

Form and function in the evolution of symbolic artifacts: A transmission chain study

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1. Introduction and Methods

Capacities for symbolic behavior—here understood in the broadest sense to include practices of decoration, marking of identity, and communication—are considered constitutive of the human species and permeate almost all aspects of contemporary human life (Deacon, 1998; Donald, 1991; Pagnotta, 2014). Yet, we still lack a detailed understanding of the mechanisms by which such capacities evolved during the Late Pleistocene. Intentional markings left on rock and bone surfaces are an important source of evidence, but these are often opaque with respect to their original meaning and function (Overmann & Coolidge, 2019). The engraved markings on ochre and ostrich eggshell from the Blombos Cave and the Diepkloof Rock Shelter, South Africa, date back to a prolonged period from 100.000 to 60.000 BP (Henshilwood et al., 2009; Texier et al., 2010). There have been heated controversies about the past function of the engravings, which have been proposed to form part of an aesthetic activity (Hodgson, 2014), an expression of group identity (Texier et al., 2013), or a medium of denotational communication (Henshilwood et al., 2009). Interestingly, the composition of engravings shows profound structural changes over time with early patterns consisting of simple parallel lines while later patterns become increasingly regular and ordered with oblique and hashtag-like intersecting lines (fig. 1).

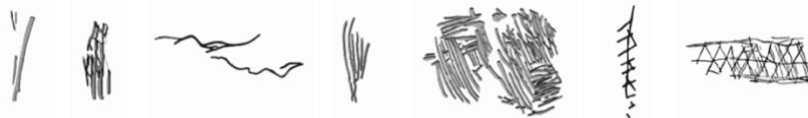


Figure 1. Examples of the Blombos ochre engravings dated to the period c. 100.000 - 70.000 BP, organized with older items to the left and younger to the right.

Here we used outlines of the Blombos and Diepkloof engravings and combined transmission chains and perceptual experiments to systematically examine whether markings evolve different cognitive implications contingent on their immersion in different contexts of use. First, we had 120 participants reproduce and transmit stimuli derived from the oldest engraved patterns at Blombos and Diepkloof over eight generations in three conditions, as part of either i) a decorative, ii) identity marking, or iii) communicative activity. We then used five perceptual experiments to examine the cognitive implications of changes accumulated in the markings over generations. Specifically, we examined whether markings became i) more salient to the human eye; ii) more likely to be recognized as purposefully made by another human; iii) easier to reproduce from memory; iv) easier to recognize as originating from a specific group; and v) more discriminable from each other. Based on Tylén et al (2020), we hypothesized that the markings produced under the different conditions of the transmission chains would show different profiles of change with implications for perception and cognition (see predictions in Table 1).

Table 1. Predicted direction of changes over generations

	<i>Saliency</i>	<i>Intentionality</i>	<i>Memorability</i>	<i>Style</i>	<i>Discriminability</i>
Decoration	increase	increase	no change	no change	no change
Group identity	increase	increase	increase	increase	no change
Communication	increase	increase	increase	no change	increase

2. Results and Discussion

Preliminary analyses indicate that markings produced within the contexts of different symbolic practices indeed evolve structural properties that differentially engage human cognitive processes (Fig. 2). And by comparing the condition-related profiles of change over generations to the evolution of the original Blombos and Diepkloof engravings, we demonstrate how we can inform inferences about their past symbolic function.

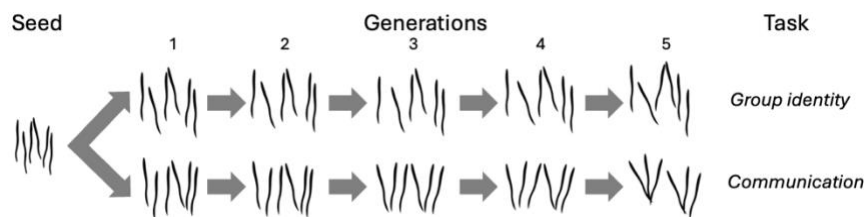


Figure 2. Examples of patterns produced by two independent transmission chains. The same initial seed stimulus accumulates different structural changes depending on the reproduction context.

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