the chemical profile and odors of fruits as they ripen. Investigation of primate sensory ecology is still in its infancy, and I end by highlighting promising avenues of future research in this dynamic and enthralling area.

back to programme

Comparative psychometrics: Establishing what differs is central to understanding what evolves

Christoph J Völter

University of Veterinary Medicine, Vienna

Great apes are famous for their flexible problem-solving abilities. Studies have shown, for example, that zoo-housed great apes use food items and conspecifics as tools, select tools based on functionally relevant object properties, and seek information about relevant tool properties. However, interpreting the performance in these studies at a cognitive level remains challenging because multiple cognitive abilities might contribute to the task performance (the task impurity problem) and it is controversial which cognitive abilities exist and can be measured within a species (the construct validity problem). In this talk, I advocate a classic psychometric approach to make theoretical and empirical progress including assessments of test-retest reliability and multi-trait multi-method test batteries. Executive functions with their strong genetic component and domain generality (as established in humans), including working memory, inhibitory control, and attentional shifting, might be a sensible starting point for this endeavour. As a case study, I present ongoing work to establish a test battery for the assessment of executive functions in nonhuman primates.

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Differences in novel food response between solitary and social great ape species

Sofia Ingrid Fredrika Forss[1], Alba Motes Rodrigo[1], Christine Hrubesch[2], Claudio Tennie[1]

[1] Institut für Ur- und Frühgeschichte und Archäologie des Mittelalters, Eberhard Karls Universität Tübingen

[2] Department of Anthropology, University of Zurich, Switzerland

The diversity of great ape feeding niches requires behavioral flexibility and innovativeness and therefore exploration of potential novel food sources can be beneficial. Simultaneously, slow life history and low reproduction rates should select for high neophobia in the great apes to prevent harmful and poisonous food intake. Social information, such as presence of conspecifics or observations of knowledgeable models have been shown to help individuals to overcome neophobia towards new food sources in primates. Here we assess whether a social life style has any evolutionary effects on novelty response across species and present results from a comparative unique large data set of 134 apes from multiple facilities and four closely related species: *Pongo pygmaeus*, *Pongo abelii*, *Pan troglodytes* and *Pan paniscus*. To control for potential social and experience effects, all individuals were tested individually under similar captive conditions and revealed significant species differences. Chimpanzees were especially cautious and explored more before tasting novel food than the other apes did. Chimpanzees and bonobos were less likely to consume novel foods than the orangutan species. In natural habitats, the probability for a chimpanzee or a bonobo to have access to social information is higher than that for a solitary orangutan. The outcomes align with the social information hypothesis expecting reliance on social cues to have an evolutionary effect by selecting for higher intrinsic neophobia in species were social information is abundant.

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Captive task-naïve chimpanzees use different tool materials to obtain buried food

Alba Motes Rodrigo[1], R Adriana Hernandez Aguilar[2], Claudio Tennie[1]

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[2] Centre for Ecological and Evolutionary Synthesis (CEES), Department of Biosciences - University of Oslo

Abstract not available online because of unpublished data

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Innovation in two sympatric mouse lemurs (*Microcebus murinus, M. berthae*)

Johanna Henke-von der Malsburg[1,2,3], Claudia Fichtel[1,2,3]

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[2] Department of Sociobiology/Anthropology, Johann-Friedrich-Blumenbach Institute for Zoology and Anthropology, University of Göttingen, Kellnerweg 6, 37077 Göttingen, Germany

[3] Leibniz ScienceCampus 'Primate Cognition', Göttingen, Germany

The propensity to flexibly innovate behavioural variants might advantage animals when dealing with novel or modified ecological or social challenges. Interspecific innovative abilities can be predicted by the degree of ecological generalism and intraspecific variation is predicted by personality traits. To examine the effects of these factors on innovation, we compared problem-solving abilities in the generalist grey mouse lemurs (*Microcebus murinus*) and the more specialized Madame Berthe's mouse lemurs (*Microcebus berthae*) in western Madagascar. We examined personality traits by testing 54 individuals in open field and novel object tests, and we assessed problem-solving abilities by presenting an artificial feeding-box that could be opened by three different techniques. The first two techniques presented novel problems and the third technique a modified problem to the more complex second novel problem. In both species, motivation, early success, and better inhibitory control characterized innovators and predicted superior problem-solving performance. Although both species performed equally well in finding a solution to the novel problems, the specialist species was more efficient in finding a novel solution to a familiar problem. Since the ecological specialist also exhibited more inhibitory control in this task than the generalist, we propose that specialists may dispose of more efficient problem-solving behaviour.

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Movement and conformity interact to establish local behavioural traditions in animal populations

Damien Farine*, Marius Somveille, Joshua Firth, Lucy Aplin, Ben Sheldon, Robin Thompson

* Max Planck Institute for Ornithology, Konstanz, Germany

The social transmission of information is critical to the emergence of animal culture. However two processes are further predicted to play key roles in whether socially-transmitted information will establish in groups to form persistent traditions that are resistant to invasion by other behavioural variants: the movement of individuals across the landscape and conformist social learning. We first develop a model where a new foraging resource can be accessed in one of two ways, and individuals learn the new behaviour from knowledgeable individuals with varying strengths of conformist bias guiding their solving preference (conformist bias measured as a sigmoidal relationship between the probability of adopting a behaviour and its frequency in the group). The population is composed of several spatially distinct sub-populations, and individuals move between sub-populations with a variable movement rate. Our results reveal a strong interplay between movement rate and conformity for determining whether local traditions establish across a landscape, or whether a single preference dominates across the whole population. We then apply the model to real-world cultural diffusion experiments in great tits, Parus major, where wild studies showed that birds exhibited a conformist bias when social learning how to access a new foraging resource. In addition, birds tended to switch their behaviour to that of the local majority when moving between sub-populations. Our model is able to replicate the patterning of emergent traditions observed in this empirical experiment, allowing for a range of predictions to be made for the emergence of animal culture under various initial conditions, habitat structure and strength of conformist bias. Finally, our work highlights that the interactions between multiple factors are likely to underpin observations of behavioural variation in natural populations.

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Mirror-induced behavior in gibbons (*Hylobatidae*) – A review

Kai R Caspar[1], Sabine Begall[1]

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Mirror self-recognition (MSR) is a well-known capacity of great apes and is commonly assumed to be absent in other primates. However, the ability to recognize a mirror-image as a self-representation has been occasionally claimed to be present in other primate taxa, including gibbons. As these form the extant sister group to the great apes, they are of special interest to retrace MSR evolution. Gibbons' mirror-induced behavior has been studied repeatedly and comprises a diverse array of different responses. The talk summarizes the history of MSR studies involving hylobatids and presents selected results from new observations on 32 zoo-housed gibbons. All available evidence indeed suggests that gibbons do not display MSR, which apparently emerged exclusively among great apes within the primate order. The application of advanced neurophysiological methods and further research on non-primate MSR models may significantly improve our understanding of how this enigmatic behavioral phenomenon evolved.

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Third-party social evaluation in cooperatively breeding common marmosets: Do they understand call combinations?

RK Brügger*, JM Burkart

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Third-party social evaluation is crucial for group living species to navigate complex relationship networks and to keep track of potential cooperation partners. Experiments with human actors have shown that marmosets are able to evaluate social interactions between humans but experimental evidence of social evaluation of their conspecifics is still lacking. Additionally, behavioral reactions during social evaluation can be very subtle and not all social evaluation necessarily leads to punishment or reward of these conspecifics. Infrared thermography is a non-invasive tool to assess emotional states in humans and animals whereas nasal temperature changes indicate changes in arousal. We assed marmosets' (n = 21) changes in arousal during playbacks of opposite sex outgroup individuals. We used two different types of playback-stimuli either simulating (1) a social interaction between an adult and an immature (interaction playback), which could be positive (combination of begging calls of the immature followed by food calls of the adult) or a negative (begging calls followed by antagonistic chatter calls), or (2) a single individual being present (non-interaction control playback) via food, chatter or begging vocalizations from a single individual. The data suggests that marmosets' changes in emotional arousal differ after having witnessed the interaction vs. the control playback. Importantly, the reactions to the interaction playbacks cannot be explained as an additive effect of reactions to the control playbacks, indicating that they understood the call combination. We validate the thermal data with behavioral measures e.g. looking behavior or piloerection of the tail.

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Dealing with stress: stress reactivity and its link to (social) behaviour in wild chacma baboons

Zina Morbach[1], Stuart Semple[1], Ann MacLarnon[2]

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While the stress response is an adaptive and evolutionarily conserved mechanism that mediates the reaction to different kinds of stressors, it has also been long known that sustained high levels of stress hormones can have negative consequences for the individual. Different types of behaviour have been linked to various measures of stress hormone levels, with strong social relationships, social integration, and coping behaviour having the potential of mitigating these negative effects of high stress hormone levels. Recently, stress hormone reactivity, rather than absolute measures of stress hormone levels, has been proposed as a more meaningful measure of stress in wild animals, as it allows consideration of the many factors that can influence hormonal measurements and takes into account unknown hormonal baseline levels. This study investigates the relationship between behaviour and stress reactivity in wild chacma baboons. We collected over 330 hours of focal animal data on association, affiliation, and agonism as well as on self-directed behaviour, from 34 adult and subadult males and females of a troop of wild chacma baboons at the field site of the Primate and Predator Project in South Africa. Additionally, we collected faecal samples for all subjects, and analysed faecal glucocorticoid metabolite levels using EIA. These were used to calculate the Demonstrated Reactive Scope for each individual. We will report the link between this measure of stress reactivity and different types of behaviours, as well as with inherent individual as well as ecological factors; this will form the basis for further analysis of coping behaviour and stress resilience in the study species.

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Social and environmental transmission of gastrointestinal parasites in semi free-ranging Barbary macaques

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Exposure and susceptibility are known contributors to parasite transmission, yet both aspects are rarely studied in combination. Here we aimed at a comprehensive picture of the factors driving strongyle nematode infections in Barbary macaques (*Macaca sylvanus*), utilizing experimental parasite clearance in 57 individuals to study predictors of reinfection. Using a combination of faecal egg counts and patch occupancy modelling, we assessed the roles of behaviour (social bonds, grooming networks, ground use) and physiology (faecal glucocorticoids, urinary c-peptides and neopterin, coinfection with gastrointestinal helminths) for transmission, using information criterion-based model selection to determine the best models predicting reinfection patterns. Coinfection with GI helminths was the strongest risk factor, and our results suggest both environmental (time spent on contaminated soil) and social (grooming partner number) components of parasite transmission. Contrarily, strong social bonds with opposite sex partners decreased reinfection probability. Studying the effects of both exposure and susceptibility simultaneously, we add to the current knowledge on the parasite-behaviour-physiology link and take a step towards assessing the relative effects of behaviour and physiology on gastrointestinal helminth infection risk.

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On the relationship among group size, health, and ecology in a wild lemur population

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Life in groups exposes individuals to various health-related costs and benefits. Group size is one key aspect of group living and can crucially impact consequences of sociality. For example, feeding competition, parasite infestations, and energetic constraints are higher in larger groups, while smaller groups face higher per capita predation risk and increased inter-group competition. Yet, there are other variables like seasonality or habitat quality that can impact consequences of sociality and could lead to apparently contradictory findings if neglected. By comparing measures of health under consideration of estimates of habitat condition, we expect to improve our current understanding of the trade-offs related to group living. Over a course of two years, we studied 43 individuals of 7 differently sized groups (range 2-10) of Verreaux's sifakas (*Propithecus verreauxi*). We combined measures of faecal glucocorticoids (GCs, n > 2300) and ranging patterns, which are both positively related to individual energy expenditure, together with intestinal parasite richness (n > 500) and estimates of habitat condition. We found individuals in medium-sized groups to have the shortest daily travel distances, but no further group size effects were detected. Moreover, no differences in home range structure were found among groups. The most influential factors for changes in behavioural and physiological patterns were based on seasonality, dominance or reproductive state. Our results indicate that group size on its own might be insufficient to explain links between sociality and health or that the absolute range of group sizes in this species is too small to induce pronounced effects.

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Differences in microfilarial infection patterns in sympatric mouse lemur species

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Population growth, shifting demographics and deforestation may enhance transmission of vector-borne pathogens at the human-livestock-wildlife interface. Endemic species play a key role in this context as potential reservoirs for emerging infectious diseases, but at the same time get exposed to newly introduced pathogens that may result in high morbidity and endanger wildlife populations. In this study, we investigated microfilarial infections in two sympatric mouse lemur species (*Microcebus murinus* and *M. ravelobensis*) in Northwestern Madagascar. Giemsa stained blood smears of captured individuals were screened for microfilaria over the course of an 11-month study period. *M. murinus* had a significantly higher risk of infection (prevalence 30.43%) and showed higher microfilaremia than *M. ravelobensis* (prevalence 6.59%), which may be explained by species differences in vector exposure and/or a lower immune competence of *M. murinus*, that may be the result of a shorter period of host-parasite coevolution. Genetic analyses of the *Onchocercidae sp*. found in this study revealed more than 99% identity with microfilariae isolated from a blood sample of a larger lemur species (*Lepilemur edwardsi*) from the same forest area, indicating low host specificity of this nematode. Neither body mass, taken as a proxy for individual fitness, nor sex influenced parasite prevalence or intensity significantly. Our findings suggest a long-term co-evolutionary adaptation of lemur hosts and parasitic nematodes, resulting in persistent infection and low morbidity and a potential influence of sleeping site ecology on vector exposure and thereby risk of infection with vector-borne pathogens.

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Caring is sharing: determinants of parasite richness at the individual, group and population level in wild redfronted lemurs (*Eulemur rufifrons*)

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Increased risk of parasite transmission is one of the major costs of group living and plays a pivotal role in driving both population dynamics (population decline, zoonose risk) and evolutionary processes (forces shaping mating and social system). Since parasite infections are ubiquitous in the wild and can have strong impact on health and fitness, it is important to understand the factors determining parasite susceptibility and transmission. We investigated determinants of parasite richness in wild redfronted lemurs in Kirindy forest, Western Madagascar. This population has one of the highest parasite richness in lemurs with twelve different morphotypes identified and frequent co-infection. We focused on ten possible determinants of parasite richness: age, sex, body condition, reproductive states, steroid hormone (glucocorticoids, testosterone and estrogen) levels and strength of social bonds at the individual level, percentage of ground use and ranging behavior at the group level and rainfall and temperature at the population level. We observed 32 adult individuals in five groups and collected 736 fecal samples for parasite and steroid hormone analyses over a period of 18 months. In our population, parasite richness was positively correlated to the rainy season. It increased with social bond strength, it was higher in females during gestation and early lactation and age played a role for both sexes. To sum up, parasite richness was influenced by multiple factors through both transmission and infection susceptibility, but individual level processes seem more important than those at the group or population level.

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Increased similarity or individual recognition – common marmosets accommodate to their partners depending on call function

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Social vocal accommodation (SVA) is a form of vocal learning that is relatively common in primates, including humans. Often, SVA in the form of convergence (becoming more similar) indicates a strong social bond. It is unclear though how convergence can be compatible with an individual's need of encoding identity in calls. Common marmosets have been found to accommodate to new conspecifics after acoustic exposure, and identity is encoded in their calls. We therefore investigated if SVA in marmosets was linked to the social function of different call types, predicting that we would find less convergence in calls where identity information is crucial, such as in long distance contact calls, and more convergence in other social calls. We recorded calls from 20 captive common marmosets over the process of pair formation and analyzed three different call types with different social functions. Using the change in Euclidian distance between pair mates' calls as a measure of accommodation, we could show that the rate of SVA is low in calls where individual ID is crucial, but high in other social contact calls. Further, breeding partners showed a high correlation in call modulation over time in calls not transmitting ID, whereas calls encoding ID showed no such correlation. This data suggest that common marmosets modify calls differently depending on their function. Calls where individual ID is less crucial have more potential to be varied for different purposes, like indicating pair bond by SVA or correlation with a new partner. Probably accommodation gets regulated by different mechanisms depending on call function, which makes it a complex and variable system of vocal learning.

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How life in a tolerant society affects the use of affiliative vocalizations: evidence from male and female Guinea baboons

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Nonhuman primates are able to use their signals flexibly and in a goal-directed way. Highly despotic female chacma baboons (*Papio ursinus*), for instance, grunt to mollify lower-ranking females, as well as females with an infant, suggesting that the power differential of the interacting dyad and the value of the interaction drive grunt usage. To test whether this assumption also holds for species living in a fundamentally different social system, we investigated the usage and function of grunts during approaches in wild Guinea baboons (*P. papio*). Guinea baboons live in a highly tolerant multi-level society with female-biased dispersal. Our analysis comprised N = 5878 approaches by N = 37 female and N = 34 male baboons. When the approaching subject grunted, baboons of both sexes were more likely to interact in an affiliative fashion and handling of the partner's infant increased. Both sexes were more likely to grunt to females than to males. Relationship strength and presence of an infant modulated the likelihood of grunts. In females, the probability to grunt was lower when the relationship strength was high, but only when an infant was present. In males, relationship strength had no impact on the likelihood to grunt during approaches. Rank did not affect grunt probability in females and could not be discerned in males, but males were more likely to grunt when an infant was in close-proximity of a female partner. Although the pattern of grunt usage and the effect on recipients varied slightly between Guinea and chacma baboons, it followed the principle that the 'desirability' of the interaction affects the usage of this affiliative vocalization.

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Close Encounters: Causes and consequences of prolonged inter-group interactions for bonobos at LuiKotale

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Research on inter-group encounters (IGEs) often emphasize the circumstances that promote aggression, while the factors that promote out-group tolerance or cooperation have received less attention. We evaluate potential benefits of different responses to IGEs for the Bompusa bonobo community at LuiKotale during a time of prolonged IGEs with the East community. We tested whether Bompusa bonobos received benefits by: 1) Out-competing the East group for access to food (Inter-group dominance hypothesis) or by 2) Maintaining social ties with out-group partners (extended social network hypothesis). Bompusa bonobos spent 50% of observation time (n= 276 hours) in the core ranging area of the East community, and were involved in IGEs during 22% of this time. A phenological survey indicated a tendency towards lower fruit availability in the Bompusa home range (GLMM, est ± SE= -1.1 ± 0.63, p= 0.07) compared with the East home range during this period. Bompusa bonobos also spent a greater proportion of feeding scans eating drupe fruits while in the East home range (GLMM, est ± SE= 0.68 ± 0.15, p< 0.001). IGEs involved increases in aggression, but outcomes of aggression were not explained by imbalances in fighting power (GLMM, likelihood ratio test, chi-square$_1$= 0.68, p= 0.41). Bompusa individuals also exhibited increases in socio-positive interactions during IGEs (GLMM, est ± SE= 1.37 ± 0.44, p< 0.001), which were primarily directed at out-group females. Results partially support the inter-group dominance hypothesis, but also suggest that bonobos gain social benefits through tolerant out-group contact.

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Effects of between-group competition on fitness in wild chimpanzees

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Between-group competition (BGC) in social organisms is assumed to be a prominent selective pressure shaping the evolution of territoriality and cooperation. However, quantifying BGC is difficult and detecting its effects on fitness remains challenging. The inter-group dominance hypothesis predicts that group dominance depends on the competitive ability of groups, and that dominant groups occupy larger territories than weaker groups, leading to fitness benefits. We hypothesize that high competitive potential of a group drives its territory size and results into fitness benefits, but that pressure from neighbors limits territory size and incurs fitness costs.

Using long-term spatial ranging data on four neighboring groups of wild chimpanzees (Pan troglodytes verus) in the Taï National Park, Côte d'Ivoire, we measure the competitive ability of habituated groups with demographic parameters and the pressure exerted by non-habituated neighbors with an index combining frequency of neighboring encounters and related spatial information.

We find that i) territory size is driven by the number of adult males but not affected by neighbor pressure; ii) females in groups with a high number of males and with low neighbor pressure have shorter inter-birth intervals; iii) high neighbor pressure during pregnancy negatively affects survival of infants. We conclude that BGC hampers fast reproduction in Tai chimpanzees and may represent a significant prenatal stress factor, and therefore that group dominance results in fitness benefits. Overall, our findings suggest that BGC is a significant selective pressure that could have shaped aspects of sociality in chimpanzees.

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Western gorilla inter-group dynamics: how neighbouring groups influence movement patterns

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Gorilla groups have large overlapping ranges in which they regularly come into contact with one another, with multiple groups feeding on the same limited resources. Whilst the overlapping ranges suggest a lack of territoriality, they raise the question of how this intelligent, social species shares geographical space and the limited resources within it. Using a large scale camera trap study we monitored 22 known western lowland gorilla groups in Republic of Congo across a 60km2 region. We used presence-absence data of groups at naturally occurring root feeding sites to build models of their movement patterns. Our results demonstrated the short term avoidance of other groups, which did not appear to vary significantly between “neighbour” and “non-neighbour” groups, but varied considerably with distance from a group’s home range. Visit rates reduced with proximity to another groups range suggesting that whilst core home range regions may not be actively defended, range delineation may be maintained through either active avoidance of other groups’ core ranges or avoidance of areas known to have depleted resources due to the presence of other groups. Our results provide the first model of how gorilla group movement patterns influence one another across their ranges, and a foundation for novel hypotheses on the cognitive rules applied by gorilla groups in their movement and foraging decisions.

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Participation in and outcome of inter-group aggression in a pair-living and territorial lesser ape, the Javan gibbon (*Hylobates moloch*)

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Inter-group interactions are often of aggressive nature when competition occurs over limited and defensible resources. Evaluating motivation to participate in inter-group interactions for both individual and group levels is essential to understand the underlying mechanism. We investigated factors influencing the individual participation and outcome of inter-group encounters in pair-living and territorial Javan gibbons (*Hylobates moloch*) over 43 months in Gunung Halimun-Salak National Park, Indonesia. We observed 247 complete encounters that were mostly aggressive. Males were more likely to participate in chasing and females in singing when more individuals from the opponent group participated. Males also participated more, when more fruits were available and when cycling females or dependent infants were present in comparison to when pregnant or lactating females, supporting the male mate and infant defense, but not food resource defense hypothesis. Females tended to sing more during the encounter when they were cycling compared to when pregnant or lactating, indicating a possibility of advertisement function of songs. Only the presence of cycling females predicted the probability of winning encounters, independent of the intensity of space use at the encounter point in any time period, i.e. 1, 3 or 6 months. The absence of the location effect might be due to high encounter rates with stable neighborhoods, where winning may not lead to monopolize the area. Our results suggest higher number of active opponents motivates individuals to participate, whereas the location-based payoff asymmetry did not affect the outcome, despite their small group size and territoriality.

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The socio-spatial dynamics of home range establishment among female Bornean orangutans at Tuanan

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Female orangutans exhibit natal philopatry, living in long-term stable home ranges that overlap with those of their mothers and maternal female relatives. Using data collected from 2003 to 2017 at Tuanan in Central Kalimantan, Indonesia, we attempt to better understand the mechanisms of female philopatry and the factors that influence the home range establishment process of young female orangutans. Data were collected during nest-to-nest focal follows of individual orangutans; 4 young females (followed from immaturity until at least 2 years after the birth of their first offspring (n=3) or until independence (n=1)) and their 3 multiparous mothers. Our data set includes over 25'000 observation hours (mean = 3'600 hours/female) of simultaneous social and spatial data. Monthly habitat fruit availability data were also collected at the site. We analyze changes in a female's day journey length (DJL), home range size and overlap with her mother, and time spent in association with her mother as she matures through different phases of development and reproduction. DJL correlates significantly with fruit availability and association time with conspecifics, while reproductive phase also has a strong influence: young females have significantly longer DJLs while they are sexually active adolescents, and fruit availability more strongly influences DJL during pregnancy. Mother-daughter home range overlap decreases gradually as young females move from dependency to adolescence, while the proportion of time that they spend with their mothers decreases more sharply, indicating that females continue to share space with their mothers even after discontinuing regular association.

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Route Selection on Black Howler monkeys (*Alouatta pigra*): energetic implications associated with landscape structure and tree monitoring

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Animal navigation requires a continuous balance of information processing and energy expenditure. As such, some primates' cognitive machinery may constrain their ability to move flexibly in space by reducing their movement choices to a fix set of pre-established routes. Nevertheless, the use of a route network to navigate across tropical forests may provide an energetically efficient strategy. Here, we hypothesize that black howler monkeys (*Alouatta pigra*) inhabiting a variant landscape may have optimized the location of routes to enable them to monitor potential feeding sources while minimizing their energy expenditure. We observed five social groups for a 12-month (Sep 2016 – Aug 2017) study in Palenque National Park, Mexico. We marked all individual trees belonging to the monkey's preferred feeding species in each one of the home ranges and we conducted landscape analysis using a detailed topographic map. Results showed that howlers intercepted more potential feeding sources across their route network than randomly simulated feeding sites ($\chi^2(1)=4.17$, $p=0.041$). A GLMM fitted by PQL revealed that routes used at least twice were negatively influenced by the proximity to canopy gaps and positively by the visibility of preferred feeding trees ($\chi^2(7)=38.16$, $p<0.001$). Routes used at least four times were also influenced by proximity to gaps and visibility of preferred feeding sources, but also positively by the terrain's slope, elevation and potential feeding sources ($\chi^2(7)=26.55$, $p<0.001$). Results suggest that howlers may have been optimizing the placement of the "skeleton" of the route network in order to avoid costly scenarios and favour tree monitoring while travelling.

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From humans foraging niche to the emergence of cumulative culture

Andrea Migliano

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What is the relationship between human cumulative culture and hunter-gatherer social structure including cooperative breeding, pair-bonding and cooperation with unrelated individuals? Contemporary hunter-gatherers provide a privileged window into the conditions for the emergence of human's unmatched cultural abilities. Here I propose that the complex social networks of ancestral hunter-gatherers were a fundamental requirement for the evolution of human cumulative culture. Pair bonding and the absence of sex philopatry in mobile hunter-gatherer groups, lead to a fluid social structure in hunter-gatherer communities, where a person i can meet and cooperate with hundreds of unrelated individuals over a lifetime. Here I show that social network structures in extant hunter-gatherers favour cultural exchange; that our tendency to form long-lasting friendships develops early in hunter-gatherer's childhood; and that the multi-layered networks formed by multi-family and multi-camp interactions promote adaptive diversification of knowledge. The understanding of hunter-gatherer's unique social structure provides new insights into cultural evolution and a new framework for comparative studies of humans and other primates.

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What predicts genital colour variation in male vervet monkeys?

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Colourful ornaments are widespread in the animal kingdom and well known to be used in inter- and intra-sexual communication. Many primate species have colourful ornaments, however, studies on the relationship between the display of these ornaments, the colour itself and individual characteristics are still rare, particularly regarding multi-colour ornaments. Vervet monkeys (Chlorocebus pygerythrus) present their colourful genitals in a behavioural display, the Red-White-and-Blue (RWB) display, making them an ideal species to investigate such relationships. We observed three groups of vervet monkeys (N=20 males) at the Samara Private Game Reserve, South Africa, over one mating season. We measured genital colouration from 405 photos, and complemented colour data with behavioural (male dominance, RWB display frequency, male-male mating competition), hormonal (faecal glucocorticoid level) and life history data (male age, tenure and injuries). Using state-of-the-art colour measuring methods such as visual modelling and measurements of perceptual distances, we assessed male variation in genital colouration (single colours as well as their contrasts) and the frequency of the RWB display with regard to male characteristics and mating competition. None of the tested predictors described the inter- or intra-individual variation in genital colouration. However, male dominance showed a strong, and mating competition a weak, influence on the number of RWB displays. Our study is one of the first to investigate colouration and its interplay with display behaviour, which will help to improve our understanding of colourful ornaments used for communication.

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Primate penile bone symplesiomorphy disclosed: why a critical literature review is crucial?

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In order to reconstruct the evolutionary history of primate penile bone (baculum) we accomplished a thorough primary literature search and critical revision, collecting data about the occurrence of baculum in 306 primate species. Although our resulting presence/absence binary matrix was mapped onto the most complete primate phylogeny (N=367; Springer et al., 2012) the analysis was performed on 255 species since we had to exclude taxa either provided with occurrence data however missing in the phylogeny or viceversa. Based on data analysed it appears that the primate ancestor had a baculum which therefore is a symplesiomorphic trait for the entire order. Main results show 8 independent losses of baculum. Two cases in particular need to be deepened: the phylogenetic parallelism of loss in *Lagothrix* and *Ateles* and the exceptional presence of baculum in only one Tarsius species (*T. syrichta*) despite the absence in the whole genus. Our evolutionary scenario clarifies uncertainties recently reported by Schultz et al. (2016) who couldn't set the ancestral state of baculum for the primate order. In that study, likely flaws were the literature source used (only reviews) which resulted in a low number of primate species included into the analysis (N=102), and the arbitrary choice of transferring occurrence data between congeneric species to maximize the covering of the phylogeny used. Our study confirms that a higher number of species can substantially modify results about the ancestral character-state reconstruction of baculum. Future multidisciplinary investigations including potential correlates might contribute to disentangle both evolution and function of this neglected bone.

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Orangutan males force copulations when they perceive mating competition

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Orangutan sexual behaviour is still not fully understood. With some variation among the two main species (*Pongo abelii* and *P. pygmaeus*), forced copulations are common. The aim is to understand (1) under which conditions males attempt to copulate, and (2) when male and female interests collide, i.e. females resist. Therefore, we examine the contexts characterizing forced copulations, with respect to male morph, population, female reproductive status, male-female relationship and immediate social and ecological circumstances.

All-occurrence behavioural data from both male and female focal follows of two wild orangutan populations were evaluated: Tuanan, Central Kalimantan, (*P.pygmaeus*) (41 628 female and 25 289 male follow hours) and Suaq Balimbing, South Aceh, (*P.abelii*) (8608 female and 3801 male follow hours). During a total of 2053 male-female associations 535 sexual interactions were recorded.

The majority of copulations were male-initiated (92 %), and in both populations, almost half of them were forced, characterized by female resistance. Forced copulations were more likely to occur on days, when females were in association with multiple males (GLMM, $p<0.05$), even when the females were not likely to be fertile. Thus, both male mating attempts and female resistance seem to be triggered by perceived male-male competition. This suggests that orangutan males do the best of a bad job: Because female orangutans do not advertise their fertility, males may perceive a nonzero chance of inseminating a female at any time, especially when at the risk of displacement by a competitor.

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The sexual "play all out" strategy of female moor macaque (*Macaca maura*)

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Reproduction is no straightforward activity. Female primates have to cyclically face behavioral, hormonal and physiological changes in any phase of reproduction, including mating. In particular, some Old World species advertise ovulation with "exaggerated" ano-genital swelling, a unique morphological signal which, especially due to its conspicuousness and cyclical renewal, might encompass energetic costs. Yet, little is known about the female actual energetic burden during this phase. We investigated in wild *Macaca maura* potential energetic costs swollen females may face by comparing them with females during (a) a potentially low cost energetic state (cycling/not swollen) and (b) a potentially high cost energetic state (lactating). We compared activity budget, nutrient/energy intake, agonism and physiological stress levels (by fecal glucocorticoid metabolite, FGCM, analysis). While lactating females showed behavioral strategies aimed at increasing feeding, nutrient and energy inputs - as a likely strategy to balance out the energetic cost of lactation - swollen females did not. The latter rather redirected their time towards interactions with males experiencing a severe decrease of nutrient/energy intake. In addition, swollen females experienced a higher aggression rate than in any other phase of the cycle. Furthermore, swollen (similarly to lactating) females, experienced higher FGCM levels than cycling/not swollen females, suggesting body energetic distress during this phase. It appears that swollen female sexual imperative overcame that for food intake in a "play all out" strategy, suggesting sexual swelling to be an energetically costly phase of *M. maura* reproduction.

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Paternal and maternal kin biases in female Assamese macaques

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Strong social bonds can enhance survival and reproductive success in group-living animals. Forming those bonds with kin even more beneficial, since cooperation with close kin increases inclusive fitness. Positive kin biases in behavior are paramount among primates but the vast majority of studies consider maternal relatedness only. Whether animals discriminate paternal kin from non-kin and bias their social behavior towards them is still under debate. While Hamilton's rule is blind as to the origin of shared genes, most studies report that paternal kin is preferred over non-kin, but to a lesser extent than maternal kin. Here we assess both maternal and paternal kin biases in the social behavior of wild adult female Assamese macaques at the Phu Khieo Wildlife Sanctuary, Thailand. We genotyped all 136 adult individuals of four multimale-multifemale groups at 17 microsatellite loci to assign kinship. This was combined to two years of observational data (4383h) on affiliative and agonistic social behavior for all 53 adult females of these groups. We find that relatedness (r) significantly increases social bond strength, with the strongest bonds occurring between closely related dyads. When distinguishing between maternal and paternal relatedness however, we find no stronger bonds between paternal kin than between non-kin. This absence of paternal kin discrimination in Assamese macaques might reflect a lack of paternal kin recognition, a saturation of affiliation with close maternal kin, or both. Overall, these results add to the growing body of research on the role of paternal relatedness in shaping social relationships in primates.

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Male bonding in Sumatran orang-utans – Why do unflanged males form temporary associations?

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The bimaturism of male orang-utans leads to two adult morphs that differ in behaviour and physical appearance. Unflanged males can arrest the development of secondary sexual characteristics that define fully developed flanged males for many years. While flanged males produce long-calls to advertise their presence, unflanged males are more mobile and move around larger areas to find receptive females. Genetic studies have confirmed that both male morphs can sire offspring. Of the two orang-utan species, more pronounced gregariousness is observed in the Sumatran orang-utan and it has been suggested that this difference derives from the higher habitat productivity on this island. Besides females also unflanged males associate more frequently. These temporary associations have been described as travel bands but the benefits remain unclear. To better explain these associations, we collected detailed focal animal data from 35 unflanged males (1240 h of observations) and analysed the long-term data set (which also include observations of male associations) collected over 10 years at Suaq Balimbing (Aceh Selatan, Sumatra). This data set allowed us to investigate the composition and duration of unflanged male associations for the first time in detail. We examined associations in context of food availability, presence of potentially fertile females and the stability of the flanged male hierarchy in the study area. We show that these associations are more frequent than previously thought and that they involve social interactions exceeding coordinated travel. A possible benefit of these temporary associations is accumulation of ecological knowledge.

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Skewed birth sex ratios in wild chimpanzees: The role of prenatal maternal glucocorticoids and maternal age

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Skewed birth sex ratios (BSR) and sex-biased maternal investment have been shown in many vertebrates including primates. This variation in maternal investment and sex allocation has been linked to maternal stress and glucocorticoid (GC) levels, but despite often emphasized, the role of prenatal maternal GC in mammalian BSR adjustment remains largely unstudied. Consequently, it remains unsolved how maternal GC levels relate to BSR, and whether GC-related variation in BSR reflects an adaptive maternal strategy or merely unavoidable maternal constraints under adverse conditions. We investigated sex-specific maternal GC trajectories before and during gestation and patterns of BSRs and interbirth intervals in a long-term study on wild chimpanzees (*Pan troglodytes schweinfurthii*) at the Kanyawara field site in Kibale National Park, Uganda. We firstly show that BSR changes with maternal age, switching from male- to female-biased around the age of 25 years. Additionally, we found interbirth intervals to be longer following male compared to female offspring in young, but not old mothers. These patterns were accompanied by sex-specific maternal GC trajectories during preconception and gestation, which again were particularly pronounced in young mothers but ceased around maternal age of 25 years. Lastly, we provide some evidence that a mother´s long-term baseline GC level relates to her overall BSR. Altogether, our results suggest a complex relationship between maternal GC and BSR in wild chimpanzees that probably involve different mechanisms.

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The road to success: Factors determining male introduction success in captive rhesus macaques

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The entrance of new males into primate groups bears high social risks, yet migration is necessary to prevent inbreeding. Wild males may increase the likelihood of successful group entry by choosing a new group based on their own and the group's characteristics. In captivity, natural migration patterns are often mimicked. Still, males are not always accepted in their new group. Applying knowledge of migratory choices from wild males to captivity may enhance male introduction success and long-term group stability. Therefore, we studied 64 male rhesus macaque (*Macaca mulatta*) introductions at the breeding colony of the Biomedical Primate Research Centre, The Netherlands. 49 (77%) introductions were successful, with the male obtaining a long-term stable social position after 38 (59%) introductions. Introductions of experienced and heavier males, into groups with more adult females, but without pregnant females were most successful. Additionally, long-term group stability was highest when males were heavier, were at least 3.5 years old when they were removed from their natal group, and groups contained few matrilines and no pregnant females. These results highlight the importance of naturalistic group housing and mimicking natural migration patterns to maintain long-term stable captive primate groups. Males should be introduced when they are heaviest (i.e. strongest), similar to wild immigrants. Moreover, groups should consist of few large matrilines, similar to the wild, wherein females are phylopatric and males are removed at natural age. Altogether, the risks associated with necessary male introductions can be minimized through mimicking nature as closely as possible.

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Baboon habitat use in a complex environment, Gorongosa National Park, Mozambique

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The questions of how primates traverse their environments and choose where to spend their time is a long-running question in primatology. To postulate how groups of primates make movement decisions whilst coping with the challenges of resource availability, predation avoidance and intraspecific avoidance, the study of extant primate behaviour in mosaic environments can contribute an invaluable insight. This study combines traditional behavioural data with GPS tracks and landscape data collected through satellite imagery, along with environmental variables such as temperature and predator presence, to examine baboon (*Papio ursinus*) movement and decision making in the diverse habitats of Gorongosa National Park, an area of heterogeneous landscape with sharply contrasting environments that are partially or fully inundated with water for about six months a year. To answer questions of circumstantial leadership, habitat use and predator influence, a group of baboons (n=34-37 individuals) was studied over six months in an environment containing dense riparian woodland, open floodplain and acacia woodland. Data was analysed to model which variables influenced which individuals were more likely to lead under different circumstances, and how the troop partitioned its activity budget and space use depending on access to tree cover, water and food. By understanding the mechanisms by which baboons choose where and how to spend their time, we can examine how long-term effects of seasonality and changing environments can influence how primates and other animals share their habitats over time.

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Genomic adaptations for digestion, taste, and olfaction in the graminivorous gelada (*Theropithecus gelada*)

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Abstract not available online

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Science of the Sociome: Tracking how individual interactions scale to complex societies

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For social organisms—from protists to primates—success often depends not on the characteristics of individuals, but instead on the behaviors and traits that emerge when groups of individuals interact. How do the group-level behaviors and traits that define complex animal societies emerge, and how are they elaborated and maintained? Technological innovation is driving a convergence in the research methods of biologists, computer scientists and social scientists working on these questions: GPS tracking, proximity loggers, drones, cellphones and online social network platforms all generate vast quantities of detailed, noisy data about individual behavior in social contexts, making it possible to explore how societies function at a resolution and scale never before possible. However, to realize the promise of comparative studies of complex social systems, we must develop a common framework for monitoring and analyzing the interactions—from dyad to group to population— that comprise the 'sociome'. In this talk, I will discuss the analytical, experimental and technological methods we are developing to map and monitor the sociomes of wild animals, and will present results from our recent study of collective movement in baboon groups, and on the comparative foraging strategies of Neotropical frugivores.

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Genomic signals of natural hybridization between *Microcebus murinus* and *M. ravelobensis* in northwestern Madagascar

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The crossbreeding between individuals of different species can constitute a threat for biodiversity when a species with a narrow distribution range meets a widespread species. In Madagascar, most of the described lemur species are restricted to small areas, but some species with a larger distribution range are known to live in sympatry with microendemic species, as it is the case in the genus *Microcebus*. So far, only one single case of hybridization, between the two sister species *M. murinus* and *M. griseorufus*, was reported in Microcebus. This study aims to investigate whether hybridization may occur between the more distantly related *M. murinus* and *M. ravelobensis* in Ankaranfantsika National Park. Genome-wide SNPs from RAD-seq from 28 M. murinus and 78 *M. ravelobensis* were used to investigate the occurrence of hybridization in two sampling sites within the Park. Clustering analyses based on nuclear data revealed eight individuals with >1% admixed ancestry. A maximum likelihood tree based on the partial COI gene revealed that all introgressed individuals had a mitochondrial haplotype belonging to *M. ravelobensis*. Our results suggest occasional unidirectional hybridization between female *M. ravelobensis* and male *M. murinus* in the two sites. It is likely that male *M. murinus* dispersed into the areas occupied by *M. ravelobensis* and successfully mated with *M. ravelobensis* females. Introgressive hybridization may have played a larger role during the expansion of *M. murinus* from southwestern Madagascar towards the North than previously thought. Given that *M. ravelobensis* is classified as Endangered by the IUCN, this process should receive more attention in the future.

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Fragmentation effects in sympatric mouse lemurs (*Microcebus spp.*) in northwestern Madagascar

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Habitat loss and fragmentation are among the most important factors threatening biodiversity worldwide. In Madagascar, forty-four percent of the native forest has been lost over the six last decades, but the effects of forest fragmentation on fauna are still not well understood. This study investigates how forest fragmentation affects the distribution and abundance of two species of mouse lemurs, *Microcebus murinus* and *M. ravelobensis*, in two fragmented landscapes, the Ankarafantsika National Park (ANP) and the Mariarano region. Field work was conducted in a total of 40 forest fragments and in 12 sites in adjacent continuous dry deciduous forest. Mouse lemurs were captured with Sherman traps (11,166 trap nights) that were installed three times along all each forest transect during twodry seasons (2017 and 2018). Whereas species representation in the continuous forest differed largely between the two landscapes, species representation was generally similar within the forest fragments in each region. The number of *M. ravelobensis* caught were positively correlated with the size of the forest when scaled by trapping effort (R^2=0.354, n=52, p<0,01). However, there was neither a correlation between the number of *M. murinus* captured and forest size (R^2=0.035, n= 52, n.s), nor between the number of captured animals of both species (R^2=0.034, n=52, n.s). Species differences might be explained by different ecological niches and/or a different vagility. These results show mixed effects of forest fragmentation on mouse lemurs in northwestern Madagascar. Thus, maintaining large and diverse areas of forest is therefore important for their conservation and long-term survival.

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A roadmap for high-throughput sequencing of wild animal populations using hybridization capture

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Since the early 1990's microsatellites have been the backbone of such population genetic studies, effectively revealing much about the dynamics of wild animal populations. However, by today's standards, microsatellites represent a small amount of genetic data and provide relatively modest power. The availability and use of high-throughput sequencing technology has exploded over the last two decades and has been applied various wild animal populations, expanding the range of questions that can be answered with genetic data. However, standard high-throughput sequencing may be cost prohibitive for the typical sample sizes required of population genetic studies, particularly if low-quality, non-invasive samples (such as feces) are used. To improve the efficiency of high-throughput sequencing, hybridization capture can be used to increase the proportion of target DNA in an extract prior to sequencing. To explore the use of hybridization capture for the study of wild animal populations we examined a set of 1,780 quality-assessed wild chimpanzee (*Pan troglodytes schweinfurthii*) fecal samples and chose 110 samples of varying quality for exome capture and sequencing. Using this empirical dataset we developed a model that predicts the sequencing effort (and therefore budget) necessary for a desired data yield from samples of a given quality. In this talk I will highlight some primatological research questions that were previously inaccessible using microsatellite alone, briefly detail the hybridization capture method, and present the results of our model as a guide for researchers wishing to implement the hybridization capture in their own study system.

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Agonistic calls: non invasive suitable tools for cryptic species in the smallest-bodied primate radiation, the mouse lemurs

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Bioacoustics uses digital technology to record and analyze animal vocalizations to enhance our understanding of animal communication, distribution as well as biodiversity. Mouse lemurs represent the smallest-bodied extant primate radiation, are nocturnal and live in diverse Malagasy forests. This primate radiation comprises 24 genetically defined, phenotypically similar species. The conservation status of most species is barely known, but the often small geographical distribution makes them highly vulnerable to anthropogenically caused habitat disturbances, a major threat for lemur's survival in Madagascar. The aim of this study was to explore by a comparative and integrative bioacoustic, behavioral and genetic approach, whether the most frequently used mouse lemur calls bear species-specific signatures allowing on the long run to establish bioacoustic rapid assessment tools for surveying and monitoring species diversity in nature. We will present bioacoustic data from mouse lemurs, originating from seven different study sites in northwestern and eastern Madagascar.The variation in vocalization and its use in signaling were determined by standardized bioacoustic methods using a social encounter paradigm (N=12 dyads/study site). Comparative data on agonistic calls between eight genetically different cryptic revealed a uniform acoustic contour, but species-specific statistical distinctiveness in acoustic structure. Acoustic divergence between species is predicted by genetic distance. The studied calls do not display habitat-specific differences, or play a major role in mate choice. Thus, findings support an acoustic diversification caused by genetic drift.

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Similar population size estimates over a twelve year period for a socially dynamic population of wild western lowland gorillas

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Repeated counting of animals within the same area over an extended period of time is crucial to infer population stability, growth or decline, but is challenging for elusive species living in less accessible habitats. Additional insights into demography and population dynamics can aid in assessing long-term prospects. Here we investigated the potential of genetic approaches to infer not only the size, but the composition of the population by inferring the age class, sex, and group membership of individuals and the spatial distribution of groups. We studied a wild western lowland gorilla population within a 100 km^2 area of Loango National Park, Gabon, for two three-year periods seven years apart, spanning a total of 12 years. By genotyping 681 non-invasive genetic samples we derived the minimum number of gorillas present and their sex, reconstructed groups and their home ranges based on sampling locations, enabling us to track group membership over time (Hagemann et al., 2018 Arandjelovic et al. 2010). We found that despite five group dissolutions, six formations and 40 individual dispersal events, the mark-recapture estimates of population size were similar for the two time periods. Furthermore, by genetically assigning parent-offspring trios we inferred a similar age structure which supports a suggestion of demographic stability. Finally, we observed a high degree of area fidelity within the four groups that were sampled across 8-12 years, despite the varying membership stability between those groups. This study illustrates the potential of ongoing genetic sampling and analysis as a monitoring tool for inferring population size and dynamics of wild primate populations.

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The Genetics of Conservation – a case study on West African primates

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The western chimpanzee (*Pan troglodytes verus*) is a critically endangered primate. Guinea-Bissau is considered one of the most important areas for its conservation. Nevertheless, lack of baseline information regarding the isolation level of the subpopulations has been hindering an assessment of the population long-term viability. Our study is the first national non-invasive genetic survey for chimpanzees in Guinea-Bissau. We analysed up to 185 faecal samples using three types of genetic markers – mitochondrial DNA, autosomal microsatellites, and one Y-linked microsatellite – to estimate genetic diversity and population functional connectivity. We found high levels of genetic diversity and subtle genetic differentiation between subpopulations, which suggests that chimpanzees have great dispersal ability across human-dominated landscapes and/or that the potential barriers to gene flow originating from human activities have started to limit dispersal recently. The lack of a strong signal of population structure for the Y-linked marker suggests that both sexes might have dispersed between groups.

Our results are similar to what had been found for other primates in Guinea-Bissau, namely colobus and baboons. Currently, an assessment of genetic diversity and population structure is being conducted for several species of primates in southeast Sierra Leone. This region still holds a continuous forest belt with little human interference, which contrasts with what is observed in Guinea-Bissau. Similarities and differences found between regions will allow for a more accurate assessment of the impact of human-wildlife interactions for the conservation of primates in West Africa.

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Impact of interactional data density on results of primatological studies

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Primatologists rely on the use of interaction rates to quantify the behavioural patterns of their study animals, for example in social network analysis, biological market studies, or to identify relationships between individuals. The assumption is that interaction rates derived from focal follows are internally consistent and represent individual tendencies. An increasing number of studies has illuminated the impact of insufficient data on the robustness of animal social network measures when using association data. This problem is potentially exacerbated in interactional data, as interactions are usually collected at much lower rates than associations and are usually dyadic, but how much differences in data collection protocols and density influence robustness of interaction rates has rarely been investigated. Here, we test the impact of different data collection densities on commonly used metrics: social network measures, overlap between behaviours, dyadic measures such as reciprocity, and relationship indices. We use simulated datasets and real-world data from chimpanzees and sooty mangabeys to show that all dyadic and group metrics can become uncertain if not enough interactions are observed per group member, especially when partner choice is flexible in large communities. We present strategies to identify whether sufficient interaction data exist for an interaction type to consider the results internally consistent and robust, and suggest ways to approach primatological questions if datasets are too limited to use interaction rates.

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Time matching between grooming partners: Do methodological distinctions between short vs. long term reciprocation matter?

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Primatologists have long focused on grooming exchanges to examine aspects of social relationships. One particular interest is the extent to which reciprocating grooming partners time match, and the time frame over which they do so. Conclusions about time matching have varied across species; some researchers find evidence for short term time matching within single grooming bouts, and others find time matching only across longer temporal intervals that include many grooming exchanges. Generally, researchers focus on the duration of pauses between grooming episodes that involve a switch in partner roles and choose a cut-off point to distinguish within bout (short term) from longer term reciprocation. Problematically, researchers have made inconsistent choices about such cut-offs. Such methodological variations are potentially concerning, as it is unclear whether inconsistent conclusions about short term time matching are attributable to species/ecological differences, or whether they are partly due to methodological inconsistency. We ask whether various criteria for separating short vs long term reciprocation influence conclusions about short term time matching among free-ranging rhesus macaques (*Macaca mulatta*). We compare several commonly used cut-offs to ones generated by the currently preferred approach—survival analysis. While most cut-offs yielded similar degrees of time matching as those derived from survival analysis, very short ones significantly underestimated both the degree of time matching and the influence of rank distance on time matching.

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Poster abstracts

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Do wild chimpanzees say "goodbye"? A study on leave-taking in *Pan troglodytes* of the Bossou outdoor laboratory

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Humans in modern societies often greet when coming together and take leave of one another when parting; albeit with contextual variation. As well as verbal indicators of leaving there are a number of non-verbal behaviours that are thought to increase prior to parting. Though the evolutionary origins of greeting have been addressed by studies in non-humans - most notably in the chimpanzee - studies of leave-taking are almost entirely absent when looking beyond humans. We report the first study on non-human leave-taking, focusing on wild chimpanzees (*Pan troglodytes verus*), in Bossou, Guinea. Patterns of behaviour leading to inter-individual parting were defined in 30 hours of manually coded video footage. Behaviours preceding 70 parting events, in 11 adults and juveniles, were recorded during a 6-minute window prior to parting. An increased frequency of behaviours associated with taking leave was predicted using Cochran-Armitage tests. Results indicate that there was an increase in self-scratching [$n=70$, $p<0.001$] and fixed gaze in the direction of parting [$n=70$, $p<0.001$] towards the parting event. Leave-taking is unlikely to be unique to Homo sapiens, and differences between human and chimpanzee leave-taking seem one of degree not kind, possibly functioning in both as a mechanism to facilitate and mitigate the costs of fission-fusion. Current work focusing on investigating contextual and cultural differences in leave-taking across species will further contribute to the debate opened up by this study on the variation and function of leave-taking behaviours.

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100 years and 2400 Lion-tailed macaques (*Macaca silenus*) worldwide in zoos: Demography and conservation potential

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The long-term survival of captive mammal populations is a key problem of conservation-oriented zoo biology. Breeding problems are common. Our study is part of a comprehensive investigation on the development and conservation potential of the global captive Lion-tailed macaque population. Previous studies reveal breeding and sustainability problems. It is based on studbooks (1899-2012) and breeding programs' reports (1980-2012). Data analysis uses SPARKS, PMx software and MS Excel. It refers to global/sub-population size and composition, births, mortality, demographic structures and reproduction in groups. The study analyzes the development of the population and uses demographic data to extrapolate possible reasons for breeding and sustainability problems. It is assumed that life-history patterns and social structures deviate from species-typical patterns. The population descended from a small proportion of the wild founders. Its growth started after 50 years only. From 1970 in 42 years the size more than doubled (N=567 in 2012) via births. Individuals were scattered over 347 institutions, mostly in small groups. The groups were smaller and less differentiated than wild ones and lacked features of female-bonded systems. Only about 40% of the females bred. Females in large groups (12%) contributed to 74% of the births. The annual number of births was slightly higher than that of deaths; infant mortality high. The conservation potential of the population was used only unsatisfactorily. More behavioral and social management as well as large group sizes allowing the development of female-bonded characters and generational overlap are required.Keywords: Lion-tailed macaque, Macaca silenus, captive population, demographic structures, social structures, life history patterns, conservation potential

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General alarm calls in primates: what do they mean?

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In several primate species' vocal repertoire, alarm calls cohabit so that one is deemed 'specific' (it only occurs when a certain stimulus is present, e.g., an aerial predator) and the other 'general' (it is elicited by a set of stimuli that may be greater than, and may include, the set of stimuli eliciting the so-called 'specific' calls). The question of the meaning of general calls therefore arises.

One hypothesis is that general alarm calls mean 'general alert'. Under this hypothesis, general alarm calls either occur in contexts that can also elicit specific alarm calls, or they are used only when the specific alarm calls are not appropriate.

The other hypothesis is that general alarm calls do not have a 'general alert' meaning. Under this assumption, general alarm calls can function as imperatives (to attract the conspecifics' attention to the receiver or to a specific part of the environment), they can be produced in contexts that are not predatory to deceive conspecifics (in particular when food is present) or they can be specific alarm calls that are misclassified by the researchers.

We hope that reviewing the various theoretical options will encourage researchers to further investigate the meaning of so-called 'general' alarm calls, as they may help unveil sophisticated cognitive capabilities in animals.

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Space and time: dimensions of captive apes well-being

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In captivity space and time represent two main axes around which the quality of life and variability of social interactions may find the proper amount of degrees of freedom to express. Environmental enrichment, arising from a proper space/time interplay, should aim at allowing an animal behavioral choice, therefore increasing sense of control, which in turn may lower stress and grant well-being. These are the stories of four chimpanzees (*Pan troglodytes verus*) who have been rescued from an inhibited and human-like life, and the last gorilla (*Gorilla gorilla*) left in Italy. In collaboration with the hosting safaris (Safari Ravenna and Zoosafari di Fasano, Italy) we provided them enriched space and time. We carried out a strictly planned environmental enrichment program and studied ape behavioral response over a control and an enrichment period. Enrichment included varied substrates for locomotion; an assorted diet; diversified food provisioning and unpredictable schedule; chances to freely express agonistic behaviors (chimps), and interaction-with-operator sessions (gorilla). Behavioral categories analyzed were displacement activities, abnormal behaviors (including stereotypies), prosocial behavior, agonism and activity budget (AB), with air temperature, amounts of public and noise as covariates. Although high chimpanzee inter-individual variability and differences in housing and social conditions between species, two main common outcomes of enrichment were: changes in AB (mainly locomotion), and the decrease of stress as measured by both displacement activities and abnormal behaviors. Further success for the gorilla was the healing of a long lasting self-induced wound.

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The population size of the Nigeria-Cameroon chimpanzee in Kom-Wum Forest Reserve, Cameroon

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The Nigeria-Cameroon chimpanzee (*Pan troglodytes ellioti* (Matschie,1914)) is the most threatened and least studied chimpanzee subspecies. It is estimated, that fewer than 6000 individuals remain in the wild. Kom-Wum Forest Reserve in North West Cameroon is a priority area in the Regional Action Plan for the conservation of this subspecies, but the population size in this reserve is unknown. This project aims to provide estimates of the population size in this reserve assuming that chimpanzee density is lower in smaller and isolated forest fragments than in larger connected fragments. A combination of distance sampling, marked nest and standing crop nest counts along line transects were used to determine chimpanzee densities. In total, 271 nests were counted along 26 km transects. All nests were used for distance sampling estimates, while 113 and 158 nests were used for marked nest and standing crop estimates. Estimated chimpanzee densities were 1.0 (95% CI range: 0.4-2.7) individuals km-2 for distance sampling, 1.3 individual's km-2 for mark nest and 1.8 individuals km-2 for standing crop estimates. Extrapolating chimpanzee densities to the total forest area of the reserve provide an overall estimate of 80 to 140 individuals depending on estimation method. These estimates may overestimate population size in reserve, as chimpanzee signs were most common in dense and connected forest patches which occupy a limited area within the reserve. There is therefore an urgent need to intensify conservation activities in this reserve and our research contributed to highlighting subareas that are of particular conservation concern.

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Comparing social tolerance between wild and captive common marmosets (*Callithrix jacchus*)

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According to the cooperative breeding hypothesis, the reliance on allomaternal care played an important role during human evolution, among others by increasing social tolerance. It thus predicts higher social tolerance in cooperatively breeding species compared to independently breeding ones. Such a link has been reported for captive primates, but we don't know how these results generalize to wild populations. We therefore developed a framework to measure social tolerance across different environments and species, piloting it with 6 marmoset groups: 2 groups from natural environments (caatinga, northeastern Brazil, Assú-RN) and 4 from captivity, with a total of 140 trials: 30/group in the natural environment and 20/group in captivity. We used a 1 m^2 arena and distributed banana pieces evenly within it (same number as non-infant subjects per group). The arena was positioned in the absence of the subjects, 1m above the ground. In the natural environment, we placed it close to one of the resting trees, in captivity in the groups' outdoor enclosures. The experiment began when the first marmoset entered the arena and ended when no banana pieces were left. We measured time inside the arena for each subject and all social interactions, and used social network analysis, validated by observational data, to compare the groups. Preliminary results suggest that wild marmosets are more, rather than less tolerant, and thus that high social tolerance in this species is not an artifact of captivity. Overall, this framework allowed us to compare social tolerance of *C. jacchus* between populations in different environments, and it could be adjusted and expanded for different primate species.

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Protecting the last populations of the western spot-nosed guenon in Guinea-Bissau using genetic tools

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The western spot-nosed guenon (*Cercopithecus petaurista buettikoferi*) has been globally declining as a consequence of increasing hunting pressure and habitat loss. The species northernmost point of the distribution in West Africa is Guinea-Bissau (GB), where insular populations in the Bijagós archipelago (BA) may be the last remaining in the country. Here, populations of *C. p. buettikoferi* are thought to be threatened by bushmeat hunting. We sampled six of the 23 largest human-inhabited islands aiming at updating the species distribution and assessing extinction risk. We used a fragment of the mitochondrial control region and ten autosomal microsatellite loci. DNA was extracted from 134 geo-referenced faecal, blood and tissue samples. A total of 52 unique genotypes and mitochondrial sequences were obtained. Using molecular tools, we confirmed the presence of the species in five of the six sampled islands. Contrary to what is usually found for insular populations, the genetic diversity within islands was relatively high for both types of genetic markers. We found a pattern of isolation in four islands, which suggest that naturally occurring dispersal between islands is unlikely. However, evidence of admixture in the past few generations was found in the Canhambaque island, which is contrasting to the other islands and may be explained by human-mediated translocations. Our results suggest special conservation efforts for *C. p. buettikoferi* in BA since human-mediated disturbances are likely to increase the extinction risk of these naturally isolated populations.

The work has been funded by Foundation for Science and Technology, The Born Free Foundation and Chester Zoo.

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Fossil sites as landscape outliers: the potential of the dbscan clustering algorithm for detecting fossiliferous outcrops in forests

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Geospatial palaeontology is a new discipline that uses satellite images and statistical algorithms to predict the probability of sedimentary deposits containing fossils. This conceptual framework is currently being applied at the southernmost tip of the Rift Valley, in Gorongosa, Mozambique.

LANDSAT8 satellite corrected data were cropped to an area of 36000 m^2 in Gorongosa containing late Miocene deposits. This dataset, with spectral bands as variables and brightness values as instances, was processed with dbscan, a popular algorithm for spotting outliers in a variety of different analytical settings. This is the first time an outlier-detection algorithm has been used in remote sensing applications in palaeontology. Clusters here are regarded as dense regions of grouped data instances in the matrix space (e.g. a Miombo forest) that are separated by regions of low-density grouped data instances. The algorithm has two input parameters, radius ε and 'minimum points'. After optimization for performance metrics, ε=64 and minPts=25 were selected. By obtaining 90% accuracy and 91.89% specificity, we clearly outperformed our earlier approach (a k-means model with acc=84.44%, spec=83.78%). We were also able to detect for the first time the richest locality known to date (GPL-12).

Here we show the potential of density-based clustering for noise detection as a viable method for discriminating fossil sites automatically in homogeneous forest landscapes, since exposed and eroding sediments can be detected as outliers. Applying this method in Gorongosa will contribute directly to enlarging the extremely small sample of late Miocene African hominoids in the fossil record.

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The times they are a-changin': The development of social tolerance in four chimpanzee groups over eight years

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The tolerance of conspecifics in the face of valuable resources, i.e. social tolerance, has been identified as a key factor in the evolution of cooperation, prosociality and fairness in non-human primates (Amici, Call, and Aureli 2012; Burkart et al. 2014). Social tolerance, as a group-level characteristic, has been found to vary systematically between primate species (Burkart and van Schaik 2013) as well as within (Cronin et al. 2014). In this study we look at the development of group-level social tolerance over time in four groups of semi-wild chimpanzees at the Chimfunshi Wildlife Orphanage Trust in Zambia and consider the possible effect of measurement style on our social tolerance construct.

Our study utilized data gathered with a group feeding paradigm. We provided each group with a valuable resource in a limited space and recorded the individuals of each group gathered within the feeding zone. Group-level social tolerance was operationalized as the proportion of the group within the zone in the presence of the resource. We collected an initial sample of 126 sessions at seven time points between 2011 and 2017. While the first year of measurements revealed large group differences in social tolerance as reported by Cronin et al. (2014), these differences have appeared to decline over the years with two of the groups increasing their social tolerance levels and the other two decreasing. To investigate a possible habituation to our measurement, we introduced a second group-level social tolerance measure during our final year of data collection in 2018. First results suggest a recurrence of intergroup differences in social tolerance when measured with a new approach.

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Personality homophily influences social bonds in wild Assamese macaques

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Animal social bonds and human friendships are both thought to function as alliances that generate adaptive benefits via support in critical situations. Specifically, homophily (the tendency to form ties with similar others) in personality, as inter-individual differences that are relatively consistent across time and contexts, may increase predictability and facilitate trust and reciprocity among partners with compatible behavioral tendencies. Following an explorative approach, we investigated whether homophily in any personality trait influences social bond formation and maintenance in 24 wild male Assamese macaques. We found that males choose bond partner with similar levels of Connectedness (i.e. frequent and diverse neighbors in 5m proximity and high rates of friendly approaches to and by others). We further demonstrated that similarity predicts social bond formation, thus alternative hypotheses, that bond partner will adapt their personalities over the time, can be rejected. In line with our prediction, that closely bonded individuals pull each other to similar ranks, we found that the stronger the male-male bond, the smaller the dominance rank difference between partners. Our results support the idea of a shared evolutionary origin of homophily as partner choice strategy in humans and animals. The main selective advantage of personality similarity may result from a more reliable cooperation among individuals with similar cooperative behavioral tendencies. Mutual coalitionary support helps bond partner to maintain or rise in social status, which is linked to reproductive success in male Assamese macaques, for instance.

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Social monogamy and pair bonds in red titi monkeys (*Callicebus cupreus*)

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Despite extensive interest in the evolution of monogamy, social monogamy in nonhuman mammals remains an evolutionary puzzle, and the mechanisms of monogamy maintenance remain largely unknown. Titi monkeys of Neotropical genus *Callicebus* live in socially monogamous groups with only one reproductive male and female per group and exhibit extensive paternal care of offspring. In order to investigate the mechanisms of monogamy maintenance, we collected behavioural and demographic data from 7 titi monkey groups in Peruvian Amazonia across 1.5 years. We compared the rates of affiliative behaviours in pairmates across different demographic stages (prenatal or postnatal periods), social environments (proximity of neighbouring animals), and physical environment (fruit abundance, home range characteristics). The rates of affiliative behaviours increased in proximity of neighbouring animals and decreased following the birth of offspring, while fruit abundance or home range characteristics did not show any significant effect. Moreover, we found between-group differences in the strength of pair bonds, expressed as differences in the rates of affiliative behavior after correction for demographic stages and social environments. This project is a part of bigger research on genetic and social monogamy in *C. cupreus*, which includes paternity and relatedness analysis for 10 titi groups.

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ManyPrimates: Establishing an infrastructure for collaboration in primate cognition research

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In recent years, projects such as ManyLabs or ManyBabies established platforms for large-scale collaborative research within psychology. The goal of these efforts is to address outstanding methodological and theoretical issues that a single research group could not study on its own. Those studying primate cognition are also often only able to test a small number of subjects and/or a limited number of species, preventing researchers from systematically answering questions from a phylogenetic or ontogenetic perspective. Therefore, this year the ManyPrimates project was created. The aim is to establish a platform for researchers to interact and collaboratively decide on research projects to be run at each contributing facility. We report the results of the first ManyPrimates study: a pilot study of the feasibility of such an endeavor. We selected the "three-cups" method, a test of short-term memory, as our initial test case because we believed it could be easily adapted for a range of species. In each trial subjects are shown three opaque cups, a reward is placed under one, and all three cups are inverted. The subject is then asked to choose the cup that covered the reward after a 0-second, 15-second or 30-second delay. With this methodology, we tested 187 primates, representing 12 species (prosimians, monkeys, and apes), housed at 13 sites across four continents. Thus, we were able to replicate earlier findings and compare a number of factors related to subjects' success including condition, species, and prior research experience. Having demonstrated the efficacy of ManyPrimates, we are excited to answer new previously-infeasible questions and welcome new collaborators.

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High genetic diversity and subtle population structure of the grayfooted chacma baboons at Gorongosa National Park

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Papio could serve as an analogue model to study population structure and gene flow in human evolution. Gorongosa National Park (GNP) is located near the boundary between two baboon species: *Papio ursinus griseipes* (grayfooted chacma baboon) and *Papio cynocephalus* (yellow baboon). GNP baboons have morphological features common in both chacma and yellow baboons, which suggests ancient and/or recent events of admixture in the region. Nevertheless, only two mtDNA samples from GNP have been collected and analysed and the hypothesis of hybridization remains un-tested. Using a comprehensible sample size, we carried out the molecular assignment of the Gorongosa baboons and provide the first genetic characterization of the population in Mozambique. We analysed 200 non-invasive faecal samples collected from social groups within the GNP limits and from an area located 100 km away, close to the Zambezi River. DNA was extracted and amplified for the first half of the mitochondrial DNA cytochrome b gene and for 15 nuclear microsatellites loci. MtDNA analysis clusters GNP individuals with the northern chacma baboon clade. Nuclear genetic diversity as measured by number of alleles, allelic richness and observed and expected heterozigosity is high. Population structure, although present, is subtle. The analysis of molecular data provided insights into the degree of population structure among GNP baboon troops and their relationship with yellow and chacma baboons. Finally, we discuss our results within an evolutionary context, highlighting the potential to provide a proxy to hominin demographic dynamics and gene flow.

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Seasonality in cortisol levels in *Alouatta caraya* juveniles

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The impact of environmental challenges on stress metabolism in primates has been extensively studied. Nevertheless, the metabolism of stress during the juvenile period in primates has received little attention. This study focuses on the effect of seasonality and environmental factors, such as minimum temperature, daily temperature amplitude and food quality consumption on urinary glucocorticoids levels (uGC) in free ranging *Alouatta caraya* juveniles. During one year (August 2014-August 2015), behavioral and hormonal data were collected from 13 juveniles (7 males and 6 females), belonging to 4 groups of *Alouatta caraya* from a wild population of northeastern Argentina. For each individual, 3 urine samples per month were collected, also 4 days a week feeding behavior data were collected with animal focal technique. Daily temperatures were obtained from National Weather Service at the Aero Corrientes station, which is located 17kmN of the study site. Urinary cortisol (uGC) of a total of 468 samples were analyzed by enzymo–immunoassay. uGC levels were analyzed in relation to environmental variables using linear mixed effects modeling. Results show seasonal differences in uGC levels, with higher levels during winter. Also uGC increase when minimum temperature decrease (LMM; estimate= – 0.77, df=448.4, $p<0.01$) There was no relationship of uGC with diet quality and daily temperature amplitude. Our results suggest that low ambient temperature is one of the biggest challenges during juvenile period for *A. caraya*, a primate species that inhabits in a seasonal environment and reaches the southernmost distribution of New World primates.

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Interspecific differences in cognitive abilities in wild mouse lemurs

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Cognition is defined as the ability to perceive, process, store and act on information from the environment, conspecifics or other animals. Animals exhibiting different lifestyles have, therefore, evolved different behavioural variants in order to best cope with daily challenges such as finding suitable shelter or food. In general, species with an opportunistic lifestyle are supposed to have an advantage over more specialized species in unstable environments because specialists are better adapted to stable environments. Kirindy forest, a dry deciduous forest in western Madagascar, is characterized by high seasonality with a hot rainy season and a cold dry season with a tremendous decrease of food availability. The specialist *Microcebus berthae* is specifically affected by this seasonality, as this small-bodied nocturnal lemur mainly feeds on homopteran secretions and animal matter. In contrast, the sympatric sister species, *Microcebus murinus*, is more flexible in adjusting its diet to seasonal available food resources. While the specialist should, thus, be better able to memorize locations of food resources, the generalist should outperform the specialist in flexible problem-solving. Respective preliminary results of a 2-years field study will be discussed.

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Vocalisations and Vigilance: Monitoring habituation and indicators of risk perception in baboons (*Papio ursinus*) in Gorongosa, Mozambique

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The collection of naturalistic data for most behavioural studies relies upon prior habituation of focal primate groups to the presence of human observers in their environments. However, details of the habituation process are often overlooked or underreported, and there are virtually no studies that quantitively monitor its progress. This study reports on nine months of habituation of two baboon troops (*Papio ursinus*) ranging in predominantly woodland (n = ca. 80 individuals) and floodplain (n = ca. 40 individuals) habitats in Gorongosa National Park, Mozambique. We present analyses of vocalisation and vigilance behaviours recorded across this time, reporting on how rates of these behaviours differ between troops, how they have changed with cumulative exposure to observers, how they fluctuate at shorter temporal scales, and how they are affected by habitat features. We discuss the implications of these patterns, not only for monitoring the progress of habituation and its applications, but also as indicators of broader risk perception adaptations in a mosaic, seasonal environment.

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Rat feeding behavior of Southern pig-tailed macaques in oil palm plantations – implications for conservation

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Conversion of tropical forests into oil palm plantations reduces habitat of naturally occurring species, including primates. In the forest-oil palm matrix, Southern pig-tailed macaques (*Macaca nemestrina*) partially divert their foraging activities into plantations where farmers hunt them as crop raiders. Contrary, we hypothesize that macaques may act as biological pest control as they frequently feed on plantation rats (*Rattus spp.*). To assess the impact of pig-tailed macaques on populations of plantation rats, we recorded the macaques' feeding behavior in oil palm plantations and conducted a rat mark and recapture study in Segari, Peninsular Malaysia. Pilot data revealed a significant decrease in rat abundance with increased presence of macaques in plantations. Further, focal observations showed a rat consumption rate of 2,085 rats per year by one group of pig-tailed macaques. Our findings can be used for mitigating human-macaque conflicts by encouraging plantation managers to protect these primates and their natural habitat.

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Tamarin seed dispersal contributes to the natural regeneration of anthropogenically disturbed forest

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Increasingly large areas of tropical rainforest are deforested and fragmented due to human activities; where regeneration is possible at all, secondary forests (SF) establish. Depending on the degree of ecological flexibility, primates may or may not colonize and persist in SF. New World primates of the family *Callitrichidae* are capable of living in SF, and it has been suggested that they may even thrive in such habitats. Next to our primary rainforest study site (Estación Biológica Quebrada Blanco, NE-Peru, 4°21'S 73°09'W), a ca. 4 ha buffalo pasture was established in 1990. This pasture was abandoned in 2000 and is regenerating since then. This provided the opportunity to study whether tamarin (*Saguinus mystax* and *Leontocebus nigrifrons*) seed dispersal from primary forest into the disturbed area contributes to the regeneration process. Tamarins started to use the regenerating area in 2000. Use increased over the years, with strong inter-annual variation. Tamarins dispersed seeds from at least eight primary forest plant species into the regenerating area, including *Parkia panurensis* (*Fabaceae*). This legume is a major food resource for tamarins which are the only known seed dispersal vector at EBQB. Genotyping and parentage analyses of *P. panurensis* seedlings from the regenerating area revealed that they stem from adult plants in the primary forest within the tamarins' home range. Distances between seedlings and putative parents are concordant with dispersal distances produced by tamarins for *P. panurensis* seeds. Thus, our study provides evidence that tamarins contribute to the natural regeneration of anthropogenically disturbed areas.

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Age-dependent influences of general anaesthesia on the cognitive abilities in long-tailed macaques (*Macaca fascicularis*)

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Aging humans experience impaired learning abilities, memory capacity and executive function. Increasing life expectancy and advances in medicine are resulting in a growing number of elderly patients undergoing surgery under long-lasting general anaesthesia. Such long-term anaesthesia may particularly impact the cognitive abilities of aging humans (post-operative cognitive dysfunction, POCD) but until now, the underlying mechanisms remain unclear. The present study aimed to establish a non-human primate model for POCD by testing the physical and social cognitive abilities of young and old long-tailed macaques (*Macaca fascicularis*) before and after general anaesthesia. Our study examined if general anaesthesia with Isoflurane in the first part and with Propofol in the second part of the study influenced cognitive abilities and if these effects were age-dependent. Subjects (N= 10) were significantly impaired in their ability to discriminate between different quantities after general anaesthesia with Isoflurane but no effect of age or interaction of anaesthesia and age could be found. In all other tasks, statistical analysis did not reveal significant effects of anaesthesia and/or age on test performance. Our results show that long-tailed macaques may experience transient dysfunction of certain cognitive abilities after anaesthesia with Isoflurane, but not Propofol, mirroring previous studies in rodents. Further studies will hone in on the question why only specific cognitive functions were affected differentially by Isoflurane, as well as their underlying physiological changes in the brain.

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How does spatial movement pattern of human foragers and chimpanzees compare when they travel to food locations in the forest?

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Humans have unique ranging behaviors such as a semi-nomadic lifestyle, central place provisioning, and extensive trail use. Yet, little is known about how these behavior patterns influence spatial performance in humans. Here we compared large-scale spatial performance of the Mbendjele BaYaka people in the Republic of Congo and Taï chimpanzees in Côte d'Ivoire in daily foraging contexts in the forest. We investigated ranging behaviors of these two groups and compared linearity and speed as they moved towards food locations. We specifically tested how linearity and speed change with the level of familiarity with an area (the sum of time spent in the area) and group composition. We found a clear species difference in the effect of familiarity and group composition on linearity and speed. The Mbendjele traveled linearly and rapidly in familiar areas, but appeared to have limited spatial performance in less familiar areas, perhaps due to a large life-time range. Yet humans increased linearity and speed with group size and presence of older group members, probably by compensating their lack of knowledge in less familiar areas with the knowledge of others. No such effect was found for chimpanzees whose spatial performance appeared to be accurate even in seasonally less familiar areas. Our study suggests that humans' unique ranging behavior could have lowered the selective pressure on human spatial performance and that group knowledge could help humans to navigate in unfamiliar areas.

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Social and genetic drivers of dispersal decisions in male Assamese macaques

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In primates like in most social mammals, some individuals disperse from their natal group while others are philopatric. The decision when to leave the natal group, whether alone or in a team, whom to disperse with and where to immigrate can have marked fitness effects. Social costs of dispersal can be reduced by parallel dispersal, i.e. simultaneous or consecutive transfer by individuals from one group into a common target group. Parallel dispersal is associated with male coalition formation in comparative analyses across primates. It is unclear, however, whether males strategically account for the social consequences when timing and targeting their dispersal, and whether parallel dispersal promotes male cooperation and ultimately increases male fitness. Capitalising on long-term data on four neighbouring groups of wild Assamese macaques (*Macaca assamensis*) at Phu Khieo Wildlife Sanctuary, Thailand, the aims of this project are: (1) to assess genetic relatedness among males; (2) test whether decisions about when to leave, with whom, and where to go are associated with the social and kin relationships of the actors with males in the source and the target group; and (3) whether males transferring solo suffer from weaker social bonds, reduced cooperation, and lower paternity success in the target group. To this end, the genetic relatedness among all males of the study groups will be assessed from genetic polymorphisms at microsatellite loci. Behavioural observations will extend the demographic database and will specifically target males with known dispersal histories. This study will provide a better insight in the underlying mechanisms of primate dispersal behaviour.

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Is chimpanzee accumulative stone throwing adapted for communication?

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Select populations of West African chimpanzees engage in accumulative stone throwing (AST), where individuals are observed to throw or bang on trees with rocks; re-visiting the same trees over and over again whereby stones accumulate at the base of these trees. We spent six months in 2017 revisiting two field sites where this behaviour was originally described, Sangaredi, Guinea and the Boe in Guinea-Bissau. At both sites we conducted reconnaissance surveys of AST sites in the region along with a detailed data collection protocol for any AST site found. We designated sites as either active or not-active based on the presumed age of impact and wound marks observable on rocks and trees, respectively. In Sangaredi, we found little remaining evidence for AST sites. Here, we predict the behaviour may soon be extinguished, along with the local population of chimpanzees. On the other hand, we found many AST sites in the Boe. Here we conducted an impact sound field experiment to investigate whether AST, 1) produces an audible signal, and if so, 2) do AST trees have any special acoustic properties? We predicted that if AST behaviour was a functionally communicative behaviour, chimpanzees would select particular trees and rocks to optimize sound transmission. Our results suggest that AST behaviour may be adaptive for communication but it remains an insignificant auditory signal in comparison to the chimpanzee loud call or buttress drumming: long-distance signals observed in all wild chimpanzees. We propose that in addition to the auditory signal, AST sites also act as conspicuous visual signals which may contribute to their overall importance in the Boe.

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Bystander jealousy-driven behaviour in zoo-housed chimpanzees, *Pan troglodytes*

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Jealousy is one possible emotion that may not be uniquely human, but rather shared with other social species such as with our highly social complex closest living relative, chimpanzees (*Pan troglodytes*). Jealousy-driven behaviour can be described as a goal-directed behaviour that protects valuable relationships and thereby promotes fitness. In this study, we defined jealousy as a negative reaction from an individual (bystander) towards social closeness between two individuals (recipients). We studied the occurrence of this behaviour in a group of fifteen chimpanzees housed at Royal Burgers' Zoo, Arnhem. A bystander was more likely to express jealousy when they had a close social bond with one or both recipients compared to neither, showing they did not want to risk the services they received from their valued partners. Thus, bystanders show awareness of multiple social relationships simultaneously in order to keep track of their valued partners and monitor their own relationships in case one is threatened. A bystander who sees that their relationship with a valued partner is threatened, would express jealous-driven behaviour to protect the relationship. This study could further increase the research of secondary emotions such as jealousy in other complex social species.

Keywords: animal emotion, jealousy, bystander, chimpanzee

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Familiar and unfamiliar human face recognition by chimpanzees: The role of mouth

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Previous research on chimpanzee face recognition has reported an important role of eyes in the conspecific face matching experiment. However, recent studies using an eye-tracker have revealed an inconsistent pattern in which chimpanzees focus more on the nose and mouth regions when they look at both conspecific and interspecific faces. Furthermore, few studies have yet tested whether chimpanzees process familiar and unfamiliar faces differently. The current study was designed to investigate the relative contribution of facial components (eyes, nose, mouth) in familiar and unfamiliar human face recognition by chimpanzees. Five chimpanzees at Primate Research Institute, Kyoto University, Japan have participated in 1) full-to-full face matching and 2) full-to-part face matching experiments using a delayed matching-to-sample procedure. Chimpanzees were better at matching familiar human faces in the full-to-full face condition. Contrary to the previous finding on conspecific face recognition, a mouth seems to play a more significant role than eyes, regardless of familiarity. Our results are consistent with the eye-tracking studies and potential reasons for the discrepancy are discussed.

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Male infant handling in Barbary macaques (*Macaca sylvanus*): paternal care or mating effort?

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Kin selection theory predicts that the intensity of male care should reflect the extent of paternity certainty. Still, males of several polygynandrous primate species care of particular infants. Two non-exclusive hypotheses have been suggested to explain their motivation. The paternal investment hypothesis sees male care as a male strategy to maximise the survival of genetic offspring and predicts an association between the distribution of mating and subsequent care (mate-then care-pattern). The mating effort hypothesis predicts that females distribute matings based on the amount of male care previously provided to their infants (care-then-mate). We tested these predictions in a group of wild Barbary macaques using 903 hours of focal data on 12 infants. Support for both patterns depended on the perspective taken. Infants were not mainly cared for by their likely fathers, but males more often engaged with infants of their main previous mating partners: Females did not preferentially mate with the main caretakers of their infants, but males mated more frequently with the mothers of infants they had previously cared for the most. We suggest that the mate-than-care pattern taken from the male perspective may lend support to the paternal investment hypothesis. Males may try to optimise paternal investment by directing infant care based on their own matings instead of monitoring all females' matings. Evidence for the care-then-mate pattern from the male but not the female perspective does not support the original mating effort hypothesis, but indicates that males may increase their individual mating success and paternal investment by maintaining relationships with females.

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The use of operant conditioning to study olfactory species discrimination in two mouse lemur species (*Microcebus lehilahytsara* and *M. murinus*)

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For nocturnal animals, olfactory communication is of high significance. Mouse lemurs, which live arboreal in dispersed social systems, use scent marking behaviours in different contexts. Since up to two mouse lemur species can co-exist in Malagasy forests, olfactory species recognition should be highly beneficial, since it should help to identify and localize potential conspecific mates. It is, however, unknown, whether urinary species-specific signatures are discriminated by mouse lemurs. Therefore, the aim of this project is to test whether mouse lemurs can discriminate between urine samples containing different species signatures. To achieve this, a non-invasive and low-budget operant conditioning setup was established, using a two-way choice arena, in which up to 15 trials were conducted per animal and day. Initially, 45 captive *M. murinus* and *M. lehilahytsara* were screened with regard to their learning motivation, the majority of which (80%) did not pass the habituation criteria within the given timeframe. However, all four finally selected test animals (aged 2-6 yrs), two *M. murinus* (1 male, 1 female) and two *M. lehilahytsara* (1 male, 1 female), were successfully trained in a 5-step-conditioning process to discriminate conspecific from heterospecific urine odour. They learned to choose correctly the conspecific urine odour over the heterospecific urine odour, requiring the median of 293 trials over the median of 27.5 test days for training. This study demonstrates the functionality of the established setup despite some methodological limitations. We conclude that mouse lemurs can learn to discriminate species-specific olfactory signatures by operant conditioning.

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Within-population variation in nest building behaviours of Bornean orangutans

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Orangutans build at least one nest every day. They need complex object manipulation and cognitive flexibility to build stable platforms in spite of differences in within-tree site architecture and wood properties of each tree species. In addition, nests can be enriched with elements that increase comfort, such as pillows, blankets and/or roofs. Moreover, an individual's nest building repertoire may include nest-specific vocalizations, twig biting and smoothing, as well as carrying in nest material over distance. Since orangutans acquire their nest building skills through the peering-practice cycle from their mothers, matrilines and even populations may differ in the use of these elements, which are therefore classified as cultural variants. To establish how strong the developmental effect is on nest building behaviour, we investigated the variation in nest building within a population of Bornean orangutans (*Pongo pygmaeus wurmbii*). We use data on 7205 nesting events (N=1871 day nests and 5334 night nests) collected during focal follow between 2003-2017 at Tuanan, in Central Kalimantan. For 120 individually recognized orangutans from different sex-age classes we recorded detailed information for each nest: type (new, rebuilt, reused), nest position, height, number and species of trees used, use of additional elements, and other nesting-related behaviours. The long-term data enable us to create behavioural profiles of individuals' nesting habits, and relate dyadic similarities to genetic relatedness, social exposure, and home range overlap. We focus on differences and similarities among and within matrilines as well as between residents (females) and immigrants (males).

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Achieving Independence in Bornean Orangutans: A Mother's Push or self-interests' Pull?

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Bornean orangutans (*Pongo pygmaeus wurmbii*) reach nutritional independence around 7 years old and range independently a few years later. During the transition from infancy to being in charge of one's own ecological and social life, a compromise between a mother's interests versus her offspring's is expected. This project focuses on changes with age, and those relative to the birth of a younger sibling, concerning 1) mother-offspring conflict over proximity, travel assistance, nursing, etc., 2) proximity of offspring and mother and who maintains it, 3) social interactions of offspring, 4) general trends in activity pattern: time devoted to exploration and play. The study was conducted between 2010 and 2018 using data from more than 850 days totaling over 9000 focal hours on 14 wild habituated orangutans from 3 to 11 years old in Tuanan, Central Kalimantan, Indonesia. Data on time budgets and dyadic proximity to conspecifics, and social interactions, within 50m were collected every 2 minutes throughout focal follow days, by observers who conducted regular inter-observer reliability tests. During the study a 4 year old was orphaned, but seemingly adopted by his newly independent sister, whereas a 9 year old lost its younger sibling allowing him closer association with his mother again. These cases likely illustrate the extremes of variation in the timing of the developmental transition.

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Prosocial motivations and similarity in personality increase cooperative success in common marmosets (*Callithrix jacchus*)

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Over the last decades much progress has been made, theoretically and empirically, in distinguishing specific decision rules that may have facilitated the evolution of cooperation. Nevertheless, there is much debate about how humans and other animals come to such decision rules and we still know very little about the intrinsic motivations for individuals to cooperate and to choose specific cooperation partners. In this study we addressed these questions in 23 captive, yet group living, common marmosets. Specifically, we investigated whether prosocial motivations and similarity in personality enhanced cooperative success. To that effect, we tested the marmosets' prosocial motivations using an experimental group-service paradigm, and their cooperative success using a loose-string paradigm. Personality (i.e. Sociability) was assessed through behavioural observations. As hypothesized, we find that cooperative success depends heavily on whether the cooperating dyad comprises at least one prosocial individual. Additionally, we show that similarity in personality indeed enhances cooperative success. So far, hypotheses concerning the motivations behind cooperation and partner choice were mostly based on comparisons between species. Here, for the first time, we have tested these hypotheses within one species. Consequently, our results shed important light on the mechanisms underlying cooperative decision-making.

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Cross-species comparison of personality structures based on everyday behaviours in callitrichids

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Comparing the personality structures of closely and distantly related species can address questions about evolutionary bases of personality in nonhuman primates as well as humans. The comparative approach, however, has been limited by using different forms of rating instruments. In our study, we examined and compared the personality structures of captive cotton-top tamarins (N=20), golden-handed tamarins (N=28), and common marmosets (N=17) through coding of naturally occurring behaviours. We predicted that the personality models of both tamarin species will be more similar in terms of number of dimensions and their interpretation. All 22 behavioural indices used as personality descriptors were moderately to highly repeatable. Contrary to our prediction, principal components analyses identified 3 dimensions in golden-handed tamarins that overlapped with dimensions of common marmosets (Extraversion, Agreeableness, Assertiveness). Personality model of cotton-top tamarins consisted of Confidence and broad Extraversion dimension resembling both to Agreeableness and Extraversion in other two species. The presence and resemblance of Confidence or Assertiveness in all 3 species demonstrates that this dimension was present in the common ancestor of callitrichids. In conclusion, together with phylogeny, social and ecological parameters such as group size, mating system, and habitat diversity can also play important roles in the shaping of the personality structures.

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Social determinants of scent-marking behaviours in red-fronted lemurs

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Scent-marking behaviours are multimodal signals combining immediate ephemeral (visual) and long-lasting (olfactory) components. This combination has been described as 'demonstrative marking' and is likely to have evolved under social selective pressures. In this sense, this composite effect has also been suggested to be associated with an audience effect. If the visual component is addressed to the actual audience, modification in the behaviours of both the emitter and receiver are expected to depend on each other. Red-fronted lemurs (*Eulemur rufifrons*) are known to intensively scent-mark squatting and dragging their anogenital region on different substrates; these scent-marking behaviours being often associated with conspicuous visual signals. Moreover, overmarking, i.e. deposition of a scent mark on top of the scent mark of another individual, appears common in this species but its social determinants have not been fully described yet. We conducted ad libitum focal scent-mark observations following 27 individuals belonging to 4 groups of wild red-fronted lemurs inhabiting Kirindy forest, Madagascar. From these observations, we aim to describe the social determinants associated with the different scent-marking behaviours in red-fronted lemurs particularly testing for a potential audience effect.

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Auditory Simon Effect in an Old World monkey, *Macaca tonkeana*

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The Joint Simon task allows testing action co-representation in partners engaged in behavioral coordination. It critically builds on the individual Simon effect, which describes an interference effect that typically manifests in a higher probability of making mistakes when choosing between two response options. The Simon Effect describes that an initially learned discrimination (e.g. between two sound stimuli to choose either the left- or the right-hand response option) is more difficult when an interfering cue (e.g. the sound indicating to choose the right-hand option is played back from the left-hand side) is present. Whereas the effect disappears when the subject only has to solve one half of the task, it reappears when the second half of the task is solved by a social partner (Joint Simon Effect). The Joint Simon Effect is described in humans and common marmosets, both cooperative breeders who routinely engage in coordinated actions. To better understand the evolutionary origin of co-representation, we therefore need to test independently breeding nonhuman primates who do not extensively engage in routine coordination. In this study, we tested semi-free ranging Tonkean macaques (n=7) at the Centre de Primatologie - SILABE platform, University of Strasbourg, France, with an auditory Simon task. Current results reveal the presence of a stable individual Simon Effect ($\chi^2(1)=94.69$, $p<.001$). We thus have levelled the playing field to also assess a potential Joint Simon Effect, which will allow us to disentangle alternative explanations for the evolution of co-representation, i.e. whether it is a convergent trait in true cooperative breeders or a primate universal.

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Oxytocin and affiliation in male Barbary macaques

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Oxytocin (OT) is a neuropeptide hormone that is implicated in the formation and maintenance of social bonds. It is often released in response to positive social interactions, though this can be context and/or partner specific. Here, we investigate the effect of affiliation – grooming and triadic male-infant-male interactions – with bonded and non-bonded partners on urinary OT levels in free-ranging male Barbary macaques at Affenberg Salem. We collected detailed data on social behavior during full-day focal protocols on 13 adult males and measured endogenous OT levels from 193 urine samples collected after affiliation events. We used a window of 15-60 min to excretion of OT in urine after a target behavior, as has been shown for other nonhuman primates. OT levels were higher following affiliation compared to non-social controls. This effect appears to be driven by affiliation with bond partners but not non-bond partners. However, when we tested grooming and triadic interactions separately, we found no effect of either behavior with bond or non-bond partners on OT levels. Our results show a tentative support for OT generally being released following affiliative interactions in this species, although it is still unclear under which social contexts this occurs. In this study, our focal males often affiliated with multiple partners in the relevant time window to OT excretion in urine, and may explain the discrepancies between the different affiliative conditions. Analyses are still ongoing.

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Variation of cognitive style is driven by level of neophobia and social enhancement in free-ranging narrow-striped mongooses

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Behavioural flexibility allows animals to adapt their behaviours when situations change in their current habitat. It is involved in behaviours comprising decision-making either in physical or social contexts. However, the ability to learn flexibly can covary with individual's personality and level of behavioural inhibition. Yet, previous work has not discerned any real pattern in the direction of the relationship between these traits. Our aim was, therefore, to examine the influence of neophobia and behavioural inhibition on behavioural flexibility performances in wild narrow-striped mongooses (*Mungotictis decemlineata*) in Kirindy Forest in western Madagascar. We quantified learning performances of narrow-striped mongooses using a discrimination and reversal-learning task. We found a negative correlation between neophobia and learning performances in both tasks, with more neophobic individuals being faster, more efficient and more flexible. Further, the performance of more neophobic individuals during the reversal-learning task was influenced by social enhancement. However, our findings are not in line with the prediction of Sih and Del Guidice (2012) stating that less neophobic individuals outperform the more neophobic ones when encountering a new situation. In conclusion, narrow-striped mongooses appear to be able to learn flexibly, and more neophobic individuals may benefit from social facilitation in order to overcome their neophobia.

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Comparing methods of vigilance observation in captive common marmosets (*Callithrix jacchus*)

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Vigilance is a category of looking behavior that functions to detect threats. Whereas the functions of vigilance are commonly accepted, reported patterns have often been contradictory between and within species. Since the measurements to investigate the behavior were rather heterogeneous in the past (reviewed in Allan & Hill, 2017), these inconsistencies may well be due to different definitions of the actual behavior (e.g. minimal duration of bout lengths) and differences in the observations methods (e.g. scan vs continuous). The goal of our study was to quantify how different observation techniques influence the outcome of vigilance studies, in terms of group size effects, reproductive status, and sex, and to identify the optimal sampling technique for common marmosets (*Callithrix jacchus*). We observed 15 groups of common marmosets when they had access to new outdoor cages for the first time. All animals were individually recognizable and naïve to this new environment. The groups were video-recorded for the first 50min outside using several cameras to minimize the time were the face was not visible. Due to this precise video documentation we were able to measure the bout durations and total vigilance, and compare it to data resulting from several different sampling regimes. Overall, we find that some of the commonly used sampling regimes result in considerable distortion of the data. Furthermore, we describe how total vigilance and bout length change with time spent outside, providing us with individual rates of habituation to the new situation, which can be used as additional measure of validation.

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The relation between undecided fights and social style in group living lemurs

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Agonistic interactions without a clear winner are common in group-living primates but are seldom studied. Understanding why undecided fights may occur is important because it may influence the dominance hierarchy and the social style. Using focal observation data that were previously collected at Kirindy forest and Berenty reserve in Madagascar, we investigated undecided fights and social style of three species of lemur, *Eulemur rufifrons*, Propithecus verreauxi and *Lemur catta*. For this, we conducted a social network analysis of aggressive and affiliative interactions. Our analyses revealed that the social style of *E. rufifrons* was the most egalitarian one with networks that had a low aggression density and a low grooming centrality index, followed by *P. verreauxi*, and the most despotic style was found in *L. catta*. Undecided fights were more likely to occur in the more egalitarian species rather than despotic species (*E. rufifrons* 41%, *P. verreauxi*, 18% and *L. catta*, 3%) and were the outcome of unclear dominance relations. Specifically, undecided fights occurred when the dominance rank of the actor and receiver was similar. Further, in *L. catta* undecided fights rarely occurred if the receiver was a male. This was probably due to the pronounced female dominance in this species. Because undecided fights have no clear winner, they may prevent the dominance hierarchy from differentiating and help maintain an egalitarian social style. Our research highlights the need of addressing both decided and undecided conflicts when investigating dominance relations and social styles in primates.

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Masturbation in Primates: Phylogeny and Functions

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Auto-sexual behaviour, or masturbation, is a common aspect of the sexual repertoire of many primate taxa, including humans. Nevertheless, its potential evolutionary significance has not yet been comprehensively studied, although various adaptive causes have been proposed. For females, potential functions include: (i) attract mates via pheromones or signal receptivity, (ii) speed up ejaculation, (iii) facilitate sperm transfer, (iv) optimise vaginal pH, (v) clean vaginal tract of disease vectors, (vi) relieve stress. For males, potential functions include: (i) attract mates via display of vigour, (ii) ejaculate inferior sperm, (iii) increase arousal and available sperm, (iv) clean genital tract, (v) relieve stress. Based on extensive literature reviews and questionnaires, we compiled information on the distribution and forms of auto-sexual behaviour across the entire primate order. Its phylogenetic history will be reconstructed via Bayesian analyses. To evaluate the multitude of explanations related to proximate and ultimate causes, we will examine trends between and within species, as well as for relationships with socio-ecological variables, such as diet, mating and breeding patterns and aspects of social structure. The results will hopefully increase our understanding of how auto-sexual behaviour evolved and thus, why it occurs.

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Catalyzing Sociality: Ecology Builds on Parental Care

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In the context of social evolution, parental care has been mostly addressed as one of the possibilities for the expression of cooperation/altruism in cooperative breeding societies with reproductive skew. Societies that arise from concealment of dispersal (i.e. subsocial) have grabbed most attention in research on both vertebrate and invertebrate species. Nevertheless, the diversity of social systems also comprises societies that arise from aggregation of individuals from the same generation (i.e. parasocial) and might be even formed by unrelated peers. We argue that ecological factors that promote the appearance of sociality build on specific factors that result from parental care as a general explanation for the above mentioned diversity. We review the hypotheses and empirical evidence to explain the evolution of animal groups in vertebrates and invertebrates. Four main ecological drivers of sociality are drawn based on this survey. We discuss their relation to parental care as a matter of importance to understand their power as evolutionary drivers. We suggest that parental care is the precondition for animal sociality because it constrains reproductive options and coevolves with offspring altriciality, both factors enhancing the relative benefits of cooperative activities with other parents. We suggest that this might apply broadly as an explanation for the evolution of most animal societies and argue that to understand social transitions a look into the caring systems of ancestral species is necessary.

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Social comparison in long-tailed macaques – competition is key

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Social comparison theory disentangles how and why humans modify behaviour and self-evaluations in response to conspecific presence and performance. Social psychologists have identified some distinct patterns of behaviour that arise following social comparison. For instance, people who carry out a task in the presence of a slightly better-performing co-actor assimilate their performance toward that of the superior standard. In the present study, we adapted an experimental paradigm from social psychology to study social comparisons in long-tailed macaques (*Macaca fascicularis*). Subjects were given the task of opening baited drawers in a test apparatus in order to retrieve food rewards. We tested if the monkeys' response latency (time between drawer pulls) was influenced by different experimental contexts. The apparatus was mounted between two cages such that a subject and a conspecific could simultaneously access drawers. Subjects experienced three conditions: Social (active conspecific foraged opposite subject), Ghost (no conspecific opposite, instead an obscured experimenter pulled drawers open via strings) and Social control (conspecific present opposite but denied access to the drawers). We manipulated the competitiveness of the setup. The monkeys did not alter their pulling rate in response to the mere presence of a conspecific; they did, however, when reward acquisition was a contest. We conclude that if social comparison processes exist in this species, they are linked to direct competition contexts; this differentiates this species from humans as we also engage in social comparison in the absence of direct physical competition.

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Ontogenetic changes in social relationship patterns and social buffering of the stress response in juvenile male Assamese macaques

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Strong affiliative relationships are found in a range of primates; such as adult male Assamese macaques (*Macaca assamensis*), who form and maintain long-lasting cooperative social bonds with other males. These bonds predict rank and reproductive success, in addition to buffering the physiological stress response in bonded partners, reducing glucocorticoid levels. While these effects are well known in adults, the social and physiological changes during the extended juvenile period of wild nonhuman primates are less well studied. The social development of the dispersing sex is of particular interest, as they face the difficult choice of whom to bond or potentially disperse to another social group with. We aim to investigate which factors drive juvenile male sociality in wild M. assamensis, using cross-sectional behavioural data collected on over 60 individuals at Phu Khieo Wildlife Sanctuary, Thailand. Our focus is on how maternal effects (i.e. sociality and rank), genetic relatedness, and personality influence juvenile social bonds, and we will study the ontogenetic changes in these relationships. Personality will be evaluated using an established multi-method approach and new primers have been created to assess relatedness. The second aim is to demonstrate a buffered stress response in juvenile males and determine how the preferred buffering partner changes during development; probably from their mother to peers. Non-invasive fecal samples will be collected for validated hormone and relatedness analysis. This study will improve our knowledge of the development of primate sociality during juvenility, the life history stage that best defines primates from other mammals.

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The role of chemical cues for indicating female fertility in primates

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Olfactory cues play a more important role in primate communication than previously assumed. Compelling evidence from various behavioural studies emphasises the role of primate body odour in diverse social and sexual contexts across a range of primate taxa. Olfaction in great apes, however, is still scarcely investigated. In my PhD, I aim to compare the role of chemical fertility cues in chimpanzees and humans, two species with contrasting patterns of visual fertility advertisement. Unlike humans, chimpanzee females visually advertise their reproductive state with sexual swellings. For my study, I apply a highly sensitive sampling method (thermal desorption tubes) novel to studying mammalian body odour. In a pilot study, I collected volatile organic compounds of the genital region of three adult, regularly cycling chimpanzees across three menstrual cycles per individual. Variation in the chemical composition of whole body odour profiles was associated with sexual swelling stages, but the preliminary data also indicated considerable inter-individual variability in body odour composition. These data are being complemented with an ongoing study on women applying the same methodological approach to further evaluate the intended sampling regime. Thereby, my preliminary studies provide valuable information about methodological adjustments to improve sample quality as well as first candidate substances that may act as fertility cues. Ultimately, this study will contribute to understanding the evolutionary history of human sexual signalling.

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Energetics of reproduction in wild female Assamese macaques (*Macaca assamensis*)

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Reproduction typically requires a large investment in terms of energy, especially in the case of lactating females. In many primates, it is common for conceiving females to go through weight loss and to change their diet and/or activity budget to cope with costly reproductive stages. Nevertheless, relatively little is known about how fluctuations in energy availability impact a female's reproductive cycle and how the energetic costs of reproduction are distributed over time. Here, we investigate the energetic costs of female reproduction in a wild population of Assamese macaques (*Macaca assamensis*) facing seasonally occurring nutritional stressors. A useful non-invasive marker of energy balance is urinary C-Peptide (uCP), a cleavage product in the insulin biosynthesis. uCP measurement has been validated for a number of nonhuman primates, including macaques. We will investigate the interplay between energy balance and reproductive outcome to examine how nutritional constraints influence a female's ability to reproduce successfully. Over a period of 13 months, we collected behavioral data (~3,000 focal hours) and 1080 urine samples of 45 adult females from three groups of wild Assamese macaques at Phu Khieo Wildlife Sanctuary, Thailand. In addition, food abundance was measured using monthly phenological records of up to 650 trees, shrubs and climbers spread over 20 botanical plots. As data analysis is currently ongoing, preliminary results will be presented on the feasibility of uCP as a marker of energy balance in this species, including the seasonal variation of uCP in relation to overall food abundance in the habitat and individual female reproductive status.

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General information

Assembly	The assembly of the members of the Gesellschaft für Primatologie will be held in the lecture hall
Bus services	City bus lines 21, 22 and 23 connect the venue with the city center. The last bus departs at the bus stop "Kellnerweg" at 11.23 p.m. On Friday night, the night line N4 departs from "Kellnerweg" at 1.36 a.m. 2.36 a.m. and 3.36 a.m. Please see the next page for a map displaying the local bus lines. An interactive schedule for each bus stop is available online; the full time-table is on display at the registration desk
Bus tickets	Can be purchased on the bus. Single tickets are available for 2.40 €; a discount is available when purchasing four single-tickets for 8.70 €. One-day tickets cost 5.70 €. Single tickets are valid for 60 minutes and allow to change buses
City maps	Are available at the registration desk
Coffee breaks	Coffee, tea, water and snacks are provided free of charge outside the lecture hall
Conference dinner	The conference dinner will be held in buffet style on Friday at 7 p.m. at the German Primate Center. Acoholic and non-alcoholic beverages are included
Internet access	please connect to the WLAN-GFP network using the key gfp_2019
Luggage	A locked storage room is available. Please contact the registration desk if you want to deposit luggage
Lunch	Lunch is provided on Thursday and Friday in the glass hallway west of the lecture hall.
Notice board	A notice board is available outside the lecture hall and can be used for announcements
Parking	Limited parking oportunities are available at the Primate Center, but we recommend using the local bus services
Poster	Posters are on display throughout the conference outside the lecture hall
Smoking	Smoking is prohibited in all public buildings. Please use the designated smoking areas outside the building
Snacks	Additional snacks can be purchased at the Primate Center cafeteria from 9 a.m.-3 p.m. (on Wednesday and Thursday), and from 9 a.m.-2 p.m. (on Friday)
Taxis	Taxis can be ordered by calling 0551-69300, 0551-65000 or 0551-484848
Uploading talks	Please upload your talks in the lecture hall either before the first morning sessions or during coffee and lunch breaks. Copy your talk into the folder designated for your session. Please label your file in the following way: *hour_minute_surname* (e.g.: *14_00_Ostner*). Files must be uploaded at the very latest during the session before your talk. Our technicians will be available to assist you.
Wardrobe	Unattended wardrobes are located outside the lecture hall

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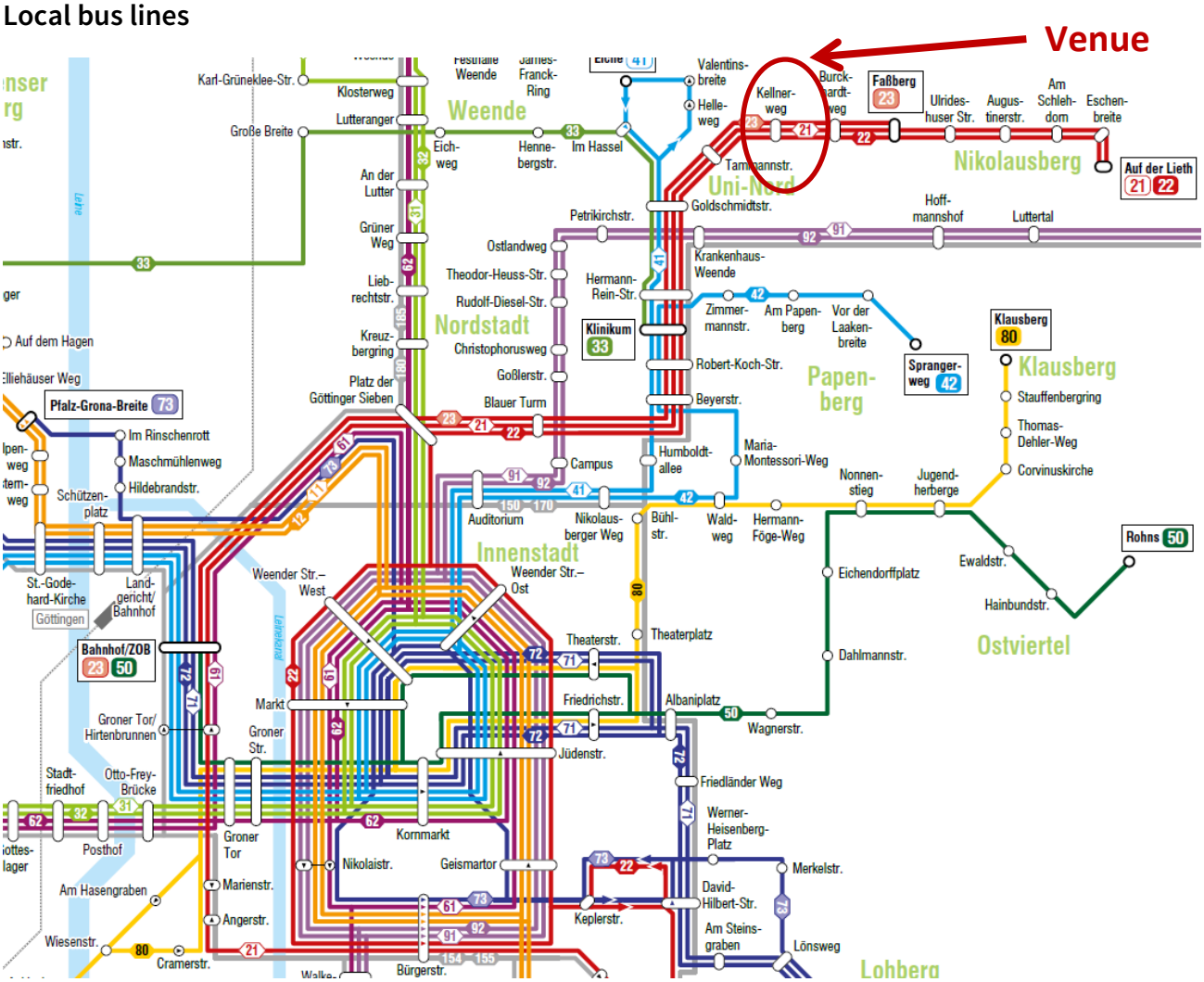
Local bus lines



interactive schedule – requires online connection

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Thank you very much for your participation.

We hope to see you all again at the

next GfP conference in 2021

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