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Primates: Biodiversity and Conservation

Oral Communications

Stress and Play Fluctuation in Wild *Lemur catta*

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Key Words: Ring-tailed lemurs · Anxiety · Indicator · Scratching · Playful activity · Madagascar

Strepsirhines have been neglected in the study of animal play. Yet, data from a wide array of primate taxa are needed to understand role, functions and social determinants of play. We investigated play behaviour in wild ring-tailed lemurs *(Lemur catta)* at the Berenty Reserve (Madagascar) where two other sympatric lemur species, and potential resource competitors, live *(Propithecus verreauxi* and *Eulemur fulvus)*. We followed two groups of ring-tailed lemurs (9 and 16 individuals) from November 2006 to February 2007. We evaluated play fluctuation during possible stressful conditions, such as the presence of neighbour groups of conspecifics (C), and the presence of groups of other lemur species (NC). We considered the absence of any other group (A) as the control condition. We first verified whether the presence of other groups did increase stress levels in the study groups. Stress levels were measured via scratching, which previous studies have shown to be a reliable indicator of anxiety in human and non-human primates. Scratching rates in the study animals were higher in the presence of other groups (C+NC) compared to when other groups were absent (A). Overall play rates were highest when other groups were nearby. In presence of NC groups, play rates decreased as NC groups approached the study groups. Instead, when only C groups were in sight, play rates increased as the distance between the study groups and other conspecifics decreased. Moreover, play was highest during extra-group aggressive encounters (involving C groups) whereas it was suppressed during intra-group fights. Our results suggest that play fluctuates in response to different stressful conditions and may be used as a mechanism to cope with anxiety.

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The Role of Emotional Engagements in the Development of Chimpanzee Minds

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Key Words: Infant development · Great apes · Social cognition · Early experiences

Most human infants, by the time they are a year old, develop a suite of triadic engagement skills (i.e., joint attention, social referencing, intentional communication), but questions have been raised about whether triadic engagement skills occur in non-human primates. Joint attention (JA) is conceptualized as coordinated joint engagement, often operationalized by alternation of infant gaze between a social partner and an object of mutual regard, and is the foundational triadic skill. In this talk, I will present evidence that emotional engagements with social partners, with objects, and with social partner's affect about objects are crucial in the development of joint attention (JA) in chimpanzees, and each are influenced by previous interactive history. Interestingly, joint attention commonly occurred, without specific training, in 8-, 9-, and 10-month-old nursery-reared chimpanzees (n = 35) during standardized cognitive testing. Using hierarchical multiple regression analysis to predict JA success, I found that emotional responses to testing and emotional engagement with social partners together accounted for over 50% of the variance in JA success at 9 months. JA developed at 8 to 10 months in chimpanzee infants, the same age as in human infants, and was accompanied by gaze alternation. I conclude that developmental histories of emotional engagements, in part, determine social cognition. Social cognition has a developmental history based in emotional engagements. Comparative studies of primate social cognition require appropriate consideration of development, in general, and must be informed by consideration of the interaction of early rearing environment with emotional development.

Faecal Androgens in Wild White-Handed Gibbon *(Hylobates lar)* Males

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Key Words: Androgens · Gibbons · *Hylobates lar* · Testosterone

Despite the central role of testosterone in influencing many aspects of the male life cycle, information on the influence of social and behavioural factors associated with androgen output is available for few non-human primate species. Social organization and mating system seem to have a strong effect on testosterone levels, but on the other hand, testosterone can alter fitness by suppressing immune function and parental care. Moreover, male development, including growth, reproduction and senescence, is often linked to testosterone output. To identify the potential influence of social and life-history variables (e.g. pair-living vs. multimale groups, social status, presence of infants, age), we measured testosterone metabolite levels in 22 white-handed gibbon males *(Hylobates lar)* of 13 groups living in the Khao Yai National Park, Thailand. We predicted that androgen levels would be: (i) higher in pri-

mary (e.g. higher-ranked) males than in secondary males; (ii) higher in males of multimale groups than in males of one male groups; (iii) higher in prime aged individuals than senior ones; (iv) lower in males residing in groups with infants than in males living in groups without infants. Despite marked inter-individual variability in androgen levels, we did not find any relation with age and social status. However, males living in pairs exhibited higher androgen concentrations compared to males living in multimale groups, and males residing in groups with infants had higher androgen levels than those living without infants. Although speculative, the increased androgen output found in gibbon pair-living males and those residing with infants might be explained as part of a strategy to face potential agonistic interaction against intruders in the first case and a predictable risk of infanticide in the second one.

Ecological and Demographic Correlates to Primate Densities in Fragments of Lowland Rainforest at La Suerte Biological Station, Northeastern Costa Rica

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Key Words: *Alouatta palliate* · *Ateles geoffroyi* · *Cebus capucinus* · Primate density · Costa Rica · Fragmentation · Forest structure

Forest fragmentation alters both the quality and area of habitat available to primate species. Determining whether there are vegetation traits associated with primate population density and structure may help to manage fragmented habitats better. In this study, we investigated whether significant demographic changes had occurred in populations of Neotropical primates over the last decade at La Suerte Biological Station, Costa Rica. Those changes were then related to forest structure and diversity. We sampled tree height, density, diversity, crown volume and canopy cover in a small fragment of old-growth vegetation (20 ha) and in a fragment of mature, second-growth forest (250 ha). We also carried out censuses of mantled howlers *(Alouatta palliata)*, white-faced capuchins *(Cebus capucinus)* and black-handed spider monkeys *(Ateles geoffroyi)*. Overall, both forests had similar vegetation structure, but the primary site had trees with larger crown volume and higher diversity. Forest age correlated positively with howler density and the size of howler foraging groups. Primate populations in the primary fragment seem to have reached carrying capacity, while populations of all three species in the secondary fragment had grown significantly. Our findings support other studies that have identified the importance of tree diversity and large trees for primate habitat.

Immature Chimpanzees and Children: A Comparison of Play Developmental Pathways

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Key Words: *Pan troglodytes* · Behavioural development · Rough-and-tumble · Meta-communication

The developmental trajectories of social play have evolved in concert with the extension of the immature period in primates. Modality, complexity, playmate choice and frequency of play can be predictive of its adaptive functions. Evaluating and comparing all these parameters in each age stage of different primate species is important to formulate hypotheses on the diverse roles of play during individuals' ontogenetic process. This study aims at contrasting a possible ontogenetic pathway of immature chimpanzee play with that of children. Our data reveal that, as in children, while solitary play peaks in motor independent infants, social play does not vary in frequency between infancy and juvenility, but it varies in complexity, asymmetry and playmate choice. Human and non-human primates seem to select peer playmates; accordingly, our data reveal that chimpanzees prefer to engage in play with peers. Moreover, we found that play between infants is more asymmetric and less complex than that between juveniles, who have to restrain themselves in order to keep the bout symmetric and limit the risk of escalating the fighting; such interpretation agrees with data in human youngsters, whose play bouts turn into fights in few cases. The asymmetry and lower complexity of infant play reflect the different degree of motor skill maturity and the difficult in performing self-handicapping. Considering play signals, such as laughter in humans, play faces in chimpanzees seem to have a role in advertising cooperative intentions thus increasing the likelihood of engaging in solid social relationships. In conclusion, in humans and chimpanzees different play modalities and signals should indicate different functions for different aims.

Contagious Yawning in Bonobos: Evidence for the Empathy and Synchronization Hypotheses

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Key Words: *Pan paniscus* · Yawn contagion · Emotional closeness · Kinship · Synchronization

Since the 1990s many studies have focussed on contagious yawning and its proximate factors in humans. The idea that yawning contagion in humans is predicated on an empathetic or a synchronization response was recently extended to other primate species. Here, we show for the first time that yawn contagion is also present in bonobos *(Pan paniscus)*. During

a period of five months, we collected data via all occurrences sampling on 16 adults (4 males and 12 females) hosted at Apenheul Primate Park (The Netherlands) and Wilhelma Zoo (Germany). Our analyses show that the frequency of contagion was higher among kin and when the trigger was a high ranking individual. These results support both the empathetic and synchronization hypotheses, which are not necessarily mutually exclusive. Kinship predicts yawn contagiousness, which is consistent with the idea that yawn contagion is mediated by emotional closeness. On the other hand, high ranking individuals have the main role in group decision-making and in regulating the group's daily activities. In this view, the stronger yawn response elicited by high ranking individuals seems to support the synchronization hypothesis.

Delay Discounting for Primary and Secondary Rewards in Capuchin Monkeys

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Key Words: Delay of gratification · Token exchange · Self-control · *Cebus apella*

Self-control is considered one of the features distinguishing humans from other animals. When facing the choice between a small immediate reward and a large delayed reward (intertemporal choice task) people tolerate longer delays than non-human animals. However, animal studies have always used food rewards whereas human studies mostly used monetary rewards, and people are more impulsive over food than over money. Here, we presented 10 capuchins with choices between: (i) 2 vs. 6 food items (*Food delay* condition), (ii) one low-value token, exchangeable for 2 pieces of food, vs. one high-value token, exchangeable for 6 pieces of food (*Token delay* condition). The small option was available immediately, and the large option was available after 80 seconds. Moreover, capuchins received a *Food control* condition and a *Token control* condition, i.e., choices between 2 vs. 6 pieces of food or between one low-value token and one high-value token, both available immediately. If capuchins shared with humans an enhanced tolerance for delay with secondary rewards, one would expect them to be more impulsive with food than with tokens. In contrast, our subjects chose the larger delayed option more in the *Food delay* condition than in the *Token delay* condition. Probably, in the intertemporal choice task the preference for the larger delayed option is partly due to an impulsive preference for the quantity rather than to a high delay tolerance. Tokens decreased the perceptual salience of the larger option, thus reducing the choices for the larger delayed option. This interpretation, if confirmed by further studies, would have important implications for studies on temporal preferences in non-human animals.

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Flexible Feeding Ecology of Collared Lemurs, *Eulemur collaris*, in Littoral Forest Fragments

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Key Words: Forest degradation · Forest fragmentation · Habitat alteration · Malagasy Littoral forests · Nutritional ecology · *Eulemur collaris* · Madagascar

Frugivorous primates are known to be particularly vulnerable to habitat fragmentation and degradation, because of the highly variable spatial and temporal availability of their feeding resources. Lemurs of Madagascar are supposed to be adapted to fluctuating ecological conditions, which naturally occur on the island. This should allow them to cope with some degree of habitat modifications. However, the behavioural and ecological strategies used by frugivorous lemurs to persist in secondary habitats have received little attention. In this study, we compared long-term data on collared lemurs in a degraded fragment of littoral forest of south-east Madagascar with that of their conspecifics in a more pristine area. Data were collected on five lemur groups totalling 1,698 observation hours from 1999 to 2007. In the degraded area, lemurs modified several aspects of their behavioural ecology by decreasing group size and by increasing feeding time, ranging areas and number of feeding patches. The above strategies were apparently able to counteract a clear reduction in both food quality and size of feeding trees. We hypothesize that the observed flexibility is favoured by lemur adaptations to Malagasy rainforests, which are known to undergo periods of fruit scarcity and low productivity.

Acoustical and Structural Development Associated with Age in the Indri's Song

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Key Words: Ontogenesis · Vocalization · Duration · Repertoire · Notes · Strepsirrhine

Interactions between development and spectro-temporal parameters of the vocal output only rarely were thoroughly investigated in non-human primates. Changes associated with age can be related to vocal tract morphological growth, physiological changes, sexual development or learning. We performed a fine-scale analysis of the acoustic and structural properties of calls given during the song of the indri *(Indri indri).* We analysed 431 individual song contributions, emitted by 32 individuals from 10 different family groups. Age of the recorded animals ranged from 2 to 12 years for males and from 4 to 12 for females. Songs were recorded between 2005 and 2009 in three different forest sites near Andasibe (Madagascar): the Analamazaotra Special Reserve, the Mitsinjo Forest Station and Mantadia National Park. Using GLM analysis we found that indris showed a remarkable degree of plasticity in the duration of individual contribution to the song and in the total number of vocalizations emitted. The total number of calls given during the song varied sig-

nificantly with age (N_{males} = 52; $N_{females}$ = 35; F = 35.919; R^2 = 0.462; $p < 0.001$) and changed depending on the interaction between sex and age (F = 4.861; R^2 = 0.462; p = 0.030). The total duration of all utterances varied with age (F = 26.602; R^2 = 0.275, $p < 0.001$), as well as the mean duration of each vocalization (χ^2 = 19.430; d.f. = 10; p = 0.035). The number of notes per note type changed during development (χ^2 = 22.275; d.f. = 10; p = 0.014) but there were no differences in the number of note types emitted per song (t = –0.858; d.f. = 10; p = 0.411). Changes occurring during development showed that the note repertoire did not significantly change after 2 years of age.

Facial Expressions as a Communication Tool in Captive Barbary Macaques

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Key Words: Facial Expressions · Display · Communication · Barbary macaque

Facial expressions in both non-human primates and humans are a fundamental intraspecific communication tool: they are displayed in the social contest and are correlated to the consequences of social interactions. This study provides an overview of the main facial expressions and their use in the Barbary macaques' *(Macaca sylvanus)* colony maintained at Parco Natura Viva – Garda Zoological Park (Italy). In particular we focused on: (i) identifying and describing the facial expressions displayed by the Barbary macaques, compared with those identified in other studies; (ii) observing each facial expression displayed by the subjects of different age classes linked to different behavioural classes; (iii) identifying the facial expressions mainly displayed in each behavioural class. Moreover, this study aimed to observe the function of two peculiar facial expressions: 'silent bared-teeth display' as the possible ancestoral expression of the human smile, and 'relaxed open-mouth display' to verify the hypothesis of it as the possible ancestral expression of human laughter. The results of this study support findings in the literature with regard to the Barbary macaques' facial expressions by reporting the different frequency of different facial expressions both in age and behavioural classes. In addition, this study shows that the 'silent bared-teeth display' is shown mainly when associated with affiliative behaviour and by adult subjects, while the 'relaxed open-mouth display' is shown mainly with social play and by juveniles and infants. These outcomes seem to reveal the evolutionary origin of human facial expressions since some pre-existing traits could be observed in non-human primates.

Visitor Impact on Macaques' Behaviour in Captivity: Implications for Welfare

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Key Words: Primates · Visitor impact · Welfare · *Macaca sylvanus*

Several studies have reported significant effects of zoo visitor density and intensity on the behaviour of captive animals. In particular, most species were found to be stressed by high num-

bers of visitors, showing decreased activity pattern as well as increased stereotyped and aggressive behaviours. The goal of this study was to investigate whether and how the presence of zoo visitors affect the behaviour of a colony of Barbary macaques *(Macaca sylvanus)* at Parco Natura Viva – Garda Zoological Park (Italy), in order to improve the captive management of this species. Data were collected on weekdays (Thursday and Friday) and weekends (Saturday and Sunday), with a low and high presence of visitors respectively. Results show that a high number of visitors appears to have no significant effect overall on the activity and resting patterns of Barbary macaques. However, a great number of visitors seems to be correlated with an increase in individual activity and a decrease in affiliative behaviours. Locomotor activity was significantly greater on weekends (with high public density) than on weekdays. On the other hand, behaviours not typically displayed in their repertoire such as *begging* appears not to vary depending on visitor density but simply on public presence, regardless of the number of people present. Furthermore, macaques spent more time in lower areas of the enclosure, closer to the public, when a large audience was present. In conclusion, zoo primates do not habituate completely to the presence of the public, nor do they ignore them. Thereby, when designing an exhibit, since zoo visitors may affect captive primate welfare, it appears to be important to consider the needs of housed animals to improve their welfare.

Why Capuchin Monkeys *(Cebus apella)* Have the Patience of a Saint? A Comparative Analysis of Five Primate Species' Performance in the Intertemporal Choice Task

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Key Words: Delay of gratification · Tool use · Self-control · *Cebus apella*

The evolution of skills such as reciprocal altruism, planning, and cooperation requires the inhibition of prepotent responses. Both human and non-human animals often face decisions between options available at different times, but whereas humans apparently tolerate delays of weeks or even months, animals tolerate delays of just a few seconds. However, delay tolerance can vary across species and it is unclear if phylogenetic relatedness, feeding ecology, social structure, or metabolic rate account for this difference. To disentangle these hypotheses we evaluated temporal preferences in capuchin monkeys. Specifically, we presented 16 capuchins with choices between a small immediate reward and a large delayed reward employing an adjusting delay procedure, i.e., varying the delay associated with the larger option across sessions until subjects were indifferent between the two options. Then, we compared their performance with that of the other primate species tested so far with the same procedure. Overall, capuchins showed a considerable delay tolerance, and – as in humans – females showed a greater delay tolerance than males, possibly because of the females' less opportunistic foraging style. Furthermore, capuchins performed significantly better than closely related species, such as tamarins and marmosets, and their performance was not significantly different from that of bonobos and chimpanzees. Capuchins' tool use abilities might explain their comparatively high preference for the delayed option. Thus, our results shed light on the evolutionary origins of delay tolerance supporting the feeding ecology hypothesis.

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Assessing Animal Welfare in a Colony of Barbary Macaque *(Macaca sylvanus)* Housed in a Modern Zoological Park: The Effects of a New Exhibit

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Key Words: Animal welfare · New exhibit · Zoo visitors · *Macaca sylvanus*

Post-occupancy evaluation (POE) provides a valuable tool with which to assess how different species behave in their new enclosure and how they use different resources within it. In order to ensure animal welfare, it is important to verify that this enclosure allows animals to express behavioural patterns matching those in the wild. The aim of this study is to analyze the effect of a new naturalistic exhibit on the behaviour of a group of 17 Barbary macaques *(Macaca sylvanus)* housed at Bussolengo Natura Viva – Garda Zoological Park (Italy), focusing on the effect of the visitors on the Barbary macaques behaviours. A continuous focal sampling was used to record the duration of the behaviours shown by the colony over a 3-month period in the new enclosure. Results highlight that macaques performed their typical social behaviours, showing grooming and forming clusters, and performed their individual behaviours such us foraging. No stereotypies were recorded and, moreover, aggression levels were very low during the entire observation period. In addition, they spent more than 30% of the time out of view of visitors. An important finding of this study was that in the new enclosure Barbary macaques did not show the typical behaviour associated to the visitors *(begging)*; on the contrary, this behaviour was performed in the old exhibit. In conclusion, this study illustrates that modern naturalistic exhibits can improve the welfare of captive primates, allowing them to perform natural behavioural patterns and choose to act away from the sight of zoo visitors.

Individual Distinctiveness in the Song of Indris

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Key Words: *Indri indri* · Song · Dimorphism · Vocal Communication · Discriminant analysis · Syntax

In animal communication, selected vocalizations have been shown to signal individual attributes, but little is known about singing primates. Indri's song is among the most complex vocal output, and song traits vary substantially between the sexes. The question remains if variation in signalling also reflects consistent individual characteristics. We report the presence of individual characteristics in the spectral and syntactic structure of indris' song. We digitized 383 songs from four adult males and adult females and transformed each individual contribution into a resynthesized sound file based on the pitch contour to represent the temporal and frequency distribution of individual singing. A statistical discrimination with cross validation performed on the resulting variables allowed us to correctly identify 87.9% of the adult individuals. Then we documented the structure of songs in terms of roar, long notes and sequences of descending phrases. A high percentage of correct classification was obtained for females considering both long notes and descending phrases notes (76.1, and 84.7%). Discriminant analysis

applied to male notes showed that 66.4% of individuals were correctly classified considering long notes and 64.9% considering descending phrases notes. Song structure reflects intrinsic behavioural characteristics such as identity traits.

The Snub-Nosed Monkeys of China

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Key Words: *Rhinopithecus* · Primates · Conservation

The genus *Rhinopithecus* comprises three species endemic to China: *R. roxellana*, *R. brelichi*, and *R. bieti*. They represent a unique, though understudied, adaptive array. Their distributions span from relatively low to high altitudes (1,000–4,000 m), from tropical to conifer forests. All species are threatened by poaching and habitat loss (because of wood extraction, building projects and illegal mining). Estimates of 1,500 to 10,000 were reported by IUCN and urgent conservation actions are required to prevent the extinction of these species. Basic descriptions of the ecology and behaviour of the three Chinese snub-nosed monkey species have been provided in recent years, but more field studies are needed to reveal how their peculiar morphology plays a role in communication.

Unusual Plant Consumption by Captive Chimpanzees *(Pan troglodytes)*, Gorillas *(Gorilla gorilla)* and Orangutans (*Pongo* sp.): Learning Mechanisms Involved

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Key Words: Neophobia · Social learning · Zoopharmacognosy · Great apes

More and more studies suggest the existence of self-medication behaviours in great apes. This study aimed to understand the factors influencing the discovery of potentially curative items and to evaluate the possibilities for social transmission of such knowledge. We presented four different categories of plants ($n_{species} = 7$) to captive groups of chimpanzees ($n_{individual/group} = 14–9$), gorillas ($n_{individual/group} = 7–5-3$) and orangutans ($n_{individual/group} = 7–10–4$): (1) more preferred-familiar item, (2) less preferred-familiar, (3) more preferred-unfamiliar and, (4) less preferred-unfamiliar. We recorded inspecting behaviours, food consumptions, inter-individual observations and food transfers with continuous sampling. Chimpanzees sniffed plants more frequently and ingested them less than the other apes. Close observations and food sharing were very rare in gorillas in comparison to orangutans and chimpanzees. We hypothesize that individual learning, allowed by low neophobia levels, may be linked to adaptation to the unpredictable habitats (orangutans) and to physiological features (the gorilla digestive system able to detoxify plants). Furthermore, social learning may be favoured by a social system that allows moderate levels of tolerance and interactions among the individuals (chimpanzees and orangutans).

Pointing towards Language: A Natural Experiment on Communication Development

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Key Words: Visual communication · Hominoidea · Gestures · Socio-ecological influences

We study primates for a variety of reasons: For example, to understand better the manifestation of particular ecological factors in social structure and in social behaviour. In this talk, I will discuss ecological influences on communication in great apes and humans. Pointing to specific entities has long been characterized as a uniquely human gesture, indexing uniquely human cognitive abilities. Here I will review observational and experimental evidence of pointing by chimpanzees and other great apes. Among great apes, pointing is commonplace in some environmental contexts (e.g., captivity), but vanishingly rare in some others (e.g., in the wild). Hence, pointing emerges in great apes–without any training–when their environments possess features that make pointing useful. Therefore, pointing exists as a 'latent gesture,' the display of which depends in significant part on factors external to the brains of great apes. Pointing emerges in great apes when they experience barriers to direct attainment of objects, and are therefore dependent upon others to act on the world for them. Thus, to understand pointing by great apes, one has to understand something about their specific learning histories. An unavoidable implication is that there are important group differences in signalling characteristics between differently socialized great apes; there is no such thing as the 'typical' ape. In contrast, most theoretical accounts of the development of pointing in the human species appeal to our unique evolutionary histories since we split from the other great apes, about six million years ago. Although pointing does not emerge in humans until about a year of age, ironically, relatively few developmental psychologists interpret pointing as an outcome of developmental processes; rather, pointing is viewed as a consequence of our phylogenetic, but not our ontogenetic histories. Pointing is seen as a kind of precursor to symbolic reference, a way to refer to things without speech that is, ultimately, a derivation of our unique species capacity for linguistic communication. Here I will argue that it is not theoretically parsimonious to account for the development of a gesture in one species as a biological adaptation (humans), but as an ontogenetic adaptation in that species' nearest living relatives (the great apes). I will argue that by virtue of our species' unique biological adaptations, we are born into the kinds of socio-ecological circumstances that facilitate pointing in all great apes. Human babies are dependent on their caregivers to act on the world for them well into late infancy, when they begin to employ sophisticated communication tactics to manipulate their caregivers, of which pointing is one example. Thus, pointing in the human species may not index a uniquely human, biologically based cognitive capacity for direct reference; instead, it may simply reflect the unusual socio-ecological developmental circumstances of humans, compared to our nearest living relatives.

Differential Use of Contact and Non-Contact Affiliation during Reconciliation in Mandrills

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Key Words: Reconciliation · Aggression · Conflict management · Behavioural flexibility · *Mandrillus sphinx*

Group living animals employ various strategies to deal with the costs and conflicts of interests associated with social life. In non-human primates, the most common behaviour following aggressive conflicts is reconciliation. In this study we analysed the postconflict behaviour of a captive group of mandrills *(Mandrillus sphinx)*, a species whose social behaviour is still poorly known. Mandrills showed a differential use of contact and non-contact postconflict affiliation: the former was more frequent between kin and when the original aggressor was lower ranking than the victim, that is, with easily accessible individuals. Non-contact affiliation was preferred to reconcile with opponents having a high probability to renew aggression, that is, with the most dangerous ones. Both types of affiliation reduced the probability of renewed aggression. These results suggest mandrills are able to adopt flexible strategies according to the varying characteristics of their antagonists.

The Role of Sociality and Physiology on the Learning Process in Unusual Feeding Behaviour in Wild Great Apes: A Window to Understand the Origins of Self-Medication in Humans

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Key Words: Ontogeny · Learning · Feeding · Seasonality

Primates evolved a natural hesitancy towards eating novel foods probably to minimize risks of being poisoned; however habitat variability and social context may decrease such neophobia. Understanding social influences on dietary flexibility alongside habitat changes is important to evaluate resilience of endangered species. Infants show dietary flexibility and a low degree of neophobia during their development. Observational learning and synchronized consumption with the mother are considered responsible for food preference transmission between generations in primates, but plant chemicals may also play a role, particularly in unstable environments. Both western gorillas and chimpanzees have a flexible diet due to seasonal changes in food availability. Providing insight into the origin of human self-medication, this study aims at investigating the role that great ape social systems and physiological features (e.g. gut specialization) play on learning mechanisms involved in the consumption of unusual and potentially bioactive food. Data from a community of 41–44 wild chimpanzees in Uganda (11 months in 2008), and a group of 11–13 wild western gorillas in Central African Republic (10 months in 2008–2009) were compared. During feeding activities, we recorded all social interactions among individuals, the subsequent activity, food consumed and its availability. Data on plant consumption from different age-sex classes were collected integrating continuous and 10-minute scan sampling.

With respect to western gorillas, frequency of unusual consumptions was higher in chimpanzees, who rely more on social information. Observational learning mainly occurred between immatures in gorillas, while in chimpanzees persisted after puberty, and adults before senescence were the most observed. Unusual feeding may be linked to medicinal plant use in chimpanzees but not necessarily in gorillas. Therefore, self-medication may have appeared in our ancestors in association with high social tolerance and lack of herbivorous gut specialization.

Selamatkan Yaki: An Integrated Approach to Saving a Critically Endangered Macaque

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Key Words: *Macaca nigra* · Sulawesi · Selamatkan Yaki

Sulawesi is a major biological hotspot. It is the largest island within the Wallacea region, where Australasian and Asian flora and fauna meet. Wilson et al. (2005) noted that the species of Sulawesi were so important that conservation funds and activities within Indonesia should be prioritised there. Of special interest is the Sulawesi crested black macaque *Macaca nigra*, one of seven endemic macaque species, and the most at threat of extinction; listed as Critically Endangered by the IUCN (IUCN, 2011). In the last 40 years the estimated *Macaca nigra* population has declined from over 300 animals/km^2 to less than 26 animals/km^2. In 2007, an integrated conservation programme was established, named Selamatkan Yaki; Bhasa Indonesian for 'Save Macaques'. To date the programme has undertaken some preliminary census surveys, evaluated the efficacy of educational materials, investigated the demographics, activities, attitudes and empathy of local people towards macaques and their habitats, as well as working to maintain a self-sustaining captive population and undertake ex-situ research. Currently, a conservation action plan is being written for circulation to stakeholders, which uses collated empirical evidence to identify the direct and indirect threats faced by *Macaca nigra*. Strategies have been noted which will hopefully mitigate these threats and these will be rolled out later this year; starting with the incorporation of a village aquaponic system to enhance food productivity and reduce poverty!

Should I Stay or Should I Go? Fitness Outcome of Male Rhesus Macaques Migration Strategies

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Key Words: Male dispersal · *Macaca mulatta* · Reproductive success

Deciding when and where to migrate is expected to influence male fitness. Consequently, factors shown to affect male reproductive success might also influence migration strategies. Lifetime fitness consequences of alternative migration strategies have been difficult to assess in primates, particularly when individuals move several times between groups throughout their lives.

This study aims at investigating how migration decisions affect fitness in male rhesus macaques *(Macaca mulatta)* on Cayo Santiago Island, Puerto Rico. We used census records collected continuously since 1956 and genetic data available for partially sampled cohorts born between 1992 and 2000 in all social groups. Initially, individual male migration patterns were determined by combining data on the number of movements between groups and the total number of groups visited during the study period (n = 447 mature males). Subsequently, genetically determined paternity data were used to check whether males that adopt alternative strategies attain similar reproductive success over time (n = 719 offspring). We found great variation in migration patterns among males (range 0–32 moves). Reproductive skew remained high over long periods of time (mean ± SD = 6.0 ± 5.7 offspring, range = 0 to 29) and more successful males tended to move less between social groups. Thus, past reproductive success is likely to play a major role in male rhesus macaque migration decisions. This study constitutes one of the first attempts to quantify long-term reproductive success for the dispersing sex in a non-human primate.

Embracing Behaviour: Distribution, Incidence and Potential Adaptive Role in a Captive Group of *Theropithecus gelada*

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Key Words: *Theropithecus gelada* · Greeting behaviour · Embracing · Social relationships

Living in a social group brings advantages but also involves a number of costs. Several primate species use different behavioural strategies to maintain an integrity in their social network by means of elaborate behavioural strategies to exchange communicative signals. The bond-testing hypothesis suggests that social animals can obtain honest information about the quality of their dyadic relationships by exchanging costly, high-risk signals [Zahavi and Zahavi 1997]. We evaluated this hypothesis by investigating whether individuals of a captive group of geladas *(Theropithecus gelada)*, in a 2 months observation period, would use intensive greeting interactions to test the quality of their relationships. We focus our analysis on a particular behaviour: the 'embrace'. We found the occurrence of 4 different types of embraces. Our data showed that embracing another individual is displayed by females only and it occurs mainly in sub-adult and adult individuals. Lastly, it seems that there is a correlation between the frequency of embracing and the quality of the social bond among females, as predicted by the bond-testing hypothesis.

Dominance Relationships in Lemurs: More than Just Female Dominance and Hierarchy Linearity

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Key Words: Lemurs · Linearity · Steepness · Sifaka · Strepsirhines

The determination of hierarchical relationships is a controversial issue in primate sociobiology, due to non homogeneity in the methodology used for hierarchy assessment. Here, we investigated the dominance style of three sympatric lemur species, *Lemur catta* (two groups),

Propithecus verreauxi (two groups), and introduced *Eulemur fulvus* × *collaris* (one group), in the Berenty forest, Madagascar. Data were collected in the periods November 2006–February 2007 (wet season) and March–July 2008 (dry season), via all occurrences animal sampling. Ad-libitum we checked for group dispersion (individuals spaced ≥20 m) and used it for a post-hoc evaluation of the cohesion level around the dominant individual. Based on aggression sociomatrices, we assessed hierarchy via both binary dyadic relationships and normalized David's scores. We assessed linearity also via supplant sociomatrices. Although all species shared female dominance and linear hierarchy, *Lemur catta* was the most despotic, showing a highly cohesive, steep and formalized hierarchy. *Eulemur fulvus* showed the shallowest hierarchy. *Propithecus verreauxi* showed a cohesive hierarchy as in *Lemur catta* but also a scarcely formalized hierarchy as in *Eulemur fulvus*. Overall, our results indicate that each lemur species has a species-specific, and even group-specific, profile, reflecting different despotism levels.

Living in Islands of Forests: Feeding Ecology of *Alouatta palliata* in Forest Fragments at La Suerte Biological Field Station, Costa Rica

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Key Words: *Alouatta palliata* · Fragmentation · Feeding ecology · Habitat use · Primate density · Costa Rica

Facets of habitat quality which allow species persistence in forest fragments are an important aspect for primate conservation. Mantled howler monkeys *(A. palliata)* seem to be tolerant of habitat fragmentation, though the limits of this flexibility are not yet clear. In some areas, howler monkey densities in small, primary forest fragments are among the highest ever recorded for the species. We hypothesize that if high density is also determined by habitat carrying capacity, primary vegetation should provide higher quality resources. Alternatively, if density is just the consequence of crowding, this would decrease the quality of the diet compared to that of monkeys living in non-crowded forests. To test these hypotheses, we studied four howler monkey groups at La Suerte Biological Field Station, North-eastern Costa Rica. Two groups occurred in a small primary forest with high howler density, while two groups lived in a large secondary forest with lower density. We collected behavioural data via a 5-min Focal Animal Sampling to estimate activity, habitat use and diet. Food samples were also collected and then analysed to evaluate their nutritional contents. Moreover, we registered GPS coordinates and estimated home-ranges and mean inter-location distances. Our results show that primary forest food samples contained a significantly lower amount of fibre and a higher protein/fibre ratio than samples from the secondary habitat. Also, primary forest groups used larger feeding trees and moved substantially less than secondary forest groups. Our results support the hypothesis that the primary forest provides higher quality resources than the secondary habitat and, as a possible consequence, howler monkeys living in the latter have to move more to meet their energy requirements.

Consolation in Bonobos: A Possible Empathetic Tactic in Conflict Management

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Key Words: *Pan paniscus* · Distress comfort · Emotional signals · Prosocial behaviour · Conflict resolution

Consolation is an interaction in which an involved bystander initiates friendly contact with a victim of aggression. While in humans this phenomenon appears to be a stress reliever, in other apes its function is puzzling. We investigated the role of consolation in bonobos, by considering the contextual framework and victim's distress. This last aspect was evaluated by measuring scratching, a displacement activity associated with anxiety. We analyzed 555 post-conflict and match-control focal observations (PC-MC) gathered on a bonobo group housed at Apenheul Primate Park (The Netherlands) in a non-continuous period spanning June 2000–October 2009. We tested the effect of conflict characteristics (outcome and intensity), presence of reconciliation, and individual features (sex, rank, and age class) on the occurrence of consolation. Additionally, we checked for the effect of the consolation victim's scratching levels by comparing them after and in the absence of consolation. Among all variables, we found that only reconciliation significantly explained the occurrence of consolation. Specifically, consolation appears to be a substitute for reconciliation. Moreover, the victim's scratching level was significantly reduced after receiving consolation by a group mate compared to when there was no third-party contact. Overall in bonobos, as well as in *Homo sapiens*, consolation plays a role in reducing stress in the victims of aggressions, thus inllustrating its empathic role.

Same/Different Concept Learning by Capuchin Monkeys *(Cebus apella)*

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Key Words: Same/Different concept · Relational learning · Matching-to-sample · New World monkeys

Scarce evidence for same/different abstract concept learning comes from studies on monkey species using matching-to-sample (MTS) tasks. This study aimed at evaluating the capacity of tufted capuchin monkeys *(Cebus apella)* to acquire abstract *same* and *different* concepts and use them to solve MTS tasks involving relations of increasing level of abstraction. Six capuchins had to choose which stimulus between two comparison ones matched the stimulus presented as sample. In Phase 1, Identity Matching-to-Sample (Id-MTS) tasks were used to evaluate the capuchins' ability to discriminate between individual items on the basis of the physical features of the stimuli. In Phase 2, Relational Matching-to-Sample (RMTS) tasks were used to assess the extent to which capuchins were able to judge the relation (either same or different) between the items in a sample display and select the comparison display in which the items had the same relation. The acquisition of the rule based on perceptual similarity (Id-MTS) and the acquisition of the rule based on relational similarity (RMTS) was inferred from the subject's ability to solve transfer tests

with novel stimuli. Results demonstrated that the capuchins' ability to judge physical equivalence and to transfer to novel stimuli is significantly increased by the number of stimuli used during training. Moreover, the capuchins' ability to judge relational similarity was positively affected by the increase in both the stimulus-set size and the number of items featuring the stimuli. These findings clarify the role of specific factors on the acquisition of abstract *same* and *different* concepts in monkeys and suggest strong similarities between New World and Old World monkeys.

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Gorillas and Chimpanzees Vary Handedness Based on the Animacy of Target Objects: A Theory for Hemispheric Specialization Based on an Evolutionary Distinction of Object Animacy

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Key Words: Chimpanzee · Gorilla · Handedness · Lateralization · Hemisphere specialization · Target

Although evidence of handedness has been reported in both human and non-human primates, the evolution of this trait remains controversial. To further the investigation of the evolution of human brain and behavioural lateralization, we recorded the frequencies of lateralized physical actions manifested by 12 western lowland gorillas (housed at Port Lympne Park, Kent) and 9 chimpanzees (housed at Parco Natura Viva – Garda Zoological Park, Italy) during their spontaneous activities with a continuous focal animal sampling method. Specifically, we tested whether the preferential use of each hand was influenced by the kind of target: inanimate, when the action was directed toward objects; animate, when the action was directed toward social partners or themselves. The results revealed a significant group-level right hand bias for actions upon inanimate objects and equivalent bilateral use of hands for actions upon animate targets. These findings suggest a hemispheric specialization for a categorical distinction of animacy. We hypothesise that the left hemisphere is preferentially recruited for processes involving order-structured actions (e.g. feeding and tool use) and the right hemisphere plays a major contribution in social situations which are not required for inanimate target objects.

Laterality in Mother-Infant Dyads of Captive Barbary Macaques

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Key Words: Hand preference · Nipple preference · Mother-infant dyads · *Macaca sylvanus*

Several studies show that preference for limbs or hand is not a unique feature of human kind. This study investigated lateral biases in nipple preferences maternal cradling, carrying, retrieval and other behaviours in 7 Barbary macaque *(Macaca sylvanus)* mother-infant dyads housed at Parco Natura Viva – Garda Zoological Park (Italy). Observations were made using

focal animal sampling techniques. Infants did not show a significant hand preference, whereas they showed a right nipple preference. Furthermore, mothers' hand preferences were found at an individual level. No correlation was found between infant nipple and mother hand preference suggesting that, even if lateral behaviours are present from birth, hand preference could be bound up with experience. In addition, it seems that hand preference may not be inherited.

Do Capuchin Monkeys *(Cebus apella)* Select Tools on the Basis of Rigidity?

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Key Words: Tool use · Object properties · Observation · Manipulation

Wild as well as captive capuchins select stones to crack palm nuts according to their weight. Does capuchins' ability to select tools on the basis of non-visual functional properties extends to other tool features? We investigated whether they select new tools on the basis of rigidity in a task in which the reward was out-of-reach and three new tools differing in colour, diameter, material, and rigidity were available. In particular, the role of manipulation and observation in tool selection was assessed in Experiment 1, in which subjects needed to select and use the rigid tool to retrieve the reward. Prior to the test, in the absence of an extrinsic reward, subjects received information about pliability of each tool. There were three conditions: (a) Manipulation, in which the experimenter introduced the three tools inside the subjects' cage so that monkeys could manipulate them; (b) Observation, in which the experimenter manipulated each of the three tools for 5 seconds in full view of the subject; (c) Visual static, to assess whether capuchins benefited from the demonstration of the tool properties. Subjects performed equally well in the conditions in which they could manipulate the tools themselves or saw the experimenter manipulate the tools but not in the static condition. In Experiment 2, subjects needed to select and use the flexible tool to retrieve a reward. This time, capuchins selected above chance level the flexible tools (as opposed to rigid ones suited to solve Experiment 1) demonstrating a good appreciation of the task demands, as shown for apes.

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An Unexpected Nocturnal Life: 24-Hour Activity in Ring-Tailed Lemurs *(Lemur catta)*

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Key Words: Cathemerality · Activity pattern · Moon luminosity · Gallery forests · Lemurs · *Lemur catta*

In the last decades, research on primate activity patterns has revealed that cathemerality, i.e., the ability to operate over the 24-hour cycle, is more widespread than previously thought.

The ring-tailed lemur, *Lemur catta*, has long been described as an example of diurnality in lemurs, overlooking the many traits shared by this genus with cathemeral species. To determine whether *Lemur catta* is strictly diurnal or could be grouped together with most members of its family, two groups were followed in two areas of gallery forests in Southern Madagascar (Berenty and Bealoka). The data were recorded over a period of 5 months via a Scan Animal Sampling every 5 minutes and were equally distributed between the diurnal and the nocturnal phase. We show that the ring-tailed lemur is a facultative cathemeral species in the wild. In two separate, yet geographically close fragments of forest, these lemurs exhibited either mainly diurnal or cathemeral activity. Diurnal activity was influenced by photoperiod, while nocturnal activity was strongly controlled by moon luminosity. Since at the two sites climate and predation pressures were assumed not to differ significantly, we argue that this flexibility was possibly related to competition and dietary needs. Our findings support the idea that flexible activity over the 24-hours could have been one of the key adaptations of early lemur radiations possibly driven by Madagascar's unique island ecology.

Imitation Promotes Affiliation in Infant Macaques *(Macaca mulatta)*

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Key Words: Imitation recognition · Affiliation · Empathy · Infant Development · Rhesus macaques

Imitation can have positive effects on social relationships, increasing affiliation, empathy and prosocial interactions between individuals who display matching behaviours. Several studies suggest that, since the early stages of life, behavioural contingency is a crucial factor in social interactions and that synchronous experiences between caregiver and infant provide the foundation for the child's cognitive, socio-emotional and self-regulatory development. Human and non-human primates show the capacity to recognize imitation, but the development of this phenomenon is still unclear, as is how imitation can impact infant social behaviour. This study investigated whether infant macaques *(Macaca mulatta)* recognize imitation and whether being imitated affects affiliation with the imitator (experimenter). We tested 20 infant rhesus macaques from 7 to 36 days of age in two experimental conditions, imitation and control: in the former, the experimenter imitated newborn mouth and tongue movements, whereas in the latter he opened his mouth 5 times every 10 seconds; in both conditions the manipulation period (2 min) was followed by a still face period (2 min). Our results show that infants are able to recognize when they are being imitated and demonstrate that, although imitation does not affect visual infant preference or proximity, it does increase affiliative behaviours (i.e., lipsmacking). Participating in synchronous exchanges may critically contribute to early social experience by promoting affiliative behaviours towards the caregiver. Thus, imitation might play a key role in providing essential social inputs for the maturation of the infant's relational skills and social competences.

Lateralized Behaviour and Posture in Two Lemurs' Species: Are They Linked?

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Key Words: Handedness · Lemurs · Posture · Postural Origins Theory

Lateralized behaviours of two different species of lemurs, *Lemur catta* and *Varecia variegata*, were observed in order to assess the relation between hand preference and posture. Behaviours of 7 black-and-white ruffed lemurs and 8 ring-tailed lemurs housed at the Parco Natura Viva – Garda Zoological Park (Italy) were recorded by focusing on the hand used for daily activities such as feeding, locomotion, jumping and posture. Furthermore, as the lemurs' tail is used in balancing, the lateralized tail position was recorded. The results of this study underline that significant hand preference was found at the individual level. In particular, the adults of both groups of lemurs showed significant right hand preference, supporting the hypothesis that hand preference becomes more stable with the increase of age of the actor. At the population level, ring-tailed lemurs show a significant right hand preference to start locomotion; on the contrary, black-and-white ruffed lemurs show no significant preference for any observed behaviour. Furthermore, neither species showed a significant lateralized tail position. In conclusion, the findings of this study suggest that lateralized behaviours of prosimians might be age-related. In addition, hand preference and posture seem not to be linked. However, further studies are necessary to assess the relation between hand preference and posture in prosimians.

The Spatial Behaviour of *Indri indri*

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Key Words: Home range · Ranging behaviour · Territory · Song

Quantitative descriptions of animal movement patterns and accurate home range estimates are important for the understanding of a species' spatial and behavioural ecology. Here, we illustrate home range size estimations and ranging behaviour of 12 groups of indris *(Indri indri)* inhabiting three different forest sites near Andasibe (Madagascar): the Réserve Spéciale Analamazaotra, the Station Forestière Analamazaotra (Mitsinjo forest) and the Maromizaha forest. A period of 14 months was spent between 2005 and 2010 collecting spatial data and information about group composition. We examined home range size, ranging behaviour and interactions between neighbouring groups, in order to increase knowledge of indri social interactions and territorial behaviour. Using the MCP (100%) method, home range size estimations varied from 6.29 ha to 26.95 ha (mean value of 14.46 ± 5.47 ha), whereas the mean daily path lengths corresponded to 287.16 ± 145.74 m and ranged from 149.44 to 397.90 m. We found a correlation between home range size and group size, which is presumably influenced by various factors such as availability of food, resources distribution and defendability of the territories. We found that indri groups defended their territories from intruders, and overlap between neighbouring groups did not occur. Inter-group encounters at the boundaries were relatively rare, supporting the hypothesis that the indris' song is effective in maintaining spacing between adjacent groups.

What Are We Singing for? Evidences of Context Variation in the Song of Wild Indris

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Key Words: *Indri indri* · Song · Context variation

Among primates, loud calls can serve for spacing neighbouring groups, promoting spatial cohesion among individuals or attracting conspecifics. Each indri *(Indri indri)* in a family group produces impressive howling cries within a complex sequence of *utterances*, usually called 'the song of the indri'. We aimed to investigate whether the song was used only for territorial advertisement or given in other contexts. We observed that the singing activity took place in three different situations: (a) advertisement of 'self', so as to warn conspecifics of presence; (b) spatial cohesion of group members, so as to facilitate re-aggregation; (c) active defence when indri groups approach each other at a common territorial border. When indris are not in visual contact, the song promotes approach between individuals, which subsequently moved for 32.05 m (sd = 43.37 m, n = 28). After an advertising song, average displacement was 1.52 m (sd = 0.50 m, n = 27; ANOVA, n = 55; F = 24.625; $p < 0.001$). Songs given in different contexts ($N_{individuals} = 31$, $N_{groups} = 11$) differed in timing and structure (*number of calls*: t-test, n = 59, t = 3.752, $p < 0.001$), and duration of the individual song (t-test, n = 59, t = 2.918, p = 0.005). Statistical analyses supported the existence of context-specific acoustic variants of the indris' song.

Response Latency and Self-Directed Behaviours by Capuchin Monkeys in an Intertemporal Choice Task

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Key Words: Scratching · Motor impulsivity · Inhibition · *Cebus apella*

Several studies have investigated response latency in different tasks, showing that more complex choices usually require more time than less complex ones. In both humans and non-human primates, self-directed behaviours, such as scratching, are related to frustration and anxiety. A few studies have demonstrated that in great apes the occurrence of self-directed behaviours during cognitive tasks increases with task difficulty. Here, we investigated how response latency, scratching and other potentially stress-related behaviours varied in nine capuchins faced with an intertemporal choice task, an inhibition task where subjects faced choices between a small immediate option and a large delayed option. We scored: (i) response latency, (ii) scratching, alarm calls, and pointing at the chosen/not chosen option (a behaviour indicating motor impulsivity) during the delay associated with the large option, and (iii) scratching and alarm calls during the intertrial interval. Overall, there was a significant decrease in response latency across sessions. Moreover, in the course of the study, capuchins adjusted their behaviour to the hard task requirement (waiting for a desired reward), becoming less stressed

during the delay. In fact, (i) scratching decreased both within each session and across sessions, and (ii) pointing at the chosen/not chosen option decreased across sessions. In contrast, during the intertrial interval alarm calls increased across sessions. Thus, experience helps capuchins to cope with productive delays (i.e., instrumental to obtaining a reward), but has a negative impact on their tolerance for meaningless delays (i.e., not related to the specific task, as in the intertrial interval).

Non-Human Primates in the European Directive 2010/63

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Key Words: Animal experimentation · Captive studies · Ethics of research · European legislation · Great apes · Non-human primates

On October the 20th, the Official Journal of the European Union published the new European Directive on the protection of animals used in scientific procedures. The new norms, known from now on as Directive 2010/63, represent a step forward towards a more ethically-sound use of animals in scientific research, although some of the articles are still ambiguous and not very clear in their effectiveness. Non-human primates are the focus of especially dedicated passages of the new Directive. In this presentation the different articles covering the use of non-human primates will be illustrated. In general, although the use of non-human primates in research appears to be still solidly justified, the new norms raise the level of justification and attention required for their use.

Posters

Primates as Leopards' Prey in Western Soutpansberg, South Africa

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Key Words: Predation · *Chlorocebus pygerythrus* · *Cercopithecus mitis* · *Papio ursinus* · Landscapes of fear · Camera traps

Predation has been considered a very important selective force in the evolution of primate behaviour. While the advantages of group living in intergroup competition are well documented in several species, few studies have established the intensity of predation on primates. Our studies aimed to reduce this lack of information by investigating leopard *(Panthera pardus)* predation on the primate species living in the Western Soutpansberg, South Africa. This research was carried out using traditional scat analysis, to determine the occurrence of primates in the diet of leopards, and camera trapping, to evaluate availability of primate species in the area and leopard's selectivity for those species. We also analyzed the correlation between leopard activ-

ity patterns and those of the primates. The study was based at Lajuma Research Centre in an area of 23.12 km^2. Data collection covered a 252-day-period between October 2008 and July 2009. We positioned 20 camera traps, and their layout covered all the different habitats: mistbelt forest, thicket, savannah and grassland biomes. Analysis of 100 scats showed remains of 103 prey belonging to 16 species. Primate species represented 29.12% of the leopards' diet. The Jacobs' index shows a positive selection for vervet monkeys (*Chlorocebus pygerythrus*; D = 0.81) and Sykes' monkeys (*Cercopithecus mitis*; D = 0.92) and a negative selection for chacma baboons (*Papio ursinus*; D = –0.90). Leopards were primarily active during twilight and this allowed the hunting of vervet monkeys while they were still foraging on the ground, with fewer chances to detect the predator. Our results showed that the leopard is the main predator of vervet monkeys in Southern Africa, in both forested and open habitats. The leopard hunting pressure on chacma baboon in Soutpansberg is slightly bigger than in the savannah, but in agreement with previous studies.

A Community-Based Project in the Maromizaha Forest (Madagascar)

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Key Words: Malagasy biodiversity · Maromizaha forest · Conservation · Lemurs

Malagasy biodiversity is dramatically declining due to the ongoing deforestation. The primary forest of Maromizaha (150 km east of Antananarivo and only 20 km from the National Park of Andasibé-Mantadia) extends from 800 to 1200 m.a.s.l. and harbours a unique community of highland and lowland species: 13 lemur species, 77 bird species, 60 amphibian and 20 reptilian species have been monitored so far. The lemurs include: *Indri indri*, *Propithecus diadema diadema*, *Avahi laniger*, *Varecia variegata editorum*, *Eulemur rubriventer*, *Eulemur fulvus*, *Hapalemur griseus*, *Cheirogaleus major*, *Microcebus rufus*, *Allocebus trichotis*, *Lemilemur microdon*. Future surveys will investigate the presence of *Prolemur simus*, recently rediscovered in the region, and *Daubentonia madagascariensis*, as well as the most impressive carnivore, the fossa *(Cryptoprocta ferox)*. Maromizaha forest was gazetted as a protected area in 2001 and GERP (Groupe d'Etude et Recherche sur les Primates de Madagascar) was designated as the managing authority. As it is well known that conservation requires the cooperation of a wide range of institutions and individuals, it is evident that a key role in conservation is played by the local population, whose sustainable economic development is directly proportional to the increase of probability in species survival. The project's activities include education of Malagasy students and communities, training of local research guides for biodiversity monitoring, training of guides for encouraging tourist visits, development of family-based agriculture and implementation of alternative sources of energy. In this way, conservation of Maromizaha's extraordinary fauna and flora will be integrated with the reduction of poverty in the area.

The project is part of BIRD 'Biodiversity Integration and Rural Development' programme supported by the European commission under grant FED/2009/217077.

A Peaceful Mixed-Species Exhibit

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Key Words: Mixed-species exhibit · Grey mouse lemur · Lesser hedgehog tenrec · Environmental enrichment

Creating mixed-species exhibits is considered to act as environmental enrichment for zoo animals. However care needs to be taken when exhibiting different species together, even those known to be sympatric in the wild. The aim of this study is to assess whether and how a mixed-species exhibit does enrich individuals of two sympatric species, evaluating differences in the use of enclosure space and in their interspecific interactions. The study was carried out with two *Microcebus murinus* and two *Echinops telfairi*, housed at Parco Natura Viva, Bussolengo (Italy). The exhibit area is divided into two enclosures linked through a guillotine door. Over a period of about one year these two species were housed separately and the guillotine door was always closed. As environmental enrichment the guillotine door was opened and the exhibit become a mixed-species one. After opening the guillotine door, data were collected over a period of 2 months, during 20-minute focal animal sessions (for a total of 24 sessions per subject). Data were analysed using non-parametric tests. The results of this study demonstrated that the two species showed differences in the use of exhibit space; furthermore, no interspecific interactions were observed. This research seems to indicate a peaceful coexistence of the two species as no aggressive or abnormal behaviours were observed, and all the subjects showed their species-specific behaviour. In conclusion, the findings of this study seem to confirm that mixed-species exhibits might be an environmental enrichment for zoo animals.

An Enrichment Programme to Enhance Welfare of a Bachelor Group of Chimpanzees

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Key Words: Chimpanzees · Enrichment · Welfare · Bachelor group

Male chimpanzees usually join together in coalitions to defend their territory and to hunt. However, few studies have been carried out regarding the status of these social groups in captivity. Ensuring animal welfare is one of the key purposes of modern zoos: environmental enrichment can be a useful tool for maintaining the psychological health of the animals, especially primates. The aim of this study was to add information about behaviour of a group of four adult male chimpanzees housed at Parco Natura Viva, Bussolengo (VR). Furthermore, this research aimed to address the importance of an environmental enrichment programme on the welfare of captive chimpanzees. The focal animal sampling method was used to collect duration of behaviours shown by the chimpanzees over two different periods of observational sessions: baseline and enrichment programme periods. Results show that the subjects exhibited a pattern of behaviours similar to those of wild chimpanzees. Furthermore, the enrichment programme seems to have improved the welfare of the chimpanzees: a decrease of agonistic and abnormal behaviour and an increase of social interactions between individuals over the enrichment pe-

riod were found. Moreover, abnormal behaviour shown by only one individual in the group during the baseline was not observed during the enrichment programme period. In conclusion, the establishment of bachelor chimpanzees groups might be an opportunity for the management of chimpanzees in captivity. Furthermore, the case study of one problematic chimpanzee highlights how an environmental enrichment programme might be a therapeutic tool for problematic behaviour in captive chimpanzees.

Spider Monkeys Use Approximate Magnitude Representations during the Expectancy-Violation Procedure with Three Items

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Key Words: Primates · Spider monkey · *Ateles geoffroyi* · Primate cognition · Magnitude representation · Expectancy-Violation procedure

We studied magnitude discrimination in black-handed spider monkeys by means of the expectancy-violation procedure. According to a cognitive hypothesis, this procedure enables the researcher to compare looking-time at expected (possible) and looking-time at unexpected (impossible) results. In the past, other authors have used an arithmetic hypothesis to approach the expectancy. Altogether, those previous reports show that human babies, as well as other non-human primates, can distinguish possible from impossible results. Now, we use the expectancy-Violation procedure to test several predictions on behaviour derived from two cognitive hypotheses, namely the approximate hypothesis and the precise hypothesis. In contrast to previous results conducted by others on several primate species, our results support the approximate hypothesis.

Birth in Bonobos: A Case Report

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Key Words: *Pan paniscus* · Delivery · Primiparous female · Newborn · Group behaviour · Placenta sharing

Birth in mammals is a crucial and delicate moment and it has been described in many species. Despite that, exhaustive descriptions of delivery in non-human primates are scarce. Moreover, in highly social animals there is a total lack of data on the reactions of other members of the group towards the mother and the newborn. This report describes a delivery in a captive group of bonobos *(Pan paniscus)* at Apenheul Primate Park (The Netherlands). Three observers followed the group: one of them collected data on the mother via focal animal sampling, the second one recorded the identities and behaviours of group members that were in proximity to the mother, and the third video-recorded the whole event, which lasted about a hour. The mother performed the characteristic squatting posture during contractions, touched her vaginal area and moved her hands from the vagina to the mouth and licked her fingers. Two adult, one ju-

venile, and one infant female were extremely interested in the mother and the newborn: they followed and frequently touched her. Males and the other pregnant female never approached the mother before the birth took place. We also observed the consumption of the placenta and its sharing among group members. Although the other pregnant female was one of the most important females in the group, she was never in proximity to the mother and she neither asked for the placenta nor received it.

Does Forest Degradation Affect Locomotion? A Preliminary Study on *Alouatta palliata* at La Suerte Biological Station, Costa Rica

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Key Words: *Alouatta palliata* · Locomotion pattern · Body size · Habitat degradation · Support size · Lowland rainforest · Costa Rica

The use of different locomotion styles is closely related to the ecological context occupied by primates. Thus, once accounting for the paramount influence of body size, quantitative changes in the use of a species-specific locomotion repertoire are expected to be shaped by habitat differences. Considering the energetic costs involved in the use of different locomotion modes, it is crucial to understand whether the decreasing primary vegetation available to primates in tropical habitats may affect their choices. To test this hypothesis, we studied four mantled howler monkey *(Alouatta palliata)* groups living in two different fragments of lowland rainforest at La Suerte Biological Station, Costa Rica, in July/August 2009. Two groups were located in a primary forest and two groups in a mature secondary forest. We collected a total of 125 observation hours on all locomotion activities using Focal Instantaneous Sampling at 5 min intervals. We also distinguished between sexes, support sizes and types of forest. The most frequent type of locomotion recorded during the study period was quadrupedalism. We found a difference in the choice of support between sexes, with females using smaller branches more often. In the primary forest, quadrupedalism was used more frequently, while in the secondary forest jumping and climbing were more often recorded. Finally, in the primary forest the animals were able to use horizontal branches more frequently than in the modified habitat. Our results support the idea that habitat modifications have a strong influence on primate locomotion. These findings, if supported by long-term data, have important implications for the survival of howler monkeys in secondary forests.

Brown or White? Sexual Bimorphism in Sifaka Males' Chests May Reflect Females' Mating Choice

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Key Words: Sexual bimorphism · Scent glands apparatus · Sifaka · Olfactory signal · Visual signal · Mating

In primate species that show marked secondary sexual characteristics, males can exhibit reversible or irreversible bimorphism (variability in the degree of expressed adornments). Here, we investigate the recently described chest bimorphism in the sifaka males *(Propithecus verreauxi)*. In this prosimian species, males possess a scent gland apparatus composed of chest and genital glands. The fur area around the chest glands shows a particular reversible bimorphism: some males (usually the higher ranking ones) display a brown-stained chest, whereas others do not. The study was conducted at Berenty (South Madagascar) on two sifaka groups, in two different periods (mating season: 11 males; birth season: 6 males). We found that stained-chest males marked significantly more than clean-chest males. We also tested the difference in the use of the two types of glands by males. Chest glands were used significantly more by stained-chest males than by clean-chest ones, whereas no difference was detected in the use of genital glands. Moreover, we found that the stained-chest males not only had priority access to females but also engaged in more copulation events than the clean-chest ones. Dominant males may enhance the information transmitted via the olfactory signal (scent glands) by adding a visual cue (the stained-chest). This may increase the probability of being detected by females and recognized as high quality, potential partners.

Red-Green Colour Vision in a Captive Colony of Chimpanzees

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Key Words: Colour vision · Trichromacy · Hand preference · Chimpanzees

There are two different hypotheses in the literature about the selective pressure for trichromatic colour vision in non-human primates. The first hypothesis suggests that trichromacy provides an important advantage for fruit eating species. The second hypothesis links trichromacy to socio-sexual intraspecific communication driving some species to develop reddish sexual skins. This study tried to assess which is the most plausible hypothesis (either foraging or sexual communication), considering whether chimpanzees can show preferences in choosing red objects compared to green ones. An important variable considered in this study was hand preference of the chimpanzees. For this purpose, pairs of green and red coloured objects with a reward were given to 14 chimpanzees housed at Parco Natura Viva. In order to assess the colour preference, we analysed the first and next choices between green and red objects. Furthermore, in order to investigate the hand preference, we recorded which hand was used in reaching for the objects. The results of this study show that chimpanzees seem to choose red

coloured objects significantly more than green ones. Even though some of the subjects showed a right hand preference in reaching for objects, no significant differences between right and left hand were found at a group level. In conclusion, the results of this study seem to support the plausibility of the foraging hypothesis. However, further studies are needed in order to make the picture of the evolution of human colour vision more accurate and complete.

The International Master in 'Sustainable Biodiversity Management and Conservation': A Training Option Contributing to Primate Conservation Programmes in Madagascar and the Comoros

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Key Words: Cooperation · Madagascar · Comoros · EDULINK-ACP-EU

One of the main problems in Madagascar and the Comoros is in the limited availability of training opportunities in the field of biodiversity management and conservation. The SCORE project focuses on improving academic and educational quality, and on strengthening endogenous processes of economic and social development (the project is funded by the EDULINK-ACP-EU Cooperation Programme in Higher Education 9th EDF, under grant agreement no. ACP RPR 118 # 36). To reach these objectives, a 2 years master course in 'Sustainable Biodiversity Management and Conservation' was implemented, in line with current European guidelines, by the Faculté des Sciences et Technique de l'Université des Comores together with the University of Mahajanga (Madagascar), working in collaboration with ENS of Antananarivo (Madagascar) and the University of Torino (Italy). The number of student was limited to 28, out of 68 applications. Teaching activities comprised lessons and practicals held in Moroni and Mahajanga, and field work. A laboratory of microscopy and information technology was installed, and a 3-month period in a public or private institution in the field of nature conservation was organised. We consider this traineeship an added value of the master's degree. Students will have the opportunity of working with professionals, will gain expertise in the field of biological conservation and will produce a final dissertation. The subjects of the master's project include animal and plant diversity, in both marine and terrestrial habitats. Six students will focus on one rare endemic primate species belonging to the genus *Eulemur*, *Microcebus* or *Avahi*. The work experience periods are also expected to reinforce connections between academic and other, non-academic, institutions.

How Captivity Could Influence the Behaviour of Grey Mouse Lemurs

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Key Words: Grey mouse lemur · *Microcebus murinus* · Captivity · Behaviours

The grey mouse lemur is generally described as a solitary species due to the fact that individuals are usually observed in the wild foraging and travelling alone. However, reports from the wild also indicate that females often sleep together in nests, whereas males sleep

alone. The aim of this study is to evaluate behavioural differences between a male and a female grey mouse lemur *(Microcebus murinus)*, housed at Parco Natura Viva (Italy). The exhibit is divided into two enclosures linked by a guillotine door, which is always open. Focusing on social and intraspecific interactions in a captive environment, this study attempted to assess whether and how captivity might affect the natural behaviours of the animals. Data were collected over a period of 2 months, during 20-minute focal animal sessions (24 sessions per subject). The results of this study showed that both grey mouse lemurs exhibited more individual than social behaviour, as observed in the wild. However, the subjects spent significantly more time in one of the two enclosures and, in contrast to reports in the literature, they shared the same nest! This study seems to suggest that the captive environment could influence the specific behaviour of grey mouse lemusr. In conclusion, these findings highlight the importance of research evaluating the role that captivity plays in developing natural behaviours.

Does Preference for a Larger Delayed Reward Necessarily Indicate Self-Control? An Evaluation of the Validity of the Intertemporal Choice Task in Capuchin Monkeys

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Key Words: Self-control · Impulsivity · *Cebus apella* · Validity

The capacity of delaying gratification, or foregoing an immediate reward to obtain a better but future reward, involves two components: (i) delay choice (selecting a delayed reward over an immediate one), and (ii) delay maintenance (keeping to the decision of delaying gratification even if the immediate reward is made available during the delay). In both human and non-human primates, two classes of self-control tasks have explored these two components of delaying gratification. In the intertemporal choice task, where the subject faces choices between a small immediate reward and a large delayed reward, the selection of the large delayed reward is regarded as behavioural evidence of self-control. In the accumulation task, where the amount of reward increases as long as the subject refrains from taking it, the more the subject waits before taking the reward the higher the assumed self-control level. Recent data on capuchins cast doubts on the validity of the intertemporal choice task as a tool to assess self-control. Thus, we employed a traditional method used to assess the validity of psychological tests and compared the performance of 14 capuchins in the intertemporal choice task and in the accumulation task. Overall, performance in these two tasks showed a not significant trend towards a negative correlation. Interestingly, whereas in the intertemporal choice task females showed a significantly higher delay tolerance than males, in the accumulation task the opposite pattern was found. Thus, our findings, for the first time, provide evidence that choices for the larger delayed outcome in the intertemporal choice task actually reflect a form of impulsivity rather than self-control.

Quantitative Description of the Indri's Vocal Repertoire

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Key Words: Strepsirhine primates · Vocal behaviour · Acoustic structure · Ambient noise

Acoustic repertoire is characterized by sex, age and context specificity. We quantitatively investigated the vocal repertoire of ten groups of wild indris inhabiting the Andasibe-Mantadia National Park and the Mitsinjo Station Forestiére in Madagascar to increase knowledge of this specificity. We considered a sample of 1,670 vocalizations belonging to 28 individuals recorded in the field from September to December between 2004 and 2008. We distinguished 8 vocal types other than the song: roar, honk, hum, long tonal call, short tonal call, kiss, wheeze and grunt. Two of them, long tonal call and short tonal call, had never been described before. Discriminant function analyses supported the qualitative classification of vocalization groups, which correctly classified each vocal unit to its own type with a percentage of 96.4% and 96.0% for the cross-validated function. We found that indris have discrete call types in their vocal repertoire, distinguishable by ear and from analysis of the spectrograms. Some utterances were used only in particular behavioural contexts (e.g. roars and honks in alarm contexts, or long and short tonal calls in physical fights), and by individuals of specific age, whereas others were emitted under a range of situations (e.g. hums). The frequency span of all calls, except alarm calls and the song, overlapped the most prominent peaks of ambient noise, suggesting they cannot be used for long distance communication. Alarm calls showed relatively wide ranges of prominent frequency bands, and include spectral areas in which the ambient noise level is lowest. The song showed a large frequency span of prominent bands, including high-frequency regions with low amplitudes in the noise spectra. This suggests that the design of the indri song is optimised to avoid masking by ambient noise.

Vocal Repertoire Investigation of *Eulemur mongoz* in Madagascar and Comoros

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Key Words: Mongoose lemurs · Vocalization · Communication · Lemur conservation · Acoustics analysis · Behaviour

Implications of human activities for species conservation are dramatically important. Deforestation and hunting are the main menaces in both Comoros and Madagascar. In Comoros, domestication and poaching are also reducing the number of mongoose lemurs in the wild. The study of vocal behaviour can reveal important aspects of how and why individuals within a species communicate in relation to ecological and social factors. We focused on vocal communication in mongoose lemurs *(Eulemur mongoz)* in Madagascar and Comoros. We sampled wild groups in 3 locations in Madagascar (Mariarano, Bombetoka, Antsilahiza) and at 2 sites in Comoros (Bambao M'tsanga, Anjouan; Tsembéhou, Anjouan), and in captivity in Europe, Madagascar and Comoros. We visually categorized vocalizations by spectrogram investigation and by ear, took note of their behavioural context, and investigated whether mongoose lemur vocal-

izations can be grouped in discrete categories. We found that mongoose lemurs have 13 call types in their vocal repertoire, distinguishable by qualitative and quantitative acoustical analysis. They were: grunt, grunt hoot, alarm long grunt, long grunt clear call, long grunt, tonal call, chatter, click, snort, scream, crui crui and aerial alarm call. Some utterances were used only in particular behavioural contexts, and by individuals of specific age, whereas others were emitted under a range of situations. This knowledge of the species' vocal repertoire is valuable for surveying lemurs acoustically in habitats where visual surveys are difficult.

Trichromatic Colour Vision: The Choice between Red and Green Colour in *Chlorocebus aethiops*

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Key Words: Trichromacy · Colour preference · Hand preference · Primates

Two main theories try to explain the nature of the selective pressure that led to trichromatic colour vision in primates. The foraging hypothesis suggests that colour discrimination is linked to the detection and selection of food, whereas another hypothesis connects trichromacy to the perception of skin colour signalling in a socio-sexual context. The goal of this study was to investigate which hypothesis was the most plausible to explain the evolution of trichromatic colour vision. For this purpose, the colour preference of a colony of vervet monkeys *(Chlorocebus aethiops)* at Parco Natura Viva – Garda Zoological Park was investigated. Pairs of red and green bags containing the same hidden reward were placed in the vervet monkeys' outdoor enclosure and their choice of red and green objects was recorded in order to investigate the effects of colour cues on object preference in the social context. Moreover, the hand used to retrieve objects was recorded to assess a possible relation between hand preference and colour choices. Results indicate that choices do not seem to be based on object colour. However, monkeys showed a significant right-hand preference to retrieve green objects. In conclusion, these observations seem not to support the foraging hypothesis of the origin of colour vision. Therefore, the role of intraspecific socio-sexual communication could be more plausible for the evolution of trichromacy, but this aspect should be better investigated in future studies.

T-Cell Intestinal Lymphoma Associated to Coeliac-Like Enteritis in the Ring-Tailed Lemur *(Lemur catta)*

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Key Words: *Lemur catta* · Coeliac-like enteritis · Intestinal lymphoma · Immunohistochemistry

A severe obstructive thickening of the intestinal wall was revealed in a 5-year-old female ring-tailed lemur *(Lemur catta)*, evaluated for apathy, inappetence and abdominal pain. Intestine and liver histological samples were collected. The histopathology of the intestine samples showed the presence of a malabsorption related-enteritis similar to human coeliac disease (4th stage, Marsh classification). The obstructive thickening was composed of a homogeneous neo-

plastic lymphoid infiltrate, displaying a pseudo-follicular dense aspect. This complex histological pattern was compatible with media cells intestinal lymphoma associated with a chronic enteritis. An intense and diffuse infiltration of lymphoid cells, resembling those invading the tonaca propria of the intestine, was detectable in the liver parenchyma. Histological sections were submitted to immunohistochemistry using a panel of antibodies (DakoCytomation, Denmark) to human CDs specific for different lymphocyte lineages/stages. A relevant part of infiltrating lymphocytes in the intestine, most of the lymphocytes composing the intestinal neoplasm, and the liver lymphoid infiltrate were immunoreactive for the T lymphocyte marker CD3. In human pathology enteropathy-type T-cell lymphoma is a recognised complication of gluten-sensitive enteropathy. In comparative terms, the role of dietary-related disorders in captive lemurs should be considered as a possible aetiology.

Is There a Correlation between Handedness and Target Laterality in the Pig-Tailed Macaque *(Macaca nemestrina)*?

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Key Words: *Macaca nemestrina* · Handedness · Target laterality · Object choice

Few studies have examined the relationship between target's laterality and hand preference in non-human primates. This study aims to verify whether monkeys' handedness affects their choice of a target or whether target position determines a retrieval using the hand closest to it. Using a *two alternative choice test*, seven pig-tailed macaques were presented with binary combinations of food items (a jelly and a piece of pineapple) of the same shape and size. The position of the two different items was counterbalanced across trials. A monkey's preference between food items was assessed by recording which of the two objects was retrieved first. Furthermore, the hand used to retrieve the favourite item (target) in each trial was recorded in order to evaluate hand preference and the target's laterality effect. Our results suggest that macaques show a specific hand preference at individual level. Most of the subjects choose to use the hand closest to the target even though it was not the preferred hand. Furthermore, some macaques showed no lateralization when retrieving an item controlateral to their preferred hand. In conclusion, target position seems to affect the hand preference in retrieving an object. In contrast, the hand preference of macaques does not seem to be linked to the retrieval of an object.

Behavioural Displays of the Guizhou Snub-Nosed Monkey *(Rhinopithecus brelichi)*

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Key Words: Ethogram · Repertoire · Social behaviour · Gray snub-nosed Monkey · China · Fanjingshan

The entire population of Guizhou (or grey) snub-nosed monkeys (*Rhinopithecus brelichi*; Thomas, 1930), has an estimated size of 800 individuals and occurs only in a restricted area of

400 km^2 in the sub-tropical semi-deciduous broadleaf forests of Wuling mountains in the Fanjingshan National Nature Reserve (Guizhou province, China). We aimed to construct an ethogram of *Rhinopithecus brelichi* and to increase knowledge about the behaviour of snub-nosed monkeys in general, for future quantitative comparison. We provide an ethogram for grey snub-nosed monkeys based on data collected from nine captive individuals (at Fanjingshan National Nature Preserve Rescue Centre). The observations from captive individuals were recorded during a period of seven months, from June to December 2009. Their number and housing conditions changed several times during the study period. Ninety behaviours were recorded. They were grouped in three main categories: individual behaviours (then divided into six sub-categories: ingestion, locomotion, postures, maintenance, investigation and individual play), social behaviours (subdivided into sexual, affinitive, social play, submissive and aggressive/agonistic behaviour) and infant care. The detailed description of each behavioural display provides a standard for systematic and quantitative comparative studies of the genus *Rhinopithecus*. We then compared our data with behavioural data of the other two Chinese endemic congeneric species: *Rhinopithecus bieti* and *R. roxellana*. We observed that some behaviours involving physical contact, e.g. Holding Lumbar, Kissing Back and Rocking, were not shown by *R. brelichi*. A better understanding of *R. brelichi* behaviour can help improve the breeding success of captive individuals and may provide useful insights for future field research.

Can Positive Reinforcement Training Enhance Welfare in Captive Vervet Monkeys *(Chlorocebus aethiops)*?

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Key Words: Training · Enrichment · Welfare · *Chlorocebus aethiops*

Studies show that training programmes may be fundamental to accustom captive non-human primates to isolation within a familiar area through positive reinforcement. Training is a procedure that allows medical treatment and behavioural research and improves animal welfare. A group of ten vervet monkeys *(Chlorocebus aethiops)* housed at Parco Natura Viva (Bussolengo, Italy) underwent a training programme before presenting them with a problem solving and social facilitation study. The focal animal sampling method was used to collect behavioural data on the monkeys during the pre-training period in order to assess social behaviour shown by the colony. The same method was used during the training period and immediately after the training session in order to understand the effects of the training programme on the behaviour of the subjects. Furthermore, each individual training session was video-recorded to detect the psychological well being of each individual during the training session in order to understand when the subjects could be involved in the cognitive research. The results of this study show significant differences across subjects when being trained. However, over a period of three months all the subjects were ready to be involved in the cognitive study. Furthermore, findings suggest that the training programme can enrich the everyday life of the captive primates to increase affiliative behaviour, decrease agonistic behaviour and increase activity. In conclusion, our study underlines the importance of the training programme as an important tool in husbandry care in order to improve animal welfare.

Infants in a Colony of Captive Chimpanzees: Social Enrichment?

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Key Words: Social enrichment · Chimpanzees · Allomother · Social relationships

Social enrichment refers broadly to the social lives of chimpanzees as social interactions with other chimpanzees. Optimizing the management of social behaviour is essential to maintaining a breeding population of chimpanzees that retain their behavioural competence over generations. This study aims to understand whether and how newborns could be considered social enrichment for a colony of captive chimpanzees hosed at Parco Natura Viva, by comparing interactions between the different members of the colony and two young females: a 2-month-old infant, fully dependent on the care of her mother, and a 4-year-old infant, completely weaned. Results highlight that the 2-month-old infant received attention significantly more from the mother and the grandmother than from the remaining subjects. On the contrary, the 4-year-old infant received more interactions from the rest of the group than from her mother. Moreover, the grandmother of the 2-month-old infant acted as an allomother. In conclusion, an infant may represent social enrichment for a group of chimpanzees, since it stimulates social relationships among individuals, especially when the strong mother-infant bond becomes less exclusive.