
Reviewed by RAY JACKENDOFF, Brandeis University

The laudable goal of this book, unfortunately not stated explicitly until page 195, is to ‘bring peace to a conflict that should never have broken out in the first place, and to show, contrary to so much that has been written over the past few decades, that the approaches pioneered by Darwin and Chomsky are fully reconcilable’. This goal, first stated prominently in an important 1990 article by Pinker and Bloom (not cited by Calvin and Bickerton), has been taken up by a growing community of researchers in the intervening decade (see, for instance, many of the papers in Hurford, Studdert-Kennedy, and Knight 1998, as well as Carstairs-McCarthy 1999 and Jackendoff 1999).

The book is written as a dialogue between the two authors, each writing relatively independently; their contributions are even presented in distinct typefaces. Occasionally one author interjects a paragraph or two of comment into the other’s chapter, but for the most part we are dealing with two separate interlaced books. Thus, unlike many collaborations, it is clear here precisely which idea is due to whom.

Derek Bickerton is responsible for what I consider one of the few good ideas in the literature on evolution of language: his proposal (Bickerton 1990) that language evolved in two stages, the second of which is the modern language faculty. The first stage is what he calls ‘protolanguage’, in which communication is accomplished essentially by unstructured strings of words supplemented by pragmatics. What makes B’s proposal of interest is his claim that protolanguage did not go away when modern language evolved. Rather, it still surfaces in situations when full language is either not yet developed (as in early child language) or disrupted (Genie, pidgins, possibly agrammatic aphasics); the communication of the language-trained apes appears to be another manifestation of protolanguage. Thus these situations function as sort of living fossils of earlier stages of human evolution. (A somewhat similar proposal appears in Givón 1979.)

Until the present book, B has argued that modern language emerged from protolanguage in a single catastrophic step (see the title of Bickerton 1998). Here, however, he advocates what I think many will see as a more reasonable gradualist position: Some innovation in the protolinguistic capacity resulted in the possibility of certain elements of syntactic structure, then further innovations, fueled by natural selection, led to the full modern capacity. Like Pinker and Bloom, B recognizes the possible role of the ‘Baldwin effect’ in ramping up evolution of an innate capacity: Put simply, if learning some particular ability promotes fitness, then individuals who can learn it more readily gain a selective advantage. One way to learn something more easily is to have some of it innately prespecified. Thus under the right conditions, some aspects of acquired knowledge can in succeeding generations be reinvented as innate knowledge. But such innate knowledge—knowledge that makes learning easier—is exactly what universal grammar is supposed to be.

To formulate a reasonable gradualist hypothesis, one must (1) suggest a plausible initial innovation that gets the process started and (2) suggest plausible steps from the initial innovation to the modern language capacity. Of course, one must also have a theory of the modern capacity that permits (1) and (2). One of the longstanding difficulties in reconciling Darwin with Chomsky is that the Chomskyan treatment of syntax does not lend itself readily to plausible incremental evolutionary steps. This is why Chomsky has advocated catastrophic emergence of language without the help of natural selection. B observes that the minimalist program offers an improvement in this respect, though not a sufficient one. In an appendix he sketches a modified minimalist theory that he claims is more adequate on both linguistic and evolutionary grounds. Aside from one comment below, I will not attempt to evaluate his proposal; I have argued on similar grounds (1997, 2001) that far more radical surgery is required on the traditional Chomskyan architecture. But B’s heart is surely in the right place.

B quite reasonably suggests phrase structure as his candidate for the innovation that set proto-
language on its way to modern syntax: the possibility of grouping a number of words and phrases around a head, the whole able to serve as an argument of some other word. Like others (e.g. Levelt 1999, Jackendoff 1997), he sees phrase structure as an exaptation of thematic role structure (argument structure) in meaning. In turn, he claims that thematic role structure developed as a consequence of being able to handle the social relationships necessary for practicing reciprocal altruism. Another possible source of thematic role structure is spatial navigation and tracking, whose importance B discounts but which (as Pinker & Bloom point out) also must be encoded in terms of relations and roles in order to deal with novel complexly structured situations.

B points out a difficulty with his position: Reciprocal altruism existed long before syntax and is practiced prolifically in ape societies. So, he asks, why did phrase structure take so long to develop? Why didn’t it emerge immediately as part of protolanguage? Here is where Calvin’s work comes in.

In a number of previous books (e.g. Calvin 1990), C has examined another human specialty, throwing. Chimps fling branches and rocks but, unlike humans, exhibit no evident intention to aim accurately. C observes that the timing precision required for accurate throwing of rocks or spears (say, in hunting) is beyond the capability of individual neurons, but precision can be achieved by massively parallel and redundant ensembles of neurons. His leading metaphor is the singing of an amateur chorus: Few members can sing their parts alone with the required accuracy, but somehow they reinforce each other to produce a massively coordinated and relatively precise effect. C therefore proposes that a task requiring timing precision recruits large assemblies of neurons. These neurons perhaps are not performing calculations they are specialized for, but like biologists singing in a chorus, they add to the mix what parallelism they can. In addition, multiple variants with the same overall goal are being run off simultaneously in competition, the most successful being executed as action and the others being extinguished. C calls this aspect of his theory a ‘Darwin machine’.

In the present book C presents a long train of speculation on how neurons manage to achieve such coordination and how entrainment of neural assemblies might be extended over multiple tracts of cortex. This is the point of contact with B. Both see the production of structured language as requiring complex timing precision in the course of formulation and motor execution. And if activity representations (hence verb meanings) are housed in frontal cortex and object representations (noun meanings) in temporal cortex, the assembly of argument structures requires massive and fast communication between these two brain areas. So their joint hypothesis is that the hominid brain expansion permitted greater parallel processing and interarea communication, for the first time making possible both throwing and syntax, as well as better planning and many other uniquely human activities.

Although both authors’ speculations are intriguing, the book is ultimately a frustrating read. It gives the impression of being not so much a collaboration as a pastiche of the two authors’ work, hastily assembled during their glorious month together at the Rockefeller Foundation’s Villa Serbelloni in Bellagio. Aside from the issue mentioned above, there are few points of contact: B talks about language; C talks about neural computation. One often has the sense of the authors talking past each other. For instance, at one point (155) C speaks of ‘deep structure’ and ‘surface structure’. B interrupts to upbraid him, explaining why these terms are not used in linguistic theory anymore and how they were misinterpreted by the general public; C then carries on using the terms with no apology.

More generally, C would have benefited from a far heavier editorial hand. Two quotations may convey the flavor of the rhetoric; they are extreme but not atypical.

A modern formulation [of the brain’s storage method] tends to use terms such as ‘chaotic attractor’ rather than resonance, helping to emphasize the way variant patterns are conformed to a standard. I tend, following the lead of Hebb’s contemporary J. W. S. Pringle, to emphasize the role of a plainchant chorus, utilizing those redundant ‘grooves’, helping to produce a standard version from all the potential variability caused by overwritings (69).

You can have incoherence at higher levels—say, for memory recall—for reasons other than corticocortical incoherence. Indeed, at a high level, we have a special term for an incoherent result: we ‘mix
metaphors”. But such writers [sic] are unlikely to have suffered a momentary lapse in their coherence at the corticocortical level (101).

More generally, my impression is that C’s proposals about neural computation are largely speculation supported by only the thinnest of evidence. His main mode of explanation is through homely analogies such as the amateur chorus. I found no references to literature either on the behavior of ensembles of neurons or on computational modeling thereof. Hence, as a nonspecialist, I am unable to judge how seriously to take his proposals.

One aspect of his proposal does raise a serious question in my mind. He emphasizes the importance of a neural ‘common code’ that enables widely separated brain areas to coordinate. He seems to think that the very same ‘spatiotemporal firing pattern’ can evoke the appearance or smell of an apple, depending whether it is executed in visual or olfactory cortex, and that the same code, executed in motor cortex, will cause the utterance of the word *apple*. But surely this is false. The structural organization of the phonology /æpl/—not to mention that of its motor execution—places entirely different requirements on neural representation than does a visual image of an apple. This is precisely why we speak of different levels of representation in linguistics. Rather than a ‘common code’, what we should be looking for is how the brain establishes correspondences between structural complexes couched in different codes, such that the association between the appearance of an apple, the concept of an apple, and the pronunciation of the word *apple* in English are linked in longterm memory and can evoke each other. Perhaps C is correct that humans can establish and use such multimodal correspondences more extensively than other primates; this remains to be seen. But they do not do it by using a ‘common code’.

Three aspects of B’s side of the story bear examination here. The first is his assumption, inherited from principles and parameters theory and the minimalist program, that syntactic branching is entirely binary and that linear order is purely a consequence of branching. From an evolutionary point of view this is a bit odd. Protolanguage is supposed to make use of linear order, and modern language surely uses it intersententially; moreover it is directly present in the surface signal, and thus learnable (Culicover 1999). Hence there is no reason evolution should throw it away as a source of structure inside the sentence. That is, we should see phrasal hierarchy as supplementing linear order rather than supplanting it.

Generative linguistics, of course, has typically pursued the goal of elegance, attempting to reduce the primitive structural notions to a bare minimum. But evolution tends to design multiple, partially redundant devices. Consider, for instance, depth perception in the visual system, which is served by mechanisms as disparate as lens accommodation (very sensory) to stereopsis (perceptual) to knowledge of how large familiar objects should be (very cognitive).

In this spirit, it is possible to envision even a gradual emergence of phrase structure in the course of evolution, starting with minimal grouping, i.e. relatively flat structures, and ending with highly structured trees. I have suggested (Jackendoff 1999) that relatively flat trees in fact still exist in modern language in the system of adjuncts, which are only loosely related to each other and whose interpretations involve large doses of pragmatics. Consider examples like 1, where the interpretation of each prepositional phrase is determined not by its position but by a subtle semantic/pragmatic interaction between the preposition and its object.

(1) a. With his trusty knife, Sam sliced the salami for two hours in the kitchen on Thursday.
   b. With Bill, Sam sliced the salami for the sandwich in a hurry on the boat.
   c. With great skill, Sam sliced the salami for Susan in ten seconds on a bet.

Beyond the grouping into PPs, syntactic structure is of little help in understanding these adjuncts and their relations to the meaning of the sentence as a whole. Even if there is strictly binary branching, it does not help. My sense, therefore, is that the grammar of adjuncts, unlike that of arguments, still retains a bit of protolinguistic flavor. B, who discusses only arguments, misses what I take to be potentially a significant amplification of the gradualist position.

Which leads to my second issue with B. He frequently argues that the difficulty with protolanguage is its overreliance on pragmatics to resolve ambiguity in the course of interpretation. The use of pragmatics is alleged to be slow and inefficient; true syntax enables language users to communicate faster and more precisely. While this point is surely valid, it requires more care.
For nearly 50 years, it has been recognized that the major obstacle to computer processing of natural language is the abundance of pragmatically resolved ambiguity in even the simplest of utterances. Moreover, speakers’ pragmatic resolution of ambiguity is hardly slow and lumbering. For example, one does not sense any inefficiency or delay in processing the adjuncts in 1a, 1b, and 1c. More tellingly, Tanenhaus et al. (1995) have demonstrated experimentally that in sentences like 2, listeners take visual input into account in resolving potential ‘garden path’ ambiguities, well before reaching the crucial point in parsing the sentence (marked with ^).

(2) Put the apple on the towel ^ in the cup.

Thus, although I basically agree with B about the selective advantage of hierarchical syntax in evolution, I think it is worth developing a somewhat more careful argument for it.

Perhaps the weakest link in B’s argument, however, is in his treatment of language processing. He claims that trees are built from the bottom up by successive binary attachment, as in the minimalist program’s operation of MERGE. While this may lead to an interesting formal account of sentence construction, it is unlikely to be an account of either sentence production or sentence perception, as B seems to be asserting. A speaker certainly need not begin constructing a complex phrase from its most deeply embedded constituent; and certainly a hearer does not wait until a rightmost deeply embedded constituent is heard before beginning to parse. B’s assertions about processing are moreover not harmless, as they constitute his main point of contact with C, who is developing a theory about how neural architecture supports language processing. Astonishingly, the book makes no reference at all to the rich experimental and theoretical literature on language processing, which by its very nature has to serve as the bridge between linguistic theory and neuroscience. Again, I think C & B are on the right track. Surely an ability to assemble temporally ordered hierarchical structure online is necessary to move up from protolanguage to modern language, and perhaps they are correct that this is a human specialization. But it is worth trying to make the argument much more carefully, making use of what is already known about language processing.

In the end, despite its weaknesses, I find this a provocative book in that it does offer a skeletal argument all the way from neurons and evolution to the properties of language. The challenge ahead is for linguists, psychologists, evolutionary biologists, and neuroscientists to collaborate, as congenially as C & B have, to fill in the picture more adequately.

REFERENCES


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This book is probably unique among studies of North American Indian languages in its accomplishments, and it is an important work for anyone interested in comparative syntax, those interested in the syntax of American Indian languages, and, above all, anyone studying Salish or other Northwest languages. The subtitle is crucial to knowing what to expect in general although it promises more than is actually presented (not surprisingly, given the huge array of possible syntactic issues in any language); what Kroeber actually does is compare a limited number of syntactic features of Salish languages, suggest reconstructions of them, and explain how they must have developed in various parts of the family. All this was no mean feat; Salish is one of the largest language families in North America (with 23 languages), and availability of pertinent data is very uneven. To make his job harder, K chose some of the most complex types of constructions that languages have to offer: complement and adverbial clauses, relative clauses, and extraction.

The volume begins with prefatory remarks on the sources he uses and how he has normalized transcriptions, essential lists of abbreviations, and a map showing the location of Salish and neighboring languages. Ch. 1 (1–78) provides a background for the rest of the book: the phonological inventory of Proto-Salish and many of its pertinent developments into modern Salish languages, then quick overviews of morphological and clausal structures that are necessary for an understanding of the body of the volume. Chs. 2 and 3 (79–251) look at complement and adverbial clauses; Chs. 4–6 (252–363) examine relative clauses, Ch. 7 (364–411) looks briefly at various fronting constructions, and Ch. 8 (412–32) speculates on possible influences from neighboring non-Salish languages. Other major syntactic issues are not treated at all, not bearing significantly on his major themes; thus there is nothing about compounding, lexical suffixes, causatives, or applicatives, all of which were found in Proto-Salish and have important syntactic ramifications in all modern languages of the family.

Very briefly, K’s findings are the following: (1) ‘Proto-Salish must have had a conjunctive inflectional paradigm of some sort’ (246), and this conjunctive ‘presumably marked conditional clauses’ (246), although how many varieties of conditional and adverbial clauses is indeterminate. (2) ‘Propositional nominalization can be assumed to have been used in most complement clauses other than interrogative ones’ (249). (3) ‘Relativization of subjects and objects presumably was marked not by any special overt inflection distinct from that of main clauses, but (if at all) merely by omission of subject or object pronominal morphology from the predicate complex’ (307). He finds it difficult to be sure how relativized objects or possessors were treated: ‘subject-centered clauses followed the present-day Bella Coola pattern’ (307); relativized oblique objects used nominalization by means of a prefixed /s-/.

The reader who pays close attention may observe a bias toward some Salish languages and a neglect of others. This was inevitable, given the availability of data. Just over 49% of K’s examples are from the Interior branch of Salish, 28% from the three northern languages of this branch alone. Forty percent are from the Central Salish branch; Tillamook and Bella Coola,