[Review]

The Biolinguistic Enterprise: New Perspectives on the Evolution and Nature of the Human Language Faculty


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A Tangled Web of Biolinguistic Questions

In October 1975, Noam Chomsky and Jean Piaget were invited to the Abbaye de Royaumont near Paris and participated in what later became known as the “Chomsky-Piaget debate” (see Piattelli-Palmarini (1980)). At this meeting, Piaget raised an important criticism of Chomskyan generative grammar, which was that the highly complex model of transformational grammar then under development was “biologically inexplicable,” lacking any sensible explanation of why the randomness of mutation endowed human beings with such an intricate cognitive structure (Piaget (1980: 31)). In hindsight, Piaget’s remarks may be regarded as presaging ‘biolinguistic’ concern for the nature and evolution of the human faculty of language (FL), which did not flourish until later. In his reply, Chomsky (1980) had no problem in concurring in part with Piaget and admitting that the evolutionary development of FL was “biologically unexplained” (p. 36), but he added that this situation was true of any biological organ in general: no one had

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a complete ‘biological explanation’ of the origin of the kidney, feather, or spine, and much the same still holds true today. Therefore, he concluded that no criticism of biological inexplicability could carry much empirical force in language science, or in natural science in general.

The Chomsky-Piaget debate took place almost forty years ago, and just one year after Massimo Piattelli-Palmarini introduced the term “biolinguistics” in the 1974 conference titled “A Debate on Bio-Linguistics,” foreshadowing the emergence of the contemporary biolinguistic enterprise (see Di Sciullo and Boeckx’s introduction, ch. 1, for historical details). Unfortunately, the evolution of the uniquely human FL stays largely as ‘biologically unexplained’ today as it was then, despite the fact that the highly complicated transformational grammar in the 1970’s has been radically reduced to a much simpler theory of UG currently assumed. Nevertheless, we have some grounds to believe that concern for the biological foundation of FL has driven several valuable conceptual shifts in generative linguistics, which constitute indispensable bases for the current biolinguistic enterprise. The first was the advancement of the Principles-and-Parameters approach, which focused on describing the basic format of UG, suggesting a way to overcome the fundamental tension between descriptive and explanatory adequacy. Second, the continuous endeavor to minimize the theoretical apparatus became explicit in the form of a research program known as the Minimalist Program (MP), which capitalizes on the strong minimalist thesis (SMT) that FL is an optimal solution to its design specifications. Third, the distinction between the three factors in language design came to be recognized ((I) genetic endowment, (II) environment/experience, and (III) principles not specific to FL), especially emphasizing the role of third-factor principles of efficient computation and design optimization (Chomsky (2005)). Fourth, FL was further divided into the two categories of FLB and FLN (the faculty of language in the broad and narrow senses; see Hauser, Chomsky and Fitch (2002)), paving the way for comparative research on human and animal cognition. Finally, the growing concern that theory must go “beyond explanatory adequacy” (Chomsky (2004)) sets an even higher goal of providing a “principled explanation” of why FL is organized the way as it is, resulting in three levels of adequacy: descriptive, explanatory, and what Narita (2010) calls biological adequacy. These theoretical notions all serve, not quite to resolve, but at least to clarify topics and problems we have to take into account in advancing the biolinguistic program. Even if the goal of biological adequacy is still on a remote horizon, we sincerely anticipate, more than ever before, that these shifts in perspective will provide us with
better conceptual bases for further progress in the biological exploration of
FL.

*The Biolinguistic Enterprise* (henceforth *TBE*) is one of the latest reports
of the state-of-the-art research in this growing field. Readers are referred
to the preceding reviews by Pietroski (2012) and Fujita (2013), and their
excellent work lets us skip our own summary of the chapters collected in
this volume. Instead, we would like to remind readers that *TBE* should be
regarded not so much as a catalog of full-fledged achievements that leading
scholars of the day have made, but rather as a series of acts in which
they each grope their own way through a dark haze of unanswered ques-
tions. *TBE* is a live record of their serious struggle, by no means trium-
phant, but at least with clear expositions of target problems that were hardly
formulable forty years ago. Henceforth, we would like to enumerate some
of the most pressing research questions addressed by these authors, which
are by no means exhaustive but certainly represent the breadth of contempo-
rary biolinguistic concerns.

[1] *What constitutes the first factor in language design, i.e. genetic
endowment? Especially, which constituents of the first factor yield the
human-uniqueness of FL, constituting FLN? How is the other part of FL,
call it FLN (equivalent to FLB minus FLN), shared by other species?* See
Berwick and Chomsky, Boeckx, Fitch, Berwick (chs. 2, 3, 7, 20) for FLN/
FLB, and Berwick and Chomsky, Piattelli-Palmarini and Uriagereka, and
Berwick (chs. 2, 5, 20) for the role of the *FOXP2* gene in the configura-
tion of FL (see also Newbury and Monaco (2010), Preuss (2012)). Ever since
Hauser, Chomsky and Fitch (2002) put forward ‘recursion’ as a candidate
for the single core, distinctively human constituent of FLN, this question
has been fostering a variety of ethological research projects on animals,
hoping for a possible comparative approach to human and animal cognition.
Recall that the dominant stance back in the 20th century was to argue for
a zero FLN with a highly articulated FLN. However, it came to be rec-
ognized that the feasibility of comparative research depends on the very
existence of FLN. Note that FLN is by assumption immune to compara-
tive research; thus, the best strategy for us to utilize animal science is to
(i) construct a theory of rich FLN and (ii) reduce FLN to a bare conceptual
minimum required for explaining why only humans acquire language. Note
also that agenda (ii) readily meets the goal of the MP, but agenda (i)
does not always do so, sometimes even going in the opposite direction of
complicating FLB just to provide room for pseudo-comparative problems
and just-so stories about evolutionary homologies and analogies (homo-
plasies). Such a move of FLN-enrichment requires careful and rigorous empirical justification. The field has experienced a number of recent cases where ill-advised sets of opposing formulations of FLN/FLB resulted in rather hostile and uninformative antagonism (monkey calls and birdsongs as precursors to FL, Pirahä as a unique language lacking recursion, etc.), numerous enough to make us wary.

[2] What is the nature of the “Merge” operation? Under the most general formulation, Merge reduces to the most unrestricted set-formation operation that takes \( n \) syntactic objects, \( SO_1, \ldots, SO_n \), and forms an unordered set of them, \( \{SO_1, \ldots, SO_n\} \). Merge represents arguably the simplest operation that one can expect to find in any recursive generative system of discrete infinity. Therefore, Merge, understood this way, is currently our best bet for FLN. However, many authors propose a variety of technical complications of Merge that deviate from the simplest formulation above. For example, it is still customary to stipulate, following the lead of Chomsky (1995), that the mechanism of labeling/projection is a built-in property of Merge, resulting in asymmetrically labeled (non-bare) tree-diagrams (Jenkins, Di Sciullo, chs. 6, 8, 13). See Narita (forthcoming) for detailed discussion of how the theory of bare phrase structure can approach a truly projection-free syntax. There are numerous other complications to Merge proposed in the literature, such as the binarity constraint that restricts \( n \) to 2, the yet ill-understood bifurcation of set-Merge and pair-Merge (the latter creating ordered \( n \)-tuples of constituents, \( <SO_1, \ldots, SO_n> \); Chomsky (2004)), the asymmetry/antisymmetry requirement on phrase structure (Di Sciullo, Kayne, chs. 13, 14; see Narita and Fukui (2012) for an opposing view), and so on. Each of these proposals complicates Merge beyond the simplest possible formulation above and hence bears the burden of empirical justification. See also Lasnik (ch. 15), who argues that the contemporary theory fails to account for the unlimited ‘flat’ expansion of coordination and adjunction, which may turn out to involve non-binary Merge, with \( n \) unrestricted (see Chomsky (1965) for much relevant discussion). However, how to restrict Merge is also a pressing problem: not only the \( n \)-ary application of Merge, but also various hypothetical instances of “tucking-in” (e.g. Richards (2001)), “sideward movement/remerge” (e.g. Nunes (2001, 2004)) and “parallel Merge” (“multi-dominance”; e.g. Citko (2005, 2011)) may easily lead to unwarranted overgeneration.

[3] Is UG “Merge-only,” or is there any other indispensable constituent of UG such as Agree, labeling/projection, uninterpretable features and checking and inheritance thereof, a cartography of functional categories, universal
word order templates like Kayne’s antisymmetry, postsyntactic rules like Function Application and Predicate Abstraction (Heim and Kratzer (1998)), etc.? Numerous chapters in TBE touch on this issue. Notice that these complications of UG each invite difficult questions regarding their nature and evolutionary origins. What is worse, these stipulations are almost always language-specific, enriching the burden of FLN. We are always better off having a minimal set of unexplained constructs in UG, following the MP.

[4] What constitutes the third factor in language design, i.e. natural laws and principles not specific to FL? For example, what is the proper characterization of the ‘minimal search’ principle that governs various domains, such as agreement, movement, head-detection (labeling) and binding? To the extent that this and other principles of minimal computation figure in the design optimization of FL, we can meet the minimalist goal of approaching the SMT (see [5]). Moreover, how does the principle of structural symmetry (or perhaps rather asymmetry/antisymmetry; Di Sciullo, Kayne, chs. 13, 14) figure in the computation of FL? (See Jenkins, chs. 6, 8, for the concept of symmetry-breaking; cf. Narita and Fukui (2012) for the view that syntactic computation is fundamentally driven for structural symmetry, or what they call ‘feature-equilibrium.’) Kayne (ch. 14) adds antisymmetry and antioptionality to the possible constituents of the third factor. See also Yang’s (ch. 9) discussion on the role of stochastic mapping in the acquisition of morphology and parameter-setting. Many more mathematical and physical principles may turn out to be operative in the domain of FL (see Narita (2009), Narita and Fujita (2010)). The desired eventual unification of biolinguistics with other natural sciences (physics, chemistry, etc.) depends very much on the progress achieved in this domain of research (see [14]).

[5] Is there any sense in which FL is a perfect/optimal solution to the design specifications imposed on it? That is, how can we make sense of the SMT? The MP is currently couched in the research endeavor of evaluating the SMT, turning the question around and searching for the external conditions for which FL is optimized, in the manner determined by the third-factor principles of efficient computation (see [4]). For now we can at least say that FL is known to fail to meet the desiderata of communicative efficiency and the ease of production/parsing, so these considerations are probably not directly relevant for articulating the SMT (Berwick and Chomsky, ch. 2). The optimization problem FL faces is thus still open to careful investigation, so “we have to learn about the conditions that set the problem in the course of trying to solve it” (Chomsky (2008: 135)). Note
also that the familiar move of stipulating *ad hoc* “interface conditions” at SEM/PHON amounts to enriching unexplained language-specificity, i.e. FLN, running afoul of the goal of the MP and biological explanation.

[6] *What is the nature of the conceptual-intentional (CI) system and its interface with syntax (SEM)? What are the three factors in the configuration of SEM/CI? How is CI different from the thought systems of other species?* See Larson, Giorgi, Hinzen (chs. 16–18). Analogously to the FLN/FLB distinction, we may distinguish the uniquely human CI in the narrow sense (CIN) and the possibly cross-species properties of CI in the broad sense (CIB), with the aim of subjecting the latter to comparative ethology. Again, the goal is to reduce stipulations in CIN, just like FLN, to a bare minimum. See e.g. Hurford (2007), who discusses a variety of possible constituents of CIB. Note, however, that lexical concepts available to human language have far more intricate and richer properties than other animals’ conceptual systems, constituting another solid instance of FLN/CIN (Berwick and Chomsky, ch. 2). Still exploring further possible reduction of CIN, Hinzen (ch. 18) raises the important question of how much we can explain CIN via syntax, i.e., how much we can seek to minimize unexplained stipulations in human semantics by attributing this apparent uniqueness to syntax, a natural object that we can scientifically study as such. See also Hinzen (2006), Chomsky (2007), Uriagereka (2008), and Narita (2009) for discussion.

[7] *What is the nature of the sensorimotor (SM) system, and of the mapping from syntax to SM (so-called ‘externalization’)? What are the three factors in the configurations of the externalization component (phonology, morphology, etc.)?* This is a domain in which we may expect to find quite a lot of FLN-constituents that are open to experimental investigation, both in humans and in animals. See Berwick (ch. 20) for the idea that the study of birdsongs may provide a rich avenue of research.

[8] *What is the role that temporal ordering (left-to-right linearization) plays in the computation of FL? Is it only part of the externalization component (Chomsky (2007, 2008)), or does it rather belong to the third-factor principles that figure in narrow syntax and possibly other parts of human and animal cognition (see Kayne, ch. 14, for exploration of the latter idea)?* Note that this problem should be carefully dissociated from the radical antisymmetry and inflating cartography of functional categories that Kayne and others are advocating, resulting in massive complication of FLN (see Narita (2010, forthcoming) for criticism).

[9] *What is the nature of the human lexicon, and of the lexical items*
stored therein? See Berwick and Chomsky (ch. 2) for the view that rich properties of lexical concepts like water, donkey, etc., are quite distinctive and uniquely human, constituting a solid instance of FLN (see [6]). See also Boeckx (ch. 3) for arguments that what actually lies in FLN is the ability to lexicalize various concepts. Turning to more specific questions, how can we characterize the distinction between lexical and functional categories, the open-closed class contrast, the noun-verb distinction (Kayne, ch. 14), the n-adicity of predicates, person split, voice (Manzini and Savoia, ch. 11), and so on? Another important question is whether the storage of lexical information is distributed over different components of UG as proposed by the Distributed Morphology framework.

[10] How does the sum of acquired experience (the second factor) figure in language acquisition? Which set of first and third factors contributes to the mapping of experience to attained grammars? This is part of the old problem of explanatory adequacy. See Yang (ch. 9).

[11] Where are the loci, and the limits, of linguistic variation? Specifically, can we restrict variation, in its entirety, to the externalization component and/or the lexicon, or should we admit variability in the domain of syntax and semantics as well, possibly originating from or correlating with the former (see Yang, Boeckx, Longobardi and Guardiano, chs. 9, 10, 12)? Moreover, are there any predetermined choices for variation in the form of parameters, or does the space of possible variation completely follow from the underspecification of UG (Boeckx, ch. 10)? FL-specific parameters enrich FLN, so the question is whether the empirical data provide sufficient support for this complication. Note that Yang’s (ch. 9) idea that children stochastically walk through the space of possible parametric variation seems to hinge on the notion of predefined parameters, but its reliance on parameters may eventually turn out to be dispensable. It should also be noted in this context that theories of parameters were once regarded as providing the framework that unifies the study of language acquisition, linguistic typology, and linguistic genealogy (diachronic change) (see Longobardi and Guardiano, ch. 12). If we minimize the explanatory role of parameters, what else can serve as a unifying framework?

[12] What are the principles governing speech perception and speech production (or more generally the use of language), and how do they figure in the design of FL? See Cecchetto and Papagno (ch. 19). Notice that if temporal ordering is a core property of linguistic computation, as Kayne (ch. 14) suggests (see [8]), it may turn out that some principle of temporal ordering uniformly governs both the core architecture of syntactic generation
and the sequential use of SOs by CI/SM.

[13] How can we establish the link between the abstract principles and structures of the grammar and nerve circuits in the human brain? Although discussion relevant to this topic is scarce in TBE (Berwick and Chomsky, Piattelli-Palmarini and Uriagereka, Fitch, Ccelchotto and Papagno, chs. 2, 5, 7, 19), suggesting its difficulty, it constitutes one of the pressing problems that future biolinguistics has to investigate. For various explorations of the neuroscience of language, see Embick et al. (2000), Musso et al. (2003), Sakai (2005), Friederici et al. (2006), Ohta et al. (2013), Berwick et al. (2013) and references cited therein.

[14] How can we unify physical sciences and mental sciences, overcoming mind-body dualism (metaphysical or methodological)? Every discussion of biolinguistics is ultimately related to this problem. The study of the first factor seeks the unification of linguistics with genomics and molecular biology (see [1]), and the study of the third factor seeks to find principles and generalizations that are to be couched in terms of physics and mathematics, pointing to unifying principles of the mind and the body (see [4]). It is also necessary to investigate the connection with brain science (see [13]). See also Narita and Fujita (2010).

[15] What is the evolutionary profile of human beings, and more specifically of the human-unique FL? Even though the discussion of the evolutionary origin of FL has become familiar in recent literature, as exemplified by not a small number of chapters in TBE, we have to remain cautious about the very feasibility of evolutionary explanations. Cf. Chomsky’s (1980) serious doubt on this matter: “We can, post hoc, offer an account as to how [the] development [of an organism] might have taken place, but we cannot provide a theory to select the actual line of development, rejecting others that appear to be no less consistent with the principles that have been advanced concerning the evolution of organisms” (p. 36). We have no reason to believe that the validity of his skepticism has diminished at all in the subsequent thirty-some years, despite the recent enthusiasm for post hoc evolutionary speculations. As mentioned above, the major value of the biolinguistic program seems to lie in its role in clarifying the matter, with the hope of subjecting it to scientific investigations (minimizing FLN and the mystery of its evolution, and maximizing the role of FLN and third-factor principles; see [1], [4] and [5]), not complicating it by importing unapproachable speculations.

The research topics in [1]–[15] characterize the considerable breadth of contemporary biolinguistic concerns, with no logical or practical priority
given to any of them over the others. They form a complex web of pressing questions, so overarching and intricately entangled that you can hardly address one without necessarily touching on the others. The chapters of *TBE* each attend to only a handful of problems of the authors’ choices, while they largely remain silent in the face of, or sometimes exacerbate the difficulty of, the other questions. The struggles experienced by these leading scholars are suggestive of how difficult it is to make progress in any one of [1]–[15] while not incurring a setback to the others.

As Di Sciullo and Boeckx (ch. 1) point out, biolinguistics is a fairly broad research program, and it allows for exploration of many avenues of research from various perspectives, as amply evidenced by every page of *TBE*. Indeed, a biolinguist can take any theoretical stance on various issues (formalist, functionalist, naturalist, internalist, adaptationist, etc.), and each perspective may have its own pros and cons. The broad umbrella of “biolinguistics” has been serving well to appeal to researchers from a variety of backgrounds and orientations, which should be regarded as a valuable step towards a better understanding of FL. However, merely jumbling up diverse (sometimes opposing) views is not the goal of the biolinguistic program, and it is not very informative, either. What we really hope for is collaboration: no one has a complete list of answers to [1]–[15], but each may have a better understanding of a different subset of the problems. By sharing biolinguistic concerns, we have to go beyond the narrow confinement of personal expertise and arbitrary interests, help each other through open-minded discussions, and rally various ideas and insights for eventual across-the-board progress in [1]–[15]. This seems to us to be a very difficult but equally exciting research avenue now ready to be navigated, toward a principled understanding of FL that could have been hardly envisioned forty years ago.

**REFERENCES**


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