Challenges to the What, When, and Why?

Berwick, Robert C. & Noam Chomsky. 2016. *Why Only Us: Language and Evolution*. Cambridge, MA: MIT Press.

by Marc D. Hauser

Why Only Us (WOU) is a wonderful, slim, engaging, and clearly written book by Robert C. Berwick and Noam Chomsky (B&C). From the authors' perspective, it is a book about language and evolution. And of course it is. However, I think it is actually *about* something much bigger. It is an argument about the evolution of thought itself, with language being not only one form of thought, but a domain that can impact thought itself, in ways that are truly unique in the animal kingdom. Seen in this light, *WOU* provides a framework for thinking about the evolution of thought and a challenge to Darwin's claim that the human mind is only quantitatively different from other animals. Since this is an idea that I have championed (Hauser 2009), I am of course a bit partial. Let me unpack all of this by working through B&C's arguments, especially those where we don't quite agree.

One caveat up front: As I have written before, including with B&C (Hauser et al. 2014), I am not convinced that the ideas put forward here or in *WOU* are testable: Animal capacities are far too impoverished to shed any comparative light on the evolution of human language, and the hominid fossil record is either silent or too recent to be of interest. My goal here, therefore, is to focus on the fascinating ideas raised in *WOU*, leaving to the side how or whether such ideas might be confronted by significant empirical tests.

One of the essential moves in *WOU* is to argue that Merge—the simplest recursive operation—is the bedrock of our capacity for infinite expression by finite means, one that generates hierarchical structure. Because no other animal has Merge, and because Merge is simple and the essence of language, the evolutionary process may well have occurred rapidly, appearing suddenly in only one species: modern humans or *Homo sapiens sapiens (Hss)*. To accept this argument, you have to accept at least five premises:

(1) Merge is the essence of language.
(2) No other animal has Merge.
(3) No other hominid has Merge.
(4) Due to the simplicity of Merge, it could evolve quickly, perhaps due to mutation.
(5) Because you either have or don't have Merge (there is no demi-Merge), there is no option for proto-language.

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I accept (2) because the comparative literature shows nothing remotely like Merge. Whether one looks at data from natural communication, artificial language learning experiments, or animal training studies with human language or language-like tokens, there is simply no evidence of anything remotely recursive. As B&C note, the closest one gets is the combinatoric gymnastics observed in birdsong, but these are neither recursive nor do they generate hierarchical structures that shape or generate the variety of meaningful expressions observed in all human languages.

I also accept (3), though here we don't really have the evidence to say one way or the other, and even if we did, and it turned out that say Neanderthals had Merge, it wouldn't really make much of a difference to the argument. That is, the fossil record for Neanderthal, though richer than we once thought, says nothing about recursive operations, and nor for that matter does the fossil record for *Hss*. Both records show interesting signs of creative thought—a topic to which I return —but nothing that would indicate recursive thought or expression. If evidence emerges that Neanderthals had Merge, that would simply push back the date of origin for B&C's evolutionary account, without changing the core details.

Let's turn to (1), (4), and (5) then. What is interesting about the core argument in *WOU* is that, although B&C place significant emphasis on Merge, they fully acknowledge that the recursive machinery must interface with the Conceptual-Intentional system (CI) on the one hand, and with the Sensory-Motor system (SM) on the other. However, once one acknowledges the non-trivial roles of CI, SM, and the interfaces, while also recognizing the unique properties of each of these systems, it is no longer possible to accept premise (4), and challenges arise for premise (5). This analysis lays open the door to some fascinating possibilities, many of which might be explored empirically. I consider a few next.

B&C devote some of the early material of *WOU* to review work on vocal imitation in songbirds, including comparative genetic and neurobiological data. In some ways, the songbird system is a lovely example because the work is exquisitely detailed and shows some nice parallels with our own. In particular, songbirds learn their song in some of the same ways as young children learn language, including evidence of an innate system that constrains both the timing and material acquired. However, there are elements of the songbird system that are strikingly different from our own, not mentioned in *WOU*, but when acknowledged, tell an even more interesting tale about the evolution of *Hss*—one that is at the same time supportive of the uniqueness claims in *WOU* while also raising questions about the nature of the uniqueness claim. Specifically, the songbird system is a striking example of extreme modularity. The capacity of a songbird to imitate or learn its species-specific song is not a capacity that extends to other calls in its vocal repertoire, nor to any visual display. That is, a songbird can imitate the song material it hears, but nothing else. Not so for our species, where the capacity to imitate is amodal, or at least bimodal, with sounds and actions copied readily, and from birth. This disconnect from sensory modality is a trademark of human thought, and of course, is a critical feature of our language faculty: At virtually all levels of detail, including syntax, semantics, phonology, and pragmatics as well as acquisition, there are no differences between signed and spoken languages. No other animal is like this. Whether we observe

songbirds, dolphins, or non-human primates, an individual born deaf does not emerge with a comparably expressive visual system of communication. The systems of communicative expression are intimately tied to the modality, such that if one modality is damaged, other modalities are incapable of picking up the tab. The fact that our language, and even more broadly, our thoughts, are detached from modality, suggests a fundamental reorganization in our representations and computations. This takes us to CI, SM, and the interfaces—and Merge.

Given the modularity of the songbird system, and the lack of imitative capacities in non-human primates, we also need an account of how a motor system capable of imitating sounds and actions evolved. This is an account of how SM evolved, but also about how and when SM interfaced with CI and Merge. There is virtually no evidence on offer, and it is hard to imagine what kind of evidence could emerge. For example, the suggestion that Neanderthals had a hyoid bone like *Hss* is interesting, but doesn't tell us what they were doing with it, whether it was capable of being deployed in vocal imitation, and thus, of building up the lexicon. And of course, we don't know whether or how it was connected to CI or Merge. But whatever we discover about this account, it showcases the importance of understanding the evolution of at least one unique property of SM.

When we turn to CI, and in particular, lexical or conceptual atoms, we know extremely little about them, even in fully linguistics human adults. Needless to say, this makes comparative and developmental work difficult. But one observation seems fairly uncontroversial: Many of our concepts are completely detached from sensory experiences, and thus can't be defined by them. If we take this as a starting point, we can ask: Do animals have anything remotely like this? On one reading of Randy Gallistel's elegant work, the answer is "Yes" (e.g., Gallistel 1990). All of the empirical work on number, time, and space in animals suggests that such concepts are either not linked to or defined by a particular modality, or minimally, can be expressed in multiple modalities. Similarly, there is evidence that animals are capable of representing some sense of identity or sameness that is not tied to a modality. If this is right, and even if these concepts are not as abstract as ours, they suggest a potential comparative approach that at this point, seems closed off for our recursive capacity. Having a comparative evolutionary landscape of inquiry not only aids in our analyses, it also raises a challenge to premises (4) and (5), as well as to Richard Lewontin's comment (supported by B&C) that we can't study or understand the evolution of cognition (Lewontin 1990). Let me take a small detour to describe a gorgeous series of studies on the evolution of cognition to show what can and has been done, and then return to premises (4) and (5).

In most monogamous species, the male and female share the same home range or territory. In polygynous species, in contrast, there are several females associated with one male, and thus, the male's home range area encompasses all of the smaller female home ranges. Based on this observation, Steve Gaulin and his colleagues (e.g., Gaulin & Wartell 1990; Jacobs et al. 1990; Puts et al. 2007) predicted that the spatial abilities of a monogamous vole would show no sex differences, whereas males would show greater abilities than females in a closely

related polygynous vole species. Using a maze running task to test for spatial capacity, results provided strong support for the prediction. Further, the size of the hippocampus—an area of the brain known to play an important role in spatial navigation—was significantly larger in males of the polygynous species when contrasted with females, whereas no sex differences were found for the monogamous species. This, and several other examples, reveal how one can in fact study the evolution of cognition. Lewontin is, I believe, flatly wrong.

Back to premises (4) and (5). If nonhuman animals have abstract, amodal concepts—as some authors suggest—then we have a significant line of empirical inquiry into the evolution of this system. If our concepts are unique—as authors such as B&C believe—then there may not be that many empirical options. Perhaps Neanderthals have such concepts, perhaps not. Either way, the evolutionary timescale is short, and the evidence thus far, relatively thin. On either account, however, there is the pressing need to understand the nature of such concepts as they bear on what I believe is the most interesting side effect of this discussion, and the issues raised in *WOU*. In brief, if one concedes that what is unique about language, and thus, its evolutionary history, is Merge, CI, SM, and the interfaces, then a different issue emerges: Are these four ingredients unique to language or part of all aspects of human thought? Said differently, perhaps *WOU* is really an account of how our uniquely human system of thought evolved, with language being only one domain in terms of its internal and external systems of expression. B&C often refer to our *Language of Thought*, as the core of language, and what is our most dominant use of language: internal thought. On this view, externalization of this system in expressed language is not at the core of the evolutionary account. On the one hand, I agree. On the other hand, I think the use of the term of 'Language of Thought' or LOT has confused the issue because of the multiple uses of the word 'language'. If the essence of the argument in *WOU* is about the computations and representations of thought, with linguistic thought being one flavor, then I would suggest we call this system the *Logic of Thought*. I suggest this substitution of L-words for two reasons. Language of Thought implies that the system is explicitly linguistic, and I don't believe it is. Further, I think Logic of Thought better captures the abstract nature of the ingredients, including both the recursive operations, concepts, motor routines, and interfaces.

The Logic of Thought, I would argue, is uniquely human, and underpins not only language, but many other domains as well. It explains, I believe, why actions that appear similar in other animals are actually not similar at all. It also provides the ultimate challenge to Darwin's argument that there is continuity in mental thought between humans and other animals, with differences attributable to quantity as opposed to quality. In contrast, if the ideas discussed here, and ultimately raised by B&C are right, then it is the Logic of Thought that is unique to humans. The Logic of Thought includes all four ingredients: Merge, CI, SM, and the interfaces. How these components are articulated in different domains is fascinating in its own right, and raises several additional puzzles. For example, if Merge is the simplest recursive operation, is it one neural mechanism that interfaces with different, domain-specific concepts and actions, or were merge like circuits effectively cloned repeatedly, each subserving a different domain? The first possibility suggests that damage to this singular Merge circuit would

reveal deficits in multiple domains. The second option suggests that damage to the Merge circuit in one domain would only reveal deficits in this domain. To my knowledge, there is no evidence of neuropsychological deficits or imaging studies that point to the nature or distribution of such recursive circuitry.

In sum, *WOU* is really a terrific book. It is thought provoking and clear. What more could you want? My central challenge is that it paints an evolutionary account that can only work if the essence of language is simple, restricted to Merge. But language is much more than this. As such, there has to be more to the evolutionary process. By raising these issues, I believe B&C have challenged us to think about another option, one that preserves their title, but focuses on the logic of thought. Why only us? Much to think about.

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