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Taï Chimpanzees

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Introduction

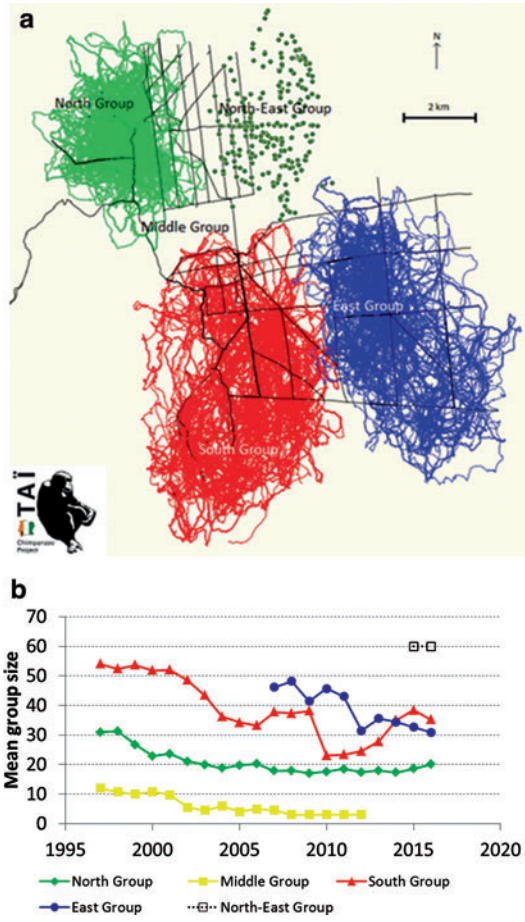
Taï Chimpanzees is a term used for a population of western chimpanzees (*Pan troglodytes verus*) located in the Taï National Park, which is situated in the southwestern region of Ivory Coast at the border to Liberia in West Africa. The *Taï Chimpanzees* are observed continuously since 1979 when primatologist Christophe Boesch and his wife Hedwige Boesch-Achermann established the Taï Chimpanzee Project (TCP). TCP (www.taichimps.org) is dedicated to the research and conservation of the *Taï Chimpanzees* (Boesch and Boesch-Achermann 2000). In the beginning, Christophe Boesch habituated North group to the presence of human observers, a process that takes 5–7 years. Over many years he and his wife followed this community with the support from only a few additional observers. TCP started to grow with Christophe Boesch's appointment as director of the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, in 1997.

Several new chimpanzee communities have been habituated since then (Fig. 1a). After many years of surveying the area south of North group, habituation of South group started in 1994 in the hope for direct observation of intergroup encounters and female migration. However, even before South group was entirely habituated it became clear that one community of chimpanzees was ranging in between. Therefore, observers started to follow Middle group in 1997, which turned out to consist of 12 chimpanzees (Fig. 1b). As a result, TCP staff started in the year 2000 with the habituation of East group, allowing for two neighboring communities to study intergroup interactions from both sides. Finally, in 2014, TCP started the habituation of North-East group, a chimpanzee community bordering all other groups. After 33 years, Christophe Boesch handed over the responsibility for TCP to Roman Wittig in January 2013. To date (2017), TCP staff observes four neighboring chimpanzee communities (Fig. 1a) with about 150 individuals (Fig. 1b) and one group of sympatric living sooty mangabey (*Cercocebus atys*). An international team of local field assistants and international researchers is observing the *Taï Chimpanzees*.

The vested interest in behavior and cognition of chimpanzees is based on chimpanzees' similarity to humans. Chimpanzees, and their sister species the bonobo (*Pan paniscus*), are our closest

The Taï Chimpanzee Project (www.taichimps.org) – research on the wild chimpanzees (*Pan troglodytes verus*) in the Taï National Park, Côte d'Ivoire

J. Vonk, T.K. Shackelford (eds.), *Encyclopedia of Animal Cognition and Behavior*,
https://doi.org/10.1007/978-3-319-47829-6_1564-1



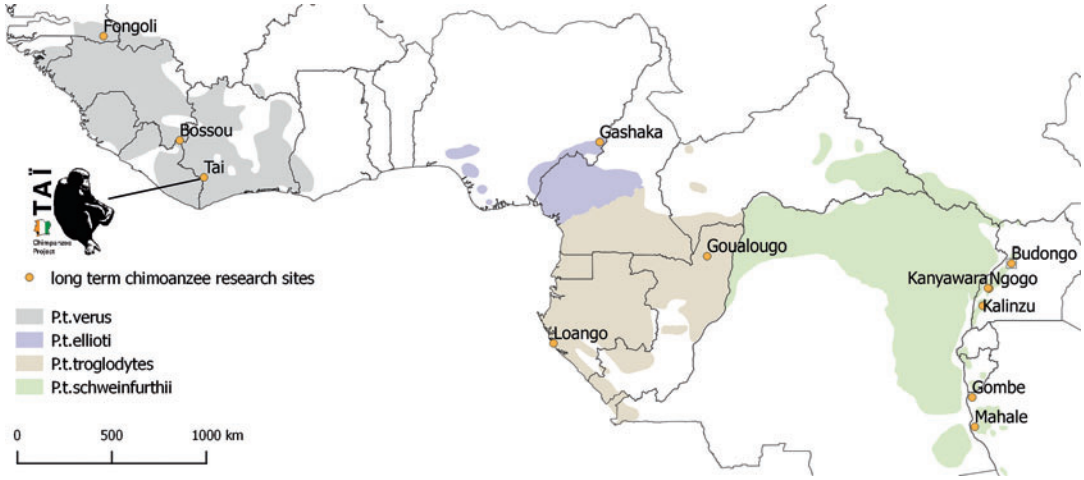
Taï Chimpanzees, Fig. 1 Five chimpanzee communities habituated for research at the Taï Chimpanzee Project: (**a**) the position of each community within the research area, and (**b**) the community size of each community through time

living relatives. Our evolutionary paths have diverted only about 7–8 million years ago (Langergraber et al. 2012). The evolutionary closeness makes chimpanzees an ideal model species to investigate behavioral and cognitive adaptations of humans, since they allow us a glimpse into the past of our own species. This makes long-term projects like TCP an essential asset to the science community.

Taï Chimpanzees show a wide range of behaviors that appear to be very similar to that of humans. They use multiple tools to extract food, they cooperate during hunting of monkey prey and border patrols, they reconcile conflicts, they adopt orphans, and they developed cultures. Although these behaviors are not unique features of *Taï Chimpanzees*, but can be found also in other chimpanzee populations (Fig. 2), observations at TCP were either leading to the discovery or significantly contributed to our understanding of these behaviors. Much of the research on the *Taï Chimpanzees* has unraveled discoveries related to human evolution and animal cognition.

Sociality and Bonds

Chimpanzees live in multi-male multi-female societies, with females migrating when they reach sexual maturity. They are typically seen as being male bonded, since males show typically higher levels of association and grooming than females, and female dominance hierarchy are usually not linearly structured. *Taï chimpanzees*, however, seem to be mixed sex bonded, showing differentiated relationships not only between males but also between females and between the sexes (Boesch 2009; Boesch and Boesch-Achermann 2000). This classification of *Taï chimpanzees* as being mixed sex bonded has several reasons. First, *Taï* females invest not only into differentiated relationships with females and males (Wittig and Boesch 2010a) but also show a linear dominance hierarchy in females (Wittig and Boesch 2003a), indicating that social relationships with and amongst females matter. Second, females in *Taï* range throughout the entire home-range of the community and do not inhabit satellite or neighborhood territories (Lehmann and Boesch 2005), as has been reported for many other study sites (Pusey and Schroepfer-Walker 2013). Third, *Taï* females can exhibit a certain choice in choosing their mating partners (Stumpf and Boesch 2006) preferring mating partners which have shared meat with them beforehand (Gomes and Boesch 2009). Finally, male violence towards females of the same community is much lower in *Taï*, where males have never been observed to commit intracommunity infanticide, killing the infants of females belonging to the same social unit, while this has been observed several times in other chimpanzee communities



Taï Chimpanzees, Fig. 2 Location of the Taï Chimpanzee Project and other long-term chimpanzee research sites across Africa in relation to the distributions of the four chimpanzee subspecies

(Wilson et al. 2014). A result of this might be the higher survival probability of chimpanzee youngsters in *Taï* during periods without disease outbreaks compared to eastern chimpanzees (Wood et al. 2017). Thus, females in *Taï* might be able to bond with the local males, range over the same territories, and exhibit differentiated mating choices because they do not need to worry about that local males would kill their infants.

Reconciling Conflicts

Taï Chimpanzees, like other social animals, face the dilemma of group living. On the one hand, they need to cooperate with group members in order to reduce predation risk, to increase territory defense or exploitation of food sources. At the same time, they compete with the other group members over mating partners, food, or shelter. Facing a conflict of interest *Taï Chimpanzees* need to decide whether they escalate the conflict into aggression, winning the resource but damaging the cooperative relationship with the opponent or to leave the resource to the opponent (Wittig and Boesch 2003b). Once the conflict is escalated to aggression the relationship to the opponent is damaged and tolerance levels are disturbed (Wittig and Boesch 2005). In this case reconciliation, the friendly interaction between former opponents after aggression, can restore tolerance levels to normal and repair the relationship between the opponents to allow future cooperative interactions (Wittig and Boesch 2005).

Approaching the former opponent to reconcile, however, is not possible all the time. Sometimes fear about reemerging aggression is making a friendly direct contact of former opponents impossible. There is, however, a solution to the problem. In such cases, *Taï chimpanzees* seek friendly contact with the friend of their former opponent or friends seek friendly contact to the opponent of their friend. The friendly contact with the former opponent's friend functions like reconciliation between the opponents, but without them needing to have direct contact (Wittig and Boesch 2010b). This friend-mediated reconciliation requires that *Taï chimpanzees* know who is friend with whom. Otherwise the friendly contact with the opponent's friend would not show any effect on the tolerance level between the opponents.

Hunting and Food Sharing

Taï Chimpanzees are specialized hunters of monkey prey. They regularly hunt for western red colobus (*Procolobus badius*) and western

black-and-white colobus (*Colobus polykomos*). During these hunts *Taï Chimpanzees* coordinate their activity and show high levels of group cooperation. In most of these hunts they coordinate their activity in time and space, while engaging in different roles (Boesch and Boesch 1989). A driver climbs up in the tree next to the monkeys and starts slowly moving towards them. The monkeys start fleeing into the next tree. Blockers sitting in other trees close by watching the monkeys and block their escape routes. This way they channel the movement of the monkeys and make them to move towards a certain direction. In this certain direction a hidden catcher is ready for the ambush. Once the monkeys reach the tree of the catcher, he makes his move, grabs one of the monkeys, and drags the prey to the ground, where the chimpanzees come together in to feed on the meat.

The meat of the monkey is usually distributed among the hunters (Fig. 2). From there it is shared with friends and friends-to-be. Why "friends-to-be," because the sharing of food is strongly linked to high levels of urinary oxytocin. Oxytocin is a hormone known to facilitate bonds between individuals. It seems that sharing food allows individuals to build new friendships and to maintain existing bonds (Wittig et al. 2014). While in some other populations meat sharing is mainly based on avoiding harassment (Gilby 2006), *Taï* chimpanzees share meat more often with individuals that were involved in the hunt (Boesch 1994) and in exchange for agonistic support (Gomes and Boesch 2011). The latter has been described similarly in other chimpanzee populations (Mitani and Watts 2001). It seems that meat sharing, or even sharing of food in general, may reflect the wish of a *Taï* chimpanzee to make a friend or coalition partner.

Tool Use and Culture

Taï Chimpanzees are famous for their nut cracking technique. They employ a hammer and anvil principle to crack open the shells of several nut species (e.g., *Coula edulis*, *Panda oleasa*, *Detarium senegalense*; Fig. 3). *Taï Chimpanzees* do so by placing the nut on a solid anvil, e.g., a root or a rock, most of which are used since many years so that the nuts have left an imprint over time, and hit the nut with a wooden club or a stone hammer until the shell breaks open (YouTube channel of the Taï Chimpanzee Project: Dilly cracks nuts). If the nut is not hit hard enough, the shell does not crack, if the nut is hit too hard, the kernel is smashed. Skilled nut crackers adjust the force so the nut shell open with one or two hits and they can consume the kernel. Infants may need many years before they are able to do so. Sometimes *Taï Chimpanzees* may be unable to remove the entire kernel from the shell. Then they may break a stick into the right length of a spooning tool and spoon the rest of the kernel out.

Although nuts like *Coula edulis* are present in many chimpanzee populations, they are only cracked west of the river Sassandra in Ivory Coast. Behavioral variation like this, independent of genetic or ecological variation, has been termed tradition, and the sum of all such variation as culture. Chimpanzees show cultural variation when comparing between populations across Africa with *Taï Chimpanzees* being described as the nut cracking culture (Whiten et al. 1999). However, *Taï Chimpanzees* exhibit also cultural variation between neighboring communities.

At the beginning of the Coula nut season, the nuts have harder shells and they are cracked and consumed in the tree. *Taï Chimpanzees* use stone hammers, which are easier to transport into the tree and better to crack the hard shell of the fresh nut. With proceeding time during the nut season, the shell drying out and loses its hardness. The chimpanzees use more and more wooden clubs to crack the nuts, which are much more abundant than stones. This makes life easier for them and long searching for appropriate tools is not slowing them down anymore. *Taï Chimpanzees* follow this rule in north and east group, but not in the neighboring south group. In south group they continue to use stones throughout the entire Coula nut season, although stones are not more abundant in the south group territory than in the others. The difference in the nut cracking behavior between south group and the two others is based on cultural differences (Luncz et al. 2012).

Taï Chimpanzees, Fig. 3 Coula nut cracking site with hammer and anvil in the Taï National Park © Roman M Wittig, TCP

Immigrating females even conformed to the culture of the south group in *Taï*. Females coming from a natal group that belong to the stone and wood hammer culture adopted the stone hammer culture of the south group after immigration (Luncz et al. 2015). Within one nut cracking season they had adopted the culture and did not change to wooden hammers back anymore. This suggests that conformity with the group culture is an important feature of group identity among the *Taï Chimpanzees*.

Adoptions

Adoptions are a chimpanzee universal, but in *Taï* we were able to observe a large number of adoptions carried out by either, female and male chimpanzees. When mothers die before their offspring have reached adulthood (with 15 years), they leave an orphan behind. With an inter-birth-interval of about 5.5 years (Boesch and Boesch-Achermann 2000), dead parous females leave usually at least one dependent offspring. Children that are orphaned before they have reached 5 years of age, while they are completely dependent on their mother, have almost no chance to survive. Generally, one can say, the younger the offspring is the lower the probability for it to survive without the mother.

In Taï about 50% of the orphans are adopted by other group members (Boesch et al. 2010). Adopters carry the orphan, share food and night nests with them, support the orphans in aggressive interactions, and wait or search for them. Interestingly, in Taï adopters can be both, close kin (in form of siblings or fathers) or unrelated to the orphan. Whether the adopters are kin or non-kin, adoption increases the orphan's chance to survive longer. The film *Chimpanzee* (2012), produced by Disney Nature, is telling the story of an adoption, featuring the orphan Oscar that is adopted by the alpha-male Freddy. The footage was taken of the *Taï Chimpanzees* and contains the adoption of Victor by the old male Freddy in TCP's East group after the death of Victor's mother Vanessa in 2008. Freddy has been ever since somebody who adopted many other infant orphans and was able to help quite a number to survive for many years.

Conservation

Western chimpanzees are critically endangered. Over the last 20 years, we lost more than 80% of the population of *Pan troglodytes verus* in the world (Kühl et al. 2017). Estimates suggest that between Ghana and Senegal there are about 35,000 western chimpanzees left. The Taï National Park is the largest remaining primary rainforest in West Africa and is, with its 4540 km^2, home to an estimated 300 chimpanzees. The population is under pressure from poaching, habitat destruction, and illegal mining.

Diseases are an additional survival hazard for *Taï chimpanzees*. During the last 35 years, *Taï chimpanzees* have been victims to a large number of different diseases, e.g., Ebola (Le Guenno et al. 1995), anthrax (Hoffmann et al. 2017), respiratory diseases (Köndgen et al. 2008). While some originated in the forest, others have human origin. Due to the chimpanzees close genetic relationship, there is a high possibility of transmitting respiratory diseases from humans to chimpanzees. Since 2009, therefore, TCP has strict hygiene rules and employs 5 days quarantine for anybody who is going to observe the chimpanzees or mangabeys (Grützmacher et al. 2017). These rules have been adopted by IUCN (International Union for Conservation of Nature) as best practice for the

research and tourism with great apes and prevented since then cases of lethal respiratory outbreaks.

Research conducted by the *Taï Chimpanzee Project*, however, is not only enlarging our knowledge about chimpanzees and human evolution but has also a direct impact on the protection of the chimpanzees and other mammals in the research area. Using National Park wide survey data showed that illegal human activity is the lowest around the research and ecotourist areas, leading to the highest animal densities for chimpanzees, monkeys, and other mammal species in the research and ecotourist areas (Campbell et al. 2011). This correlation between research area and animal density shows the crucial conservation effect of long-term research sites like the *Taï Chimpanzee Project*.

Conclusion

When comparing *Taï Chimpanzees* to other chimpanzee populations (Fig. 2) we find some pattern that seem to differ. *Taï Chimpanzees* build friendships between males, between females, and between males and females. If unable to reconcile the conflict with the former opponent, they seem to have the ability to repair the damage done by the aggression when "reconciling" with a friend of the former opponent instead. Although *Taï Chimpanzees* are competitive and violent to the rival groups (neighbors), they do not seem to commit killings within their own group. All these features make the *Taï Chimpanzees* a population of chimpanzees with lower violence and a higher degree of mixed sex bonding compared to other long-term sites. Whether this is a *Taï* trait, a western chimpanzee characteristic, or features that can develop anywhere under certain ecological conditions remains to be investigated.

The presence of the *Taï Chimpanzee Project* is vital for the survival of the *Taï Chimpanzees*. Without a long-term investment in research, the sustainable management of the Park as a protected area seems impossible. Research at the *Taï Chimpanzee Project* incorporates the three pillars of the millennium declaration by the UN on sustainability. First, the social development in form of providing knowledge for society and education for local human population; second, the economic development in form of salaries, health insurance, and microloans for local staff; and third, the environmental protection, in form of effective safeguarding of the only irreplaceable protected area for biodiversity in West Africa, the Taï National Park (Saout et al. 2013).

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