**Study subjects**

First, we included four groups of siamangs (N=18), two housed at the Zoo Krefeld (Germany) and two at the Howletts Wild Animal Park in Bekesbourne (United Kingdom). Siamangs usually live in small cohesive family groups, mostly characterized by monogamous mating systems (Palombit, 1996). Our study sample included 9 females and 9 males, aged between 1 and 27 years (see Table S1). Each group consisted of one adult female and one adult male representing the breeding pair and their 2 to 3 offspring of different ages. Groups A and B at Howletts Wild Animal Park lived in outdoor enclosures measuring about 15 m x 7 m x 8 m and 12 m x 10 m x 8 m, respectively, with access to adjoining sleeping rooms. Group 1 at Zoo Krefeld lived in an indoor enclosure measuring about 9 m x 5.5 m x 3 m, from where it was possible to observe the group during the whole day. Group 2 at Zoo Krefeld lived in an outdoor enclosure measuring 8 m x 4 m x 3 m, with a small indoor area not visible to the observer, to which individuals could retreat at any time. All enclosures were equipped with stems, branches, wooden platforms and/or several ropes and nets. All groups were fed twice a day: once in the morning and once in the late afternoon, with a wide variety of different types of fruits and vegetables. Foliage, branches, or grass were also given as additional enrichments.

Second, we included two groups of Sumatran orangutans (N=16), one (N=9) housed at the Zürich Zoo (Switzerland) and one (N=7) at the Leipzig Zoo (Germany). Orangutans are considered the less cohesive of all the apes (Aureli et al., 2008), being characterized by loose communities with high levels of fission-fusion (van Schaik, 1999; Delgado & van Schaik, 2000). Our study sample included 12 females and 4 males (2 flanged and 2 unflanged), aged between 1 to 35. All individuals except one (Pongo) were born in captivity. The Leipzig group was housed in an outdoor enclosure measuring about 1700 m2, with an indoor area of about 300 m2, both containing several trees, ropes and platforms, and a variety of permanently installed enrichment devices, such as shaking boxes and poking bins. The Zürich group was housed in one large and a small indoor cage that contained several trees, robes and sleeping nests.

Finally, we included one group of chimpanzees (N=19) at the Yerkes Regional Primate Research Center (Field Station) in Atlanta, Georgia, USA. In the wild, chimpanzees are characterized by high levels of fission-fusion, forming large groups that frequently fission into temporary subgroups of varying size and composition (Boesch & Boesch-Achermann 2000; Nishida & Hiraiwa-Hasegawa, 1987). Our study group included 12 females and 7 males, aged between 1 and 33. With the exception of two individuals, all group members were born in captivity. The group lived in an outdoor enclosure measuring approximately 24 m x 30 m, with access to five indoor cages (each 3m x 3m), a wooden structure in the center and various objects (e.g. toys, barrels, branches) throughout the compound. It was unfortunately not possible to obtain more detailed information about the raising histories of chimpanzees from the Yerkes Regional Primate Research Center.

**Table S1.** List of the species tested, including the study groups, study subjects, their age (in years), sex and centrality (a measure of subjects’ importance as “social hubs”; Farine & Whitehead, 2015; Farine, 2017).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Species** | **Group** | **Subject** | **Age** | **Sex** | **Centrality** |
| Chimpanzee | Atlanta | Amos | 18 | Male | 0.45 |
| Barbi | 23 | Female | 0.36 |
| Chip | 10 | Male | 0.57 |
| Cynthia | 19 | Female | 0.52 |
| Daisey | 10 | Female | 0.24 |
| Ericka | 26 | Female | 0.88 |
| Jaimie | 4 | Female | 0.68 |
| Julianne | 1 | Female | 0.92 |
| Karri | 4 | Female | 0.45 |
| Magnum | 10 | Male | 0.28 |
| Phineas | 33 | Male | 0.52 |
| Polyanna | 10 | Female | 0.36 |
| Reid | 6 | Male | 0.12 |
| Sean | 7 | male | 0.56 |
| Steward | 6 | male | 0.69 |
| Tai | 32 | female | 1.00 |
| Virginia | 8 | female | 0.82 |
| Vivienne | 25 | female | 0.62 |
| Waga | 17 | female | 0.42 |
| Orangutan | Leipzig | Bimbo | 21 | male | 0.05 |
| Dunja | 28 | female | 1.00 |
| Kila | 1 | female | 0.99 |
| Padana | 4 | female | 0.26 |
| Pini | 13 | female | 0.16 |
| Toba | 7 | female | 0.88 |
| Walter | 12 | male | 0.43 |
| Zürich | Djaro | 12 | male | 0.36 |
| Lea | 35 | female | 0.22 |
| Oceh | 14 | female | 0.96 |
| Pongo | 41 | male | 1.00 |
| Salih | 10 | female | 0.30 |
| Selatan | 19 | female | 0.23 |
| Timor | 27 | female | 0.27 |
| Tuah | 9 | female | 0.26 |
| Xira | 5 | female | 0.37 |
| Siamang | Howletts A | Bulu | 27 | female | 0.93 |
| Xhabu | 3 | male | 0.79 |
| Xhali | 1 | female | 1.00 |
| Xhari | 19 | male | 0.41 |
| Xhulu | 7 | male | 0.57 |
| Howletts B | Agog | 3 | female | 0.88 |
| Demagogue | 1 | female | 0.77 |
| Gog | 21 | male | 0.60 |
| Jogog | 7 | male | 0.80 |
| Kuku-Gog | 9 | female | 1.00 |
| Krefeld 1 | Alice | 3 | female | 1.00 |
| Ellen | 26 | female | 0.93 |
| Helge | 6 | male | 0.82 |
| Ringo | 26 | male | 0.53 |
| Krefeld 2 | Elvis | 26 | male | 0.68 |
| Guildo | 2 | male | 1.00 |
| Karen | 5 | female | 0.93 |
| Kathrin | 26 | female | 0.61 |