A Naturalist Reconstruction of Minimalist and Evolutionary Biolinguistics

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Kinsella & Marcus (2009; K&M) argue that considerations of biological evolution invalidate the picture of optimal language design put forward under the rubric of the minimalist program (Chomsky 1993 *et seq.*), but in this article it will be pointed out that K&M's objection is undermined by (i) their misunderstanding of minimalism as imposing an aprioristic presumption of optimality and (ii) their failure to discuss the third factor of language design. It is proposed that the essence of K&M's suggestion be reconstructed as the sound warning that one should refrain from any preconceptions about the object of inquiry, to which K&M commit themselves based on their biased view of evolution. A different reflection will be cast on the current minimalist literature, arguably along the lines K&M envisaged but never completed, converging on a recommendation of methodological (and, in a somewhat unconventional sense, metaphysical) naturalism.

Keywords: evolutionary/biological adequacy; language evolution; methodological/metaphysical naturalism; minimalist program; third factor of language design

1. Introduction

A normal human infant can learn any natural language(s) he or she is exposed to, whereas none of their pets (kittens, dogs, etc.) can, even given exactly the same data from the surrounding speech community. There must be something special, then, to the genetic endowment of human beings that is responsible for the emergence of this remarkable linguistic capacity. Human language is thus a biological object that somehow managed to come into existence in the evolution of the human species.

In a recent issue of *Biolinguistics*, Kinsella & Marcus (2009; K&M) argue that 'evolvability' should be a central constraint on linguistic theorizing, both in terms of methodology and empirical content. They specifically argue that evolution in

the natural world is known to create all sorts of imperfect and redundant organisms, and thus human language should also be expected to fall in this major category of imperfection. They pose their evolutionary argument in opposition to the minimalist program for linguistic theory advanced by Chomsky (1993 *et seq.*), which seeks signs of optimality in the computational mechanism of human language. K&M's position is also in opposition to the thesis that the theory of language evolution very much depends on the theory of language, for which we can find various resonances in the linguistic literature (see, e.g., Chomsky 1980, Jackendoff 2010).

We totally agree with K&M in that our theory of language must achieve evolutionary plausibility or meet the evolvability condition. Unfortunately, however, their conception of this notion is not a legitimate one, ignoring many aspects of biological evolution that are not readily captured by their biased view on adaptation. In this paper, we will reject K&M's framing of these issues and argue that there should not be any stipulated or presumed asymmetric dependency between the theory of language and the theory of evolution. We will critically examine K&M's counterarguments to biolinguistic minimalism, and point out that (i) they fail to discuss the third factor of language design, which plays a central role in biolinguistic minimalism (Chomsky 2005), and that (ii) K&M's adherence to the Neo-Darwinian dogma of gradual adaptation by natural selection is in exact opposition to their otherwise sound warning that we should not be trapped by any aprioristic presumptions regarding the nature of the object of inquiry. We will also discuss how these considerations relate to methodological naturalism originally put forward by Chomsky (1995a, 2000b).

2.   The Minimalist Program and the Third Factor of Language Design

K&M point to various corners of natural language and suggest that human language cannot be regarded as either perfect or optimal. According to K&M's view, not only countless superficial performance errors like slips of the tongue and garden-path parsing but also various aspects of the core architecture of grammatical competence such as morphological redundancy and irregularity, lexical and structural ambiguity, and other apparently unnecessary complexities constitute ample evidence for the imperfection of human language. K&M claim that inelegance and inefficiency are traits that we usually expect biological objects to have, given the overall tendency for evolution to fall short of ideal architectural designs. They adduce these facts against the *strong minimalist thesis* (SMT) of biolinguistic minimalism (Chomsky 2000a *et seq.*), according to which human language is an optimal solution to the usability conditions imposed by the neighboring performance systems (see also Narita 2009a, 2009b). They claim that the SMT is quite at odds with the above-mentioned facts of linguistic imperfection. They further claim that 'evolvability' should be a central constraint on linguistic theorizing, and that an evolutionarily plausible theory of human language should provide much more room for imperfect constituents than does the minimalist endeavor to seek optimality and perfection in the linguistic system.

K&M further argue that because minimalist notions like optimality and

perfection are never clarified in the minimalist literature, they cannot put any meaningful and realistic constraint on linguistic theorizing. Building on Pinker & Jackendoff's (2005: 27) remark that "nothing is 'perfect' or 'optimal' across the board but only with respect to some desideratum", K&M go on to examine various possible criteria of optimality, including ease of production, ease of comprehension, ease of acquisition, efficient brain storage, efficient communication, efficient information encoding, and minimization of energetic costs. None of these criteria strike them as plausible or promising, and so they draw the conclusion that, "unless there is some clear, *a priori* criterion for optimality, claims of optimality have little force" (K&M: 198).

It is curious to note that, despite their forceful attempt to undermine the content of optimality and economy in the minimalist conception of human language, K&M fail to discuss (either involuntarily or deliberately) the source of optimality and efficiency that has been repeatedly (if not thoroughly) discussed in the minimalist literature: The *third factor of language design* (Chomsky 2005, 2007a, 2007b, 2008). Chomsky (2005) reminds us of a virtual truism that the design of the faculty of language (FL), or of any biological system for that matter, should be attributed to three factors: (i) genetic endowment, (ii) external stimuli from the environment, and (iii) physical principles that are not specific to FL. Chomsky repeatedly emphasizes that among the third factor constituents is the principle of computational efficiency, which is expected to be of particular significance for discrete generative systems such as human language.[1] K&M examine many candidates for the measure of economy (asking, "optimality for what?"), but strangely, they completely fail to discuss the third factor, a central concept of the minimalist program that is claimed to be *the* criterion of computational optimization of human language.

The nature of the third factor that enters into the SMT, let alone what kind(s) of energy or cost it is optimizing human linguistic computation for, is admittedly quite ill-understood at this early stage of minimalist inquiry, but there are already some promising proposals. For example, it is likely that the *principle of economy of derivation* (Chomsky 1995b: 138–145) will come to play a significant role in the undertaking of the SMT. It requires that syntax choose the least costly derivation to reach the interfaces, where the cost of derivation is determined solely by some syntax-internal metric, such as the number of derivational steps. This principle can be arguably regarded as a linguistic analogue of Hamilton's Principle of Least Action; see Fukui (1996) for much relevant discussion. It is moreover conceivable that such an inherently global principle of computational optimization further forces syntactic derivation to adopt some sort of computational cycles, such as *phases* (Uriagereka 1999, Chomsky 2000a, 2007, 2008), constituting a kind of heuristic 'computational trick' (Chomsky 1995b: 162, Fukui 1996) that syntax uses for restricting computational domains locally and thus reducing the computational load. Importantly, such a move toward optimization of

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[1]   In addition to the principle of computational efficiency, Chomsky also adds the constraints that enter into all facets of development and evolution of any organisms to the (forthcoming) catalog of the third factor principles. Such principles are now explored intensively in the so-called "evo-devo revolution" (Chomsky 2007a: 3).

syntactic derivation is also corroborated by certain empirical considerations, as discussed in Chomsky (2000a *et seq.*) and Uriagereka (2009). Note further Uriagereka's (2009) claim that the *Chomsky Hierarchy* of strong generative capacity figures in any computational system so naturally that it "can be understood as a primitive for the purposes of the SMT" (p. xvii). Uriagereka also makes the claim, following Hinzen & Uriagereka (2006), that syntax (as well as semantics) has formal structural bases akin to number theory and topology, hinting at the possibility of comparative study of these human-unique capacities. Quite relevant to this future comparative research is Kuroda's (2009) discovery that there exists a formal procedure for transforming the Euler product representations of certain ζ-*functions* (a fundamental concept in number theory) into phrase-structure representations, an intriguing result that should be readily translated into the Merge-based generative system, as pointed out by Fukui (forthcoming); see also Fukui (1996, 2008), Uriagereka (1998, 2002, 2009), and Narita (2009a, 2009b, 2010a) for related discussion.

Needless to say, none of these proposals receive wide acceptance in the literature. They are rather under serious empirical scrutiny, and controversy arises as to how (or whether) these hypotheses can be refined or modified to accommodate apparent counterexamples. But this is the nature of any scientific inquiry, and we can only hope that we can eventually revise or refine the proper formulation of the relevant computational principles through empirical examinations not only in linguistics proper but also language-external domains.

Contrary to such a normal research attitude toward the eventual refinement of theoretical constructs, however, K&M claim that biolinguistic inquiry must meet a stringent requirement: That it attains some *a priori* content of the linguistic criteria of optimality before it can investigate the effect of such optimization. Such a peculiar constraint upon possible lines of empirical inquiry is unheard of elsewhere in natural sciences. Rather, as is familiar with any other natural science, "we have to learn about the conditions that set the problem in the course of trying to solve it" (Chomsky 2008: 135–136). In such a naturalistic inquiry, the research task is bound to be interactive, in that it must seek to "clarify the nature of the interfaces and optimal computational principles [i.e. third factor principles — HN & KF] through investigation of how language satisfies the conditions they impose" (p. 136). Inquiry into these problems is, further, naturally and ordinarily benefitted by posing the SMT as a working hypothesis: The research decision to investigate the effect of third factor principles in the domain of FL entails the expectation that there are indeed some such third factor principles which are operative in the architecture and working of FL, and which we can hope to discover eventually.

K&M repeatedly accuse biolinguistic minimalism of the "presumption of perfection in language" (p. 187, 197, 201, 207). However, now we can conclude that their condemnation is primarily based on their misunderstanding of the SMT. As we have recapitulated above, the third factor and its efficient optimization in the domain of FL is something that minimalism is searching for, not something that it presumes. The SMT is *not* aprioristic presumption of perfection, but a working hypothesis that is adopted to (hopefully) enhance the eventual discovery of some real substance in these notions. Optimality is just a nickname for

what we want to discover, not what we aprioristically insist on by vacuous speculation.[2] It is trivially true that we have not come up with a proper and complete characterization of the relevant optimization principles, but that does not constitute any reason for us not to hope for one.

3.   Evolvability, Adaptationism, and Minimalism

Let us stress at this point that our position is in perfect agreement with K&M's in several important respects. First and foremost, we firmly believe that our theory of language, if it is to be a biolinguistic one, must be compatible with what is known about biological evolution, of which language evolution represents a recent example. In fact, we have independently discussed and emphasized the importance of this kind of evolutionary plausibility constraint on linguistic theorizing under the rubrics of 'evolutionary adequacy' (Fujita 2007, 2009) and 'biological adequacy' (Narita 2010a), which we take to be conceptually equivalent to K&M's evolvability condition understood in the most general sense; see also Boeckx & Uriagereka's (2007) discussion of 'natural adequacy'.[3] We also agree with K&M (and with every evolutionary biologist) that gradual adaptation by natural selection is a major element of biological evolution and that for familiar reasons it often yields only sub-optimal solutions, absolute optimality or perfection being rare cases.

That being said, we can point out several flaws in K&M's arguments against minimalism. To begin with, as K&M themselves admit, "evolution sometimes achieves perfection or near-optimality" (p. 188). So it is rather self-contradictory that they reject from the start the possibility that language is one instance of such perfection. By doing so, they are actually claiming that language is very special in the biological world, contrary to their own belief that it is not. In fact, many instances of biological design can be shown to obey some optimization principles. A classic case is bone structure, which achieves maximal strength with minimal material (Roux's maximum-minimum law; see Gierse 1976). Likewise, blood vessels are known to have an architecture that ensures efficient blood flow with minimum energy consumption. Also, Christopher Cherniak's work on brain wiring minimization, often cited in Chomsky's recent writings (Chomsky 2005 *et seq*.), points to the fascinating conclusion that neural optimization is a ubiquitous biological property derived "for free, directly from physics" (Cherniak 2005, 2009, Cherniak *et al.* 2004). In fact, there is a long history of debate among biolo-

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[2]   However, see section 4 for our own assessment of the current minimalist literature.

[3]   More technically, evolvability can be defined as "the organism's capacity to facilitate the generation of nonlethal selectable phenotypic variation from random mutation" (Gerhart & Kirschner 2003: 133) or "how probable […] it is that a species, or life form in general, will evolve into something new" (Ridley 2004: 587). It is therefore somewhat misleading to claim that language is evolvable in order to express the truism that language is a product of biological evolution. Precursors of language, or our ancestors who had them, were evolvable, but whether language itself is evolvable (according to the strict definition given above) even today is another matter. See also Masel & Trotter (2010) for an in-depth examination of the notion of evolvability.

gists with respect to the extent to which biological design can be said to be optimized for relevant functions. The theory of 'symmorphosis', for example, claims that a biological structure is economically designed, to an extent that is just sufficient to satisfy its functional need (Weibel 1998, Weibel *et al.* 1991). Given this state of affairs, we need to realize that at least conceptually, the evolvability condition on language does not preclude the possibility that (part of) the human language faculty also instantiates such optimal design found elsewhere in the biological world.

It is interesting to note in this context that already in the famous Chomsky–Piaget debate in 1975 (see Piattelli-Palmarini 1980), Piaget criticized the highly complex ('imperfect') model of transformational generative grammar which was then under development as "biologically inexplicable" (Piaget 1980: 31; we may justifiably rephrase it as 'un-evolvable'). In his reply to Piaget, Chomsky (1980) had no problem in admitting that the evolution of human language is "biologically unexplained", but he added that this situation is generally true for any other biological organisms, and that, correspondingly, any criticism of biological implausibility/'inevolvability' cannot carry much empirical force in natural science. The evolution of an organism is, like anything else in the biological world, a result of complex interplay among the three factors of design mentioned in the last section, and without sufficient understanding of their delineation, jumbling such massive interaction effects under the broad name of evolution or evolvability cannot be really helpful or informative. Nor, in the absence of a precise understanding, can it reasonably be defended as a constraint on any biological theorizing, be it the highly complicated model of transformational grammar in the late 1970's or the currently developing minimalist inquiry.

K&M observe, ostensibly correctly, that perfection and optimality do not very often result from adaptation by natural selection, but then they hastily conclude, incorrectly, that evolvability considerations do not tolerate the optimality of language design that minimalism is searching for. While surely adaptation by natural selection is one major aspect of evolution, it must also be admitted that natural selection does not work in a vacuum, and a full understanding of biological evolution requires taking into account many factors other than natural selection, including random genetic drift, genetic assimilation, exaptation, self-organization, canalization, etc., all of which are presumably governed by the physical laws of nature. In other words, a theory of natural selection needs to be supplemented by those mechanisms if it is to explain anything about evolution.

As we saw in the previous section, minimalism is essentially a research program that seeks to identify the (optimizing) effect of physical laws of nature in the domain of human language. K&M's rejection of the minimalist endeavor, then, essentially amounts to making a very unrealistic claim that we had better disregard the relevance of all such effects (viz. the third factor) from biolinguistic theorizing, prioritizing the notion of gradual adaptation. We hold that this position is not tenable for language, or indeed in any evolutionary studies. It is quite possible that K&M themselves fail to appreciate their commitment to this unrealistic claim, but this is again due to their failure to recognize minimalism as a quest for the third factor.

It can be pointed out that the above-mentioned unrealistic view can be seen as a particular instantiation of what Godfrey-Smith (2001) calls 'empirical adaptationism', a very strong empirical hypothesis which holds that it is possible to predict and explain the outcome of evolutionary processes by attending only to the role played by natural selection (p. 336). According to this view, no other evolutionary factor has the degree of causal importance that natural selection assumes, so that we can safely ignore all other non-selective factors, if any, and focus on adaptation by natural selection for the purpose of understanding evolution. Empirical adaptationism understood as such is easy to refute, for which we regard the references cited above as providing ample evidence.

Incidentally, Godfrey-Smith points out that it is important to appreciate the difference between empirical adaptationism and at least two other kinds: explanatory adaptationism and methodological adaptationism. According to Godfrey-Smith, 'explanatory adaptationism' is the position which holds that adaptedness of the design of organisms to environments is the most important problem to be addressed in evolutionary biology and that natural selection should be the primary solution to understanding it. According to this view, natural selection keeps its central role in evolutionary biology even if its effect eventually turns out to be scarce in the actual world. Thus, if some trait exhibits adaptedness to an environment, it is regarded by explanatory adaptationism as primarily a result of natural selection, but there is no implication here that all traits are adaptations, nor that natural selection always yields adaptive traits. In contrast, 'methodoloagical adaptationism' only makes the claim of heuristic interest that adaptation and good design fashioned through it are the first things biologists should seek in evolutionary studies. According to this third view, the idea of adaptation is a good "organizing concept" (p. 337), and the search for it offers the best methodological guideline for the study of evolutionary biology, by and large independent of the actual privilege natural selection assumes in evolution. Godfrey-Smith points out that most of the perplexing controversy concerning the (in)validity of the adaptationist program derives from failure to differentiate these three kinds of empirical adaptationism: Some argue in favor of one kind, while others try to refute them when in fact they are only arguing against another kind of adaptationism. Misunderstandings of this sort should be regarded as a harmful barrier to the development of evolutionary biology and in particular to the sound progress in biolinguistic studies of language evolution. See Godfrey-Smith (2001), and also Shanahan (2004), for relevant discussion. Needless to mention, our refusal of adaptationism does not in itself imply that we discount the potential of the adaptationist research program to bear fruit along the other two research guidelines.

If only for the sake of understanding the real force of K&M's criticism, it might be advisable to entertain a parallel categorization of the oft-noted different interpretations of minimalism, which can be achieved basically by replacing 'adaptation' and 'natural selection' in the above discussion with 'optimality/ simplicity' and 'the third factor', respectively.[4] On one hand, science is guided by

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[4]   However, let us stress from the outset that we are *not* claiming that the three aspects of mini-

a research methodology that seeks to eliminate redundancies in assumptions as much as possible, and thus calls for parsimony and simplicity in theory constructions — the usual 'Occam's razor' considerations, indeed a general feature of any theoretical inquiry. In the case of biolinguistic inquiry, this generic research methodology substantiates itself in what is often referred to as 'methodological minimalism'. It takes the notion 'simplicity of language' primarily as a good "organizing concept", and regards the search for simplicity and optimality in this object of inquiry as offering the best research heuristics for biolinguistic inquiry, largely independent of claims about the actual relevance of the third factor to the design of FL. On the other hand, minimalism is also understood as a substantive empirical hypothesis about language design, that language is in fact optimally designed for elegance, thus taking the concept 'simplicity/optimality of language' as having substantive empirical content. This position is what is often called 'substantive minimalism'. We may further say that substantive minimalism in principle allows at least two different interpretations. Let us say that 'empirical minimalism' is the empirical hypothesis which holds that it is possible to predict and explain the entirety of the architecture of FL by attending only to the role played by the third factor, and that we can safely ignore all other factors and focus on optimization by the third factor for the purpose of understanding the whole design of FL. 'Explanatory minimalism', by contrast, holds that optimal design is the most theoretically interesting *explanandum* in biolinguistics and that the third factor should be the primary solution to understanding it. Thus, the third factor remains to be a central concept in explanatory minimalism even if its optimizing effect may eventually turn out to govern only a fraction of language design.

We must concede that empirical minimalism is plainly implausible — it seems indeed "too much to expect" (Chomsky 2004: 106) at the current stage of understanding. First of all, empirical minimalism in its strongest interpretation amounts to denial of any significant relevance of the first factor (genetic endowment) and the second factor (external stimuli from the environment) to language design. This cannot be right, if only because language is a genetically grounded, species-specific trait, and its maturation in a particular individual requires at least three to four years of complex social interaction with the speech community.

Moreover, even if we grant a weaker interpretation of empirical minimalism as a claim of explanatory priority of the third factor and its optimizing effect, it is still a rather daunting hypothesis, *prima facie* easy to refute. Arguably, it is primarily to this refutation that K&M make a rather sound contribution by citing various signs of imperfection in language design. However, just as rejection of empirical adaptationism does not entail exclusion of the other two

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malism discussed below are mutually incompatible. Rather, they should be regarded as mutually supporting *dimensions* of one and the same research program (see below). The everlasting centrality of the notion of simplicity that figures in various aspects of the generative grammatical research since its earliest stage of development is explicitly acknowledged by Chomsky (1955). The earlier work by Nelson Goodman (and also W.V.O. Quine) on the general notion of simplicity is particularly influential in this respect (see Tomalin 2003 for related discussion).

kinds of adaptationist research, K&M's refutation of empirical minimalism by no means justifies their conclusion that the whole minimalist enterprise is unwarranted. It is rather regrettable to observe that K&M seem to regard their criticism of minimalism as completed just by simply referring to a small set of ill-understood drawbacks of language design. Even more puzzling is the observation that K&M's relatively sound criticism of the current minimalist literature is invalidated by their unmindful (if not deliberate) adoption of empirical adaptationism. Incidentally, K&M's misinterpretation of the minimalist enterprise is quite reminiscent of the oft-made mistake in philosophy of biology that Godfrey-Smith identifies. That is, just as the adaptationist research program in its entirety should not be frowned upon solely by attending to apparent counterevidence to empirical adaptationism, methodological and explanatory minimalism cannot be disproved simply by citing examples of apparent imperfections in language design.

Let us emphasize, along with Godfrey-Smith, that the three forms of adaptationism and minimalism are not so much mutually exclusive partitions as mutually supporting *dimensions* of the shared research program (see footnote 4). In this context, it can be somewhat puzzling to admit that one can make a legitimate decision to put forward claims of empirical adaptationism or empirical minimalism *as effective research heuristics*, thus utilizing the very empirical thesis for methodology's sake. Indeed, this is the reading that Godfrey-Smith proposes to grant to, for example, the strong adaptationist take by Richard Dawkins. Minimalism's advancement of the SMT can and should be understood in a similar vein, too. Thus, it often happens that postulations of unwarranted redundancies or questionable stipulations in the model of FL are refuted as not deducible from the SMT — a very weak argument in itself, if only because we have only a partial understanding of the third factor at present, but nevertheless of some heuristic value. If anything, K&M's misunderstanding of minimalism as presumption of optimality in language may be partially rooted in their failure to appreciate the legitimacy of such options. Of course, K&M and others can question the fruitfulness of this sort of approach, again perfectly legitimately.

By acknowledging the current weakness of empirical adaptationism and empirical minimalism, we are only restating the virtual truism that the factors entering into biological evolution cannot be exhausted either by natural selection or physical constraints. Pluralism, instead of the belief in the omnipotence of natural selection, is the norm in evolutionary biology today. Reference to evolvability is justified in every respect in a biological study of language, but K&M miss the point that evolvability cannot be defined solely in terms of adaptation by natural selection. Obviously, natural selection only serves as a filtering condition on pre-existing variations, and the primary question is how these variations first came into existence. In other words, arrival of the fittest, instead of survival of the fittest, is the core issue in any evolutionary study. It is in this context that the primacy of physical constraints on possible forms is emphasized in modern biology as well as in biolinguistic minimalism (the third factor). Thus, Chomsky (2004: 105) stresses that "natural selection can only function within a 'channel' of options afforded by natural law", which is essentially a restatement of Stephen Jay Gould's remark on the importance of physical channels. Chomsky (2002: 140–

141) also suggests the possibility that "the whole of evolution is shaped by physical processes in a deep sense, yielding many properties that are casually attributed to selection". More recently, Fitch (2010) points to the tight connection between selection and constraints (developmental and otherwise) in his discussion on evolvability; "the mutually informative roles of selection and constraints are now accepted by most biologists as important aspects of biological and evolutionary explanation" (p. 63). The central role played by natural laws in evolution is discussed in detail also by Fodor & Piattelli-Palmarini (2010), who argue intensively that natural selection does not have strong explanatory force in naturalistic studies of evolution, and if their observations have attracted harsh criticism from biologists (see, for example, Futuyma 2010), that is so because they sound as if they are just attacking a straw man of empirical adaptationism, which cannot reasonably be called "What Darwin Got Wrong" because Darwin never believed it in the first place. He concluded his Introduction to *The Origin of Species* by explicitly writing that he was "convinced that Natural Selection has been the main but not exclusive means of modification".

Needless to say, whether or not the other versions of adaptationism (methodological and explanatory) are promising is a totally different matter, and without doubt many biologists remain strongly committed to them, still attending to natural selection as a primary explanatory concept. It seems justifiable to say that biolinguistic minimalism departs from this tradition, in the sense that it puts forward the SMT both as a heuristic working hypothesis and as an empirical conjecture, primarily focusing on advancing the discovery and demonstration of the third factor principles and the sense in which they optimize the design of FL (and of biological organisms in general). The choice between methodological/explanatory adaptationism and methodological/explanatory minimalism cannot be made *a priori*, and we hope that both positions have their own contributions to make for the future progress of biolinguistics; perhaps a successful reconciliation or unification of the two approaches will be a key factor for our comprehensive understanding of human language, and we are more enthusiastic than anyone else to learn about an adaptationist account, if any, of the origin and evolution of the computational system of language, whose internal mechanism is most unlikely to fit in with the notion of adaptive fitness.

Recall also that the new framework of evo-devo is characterized, in part, by its shift of focus from adaptation to constraints on developmental processes in explaining evolution (and also by its departure from genetic determinism). The reemerging strong interest in morphology and laws of form, which dates back to the days of Goethe, is changing our view of how new biological species and traits emerge. Perhaps a simplistic dichotomy of adaptation vs. constraints is inappropriate, and a pluralistic approach to evolution is called for more than ever today. This standpoint of New or Expanded Synthesis is fully compatible with the minimalist view on language design and language evolution that proposes to take the third factor into fuller consideration.[5]

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[5]   Let us add in this connection that K&M's sympathy with an optimality-theoretic account of parametric variation among languages stands in direct opposition to their own standard of

Before closing this section, we would like to note that the notion of evolvability is to be regarded with more or less the same status as that of optimality (recall the discussion in section 2) since at present, we have little understanding of laws and principles that constrain the class of possible evolutionary (and developmental) processes, of which attested specimens might be only a tiny accidental fraction. If we are hoping for a better understanding of biological and language evolution, we have to "learn about the conditions that set the problem in the course of trying to solve it"; that is, we have to seek insights into the conditions on evolution and development, imposed by natural law (i.e. the third factor), in our theoretical inquiry into the nature of any biological mechanism, including human language. To this end, we need to reject any aprioristic adherence to a particular framing of the relevant issues, empirical adaptationism being a typical example.

In this section, we have pointed out that current understanding of evolutionary processes in the biological world requires all sorts of theoretical explanations as well as speculations that are by no means exhausted by adaptation by natural selection, and hence that the notion of evolvability, if defined solely in terms of adaptation, cannot serve as a legitimate constraint on linguistic theorizing. Instead, it has to be framed from a pluralistic viewpoint, in conformity with the emerging new picture of biological evolution. Correspondingly, K&M's rejection of minimalist inquiry into the relevance of the third factor to language design, which amounts to empirical adaptationism, cannot be tolerated as a rational and naturalistic approach to the evolution of human language. We conclude that although K&M's call for an evolvability constraint on linguistic theory is sound and fair in itself, it is exactly because of this constraint, properly understood in light of modern evolutionary thinking, that minimalism stands as a promising research agenda.

4.   Emancipating Biolinguistics from Methodological Dualism

We saw in the previous sections that K&M's criticism of the minimalist endeavor was largely based on (i) their misunderstanding of the minimalist program as aprioristic presumption of perfection, and (ii) their unbalanced formulation of the constraint of evolvability. We regard it as rather unfortunate that these serious flaws render their objection to the recent minimalist work almost invalid. In this section, however, we would like to express our sincere regard for K&M's otherwise sound and reasonable criticism of recent work in the purported minimalist framework.

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evolvability. They favor OT because it "captures the facts as a result of relaxing the demands of perfection and economy" (p. 206). According to OT, knowledge of language is seen as a set of competing constraints, with different rankings among them giving rise to different types of grammar. This kind of theorizing fares well if one's sole concern lies in a neat description of language variation. The problem is, of course, that those OT constraints, and their rankings, because of their highly language-specific composition, are not something one can expect to find a biological and evolutionary explanation for, particularly if one is committed to the kind of adaptationist program K&M tacitly recommend.

We noted that the minimalist program seeks signs of optimality in human language only as an intermediate step toward the attribution of them to third factor principles that are yet to be discovered.[6] However, it is admittedly the case that most practitioners of minimalism rarely present serious discussion on the third factor of language design. In fact, the scarceness of pertinent discussion in the minimalist literature may partially justify K&M's failure to notice the importance of this fundamental concept. It is a regrettable fact that minimalism is often misconstrued, sometimes even by those researchers who count themselves as practitioners of this research program, as a dogmatic or authoritarian excuse to disrespect empirical problems and take advantage of vaguely and arbitrarily invoked notions of simplicity and optimality in favor of their favorite descriptive technologies.

The worrisome descriptive tools put forward in self-described minimalist work include, to mention a few, the proliferating cartography of functional categories,[7] an intractable number of parameters (micro or macro) distributed over different modules of FL,[8] countless uninterpretable features ('viruses') that are stipulated to selectively attract neighboring X^0s and XPs,[9] and massive stipulations of head- and phrasal (remnant) movement to accommodate, for example, the universal linear order template (Specifier–Head–Complement) of Kayne's (1994) LCA.[10] We regard these descriptive technologies as a residue of the earlier pre-minimalist practice of enriching UG from descriptive pressures. To the extent that they are claimed (admittedly on questionable premises and with auxiliary assumptions) to achieve some descriptive adequacy, we should regard them not as a final explanation but as a first descriptive approximation of the data to be explained in terms of the three factors in the language design (Chomsky 2005). Whether we really need to live with these *prima facie* imperfections is purely an empirical question, but little discussion is provided regarding how these constructs relate to the third factor or, if not, how they are ever acquirable from the impoverished primary linguistic data. Discussion of learnability and/or biological plausibility is really a *must* for the advocates of these technical concepts, and the apparent scarceness of any such justification must have made K&M and others queasy. 'Conceptual' arguments from arbitrarily defined notions of optimality are occasionally provided for these constructs in the literature, but most of them are largely irrelevant to, and, even worse, rather noticeably contradict, the real concern of evolutionary/biological adequacy.

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[6]   This is not to deny the possibility that adaptation by natural selection can be one of the decisive optimizing factors for some particular aspects of the biological world.

[7]   See Cinque (1999, 2002), Rizzi (2004), Cinque & Rizzi (2010), and references cited therein. See Narita (2010a) for criticism.

[8]   See Newmeyer (2005, 2006, 2008) for serious criticism. See also an inconclusive reply to Newmeyer by Roberts & Holmberg (2005).

[9]   See Boeckx (2010, to appear) and Narita (2010a) for criticism of the unconstrained use of features.

[10]   See Kayne (1994, 2004, 2009). See Fukui & Takano (1998), Chomsky (2004), Richard (2004), Narita (2010a, 2010b), and references cited therein for criticism of the LCA. Incidentally, Kayne is right in admitting, in response to Chomsky's (2004) charge that the LCA is an 'imperfection': "It might alternatively be the case that our initial intuitions about perfection vs. imperfection (in this technical sense) are not fully reliable" (Kayne 2004: 4–5).

In a nutshell, stipulating arbitrarily formulated conceptions of 'optimality', let alone presuming them, is very much at odds with the minimalist quest for an evolutionarily or biologically adequate theory of FL (see Fujita 2007 and Narita 2010a). We completely agree with K&M on this point. More generally, we take the essence of K&M's suggestion to be that we should not be trapped by any prejudices or arbitrary anecdotes regarding the nature of the object of inquiry, a sound warning that supports K&M's criticism of the actual practice of purported minimalists, while it simultaneously invalidates K&M's own adherence to anti-minimalist imperfectionism.

This discussion leads us to a natural conclusion: We had better not commit ourselves to what Chomsky (1995a, 2000b) calls *methodological dualism*, a view that "we must abandon scientific rationality when we study humans 'above the neck' (metaphorically speaking), becoming mystics in this unique domain, imposing arbitrary stipulations and *a priori* demands of a sort that would never be contemplated in the sciences" (Chomsky 2000b: 76). So-called semantic externalism (Putnam 1975, Dummett 1986, among many others) was originally subsumed under this methodological category, but it rather straightforwardly applies to such research doctrines that are entangled in mystic presumption or terminological manipulation of vague and arbitrary notions of optimality or evolvability (see Kuroda 1999, 2009, Hinzen 2006, and Narita 2009b for related discussion). This insidious doctrine is counterposed to *methodological naturalism*, a naturalistic approach to the mind that "investigates mental aspects of the world as we do any others, seeking to construct intelligible explanatory theories, with the hope of eventual integration with the 'core' natural sciences" (Chomsky 2000b: 76). Specifically, at the current stage of understanding, where little is known about the three factors of language design and their interactions, we should proceed to study human language as it is, without any preconception about what we can eventually learn from this domain of inquiry. This naturalistic inquiry may be benefited by adopting the SMT as a conjecture or as a heuristic working hypothesis, but only to the extent that it is reasonable.

Contrast this overall picture of naturalistic inquiry with the dualistic speculation that apparently underlies K&M's discussion. The speculation is to the effect that biology is different from physics, with language exclusively belonging to the domain of the former. Marcus (2008: 115), in expressing his discontent with minimalism, explicitly states: "[W]hat works for physics may well not work for linguistics. Linguistics, after all, is a property of biology — the biology of the human brain — and as the late Francis Crick once put it, '[i]n physics, they have laws; in biology, we have gadgets'". He continues that "evolution is often more about alighting on something that happens to work than what might in principle work best or most elegantly; it would be surprising if language, among evolution's most recent innovations, was any different".[11] The kind of alighting effect

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[11]   And because language is such a recent innovation, K&M argue, there must have been little time for "debugging" (p. 190). We take this to mean nothing more than that natural selection did not have enough time to modify the design specification of language. The two sides agree that optimality of language design cannot be explained by natural selection. From this, K&M reason that language cannot be optimal; our alternative reasoning is that natural

mentioned here has been known as tinkering or bricolage (*à la* François Jacob) and it is an important facet of biological evolution, but still it has to be emphasized that tinkering is still constrained by the laws of physics. To say that biology and physics are categorically distinct and unrelated, that there is nothing in biology (and linguistics) that can be understood in terms of natural laws, is plainly a dualistic attitude which hinders the progress of a highly interdisciplinary project like biolinguistics. In fact, as Dawkins (1988: 15) once put it:

> The biologist tries to explain the workings, and the coming into existence, of complex things, in terms of simpler things. He can regard his task as done when he has arrived at entities so simple that they can safely be handed over to physicists.

Thus the division of labor between biology and physics must be pursued with the eventual goal that biological issues will someday turn into physical issues (though probably not by simple reduction), rather than adopting the ungrounded belief that biology will never come into contact with physics; the development of biophysics in the domain of morphogenesis is a clear exemplar of the still-developing progress of scientific unification of precisely the type for which we advocate. Biolinguistic minimalism can be seen as nothing more than a linguistic version of modern biology which is making every endeavor to disentangle the surface complexities of the biological organ which we call language, so that those complexities may eventually be explained by simple primitives and universal laws of nature.

5.   Remarks on the Metaphysics of Minimalist Biolinguistics

Before concluding the discussion, we would like to remark that methodological naturalism, if couched in minimalist terms, is closely connected to naturalism of a *metaphysical* sort, too, which is quite reminiscent of the fact that methodological dualism was historically contingent on the corresponding metaphysical mind–body dualism of the Cartesian sort.

At the time of Descartes, at least, there was a naturalistic definition of the physical, which was based on 'mechanical philosophy', a metaphysical doctrine dominant in the 17th century. The physical (body, matter, etc.), as conceived of in mechanical philosophy, was defined as any material substance with three-dimensional spatial extension; such material, and only such material, could move and participate in Descartes' contact mechanics. In pushing this hypothesis, Descartes categorically rejected the relevance to physics of any mystical forces or powers, "occult qualities" of sympathy, antipathy, and so on, presumed in the then-dominant Scholastic and Aristotelian view of the world, and put forward a very strong empirical hypothesis that all phenomena of motion are to be explained strictly in terms of immediate contact of contiguous materials. The Carte-

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selection alone is therefore unable to explain language evolution or, for that matter, biological evolution in general.

sian mechanical philosophy was quite congenial to our common-sense under-
standing of the world (folk physics), so intuitively appealing and intelligible to
our common-sense understanding of the world that we often forget that this
mechanical conception of the physical was effectively demolished by one of
Newton's discoveries in the late 17th century. Specifically, Newton's notion of
gravity affects objects at a distance, without any medium of body. Thus, his pro-
posal was regarded by the leading scientists of the day as a reintroduction of an
"immaterial", "occult" cause that Cartesian contact mechanics had eliminated
long before. The mechanical philosophical conception of the material world,
where causality among the physical is confined to immediate contact of the phy-
sical as a matter of principle, thus turned out to be a wrong scientific hypothesis.

When metaphysical mind–body dualism declined, we were explicitly told
by Newton's discovery that we have no valid, metaphysically closed framework
of the physical that partitions off the domain of application of physical laws as a
matter of principle. This conclusion troubled Newton and his contemporaries a
lot, and he was often accused of reintroducing an immaterial occult force to the
domain of physics. But, at least for the purpose of pursuing cognitive sciences,
we can regard this Newtonian conclusion as advantageous: Thanks to Newton,
there is no longer a well-defined boundary for the coherent physical domain in
the post-Newtonian era, and correspondingly, there is no longer any principled
reason to exclude the possibility that the set of laws of physics, chemistry, mathe-
matics, and other natural sciences are also applicable to the domain of the mind
as well. We can only conjecture, as Descartes did, that the creative aspect of lang-
uage use (Chomsky 2000, 2009a; see also McGilvray 2009a, 2009b, and Narita
2009b) still somehow resists explanation in terms of these natural laws, but the
possibility becomes an open empirical question for mental computational mecha-
nisms discovered by contemporary biolinguists and carefully delineated from the
boundless creativity of language use. There are indeed quite a few general laws
of nature that have been discovered and independently justified by physicists,
mathematicians, and other scientists as empirically necessary in their domains of
inquiry. Some of these empirically necessary postulates might eventually turn
out, probably with the help of further abstraction and refinement, to be operative
in the design of FL, too, in which case such principles will enter into the category
of the third factor of language design. Indeed, the null hypothesis is that the
general laws of nature are also applicable to the mental aspects of the world. The
*in*applicability of them to a certain domain, say of language, would be a non-
trivial empirical finding that calls for explanation.

Taking this null hypothesis seriously, investigation into the third factor of
language design regards even mental phenomena like language as sources of
data that might turn out to be susceptible to accounts in terms of general laws of
nature. Along these lines, we would like to point out that minimalist inquiry can
be seen as proposing a somewhat unconventional variety of 'metaphysical natu-
ralism'. Metaphysical naturalism, whose essence basically amounts to denial or
non-employment of metaphysical dualism, is almost always equated with the
reductionist thesis called 'physicalism' or 'materialism' in the philosophical tra-
dition, which holds that only the physical (or the observable) is real and that the
mental can and should be reduced to entities of those categories (see, e.g., Chom-

sky 2000b: 79ff. and 143ff. for discussion of varieties of alleged naturalism and materialism). However, the equation is only illusory. The upshot of the above-mentioned Newtonian conclusion is that we no longer have any scientifically coherent definition of the 'physical' to which we can reasonably entertain any meticulous reduction. Thus, unless some alternative characterization of the physical (body, matter, etc.) is provided, any statement of the form "everything there exists in the world is physical" diminishes to an uninteresting proverb of little empirical import (see Stoljar 2000, 2001, 2006, Chomsky 2009b, and Narita 2009b for related discussion). Rather, the notion of physicality, just like optimality and evolvability, is not something that can constrain, let alone serve as the 'reduction base' for, the study of the mental. It is instead something that we must study through investigation into various aspects of the world, mental and otherwise. Time will tell how feasible such research is, but there is no reason to discredit the fact that human language constitutes an interesting specimen of the natural world that happens to admit scientific exploration to some extent, and the hope is that we can eventually find laws and principles that are operative in the design of FL as well as the other aspects of the world. Furthermore, to the extent that we can make any empirical progress in this line of approach, we are heading toward the eventual unification with other natural sciences that biolinguistics, as well as earlier Cartesian studies of the mind, have long been looking for, an overarching desideratum that amplifies the contemporary significance of minimalism, especially of the 'explanatory' dimension mentioned above.

This kind of research is methodologically naturalist in that it does not admit any stipulated differentiation of the methods of inquiry. Moreover, it is metaphysically naturalist in that it does not allow itself to be entangled in any stipulated preconceptions or partitions of the world ("evolution yields imperfection", "language is (im)perfect", "the mental is reduced to the physical", etc.), and it searches for overarching laws and principles whose effects crosscut both physical and mental aspects of the world. No success is guaranteed, but this is again a familiar feature of naturalistic inquiry.[12]

6.   Concluding Remarks

As we saw in the previous sections, K&M's insistence that evolvability should be a central constraint on linguistic theorizing, though sound in principle, cannot carry much force unless it reflects the full range of complex factors that drive biological evolution, many of which remain rather unclear at the current stage of understanding. We pointed out that K&M's conception of evolvability is specifically prejudiced toward Neo-Darwinian adaptationism and fatally flawed by what we have called the fallacy of empirical adaptationism, and that imposing such a presumptuous framework on biolinguistics might not foster empirical discoveries in

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[12]   See also Chomsky (2007a) and Narita (2009a, 2009b) for related discussion on Hinzen (2006) and Uriagereka's (2009) approach to the issue of 'naturalization of meaning'. See also McGilvray (2009b).

the domain of inquiry. We noted that it is quite unfortunate that K&M's otherwise reasonable and partially justifiable objection to the body of current minimalist literature is marred by (i) their misunderstanding of the SMT as an aprioristic presumption of optimality and (ii) their adherence to anti-minimalist imperfectionism based on their biased view of evolution. Notwithstanding these flaws, we remain obliged to K&M in that their criticism has illustrates exactly why practitioners of the minimalist enterprise should stop inventing stipulative technologies without scrutinizing their biological plausibility, and that we must also be careful not to make use of undefined notions of optimality as unwarranted justifications for arbitrary conclusions. This amounts to just another recommendation of methodological naturalism (Chomsky 1995a, 2000b), which we may hope to invest with some metaphysical import, too, as future biolinguistic inquiry under the guidance of the SMT might reveal.

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