

What makes humans different

Ehud Lamm

Books under review:

- Derek Bickerton, *More than Nature Needs: Language, Mind, and Evolution*, Harvard University Press. 2014. 324pp. \$30.29 (0674724909)
- Philip Lieberman, *The Unpredictable Species: What Makes Humans Unique*, Princeton University Press. 2013. 255pp. \$26.96 (0691148589)
- Michael Tomasello, *A Natural History of Human Thinking*, Harvard University Press. 2014. 178pp. \$31.50 (0674724771)

There are various reasons to study the evolution of language beyond mere curiosity about the past. Better understanding of language evolution may help understand the social-cultural, cognitive, neurobiological, and genetic bases of language, establish the relation between language and other aspects of human intelligence, refine our understanding of human evolution more generally, and better understand the role of language-driven cultural evolution in human evolution. These issues may have implications for developmental psychology and possibly even for the treatment of autism and other conditions. Like any basic science, it is impossible to foresee the implications. The evolution of language, however, also seems to be a key to understanding what, if anything, makes *Homo sapiens* unique. The three very different books under review all share a preoccupation with this question. This is well reflected in their titles. Another similarity that will probably surprise people unacquainted with the field is that all exemplify how little is known about the evolution of language and the little consensus there is among researchers.

The books are very different in style, content, and tone, ranging from the technical and scholarly (Tomasello) to the more popular and occasionally semi-autobiographical (Bickerton and Lieberman). Moreover, the books primary focus is different: Tomasello is concerned with social cognition, Lieberman places significant attention on auditory production and comprehension and Bickerton is mostly concerned with syntax. Each of the authors is well-known for their work on the topics they emphasize and the books build on their previous work. Given this range, I will not attempt to give an outline of the arguments presented in each book, but rather focus on the views expressed by the authors regarding several fundamental questions.

Universal Grammar is dead

The enormous intellectual influence of Noam Chomsky, in particular on linguistics and cognitive science, is such that people outside the field of language evolution would be reasonable to expect that research on language evolution is concerned with the evolution of the *LAD*, the proverbial innate Language Acquisition Device. All three books reviewed here, not unlike copious other work on language evolution, set aside Chomskyan linguistics. Of the three, Bickerton is closest to the Chomskyan program and devotes considerable space to a useful review of the vagaries of Universal Grammar. Likewise, his positive proposal is presented as a variation on the Minimalist Program's Merge operation, which is the fundamental operation giving rise to syntax according to Chomsky's current views. The other two authors owe even less to the Chomskyan program. This distancing partly reflects the changing winds within linguistics (Behme 2014) as well as the notorious difficulty with reconciling Chomsky's views on language, including his current ones, with an evolutionary account. Indeed, while Chomsky is the author of highly cited papers on language evolution, along with his co-author Marc Hauser he has recently emphasized that the fundamental questions about language evolution remain "as mysterious as ever" (Hauser et al. 2014). While this may be slightly overstated, this claim is indicative of the state of the field.

What then had to evolve for language to exist, if not an innate Universal Grammar or the tree-building Merge operation? Each of the three books proposes different key elements.

Language and Thought: What evolved

Bickerton, as I mentioned, argues for language specific, or rather syntax specific, brain mechanisms which are however different than Merge and that closely interact with acquired lexical elements for their development and operation (chp. 5). Lieberman belongs to the other camp and notes, in contrast, that it is "becoming less and less likely" that there are neural structures devoted strictly to language (p. 54). Tomasello also leans strongly in the direction of general purpose mechanisms that underlie human intentionality not just language. This continues his previous line of argument, argued for forcefully in (Tomasello 2003). In a phrase he likes to quote: today's syntax is yesterday's discourse.

Both Lieberman and Tomasello mention the well-known story of the Nicaraguan Sign Language that very quickly emerged when deaf children who were isolated from other deaf people came into contact with one another in a newly established school for the deaf. Tomasello uses this example to argue that simple home-signs or pidgin communication works when there is strong common ground, as happens during stereotypical social interactions. Once situations become more diverse and the number of possible interlocutors increases communication breakdowns

prompt the conventionalization of grammar (p. 100). Lieberman, however, notes that the story is used as evidence for an innate Universal Grammar, and sarcastically calls it a “minor miracle” for the Chomskyan faith. He claims that the story that was widely publicized is false in most respects and that the sign language that supposedly developed out of thin air in fact benefited from the input of an American Sign Language teacher and a child who attended a school for the deaf for eight years.

Creole languages, a subject on which Bickerton is an expert, show how the syntax specific operations he identifies work after being “reset”. They thus provide crucial evidence on how these mechanisms work. His discussion of recent work on creoles in chapter 8 is fascinating. Language acquisition, according to Bickerton, is driven by the acquisition of lexical elements, not by maturation of a LAD. The crucial ecological shift that enabled the evolution of these abilities was confrontational scavenging by groups which required communicating about unseen things and led to displaced reference (p. 85). This led to abstract categories or mental concepts, that is, to symbolization. Next came a phase of brain self-organization driven by internal efficiency considerations of brains saddled with words. Finally, the fourth stage consisted of making languages easier for hearers, a cultural evolutionary process taking place in the last 150,000 years (pp. 259-262). The result is “more than nature needs”, since the ecological challenge that led to confrontational scavenging of large animals resulted in a system much richer than was needed to overcome this challenge. The four stages necessarily lead to one another, which explains why we do not find species with subsets of these abilities. As to the question of the evolutionary relation between language and thought, Bickerton concludes that, “[h]uman ancestors began to communicate with displaced reference, and that was what triggered the processes that eventually led to advanced cognition.” (p. 263) Up until the last stage, what evolved according to him primarily affected thought, while the evolution of language per se happened late. However, he correctly argues that this does not mean that the cognition of modern humans depends on language (p. 103). Once there is a “common code” to all forms of mental activity, as a result of the evolutionary process that led to language, we get stream-of-thought and the ability to combine abstract concepts for free (pp. 270-271). The ordering between the evolution of general cognition and the evolution of language that Bickerton suggests is similar to the one proposed by Tomasello.

Lieberman argues that the elaboration of neural circuits is what made the difference evolutionarily, most critically circuits connecting the cortex and basal ganglia. This happened in the last 200,000 to 500,000 years. The cortex-basal ganglia circuits endow humans with cognitive flexibility and hence creativity, while also enhancing motor control allowing speech (p. 23). Creativity, as opposed to rigidly remaining stuck along one line of thought is key. Using evidence from his work with Parkinson disease patients and oxygen deprived climbers of Mount Everest, Lieberman argues that basal ganglia circuits play a crucial role in cognitive flexibility and motor skills. The basal ganglia also play a role in associative learning and hence in forming expectations, performing

sequences of actions and hence, Lieberman argues, in learning grammatical rules (p. 111).

Tomasello's book is concerned primarily with thinking and only secondarily with language. Based primarily on his studies of human infants and on apes he argues that humans are capable of acts of shared intentionality that are beyond the abilities of apes. He proposes a two-stage evolutionary process to explain how these evolved. The first stage led to joint intentionality (i.e., second-personal social engagement between ad-hoc pairs) for the purposes of collaborative foraging (chp. 3). This entailed perspectival and symbolic representation, socially recursive inferences and second-personal self-monitoring (p. 5). The cooperative behaviors that developed were necessary to pave the way for the next stage, the evolution of collective intentionality (i.e., group-mindedness based on cultural common ground of collectively known conventions) and of culture (chp. 4). This is similar to Bickerton's view according to which prior communication skills paved the way to increased communicative repertoire, and were thus a necessary step even though they are not in any sense precursors to language (p. 81). Tomasello points to three components of thinking: cognitive representation, inference, and self-monitoring, and argues that all three changed in each of these transitions. The second stage improved on previous cooperative communication and led to conventional communication, in other words to language. The first stage was driven by ecological change that necessitated collaborative foraging and the second by a demographic change in human populations, specifically competition with other loosely-organized bands and an increase in population size. It happened at the earliest 200,000 years ago, that is with *Homo sapiens sapiens*. Joint and collective intentionality develop during ontogeny and require constant interaction with the social environment (p. 145). What we end up with is what Tomasello calls objective-reflective-normative thinking, which is unique to humans. Its unique feature is the ability to reason from an agent-neutral point of view, what philosophers refer to as the "view from nowhere." Tomasello argues that this perspective reifies the group's perspective. Indeed, he argues that humans exercise normative self-governance based on their culture's norms of rationality. This is connected to a built-in desire to conform to the group (p. 119). The subtle relationship between culturally-relative norms of rationality and presumably universal truth-tracking inferences, however, requires more elaboration than found in the book. Moreover, while I am totally sympathetic to the emphasis on collective intentionality, I find Tomasello's account too collectivist as a full analysis of this mode of thinking: Individuals can rationally transcend their group and are able to some extent to judge their own commitments based on norms that they personally endorse. Moreover, we are intrinsically motivated to try and justify them to ourselves and others. To my mind, these are the key elements that need explaining and do not seem possible as late-additions to already ingrained cognitive processes. An alternative account that I have argued for is that the view from nowhere, and generic descriptions of events more generally, are the result of normative deliberations rather than just enforcement and of repeated interactions of giving and asking for reasons (Lamm 2014).

This picture is similar the one painted by Mercier and Sperber (2011), in which reasoning evolved for argumentation, as well as with Tomasello's recasting of their account (p. 110). Tomasello emphasizes goal-directed interactions, such as collaborative hunting, rather than socially motivated interactions, but it seems reasonable that once social life gets started this distinction becomes increasingly irrelevant. More generally, a co-evolutionary account of the sort I proposed differs from Tomasello's preferred mode of explanation, a point I will return to.

For Tomasello, language comes into the story only in the second of the two stages, that is late into the process. It is in his words the capstone of human cognition, not its foundation (p. 127). Thus, cognitive building blocks that make language possible evolved earlier for the purposes of joint and collective intentionality, rather than co-evolved with language; they were however influenced by earlier forms of cooperative communication. During the first stage, communication consisted of pointing, gestures, and pantomiming which depended on perspectival and symbolic representation and propositional contents. The second, conventionalized, stage introduced objective representations and genuine propositions.

All three authors emphasize evolutionary changes to the brains of individuals not the evolution of social institutions (e.g., parenting technologies, division of labor) or cultural artifacts (e.g., educational toys). But at the end of the day, human thinking is, according to Tomasello, "no longer a solely individual process... it is an internalized dialogue between 'what I do think' and 'what anyone ought to think' (Sellars, 1963)" (p. 123). What role does the social and cultural context play in contemporary human cognition and its development, in language in particular? Bickerton has a lot to say about the debate between so-called nativists and empiricists about language and argues that syntax skills develop through the acquisition vocabulary. For Tomasello, constant interaction with the social environment is essential for both joint and collective intentionality, even though before the age of three children operate at a second-personal mode rather than the group-mode thinking of collective intentionality. He speculates that a group of isolated children without adult input would develop joint intentionality but not collective intentionality (p. 146). However, not enough discussion is devoted in these books to the cultural evolution processes that are responsible for creating this developmental scaffolding and why, if this scaffolding is required, collective intentionality is culturally universal. Tomasello discussed these issues in his 1999 book on the cultural origins of human cognition (Tomasello 1999). It is also not obvious that skills that evolved hand in hand with language and collective intentionality would not begin operating early in ontogeny, without significant cultural input, particularly if they aid language acquisition. For example, why wouldn't the isolated children Tomasello imagines see themselves as a group, even with none existing, due to innate predispositions? More generally, skills like pointing that appear early in development are not ipso facto evolutionarily early, and the evidence for them in non-human raised apes seems at best equivocal.

When

A central bone of contention among people studying the evolution of language is the timing of the main evolutionary change. Of particular interest is whether Neandertals possessed language, as more and more evidence suggests that they were hardly the simpletons they were considered to be and showing that they coexisted and interbred with modern humans. It has recently been argued convincingly that the origin of language should be pushed back to at least around 500,000 years ago, while rich social interaction preceded that for close to million years, and that Neandertals possessed language (Dediu and Levinson 2013; Dediu and Levinson 2014).

Tomasello dates his first stage, the evolution of joint intentionality, between around 2 MYA to *Homo hiedlebergensis* around 400,000 YA, but who probably lived earlier (p. 36). The second stage, the evolution of collective intentionality, he dates to before the migration from Africa, ca. 100,000 YA (p. 141).

Bickerton locates the transition to confrontational scavenging around 4 to 2 million years ago and the transition from *Homo habilis* to *Homo erectus* (pp. 83-85). This gave rise to displaced reference. The subsequent phase of brain reorganization took millennia.

Lieberman focuses on a genetic sweep that led to the fixation of the human version of the FOXP2 gene. This gene is the most well-known gene related to language abnormalities, though its function is far from clear. Lieberman provides an enlightening and engaging discussion of the work on FOXP2 and the differences between the human and Neandertal versions of this gene in chapter 4. DNA extracted from Neandertal fossils has the same two amino acid substitutions that humans carry, however the gene may have come from interbreeding with humans and there may be differences in the genes that FOXP2 (which is a transcription factor) regulates. There may also be differences in regulatory regions rather than the amino acid sequence of FOXP2. From the dating of FOXP2 and other considerations Lieberman concludes that language evolved ca. 260,000 YA (p. 147). Neandertals possessed some form of language according to Lieberman, but he argues that Neandertals were limited in their ability to imitate, and that this ability is the crucial element of human cognition (p. 152). Lieberman famously studied the language production of the vocal apparatus of Neandertals, and argued that they were not able to speak as clearly as modern humans. His description of this and subsequent work in chapter 5 is one of the highlights of the book. As concerns timing, he concludes there was no cognitive revolution in the Upper Paleolithic, ca. 40,000 YA, as has been often argued based on archaeological finds in Europe, and that the changes in human cognition occurred earlier, 260,000 YA, though after the split with Neandertals who remained more limited cognitively.

It seems that while there remain differences in interpretation and timing, the time frame suggested by Dediu and Levinson agrees with the time of the first

stages suggested by Bickerton and especially Tomasello. However, both of them argue for full natural language being a much later phenomenon.

Evolutionary dynamics

Two ideas that frequently appear in accounts of the evolution of language are co-evolution (e.g., between speech and language; production and comprehension; language and thought; social cognition and language; co-evolution between genes and culture) and evolutionary spirals that lead to increasing complexity. Given the kinds of difficulties in explaining language, the appeal of these ideas should be obvious. However, for both Tomasello and Bickerton the key to language evolution lies elsewhere. Bickerton disparagingly dismisses evolutionary spirals (e.g., p. 259). Tomasello, for example, argues that since the cognitive faculties involved are blind to content and that the diversity of human cultures is immense, the evolution of these cognitive faculties had to have happened at an intermediate stage between us and the last common ancestor with other primates (p. 32). Unlike Tomasello's account in which changes in cognition result from an ecological change and a demographic change, Bickerton emphasizes in addition internal processes of brain rewiring that minimize energy consumption and increase processing speed. While this should clearly affect fitness, Bickerton argues that these changes are not the result of natural selection (p. 107, 162). Presumably, the idea is that the reorganization is not the result of gradual accumulation of fitness enhancing neural changes, but rather reflects internal tendencies of the brain. However, we are not given a precise account of how ontogenetic brain changes become evolutionary changes in brain organization, something co-evolutionary and evolutionary developmental biology accounts attempt to do.

Bickerton urges us to consider evolutionary convergence and so has us reconsider the communication systems of bees and ants rather than primate cognition (p. 56). We should deduce the first steps toward human language, based on understanding what prompted the evolution of these systems (p. 81). The challenges in gathering food that these species face motivate his appeal to confrontational scavenging. This final suggestion points to ecological considerations similar to Tomasello's. However, while evolutionary convergence is certainly always a possibility, it typically presupposes an explanation based on evolutionary adaptation and on common selection pressures (see, for example, the criteria Bickerton suggests on p. 71). Bickerton sees only the first step toward language as an adaptation, however the insistence on discrete stages, each motivated by independent evolutionary causes is unmotivated. Evolutionary spirals, which may indeed be uncomfortably vague, suggest an alternative. While ecological causes could get the process started, these need not be the same ecological causes that led to superficially similar adaptations for communication, since evolution of communication is so intimately connected to social organization, social practices, and social cognition. Displaced reference may or may not be the

necessary first step toward language – Tomasello would argue that cooperative behavior is the key evolutionary stage we should focus on. Bees, however, are not a sufficient justification for this conclusion, merely a motivating example from species that, of course, did not go on to evolve language. It is instructive to compare the strategy Bickerton recommends with an even more radical strategy. Using simple game-theoretical models, the philosopher Brian Skyrms has argued that signaling systems can readily emerge when organisms have a shared interest in communication (Skyrms 2010). This happens simply as a result of evolutionary or learning dynamics. Skyrms shows that categorization can evolve in these simple signaling games without any substantive cognitive requirements. For Bickerton, using abstract categories is key to symbolization and is only possible with displaced reference (pp. 93-94), but recall that this is allegedly found in bees. The question is, then, just how far can we rely on convergence with simple models or organisms and on adaptationist reasoning? If Bickerton's strategy is accepted why not go the whole nine yards to accounts such as Skyrms's and explain symbolization more easily? Bickerton's criticism of Cangelosi's work, which similarly purports to show that simple virtual creatures can evolve categorization, is thus in tension with his insistence on evolutionary convergence.

A potentially useful explanatory device for explaining pro-social behavior is group selection of various sorts (e.g., Bowles and Gintis 2011). Tomasello argues for cultural group selection, in which group cohesion results from cultural conformity. However, group selection only occurs at the second stage of his account, since it depends on many non-trivial prerequisites (p. 128): group selection cannot be used to explain the capacities that make group selection possible. This is an important argument that some scholars overlook. But here too an evolutionary spiral account can make a difference: weak group tendencies may be reinforced via increasingly more robust group selection. Cumulative cultural evolution appears with the transition to group conformity (p. 121). In other words, effective cumulative cultural evolution appears late, with modern humans (p. 141). Tomasello is open to co-evolutionary possibilities, but to what extent? He holds the view that many of the complexities of language are “built on universal cognitive processes but with culturally constructed concrete manifestations” (p. 142). This suggests that cultural evolution did *not* lead to changes in innate abilities. This is certainly reasonable if one starts looking at cultural evolution that emerges with language, since children from different cultures can all learn each others languages. But it goes against the possibility that earlier stages of genetic evolution in humans were affected by cultural and social dynamics, a possibility that has many supporters. It is also in tension with evidence about Neandertal culture, assuming the bases of cultural evolution evolved in modern humans after the split from the common ancestor with Neandertals. More generally, it seems that the evolution of joint intentionality and of collective intentionality could have benefited from even limited cultural evolution and social support practices, such as alloparenting, that depend on culture, but this option is not developed.

Cumulative cultural evolution is particularly powerful in modern humans, according to Tomasello, because of their powerful imitation abilities, their tendency to teach one another, and to conform when being taught. Norms play an even greater role than this list suggests, however, since they enable rich social scaffolding of development. Norms and norm psychology are required for maintaining complex social institutions, including those responsible for supporting the development of the young, such as games and parenting practices. To take part in these practices and fully benefit from them children need to be highly receptive to norms. Tomasello's work with young children has shown that indeed they are receptive to norms and even attempt to enforce them from a very young age.

Bickerton argues that changes in behavior led to change in the brain, rather than the other way around. In this he accepts the idea that behavioral plasticity plays a key role in understanding cognitive evolution. This is in agreement with a more general conception, according to which many evolutionary changes are driven by phenotypic plasticity with genetic changes only following suit (West-Eberhard 2003). This insight supports the bi-directional, co-evolutionary interaction between culture and cognition that leads to evolutionary spirals that are eschewed by Tomasello and Bickerton (see, for example, Jablonka and Lamb 2005).

Wallace's problem

All three books are concerned with what makes humans cognitively unique. Bickerton is troubled by a more extreme version of this question, which he calls "Wallace's problem" after Alfred Wallace: "How did the human species acquire a mind that seems far more powerful than anything humans could have needed to survive?" (p. 1). His proposal is meant to explain why after the first step that was ecologically driven, the rest was inevitable. But is Wallace's problem real?

It is at best overstated. Nature is full of marvels and many species harbor unique features that might seem extravagant. Evolutionary analysis has managed to use standard tools to explain many such cases, from giraffe necks to bird songs to elephant trunks, to the compressed representation of genes in mitochondrial genomes, to the ability to withstand extremely high temperatures by thermophiles and so on. While cognition is harder to study than most traits, there is no reason to suppose it requires a unique style of explanation. Think of spider webs. The marvel of intricately designed spider webs is not found in species other than spiders. Evolutionists only rarely ask, "could spiders survive with something less powerful". Sure they could - other species use other means of survival. But that's neither here nor there when it comes to explain the evolutionary origin of the design of spider webs, for example their symmetry. Why there are no multiple species of humans, akin to multiple species of spiders, is an interesting question, but not necessarily one about the origin of human cognition.

Optimality and frugality considerations, which underly Wallace's problem, presuppose that traits are adaptations, but we are now well aware that not all traits are simple adaptations to a fixed ecological niche. For traits that evolved over long periods of time and in diverse ecological and social contexts we should be weary of assuming a single known niche and selection pressure. Language and its related cognitive skills certainly had multiple uses. Moreover, other factors affect evolutionary change such as historical constraints, developmental constraints and non-fitness directed changes such as genetic drift. Since adaptations do not arise in a vacuum, understanding their precursors and the constraints imposed by homology are critical. Here, Bickerton's objection to primate-centric approaches seems ill advised, while Tomasello's and others work on ape cognition is highly informative.

Thinking about the contexts in which language evolved suggests that co-evolution with social organization and culture could have played an important role and the social origins of language are increasingly recognized (Dor, Knight, and Lewis 2014). The co-evolutionary hypothesis comes from considering the bi-directional casual effects of language on social organization and culture, not from difficulties in evolutionary analysis. Moreover, as I have argued elsewhere, evidence from language and cognitive development supports a co-evolutionary explanation. Co-evolutionary scenarios indeed offer explanations for increased complexity and even evolutionary extravagance and the co-evolution of cognition and culture can produce similar complexification. This does not mean that cognition is not an adaptation, merely that it is not solely an adaptation to fixed ecological demands. The reason we found ourselves with this kind of evolutionary solution is rooted in where we started: a social species with unique learning abilities and, as Lieberman notes, impressive cognitive flexibility and creativity. A significant part of the arguments in these books is dedicated to explaining this starting point, too little on explaining how evolution took off after that.

To sum up. Reading Tomasello's book is a good way to understand how he connects the multiple ideas he has been developing over the years to form a coherent evolutionary story. It explicitly discusses his indebtedness to Lev Vygotsky, George Hebert Mead, and Mikhail Bakhtin as well as contemporary philosophers in particular Robert Brandom. His arguments in the book will surely be debated extensively in the near future. It is certainly a must read for people following the field. Bickerton's book discusses the peculiarities of language and its acquisition in greater depth than the other two books. It is an important update of Bickerton's well known work. His evolutionary views, and in particular his appeal to both convergent evolution and niche construction and evo-devo, deserve more space than I could devote to them here. Lieberman's book is the most idiosyncratic of the three and is geared toward a broader audience. Sadly, it suffers from many copy-editing mistakes which make reading less enjoyable.

Author information

Dr. Ehud Lamm, The Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, Tel-Aviv 69978, Israel. ehudlamm@post.tau.ac.il

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