Two Recent Contributions to the 'Origin of Language'- Debate

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Daniel C. Dennett's *From Bacteria to Bach and Back: The Evolution of Mind* was published in 2017, Robert C. Berwick's and Noam Chomsky's *Why Only Us: Language and Evolution* one year earlier, in 2016. Both books focus on the role and place of language in the evolution of the human species.

1 Dennett (2017)

Dennett does not accept the severing of body from mind proclaimed by adherents to Cartesian *Dualism*. He favours the view that the human mind is a function of the brain and that it enables us and only us, humans, amongst living creatures, "to act as reflective users of thinking tools". This is how he makes his point. Imagine for a moment a canary seeing from morning till evening a multitude of signs printed on the newspaper lining the floor of its cage. It must have watched his master looking at them intently during breakfast, before spreading the newspaper on the floor of its cage in order to keep it clean. In the bird's *Umwelt* those signs do not play any role at all, whereas for his master they are his favourite thinking tools, instrumental in conveying information and in a larger sense a substantial part of his *human* culture.

Dennett claims "that human culture started out profoundly Darwinian with uncomprehending competences yielding valuable structures in roughly the way termites build their castles, and then gradually de-Darwinized, becoming ever more comprehending, ever more capable of top-down organization…" (p. 148)

Another central idea of his is that our kind of human comprehension is only made possible by the arrival on the scene quite recently of a new kind of evolutionary replicator: "culturally transmitted informational entities: memes." (p. 175)

The Oxford English Dictionary defines *meme* as "an element of culture that may be considered to be passed on by non-genetic means". How a chimp learned to crack nuts with stones or to fish for ants with sticks or straws can be seen as rudimentary examples of culturally transmitted memes. *Homo sapiens* is the privileged user of memes and consequently the only species with a richly cumulative culture. The key ingredient that made this possible was language, where words, the best example of memes, are the essential instrument. The engulfment of the planet and the transformation of the environment by humans are manifestations of the superiority brought about by that linguistic capacity. During the last two centuries the world population swelled from a billion to seven billion. It will reach eight billion in less than a decade. Words play an "ineliminable" role in our explosive cultural evolution. During the last 50,000 years no important genetic changes occurred, yet the human cultural innovations were overwhelming: cooking, agriculture, transportation, religion and science.

Before Dennett sets out exposing his views on the role of words and on the origin of language within the "memetic" framework, he takes time for a swipe at what he calls the attitude of the 'Chomsky camp at MIT". Contrary to what one might expect of the pioneer of the idea of an innate *Language Acquisition Device*, Chomsky appears to "have disparaged evolutionary thinking in linguistics in almost all regards" (p. 188). In the ensuing skirmish with Silvain (sic) Bromberger Dennett shows a strong aversion for what is termed a "typical MIT style". Bromberger's criticism in 2011 of David Kaplan's article on "Words" in *The Proceedings of the Aristotelian Society* in 1990 is rejected in an unusually abrasive way.

According to Dennett the word is selfish in exactly the same way a gene is (cf. Dawkins 1976). "How do words reproduce?" is the first question addressed. It may seem a bit farfetched, but memes/words like autonomous items, are said to share with genes an urge to survive and reproduce! Between a human infant's birth and age 6, around 15,000 words are installed, 200 in the first two years. Each word is a novel auditory event. Its phonology is an anchor of sorts in the brain. Repetitions pile up, words take residence in the infant's brain and consciousness for language slowly grows. Meaning is acquired almost without instruction and syntax could well be imposed by an evolved brain structure.

Dennett also refers to "synanthropy" as an agent that helps infants acquire language. Their first words can be seen as a synanthropic species thriving in the company of humans with their peculiar physiology, habitat and needs. Just like the pups of wolves, that at first must have been attracted by discarded edible food, and later became junkyard dogs belonging to nobody. As a familiar pres-

ence in the company of humans, the pups domesticated themselves over many generations, their human neighbours becoming their owners, their guardians and finally their masters.

In a similar way the infant's words must have become domesticated with the backing up of the Establishment, the community in which they grow up. Phonemes are perhaps the most important design features of human language. They accomplish the digitalisation of the auditory medium. Without a digitalisation scheme audible sounds are hard to recognise or to remember. It is as if spoken words have to be shoehorned into phoneme sequences. Nonsense words like *fiddle-de-dee* or *razzamatazz* seem for that reason to persist only if they have phonemic parts.

Can one say that words do really exist? The answer should be no if one takes into account that they have no mass, no chemical composition and that they are not part of the scientific image. But on the other hand words are very prominent denizens of our "manifest image", i.e. the world we live in and know we live in. There are good reasons to include them in our ontology.

The role played by words in cultural evolution can be compared to the role of DNA in genetic evolution. But unlike the physically identical ladder rungs in the double helix made of Adenine, Cytosine, Guanine and Thymine, words are not physically identical replicators; they are identical only at the user-illusion level of the manifest image. Words are a kind of virtual DNA, a largely digitised medium that exists only in the manifest image.

Summing up: Dennett observes that chimpanzees experience speech very much like the rustling of leaves in the trees. Human infants on the contrary are hungry for verbal experience from birth. Words are affordances our brains are designed to pick up.

But how does Dennett explain the origin of language and how does he link the unique human cultural evolution to the acquisition of language?

Basically there are two different ways a bottom-up process can generate the know-how manifested in our linguistic skill. It either comes by genetic inheritance or it results from an unconscious deep pattern learning process. There is much to say in favour of the first assumption: an innate universal grammar enables infants to set its parameters according to the language or languages they are exposed to. Dennett agrees with Chomsky's "poverty of the stimulus argument". The infants' competence cannot be based only on the grammatical sentences they hear from their parents and caretakers. It must at least be partly innate.

Dennett's acceptance of the Language Acquisition Device (LAD) is immedi-

ately followed by the statement that Chomsky made the claim suspect in many quarters "by his adamant resistance to any attempt to account for the design of the LAD by natural selection." (p. 277). This refusal entails that the LAD looks more like a "skyhook" than a "crane", an inexplicable leap, a "gift from God" and definitely not the result of an arduous evolution over many generations, driven by natural selection.

The Minimalist programme and the switch to Merge as the sole and powerful logical operator (Hauser et al., 2002) is discarded as misguided without further ado. Its rebuttal by Pinker & Jackendoff (2005) is greeted with enthusiasm and "recursion" and "embedding" must not be taken seriously. Any attempt to consider the origin of language as a sort of "one-step cosmic accident, a found object—lucky us—not an evolved tool" (p. 277) must be misguided.

It is however not entirely impossible to come to terms with Chomsky's proposals, provided one ignores his antagonism to the hypothesis that natural selection is responsible for LAD. A plausible new conjecture could be to admit that Merge was not a fortuitous giant step, not a saltation, but rather a gradual development of more concrete versions of Merge. Dennett admits the possibility of Merge being a hard-wired operation of the brain, but excludes the hypothesis of a chance mutation of the brain structure. That a random mutation can transform a species in one fell swoop is not remotely credible.

The suggested reconciliation between the early and late Chomsky is possible only if one is prepared to consider Merge or something like it as an early candidate for a transitional innovation leading step by step to our modern languages. Merge could thus have been a deeply embedded pattern in ways of speaking, subject to improvements wrought by evolution, both genetic and cultural.

The Darwinian sacrosanctity of natural selection should by now have passed the test with flying colours. Dennett's next step is to extend the 'ubiquity of gradualness'-claim to the cultural evolution. Here is where Dennett's philosophy climaxes and where its innovating impact is manifest.

The assumption is that human culture started along the lines of Darwinian thinking but at a later stage de-Darwinized. This implies that uncomprehending competence,—think of termites building their castles—is profitably replaced by a process of ever more comprehension. The de-Darwinization must have gone on for a few hundred thousand years, developing, metaphorically speaking, cranes that helped to build other cranes lifting still more cranes. (No room left here for a Chomskyan "skyhook"!) Total change came when language got in place and when "memes" infected the brains of the apes humans no longer were.

Chimps and bonobos lack the talent to imitate. Humans on the contrary are talented imitators and thus kindled the cumulative cultural wildfire that marks us off from the other hominids. Verbal communication became the obligatory talent for our species and then started to exert a selective pressure in favour of organic modification, and in its turn this enhanced or streamlined the acquisition of language. A chief innovation was 'altriciality', prolonged infancy that extended the time of dependency of parents and caretakers for protection, nourishment and education.

Another interesting example of cultural/genetic coevolution is 'gaze monitoring'. Shared attention and intention coinciding with looking each other in the eyes is a necessary condition for the learning process during the "altricial" face time. Humans are very good at it. Domestic dogs are the only other mammals that also engage in gaze monitoring, but only with their masters, not with other dogs.

It is also noteworthy that only humans have "whites of the eyes" where other apes have dark sclera around the pupils. This could be an adaptation to facilitate gaze monitoring! A genetic response to a novel behaviour, itself intended as a means to enhance the transmission of memes.

The natural habitat of memes is, according to Dennett, our "manifest image". The latter is different from the original, scientific image. Memes are affordances we are equipped to notice, to recognize, to remember, to respond to. The moment we start to own them and to reflect on them, we have moved from the original image to the 'manifest image', to our world, the one we live in and know we live in.

In this process of growing competence language plays an essential role as a thinking tool. Competence designed by natural selection, now both genetic and memetic, provides expanding levels of further competence. Human culture accumulates at an ever swifter pace things to think with: writing, arithmetic, money, clocks, calendars. Memes triumphantly invade our brains and turn them into minds. "Cultural evolution has been de-Darwinized by its own products, but its Darwinian ancestry is still very much in evidence, and synanthropic, unauthored memes, like the bacteria that outnumber and outweigh us still surround us every day." (p. 331)

2 Berwick & Chomsky (2016)

Why Only Us is a collection of four essays: *Why now? – Biolinguistics Evolving – Language Architecture and Its Import for Evolution –- Triangles in the Brain*.

Three answers are provided to the question raised in the title of the first essay: (i) the linguistic theory has now reached maturation; (ii) the understanding of the biological basis for language has now considerably improved; (iii) the evolutionary theory has itself evolved. They are at the same time the three reasons for publishing this book. Its key goal is to resolve the tension between Darwinian continuity and change.

Darwinism demands a strict gradual continuity leaving room only for "numerous, successive, slight modifications between our ancestors and us". But there is also a yawning chasm between what we human animals can do and what other animals cannot. Its name is language. So we have to figure out "whodunit". The following five questions will be raised: What?, Who?, Where/When?, How? Why?

2.1 What?

European and American Structuralism put an end to the so far exclusively historic and comparative type of linguistic research. Language was seen as a "social contract", an "array of habits", the "totality of utterances made in a speech community". There was no inclination yet to consider language as a biologically relevant phenomenon.

Things changed when the need was felt to explain why acquisition of language by human infants seemed so easy and natural. Language was for the first time understood as a "mental organ". The investigation of the constraints on the biological system, the supposedly innate LAD (language acquisition device) contributed to the definition of what was termed "Universal Grammar"(UG). This led to the wide ranged investigation of the "Principles and Parameters" underlying UG. And then, during the 1990s, the pursuit began of the simplest, most minimal system in an attempt to characterize the narrowest imaginable phenotype of UG.

In the meantime "The Basic Property of Language" had been narrowed to the following definition: Language is a finite computational system yielding an infinity of expressions, each of which having a definite interpretation in semantic-pragmatic and sensorimotor systems. It has three components: (a) the central processing unit (CPU) with access to the lexicon of atomic elements (words and

morphemes); (b) an interface with the system of externalization (sensorimotor sounds or gestures); (c) an interface with the interpretative system.

The driving force of the CPU is assumed to be Merge, which applies to two objects X and Y and constructs from them a new object Z, leaving them unordered. Z is set {X Y}. Merge's output is a kind of triangle. The two arguments form the two legs of the triangle's base and the label sits on the top. X and Y can be two different elements selected in the CPU workspace, as when *read* and *books* are merged to form the syntactic object underlying the noun phrase *read books*.

This Strong Minimal Thesis (SMT) that is presented here, is far from being widely accepted. In the 1990s there was a current that led to the conclusion that UG doesn't really exist. Tomasello (2009) even proclaimed that UG was dead. The emergence of Language is considered to be solely due to the evolution of cognitive processes. Evidence on the dissociation of language capacity from other cognitive processes is ignored. And the same holds for the uniqueness of UG to humans. Frank et al. (2012) argue in favour of a non-hierarchical model of language use and claim that purely sequential structure is fundamental to human language processing.

This however is arguably wrong. Structural distance is measured by number of nodes crossed in a hierarchical representation. Linear distance is measured in terms of number of words intervening in the linear representation. In the following ambiguous sentence the adverb *instinctively* can be seen to modify either the preceding or the following verb.

(1) Birds that fly instinctively swim.

If the adverb is extracted and put first as in

(2) Instinctively birds that fly swim.

the existing ambiguity is eliminated and the adverb is construed only with the remote verb *swim*, and definitely not with the proximal *fly*. This is proof that the human brain does not seem to compute in a strict left-to-right order.

Hierarchical structure is also what matters in the following series of three sentences. The presence or absence of referential identity between the pronoun and the substantive manifestly depends on degrees of structural hierarchy. Note the subscripted noun phrases:

(3) a. He_i said Max_j ordered sushi.

b. Max_i said he_iordered sushi.
c. While he_i was holding pasta Max_i ordered sushi.

In (3-a), linking between the pronoun and the proper name *Max* is impossible, whereas it is in (3-b) and (3-c), although the pronoun precedes *Max* both in (3-a) and (3-c). Connection is fixed in human language by hierarchical structure, not by left-to-right sequential linear order. Nonhuman animals do not build comparable hierarchically structured representations. Only humans have Merge working hand-in-glove with word-like elements.

Berwick and Chomsky claim that language is in essence an instrument of thought and that there is a division of labour between hierarchical and linear order. The mental operation involving language should be independent of order. Order is a reflex of the sensorimotor system. When we speak we have to impose order on words.

This sensorimotor system must have been substantially in place long before language emerged, as will be explained in what follows.

2.2 Who?

The externalization of language as speech or text is made possible by a sensorimotor system that is itself based on a half a million years old capacity of producing articulated sounds. Recent research has discovered a convergence in an identical but independent evolution of vocal learning and production by songbirds and by us.

The ability to learn distinctive, ordered sounds is bootstrapped from perhaps 100-200 genes (Pfenning et al., 2014). Vocal learning in both songbirds and vocal-learning mammals comes with a distinctive neurobiology: projections from the vocal cortex motor regions to the brainstem vocal motor neurons. Zebra finch male birds and human vocal learners have a direct projection, which is conspicuously absent in non-vocal learners like chicken or macaques. There appear to be precedence-based dependencies at work in both birdsong and the externalization sound system of human language. But birdsong misses the key property of language, viz. hierarchical structure. Birds are not capable of recognizing hierarchical patterns. Birdsong is only a model for speech, not language.

Nonhuman mammals have an auditory perception that is perfectly adequate to perceive speech plus a vocal tract anatomy enabling them to produce a variety of perceptibly different sounds. They are equipped with a "language readiness". But where apes hear nothing but noise, infants extract language-relevant mate-

rial from the noise. They are capable of doing so thanks to an internal processing unique to human infants.

One of the most renowned attempts to teach chimpanzees human language was the project Nim. Researchers at Columbia attempted to teach Nim American Sign Language. All what Nim was capable of was a kind of rote memorization, short linear sign sequences. He never managed to produce a clearly hierarchically structured sentence. Chimps can store a list of explicit mind-independent associations. But they lack both Merge and the word-like elements. Chimps don't do language the way people do.

2.3 Where & When?

With this pair of questions about the evolution of language the third chapter in the "whodunit"-story has been reached. The questions concern the way organisms evolve. To the preliminary question "Is it evolution by creeps or evolution by jerks?" the authors reply without hesitation: "both of course!" They embrace the long-term possibilities and the short term ones.

Millions of years and hundreds of thousands generations may have been involved in the evolution of a vocal learning toolkit antecedent to both avians and us. But it just as well happens that only a few thousands of years and hundreds or a thousand generations are needed: in the case of relatively recent adaptations such as the Tibetan ability to thrive at high altitude and with scarcer oxygen, or acquiring the ability to digest lactose past childhood in dairy farming cultures.

Another example (the core thesis of the book!) is the short term and innovative ability to assemble hierarchical syntactic structure. There are other very early examples as well: the abrupt genomic/phenotypic shift from prokaryotes with simple cellular life, circular DNA, no nucleus, no sex and no death, to eukaryotes, with linear DNA, mitochondria, a nucleus, complex organelles, sex, love, death and language.

The authors further claim that Darwinism need not be viewed in an orthodox, fundamentalist and uniformitarian way as "micromutational".

The origin and emergence of mind-dependent word-like elements remains a mystery. It must have been prior to Merge. The first unambiguous evidence of symbolic behaviour as a proxy for language are, as far as we know, the artefacts dating from 80,000 years ago and found in the Blombos cave in South Africa: geometric ochre engravings and beads. They provide a reasonable time and place for the appearance of language.

Since there is a long period of stasis between a morphologic change and any associated behavioural or technologic shift, we can pin the appearance of anatomically modern humans at approximately 200,000 years ago in Southern Africa and the first behavioural modern humans at roughly 80,000 years ago, at the latest 60,000 years ago. And then Exodus started from Africa to the Old World and to Australia. This leaves us with about 130,000 years or approximately 5,000-6,000 generations of time for evolutionary change.

Autapomorphic, exclusive human language must have arisen between 200,000 years ago at the earliest and 60,000 years ago at the latest, but well before the African Exodus. This is not "overnight in one generation", but neither is it on the scale of geological eons. It is according to Nilsson & Pelger (1994) comparable to the time required for the full evolution of a vertebrate eye from a single cell.

2.4 How?

With this and the following question our mystery story becomes very speculative.

We do not really know how the Basic Principle or how the lexicon are actually implemented in neural circuitry. Experimental and genetic manipulations are impossible to be carried out in humans. Recent research has however revealed interesting things about the neurobiology of language. But before looking at a couple of them, the authors warn of a path they decidedly won't walk.

They refuse to accept that human language is "just like" standard sequential processing in other animals (cf. Bornkessel-Schlesewsky et al. (2015) or Frank et al. 2012 mentioned earlier.) And they also disagree with accounts that tend to explain language as parasitic on a pre-existing computational ability. Language cannot be seen as just a spin-off of the same capacity that explains gestures, music, pre-Google era complex navigation, complex food caching, knot tying and even baked potatoes (Hardy et al., 2015).

The Basic Principle distinguishes (a) a computational operation (Merge!); (b) the existence of word-like elements or previously constructed syntactic representations; (c) the computation itself. Where might all this happen in the brain?

This is what recent research has to offer. Perani et al. (2011) claim there are in the human brain long-range major fiber tracts linking the language related dorsal (superior) brain regions (Brodmann areas 44 and 45) to the language related ventral (inferior) regions. The former region, also known as Broca's area, is associated with syntactic computation and deficits; the latter region, also known as Wernicke's area, is where the lexicon is stored.

The key idea is that the dorsal and the ventral tracts form a "ring" that moves information from the lexicon to areas on the dorsal side, where it is used by Merge. If this fiber-tract ring is not in place the syntactic processing cannot work.

There is also evidence that the fiber tracts forming this ring mature over time. The brain is apparently not properly wired up at birth. Syntactic processing is not possible as long as the fiber tracts have not become functional. By about the ages two to three syntactic processing appears to be possible.

Auditory processing, to the contrary, is functional at birth. Children acquire the sound system of the language or the languages they hear. Comparative evidence shows the presence of the same fiber tracts in the brains of the macaque or the chimpanzee. But the latter miss a complete ring from dorsal to ventral sides. These data speculatively suggest that a fully wired ring is necessary to enable the Basic Property and the functioning of Merge in the lexicon-workplace

What is the evolutionary point? If syntax requires indeed a fully "wired" ring, it would perhaps not be "far off the mark" to assume that some "small rewiring of the brain" could have resulted in a fully working syntactic system, viz. Merge. A small genomic change in a growth factor for one of the fibers, along with proper fiber tract guidance might then suffice. And there was undoubtedly enough time for this to happen!

2.5 Why?

Why do we have language at all?

Throughout the book the authors have stressed that they do not accept that "communication" was the driver. Neither do they accept planning, navigation, or something like "the theory of minds and other minds" as a better explanation. They insist all this can be more readily subsumed under the banner that language is "an inner mental tool", the conceptual-intentional interface, which must be given functional priority.

Language is of course a means of communication, but it is in the first place an internal trait that boosted selective advantages, by means of better planning, inference and the like.

A reference to experimental research by Hermer-Vazquez et al. (1999) is presented on the last full page of the book.

Language appears to be the lingua franca, capable of binding together different representations from different modules just as an "inner mental tool" should. The capacity to integrate a variety of perceptual cues and reason would seem to have definite selective advantages. (Is the dangerous animal above or below the

rock? ... Did we hide the object in the corner where the white and the blue wall meet?) "Such a trait could be passed on to offspring, and might come to dominate a small breeding group – the evolutionary scenario we have envisioned. The rest is, literally, our story—the history of only us as a modern species." (p. 166)

3 Concluding remarks

There are a couple of manifest and apparent differences between *From Bacteria to Bach and Back* and *Why Only Us*. The former is by far the more voluminous of the two and has one author and a very catchy, sonorous "alliterative" title. The latter contains four separate "essays", it has two authors and a title that reads like a headline in a newspaper.

There are a number of more essential differences as well.

Dennett is a philosopher with a message, who proposes an interpretation of an evolutionary process. Berwick and Chomsky are scientists in search of what they assume is the best available explanation of same process.

The two approaches have one conviction in common: the emergence of an exclusive and specifically human language faculty challenges current Darwinian tenets.

Dennett adheres as long as possible to an unmitigated, "orthodox" Darwinian interpretation of the facts. When this mode falls short of providing the expected answers, he switches to a de-Darwinized approach. Once the innovating concept of memes is established, the book traces the rest of the evolutionary path from Bacteria to Bach along the lines of the new theoretical framework.

The presentation of the "memetic" interpretation is interesting and well documented. For it to be convincing, the reader has to put aside a series of likely objections.

Is one to accept that the first, primitive words ever used were a synanthropic, memetic and "selfish" species, thriving, as the word says, in the company of humans? Infecting the brains of the apes our ancestors no longer were? This may look exaggerated, but it is what Dennett claims. It is the centrepiece of his explanation of the evolution of the human species, with genes accountable for the genetic, and memes for the cultural aspect.

Apart from this peculiar stance Dennett also vents a strong aversion against "the MIT camp". One example has been mentioned, where S. Bromberger was "exposed". It probably has further consequences. The author fails or does not see a reason to mention Lenneberg (1967) (*Biological Foundation of Language*);

nor the year-long publication of the journal *Biolinguistics*; nor important recent contributions like Orr & Coyne (1992); Orr (2005); Yang (2002, 2013); Pinker & van der Lely (2014), to quote just a few. It is difficult not to interpret these and other omissions in the text and the list of references as a sign of disregard for opponents' points of view.

The absence of that type of bias in *Why Only Us* is quite obvious. So is the absence of a question mark in the title. The first word is not an interrogative but a relative pronoun, without explicit antecedent. The book's honest aim is to focus on a couple of 'reasons why' the faculty of language is exclusive. Ian Tattersall in the New York Review of Books predicts it "will fascinate anyone interested in the extraordinary phenomenon of language". One tends to agree.

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