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Mammals and Others

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An independent academic psychologist, based in England, who has written extensively on different areas of psychology with an emphasis on the critical stance towards traditional ideas.

A complete listing of his writings at http://psychologywritings.synthasite.com/. See also material at https://archive.org/details/orsett-psych.

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1. CARNIVORES EAT FRUIT

Herbivores are the main seed dispersers for plants, but analysis of scat shows that carnivores also do so. "Carnivores are less likely than herbivores to crush seeds while eating fruit and may thus be particularly effective for seed dispersal" (Shikesho et al 2024 p309).

Shikesho et al (2024) took the example of the !nara melon in the Namib Desert and the black-backed jackal (Canis mesomelas). Eating fruit (frugivory behaviour) by the jackals had previously been reported by scat analysis (eg: Kamler et al 2020). But Shikesho et al (2024) wanted to observe fruit removal, and establish if the choice of fruit is an opportunistic behaviour or whether jackals actively search for ripe fruit.

The study took place between December 2018 and January 2020, and involved a number of methods:

i) Examination of scat of jackals for intact !nara melon seeds. Ingested seeds were kept to see if they would germinate.

ii) Video camera traps (n = 14) around eight !nara plants. The number of melons removed per visit, and time at plant were measured.

iii) An experiment with unripe and ripe melons buried at four sites to see if olfactory cues attracted jackals.

Overall, 20 fruits per plant per season were seen to be removed by jackals. Jackals made up over 95% of the carnivorous mammals that consumed the melons, though only one melon was harvested at a time.

Jackals found all the experimentally buried melons, and within an average of two days for the ripe ones (n = 33), but an average of ten days for the unripe melons (n = 22).

Seeds retrieved from jackal scat (n = 141) had improved germination compared to control (uningested) seeds (n = 141).

It appears that the jackals eat ripe fruit (based on olfactor cues), and that their eating of the !nara melons is important in seed dispersal. "The dominance of jackals as !nara frugivores may be due to the tough, spiny rind of !nara melons, which may prevent smaller mammals, such as rodents and genets, and birds from opening the melons. Although large herbivores such as oryx and domestic donkeys have been seen consuming !nara melons, they are

not considered seed dispersers because the seeds are crushed during feeding" (Shikesho et al 2024 p314).

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2. BATS MIGRATING

Modern technological developments are helping in the study of animal migration, particularly bats, which are "small, only come out at night, are silent (to humans), and can fly hundreds of kilometres a night" (McGuire 2025 p25). Limited information is known about bat migration compared to other animals, including big questions like when and where to go, whether to stop en route, and the impact of weather (McGuire 2025).

The basic method of study has traditionally been capture and mark in one place and recapture somewhere else, but the recapture rate is generally low (McGuire 2025). Biotelemetry is a newer method involving attaching small radio transmitters to individuals. "However, the small body size and the spatial scale at which migrating bats traverse the landscape limit the possibilities of documenting migration (transmitters must be small with a short battery life, and bats can quickly fly out of range of the receiver). A relatively small number of large-bodied bats can carry a device that uses Global Positioning System (GPS) satellites to track their movements. Although smaller GPS units are now available, they cannot transmit signals and must be recovered from bats" (McGuire 2025 p25).

Hurme et al (2025) reported the use of technology based on the "Internet of Things". This is a "new biotelemetry tag that not only records location information but also measures physical activity with accelerometry, as well as temperature of the surrounding environment. Notably, the bat does not need to be recaptured, and the tag does not need to be recovered. The device records information every 60 s and transmits summary data to the network once per day, providing location, daily maximum and minimum temperature, proportion of active time (from accelerometry), and an index of daily energy expenditure (total vectorial dynamic body acceleration)" (McGuire 2025 p26).

Hurme et al (2025) collected up to 46 days of tracking data per individual over three years from 71 pregnant female migrating common noctules (Nyctalus noctula). The overall migration distance was greater than 1100 km across Europe (from the Alps northwards), including nearly 400 km on one night. There was also evidence of decisions to migrate on relatively warm nights with favourable tailwinds and low crosswinds (at least in the first half of the spring migration). "Later in the season (mid-May to early June), pregnant females

face increasing energy costs of flight because of the increasing weight of the developing embryo. Thus, there is a trade-off between waiting for favourable flight conditions and the risk of increased flight costs. Indeed, Hurme et al [2025] observed that bats that migrated later in the season experienced less supportive wind conditions and greater energetic costs" (McGuire 2025 p26).

References

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3. SAME-SEX SOCIO-SEXUAL BEHAVIOUR

MACAQUES

Same-sex socio-sexual behaviour (SSB) has been reported in a variety of animals with varying explanations for it (table 3.1). "However, such reports of SSB tend to be opportunistic ad hoc observations of behaviours that are typically described as rare. Consequently, both the proximate and ultimate bases of variation in SSB remain poorly understood, in particular the degree to which SSB is determined by heritable (for example, genetic) or non-heritable (for example, exogenous environmental) effects, and whether it can thus be driven by adaptive/non-adaptive evolutionary processes" (Clive et al 2023 p1287).

- Different-sex behaviour (DSB) deprivation hypothesis - A shortage of females relative to males generally, or a by-product of low-ranking males failure to find females.
- Dominance expression hypothesis - Mounters show their dominance over mountees.
- Biological differences - The mounter is an over-masculinised male and the mountee is an over-feminised male.
- Bisexual advantage - SSB males have more success in DSB.
- Social alliance mediation - SSB strengthens coalitions between males.

Table 3.1 - Some explanations of male SSB in non-human animals.

Clive et al (2023) analysed three years of observational data on 236 male semi-wild rhesus macaques, along with pedigree records since 1938. The data came from the island of Cayo Santiago, Puerto Rica, where 1700 macaques live freely without humans.

The researchers investigated five questions:

i) Is SSB common (compared to DSB)?

"Mounting behaviour" was the measure used. During the observation periods, using "scan sampling" (ie: a count of the behaviour or not during a ten-minute period of time) and with over 25 000 counts, same-sex mounting

was more frequently seen that different-sex mounting.

ii) Is SSB heritable?

Using records of genetic relatedness, it was calculated that the heritability of SSB in males was 6.4%. For example, twin studies with humans and self-reported SSB or orientation (eg: Kirk et al 2000) have calculated a heritability estimate of 30-60%, though single-nucleotide polymorphisms (SNP)-based studies have found lower figures (Clive et al 2023).

iii) What about the different types of SSB - ie: mounter and mountee activities?

A genetic basis to both was found.

iv) Is SSB costly in evolutionary fitness terms?

For example, engaging in SSB may mean the loss of DSB and reproduction opportunity (called the "Darwinian paradox"; eg: Sommer and Vassey 2006). No evidence of this found.

v) Are there benefits to SSB?

SSB predicted coalitionary partnerships between males, and forming male coalitions has been shown to improve reproductive success in other studies, "indicating that social benefits of SSB can at least partly explain its evolutionary maintenance in these primates" (Clive et al 2023 p1292).

While warning against the naturalistic fallacy (in generalising to humans), the researchers concluded that "some degree of SSB can evolve adaptively, and thus may be a common feature of primate reproductive ecology" (Clive et al 2023 p1292).

MICE

Stress can influence socio-sexual preference of animals. Studying mice, Wei et al (2025) found that a threat-associated stimulus (eg: predator odour) can

change the social preference from females to males in both sexes. "Male and female mice preferred to socialise with female mice under normal conditions" (Joo and Tye 2025 p139). The change was found to be caused by dopamine-expressing neurons in part of the hypothalamus.

This research operationalised socio-sexual preference as "which mice a given mouse wants to be near rather than which mice it is sexually attracted to" (Joo and Tye 2025 pp138-139).

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4. CHIMPANZEES AND THEIR SUB-SPECIES

HABITATS

Chimpanzees (Pan troglodytes) (in the form of their four sub-species; table 4.1 [1]) inhabit diverse environments from rainforest to woodland-savannah. "Forests have closed canopies with high availability of food and water throughout the year, support high population densities, and harbour a diversity of pathogens and disease vectors. Conversely, savannahs are on the edge of the chimpanzee distribution in East and West Africa and are characterised by open canopies, higher temperatures, lower annual rainfall, and higher rainfall seasonality" (Ostridge et al 2025 p153).

- Central - Pan troglodytes troglodytes
- Eastern - Pan troglodytes schweinfurthii
- Nigeria-Cameroon - Pan troglodytes ellioti
- Western - Pan troglodytes verus

Table 4.1 - Four sub-species of Pan troglodytes (Ostridge et al 2025).

Behavioural diversity and adaptation are evident in the different habitats, including tool use, foraging, communication, and thermoregulation. Savannah chimpanzees "tend toward greater behavioural diversity than forest chimpanzees, a potential adaptation to higher environmental variability" (Ostridge et al 2025 p1). But there are also genetic differences between the populations.

Based on genome analysis of faecal samples from 825 wild chimpanzees in different habitats (52 sampling sites), Ostridge et al (2025) found locally adaptive genetic differences among populations based on type of habitat. For example, forest inhabitants had more malaria-related genes (ie: an environment where malaria parasites are a threat). These were "the same genes underlying adaptation to malaria in humans" (Ostridge et al 2025 p1).

Ostridge et al (2025) ended: "The evidence of genetic adaptation in forests demonstrates the importance of new adaptations even in habitats with high availability of resources that support high population

[1] The sub-species split between 633 000 and 139 000 years ago (Gunasekaram et al 2024).

densities. This is perhaps because the struggle against the high pathogen load of lowland forests shapes the evolution of these populations. This is not surprising, as pathogens have been important selective pressures for chimpanzees over longer timescales" (p7).

CUMULATIVE CULTURE

Richerson and Boyd (2024) asserted: "Human dependence on cultural adaptations and the ability to cumulatively evolve extremely complex technology and social institutions are not matched quantitively by any non-human species, but most of the qualitative features of human culture have been documented in other species" (p846) (table 4.2).

- One aspect of biodiversity loss often overlooked is "the degradation of behavioural and cultural diversity of animals" (Kalan and Luncz 2025 p26).
- Kalan and Luncz (2025) explained further: "Cultural behaviours — the activities and skills acquired through social learning — can contribute to a species' ability to adapt to environmental changes, which can enhance the overall health and functionality of ecosystems" (p26). The steep decline in population sizes of animals that show behavioural diversity will impact these animals, and the researchers who study such behaviours (eg: tool use). "Moreover, examining how cultural practices vary across species can provide a deeper understanding of the similarities and differences in social behaviours and cognitive abilities between species, including humans" (Kalan and Luncz 2025 p26).
- Kalan and Luncz (2025) made this plea: "Presently, there is no concentrated effort to explicitly preserve or protect animal material culture beyond its fortuitous inclusion within a protected area or national park. To secure the intergenerational transmission of cultural behaviours, tool-using animals must continue to have access to the materials needed to carry out these behaviours. Protecting the living cultural landscapes of animal stone-tool-use sites involves preserving the environments where these behaviours occur and recognising the intrinsic value of animal cultures" (p27).

Table 4.2 - Saving the Cultural Legacy.

One feature is "cumulative culture" (ie: the diffusion of information between groups). Gunasekaram et al (2024) provided evidence from 35 chimpanzee populations (and 4 sub-species) comparing tool use with

migration between groups. Groups were rated as "no tool foraging", "simple tool use" (eg: digging stick), and "complex tool use" (eg: digging stick and probing tool). It was found that "chimpanzee populations with more social exchanges have more complex toolsets. Thus, chimpanzee dispersal may have fostered cultural accumulation" (Richerson and Boyd 2024 p847). Migration between groups over thousands of years was determined by genetic analysis (specifically of chromosome 21 collected a non-invasive way from 240 individuals). Data on the cultural repertoire came from the "Pan African Programme" (Lester et al 2021).

PLAY

Play between adults, or between an adult and an immature individual are rare among non-humans. But these behaviours have been observed in wild chimpanzees, over ten years (2010-2019) in the Kibale National Park, Uganda (Thompson et al 2020).

Sabbi et al (2024) analysed 3891 play bouts recorded by observers of these well studied chimpanzees. Approximately 10% of the bouts involved adults playing together, half of an adult playing with an unrelated immature individual, and the remainder an adult and offspring playing.

The researchers found that play was linked to diet. "Social play was infrequent when diet quality was low but increased with the proportion of high-quality fruits in the diet. This suggests that adults engage in play facultatively when they have more energy and/or time to do so. However, when diet quality was low and most adult play fell to near zero, play persisted between mothers and offspring. Increased use of play by adult chimpanzees during periods of resource abundance suggests that play retains value as a social currency beyond development but that its costs constrain its use. At the same time, when ecological conditions constrain opportunities for young to play, play by mothers fills a critical role to promote healthy offspring development" (Sabbi et al 2024 p1364). This was classed as a "hidden cost of motherhood".

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5. INNOVATION AND UNGULATES

"Innovation" is "the ability to solve new problems or find novel solutions to familiar problems" (Caicoya et al 2023 p1). It is well studied in humans, but innovative behaviour is beneficial in non-human species. "Innovation, for instance, can be highly adaptive to exploit new food sources, to innovatively reduce predation pressure, or to effectively cope with environmental changes by better adapting to novel ecological conditions. From great tits (Parus major) opening milk bottles to chimpanzees (Pan troglodytes) using new tools to solve novel foraging problems, experimental evidence has clearly shown that innovation is widespread in the animal kingdom" (Caicoya et al 2023 p1).

At the level of the species, the species showing higher levels of innovation tend to exploit a wider variety of habitats, including more urban environments, live in social groups that require complex cognitive skills, and be domesticated (though some researchers see domestication as reducing cognitive abilities), for instance (Caicoya et al 2023).

Within the same species, some individuals will show innovative behaviour more than others. Are there common characteristics of such individuals? Caicoya et al (2023) investigated this question with 111 individuals from thirteen ungulate species at four zoos in Europe (eg: impala, giraffe, red deer). Based on previous studies in the literature, nine predictions were tested. Innovation should be "more likely in species with higher fission–fusion dynamics (Prediction 1), with a wider dietary breadth (Prediction 2), living in larger groups (Prediction 3) and/or having been domesticated (Prediction 4)" (species level), and, at the individual level, "more likely in more subordinate individuals (Prediction 5), in females (Prediction 6), in younger individuals (Prediction 7), in less neophobic ones (Prediction 8) and in individuals that are less integrated in the social group (Prediction 9)" (Caicoya et al 2023 p2).

The animals were observed at length (table 5.1) to score dominance rank, and social interactions, and neophobia by response to familiar food placed close to a novel object. The innovation task was the accessing of food visible in a plastic cup with a lid. Measures included attempting the task, successful solution, time to solve the first time, and the strategy used (eg: opening the lid with the lips, nose, muzzle or tongue).

Overall, 62% of individuals attempted the task, but the species varied (eg: 100% of seven dromedaries vs 33% of nine sheep). In total, 36% of all animals were successful in retrieving the food. "The species with a higher percentage of successful individuals were dromedaries and goats, with 86% and 69% of the individuals opening the cups, respectively. Among the individuals that solved the task, latency to open the cup for the first time was on average 51 s, ranging from an average of 6 s for Prewalski horses to more than 5 min for mhorr gazelles" (Caicoya et al 2023 p4).

In terms of species, domesticated species, and those with higher fission-fusion dynamics (simply, groups changing often) were more likely to attempt the task (but no better at solving it). Individually, less neophobic, and socially less integrated animals were more likely to solve the task. Predictions 8 and 9 were, thus, supported, while Predictions 1 and 4 had no support technically. The other Predictions had no support.

The study involved one innovation task with a small number of captive individuals from each species. Caicoya et al (2023) stated: "Our results are also in line with other studies showing a link between higher innovation rate and lower neophobia in wild and captive animals. Moreover, our study showed that little integration in the social network was linked to higher innovation. These findings provide support for the hypothesis that, also in ungulates, socially less integrated individuals may be more likely to interact with novelty and to innovate... Less integrated individuals may more likely overcome neophobia and deal with novel socio-ecological challenges to get a better share of resources, likely because they have to overcome the lower fitness benefits of low social integration... and/or because their social position does not allow them to adequately rely on social information" (p5).

- "Occurrence sampling" - recording every occurrence of a focal behaviour during a particular time period (eg: agonistic interactions).

- "Instantaneous scans" - noting the behaviour occurring at a particular time (instance) (eg: social integration - how close an individual was standing to others).

Table 5.1 - Two observational techniques used by Caicoya et al (2023).

To sum up, individuals who are likely to investigate new things (ie: less neophobic) place themselves in situations to attempt innovation, while "loners" (ie: less socially integrated) have to rely on their own resources.

REFERENCE

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6. RECURSIVE VOCALISATIONS AND ORANGUTANS

Recursive procedures in language allow the placing of "a vocal signal inside another of a similar kind" (Lameira et al 2023 p1). It is generally believed that "this ability rests on a computational process in the brain that is unique to humans, known as recursion. Recursion enables humans to produce and place a language element or pattern of elements inside another element or pattern of the same kind. In this way, a clause can be embedded inside another 'carrier' clause to extend a thought, argument, or scenario, for example, 'the dog, which chased the cat, was barking'. While recursion offers a simple, yet potent, explanation for the endless possibilities of language, how and why recursion – and by extension language – emerged in humans but no other animals remains a mystery" (Kalan 2023 p2).

Lameira et al (2023) analysed the long calls of wild male orangutans (Pongo pygmaeus wurmbii), and found evidence of recursion. The researchers explained that the "long calls feature rhythmically isochronous call sequences nested within isochronous call sequences, consistent with two hierarchical strata" (Lameira et al 2023 p1). Kalan (2023) described the calls as "organised as two layers, where calls with a regular beat (or tempo) are produced within another 'carrier' call of a different tempo. Up to three different call types, each with their own signature tempo, can occur within the same carrier call" (p2).

The evidence of recursion in these calls "could represent a possible precursor to recursion in humans, offering a potential avenue for studying how recursion, and ultimately language, evolved in humans" (Kalan 2023 p2).

Lameira et al (2023) collected sixty-six long call audio recordings produced by ten males during over 2500 hours of observations at Tuanan Research Station, Central Kalimantan, Indonesian Borneo. Seven acoustic measures were extracted from the spectrogram of the recordings. Five different element types were identified in the rhythmic analyses as the structural building blocks of the long calls - full "pulses", and four types of "sub-pulses".

The calls were not simple repetition of sounds at a constant interval, but a combination of different sounds repeated at a constant interval of different tempi.

Lameira et al (2023) admitted: "Recursive self-embedded vocal motifs in orangutans indicate that vocal

recursion among hominids is not exclusive to human vocal combinatorics, at least in the form of temporally embedded regular rhythms. This is not to suggest that orangutan recursive motifs exhibit all other properties that recursion exhibits in modern language-able humans, or that the two are the same, or equivalent" (p7).

BIPHONIC CALLS

The above data has also been used in other studies by the researchers, like Lameira and Hardus (2023).

They reported "two types of biphonic call combination in wild orangutans that articulatorily resemble human beatboxing and that result from the simultaneous exercise of two vocal sound sources: one unvoiced source achieved through articulatory manoeuvring of the lips, tongue, and jaw as typically used for consonant-like call production, plus one voiced source achieved through laryngeal action and voice activation as typically used for vowel-like call production" (Lameira and Hardus 2023 p1). This biphonic call showed evidence of vocal motor control, which is an important basis to the evolution of language.

Lameira and Hardus (2023) explained: "Even under the most conservative hypothetical scenario, where spoken language might be considered to have come into existence anew and abruptly in modern humans, one would still expect it to have been directly or indirectly leveraged on the neuromotoric mechanisms already present in prelinguistic hominid ancestors. Using the simile of saltationist hypothesis (Chomsky and Mukherji 2009) that language was ignited as if by lightning strike, lightning can only kindle a fire when combustible materials are present where it strikes. Reconstructing the forerunning system of speech among ancestral hominids shall, therefore, remain imperative for explaining why spoken language emerged in the human lineage, irrespective of one's theoretical leanings or alliances" (p1).

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7. DEN SHARING BY PREDATOR AND PREY

"The majority of mammals are known to use dens... Dens are burrows or lairs that function as places to raise offspring, rest sites, and shelters... Dens may be above or below ground, and their substrate is usually earth, stone, or wood... The same den may be used by multiple mammalian species at once, even those that ostensibly should not peacefully co-exist, such as intra-guild competitors, or predators and prey" (Dupuis-Desormeaux et al 2023 p1006).

In the case of predator and prey den sharing, red foxes with multiple rodent species in Japan, for example, and crested porcupines, red foxes, and European badgers in Italy (Dupuis-Desormeaux et al 2023).

Dupuis-Desormeaux et al (2023) described "a novel phenomenon", first observed on camera trap footage in 2016, of "concurrent subterranean den sharing between spotted hyaenas, warthogs, and crested porcupines at a wildlife conservancy in Kenya" (p1006). The data covered the period of January 2016 to December 2021, and involved the video monitoring of five separate hyaena dens. Camera traps at the entrances showed that two dens had concurrent sharing.

The researchers outlined the findings: "In den #1, camera trap data revealed that there were two porcupines, three warthogs, and seven hyaenas occupying the den between January–March 2016 and January–March 2017. In den #2, we found two porcupines, six warthogs, and 11 hyaenas living in the same den between March–April 2018 and between March–May 2019. These cohabitations lasted a total of 24 weeks at den #1 and 20 weeks at den #2 with daily departures and re-entries using the same den entrance over those time periods and sometimes at remarkably close intervals (less than 5 minutes)" (Dupuis-Desormeaux et al 2023 p1008).

"Temporal partitioning" or "time-share", where the different species occupy the same den at different times seems more logical, but this study found "evidence of all three species being inside at the same time" (Dupuis-Desormeaux et al 2023 p1008). The researchers commented: "Although we have not dug the dens to verify for multiple chambers, we assume that these dens have a subterranean layout with branches and chambers that are occupied by the different species" (Dupuis-Desormeaux et al 2023 p1008).

They continued that the "study site is composed of hard volcanic murram soil (pisolitic iron oxide laterite)

over Archean basement rocks..., which may make digging new dens a challenge. We observed cohabitation occurring during the dry season when the hardened ground might have made digging new dens more difficult. Cohabitation seemed to end with the start of the rains (in April and May), which would have softened the soil" (Dupuis-Desormeaux et al 2023 p1008).

"It is important to note, however, that both warthogs and porcupines are well-armed against predation. Warthogs have sharp tusks and a compact, powerful build. Porcupines have long, rigid quills (up to 30 cm), which makes them formidable prey... Dangerous as these armouries already are, the threat they present is amplified to a predator encountering them in the close quarters of a subterranean den" (Dupuis-Desormeaux et al 2023 p1007).

The researchers speculated that the hyaena clans in the observed dens may have foraging habits and prey selection that do not include porcupines and warthogs.

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8. KNOWING WHAT OTHERS KNOW

"Theory of mind" refers to the ability to take the perspective of another person. For example, if A can see an object but B cannot, A is aware of B's lack of knowledge. So, A should adapt their communication to B's ignorance.

There is debate around whether theory of mind is unique to humans. There is some evidence of this ability in non-human great apes. For example, Crockford et al (2012) observed that wild chimpanzees produced more warning vocalisations about a nearby snake when groupmates were ignorant than aware of the snake's approach. But greater control, as in an experiment, is needed to isolate alternative explanations (eg: driven by arousal; Townrow and Krupenye 2025).

Townrow and Krupenye (2025) performed one such controlled experiment with three male bonobos. "Bonobos could receive a reward that they had watched being hidden under one of several cups, if their human partner could locate the reward. If bonobos can represent a partner's ignorance and are motivated to communicate based on this mental state attribution, they should point more frequently, and more quickly, to the hidden food's location when their partner is ignorant about that location than when he is knowledgeable" (Townrow and Krupenye 2025 p2).

Each test session involved three trials where the human was ignorant and three where they were aware (control condition) of the position of the hidden reward. "Bonobos were significantly more likely to point... and did so significantly more quickly... in ignorance trials than knowledge trials" (Townrow and Krupenye 2025 p2).

The findings suggested that the bonobos showed theory of mind - ie: in this case, the ability to separate reality (where they saw the reward hidden) from the human's state of knowledge (eg: ignorant about the hiding place).

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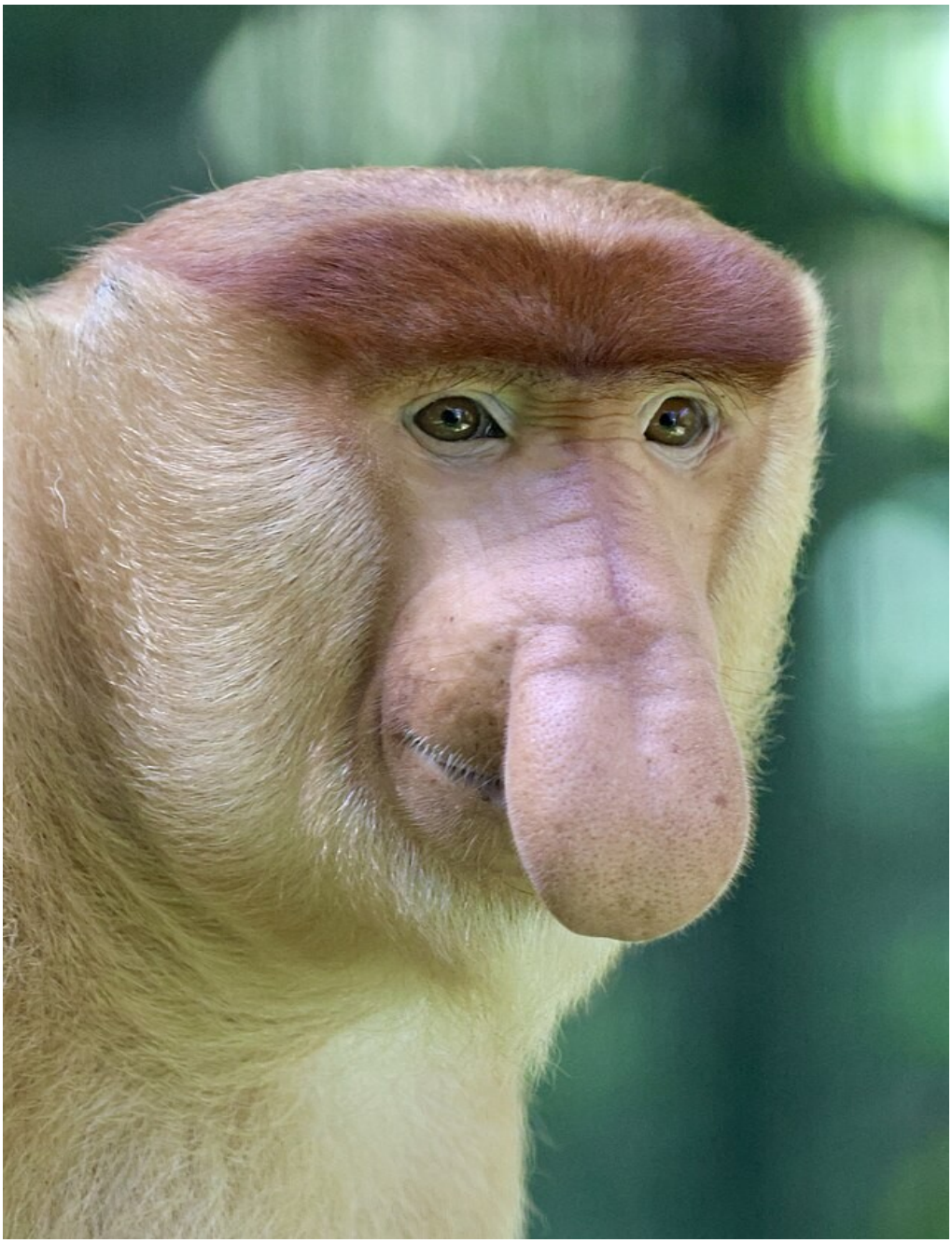
Townrow, L.A & Krupenye, C (2025) Bonobos point more for ignorant than knowledgeable social partners PNAS 122, 6, e2412450122

9. SEXUALLY SELECTED FACIAL TRAITS

"Among many mammals, exaggerated sexually-selected facial traits in males serve as honest signals of fighting ability, and influence female mate choice. Among primates, the large, bulbous nose of male adult proboscis monkeys (Nasalis larvatus) (figure 9.1) is unique, and has long been recognised as a sexually dimorphic trait, whose emergence has been linked to sexual selection through audio-visual signalling. It serves as a visual signal, where male nasal enlargement is associated with the number of adult females per proboscis monkey breeding group, and the noses of males who are in breeding groups are significantly larger than those of males in non-breeding, all male groups. There is evidence that enlarged nasal structures among male proboscis monkeys also play a role in acoustic communication, where larger formant ratios (a measure of vocal resonance properties) are tentatively associated with larger male nose size. Therefore, enlarged nasal structures in male proboscis monkeys may allow them to emit louder or deeper nasal vocalisations, namely brays, honks and nasal roars, which communicate dominance and aggression, often in the context of inter-male competition, inter-group communication and group protection. This allows male proboscis monkeys with enlarged nasal structures to enhance their reproductive success" (Balolia and Fitzgerald 2024 p1).

But did the enlarged nasal structures evolve due to selection processes associated with visual signalling or acoustic signalling? Balolia and Fitzgerald's (2024) analysis of the morphology of the skull suggested both. Nearly 150 adult cranial specimens were studied from proboscis monkeys and three related species - blue monkey (Cercopithecus mitis), king colobus (Colobus polykomos), and crab-eating or long-tailed macaque (Macaca fascicularis).

Balolia and Fitzgerald (2024) explained their findings: "The visual signalling hypothesis is supported based on large nasal aperture size among males, ie: the bony attachment area of the nasal soft tissue, and male nasal aperture growth beyond dental maturity, consistent with enlarged nasal structures developing in mid-adulthood among some male proboscis monkeys. The acoustic signalling hypothesis is supported based on increased nasal cavity sexual shape dimorphism among proboscis monkeys, and a longer, lower nasal cavity shape among males. Male proboscis monkey nasal cavity shape and enlarged nasal cavity size is consistent with the



(Source: Pangalau; public domain)

Figure 9.1 - Male proboscis monkey.

expression of low formant nasalised vocalisations" (p5).

Reference

Balolia, K.L & Fitzgerald, P.L (2024) Male proboscis monkey cranio-nasal size and shape is associated with visual and acoustic signalling Scientific Reports 14, 10715

10. FORENSIC ODONTOLOGY

Where wolves co-exist with domestic dogs, identifying the attacker of livestock can be difficult. "Like wolves, domestic and wild dogs can form packs and attack animals in order to feed, but they can also act as scavengers... causing modifications on the bones during meat/bone exploitation. Although determining the predator responsible for an animal death is often difficult..., a few studies have focused on the identification and differentiation of wolves or dogs, through the analysis of tooth marks on bone remains, mainly in archaeological, zoo archaeological, or taphonomic contexts, but rarely in forensics" (Toledo Gonzalez et al 2023 p2).

Toledo Gonzalez et al (2023) analysed tooth patterns on bovine bones for the purpose of distinguishing domestic dogs and Iberian wolves in an experiment with captive animals in Spain. Eighty-four fresh and carefully defleshed and disarticulated bovine scapular bones were used with seven wolves and seven mixed hunting dogs (local name "Rehala"). "This type of dogs was chosen because they share certain physical (eg: size, weight, and high biting force) and aetiological (eg: hunting in packs) characteristics with Iberian wolves" (Toledo Gonzalez et al 2023 p2).

It was found that the tooth marks made by wolves were larger and wider, but there was overlap between the two groups.

References

Toledo Gonzalez, V et al (2023) A comparative taphonomic study of tooth marks caused by Iberian wolves (Canis lupus signatus) and domestic hunting dogs (Rehala) (Canis familiaris) on bovine scapulae, for taxonomic differentiation Applied Animal Behaviour Science 265, 105988

11. SEARCH-AND-RESCUE DOGS

Dysfunctional behaviour can be an issue for working dogs, with an impact on the dogs' well-being, their performance, and on the handler and the relationship with the dog. One type of working dog is a "search-and-rescue" (SAR) dog. "These SAR dogs are highly trained to support mankind in disaster response operations to locate missing individuals and provide critical support to disaster response teams. It can be expected that the best performance of working dogs is achieved when they experience adequate physical health and mental well-being... However, several studies have shown evidence of physiological and behavioural manifestations of acute stress during their deployments" (Salden et al 2023 p1).

Salden et al (2023) performed a systematic literature review on the subject, finding eleven relevant studies published before February 2023. The studies covered five disaster scenarios - Oklahoma City bombing 1995; September 11th 2001 terrorist attack ("9/11") (seven studies); Haiti earthquake 2010; Oso, Washington state landslide 2014; and Camp Fire, California, wildfire 2018.

The findings can be summarised as:

a) Physical health of dog - "Prevalent but mild": skin wounds, gastro-intestinal symptoms (eg: diarrhoea; vomiting). Four of the studies in their follow-up found that "no significant difference between the age of death, the incidence of death, or the cause of death was observed between deployed and control dogs" (Salden et al 2023 p6).

b) Behaviour change - "Little systematic research", but evidence of fatigue, and "attitude change" (eg: increased anxiety; lethargy; more protective aggression; more friendly behaviour; hiding) in a few studies. These behaviours were during deployment or for a short time after, though long-term follow-ups were rare. "On the contrary, several studies indicated no evidence of dysfunctional behaviour post-deployment" (Salden et al 2023 p7).

The following methodological issues can be noted about the studies in the review:

i) When the data collected post-deployment - eg: 8-9 months after 9/11. Length of follow-up post-deployment -

eg: from one week to five years.

ii) Control of variables - eg: impact of disaster upon human handler and relationship with dogs; general environment of SAR dogs compared to pets or military working dogs; dog-and-handler mediated factors (eg: training; type of trauma; social support; individual resilience). "It can be debated whether dog-handler dyads have a different type of relationship and support than a pet-dog-owner relationship" (Salden et al 2023 p8).

iii) Measurement of behaviour change - eg: "Canine Behavioural Assessment and Research Questionnaire" (C-BARQ) (Serpell and Hsu 2001) (table 11.1); owner/handler-completed rather than independent observations.

- "Just before being taken for a walk": calm (0) to extremely excitable (4)
- "When toys, bones or other objects are taken away by a household member": no aggression (0) to serious aggression (4)
- "When an unfamiliar person tries to touch or pet the dog": no fear/anxiety (0) to extreme fear (4)
- "Obeys a 'sit' command immediately": never (4) to always (0)

Table 11.1 - Example of items from C-BARQ.

iv) Sample size -eg: les than 20 to over 100 (including controls).

v) Control sample - eg: SAR dogs that did not participate in the disaster response.

vi) Pre-deployment/baseline measures - rare.

The researchers searched two well-known academic databases - "PubMed" and "Web of Science". Studies published in journals not included in these databases would be missed, and studies not published in the academic literature.

All but one study took place in the USA.

The researchers did not systematically rate the methodological quality of the studies, though weaknesses were noted in study design and information reported.

Salden et al (2023) ended: "Ideally, in future research, each SAR dog should receive a thorough

behavioural examination prior to deployment, during deployment, and regularly after deployment, in controlled environments, to ensure optimal productivity and longevity of working dogs, as well as to secure their well-being and quality of life. However, achieving this high level of care and monitoring can be very challenging in the field" (p8).

NOISE AND TRAINING DOGS

Sheldon et al (2023) began: "Working dogs perform a variety of tasks that require them to attend to specific features of their environment whilst disregarding others. When dogs become distracted by extraneous stimuli, their task performance, including accuracy and speed, can become impaired... Distractions that lead to performance deficits are particularly concerning for dogs in roles where optimal performance is critical for safety... Distraction in a guide or detection dogs for example, can potentially be life-threatening to the dog, its handler, and others" (p1).

These researchers studied auditory distraction when training 24 volunteer dogs. The task was to find a food reward hidden in one of nine buckets and to return to the start position. Half the dogs were trained in silence and half with a recording of people clapping and cheering played at 60 dB on a speaker. The dogs were subsequently tested with other noises playing or strobe lighting.

The efficiency of training was scored as the number of trials it took to learn the sequence of finding the reward and returning to the start position. The mean was 18.6 for training in silence and 31.0 for the sound condition.

In the test trials there was no difference between the dogs. Both trained groups took longer in the sound than light condition. The researchers stated: "Contrary to our predictions, dogs trained with an acoustic distractor did not perform better than dogs trained in silence when tested with a distractor of the same (acoustic) or different (light) modality" (Sheldon et al 2024 p4).

The study, overall, showed the importance of training working dogs in non-distracting environments.

References

Salden, S et al (2023) Disaster response and its aftermath: A

systematic review of the impact of disaster deployment on working dogs Applied Animal Behaviour Science 265, 105987

Serpell, J.A & Hsu, Y (2001) Development and validation of a novel method for evaluating behaviour and temperament in guide dogs Applied Animal Behaviour Science 72, 347-364

Sheldon, E.L et al (2023) The impact of auditory distraction on learning and task performance in working dogs Applied Animal Behaviour Science 265, 105977

12. FEEDLOT CATTLE

Feedlot cattle have an increased risk of metabolic diseases because of the rations (eg: low in fibrous forages) they are fed (eg: easily-fermentable carbohydrates leading to sub-acute ruminal acidosis (SARA)) (Coon and Tucker 2023).

Additional roughage can reduce SARA. The motivation of feedlot cattle to access this can be measured by a "thwarting test", "where animals are able to interact with feed but not consume" (Coon and Tucker 2023 p1). For example, a feed bin that the animal is used to eating from is covered with wire mesh to stop access, and the time spent at the bin is measured.

Reference

Coon, R.E Tucker, C.B (2023) Measuring motivation for forage in feedlot cattle fed a high-concentrate diet using a short-term thwarting test Applied Animal Behaviour Science 265, 105950

13. HUMANS IMITATING FACIAL EXPRESSIONS OF MACAQUES

Facial expressions are key communications between individuals of the same species, and between species. In the latter case, for example, dogs distinguishing human facial expressions and vice versa.

Mirroring the actions and expressions of others is linked to this. For example, human visitors to a zoo copied the behaviour of captive chimpanzees (eg: hit on window; kiss-like gestures) (Persson et al 2018).

Luisi et al (2023) investigated specifically humans copying the facial expressions of Barbary macaques (Macaca sylvanus) at a wildlife park in France. The study was an experiment involving photographs of unknown adult male macaques and humans showing three macaque facial expressions - open-mouth threat, scream-fight threat, or a neutral face. The react of the macaque observing the photograph was recorded (aggression, submission, self-scratching).

Towards the neutral face, macaques displayed more self-scratching when it was a human than a macaque, and vice versa for the open-mouth threat. More aggression was shown towards the macaque neutral and open-mouth threat faces. There was no significant difference in response to the scream-fight threat shown by a macaque or a human.

Humans copying macaques' facial expressions did carry meaning for the macaques. This has consequences for "facial signalling (mis)communication between species, which has implications for animal welfare and human safety" (Luisi et al 2023 p1). Marechal et al (2017) had observed tourists mimicking the open-mouth threat face "thinking they were reproducing friendly expressions to initiate a friendly interaction with macaques.... This misunderstanding in facial signalling, and its reproduction can result in an escalation of aggressive exchanges between species which can have dire consequences for both parties, such as physical injury and pathogen transmission" (Luisi et al 2023 p2). Luisi et al (2023) found that over 40% of human faces elicited an aggressive response.

Only one adult male human was used to imitate the macaque faces in Luisi et al's (2023) experiment, and only photographs were used for ethical reasons.

References

Luisi, B et al (2023) Monkeying around: Non-human primate behavioural responses to humans reproducing their facial expressions Applied Animal Behaviour Science 265, 105990

Marechal, L et al (2017) Experience-based human perception of facial expressions in Barbary macaques (Macaca sylvanus) PeerJ 5, e3413

Persson, T et al (2018) Spontaneous cross-species imitation in interactions between chimpanzees and zoo visitors Primates 59, 19-29

14. HOUSING AND AFFILIATIVE BEHAVIOUR

Lau et al (2023) began: "The physiological and neurological similarities between non-human primates (NHP) and humans make NHP use in laboratory research significant both in potential impact and ethical consideration... NHP model species are often housed in captivity in research facilities and primate centres" (p1). These researchers wondered about the impact of captivity on pair bonding, and, in particular, coppery titi monkeys (Plecturocebus cupreus) housed at California National Primate Centre (CNPRC).

"Like many pair-bonded species, titi monkey adults form and maintain their pair bond through prolonged physical contact and affiliative interactions... Titi monkeys regularly engage in territorial defence through loud, co-ordinated calls and aggression towards unfamiliar individuals...; such territorial behaviours have been observed in both wild... and laboratory settings... Although the titi monkeys housed at the CNPRC cannot physically interact with other family groups and have minimal visual access to non-family members, there are currently many animals in acoustic and olfactory contact with each other" (Lau et al 2023 p1).

The researchers studied 23 pairs, each housed in cages, but within the same room. The affiliative behaviour of a pair was scored on the following categories - "if pair mates engaged in 'tail-twining' (male and female sitting side-by-side with tails intertwined at least one turn), 'contact' (bodily touching including sitting, grooming, or copulation), or remaining in 'proximity' (within one titi monkey arm's length of each other). Failure to meet any of these criteria was marked as non-affiliative behaviour, 'none'" (Lau et al 2023 p2).

Affiliative behaviour was higher when the pair were caged in smaller rooms (eg: four cages together), and when there was no offspring present. "The higher titi monkey affiliation rates observed in small rooms may be because of pairs engaging with their acoustic environment. In large rooms, the detection of more vocalising titi monkeys may draw the attention of pair mates away from each other and to outside the cage. In titi monkeys, vocal communication, specifically vocal duetting, is a known form of intergroup communication that conveys information about caller territory..., age..., pairing tenure..., identity..., and family lineage... Therefore, it is possible that titi monkeys in large rooms spend more time attending to these socially

relevant caller cues compared to titi monkeys in small rooms" (Lau et al 2023 p3).

The rooms at the CNPRC were not comparable, admitted the researchers. They stated: "Despite being maintained on the same light cycle, large rooms do have small skylights that let in natural light. Small rooms do not have equivalent natural light sources. While other factors like care staff and distance to other CNPRC facilities (ie: cage wash, roadways) appear to be relatively analogous between the two room sizes, small, yet unmeasured differences may exist" (Lau et al 2023 p3).

In summary, the study showed that the pair's behaviour was influenced by the number of neighbouring cages of pairs. This is especially important if the monkeys are being used in research on social behaviour (Lau et al 2023).

Reference

Lau, A.R et al (2023) Room size and offspring presence impact pair-bonded primate affiliation Applied Animal Behaviour Science 265, 105994

15. HORSES AND FACIAL EXPRESSIONS

The welfare of captive animals includes their physical well-being, as well as their mental and emotional health. The latter having become more important in recent years (Ricci-Bonot and Mills 2023).

"Emotions can be characterised along two main dimensions, their valence (such as positive/ pleasant/ attractive/rewarding versus negative/ unpleasant/ aversive/punishing) and the level of arousal or activation (such as high or low intensity) which together make up core affect" (Ricci-Bonot and Mills 2023 p1). But how to assess these dimensions? Arousal can be detected from physiological measures, while behavioural signs can help generally.

Ricci-Bonot and Mills (2023) concentrated on horses, and how facial expressions could be used to indicate emotional information. Thirty-one horses were studied for three emotions in a learned situation - anticipation of a reward (which they had been taught to expect: ten seconds between food appearing in feeder and access to it), frustration during waiting, and disappointment when the reward did not appear (ie: an empty feeder). Video recordings of facial expressions were made, and categorised using the "Horse Facial Action Coding System" (EquiFACS). This is "an objective system for coding facial movements on the basis of the contraction of underlying muscles, as well as their behaviours" (Ricci-Bonot and Mills 2023 p1).

No specific facial markers were found for anticipation, but nine actions and behaviours distinguished between frustration and disappointment. For example, frustration involved more "biting feeder", "ear rotator", and "eye white increase", while disappointment was characterised by more "blink", "nostril lift", and "licking feeder". There were gender differences observed.

Reference

Ricci-Bonot, C & Mills, D.S (2023) Recognising the facial expression of frustration in the horse during feeding period Applied Animal Behaviour Science 265, 105966