First words: the origins of language

Martin Edwardes explores what makes humans different from other animals and how our amazing linguistic ability came about.

A key difference between humans and other species is that we produce and understand complex signals. Human language is more versatile than any other natural communication system, allowing us to move new information between minds in new ways. This capacity has not always been available: there was a long time when there was no language in the world. So, when did humans develop language? Did it happen over a long period, or was it relatively sudden? Was it the result of a genetic change; and, if so, in what other ways would we have changed? These questions have been debated since ancient times, but it is only recently that we have been able to look at them scientifically.

Diligent fieldwork and careful experimentation during the last twenty years have led to massive advances in our understanding of other primates (chimpanzees, bonobos, gorillas and orang-utans); and we know more about our own evolutionary history, thanks to some significant archaeological finds. Our understanding of how genes work has also grown: we can compare human genomes with a range of living species, and careful extraction of DNA from fossils allows us to compare ourselves with some extinct species, too. We even understand how differences in particular genes make humans different from other primates. It does seem that we should be on the edge of knowing how we got to language.

There remain, however, some substantial problems. The physical evidence can only get us so far: language is a behaviour, and behaviours don't leave obvious traces in the fossil record. We have to infer the cognitive complexity of early humans from the tools they have left; and the complexity of their social life has to be deduced from other evidence, such as group sizes, burial practices, and what we can know of their diet, art and lifestyles. From this we can then make a rough guess at how those complexities would affect communication; but it is all rather haphazard, and open to interpretation.

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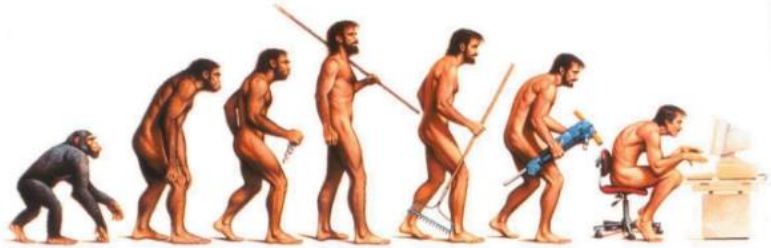
Nevertheless, we have been able to generate some new theories of language origins based on the new evidence available; and some previously accepted theories have been abandoned or modified.

What do we know?

So what do we know about our species' early steps in language? First, we know that how we define language determines where we look for answers. If we concentrate on our physical capacity for language then we look at speech and gesture, and their control mechanisms in the brain. If thinking symbolically is the key feature then we look at the archaeological record for answers. If handling complex rules is most important then we look at rule systems in humans and other animals. If language is needed to support our complex social systems then we consider the societies of early humans. As we shall see, all of these tell us something about language origins.

The second thing we know is the timescale for the evolution of Homo sapiens. An increasingly rich and carefully dated fossil record, accompanied by studies on genetic mutation rates, indicate that human and chimpanzee lineages separated about six million years ago. We know that several species of Australopithecus, ancestors of modern humans, existed up to about one million years ago; and we know that a later ancestor species, Homo ergaster, existed from about two million years ago. Our own species, Homo sapiens, appeared about 300,000 years ago, probably as an offshoot of Homo heidelbergensis, itself an offshoot of ergaster.

We also know, because evolution works that way, that the change between species would have happened over many generations. No Homo sapiens babies were born to heidelbergensis mothers; but, over generations, children were born a little more sapiens-like and a little less heidelbergensis-like than their parents.



The slow process of evolution!

This slow process of evolution has implications for language: it is very unlikely that language appeared whole and complete in a single individual, it is much more likely that it developed slowly over a long period. When we look at all aspects of language evolution – physical, symbolic, grammatical and social – we are looking at a process which probably started before Australopithecus. So what can each of these aspects tell us about our journey to language?

Bodies and language

Language is a natural communication system and therefore relies on a capacity to produce reliable signals. In the case of language, we must be able to produce a range of vocal movements to signal effectively. However, we are not just producing words when we speak, we are signalling with gestures, facial expressions, and non-language vocal effects. Language is, therefore, an embodied experience: it involves our whole physical selves and not just a coding mechanism between brain, ears and voice.

Unlike other apes, humans are dextrous, able to use our hands with great precision; we are more skilled vocally, able to produce a greater range of sounds and with greater control over our sound-making; we look at each other's faces when communicating, which means we can give information about our emotional states in our expressions; and our signalling is dialogic – the receiver is involved in negotiation to meaning with the sender. All of these are species-specific capacities which rely on exceptional physical control.

So how did we become the gesturing ape? One possible route is tool use and tool-making. At one stage these were thought to be the obvious source of our linguistic dexterity: we became good at complex manual manipulation, which made us good at complex vocal and grammatical manipulation as a by-product. At first it was thought that only humans use tools – until Jane Goodall showed that chimpanzees use sticks to fish for termites and stones to crack open nuts. We now know that many species use tools for a wide range of purposes. Next, it was assumed that only humans manufacture tools. This has also been disproved, and we now know that many species can adjust tools to make them more fit for purpose, or even make them out of raw materials. Examples include chimps making honey brushes to raid bee nests, and New Caledonian crows making barbed spears out of pandanus leaves to pull grubs out of their holes.

Nonetheless, humans still seem to be the only animal that makes composite tools. Examples of our earliest stone-and-wood composite weapon, the spear, have now been dated to 500,000 years ago, thanks to a 2012 discovery by Jayne Wilkins' team at Kathu Pan in South Africa. No other animal seems to combine different materials to make tools, and this capacity does seem to be similar to the way humans combine different types of words to make utterances.

Some theorists, however, have reversed this argument: it was the complexity of language that allowed us to make and use complex tools. Chimpanzees were initially believed to have no control over their vocalisations: they automatically make food calls when they see food, fear calls when they are afraid, and so on. They do, though, seem to use hand gestures for a series of voluntary signals, such as grooming, consoling, offering and begging. If our ancestors had to signal complex ideas, then using our hands would have been easier than using our voices. So could the complexity of language have been the driver for our manual dexterity?

Although this was a popular theory until recently, there are two problems with it. The first is, how and why did our ancestors change from manual signalling to vocal signalling? They would have needed voluntary control over their vocal system; but species cannot evolve towards better solutions unless there is already a base capacity to exploit. In this case, there had to be some voluntary control over vocal signalling. In fact, in a series of studies in 2012 and 2013, Catherine Crockford and her team showed that chimpanzees do indeed have greater voluntary control over their signalling than had been believed.

This, though, only raises the second problem: if there is control over vocalising, why bother with gesturing? Vocalising has many advantages: sound is not directional; it works in the dark, when out of sight, and over greater distances; and animals do not close their ears. Modern language is a full-body experience, and both gesture and vocalisation work as conduits for meaning. It is more likely, therefore, that gesture and vocalisation developed together.

The gestural approach to language origins concentrates on signal production: we have complex ideas to convey, so we need a versatile signalling system. However, producing complex signals is pointless unless the receiver can interpret them correctly. The costs of language are in reception as well as production, and similar language systems are needed in both brains. Perhaps, therefore, we should look at the complex cognitive machinery that language requires to understand its origins.

Bonobo fishing for termites

Thinking symbolically

We can infer symbolic thinking in our ancestors from the traces of art they left. The existence of any type of deliberate art means that the producer is able to think in symbols – to see meanings in an object that are unrelated to the object itself. So finding, say, shells which had being strung together to make a necklace would indicate a mind capable of symbolic thought – and this is precisely what Chris Henshilwood's team, digging at Blombos cave in South Africa, found in 2004. They dated their find at about 75,000 years old, making symbolic thought much older than previously believed. This find was supported in 2007 by 82,000-year-old shell beads found in the Grotte des Pigeons cave in Morocco, and by a find in Skhul cave in Israel, which seems to be over 100,000 years old. This last set of beads was excavated in 2006, but its significance was only identified in 2009 by Marian Vanhaeren's team.

It seems unlikely that the symbolism of a necklace of shells would have appeared independently in three minds 25,000 years apart, it is much more likely that the necklaces represent a shared symbolic culture of personal ornamentation – and a communication system able to share those symbols.

What does it mean to "share symbols"? A symbol is a representation of something, but it only represents that something by agreed convention. Paradoxically, signals have to be capable of being mistaken to be symbolic. For instance, if I cut my hand and cry out in pain, I am making a universal signal which other humans immediately understand; it does not need a social convention to give it meaning. If, however, I say "I've cut my hand!", I am saying either more or less, depending on circumstance: if I say it to a group of English speakers, they will know not just that I hurt, but why and where I hurt; if I say it to a group of non-English speakers, they will not even know that I'm hurt.

The shell bead necklaces show that humans have been sharing physical symbols – and probably sound symbols, or words – for at least 100,000 years. As a large part of language involves sharing symbols, it seems likely that early human communication was language-like in this way, at least. However, is communicating symbolically sufficient by itself to explain all of language? Surely the capacity to embed symbols into a linguistic rule system, or grammar, is needed before we can say that language exists?

Making the rules

For a long time it was believed that only human signalling incorporated rules. These rules allow language to be segmented (a signal can be composed of several meaning-units), differentiated (different meaning-units can perform different roles in the signal), hierarchical (meaning-units can be combined to create new meaning-units), and iterative (meaning-units can contain meaning-units, which can contain meaning-units, and so on).

To have language-like rules, therefore, there has to be meaning. So is the capacity to mean exclusively human? Do animals just signal what they are feeling, or do they wish to tell another animal something? For instance, does a vervet make a fear-screech when it sees a leopard because it is afraid, or because it wishes to warn its troopmates; and do other vervets respond to the call because it makes them afraid, or because it means there is a leopard around? Dorothy Cheney and Robert Seyfarth showed, in a series of experiments in the 1980s, that vervets only give warning calls when there are troopmates they wish to warn, and may not respond to a call if they think they are not themselves at risk. So it seems that the vervet calls do mean, and they mean the same to both sender and receiver.

This has now been shown to be true for several other species, including chimpanzees; so it is likely that our early ancestors' signals had meaning. Would they, though, have been segmented, differentiated, hierarchical and iterative? Klaus Zuberbühler's team has shown that wild Campbell's monkeys in Ivory Coast produce "krak" calls on seeing a leopard, and "hok" calls on seeing a crowned eagle. However, an "-oo" added to the end changes the leopard call into a general ground alarm call, and the eagle call into a general aerial alarm call. It seems, therefore, that Campbell's monkey calls have two of the features of human language, segmentation and differentiation. Their signalling system may be basic, but it is also, in this respect, language-like.

So what about hierarchy and iteration? It turns out that bird calls contain both of these. Kazuo Okanoya has shown that Bengalese finch calls are composed of subunits into which other subunits are merged; the calls are therefore both hierarchical and iterative. The subunits do not, however, carry individual meanings. The complexity of the song is itself an indicator of fitness, and females prefer males with complex songs; but the message is in the whole song, not in the subunits.

It seems, therefore, that only human language is meaningfully hierarchical and iterative. Of course, our knowledge of nonhuman communication systems is woefully inadequate, and it is quite possible that whale song or dolphin calls, both of which seem to be hierarchical and iterative, will turn out to be more like language and less like birdsong; but, currently, meaningful hierarchy and iteration do seem to be exclusively human. Noam Chomsky, in particular, takes the view that meaningful recursion (nested iteration) is what differentiates us as a species.

There is, though, a problem here: what is all this complexity for? Most animals need only simple signals; what do humans have to communicate that needs complexity? To answer this, we need to look at human culture.

Working together

Humans are a highly social species: we work together in large groups; we adopt specialist roles, in the certainty that others will exchange what they produce for what we produce; and we cooperate in joint enterprises, producing results that are impossible for individuals to achieve. Such a high level of sociality gives us a lifestyle unlike any other primate. Clearly, language has to be part of this, negotiation to complex meaning needs a complex communication system; but did the communication system come before or after the social complexity?

Once again, evolution gives us a clue: the first event cannot rely on the second. Complex communication, without social complexity, offers nothing useful to an individual or group – it brings no food into the camp. Social complexity, though, allows humans to work together to the advantage of both the group and the individual; so we can say that social complexity most likely led to language, and not the other way around.

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The roots of language

This does not rule out a "ratchet effect": complex activities required enhanced communication, which then allowed more complex activities, requiring more complex communication, and so on. Our drive to social complexity would have been self-sustaining if we had an open-ended communication system, like language, to support it.

Yet there is still a key question unanswered: what aspect of socialisation is likely to have started the ratcheting? Robin Dunbar has proposed that exchanging information about other tribe members, or gossip, started things; Terrence Deacon thinks that it is the capacity of each new generation to build on the social complexity of their forebears that drives language complexity; Chris Knight takes the view that women organising to resist the dominance of males created the ground rules for language; and there are many other suggestions. More practically, Michael Tomasello and his team in Leipzig have, for some years, been comparing how nonhuman and human babies see the world, and they have identified many similarities and differences which provide clues to the relationship between language and human socialisation. For instance, humans seem to have a longer period of brain plasticity, making us better learners than chimpanzees.

The social approach to language origins remains difficult to explore. It does not offer simple solutions, and relies heavily on supporting physical, symbolic and grammatical explanations. Despite this, though, it is probably where the most productive research will be concentrated over the next decade.

The roots of language?

The origin of language is one of the difficult questions of evolution: it is key to understanding when and how we became human, and yet it seems that we still do not have a coherent explanation. Perhaps it is time to give up and work on easier questions.

All we may need, though, is a change of perspective. The emphasis so far has been on finding a single answer; but that may not be the best target. For the last 20 years we have been working as individuals or small teams, each on our own projects. We now have well-tested solutions for different parts of the problem, but these solutions have not been brought together in a systematic way. Hopefully, the next 20 years will see more integration of these partial solutions into a working model; and then we will know so much more about being human, and about ourselves.¶

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Find out more

Books

How Monkeys See the World: Inside the Mind of Another Species by Dorothy L Cheney and Robert M Seyfarth (University of Chicago Press, 1990).

The Human Story: A New History of Mankind's Evolution by Robin I M Dunbar. (Faber & Faber, 2004).

The Origins of Grammar: An Anthropological Perspective by Martin Edwardes (Continuum, 2010).

Language: The Cultural Tool by Daniel Everett (Profile Books, 2012).

The Oxford Handbook of Language Evolution by Maggie Tallerman and Kathleen R Gibson (Oxford University Press, 2012).

Why We Cooperate by Michael Tomasello (Boston Review, 2009).