Self-domestication traits in vocal learning mammals

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Both vocal learning and the human self-domestication hypothesis have been posited as relevant phenotypes for explaining language emergence in our species. *Vocal learning* (VL; i.e., the ability to learn new vocalizations or modify existing ones based on auditory experience) is a prerequisite for human speech acquisition and development, potentially providing insights into the *biological* underpinnings of language (Jarvis, 2019; Vernes et al., 2021). Until now, VL traits have been observed in groups of birds (parrots, songbirds, and hummingbirds) and mammals (humans, bats, elephants, cetaceans, and pinnipeds) (Petkov & Jarvis, 2012), with limited evidence found in non-human primates like marmosets (Takahashi et al., 2017). *Self-domestication* (SD; i.e., selective pressures against aggression and in favor of prosociality that give rise to a set of cognitive, behavioral, and physiological traits collectively known as the domestication syndrome) was recently invoked to potentially provide insights into language evolution through a *cultural* mechanism (Hare, 2017; Thomas & Kirby, 2018; Benítez-Burraco & Progovac, 2020; Raviv & Kirby, 2023). To date, SD has only been found in a narrow set of species (humans, bonobos, elephants, and perhaps marmosets; Hare, 2017; Ghazanfar et al., 2020; Raviv et al., 2023).

Both VL and SD are associated with two relevant traits that have been linked to language emergence. Specifically, despite variability in VL capacities (Vernes et al., 2021), vocal learners possess an improved vocal ability to share information with others (Nowicki & Searcy, 2014), helping them to better modulate social interactions. Similarly, despite variability in SD traits (Sánchez-Villagra et al., 2016), domesticated species show reduced aggression and increased prosocial behaviors, supporting more complex community ties (Burkart et al., 2018; Raviv et al., 2019; Dunbar, 1993). Interestingly, some domesticated species also show increased vocal complexity compared to their wild conspecifics, including Bengalese finches (Okanoya, 2017) and certain mammals (cats: Nicastro, 2004; dogs: Feddersen-Petersen, 2000; foxes: Gogoleva et al., 2011; cavies: Monticelli & Ades, 2011). This increase in vocal complexity may be due to altered stress responses as animals become tame, consequently leading to changes in dopaminergic activity in neural circuits crucial for VL (O'Rourke et al., 2021).

Could there be a link between these phenotypes? For example, do VL species also show a large number of SD traits? Given the potential link between the two phenotypes, we predict that some characteristic domestication traits, such as increased social tolerance, will be found across vocal learners. Testing to what extent these two phenotypes may overlap can improve our understanding of human language evolution, and help identify which non-human animal models are most useful for comparative language evolution studies.

Here, we conducted an exploratory cross-species comparison of SD traits in vocal learners. We focused this study on six VL mammals (elephants, bats, dolphins, whales, seals, and marmosets), of which only elephants have been the subject of previous SD research (Raviv et al., 2023). We looked at more than 20 behavioral and biological SD traits derived from previous work (e.g., Shilton et al, 2020). Besides elephants, our analysis did not reveal clear *morphological* SD traits in our studied species. For example, we did not observe a morphological reduction in the size of the skull, face, and jaw, which is typical to domesticated species, likely due to ecological differences related to feeding and habitat preferences (e.g., terrestrial vs. aquatic). Nevertheless, preliminary results show that the most crucial *behavioral* traits of SD (i.e., prosociality, exploratory behavior, and play) are shared across the VL mammals we investigated. This finding underscores the idea that, when taken together, these traits may be linked to the evolution of language, possibly through a shared mechanism. In future work, we plan to extend our comparisons to birds and include a control species.

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