

ELEPHANTS AS A NEW ANIMAL MODEL FOR STUDYING THE EVOLUTION OF LANGUAGE AS A RESULT OF SELF- DOMESTICATION

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1. Self-domestication and the evolution of language

Humans are unique in their sophisticated culture and societal structures, their complex languages, and their extensive tool use. But why did humans, and no other animal, develop these sets of complex traits? According to a prominent theory which is gaining more and more attraction, namely, the Human Self-Domestication hypothesis (HSD), this unique set of traits may be the result of an evolutionary process of self-induced domestication, in which humans have evolved to be more cooperative and prosocial as a result of environmental pressures in the middle and late Paleolithic (Hare, 2017; Benítez-Burraco, Clay & Kempe, 2020). According to the HSD hypothesis, self-domestication has resulted in less aggressive individuals who were more prone to interact with others (e.g., with kins and in-group members, but also with strangers), leading to increased social contacts and community structure, as well as more sophisticated forms of explicit teaching, learning, and exploration. Crucially, these properties may have ultimately given rise to the specific niche that enabled many of humans' distinctive traits, including our sophisticated linguistic abilities. The potential explanatory link between self-domestication and language evolution is gaining momentum in the field, with HSD invoked to explain many of the biological and cognitive changes that underlie the process of the cultural evolution of language (Thomas & Kirby, 2018; Progovac & Benítez-Burraco, 2019), as well as many critical features of modern languages such as pragmatics and turn-taking (Benítez-Burraco, Ferretti & Progovac, 2021), child-directed speech (Benítez-Burraco & Kempe, 2018), grammar sophistication and innovation (Langley, Benítez-Burraco & Kempe, 2019), , and cross-linguistic variability (Benítez-Burraco, 2020; Benítez-Burraco & Progovac, 2020).

While HSD is a compelling theory, it is hard to test. Most notably, the only other species that has been argued to be self-domesticated besides humans is Bonobos (Hare et al, 2012; Hare 2017; Kovalskas et al., 2021), resulting in a very narrow scope for investigating this theory beyond the primate family.

2. Are Elephants also self-domesticated?

Our work poses the novel question of whether Elephants may have also undergone a process of self-domestication, similar to humans and bonbons. If true, Elephants may serve as a new animal model for studying the potential impact and triggers of a self-domestication, and specifically the cultural evolution of language. Since the most recent common ancestor of humans and Elephants is likely the most recent common ancestor of all placental mammals, comparing the process of self-domestication and its outcomes in these species can lead to important insights about convergent evolution beyond the primate taxa, and open the door for exciting new research and better understanding of this process and its implications to communicative complexity in the broad sense.

We first motivate our hypothesis of Elephants as a self-domesticated species with an extensive cross-species comparison of relevant cognitive, behavioral, and physiological similarities between Elephants and the two other species that have been put forth as self-domesticated (i.e., humans and bonobos). This cross-species comparison demonstrates that Elephants indeed exhibit many of the features associated with self-domestication, including reduced aggression, increased prosocial behavior, extended juvenile period, increased play behavior, socially regulated cortisol levels, and complex vocal behavior. With respect to linguistic abilities, Elephants rely on a rich multimodal communication system that includes an extensive repertoire of vocal, visual, tactile and chemical signals to mediate the intricate teamwork displayed by members of an Elephant family (Jacobson & Plotnik, 2020). Their vocal signals have been shown to encompass specific meanings and intents shared with other members of the herd (e.g., Kahl & Armstrong, 2000; Poole & Granli, 2003; Wierucka, Henley & Mumby, 2021), and it shows a degree of intra-specific variation within and between individuals and across different herds - which is seen as an important feature of human language (e.g., Evans & Levinson, 2009). Next, we present novel genetic evidence to support our proposal and expose the positive selection of candidate genes for domestication in African Elephants. These novel analyses provide empirical evidence for our hypothesis: they show that genes positively selected in African Elephants are enriched in pathways that are involved in domestication, and that several candidate genes associated with domestication have been positively selected in African Elephants. We also discuss several explanations for what may have triggered a self-domestication process in the Elephant lineage, and discuss the potential implications of our theory to the field of language evolution.

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