THE EVOLUTION OF WHAT?

CHRISTINA BEHME
Department of Philosophy, Mount Saint Vincent University,
Halifax, Canada
ChristinaBehme@msvu.ca

Abstract: In spite of impressive accomplishments there remain significant gaps in our understanding of language evolution. It will be argued that striving for more conceptual clarity will assist empirical research, eliminate fruitless debates, and (re)focus attention away from pseudo-problems. Attention will be paid to analogies that construct powerful conceptual tools in support of specific hypotheses. It will be shown that this use of analogies is not unproblematic and suggested that analogical reasoning should be used more often to challenge one's own hypothesis.

1. Introduction

Noam Chomsky is often credited with reawakening language evolution research from the 'sleeping beauty' existence it had led for more than a century. Decades ago he proposed that the "idea of regarding the growth of language as analogous to the development of a bodily organ is …quite natural and plausible" (Chomsky, 1975, 11) and that "the language faculty may be regarded as fixed function, characteristic of the species, one component of the human mind" (Chomsky, 1977, 63). These proposals came at a time when Chomsky's generative grammar had "become the conventional wisdom [in linguistics]" (Searle, 1973, 8) and his influence had extended into psychology, philosophy, anthropology, and other fields. Many non-linguists accepted the assumption that language was a biological organ, and attempted to address the question of how such an organ might have evolved. Today we find a thriving language evolution research community that includes experts from anthropology, archaeology, cognitive neuroscience, computer science, genetics, linguistics, neuro-physiology, philosophy, physics, primatology, and psychology. These experts have generated an impressive body of work. However, in spite of impressive accomplishments there remain significant gaps in our understanding of language evolution. As observed by one leading language evolution researcher: "many different scholars have reached valid insights about human language … but no one scholar or discipline has yet achieved an adequately comprehensive overview of this complex system" (Fitch, 2010, 2). Not undeservedly, language evolution has been called "the hardest problem of science" (Christiansen & Kirby, 2003).

2. What is language?

It seems that before debating about the most promising routes towards substantial progress researchers need to acknowledge that there is no broadly accepted consensus about the 'object' of evolution: language and to specify which definition of language they subscribe to. While virtually everyone assumes something in our biology accounts for our ability to use language, the exact nature of this putative "language organ" or "language instinct" remains a matter of controversy and many questions about the ontological status of language and the exact relationship between language and biology still await satisfactory answers. I am of course not the first to notice that terminology is used ambiguously in the language evolution literature. It has been suggested that language is not a 'monolithic whole' but "a complex system made up of several independent subsystems" (Fitch 2010, 17) and that the "unspecified use of ...the word 'language'...is probably best avoided" (Fitch 2010, 24).

This cautionary note is often ignored and many researchers either do not define what they mean by language or they focus on specific aspects of a very complex phenomenon without suggesting how their results are relevant to other aspects or could be integrated into a more complete picture. One example, representative for many articles on language evolution is an excellent survey article by Tallerman (2007). She contrasts synthetic and holistic approaches to language evolution. Synthetic approaches assume that humans used single words first and "that an evolving syntax takes single items and forms structure by combining them" (Tallerman 2007, 580). Holistic approaches on the other hand assume "that protolanguage consists of 'a small inventory' of indivisible utterances" (Tallerman 2007, 580), and that words emerge later via a process of fracturing. This seems to suggest that what evolves is the system of words and their possible combinations. Protolanguages are systems that are simpler than and/or lack some of the components of fully evolved languages. However, throughout the article Tallerman also discusses cognitive and brain evolution. Yet, it is often not clear if brain structures are relevant for producing language sounds or if they also underwrite grammatical relations between words. She refers to "a fully modern UG or innate predisposition towards learning language" (Tallerman, 2007, 589) and "a fully modern linguistic brain" (Tallerman, 2007, 594) but it is not clear exactly what is innate on her view: cognitive capacities required to learn and use language, specific information related to grammatical structure, or computational mechanisms underwriting language use. Furthermore, it is also not clear whether 'innate predispositions' have to be specific to language or could be domain general.

One might argue that terminological imprecision is unproblematic because individual researchers know what they mean by 'language' and the time required to conceive of more precise definitions is better spent conducting empirical research. However, the current situation has several undesirable consequences. First, researchers often get entangled in fruitless debates because they start from

different assumptions about 'language'. In one extreme case it has been suggested that the majority of language evolution researchers hold a 'non-existence thesis' regarding language.

> "It is widely held that ''There are well-developed gradualist evolutionary arguments that language is entirely grounded in a constellation of cognitive capacities that each -- taken separately -- has other functions as well,'' in which case language exists only in the sense that today's weather exists: a constellation of factors that have independent functions, not an object of serious scientific inquiry in itself … All of these approaches share the conception of half a century ago that there is no such thing as language in any serious sense ... under the ''non-existence'' assumptions, the approaches to UG that have so far led to serious results would have to be reshaped. How, it is idle to speculate without credible proposals" (Chomsky 2011, 34).

Chomsky implies here that the majority of language evolution researchers is committed to the ridiculous view that 'there is no such thing as language in a serious sense'. How could anyone plausibly suggest that virtually the entire language evolution-community studies the evolution of something they do not believe to exist? Upon closer reading it becomes clear that Chomsky's implication is based on two assumptions: (i) that 'language' is equivalent to Universal Grammar (a hypothesized construct of Chomsky's linguistic theorizing) and (ii) that anyone who denies that this Universal Grammar exists holds that language is 'not an object of serious scientific inquiry'. Unfortunately, this uncharitable interpretation of the work of others is aided by the often cavalier use of 'language'. Adopting an 'everyone knows what I mean by 'language' attitude is not productive when there is very good evidence that not everyone knows (or wants to know).

3. Helpful analogies?

Humans are the only animals that use language. This makes it impossible to conduct direct comparative research between human language and animal communication systems or to draw inferences about human language based on animal experiments. This situation invites the use of analogical reasoning in language evolution theorizing. It is worthwhile remembering that "[r]easoning by analogy involves identifying a common relational system between two situations and generating further inferences driven by these commonalities" (Gentner & Smith, 2012, 130). These analogies construct powerful conceptual tools but they do not establish that underlying cognitive phenomena are similar.

However, some of the frequently employed analogies hinder instead of furthering progress. That is because researchers often assume as default what needs to be established: that two phenomena (e.g. human language and monkey alarm calls) are similar in certain aspects. Based on this assumption they focus on similarities between these phenomena and set aside differences.

> … if Everett were right, it would show that Piraha doesn't use the 'resources that Universal Grammar makes available'. But that's as if you found a tribe of people somewhere who crawled instead of walking. They see other people crawl, so they crawl. It doesn't show that you can't walk. It doesn't show that you're not genetically programmed to walk [and do walk, if you get the relevant kind of input that triggers it and are not otherwise disabled] (Chomsky 2012, 30)

Chomsky's analogy (between language and walking/crawling) nicely illustrates multiple problems with reasoning by analogy. First, in order for the analogy to be valid the underlying processes (language and the ability to walk being genetically pre-programmed) would have to be the same. But, Everett challenges the claim that language is based on an innate Universal Grammar of the kind proposed by Chomsky. In order to address this challenge Chomsky can not assume what needs to be established (that there is a Chomskyan UG) but needs to provide independent arguments in support of his hypothesis. Second, an analogy should only be used to draw conclusions about the underlying process in two domains when the effects of this process are the same as (or at least similar to) the effects in both domains.

When comparing crawling/walking to language development it becomes clear that the domains are quite different. Most infants go through a crawling stage before they learn how to walk. The transition requires some practice from the first tentative and often wobbly steps to confident walking. But once humans have acquired the skill they hardly 'look back' and one finds rarely any adult regularly crawling. Looking now at the acquisition and use of recursion one notices important differences. First, there seems to be no phase during which children acquire and practice recursion[1]. Second, even after children acquire the ability to produce recursive structures they continue to produce sentences not

[1] In early language acquisition children move from a stage in which they use single-word utterances to a stage in which they use multi word utterances. But since Piraha children also go through these stages it cannot be argued that the ability to use multi-word utterances is disputed by Everett (for detailed discussion of this ongoing dispute see Everett (2009) Nevins et al. (2009), Adger (2015), Behme & Evans (2015)). More importantly, the ability to string together several meaningful units is shared by several species and could not be considered a species specific property.

containing such structures. So, unlike in the crawling/walking case there is no (virtually complete) replacement of one behavior by another.

Another difference between the two cases is noteworthy. Anyone hypothesizing that our genetically underwritten 'walking faculty' enables us to add one step to another and repeat this operation indefinitely, could find some empirical confirmation for such a hypothesis: humans are indeed able to perform walks consisting of hundreds or thousands of steps. Looking at the case of language one should find a similar ability. Chomsky insists that "the language faculty is that it is a system of discrete infinity. Any such system is based on a primitive operation that takes n objects already constructed, and constructs from them a new object … call that operation merge… With Merge available, we instantly have an unbounded system of hierarchically structured expressions. (Chomsky 2005, 11). Allegedly this computational operation was installed in human brains by a single mutation: "The simplest account of the 'Great Leap Forward' in the evolution of humans would be that the brain was rewired, perhaps by some slight mutation, to provide the operation Merge" (Chomsky 2005, 11-12). If this ability to generate an unbounded system of hierarchically structured expressions is indeed the essence of language one would expect that humans use massively long and multiply recursively structured sentences. Yet, the vast majority of sentences actually produced and/or used by humans is pathetically short (compared to a hypothetical discrete infinity): the vast majority of sentences contains fewer than 88 words and a 40.004-word sentence would be neither produced spontaneously nor could it be understood by any normal human.

As the forgoing has shown, in many performance aspects there are considerable differences between walking and language. Hence there do not seem to be (strong) analogies between the two domains. It remains of course possible that in spite of these differences the mechanisms underwriting walking and language are of similar nature. But in order to establish such similarities researchers would need to pursue strategies different from analogical reasoning. In fact, the strong dis-analogies between the two domains could suggest that the working hypothesis (that both language and walking follow innately pre-determined developmental patterns) needs to be re-evaluated.

Reasoning by analogy is widely used in the language evolution literature. Especially when comparing communication systems of non human species and language researchers focus on similarities and support their arguments with analogies. Given that on some level of analysis many phenomena are similar to each other, it is not surprising that those looking for similarities will find them. Many evolutionists prefer gradualist accounts and study the mental mechanisms underlying the communication of our closest relatives, non-human primates. Researchers attempt to establish which aspects of human language are within the non-human primates' capabilities and which are not. When researchers find

similarities between the use of animal vocalizations and human language they sometimes theorize that underlying mechanisms might be similar or that animal calls could be (evolutionary) precursors of language. It has been known for some time that vervet monkeys (*Chlorocebus pygerythrus*) produce predator specific alarm calls for leopard, martial eagle and python. Different alarm calls seem to evoke different responses. Leopard alarm calls prompt the monkeys to climb into trees, eagle alarm calls result in monkeys hiding in nearby bushes, and Python alarm calls prompt the monkeys to cautiously survey the ground. It is well established that the alarm calls convey specific information about approaching predators to other members of the group. Yet, it was assumed that the calls where instinctual, and did not involve vocal learning. Further calls seemed a direct response to a visual stimulus (predator) and not intended to convey benefits to other group members (Seyfarth et al. 1980). These features make alarm calls fundamentally different from human language.

Recent work on other species has attempted to establish closer similarities to human language. For example, 'Contest hoots' are acoustically complex vocalisations produced by adult and subadult male bonobos (*Pan paniscus*). These calls are often directed at specific individuals and regularly combined with gestures and other body signals. They provoke a social reaction in the targeted individual and may function to assert social status. The intentional use of multi-modal sequences to initiate social interactions with important group members could indicate more cognitive complexity than previously attributed to bonobos. (Genty et al. 2013). Since it is assumed that human language requires a great degree of cognitive sophistication one might argue by analogy that cognitive complexity in bonobos indicates that they are cognitively 'language ready'. Further corroboration for the intentionality of primate vocal communication comes from research on chimpanzees (*Pan troglodytes*). In an experiment designed to test for higher order intentionality (the animal knowing what another animal likely knows), researchers presented wild chimpanzees with a python model and found that alarm calls depended on the presumed knowledge level of receivers. The researchers argue that "alarm calls were: (i) socially directed and given to the arrival of friends, (ii) associated with visual monitoring of the audience and gaze alternations, and (iii) goal directed, as calling only stopped when recipients were safe from the predator" (Schel et al., 2013, 1). These findings have been taken to suggest that cognitive capacities required for human language use (the understanding of both one's own and others' mental states and a desire to modify another's mental states) are present in some non-human primates. Because researchers discover analogies between different species, their findings are taken to indicate that the cognitive gulf between humans and other primates may not be as wide as previously assumed.

If there are (strong) language relevant cognitive similarities between humans and non-human primates one has to wonder why we are the only 'fully

linguistic' species. It has been hypothesized that, unlike humans, non-human primates are not able to produce a wide variety of distinct sounds and thus lack an essential prerequisite for spoken language (for overviews see Fitch 2010, Lieberman, 2013). On the other hand, songbirds are able to produce a wide variety of distinct sounds, and it has been shown that they are capable of complex vocal learning, an ability also required for language acquistion. For example, European starlings (*Sturnus vulgaris*) can be trained to recognize acoustic patterns of a complexity comparable to a recursive, self-embedding, context-free grammar. They are able to classify new patterns defined by the grammar and reliably exclude ungrammatical patterns (Gentner et al. 2006). Recent work on Zebra finches has shown that these songbirds can learn to recognize affixations. Affixes have grammatical function in language and recognizing them is one of the many abilities needed in language acquisition. Finches learn to recognize different affix-patterns and show preference for prefixes (Chen et al., 2014). The claim is not that finches recognize affixes as affixes, far less that they are aware of grammatical function. Rather, they are capable of very fine-tuned discrimination, an ability considered crucial for human language production and comprehension. Extensive work on African grey parrots (*Psittacus erithacus*) has shown that these birds can acquire a large vocabulary, learn to differentiate meaning and rudimentary syntax, and can engage in a simple conversation with a human trainer (Pepperberg, 2008). In addition to vocal ability some corvids also show impressive social intelligence, suggesting that these birds have complex cognitive abilities. For example, Scrub jays (*Aphelocoma coerulescens*) remember not only numerous sites where they cached food but also where conspecifics have cached. They pilfer those sites when given the opportunity. It was shown that jays with prior experience of pilfering another bird's caches subsequently re-cached food in new cache sites when they had been observed by other birds caching. This suggests that jays relate information about their previous experience as a pilferer to the possibility of future stealing by another bird, and modify their caching strategy accordingly (Emery & Clayton 2001). Similarly complex abilities have also been confirmed in ravens (*Corvus corax*) (Bugnyar & Heinrich 2005), and New Caledonian crows (*Corvus moneduloides*) (Taylor at a., 2012).

Taken together, the work on non-human animals suggests that several species possess rich cognitive resources underwriting the ability to interpret (and to a lesser degree) produce meaningful acoustic signals. Reasoning by analogy suggests that some of the mechanisms involved in animal cognition are similar to those involved on human language. However, there are also important dis-analogies and no other species has a communication system rivaling human language. Possible reasons for this disparity could be (i) that in spite of similarities in cognitive sophistication the underlying mechanisms are very different or (ii) that only some of the many cognitive and physiological resources needed for language are accessible to members of other species while

only humans have access to the full suite or resources, or (iii) it could be the case that non-human animals are unable to overcome specific barriers to achieving a linguistic communication system. "How humans overcame (or side-stepped) these limitations [remains] a central question for theories of language evolution" (Fitch 2010, 202).

4. Conclusions

Language evolution research conducted in recent years has generated a wealth of exciting results. Nevertheless, there remain significant gaps in our understanding of language evolution and no model that could address the evolution of the full spectrum of human language is currently on the horizon. Language evolution researchers could profit from paying closer attention to conceptual issues. Striving for more conceptual clarity will assist empirical research, eliminate fruitless debates, and (re)focus attention away from pseudo-problems. While it may be neither feasible nor beneficial that all language evolution researchers adopt the same definition of 'language' it would be desirable for them to explicitly state which definition they adopt. Analogies used by language acquisition researchers can construct powerful conceptual tools but they do not establish that underlying cognitive phenomena are similar. Given our tendency to interpret the world in ways that are consistent with our hypotheses (confirmation bias), researchers need to resist the temptation to focus on analogies between phenomena they hypothesize to have similar underlying mechanisms. Instead they have to be explicit about the assumptions they are making and consider whether the evidence they gather is inconsistent with those beliefs. This process can be aided if analogical reasoning is used more often to challenge one's own hypothesis.

References

Adger, D. (2015). Mythical myths: Comments on Vyvyan Evans' "The Language Myth" *Lingua, 158*, 76-80.

Behme, C. & V. Evans. (2015). Leaving the myth behind: A reply to Adger (2015), *Lingua, 162*, 149-159.

Bugnyar, T., & B. Heinrich. (2005). Food-storing ravens differentiate between knowledgeable and ignorant competitors. *Proceedings of the Royal Society of London, Series B 272*, 1641-1646

Chen, I., N. Jansen, & C. Ten Cate. (2014). Zebra finches can learn to recognize affixations. *The Evolution of Language Proceedings of the 10th International Conference EVOLANG 10*, 411-412, Vienna, Austria.

Chomsky, N. (1975). *Reflections on Language*. London: Temple Smith.

Chomsky, Noam. 1977. On the nature of language. In: *Essays on form and interpretation* (pp. 63 – 80). New York: Elsevier.

Chomsky, N. (2005). Three Factors in Language Design. *Linguistic Inquiry. 36*, 1-22

Chomsky, N. (2012). *The Science of Language*. Cambridge: Cambridge University Press.

Christiansen, M. & Kirby, S. (Eds.), (2003). *Language Evolution*. Oxford: Oxford University Press.

Emery, N. J. & N. S. Clayton. (2001). Effects of experience and social context on prospective caching strategies by scrub jays. *Nature, 414*, 443 – 446.

Everett, D. (2009). Pirahã Culture and Grammar: A Response to Some Criticisms. *Language, 85*, 405-442.

Fitch, W. T. (2010). *The evolution of language*. Cambridge: Cambridge University Press.

Gentner, D. & Smith, L. (2012). Analogical reasoning. In V. S. Ramachandran (Ed.) *Encyclopedia of Human Behavior* (2nd Ed.). pp. 130-136. Oxford, UK: Elsevier.

Gentner, T. Q., K. M. Fenn, D. Margoliash, & H. C. Nusbaum. (2006). Recursive syntactic pattern learning by songbirds. *Nature, 440*, 1204-1207

Genty, E., Z. Clay, C. Hobaiter, & K. Zuberbuehler. (2013). Multi-Modal Use of a Socially Directed Call in Bonobos. *PLoS ONE* 9(1): e84738. doi:10.1371/ journal.pone.0084738

Lieberman, P. (2013). *The unpredictable species*. Princeton, NJ: Princeton University Press.

Nevins, A., C. Rodrigues, & D. Pesetsky. (2009). Pirahã Exceptionality: a Reassessment. *Language 85.2*, 355-404.

Pepperberg, I. M. 2008. *Alex & Me*. New York: Harper Luxe.

Savage-Rumbaugh, Sue, & Roger Lewin. (1994). *Kanzi: The Ape at the Brink of the Human Mind*. New York: Wiley

Schel, Anne Marijke, Simon W. Townsend, Zarin Machanda, Klaus Zuberbuehler, & Katie E. Slocombe. (2013). Chimpanzee Alarm Call Production Meets Key Criteria for Intentionality. *PLoS ONE 8*(10): e76674. doi:10.1371/journal.pone.0076674.

Searle, John. (1973). Chomsky's revolution in linguistics. In: G. Harman (ed.) *On Noam Chomsky: critical essays.* (pp. 2 – 33). New York: Anchor Books.

Seyfarth, Robert M., Dorothy L. Cheney, & Peter Marler. (1980). Monkey responses to Three Different Alarm Calls: Evidence of Predator Classification and Semantic Communication. *Science 210,* 4471, 801-803.

Taylor, Alexander. H., Miller, R., & Gray, R. D. (2012). New Caledonian crows reason about hidden causal agents. *Proceedings of the National Academy of Science U S A, 109 (40),* 16389-16391

Tallerman, M. (2007). Did our ancestors speak a holistic protolanguage? *Lingua, 117*, 579–604

Tomasello, M. (2009). *Origins of communication.* Cambridge, MA: MIT Press.