
To the Editorial Board of *Nature Ecology & Evolution*

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On the 2021-12-14,

Dear Dr. Vera Domingues,

We hereby submit our manuscript entitled “**Species sympatry shapes brain size evolution in Primates**”, by Benjamin Robira, and Benoît Perez-Lamarque, for consideration as a Research Article to *Nature Ecology & Evolution*.

The road to understanding the evolutionary history of cognition is still little paved. Currently formulated theories generally oppose social and ecological drivers of cognition, and prioritise direct or indirect interactions with conspecifics. Yet, space is also shared with other species with similar ecological niches. Thus, it is likely that cognate species that compete for food are likely to affect the social and ecological environment a species evolves in too. This should therefore loop onto the selective pressures that apply to cognition. This facet remained unexplored.

To help fill this gap, we perform a global-scale analysis to investigate the role of sympatry in shaping the size of different brain areas, and shaping their evolutionary success. In particular, we focus on frugivorous primates because the consumption of fruits is highly tightened to advanced cognitive skills. Using recently developed phylogenetic models accounting for species sympatry or not, we retrace the evolution of the size of brain areas related to foraging or not. We also correlate brain sizes, species diversification rates, and levels of sympatry.

We show that the evolutionary history of brain areas associated with foraging tasks is more accurately described by models considering sympatry. In particular, sympatry negatively affects their relative size. We additionally show that, even if these brain sizes do not directly impact primate diversification, this latter slows down when sympatry increases. Altogether, these findings suggest that sympatry is associated with a positive selection for smaller brains. We speculate that this is due to an over-complexification of the environment, which makes cognition not advantageous anymore for sympatric species.

This study enlarges our understanding of the effect of space use and species distribution in animal cognition. It shows unprecedented evidence of the direct and/or indirect effects of interspecific competition on cognition evolution, questioning proximate mechanisms at play. We strongly think that this stands as an important complementary piece of global analyses that were already published in your journal. We believe it will be of interest to empiricists and theoreticians from ecological and evolutionary fields. On behalf of all authors, I certify that this is a completely novel contribution that has not been submitted elsewhere, and that all authors approved the manuscript and its submission to *Nature Ecology & Evolution*.

Benjamin Robira, on behalf of all authors.

