

# **LOCALLY RESTRICTED BEHAVIORS: IN SEARCH OF POTENTIAL GREAT APE CULTURE DEPENDENT TRAITS**

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## **1. Introduction**

Human culture is cumulative: behavioral traits are modified during the course of a generation and these modified traits are then successively copied by naïve individuals, which in turn modify the traits further (Boyd & Richerson, 1996). The main products of cumulative culture are culture dependent traits (Reindl, Apperly, Beck, & Tennie, 2017). Culture dependent traits are behavioral forms that rely on copying variants of social learning to be acquired, as due to the successive cumulation of modifications they have become too arbitrary, complex and/or opaque to be individually learned. The specifics of human languages (lexicon and gestural repertoire) are examples of culture dependent traits.

Humans are not the only species that possess culture. Other non-human animal species, including non-human great apes (henceforth apes), also have culture at least in a minimal sense (if general social learning has at least some influence on trait frequencies). However, the question remains of whether apes possess human-like culture. Whether or not apes possess cumulative culture is relevant in order to reconstruct the evolution of human culture based on the cognitive abilities of the last common ancestor (LCA) of hominins and apes.

Currently, there are two main hypotheses about the learning mechanisms underlying ape behavioral repertoires. The null hypothesis states that ape behavioral forms can be individually learned without the need to rely on copying variants of social learning (such as imitation; Tennie, Call, & Tomasello, 2009). According to this hypothesis, ape behaviors across domains are latent solutions forming latent repertoires (Tennie et al., 2009). The

alternative hypothesis states that at least some ape behavioral forms rely on copying variants of social learning to be acquired and can therefore not be individually learned (Whiten et al., 1999; Whiten et al., 2001). According to this latter hypothesis, apes could possess culture dependent traits (and by extension have cumulative culture). In order to test these hypotheses we applied a methodology adapted from Byrne (2007) that we named the Method of Local Restriction.

## **2. Methodology**

The Method of Local Restriction identifies locally restricted behaviors, which are present in one population (or connected population cluster) of an ape species and are performed by at least two individuals (to exclude idiosyncratic behaviors). Locally unique behaviors are a special type of locally restricted behaviors that are only present in one population of one species and absent in the other ape species. We focus on locally restricted behaviors because being only present in one population could indicate that only culturally connected individuals can acquire these forms (perhaps via copying). Applying the Method of Local Restriction we conducted an exhaustive literature search across behavioral domains (tool use, non-tool use foraging behaviors, gestures, vocalizations/sounds and environment-related behaviors) and species. As a result of this search and after consultation with experts, we have compiled a list of potential culture dependent traits in apes.

## **3. Results and Conclusion**

We have identified the staggering low number of seven locally unique behaviors across all domains and ape species. Among these behaviors, we found one vocalization ("harmonic uuh") and a sound ("grinding") produced by Sumatran orangutans. In general, our results support the null hypothesis that the vast majority of great ape behavioral forms, including gestures and vocalizations, are present in multiple unconnected great ape populations, meaning that there were multiple independent innovators who must have individually learned these forms. We therefore conclude that great ape behavioral forms (excluding for the time being locally unique behaviors) across domains can be acquired via individual learning and consequently constitute a latent repertoire that is shared to some degree among great ape species. Although our results show that a few great ape traits might be culture dependent, we also show that cultures mainly based on copying were not present in the LCA of humans and great apes and that cumulative culture evolved later in the hominin lineage.

#### **4. References**

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