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# THE EMERGENCE OF LANGUAGE

The science of language evolution has become a vibrant, modern and interdisciplinary field of scientific research.

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The origins and emergence of language have always fascinated people. In centuries past, this led to a multitude of unconstrained speculation about how humans came to have language. Speculation was so rampant, in fact, that in 1866 the Linguistic Society of Paris famously banned any debate on the origins of language.

However, this situation has changed dramatically, especially due to advances in the last 30 years, once a proper “science of language evolution” began to emerge in the 1990s. Today, language evolution research has become a vibrant, interdisciplinary and modern field of scientific research, and discoveries from disciplines such as cognitive science, animal communication, biology, genetics, anthropology, archaeology and palaeoanthropology, neuroscience, psychology, linguistics, computer science, and many others have profoundly changed our view of how language evolved and why it is special.

Research on animal communication has shown that many non-human animals have communication systems that are surprisingly complex. This indicates that there are much more continuity and similarities between animal communication systems and human language than was previously believed. Monkey species (e.g. putty-nosed monkeys and Campbell’s monkeys) and bird species (e.g. Japanese tits and southern pied babblers) produce complex calls that can even be combined in simple ways to yield new meanings.

Great apes such as chimpanzees not only use complex vocalisations, but also use a surprising number of gestures to communicate.

## Human communication

However, advances in linguistics also show that there are still many aspects that are special and unique about human language. The tens of thousands of words any person knows simply dwarves – by far – the size of any animal communication system. Language also seems to be the only communication system that exhibits complex ‘compositionality’, whereby words can be combined in complex ways to yield ever-new and complex meanings. Human language is unlimited and can be used to talk about anything, be it what we had for breakfast yesterday, making predictions about an upcoming election, or discussing the importance of freedom in a society. Animal communication systems, on the other hand, for all their complexity, are severely restricted in what they can express.

In recent years, the language sciences have also increasingly highlighted the importance of aspects of human communication that have not received enough attention. For example, language is fundamentally “multimodal.” Language is not restricted to speech but can use different modalities, or communication channels; in particular, speech is almost invariably accompanied by gestures and facial expressions. Although signed languages have a visual rather than vocal nature, they are nevertheless fully-fledged, complex linguistic systems in their own right, in no way inferior to spoken languages. All languages, both spoken and signed, are complex symbolic and structured systems of communication that are used in interaction to share perspectives and co-create meaning together.

Linguistics and psychology have also shed increasing light on the cognitive abilities that underlie lan-



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guage. These include our ability to extract statistical regularities and patterns from complex sequences and our social abilities to “put ourselves in the shoes of others.” This in turn helps us recognise the intentions behind the words our interaction partners use (for example, we might say “It’s pretty stuffy in here” when we want someone to open the window). These continuing insights help us to determine what changed in the course of human evolution to make language possible. Staggering advances in neuroscience, using techniques such as fMRI brain imaging, have also helped uncover the “language network” in the brain, the components and areas in the brain that store our knowledge of language and perform linguistic operations.

From an evolutionary perspective, developments in genetics and palaeoanthropology suggest that many aspects that support language may be much older than was previously assumed. In the past, many researchers assumed that language emerged quite late in human evolution, around 50,000 to 100,000 years ago. But more and more research suggests a much more gradual, protracted, and long evolutionary history, begin-

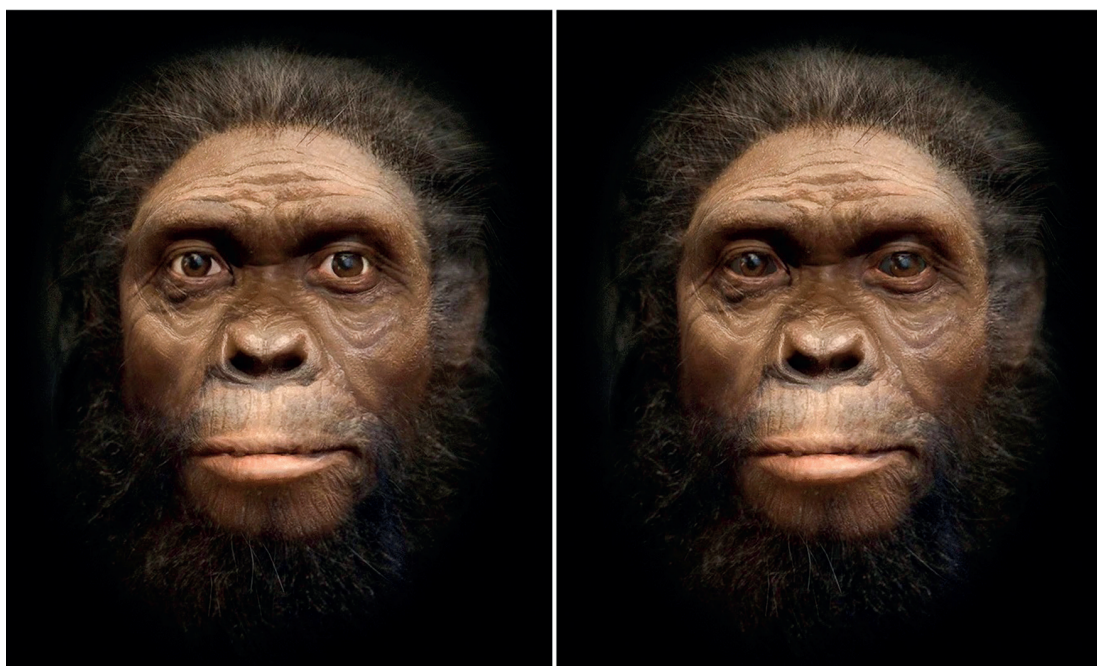
ning almost about 2 million years with *Homo erectus*. The view emerging from genetics, archaeology, and paleoanthropology is that many important foundations of language and speech were already present in the last common ancestor between modern humans and Neanderthals some 500,000 years ago, indicating that some form of language might have already been present since then.

The language and cognitive sciences, as well as evolutionary and linguistic anthropology, further add to this picture by detailing the social settings and social processes that help language emerge in communities of people interacting with each other. Here we encounter another property that is unique or near-unique to humans, at least among primates: *information donation*. Other species of apes and monkeys do not tend to give valuable information to each other, just as they do not give each other food. This makes evolutionary sense – why should I donate food or information to enhance the evolutionary fitness of others, if I can instead focus on my own, or better still, manipulate others to my advantage? In these key respects, humans are strangely different.

Many non-human animals have communication systems that are surprisingly complex. Chimpanzees, for instance, use both vocalisations and gestures to communicate

Research highlights the fundamentally multimodal nature of human communication.

For instance, comparing bright, human-like sclerae with dark, ape-like sclerae shows that brighter sclerae enhance gaze visibility. This aids gaze-tracking and social perception, crucial for non-verbal communication, and likely supported the evolution of human language



SOURCE: WACEWICZ ET AL., SCIENTIFIC REPORTS, 2022

We like to share food and information – we do not keep useful information all to ourselves, but often even compete to be the first to provide others with a juicy bit of news.

## Rapid development

One of the most fascinating discoveries in recent language evolution research is the concept of “cultural evolution,” namely that complex communication systems exhibiting key properties of human language can emerge over relatively short timespans, with multi-

Humans are very unusual among primates: we like to share information, rather than keeping it to ourselves.

ple generations of people interacting with each other. Words and structures compete with other words and structures, quite like living beings do: those that are most useful, prestigious, or easy to remember catch on and are propagated, whereas others die out. From this perspective, language evolution has been compared to the evolution of “useful parasites” that need to adapt to their hosts – in the case of languages, to the brains of language-users.

Evidence for this comes from many quarters – such as from historical linguistics, which studies language

change. For example, research on “grammaticalization” has shown that many aspects of grammar can emerge over historical time, and that we can trace these developments at different historical stages of a language. A classic example is the modern “going to” future tense. In Middle English (1150–1500) “going to” was only used in its literal sense, but over time it increasingly acquired a grammatical function, so that in Early Modern English (1500–1700) it began to be used more abstractly to refer to future plans and intentions and not necessarily a physical action (“I am going to read this book”). Finally, in Modern English (1700–present) the “going to” future has become fully grammaticalized as a future tense marker (as in “it’s going to rain”), which is often even contracted to “gonna” in spoken English to mark actions and events that are planned or imminent.

More recent discoveries show that linguistic structures can emerge within even shorter timescales. One fascinating case involves “emerging sign languages,” in which communities of Deaf people, or communities with a high incidence of deafness, create their own, complex structured sign languages. This has happened all over the world, if the right social conditions were met. For example, Nicaraguan Sign Language emerged in the late 1970s and 80s, when Deaf children who had not previously learned any sign language were brought together in a school setting and started to communicate with each other. Al-Sayyid Bedouin Sign Language, in turn, started emerging around 75 years ago in a Bedouin community in Israel with a high incidence of congenital deafness. Importantly, these emergent sign languages serve our human need to communicate and co-create shared meaning

together, just as much as more well-established spoken languages like English, Polish, or Swahili do.

## Systems of communication

While many of the processes that lead to the emergence of languages in such a short time have yet to be properly understood, there has also been increasing experimental work investigating how people interacting with each other create structured communication systems together. In a relatively recently established paradigm called *experimental semiotics*, study participants are put in situations where they have to communicate with each other, but are not allowed to use human language. Instead, they have to make use of symbols and shapes on a computer screen, drawings, their own words and vocalisations that they have to make up on the spot, instruments such as whistles, or gesture and pantomime. Studies of this kind, using

many different channels and modalities of communication, all show that participants co-create complex communication systems that become increasingly structured and language-like over a relatively short period of time. That is, it turns out that participants quickly develop language-like systems together, no matter what kind of “material” or modality they can use to communicate.

In our own lab, the Centre for Language Evolution Studies at Nicolaus Copernicus University in Toruń, we perform such studies using state-of-the-art technologies (such as motion-capture and Virtual Reality) to examine the processes by which humans co-create communication systems. We especially study dyads of participants communicating with each other using full-body pantomime, much like in the popular game of charades. Due to its visual nature, pantomime is especially well-suited to “bootstrapping” meanings in the absence of shared signs that can be used for communication.

In our view, the fact that pantomime is whole-body is crucial. Other studies have addressed similar questions with manual gestures, where participants are seated and can rely mostly on moving their hands and arms. When you need to communicate the concept of “walking,” it is true that you can show it manually by moving the index and middle fingers, perhaps even with some degree of success. However, when you actually use your whole body to mime walking, it tends to be understood much more readily. Our lab’s research has found that participants begin by using their entire bodies and the space around them, so as to best illustrate the intended meanings, and that a manual gesture is only the next step. With increasing repetition and conventionalisation, pantomime becomes increasingly structured and gradually transitions to more economic manual gestures.

We have managed to show this quantitatively with motion capture measurements. Whole-body pantomime, which in terms of effort can be seen as quite “costly” and movement-intensive, gradually comes to occupy a smaller and more structured “communication space.” This result demonstrates that communicative principles such as conventionalisation and minimising articulatory effort represent important processes that make communication systems more structured. It also demonstrates that using an experimental approach, there is much to be learned about which principles underlie the formation of complex communication systems such as language.

The science of language evolution has certainly come a long way from the days of unconstrained speculation. It has evolved into a multi- and interdisciplinary, mature and modern scientific field that promises to shed more and more light on what has been called “the hardest problem in science”: the question of how language evolved. ■

Evidence suggests that pantomime may be the original human-specific communicative system, preceding language. Similar to language, pantomime is highly multimodal and offers various ways to express the same concept. For example, “hammering” can be depicted by a first-person perspective gesture (above) or a third-person perspective gesture (below)



SOURCE: ZLATEV ET AL., JOURNAL OF LANGUAGE EVOLUTION, 2020

Further reading:

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