



**HAL**  
open science

## Arboreal bipedalism in captive chimpanzees: new experimental setup and initial results

Victoria A Lockwood, François Druelle, Mathieu Domalain, Alicia Blasi-Toccaceli, Jean Pascal Guéry, Guillaume Daver

### ► To cite this version:

Victoria A Lockwood, François Druelle, Mathieu Domalain, Alicia Blasi-Toccaceli, Jean Pascal Guéry, et al.. Arboreal bipedalism in captive chimpanzees: new experimental setup and initial results. European Society for the study of Human Evolution, Sep 2024, Zagreb, Croatia. 10.48738/2024.iss2.1209 . hal-04954458

**HAL Id: hal-04954458**

**<https://hal.science/hal-04954458v1>**

Submitted on 18 Feb 2025

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

Podium Presentation, Session 9, Saturday 9:00–10:40

## Arboreal bipedalism in captive chimpanzees: new experimental setup and initial results

Victoria A. Lockwood<sup>1</sup>, François Druelle<sup>2,3,4</sup>, Mathieu Domalain<sup>5</sup>, Alicia Blasi-Toccaceli<sup>1,6</sup>, Jean Pascal Guéry<sup>7</sup>, Guillaume Daver<sup>1</sup>

1 - PALEVOPRIM: Laboratoire de Paléontologie, Evolution, Paléocosystèmes et Paléoprimatologie, Université de Poitiers, CNRS, Poitiers, France · 2 - Histoire Naturelle de l'Homme Préhistorique, UMR 7194, CNRS-MNHN-UPVD, Paris, France · 3 - Primatology Station of the CNRS, UAR 846, Rousset, France · 4 - Functional Morphology Laboratory, University of Antwerp, Campus Drie Eiken (Building D), Antwerp, Belgium · 5 - Institut Pprime, Université de Poitiers, CNRS UPR 3346, France · 6 - Department of Anatomy, Midwestern University, Glendale, AZ, USA · 7 - Zoological Park La Vallée des Singes, Romagne, France

Questions on bipedalism and its origins form a cornerstone of the study of human evolution. Arboreal bipedal locomotion and posture have been suggested as a key component of the evolution of hominin bipedalism [1-5]. Given their close phylogenetic relationship with modern humans, chimpanzees (*Pan troglodytes*), are a study species of particular interest for investigating hominin locomotor evolution. However, whilst the latter have been observed to engage in arboreal bipedal behaviors there are limited gait and biomechanical data on these behaviors for chimpanzees in comparison to terrestrial bipedalism. Observations of arboreal bipedal locomotion in free ranging primates are complicated by visibility issues and the rarity of arboreal bipedalism. We developed an experimental set up that permits consistent observations of arboreal bipedalism in captive hominoids and the collection of data for gait and kinematic analyses of chimpanzee arboreal bipedalism in addition to hand and foot contact information. Here we present the experimental set up and an overview of the observed variation within arboreal bipedal locomotion alongside initial hand contact results. A simulated arboreal foraging scenario using PVC tubes dispensing a high value food reward was presented to the chimpanzee community (n=6 [adults, 3 females, 3 males]) at the zoological park of La Vallée des Singes, Romagne, France. The chimpanzees' voluntarily engagement with the equipment was recorded via five synchronized GoPro cameras (n=60 locomotor observations). Individual ID, specific variation of arboreal bipedal locomotion and postures, and hand contact data were extracted. Multiple distinct variations of arboreal bipedal locomotion were observed: forward facing, and sideways steps. In forward facing arboreal bipedalism the median plane of the body is positioned facing the direction of travel and the foot of the leading hindlimb is placed directly in front of the foot of the trailing hindlimb. In sideways step arboreal bipedalism, the median plane of the body is perpendicular to the direction of travel and the feet are positioned next to each other but do not cross over each other during the step. Sliding, using a combination of bipedal posture with forelimb suspension, was observed in one male only. The frequency of use of each of these styles varied between individuals. The males engaged with the experimental setup at the lowest frequency, followed by the older female, and then the younger females. Hand contacts between the first and final bipedal postures in bipedal locomotor sequences (n=55 sequences) were used to calculate a handedness index for walnut and support contacts. Manipulating the walnut along the PVC tube had a significant right-hand preference ( $z=-4.86$ ,  $p<0.001$ ,  $r=0.675$ ), whereas there was a significant left-hand preference for support contacts ( $z=-4.61$ ,  $p<0.001$ ,  $r=-0.639$ ). Overall, these initial results highlight the wide range of variation encompassed by the locomotion category 'arboreal bipedalism' and suggest that potential morphological correlates for distinct variations of arboreal bipedalism should be investigated in greater detail. Forthcoming gait parameter and kinematic data will help discriminate the biomechanical contexts of the observed variation in bipedal locomotion. The behavioral variation documented by this pilot study provides a new facet through which to assess the bipedal capabilities of the earliest hominins.

We would like to thank the following people for facilitating the study of the chimpanzees from La Vallée des Singes: Pierre Brandibas and all the caregivers for the chimpanzees, F. Guy, J.R. Boisserie, O. Chavasseau, and G. Merceron, as well as the University of Poitiers. Funding was provided by the Région Nouvelle Aquitaine (AAPR 2020-2020-8624210), the International Research Network 'Bipedal Equilibrium' (CNRS-INEE GDRI0870) and the ANR HOMTECH (ANR-17-CE27-0005-02).

References: [1] Stamos, P.A., Alemseged, Z., 2023. Hominin locomotion and evolution in the Late Miocene to Late Pliocene. *Journal of Human Evolution*. 178, 103332. [2] Daver, G., Guy, F., Mackaye, H.T., Likius, A., Boisserie, J.-R., Moussa, A., Pallas, L., Vignaud, P., Clarisse, N.D., 2022. Postcranial evidence of late Miocene hominin bipedalism in Chad. *Nature*. 609, 94–100. [3] Lovejoy, C.O., Suwa, G., Spurluck, L., Asfaw, B., White, T.D., 2009. The pelvis and femur of *Ardipithecus ramidus*: The emergence of upright walking. *Science*. 326, 71. [4] Richmond, B.G., Jungers, W.L., 2008. *Orrorin tugenensis* femoral morphology and the evolution of hominin bipedalism. *Science*. 319, 1662–1665. [5] Thorpe, S.K.S., Holder, R.L., Crompton, R.H., 2007. Origin of human bipedalism as an adaptation for locomotion on flexible branches. *Science*. 316, 1328–1331.