

## **THE FORM AND FUNCTION OF CHIMPANZEE BUTTRESS DRUMMING**

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### **1. Introduction**

Human language is flexible. Speakers combine signal types (e.g., speech, gestures, facial expressions) to adjust the meaning of their messages. Signal combination is also present in non-human apes, but the functions of multi-signal combinations are still unclear (see Genty et al., 2014; Hobaiter et al., 2017; Wilke et al., 2017). Buttress drumming is a non-vocal acoustic signal often combined with pant-hoots, the species-typical long-distance vocalisation (Arcadi et al., 1998; Babiszewska et al., 2015). Chimpanzees produce drumming bouts by hitting the buttress roots of trees, generating low-frequency sounds that can be heard at over one kilometre (Arcadi et al., 1998). To understand why chimpanzees drum during pant-hoots, we investigated whether individual differences exist in the acoustic structure and in the timing within the pant-hoot of drumming bouts produced by adult male chimpanzees in different contexts and whether individual, contextual, and social factors impact their use of drumming.

### **2. Methods**

Data were collected June-July 2019 and January-March 2020 in the Waibira chimpanzee community of the Budongo Forest Reserve, Uganda. During focal follows we noted the behavioural context of the focal individual and communication events produced while they were on the ground including a pant-hoot and/or drumming. We marked the identity of other individuals near the focal, representing the “party composition”, and calculated the preferred social partners of each focal (following Babiszewska et al., 2015). Drumming events by any adult male were filmed and recorded *ad libitum*.

A ‘Drumming bout’ was defined as a series of beats produced by hitting the buttress roots of one tree with hands and/or feet (Arcadi & Wallauer, 2013). We coded five measures of acoustic structure for analysis (number of beats; bout duration; mean inter-beat duration; shortest inter-beat interval; longest inter-beat interval) and marked the start and end point of the drumming bout during the pant-hoot (Arcadi et al., 1998; Fedurek et al., 2016).

### **3. Results**

We found individual differences in the acoustic structure of drumming bouts produced during traveling ( $n=105$ ; DFA1:  $p<0.001$ ) and in their timing during the pant-hoot. In contrast, we found no individual differences in the acoustic structure of drumming bouts produced by the same individuals during displays ( $n=36$ ; DFA2:  $p=0.589$ ). Pant-hoot drumming combinations were mainly present during traveling while virtually absent during displays. Chimpanzees drummed most frequently in the context of traveling and drummed less frequently as their party size increased. We found no effect of the social composition of the party on the use of drumming.

### **4. Discussion**

Encoding of individual identity and increased use while traveling and when in smaller parties suggest that drumming may be incorporated in pant-hoots during traveling to facilitate chimpanzee fission-fusion spatial dynamics, specifically to join other individuals. In addition, absence of individual differences in display drumming suggests that chimpanzees can choose when to encode signaller identity in drumming “signatures”, altering the function of this signal across social and behavioural contexts. By exploring the use of pant-hoot drumming this study helps elucidate the functions of multi-signal combinations in non-human apes, contributing to our understanding of the evolutionary origins of the flexibility central to human language.

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