



WORDS BONES GENES TOOLS

Tracking Linguistic, Cultural, and Biological Trajectories of the Human Past

Annual Symposium

Evolutionary Perspectives on Tool Manipulation and Gestural Communication

October 13th— 14th 2022

**Hybrid Event: Digital via Zoom and live in Neue Aula
University of Tübingen**

EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN



DFG

The DFG Center for Advanced Studies



Inaugurated in 2015, the DFG Center for Advanced Studies “Words, Bones, Genes, Tools: Tracking Linguistic, Cultural and Biological Trajectories of the Human Past” aims to help establish the theoretical foundations for a new cross-disciplinary field of bio-cultural coevolution by pushing the limits of cooperation between traditional disciplines. The center is therefore a forum for interdisciplinary discussion, bringing together scholars from relevant fields to exchange ideas and develop common research questions and methodological approaches. The University of Tübingen is particularly well positioned to host such a center, with a tradition of excellence in prehistorical and linguistic research. The center is funded by the German Research Foundation (DFG), which currently sponsors 25 Centers for Advanced Studies across Germany.

The University of Tübingen



The University of Tübingen, founded in 1477, looks back on rich academic traditions, yet is home to world-class institutions conducting state-of-the-art research in the Life Sciences, Humanities and Social Sciences. As one of the German government’s designated Universities of Excellence, with significant extra funding from the state and federal governments and a rising amount of third-party sponsorship, it has been able to boost top-level research and attract outstanding international researchers. The university comprises some 27.000 students, 450 professors, and more than 5.000 academic staff.

The German Research Foundation

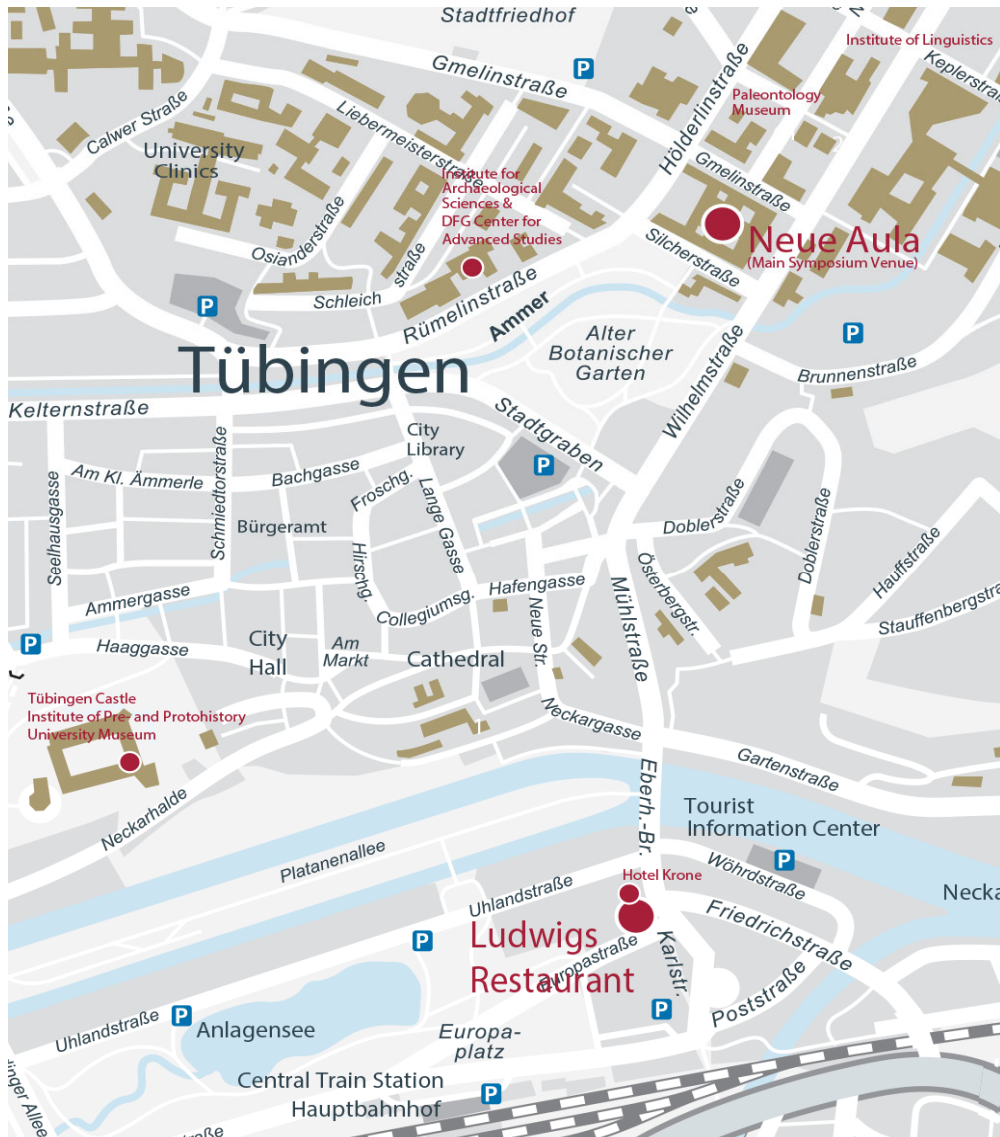


The German Research Foundation (Deutsche Forschungsgemeinschaft or DFG) is the central self-governing research funding organization in Germany. It serves all branches of science and the humanities by funding research projects at universities and other research institutions. The DFG promotes excellence and quality by selecting the best research projects on a competitive basis and actively encourages international research cooperation. It is particularly dedicated to the promotion of young researchers and to gender equality in science and academia. It also advises legislatures and government agencies on scientific matters. The DFG’s annual budget of about 2.5 billion euros is underwritten by Germany’s federal (67.1%) and state governments (32.7%), as well as the European Union and private donors.

Locations

Neue Aula, Geschwister Scholl Platz
Main symposium venue

Restaurant Ludwigs – Uhlandstraße 1
Dinner: Thursday 13th of October



Institute of Archaeological Sciences – Rümelinstraße 23

Institute of Linguistics – Wilhelmstraße 19

Schedule

THURSDAY, 13TH OCTOBER

9:30 Welcome & Introduction to the DFG Center, **Katerina Harvati** and **Gerhard Jäger**

Cognitive interactions between tool use and gesture: Part 1

Session chaired by Katerina Harvati

10:00 **Miri Mertner and Alexandros Karakostis**, University of Tübingen
An interdisciplinary perspective on the role of the hands in language evolution

10:30 **Brienna Bill-Eteson**, University of Tübingen
Biomechanics and cognitive correlations of hominin stone tool efficiency

11:00 - 11:30 **Coffee Break**

11:30 **Simona Affinito**, University of Tübingen
Exploring the evolutionary interplay between stone tool-use and communication: an EEG study

12:00 **Discussion**

12:30—14:00 **Lunch (and coffee)**

14:00 Group photo of people attending in person (in front of the “Neue Aula”)

Cognitive interactions between tool use and gesture: Part 2

Session chaired by Alexandros Karakostis

14:30 **Antoine Balzeau**, Muséum National d'Histoire Naturelle, Paris
How to improve our analyses and interpretations of paleoneurological data: The PaleoBRAIN project

15:00 **Ameline Bardo**, University of Kent
Evolution of tool use manipulation in primates: A multidisciplinary approach with behaviour, morphology and modelling

15:30 -16:00 **Coffee Break**

16:00 **Francois Osiurak**, Université Lumière Lyon
Cumulative technological culture as the cognitive scientist views it

16:30-17:00 **Discussion** (and closing for the day)

19:30 **Dinner at Restaurant Ludwigs**

FRIDAY, 14TH OCTOBER

The role of gesture in language evolution and interaction: Part 1

Session chaired by Gerhard Jäger

10:00 **Marlen Fröhlich**, University of Tübingen
Plasticity in great ape gesture and the origins of productivity in human language

10:30 **Bart Geurts**, Radboud University
Normativity, tools, and talk

11:00 -11:30 **Coffee Break**

11:30 **Ronald Planer**, University of Wollongong, University of Melbourne
The interactional engine at work in a tool-making niche

12:00 **Discussion**

12:30-14:00 **Lunch (and coffee)**

The role of gesture in language evolution and interaction: Part 2

Session chaired by Miri Mertner

14:00 **Pamela Perniss**, University of Cologne
Multimodality and its implications

14:30 **James Trujillo**, Max Planck Institute for Psycholinguistics
The role of visual signals in human communication: Perspectives from autistic and neurotypical individuals

15:00-15.30 **Coffee Break**

15:30 **Connie de Vos**, Tilburg University
The resilient properties of interaction

16:00 **Victoria Nyst**, Leiden University
What West African sign languages can tell us about language emergence

16:30-17:00 **Discussion**

17:00 **Closing Ceremony**



Abstracts

An interdisciplinary perspective on the role of the hands in language evolution

Miri Mertner^a and Alexandros Karakostis^b

^aDepartment of Linguistics, University of Tübingen, Germany

^bPalaeoanthropology, Institute for Archaeological Sciences,
University of Tübingen, Germany

In recent years, multimodality has increasingly come to be recognised as an intrinsic property of human communication, and one that was likely fundamental to the evolution of language. Along with this conceptualisation of gesture as an inextricable part of language, a renewed interest in the role of iconicity has taken place. Gestures allow for the iconic representation of a far greater number of referents in the visual modality, and thus they were once considered a kind of ‘universal language’ which was not subject to conventionalisation at all. Now, we have ample evidence that gestures are culturally specific, and that conventionalisation occurs to some degree at all levels of gestural behaviour. However, there are undeniable similarities which occur across unrelated linguistic communities. Such similarities suggest that, while gestures are highly diverse, there are factors which constrain that diversity. In this talk, we will explore some of the ways in which our understanding of the interplay of universality and diversity can be bolstered by an interdisciplinary approach. We will touch upon some of the cognitive and biomechanical aspects which may have shaped global similarities in gestural behaviour, focusing especially on the biomechanics of the hand and what the reconstruction of past manual activity can tell us about communicative gestures and tool use throughout hominin prehistory. We will then discuss some promising new directions in this field, including experimental and archaeological approaches focusing on tool use and gestural communication.

Abstracts



Biomechanics and cognitive correlations of hominin stone tool efficiency

Brienna Bill-Eteson

Palaeoanthropology, Institute for Archaeological Sciences,
University of Tübingen, Germany

Hominin stone tool use has a strong and continuous archaeological record dating back to 2.6 MYA. The technological advancement displayed in the lithic record is often inferred to have been key to the evolution of humans' complex and unique cognitive abilities, such as language, working memory, and social learning. This project develops a novel, multidisciplinary approach to analysing the biomechanics and cognitive activation during stone tool use to explore the evolving efficiency of the tool industries during the Lower Palaeolithic. We developed a tool use experiment performed by 25 individuals that represents a potential transitional period that is hypothesized to have greatly impacted hominin evolution using electroencephalography (EEG) and electromyography (EMG). This experiment compares percussive hammerstone nut cracking that is observed in wild chimpanzee communities to one of the oldest recorded stone tool industries, Oldowan flakes. This transition has been posed as being at the 'threshold' of human evolution and technological advancement, with Oldowan tools representing the first evidence of habitual precision grasping during tool use in hominins.



Abstracts

Exploring the evolutionary interplay between stone tool-use and communication: an EEG study

Simona Affinito

Palaeoanthropology, Institute for Archaeological Sciences,
University of Tübingen, Germany

The idea that language may have evolved from an already settled context related to manual praxis has a long history. A growing body of work suggests that tool use/making and language present structural and functional similarities that rely on common brain activation patterns, giving support to the hypothesis of a coevolution between tool use and language. Even though previous research has addressed the biomechanical and cognitive requirements for tool manipulation as well as its neural correlates with language communication, the interaction between these two has never been investigated together under real-time experimental conditions. Moreover, no experimental work to date has focused on the potential neural correlations between early stone tool use and gestural communication. Here we present an experimental study that aims to explore the neural patterns underlying early stone tool use-related communication by comparing different forms of basic communicative actions. The brain activation patterns of 25 participants were recorded in real-time conditions by using Electroencephalography (EEG) while performing two different communication tasks (gestural and vocal). These tasks involved the choice of cracking and cutting behaviours in response to a visual stimulus represented by a raw material. The experiment has been designed to isolate the planning and retrieving components of using a specific tool, and the action of communicating this to an external party. By doing so, this study seeks to contribute to creating a comprehensive framework for the existence of potential links between tool use, gestural communication and language.

Abstracts



How to improve our analyses and interpretations of paleoneurological data the PaleoBRAIN project

Antoine Balzeau

Muséum National d'Histoire Naturelle, Paris

Trying to understand the evolution of the human brain and the possible links with capacities and behaviors is an exciting, but particularly complex topic. The brain never fossilizes, leaving scientists with only the superficial imprints it creates on the inner surface of the skull, namely the endocast. Recent advances in neuroscience and ethology have shown how much our knowledge of the current human brain remains fragmented. In this context, we are developing a multidisciplinary project in paleoneurology. To do this, we will study for the first time the correlation between the shape of the brain and that of the endocast within a sample of present-day humans using MRI acquisitions, some of which with a specific sequence (ultrashort echo time, UTE) which allows the characterization of bone tissue. Comparison of morphometric data and anatomical traits between brain and endocast will be performed using state-of-the-art quantification methodologies and will include examination of brain asymmetry patterns to address functionally related traits. These data will be supplemented by behavioral analyzes on the same sample of volunteers. The objective is then to evaluate the anatomical characteristics of hominin fossils in order to better understand the morphology of their brain and to possibly discuss the behavioral implications of these results.



Abstracts

Evolution of tool use manipulation in primates: A multidisciplinary approach with behaviour, morphology and modelling

Ameline Bardo^{a,b}

a UMR 7194, CNRS, PaleoFED team, Département Homme et Environnement, Muséum national d'Histoire naturelle, Paris, France.

b Skeletal Biology Research Centre, School of Anthropology and Conservation, University of Kent, Canterbury, United Kingdom.

Modern human manipulative abilities are traditionally linked to specific morphological features of the hand, such as short fingers with broad finger tips, proximodistally-aligned radiocarpal joints, and a mobile and powerful thumb, all of which are considered beneficial for forceful precision grips, particularly between the palmar pads of the thumb and one or more fingers. This morphology and enhanced dexterity are linked to the evolution of increasingly complex tool technologies within the hominin clade, particularly stone tool-related behaviors. However, we still do not know what the extent of manual abilities in primates is, nor how they evolved. What makes humans unique? In my research, I investigate the evolution of manipulative abilities in Hominids, using an interdisciplinary framework combining behavioural, morphological, functional, and biomechanical approaches. I will present the different results of this integrative approach that clearly shows that the different manipulative abilities of Hominids cannot simply be a consequence of the different thumb morphologies but also of the different mechanical constraints related to the overall hand proportions. These results highlight and discuss the difficulties of inferring manual abilities in fossil taxa from morphology, without taking into account the overall morphology of the hand and its possible link with biomechanical constraints.

Abstracts



Cumulative technological culture as the cognitive scientist views it

François Osiurak

Laboratoire d'Étude des Mécanismes Cognitifs, Université de Lyon, France
Institut Universitaire de France, Paris, France

Cumulative technological culture refers to the increase in the efficiency and complexity of tools and techniques over generations, a phenomenon that could be restricted to humans. The dominant view (also called the cultural niche hypothesis) posits that cumulative technological culture emerges in humans because of our unique ability to learn from each other and not because of specific technical skills. More specifically, the dominant view assumes that (1) high-fidelity transmission plays a crucial role in cumulative technological culture, with the rationale that, when an innovation appears, it will quickly be lost if it cannot be faithfully transmitted to others and (2) high-fidelity transmission can emerge through a so-called high-fidelity copying ability. In other words, individuals can reproduce the tool-use actions performed by others without requiring understanding of how these technologies work, that is, without causal understanding. The cultural niche hypothesis has been mainly developed from evidence from anthropology, economics, and biology. Yet, it is also a cognitive view given the marked cognitive distinction drawn between high-fidelity copying and causal understanding. Surprisingly, this view is relatively silent on the cognitive origins of these abilities, and particularly on the copying ability. Yet, for a cognitive scientist, understanding how people copy the actions of others is not the end, but the beginning of the story. In this talk, I will discuss empirical findings from the cognitive science literature (e.g., experimental psychology, cognitive neuroscience, neuropsychology) that question the distinction between high-fidelity copying and causal understanding and, more particularly, the cognitive reality of the so-called high-fidelity copying ability. Instead, these findings suggest that causal understanding is strongly involved in the ability to reproduce tool-use actions performed by others and, more generally, in cumulative technological culture. As a result, the main assumptions of the dominant view are misleading, leading us to revisit the (neurocognitive) origin of cumulative technological culture.



Abstracts

Recent references

- Osiurak, F., Claidière, N., Bluet, A., Brogniart, J., Lasserre, S., Bonhoure, T., Di Rollo, L., Gorry, N., Polette, Y., Saude, A., Federico, G., Uomini, N., & Reynaud, E. (2022). Technical reasoning bolsters cumulative technological culture through convergent transformations. *Science Advances*, *8*, eabl7446.
- Osiurak, F., Lasserre, S., Arbanti, J., Brogniart, J., Bluet, A., Navarro, J., & Reynaud, E. (2021). Technical reasoning is important for cumulative technological culture. *Nature Human Behaviour*, *5*, 1643-1651.
- Osiurak, F., & Reynaud, E. (2020). The elephant in the room: What matters cognitively in cumulative technological culture. *Behavioral and Brain Sciences*, *43*, e156.

Abstracts



Plasticity in great ape gesture and the origins of productivity in human language

Marlen Fröhlich

Palaeoanthropology, Institute for Archaeological Sciences,
University of Tübingen, Germany

Human communication requires exceptional behavioural plasticity, given that effective language use relies on highly flexible adjustments to social context, interaction partner and ecological setting. Thus, whether nonhuman species can adjust their communicative behaviour in response to the immediate and developmental environment has critical implications for communicative innovativeness prior to the emergence of human language, with its unparalleled productivity. Here, we used a large comparative sample of wild and zoo-housed orang-utans of two species (*Pongo abelii*, *P. pygmaeus*) to assess wild-captive contrasts in two studies of communicative plasticity, focusing on (1) gestural repertoires (i.e. sets of gesture types) and (2) gestural redoings (i.e. repetition and elaboration of initial gestures after communicative failure). In the first study, we showed that repertoires on both the individual and population level are larger in captive versus wild settings, regardless of species, age class or sampling effort. In the more sociable Sumatran species, dominant use of signals towards single as opposed to multiple outcomes (i.e. functional specificity) was also higher in captive settings. In the second study, we identified wild-captive contrasts in gestural redoings in Borneans, but not in Sumatrans. Moreover, we found that effectiveness of elaboration in eliciting responses was higher in Sumatrans, especially the captive ones, whereas effectiveness of mere repetition was influenced by neither species nor setting.

We conclude that orang-utans exposed to more sociable and terrestrial conditions evince remarkable behavioural plasticity, in that they produce additional innate or innovated signals as well as more elaborate communicative repair strategies. Our findings also demonstrate that social tolerance, as a foundation for extended social interactions, plays a central role in the emergence of complex communicative exchanges in great apes. Overall, these studies suggest a latent capacity for innovativeness in orang-utans' communication systems, which is backed up by preliminary evidence for geographic variation in the use of vocalizations and gestures. A future large-scale project that systematically maps differences in repertoire and functional use across study sites may advance research on the precursors of productivity in unprecedented ways.



Abstracts

Normativity, tools, and talk

Bart Geurts

Radboud University, Netherlands

According to the standard view in evolutionary studies, the defining purpose of communication is to transmit information, and in connection with the evolution of language it is widely held that the transmitted information is about the source's beliefs, intentions, and other mental states. Both views are problematic, but fortunately there is an alternative, which highlights the importance of normativity: in our lineage social interactions have become thoroughly normative, and this holds in particular for our communicative exchanges. The evolution of language and human communication is part and parcel of the evolution of human sociality, which is all about dos and don'ts, rights and wrongs, commitments, permissions, and so on.

Within this general framework, I will discuss various ways in which the evolution of tool use and tool making may have related to the evolution of language and human communication, and I will argue that both were inextricably enmeshed with the evolution of normative behaviours.

Abstracts



The interactional engine at work in a tool-making niche

Ronald Planer

University of Wollongong, School of Liberal Arts

University of Melbourne, School of Languages and Linguistics

In a series of articles and a recent book, Steven Levinson has argued for a novel approach to the study of the evolution of human communication. The approach is targeted on what Levinson calls “the human interactional engine.” The interactional engine consists in a broad family of social-cognitive capacities, some of which are shared with other primates, and some of which are uniquely human, or at least uniquely developed in humans. Put briefly, the goal of this talk is to explore possible evolutionary connections among tool-manufacture and use, on the one hand, and human communication, on the other, from the perspective of Levinson’s interactional engine framework. In particular, my focus will be on three ideas developed by Levinson in this framework, namely: (i) the multi-modal nature of face-to-face human communication (for example, the incorporation of gesture and gaze); (ii) the role of (in many cases, exact) timing in human communication; and finally, (iii) the interactional origins of recursion in human communication (including, but not limited to, recursion at the sentence level). I shall propose that each of these ideas bear interesting and unobvious connections to tool-manufacture and use, suggesting some rich, co-evolutionary relationships in this domain that have as yet gone unnoticed or been underappreciated.



Abstracts

Multimodality and its implications

Pamela Perniss

University of Cologne , Germany

In the language sciences, understanding language remains foremost the challenge of describing a rule-governed system of linguistic symbols that denote by convention alone. Recently, there has been growing recognition that in order to further our understanding of language, we must focus our attention on language use in face-to-face contexts of communicative interaction. Once we take such a perspective, language appears as a multimodal phenomenon, with widespread use of iconicity and indexicality and across different visual and vocal channels of expression. In this talk, I offer examples of how and why meaning making in language is fundamentally multimodal and discuss the implications of multimodality, and in particular of iconicity, for language evolution and development.

Abstracts



The role of visual signals in human communication: Perspectives from autistic and neurotypical individuals

James Trujillo

Max Planck Institute for Psycholinguistics, Netherlands

When communicating and interacting with one another, we use not only speech but also visual signals, such as facial expressions and manual gestures. In this talk, I will first discuss recent evidence of how these visual signals contribute not only to the semantic content of what one is saying, but can also signal other communicative and conversational intentions, both through the types of signals that are used (e.g., the specific facial signals) as well as the qualities of those signals (i.e., kinematics). Second, I will zoom in more on manual gesture and discuss how gestures are adapted to the current communicative context, and what this tells us about the flexible, multimodal nature of human communication. Finally, I will discuss how gesture use may differ across neurodiverse populations. Specifically, I will examine both the differences and similarities in gesture production and comprehension/interpretation between autistic and neurotypical individuals, and discuss what this can tell us about the diversity of communicative behavior.



Abstracts

The resilient properties of interaction

Connie de Vos

Tilburg University, Netherlands

Homesigners are deaf individuals who have grown up in the absence of conventional language input whether spoken or signed. The homesign systems they co-create with their hearing relatives and friends form a natural testcase to understand the human endowment for linguistic communication. Prior work on homesign systems has identified several ways in which homesign may exhibit language-like characteristics, but the pragmatic competence that supports mutual understanding in these interactions has not been studied until recently. In my presentation I present data from the newly created Balinese homesign corpus, capturing spontaneous interactions between Balinese homesigners and their regular communication partners. Our conversation analyses identify several robust features of these interactions including the ability to produce timely and contingent responses, to signal mutual understanding, and to anticipate and resolve communicative trouble when it arises. An important question moving forward will be to determine to what extent pragmatic competence is shaped by social experience, and how the resilient properties of interaction support the emergence of new languages.

Abstracts



What West African sign languages can tell us about language emergence

Victoria Nyst

Leiden University, Netherlands

Sign languages emerge in frequent interactions with and between deaf people. Regular interactions between deaf people are famously brought about by deaf schools. Thus, sign language emergence at deaf schools is documented in the case of Nicaraguan SL and Guinea-Bissau SL (Senghas et al. 2001; Martins & Morgado 2013). In West Africa, access to deaf schools is limited, but regular interactions between deaf people appear to be brought about by other factors bringing together a critical number of local deaf people. These factors local spikes in hereditary and acquired deafness and generally limited access to adequate health care. Also, urbanization seems to be sufficient to bring together a signing community. As a result, West Africa hosts a high number of spontaneously evolved sign languages, many of which are isolates.

Based on a survey in central Mali (Nyst, Sylla & Magassouba 2012) among others, this presentation evaluates what these spontaneously evolved West African SLs can tell us about language emergence, looking at the effect of variability in sociolinguistic setting.

It also looks at the types of elements used by emerging sign languages to create linguistic structure, zooming in on how gestural elements are adopted, enhanced and turned into grammatical and lexical structures. Comparing signs and gestures of size and shape in several West African signed and spoken languages shows the process through which gestural elements are “linguified” (Nyst & Tano 2018, Nyst 2018). Comparing gestures and lexical items in various West African sign languages show that quotable or emblematic gestures are wholesale adopted as lexical items (Nyst & Martins, forthcoming). The analysis of the integration of gestural elements furthermore implies that sign languages without a shared ancestor sign language or contact with each other may display similarities in grammar and lexicon.



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