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Deadline of the next issue is October 2014!

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Encountering Crocodiles while Chasing Chimpanzees

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The Nile crocodile (*Crocodylus niloticus*) is sympatric with the chimpanzee (*Pan troglodytes*) across most or all of its range (IUCN 2013). The crocodile is a top predator and even when not fully grown is big enough to prey upon a chimpanzee. Crocodiles prey on smaller-bodied monkeys (Galdikas & Yeager 1984; Galdikas 1985; Cheney & Seyfarth 2007). Njau and Blumenschine (2012) showed that crocodiles of only 1–2 m body-length preyed on *Homo habilis*, whose body-size was chimpanzee-like. However, crocodiles are rarely listed as a potential predator in studies of wild chimpanzees.

In reports of the ethology and ecology of chimpanzees, crocodiles figure, if at all, only in passing comments (McGrew *et al.* 1996, p. 318). Risk of predation by aquatic predators, including crocodiles, is not mentioned in published accounts of chimpanzees' avoidance of water (hydrophobia) (Angus 1971; McGrew 1977; Nishida 1980). There seem to be no detailed published data on interactions between the apes and these reptiles, nor any data on potential encounter rates between the two species. The aim of this short report is to present some data on chimpanzees and crocodiles in close sympatry, with the two species making use of the same watercourses at a single study site.

If we have not yet seen crocodiles and chimpanzees encounter one another, then the next best source of data may be primatologists searching for or tracking unhabituated chimpanzees. Because such researchers seek to maximise the chances of contacting wild chimpanzees in their daily activities, the humans' encounter rate may be a proxy for that of the apes.

As Mt. Assirik, in the Parc National du Niokolo-Koba, Republic of Senegal, we studied chimpanzees (*P. t. verus*) over almost four years, from February 1976–December 1979. We spent each working day walking through various types of habitat, in search of chimpanzees. We focussed on gallery forest along seasonal watercourses, which, although comprising only 3% of the surface area of the 50 km², yielded most of the chimpanzee contacts. Assirik is a hot, dry, and open habitat dominated by grassland and open, deciduous woodland (McGrew *et al.* 1981). The dry season lasts for 7 months (November–May), during which time almost all watercourses either dry up or cease flowing. Assirik has no rivers but instead tributary streams of varying size, none more than 2 m in width. Chimpanzees drink daily and prefer running water; as the dry season progresses, they must make use of water in gallery forest strips.

We encountered crocodiles nine times during the study (see Table 1). This equates to one encounter every 5.2 months (when the median number of days per spent in the field per month was 27). All but one of the encounters took place in the dry season, when the reptiles were confined to pools in watercourses. The exception (10 June 1976) was a dead individual in a shallow pool, ridden with maggots. Only half of the encounters were in closed-canopy gallery forest; the others were in more open



Nile crocodiles (Photo by M. Nakamura)

Table 1. Details of encounters with crocodiles, Mt. Assirik, Senegal.

Date	Habitat type	Place	Length (m)	Comments
28-Apr-76	??	Hidden Valley	1.2–1.5	Dead in pool; in steep-sided bat grotto; maggots
10-Jun-76	??	Stella's Valley	??	In stream
14-Feb-77	W	Lower Lion Valley	1.5	Flees from bank into pool
07-Mar-77	G	Tsetse Plains	small	Only intermittent pools but some running water
04-Jan-78	F	Elephant Rib Valley	1.5	Slides into pool
02-Nov-78	F	Elephant Rib Valley	0.9–1.2	Beginning of forest
13-Feb-79	F	Middle Lion Valley	1.2	Stream; upstream from bathing pool
14-Mar-79	G	Tsetse Plains	0.6	Pool
25-Apr-79	F	Middle Lion Valley	??	Old Camp bathing pool

Habitat type: F = forest, G = grassland, W = woodland

habitat types. All crocodiles were immature, ranging from 1–1.5 m long. All retreated upon encountering us, into whatever water was available.

Lacking permanent surface water, Assirik is probably too dry to maintain a population of crocodiles, but it seems likely that young crocodiles disperse in the rainy season up the rain-swollen tributaries of the Gambia River, bringing some of them into the main valleys of the study area. Those that did not retreat with the advancing dry season were probably trapped in diminishing pools, where they were temporarily more exposed and observable, but ultimately perished.

Are crocodiles a predatory threat to the Assirik chimpanzees? Perhaps.

ACKNOWLEDGEMENTS

I thank the 15 other researchers who took data on animal encounters during the Assirik project, especially Caroline Tutin and the late Pamela Baldwin; Kazuhiko Hosaka and Michio Nakamura for helpful comments and suggestions on the manuscript. Writing of this report was supported by an Emeritus Fellowship from The Leverhulme Trust.

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<NOTE> Discriminating *Saba* and *Landolphia* Seeds in Chimpanzee Feces at Mahale

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INTRODUCTION

The fruits of *Saba comorensis* (local name, ilombo) and *Landolphia owariensis* (local name, mpila) are often enthusiastically eaten by chimpanzees at Mahale, and they have been classified as a “major food” and “important food,” respectively, by Nishida (1991). Both of them belong to the family Apocynaceae with liana life forms, and they share some common characteristics. However, the



Figure 1. Seeds of *Saba* (above) and *Landolphia* (below). Although the former is slightly larger than the latter, it is not easy to distinguish between the seeds in chimpanzee feces.

fruits of *Saba* and *Landolphia* are easily distinguishable by their color and size: the ripe fruit-shell color of *Saba* is yellow, while that of *Landolphia* is orange; the color of the fruit pulp is yellow in the former and white in the latter, and the fruit size of the former (typically ca. 7–10 cm in fruit-shell diameter) is about twice as large as that of the latter (ca. 3.5–5 cm). Therefore, no researchers would confuse these species when they actually observe chimpanzees eating these fruits.

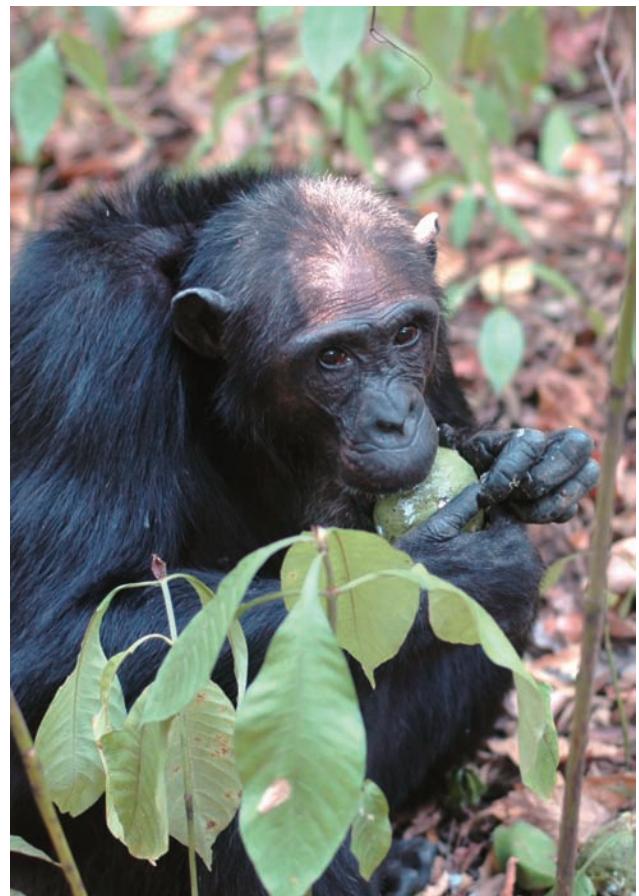
However, it is very difficult to identify the seeds found in chimpanzee feces (see McGrew *et al.* 2009 for the standard protocol for fecal analysis). Chimpanzees typically swallow seeds of both species together with the fruit pulp. Seeds are then defecated intact in their feces. The shapes and colors of their seeds resemble each other and are thus not easily distinguishable (Figure 1). Because these fruits are available in the same season, it is also not possible to discriminate them by season. Therefore, *Saba* and *Landolphia* were clumped together in most previous studies on seed dispersal and fecal analyses at Mahale (Nishida & Norikoshi n.d.1, n.d.2; Takasaki 1983; Takasaki & Uehara 1984). However, because *Saba* is the most important fruit species for Mahale chimpanzees, it may be useful to develop some simple criteria to distinguish its seeds from those of *Landolphia*. The *Saba-Landolphia* problem in fecal analyses may go beyond Mahale, because different species of these two genera are known to coexist in some other chimpanzee study sites (*e.g.*, *Saba senegalensis* and *Landolphia heudelotii* are eaten by Assirik chimpanzees in Senegal: McGrew *et al.* 1988).

METHODS

I collected 25 *Saba* seeds and 28 *Landolphia* seeds from ripe fruits (five to six fruits each) of these plants in December 2013 at the Mahale Mountains National Park, Tanzania. The fruits were collected from the middle of the home range of the habituated M group. The sampling was performed opportunistically because of the difficulty in randomly collecting fruits from the high canopy where these fruits are typically seen. After removing the fruit pulp and air-drying the seeds, I measured the longest axis (hereafter “length”) and the second longest axis (orthogonal to the longest axis, hereafter “width”) of each

seeds by using a vernier caliper to the nearest 0.05 mm. Linear discriminant analyses were then conducted using R software (version 2.12.1) with these length and width measures.

I also collected 24 *Saba/Landolphia*-shaped seeds from a chimpanzee fecal clump found during the same study period. After washing and air-drying, their length and width were measured in the same way. The size data for these seeds were used in order to trial-run the applicability of the analysis.



A Mahale chimpanzee feeding on a *Saba* fruit.

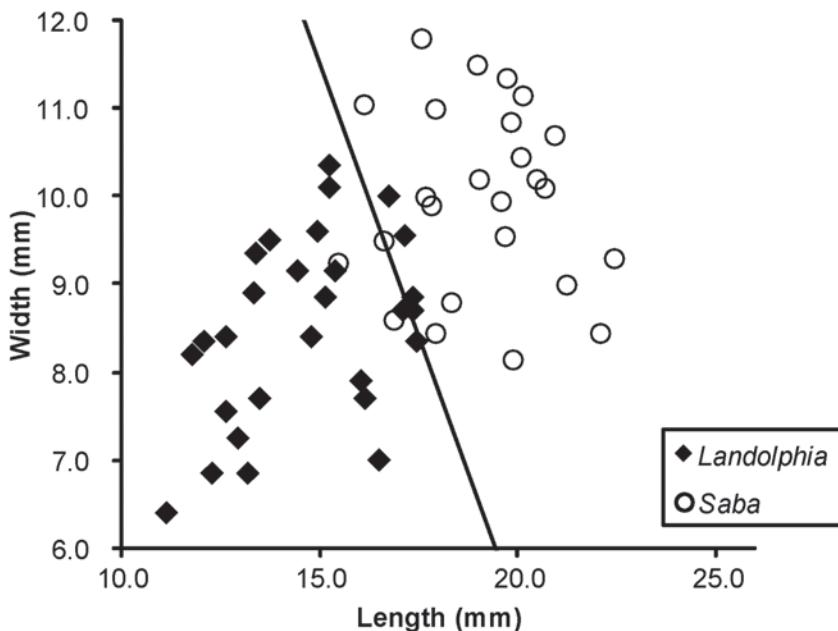


Figure 2. Length-width plots of known *Saba* and *Landolphia* seeds. The line is the discrimination line between the two species (i.e., $D_{sp} = 0$). Although a few seeds of each species are inaccurately judged as the other, 88.68% of the data points are plotted on the correct sides of the line.

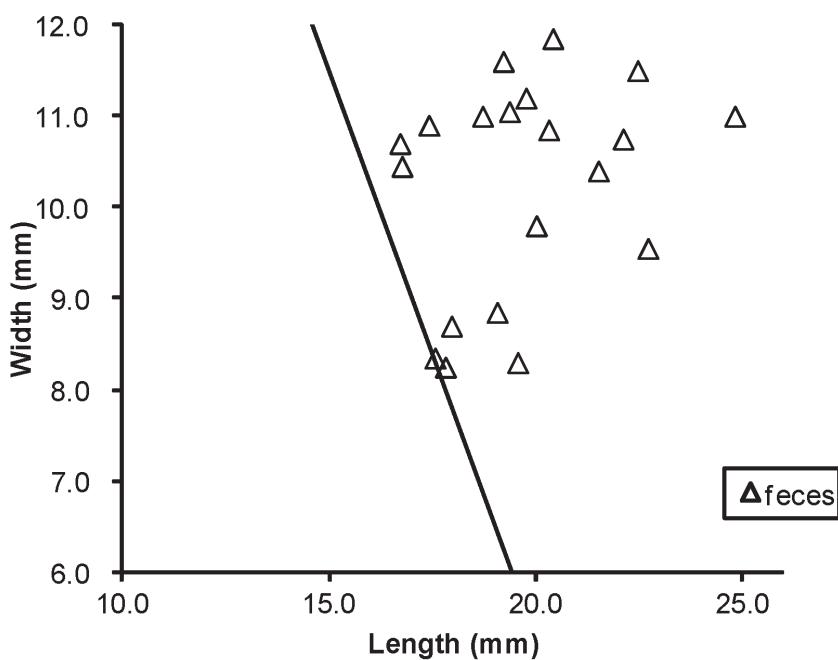


Figure 3. Length-width plots of unknown *Saba/Landolphia*-shaped seeds from chimpanzee feces. The line is the same discrimination line (i.e., $D_{sp} = 0$) as that in Figure 2. Almost all seeds are plotted on the side of *Saba*.

RESULTS AND DISCUSSION

The length and width data for known *Saba* and *Landolphia* seeds are plotted in Figure 2. *Saba* seeds averaged 19.06 (± 1.81 SD) mm in length and 9.97 (± 1.05) mm in width, while *Landolphia* seeds averaged 14.64 (± 1.92) mm by 8.49 (± 1.05) mm. *Saba* tends to have a longer and wider shape than *Landolphia*, but there is still some overlap in their sizes. It seems that length has less overlap than width (thus, *Saba* is relatively longer and ovoid than *Landolphia*).

Linear discriminant analysis yielded the discriminating function of the two species (D_{sp}) in the following formula:

$$D_{sp}(L, W) = -0.455 \times L - 0.367 \times W + 11.06$$

where L is the length and W is the width of a seed in millimeters. When the D_{sp} value is negative, the seed is judged to be that of *Saba*, and when it is positive, judged as *Landolphia*. Re-evaluation of the original data set in this formula resulted in the misidentification of three *Saba* seeds as *Landolphia* and three *Landolphia* as *Saba*. Thus, discrimination accuracy was 88.68% (47/53).

When length/width values of the 24 unidentified *Saba/Landolphia*-shaped seeds from a chimpanzee fecal clump were assigned to this formula, all but one was judged as *Saba* (Figure 3). I assume that the fecal

clump actually contained only *Saba* seeds (*i.e.*, one was misjudged as *Landolphia*) for the following reasons. First, the one judged as *Landolphia* was almost on the border of these two species ($D_{sp} = 0.002$), and the proportion of seeds judged as *Saba* (95.83% = 23/24) was higher than the discrimination accuracy of 88.68% (thus, it is very likely that a small portion was misjudged). Second, because chimpanzees usually swallow multiple seeds of a *Saba/Landolphia* fruit at a time, that is, a fecal clump is expected to contain multiple seeds from one fruit, it is not very likely (though not completely impossible) that only one *Landolphia* seed was contained in a fecal clump with many *Saba* seeds. In addition, direct observations of feeding at the time showed that the chimpanzees more often fed on *Saba* than *Landolphia*.

Although this result is preliminary and we may need more data by performing additional random sampling of fruits, simple measurements of the length and width of a seed seem to distinguish these two species with an accuracy of close to 90%. There are, of course, more accurate ways to discriminate the species, for example, by germination tests to confirm the species by the characteristics of their seedlings or by DNA analyses to genetically identify species. However, measuring sizes is far easier for field researchers. Thus, this may be useful for future studies of chimpanzee seed dispersal and/or fecal analyses at and around Mahale, especially on unhabituated chimpanzee groups whose direct observation is often difficult but who may share similar food items with the M group. A similar method may also be applicable to other study sites where *Saba-Landolphia* (and other confusing sets of species or genera) coexist, with modifications of the formula with their own data sets.

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<NOTE>

Homosexual Interactions among Young Female Wild Chimpanzees: An Example of Social Pretend Play?

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INTRODUCTION

Homosexual behavior among animals is ethologically defined as a display of courtship that involves mounting and/or genital contact and stimulation between same-sex individuals (Vasey & Sommer 2006, p10). Several studies have examined homosexual behaviors between two females of the genus *Pan*. Wild female bonobos (*P. paniscus*) frequently engage in homosexual interactions such as genito-genital rubbing (GG-rubbing; *e.g.*, Fruth & Hohmann 2006). Conversely, wild female chimpanzees (*P. troglodytes*) rarely engage in homosexual interactions (Zamma & Fujita 2004), even though young captive female chimpanzees in a group engaged in GG-rubbing as frequently as did wild bonobos (Anestis 2004). During homosexual interactions, it has been observed that most wild female bonobos rub their genital regions on a lateral axis in the ventroventral position, and rarely engage in pelvic thrusts (Fruth & Hohmann 2006). Captive female chimpanzees, in contrast, rub their genital regions on a front-back axis in the dorsoventral position (Anestis 2004). Homosexual interactions between female bonobos frequently occur during feeding, when group excitement is high (Fruth & Hohmann 2006). In captive chimpanzees, however, most interactions occur during group rest periods (Anestis 2004). Only one previously observed case of homosexual interaction between chimpanzee females of the Mahale M group occurred during a relaxed situation (Zamma & Fujita 2004).

Several hypotheses have been proposed and tested regarding the function of homosexual behavior between *Pan* females (Anestis 2004; Fruth & Hohmann 2006). However, in other animal species, such as American bison (*Bison bison*) (Vervaecke & Roden 2006) or cervid species (Bartoš & Holečková 2006), some homosexual interactions between young females were interpreted as social play or biologically functionless byproducts of adaptations (Vasey & Sommer 2006). Although Anestis (2004, p481) reported that one captive female chimpanzee vocalized play-panting with play-face during a homosexual interaction, researchers have not discussed the possibility that homosexual interactions between wild *Pan* females are a pattern of social play. In this article, I describe an observed case of homosexual interaction between wild female chimpanzees, and discuss the property

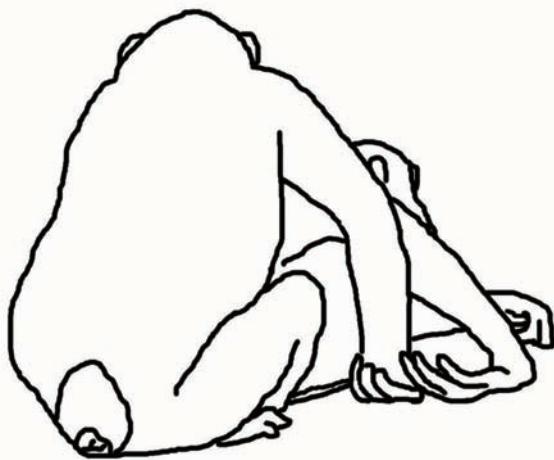


Figure 1. XP (left) is mounting EJ (right) dorsoventrally during the first bout (image traced from video footage).

of the interaction as social pretend play (Bjorklund & Pellegrini 2002).

METHODS

Well-habituated wild chimpanzees of the M group in Mahale Mountains National Park, Tanzania were studied from December 2013 to January 2014 (nine observation days and 60.2 observation hours in total) (see Nishida 2012 for details of the research site). I use *italics* to emphasize likely homosexual interactions. The number and symbol in parentheses after each individual's name represents his/her age and sex, respectively.

OBSERVATION

On January 3, 2014, at 13:47, I found XP (13♀), without signs of estrous, together with her infant daughter XP12 (1♀), and began to follow her. At 14:32, XP encountered a party consisting of four adult males (CT, AL, OR, and DW), an old female WX, and an adolescent female EJ (estimated 10♀). EJ showed minimal sexual swelling, exclusively in her perineal area. Most party members calmly engaged in grooming.

At 14:32:33, XP approached CT, and they kissed each other with open mouths. Then XP turned to EJ, embraced, and kissed her with an open mouth. At 14:33:23, EJ presented her genital region to XP with a crouching posture on the ground. *Sitting behind EJ, XP began to thrust her hips back and forth toward the genital region of EJ, and continued thrusting until 14:34:01* (Figure 1; see also Video 1: available online at [mahale.main.jp/PAN/21_1/21\(1\)_03.html](http://mahale.main.jp/PAN/21_1/21(1)_03.html)). During the mounting, XP's clitoris, or her genital region, faced toward the outside of the area between XP's hip and EJ's hip. Their facial expressions were not visible from my vantage point (Figure 1). No clear vocalization accompanied the interaction. At 14:34:08, they investigated each other's genital regions. EJ expressed play-face and XP reached out her arm in order to grasp EJ's arm. At 14:34:22, XP and EJ kissed with

open mouths, and then began wrestling and tickling each other. They continued playing until 14:35:08.

At 14:36:49, XP approached the grooming males. AL first groomed XP, and then XP was groomed by AL, while EJ groomed WX next to XP. XP stopped grooming at 14:37:03, and started tickling XP12 with DW. EJ stopped grooming at 14:38:00, and approached XP. At 14:38:52, XP stopped tickling XP12. *EJ presented her genital region to XP in a crouching posture on the ground at 14:39:03, and XP touched EJ's genital region with her right hand. She then sat and mounted EJ at 14:39:06, and thrust her hips subtly until 14:39:09* (Figure 2). Then, XP began grooming EJ's back. After XP stopped grooming at 14:39:16, EJ walked away and started grooming WX. DW and XP began tickling each other, and they continued in social play with XP12 until 14:44:30. I observed XP until I lost her at 15:06, and then I observed EJ until 16:00. Neither of them mated with any males.

I asked several Mahale researchers whether they had observed similar interactions under similar circumstances. No researchers had made such observations previously.

DISCUSSION

This observation included two homosexual bouts, which lasted for 38 and 3 seconds, respectively. EJ's presenting, and XP's mounting that followed, were homosexual behaviors according to Vasey & Sommer's (2006) definition, even if their genital regions did not make contact.

According to Burghardt (2005), activities are recognized as play behaviors when they fulfill the following five criteria: (1) incompletely functional, (2) voluntary,

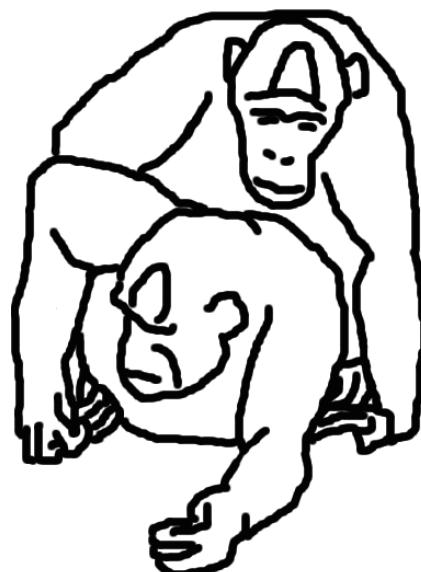


Figure 2. XP (back) is mounting EJ (front) dorsoventrally during the second bout (image traced from video footage).

(3) different structurally or temporally from the related serious behavior system, (4) expressed repeatedly, and (5) initiated in benign situations. The case reported here appears to fulfill these criteria. (1') The direct function of the observed homosexual interaction is unclear, even though some hypotheses have been suggested to explain the biological function of homosexual interactions between female bonobos (Fruth & Hohmann 2006). In addition, if the behavior had a direct function—which is unlikely—many other individuals certainly would have performed the behavior. (2') EJ presented her genital region to XP, and XP mounted EJ independent of any external factors, as the interactions were observed in rather calm situation. (3') The ethological pattern of the interactions was different from heterosexual interactions. For example, the first case lasted substantially longer (38 seconds) than typical heterosexual copulations, which last for an average of 7.1 seconds (range 2–13) in the wild (Nishida 1997), and 6.7 seconds (range 1–30) in captivity (Anestis 2004). (4') Two bouts of homosexual interactions were observed; thus, the behavior might have been repetitive, at least between XP and EJ. (5') Because these two bouts were performed directly after encountering and kissing each other, and socially playing or grooming, respectively, their contexts were considered calm and benign. Considering these five factors, it is reasonable to regard the homosexual interaction between XP and EJ as a pattern of social play, even though they did not demonstrate clear signs of play, such as play-face or play-pant. This interpretation is not contradictory to the fact that they began tickling and wrestling play directly after these interactions.

During these interactions, XP and EJ took the roles of male and female, respectively, as they occur in normal heterosexual interactions. Homosexual interactions between female bonobos, which normally involve their clitoris with lateral movements (Fruth & Hohmann 2006), could impart sexual pleasure. However, there was no evidence that XP and EJ reached orgasm, as they did not show any distinct facial expressions or vocalizations, and their sexual organs did not touch during the homosexual interactions due to their body postures. This suggests that they might have synchronized their movements only to “pretend as though” they were interacting heterosexually. Pretense can be recognized if a subject intentionally performs an idea that he/she knows to be a fiction, and controls the action (Mitchell 2007). Although no evidence thus far has confirmed social pretend play among play partners in wild non-human animals (Tomasello & Call 1997; Bjorklund & Pellegrini 2002), the present observation might be interpreted as a rare case of social pretend play with a division of roles.

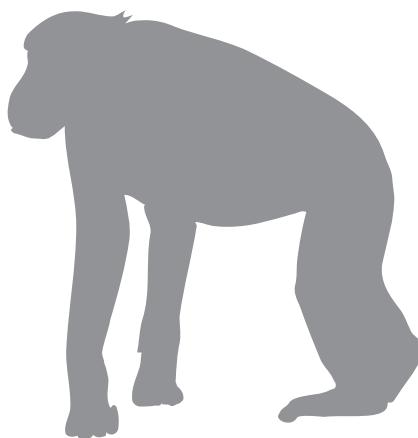
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