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Review of Ronald J. Planer and Kim Sterelny's *From Signal to Symbol: The Evolution of Language*

Ronald J. Planer and Kim Sterelny, *From Signal to Symbol: The Evolution of Language.* Cambridge: The MIT Press (2021), 296 pp. $35.00 (hardcover)

From Signal to Symbol is a recent contribution to the ongoing debate on how language evolved. Some tout this as the hardest problem in science (Christiansen and Kirby 2003). For one, the distinction between human linguistic communication systems and the simpler nonlinguistic communication systems of nonhuman animals is vast. Difficulties are exacerbated by the fact that any evidence for language origins is necessarily indirect—to wit, no fossils, no time machines. Furthermore, there is no consensus on what language *is*, so one's theory of language origins is (at least partially) determined by one's theory of language (Jackendoff 2011).

The question has been approached by linguists, anthropologists, evolutionary biologists, philosophers, primatologists, cognitive scientists, and more. Each discipline brings its tools and intuitions (or biases) to bear on the question, and researchers may carve the joints of the language-origins literature in several ways. Without delving too deeply into the divides (sometimes drama) between those who study the subject, Planer and Sterelny propose a theory of language origins that is (1) *wholly gradualist*, whereby language evolved incrementally via a series of increasingly rich *protolanguages* (lexically language-like communicative tools that lack overt morphology or syntax); (2) *gesture-first*, whereby complex signals began gesturally as combinations of simple point plus icon signals, later moving to the vocal-auditory channel; (3) an example of "*mosaic evolution*," whereby a set of initially independent abilities coevolved and gradually became more integrated (while still being relevant to other cognitive and social abilities); and (4) couched in a *sender–receiver framework*. Although none of these features is uncontroversial within the field, each claim is justified independently and fits well into Planer and Sterelny's overall picture.

Whether language origins is the most difficult problem in science, it is *a very difficult problem*. Hence one distinctive feature of this book is its clarity, despite its (vast) breadth and (relative) depth. Early on, Planer and Sterelny specify the rules of the game they are playing and then adhere to them strictly (5–7). They suggest that

any credible theory of language origins should satisfy (at least) the following *language-explanation criteria:*

1. The account should identify a sequence of changes, beginning with the communicative capacities of great apes (the baseline) and ending with roughly contemporary human capacities (the end point).
2. The baseline capacities proposed must be principled and supported by independent empirical evidence.
3. Each stage in the sequence should have only minor variations from its predecessor and successor.
4. Successor states must have some plausible and explicable fitness advantage based on (inference about) the selective environments of the agents in question.
5. The theory should have testable implications regarding the historical record.

Essentially, the explanation must be well supported and not depend on miracles. In addition, they propose the following *language-specific criteria:*

6. The account should explain the honesty of early language because deception is theoretically problematic when interests fail to align.
7. It should explain language's distinct scope and expressive power because generalization partly differentiates language from simpler communication systems.
8. It should account for uniqueness because there is an additional puzzle of why language evolved *only* in our lineage.

With this groundwork laid in chapter 1, chapter 2 outlines the end points of the lineage explanation, that is, the baseline cognitive and communicative capacities of early hominins. This provides a starting point for their explanation, bolstered by empirical evidence from comparative biology and paleoanthropology. Chapter 3 then argues that simple hominin protolanguages (at least 1.7 million years ago) expanded toward rich protolanguages used by *erectines* in the mid-Pleistocene. These gestural protolanguages, involving structured signaling, became more complex as the "lifeways" of *Homo erectus* expanded, and the lineage transitioned to *Homo heidelbergensis* during the late Pleistocene (approximately six hundred thousand years ago). Chapters 4 and 5 address the evolution of composite signaling, focusing on linear and hierarchical syntax, respectively. Chapter 6 addresses the transition from gestural to vocal modes of communication driven by the control of fire. Chapter 7 discusses the "second cooperation revolution," characterized by regular, delayed-return cooperation, leading to increased communicative demands and an environment in which cultural learning was more efficient. This last transition, they suppose, would lead to the advent of fully modern human language approximately 150,000 years ago.[1]

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[1] Related to baseline capacities, the authors suggest that all the necessary cognitive machinery for full language was in place by at least two hundred thousand years ago. Still, the lives of these hominins were not "economically, socially, or technically complex enough to require" the rich communicative tools of language (179).

Many of the ideas in this language-origins narrative have already been proposed by others.[2] However, their account is distinctive insofar as these (often disparate) research programs are packaged together in a "novel, coherent" narrative that includes recent paleontological, archaeological, phylogenetic, and genetic evidence. By their own lights, theirs is (perhaps) "the only monograph-length model of the evolution of language organized around and embedded in a specific, reasonably detailed, empirically constrained view of changing hominin lifeways" (xiii).

One reason the account appears so successful is that Planer and Sterelny pack a lot into the antecedents—namely, the baseline capacities—of the "language mosaic": short-term memory, online-processing capacities, and control; semantic memory; mental models; theory of mind; social learning; and prosociality (see chapter 2). The suggestion is that essentially everything required for language already existed in the ancestral species of *Homo sapiens.* Indeed, they suggest that extant great apes are "on the cusp" of composite sign use (98, 102) as they appear to have all the baseline capacities required for (simple) syntax. Thus the evolution of linear syntax is not a deep mystery; the explanatory gap is between linear and hierarchical syntax.

Here *hierarchy* is understood neuroscientifically—as a representation of action (in complex action plans)—instead of in terms of formal grammar. The authors highlight empirical evidence suggesting deep evolutionary precursors of this computational system in old-world monkeys. Thus many of the basic ingredients to cook up language were present in the baseline. Their evolutionary story, then, is how these baseline capacities were suitably upgraded or repurposed for communication. The (indirect) empirical evidence for their claims is subtle and diverse, including archaeological records of tools (since the transition from Oldowan to Acheulian industries would have placed evolutionary pressure on the cognitive capacities required for language); hunting habits, fire sites; and modern lab- and fieldwork with extant primates, genetic records, neuroimaging, and so on.

Despite this rich empirical work, there is little discussion of evidence from computer simulation and evolutionary game theory. Signaling-game models are quickly dismissed as overly simplistic. Although simple evolutionary models should be empirically grounded, they can have surprising results and be useful for testing the internal validity of a theory (LaCroix 2020). That said, considering the (self-proclaimed) gaps in their account, Planer and Sterelny gesture toward a body of future work—some of which may be fruitfully explored using computer models.

In the short final chapter, Planer and Sterelny assess how well their account satisfies their own rules. This chapter is a picture of epistemic humility: they do not claim to have satisfied each rule exactly, nor to have explained everything relevant to a *complete* picture of language origins. Nonetheless, they offer a baseline of early hominins' capacities and an "incrementally plausible and empirically principled" account of how this baseline expanded (214). Thus, although they do not claim to have fully satisfied the lineage explanation criteria, they have provided an outline (and

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[2] This includes their gesture-first account; that syntactic and cognitive abilities linked to language were driven by stone toolmaking; that large-game hunting and fire control increased communicative complexity via increasing demands of cooperation and coordination; that singing and laughter served an important preadaptive role for the transition to vocal language, where the "fireside niche" provided an ecological context for this transition; and that relationship tracking facilitated displaced reference.

sometimes more) of such an explanation. Notably, for the language-specific criteria, they have painted a gradualist picture of "an expandable lexicon, displaced reference, the core cognitive capacities on which syntax depends, the gesture–speech transition (assuming there was one), and the expanded functionality of language" (222).

Research on language origins appears close to a purely epistemic project: we want to know how language evolved simply to know. However, the recent popularization of language models in artificial intelligence might contradict this view. Despite overblown claims about these models' capacities, it is apparent that they will have significant social impacts. However, it is not obvious that generative AI models are *linguistic*, in any robust sense. Plausibly, language-origins research might clarify claims about capacities of AI models (LaCroix 2022).

It is stunning (perhaps absurd) that such a complex subject could be adequately treated in fewer than three hundred pages. Nonetheless, the result is an incredibly dense, rich, subtle, and (dare I say) plausible account of language origins. For those invested in the debate, this book is exciting to read. Except for some more niche concerns—whose importance may not be appreciated by researchers unfamiliar with the literature's landscape—the book also works as a detailed introduction to the subject.

Unfortunately, some substantive claims are bolstered by mere reference to the authors' prior work. This is a blessing and a curse. On one hand, this book fits within a larger tapestry of the authors' (joint and independent) research programs on general conceptions of human evolution (Sterelny) and the language-specific components of the argument—particularly concerning cognitive neuroscience and the evolution of structure (Planer). On the other hand, readers unfamiliar with these larger programs may not fully appreciate some of the subtleties contained in the book. Even so, the details the authors provide are sufficient to excite interest. My own approach has focused on linguistics, evolutionary biology, and signaling games, so much of the paleoanthropological evidence the authors discuss was novel to me. While reading, I was continuously reminded that it is a wonder we know anything at all—and that is a gift.

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