



**HAL**  
open science

# Investigating extant non-human primates to infer fossil primate manual abilities: An interdisciplinary approach utilizing behaviour, morphology and modelling evidence

Ameline Bardo, Laurent Vigouroux, Raphaël Cornette, Emmanuelle Poydebat

## ► To cite this version:

Ameline Bardo, Laurent Vigouroux, Raphaël Cornette, Emmanuelle Poydebat. Investigating extant non-human primates to infer fossil primate manual abilities: An interdisciplinary approach utilizing behaviour, morphology and modelling evidence. XVIII<sup>e</sup> Union International des Sciences Préhistoriques et Protohistoriques (UISPP) World Congress, Jun 2018, PARIS, France. hal-03970534

**HAL Id: hal-03970534**

**<https://hal.science/hal-03970534>**

Submitted on 2 Feb 2023

**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.

# Investigating extant non-human primates to infer fossil primate manual abilities: An interdisciplinary approach utilizing behaviour, morphology and modelling evidence

Ameline Bardo <sup>\*†</sup> <sup>1</sup>, Laurent Vigouroux <sup>2</sup>, Raphaël Cornette <sup>3</sup>,  
Emmanuelle Pouydebat <sup>4</sup>

<sup>1</sup> Skeletal Biology Research Centre, School of Anthropology and Conservation, University of Kent – Canterbury, Kent, CT2 7NR, United Kingdom, United Kingdom

<sup>2</sup> Institute of Movement Sciences (CNRS UMR 7287) – Université Aix-Marseille – Marseille, France

<sup>3</sup> Institut de Systématique, Evolution, Biodiversité (CNRS/MNHN/UPMC/EPHE, ISYEB) – CNRS : UMR7205 – France

<sup>4</sup> Department of Adaptations du vivant, UMR 7179, Mécanismes adaptatifs, des organismes aux communautés (CNRS-MNHN, MECADEV) – UMR 7179 – Pavillon d’anatomie comparée, 55 rue Buffon, case postale 55, 75231 Paris cedex 5., France

Humans are considered to have unique manual abilities in the animal kingdom. However, we still do not know what the extent of manual abilities in primates is, nor how they evolved. What makes humans unique? The present study investigates the manipulative abilities of Hominids, using an interdisciplinary framework combining behavioural, morphological, functional, and biomechanical approaches. Behavioural strategies were quantified across captive great apes and humans during the same complex tool use task. A three-dimensional geometric morphometric (3DGM) approach was also used to investigate surface shape variation and co-variation at the base of the thumb. This was combined with a musculo-skeletal model to better interpret the behavioural results and to test the putative biomechanical constraints imposed by Hominid hand proportions during tool use. The behavioural and functional results demonstrate that each species uses different techniques. More complex manual abilities, such as in-hand movements, were observed in African great apes and humans to the exclusion of Pongo. However, humans show distinct manual dexterity and perform faster the task than great apes. The different behavioural demands of each species habitat may explain this variability, as well as their concurrent variability in manual morphology. Results of 3DGM show that shape variability at the base of the thumb seems to be linked with the in-hand movements used by each species. Results of the musculo-skeletal model show that certain grips are more challenging for some species, particularly orangutans, such that they require stronger muscle forces to perform these grips in a given range of motion. This integrative approach clearly shows that the different manipulative abilities of Hominids cannot simply be a consequence of the different thumb morphologies but also of the different mechanical constraints related to the overall hand proportions. These results highlight and discuss the difficulties of inferring manual abilities in fossil taxa from morphology, without

---

\*Speaker

†Corresponding author: abardo@mnhn.fr

taking into account the overall morphology of the hand and its possible link with biomechanical constraints.

**Keywords:** Hominids, tool use, grips techniques, hand, manipulation