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Well Digging by Semliki Chimpanzees: New Data on Laterality and Possible Significance of Hydrology

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INTRODUCTION

The wild chimpanzees (*Pan troglodytes schweinfurthii*) of Toro-Semliki Wildlife Reserve, Uganda, are the only population of wild apes yet reported to dig wells for drinking water¹. They dig holes by hand in sandy riverbeds, then drink the water collected there by mouth or with ‘sponges’ made of leaves. We previously reported that the excavated tailings of this digging were often ‘bilobed’ in distribution on the substrate, that is, clearly divided into separate piles of sand to the left and right sides of the hole (McGrew *et al.* 2007). Because these piles were symmetrical in volume, we inferred that the chimpanzees were manually ambilateral, that is, that they did not favour one hand or the other in digging. That is, we inferred that had their digging been right-biased, then the rightside pile of sand would have been bigger.

However, our first report was no more than a pilot study, as it was done with only 2 days (July) of intensive etho-archaeological data collection over less than 1 km of riverbed, only in the dry season. Furthermore, it was done with only a single measure, ‘volume’. Here we report a longer study done over 6 months (May–Nov.) over more than 5 km of riverbed, done in both wet and dry seasons. The aim of the follow-up study was to replicate and extend the pilot study’s findings, but in the process several unexpected factors were revealed, chiefly hydrological ones.

In the first study in 2006, flow of surface water in the bed of the Mugiri River had ceased, leaving only scattered, stagnant pools. In some places, the sandy substrate was still moist, but in others it was dry. In the second study in 2008, surface water flow never ceased, though it varied in depth and volume, and the sand in the riverbed was always moist. Thus, environmental affordance of drinking water for the chimpanzees showed marked inter-annual variation.

With regard to laterality, we expected (as in the pilot study) that if the chimpanzees were manually biased at population-level to one side or another, then overall either left or right piles of tailings (lobes) would be larger. If there was no bias in the pooled data, then we expected no difference in any left- versus right-side measurements.





Figure 1. Dry Mugiri riverbed in 2006.

METHODS

Full details of the study site and methods are given elsewhere (Hunt 2000; Hunt & McGrew 2002).

We found 121 wells, but 67 were either too disturbed by trampling to provide data or had a single, central tailing of excavated sand, so they could not provide data on laterality. For the remaining 54 wells that were bi-lobed (that is, had distinct left and right tailings), we recorded by tape measure (cm) the following variables: well length, width and depth; length, width and depth of water in well (if present); mean distance to nearest running water; mean distance to nearest well (if present within 5 m); presence/absence of leaf sponges. For each lobe, we recorded: length, wide, height (which multiplied gave



Figure 3. Measurement of water depth in well containing leaf 'sponge'.



Figure 2. Mugiri riverbed in 2008. Two researchers examine well on sandbar, with flowing water behind.

volume); weight (nearest 100 g, by spring balance). All variables except weight were for replication of 2006 data. Note that no data could be assigned to individuals, so data were pooled, which is usual practice for artefacts in archaeology.

RESULTS

Despite intensive searching and monitoring over a 5-fold longer distance of riverbed and over a 6-fold longer period in 2008, we found wells at a much lower rate and had no direct observations of well digging. Thus, the study remained archaeological, that is, based on indirect evidence.

Table 1 compares left vs. right lobes of bi-lobed tailings left at wells. As in 2006, there was no difference in 2008 in volume between them. Similarly, the new variable, weight, also showed no difference between left vs. right. Table 2 shows the extent of contrast between volumes of left and right lobes, that is, the ratio of R/L when right lobes were bigger vs. L/R when left lobes were bigger. In both 2006 and 2008, there was no difference between these ratios.

Table 1. Left vs. right 'lobes' of excavated sand tailings of wells compared by volume for two years; weight of lobed tailings only for 2008.

Year	N of wells	Mean volume (cm ³)			Mean weight (g)		
		L lobe	R lobe	<i>p</i>	L lobe	R lobe	<i>p</i>
2006	25	10,679	11,759	NS	NA	NA	NA
2008	54	7,030	5,854	NS	2,295	2,128	NS

L vs. R = Sign Test, two-tailed, NS = not significant; NA = not available

Table 2. Extent to which volumes of left vs. right tailings (lobes) (R/L, L/R) differ, for two years.

Year	N of wells	Dominant Lobe			
		Left		Right	
		Mean L/R	<i>p</i>	Mean R/L	<i>p</i>
2006	25	1.92	NS	2.22	NS
		(<i>n</i> =31)		(<i>n</i> =23)	
2008	54	2.00	NS	1.68	NS

L vs. R: Mann-Whitney U, two-tailed, NS = not significant

Table 3. Presence or absence of leaf-sponge tools at well, comparing two years.

Year	Well		Total
	Tool	No Tool	
2006	11	80	91
2008	1	120	121

Chi-squared test, two-tailed, $p < 0.01$

However, there were differences between years: Table 1 shows that wells were smaller in 2008: Volume of both left and right lobes was less. Table 3 shows that in 2008, only one leaf sponge tool was found at 121 wells, while in 2006, one or more sponge tools were found on average at every ninth well.

DISCUSSION

The symmetry between left and right lobes was replicated across study years, adding more data to the long list of studies that have failed to find handedness in wild chimpanzees (e.g. Marchant & McGrew 2013).

However, the unexpected inter-annual differences found require explanation. Overall rainfall seems not to suffice: Table 4 compares monthly rainfall totals over the study period in 2008 with average totals for a previous 10-yr period (1997–2006). Overall, 2008 was not an atypical year, although July was very wet (180 mm) and August very dry (50 mm). There was no correlation between

Table 4. Relationship between rainfall (mm) and abundance of wells: Month-by-month comparison of 2008 versus 1997-2006 (median).

Year(s)	Rainfall (mm)							Total
	May	June	July	Aug	Sep	Oct	Nov	
1997-2006	164	55	73	141	94	149	168	844
2008	(73)	98	180	50	86	210	(182)	879
Wells found 2008	0	29	25	48	19	0	0	121

Spearman's ρ , $r_s = -0.46$, two-tailed, NS

() = extrapolated figure based on partial data only

monthly rainfall and abundance of wells.

Instead, the contrast may reflect hydrological differences, that is, the level of the water table in the riverbed. A high water table allows for shallower wells and so, less sand needs to be removed, while a low water table requires deeper wells and the removal of more sand. Similarly, water can be drunk directly with the lips from a shallow well, while sponge use facilitates drinking from a deeper well.

Such hydrological factors rarely, if ever, have been addressed in field studies of wild chimpanzees, but they may be crucial for explaining the presence or absence of potable drinking water in hot, dry and open habitats, especially in the dry season. Further study is needed.

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Figure 4. Leaf 'sponges' for extracting water from wells. Top row: Intact leaves plucked from source. Middle row: Processed leaves with softer tissue removed and used but stiff veins discarded. Bottom row: Used sponges.

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Notes

1. Another population of chimpanzee (*Pan troglodytes verus*) in southeastern Senegal has been reported to dig wells (Galat-Luong & Galat 2000; Galat-Luong et al. 2009). The authors reported that apes used tools to dig their wells, but baboons as well as chimpanzees were said to dig wells, and no criteria were presented for distinguishing between the two species' wells. The first report is an abstract, and the second was published in a non-peer-reviewed journal. Neither presented any systematic or quantitative data, nor observations of behaviour, so these claims must be taken as tentative until documentation is provided.

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adult female chimpanzee in the Bossou community.

METHODS

Behavioral observations were conducted at Bossou, one of the long-term research sites for chimpanzees located at the south-east corner of the Republic of Guinea, West Africa (Matsuzawa et al. 2011). The core area used by Bossou chimpanzees includes approximately 6 km², dominated by primary and secondary forest and surrounded by cultivated or abandoned fields and shrub forest. Consumption of the wild bird was observed by LY and BZ, who recorded all behavioral occurrences during the event *ad libitum*.

OBSERVATION

On October 30, 2012, at 7:39 AM, we (LY and BZ) observed four adult chimpanzees (JJ, TA, FF, and Jr) in the forest. At 7:47 AM, three adult male chimpanzees (JJ, TA, and FF) started to move. However an adult female chimpanzee Jr (estimated to be 54 years old) remained. For approximately ten minutes, Jr showed no movement. At 7:57 AM, shrubs began to rustle. We heard a typical call of coucal (a bird belongs to cuckoo family) from a nearby bush. The call consists of a series of 'hoos' which at first increase in rate and volume and die away at the end (Serle et al. 1990). A few seconds later, Jr suddenly moved toward the bush. We saw Jr capturing two nestlings at once from a nest that had been constructed in the bush and located ca. 2 meters above the ground. Jr walked a few steps away holding the two nestlings one in each hand and sat on the ground. Jr started to take a bite of the nestling in her left-hand. Then Jr put the remainder of the nestling on the ground and consumed a few leaves from a nearby liana. We (BZ and TM) later identified the leaves as *Clerodendrum silvanum*. This liana is characterized by its needle-like spines that are derived from young stems and petioles but not on epidermis (Hawthorne & Jongkind 2006). For the next few minutes, the nestling and leaves were consumed in an alternating manner. Only the left-hand was used during consumption of both items, while the right-hand continued to hold the other nestling. At 8:07 AM, Jr stopped eating and put what remained of the consumed nestling on the ground. Jr stood up bipedally, moved a few steps and started slapping the other nestling on the ground. The nestling emitted some vocalizations when it hit on the ground. In response, Jr released the nestling from her hand and stepped back. Soon, Jr took the nestling again and continued to slap it on the ground. After several cycles of slapping and stepping away from the nestling, Jr picked the nestling up and moved out of sight.

At 9:09 AM, after we lost track of Jr, we returned to the bush and discovered a bird carcass on the ground amid scattered leaves that had been consumed (see Figure 1). We assumed this carcass was the first nestling that Jr consumed because it lacked some body parts; its head and legs were missing from the carcass while most of the body trunk remained intact. We could not find any detached body parts in the vicinity of the carcass, suggesting that these had all been consumed by Jr. Because of the emitted call and the carcass, it was identified as the black-throated

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Newly Observed Bird Consumption by a Chimpanzee (*Pan troglodytes*) at Bossou, Guinea, West Africa

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INTRODUCTION

Bossou chimpanzees have shown low rates of meat consumption compared to other communities (Sugiyama & Koman 1987; Hockings et al. 2012). Therefore, the addition of data describing their prey repertoire is imperative for ecological and behavioral studies at this site. Here, we report a novel observation of bird consumption by one