

# Tool Use, Analogy and the Evolution of the Cognitive Foundations of Metaphor: An Archaeological and Comparative Perspective

Michael Pleyer<sup>1</sup>, Svetlana Kuleshova<sup>1,2</sup> & Elizabeth Qing Zhang<sup>3</sup>

<sup>1</sup>Nicolaus Copernicus University in Toruń, <sup>2</sup>Université Paris Nanterre, <sup>3</sup>Jiangsu Normal University  
pleyer@umk.pl, 503461@doktorant.umk.pl, zqelizabeth@gmail.com

**Keywords:** Language Evolution, Analogy, Tool Use, Metaphor, Archaeology, Comparative Cognition

Metaphor has been shown to be a central process in human language and cognition (Lakoff & Johnson 1980). What is more, metaphor has also been assigned an important functional role in the evolution of language both in diachronic change (Hopper & Traugott 2003), and the emergence of linguistic properties such as grammatical structure (Smith & Höfler 2015) and compositionality (Ellison & Reinöhl 2022). Uncovering the evolution of metaphor and the cognitive processes supporting it therefore presents an important part of explaining the evolution of human language and cognition.

In this talk we focus on one central process supporting metaphor, that of analogy. Analogy has been argued to be a central process underlying metaphor, as it represents the process of comparing a source and target domain in terms of potential correspondence relations among its constituent elements (Itkonen 2005). Here we present two sources of evidence to investigate the evolution of analogy and the cognitive foundations of metaphor: archaeological and comparative data.

From the perspective of archaeology, we can try to look for analogical abilities in archaeological artifacts. Although it falls within the realm of cognitive archaeology there are few examples of discussion of analogical capacities (de Beaune 2004, Osiurak & Reynaud 2020). Here, we propose a different way to look for analogical capacities in archaeological artifacts by considering the productional diversity (i.e. different ways to achieve the same goal) of an archaeological collection. Differences in chaînes opératoires leading to the same productional goal may indicate the presence of analogical capacities. We develop this methodology using the example of the Collection de la Pointe aux Oies, Wimeureux, France (Tuffreau 1971). In this collection, we find two types of core preparation for further knapping either by opening a striking platform with a preliminary flake or by searching for a core with a natural striking platform. Since the productional goal and the technical criteria of both types of striking platforms were identical, we can suppose analogical capacities for the population who produced these tools.

From the perspective of comparative cognition, analogical abilities have also been found in tool use. In birds, for example, New Caledonian crows use two types of tools—hooked-twigs and stepped-cut tools—to achieve the same goal—looking for food in living and dead wood (Hunt, 1996). The manufacture of the hooked tools includes multiple steps with variations of material and ways of manufacturing (Hunt & Gray, 2003). In nonhuman primates, wild chimpanzees use leaves and moss functioning as sponge to absorb water (Hobaiter et al., 2014), and hands and folding leaves as “containers” to drink water (Sousa, Biro & Matsuzawa, 2009). They also crack nuts with a hammer-like tool on an anvil. The selection of the toolkit depends on multidimensional features, such as weight, material, distance to nut and the anvil (Sirianni, Mundry & Boesch, 2015). These data suggest that nonhuman animals can use different methods to achieve the same productional goal in an analogical fashion.

In sum then, we demonstrate that archaeological and comparative data on tool use and analogy can shed light on the evolution of metaphor.

## References

- De Beaune, Sophie A. 2004. The invention of technology: prehistory and cognition. *Current Anthropology* 45(2). 139-162.
- Ellison, T. Mark., & Uta Reinöhl. 2022. Compositionality, metaphor, and the evolution of language. *International Journal of Primatology*. <https://doi.org/10.1007/s10764-022-00315-w>
- Hobaiter, Catherine, Timothée Poisot, Klaus Zuberbühler, William Hoppitt & Thibaud Gruber. 2014. Social network analysis shows direct evidence for social transmission of tool use in wild chimpanzees. *PLoS Biology* 12(9). <https://doi.org/10.1371/journal.pbio.1001960>
- Hopper, Paul J. & Elizabeth C. Traugott. 2003. *Grammaticalization*. Cambridge: Cambridge University Press.
- Hunt, Gavin R. 1996. Manufacture and use of hook-tools by New Caledonian crows. *Nature* 379(6562). 249-251.

- Hunt, Gavin R., & Russel D. Gray. 2003. Diversification and cumulative evolution in New Caledonian crow tool manufacture. *Proceedings of the Royal Society B: Biological Sciences* 270(1517). 867–874.
- Itkonen, Esa. 2005. *Analogy as structure and process: Approaches in linguistics, cognitive psychology and philosophy of science*. Amsterdam & Philadelphia: John Benjamins Publishing.
- Lakoff, George & Mark Johnson. 1980. *Metaphors We Live By*. University of Chicago Press.
- Osiurak, François & Emanuelle Reynaud. 2020. The elephant in the room: What matters cognitively in cumulative technological culture. *Behavioral and Brain Sciences* 43. e156.
- Sirianni, Giulia, Roger Mundry & Christophe Boesch. 2015. When to choose which tool: Multidimensional and conditional selection of nut-cracking hammers in wild chimpanzees. *Animal Behaviour* 100. 152–165.
- Smith, Andrew D. M. & Stefan H. Höfler, S. 2015. The pivotal role of metaphor in the evolution of human language. In Javier E. Díaz-Vera (ed.), *Metaphor and Metonymy across Time and Cultures: Perspectives on the Sociohistorical Linguistics of Figurative Language*, 123-139. Berlin: De Gruyter.
- Sousa, C., Biro, D., & Matsuzawa, T. (2009). Leaf-tool use for drinking water by wild chimpanzees (*Pan troglodytes*): Acquisition patterns and handedness. *Animal Cognition*, 12(1 SUPPL).
- Tuffreau, Alain. 1971. Quelques Observations sur le Paléolithique de la Pointe-aux-Oies à Wimereux (Pas-de-Calais). *Bulletin de la Société préhistorique française. Études et travaux* 68(2). 496-504.