Introduction to the Special Issue on Parameters[1]

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1. Introduction

Suppose a child has to literally *learn* his/her mother language on the sole basis of positive evidence (no corrections are part of the process). Suppose that the grammar has 100 rules and that the child has to learn them all by "fine-tuning." As an extreme idealization, suppose the child receives one new *type* of sentence every second. How long would it take for the child to accomplish this task that is, acquiring the correct grammar for the language? Robert Berwick (in a yet unpublished work) has made the calculation. The stunning answer: 150 centuries! 15,000 years! This can be called Berwick's paradox. Even admitting, for the sake of prudence, that this calculation is inflated, that the correct answer is orders of magnitude less, say, "only" 1,000 years, we are still wildly off what we know about real language acquisition. Something totally different must be going on. What?

Our best guess is a schema based on Principles-and-parameters. Differences between languages are discrete, not continuous. There is a limited number of points of variation and, on each one of these, differences reduce only to the choice of a binary option (+ or -). A further idealization is that one single "signature sentence" (a trigger) (Gibson and Wexler, 1994) suffices to reveal which value (+/-) the local language has chosen. By being exposed to that sentence, the child instantly acquires the value of that parameter. Those signature sentences are triggers for acquisition.

This picture is based on some core assumptions: The "learner" (the child) has all these different potential grammars already available (innately) and has the capacity to check incoming sentences against the temporary grammar he/she has conjectured so far. He/she always instantly knows whether a new sentence is, or is not, compatible with the conjectured grammar, knows how to shift to a different grammar by resetting the relevant parameter and does that only if strictly necessary, that is, only if the new value for the parameter renders the new sentence well-formed.

Needless to say, even this idealized picture generates some major problems. Even with just 30 binary parameters, we have over a billion of possible complete grammars. The exploration space is still enormous. Are there "default" (unmarked) parameter settings? For all parameters? Only for some?

Instant convergence is an idealization (See Charles Yang, 2002, for a probabilistic rapid convergence) and the contribution by Sakas, Yang and Berwick in this issue. Are all parametric values really only binary? What if two or more different re-settings of parameters can make a trigger sentence grammatical?

In Government and Binding Theory there were more problems (see Chomsky and Lasnik, Chapter 1 of the 1995 The Minimalist Program volume), some have disappeared in Minimalism, but some are still with us. The questions in GB Theory were whether parameters are located at D-structure or at S-Structure, at the interface with LF or at the interface with PF? Are there only macro-parameters, only micro-parameters, or both? Each of the (then) modules of syntax was a candidate for parametric variation across languages. This is presently radically reconsidered in Minimalism, as Part 1 of this issue will show.

The problem of an exceedingly vast space of exploration was initially reduced by Hagit Borer (1981), suggesting that parameters are restricted to functional categories, then by Mark Baker (1996), postulating a hierarchy: a parameter is fixed first, then, depending on how that parameter value is fixed, a second (lower) parameter is fixed, and so on. But let's briefly go back to the very beginning of the inquiry regarding parameters.

The first seed of a parametric conception of language differences (before the term parameter was used explicitly) is due to Luigi Rizzi (Rizzi, 1978, reprinted in Rizzi, 1982) in his famous (in hindsight) footnote 25, in which issues of learnability were already predominant. A selection of problematic sentences in Italian versus English from that footnote is:

> *L'uomo di cui ritengo che la sorella maggiore sia innamorata di te e' Gianni.*
> The man of whom I believe that the elder sister is in love with you is Gianni (= the man whose elder sister…)

> *L'autore di cui alcuni racconti sono stati pubblicati recente-*
> *mente e' mio fratello.*
> The author by whom some tales have been published recently
> is my brother.

Rizzi observed that English obeys *both* the wh-Island Constraint *and* the Subject Constraint, while Italian seems to obey neither. One possibility would have been to suppose that the Subjacency Condition[2] is not part of Universal Grammar, but applies in some languages, though not in others. Another brilliant solution was that the Subjacency Condition is indeed universal, but the choice of cyclic nodes (the application of the Binding Principle) has a "binary" option: Bounding categories in English are: S', S, NP and PP, while in Italian and French S' is a bounding node, but S is not (see also Sportiche, 1981): i.e., English [+S bounding, the unmarked choice] Italian and French [-S bounding, the marked choice].

In the same year, Tarald Taraldsen (1978) expanded this kind of binary approach to the null subject parameter and highlighted several consequences, stressing that a parametric choice has immediate consequences for apparently unrelated syntactic differences between languages. The "Taraldsen Generalization" corresponds to the idea that there is a connection between the occurrence of empty subjects in finite clauses and the morphological "richness" of the verbal agreement. More precisely, according to Taraldsen the NIC (Nominative Island Condition) does not apply to null subjects in Italian because the agreement feature of the finite verb binds the nominative anaphor.

Soon after, Jean-Yves Pollock (Pollock, 1989) adopted this approach to differences in inflection between Romance and English, stating that Inflection lowers onto the verb in English while the verb raises to Inflection in French and Italian.[3]

The quest for parameters intensified in the following years, sometimes threatening an inflation of micro-parameters. For instance, Longobardi and Guardiano proposed 30 parameters in 2003 just for NP (Longobardi and Guardiano, 2009), and a full 74 parameters in 2017—see his contribution to this issue). Some (for example New-

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[2] The Subjacency Condition (Chomsky 1973): In the structure: ..X..[$_a$...[$_b$.. Y...]...]...X.. no rule may "involve" X and Y, where α and ß are bounding categories.
[3] For a detailed historical reconstruction of the emergence of the notion of parameters see the remarkable dissertation of Alessandro Riolfi (2017).

meyer, 1996) claim that an excessive proliferation of parameters makes the parametric approach indistinguishable from a classic rule-based grammar. We will, in fact, see in Part 2 of this issue that some have abandoned this idea and offer alternatives that the reader will evaluate.

2. Summary of the contributions

In this section, we try to summarize the insightful contributions to this special issue.

2.1 Part I: Parameters? They *do* exist

Luigi Rizzi aims at properties of classes of verbs, not individual verbs, and classes of relevant morphosyntactic features, not individual features. He suggests three kinds of parameters:
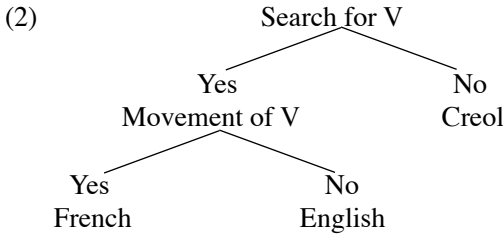
- Merge parameters, operating on structure building,
- Movement parameters, triggering different kinds of movement and,
- Spell-out parameters, giving instructions on the syntactic positions that are or are not pronounced.

<div align="right">(see also Rizzi, 2014)</div>

A parameter is an instruction for the triggering of a syntactic operation, expressed as a morphosyntactic feature associated with a functional head. Adopting a central view of Minimalism—that each operation is triggered by a morphosyntactic feature—Rizzi suggests that we may envisage the following general definition of the format for parameters:

(1)   X has F

in which X is an element of the functional lexicon, and F is a morphosyntactic feature triggering syntactic operations of merge, move, and spell-out. X may have F in one language, and not in another language; there is a binary choice.

(2)

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                        Search for V
              Yes                      No
        Movement of V                  Creol
    Yes              No
   French            English
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In SVO languages we have a search from a Phi-type head to the closest nominal expression in its domain, followed by internal merge of the goal to the projection Specifier of the probe Phi. In VSO languages the search relation between Phi and Subject is established, so that agreement in Phi features is checked, but not followed by internal merge of the goal.

In conclusion, Rizzi suggests that move parameters involve two pairs of featural instructions, one involving search and internal merge for a phrase, and the other involving search and internal merge for a head. He adopts the idea that linearization is an extra-syntactic process, taking place when syntactic representations are transferred to the sound/gesture system. In this view, the relevant parametric properties would involve spell-out parameters, which could also be associated with the functional entries of v, n, etc.

An interesting point made by Rizzi concerns the left periphery, which is populated by a sequence of "criterial" functional heads such as Top[ic] and Foc[us]. Criterial heads attract to the left periphery phrases that are endowed with matching features, and guide the interface systems to interpret the configuration in the appropriate way (e.g., as Topic—Comment), and to assign the special intonational properties that go with these configurations.

The West African language Gungbe marks both topics and foci with overt particles (yà and wè respectively), occurring in the left periphery. This can be recursive, as in Italian, English, and other languages. The parametric options are [+One Topic Only, -One Topic Only]. The language system, as is well known, does not "count," so it is one or many.

Mark Baker, drawing very heavily on his extensive recent work on structural case (reported in Baker (2015) and related publications), stresses the urgency of the distinction between macro-parameters and micro-parameters by claiming that structural case is a domain where

we find syntactic microparameters. This is a potentially important case, since it challenges the sense in the field that smaller-scale crosslinguistic variation can probably always be made consistent with the Borer-Chomsky Conjecture. It thus raises the possibility that we will find more truly syntactic variation when we look more carefully at even microparametric differences. Re-examining crosslinguistic variation in overt morphological case marking between ergative and accusative languages, Baker offers examples from Cuzco Quechua, a typical accusative language, in which he selects two intransitive verbs, one from the so-called unergative class, with an agentive subject, and one from the so-called unaccusative class, with a theme/patient subject, in order to show that they do not differ in their case marking properties. In contrast, the Shipibo language, genetically unrelated to Quechua, is a canonical ergative language: the object of the transitive verb has the same case marking as the subject of the intransitive verb, while the subject of the transitive verb has a distinct morphological marking, which is a significantly different pattern. Baker suggests that the overall typological picture can be filled out by including two additional alignment types: tripartite alignment and neutral alignment. Tripartite alignment is a relatively rare one in which transitive subjects, transitive objects, and intransitive subjects all bear different cases. This can be thought of as the result of a language having both accusative case marking (for transitive objects), and ergative case marking (for transitive subjects). The Nez Perce language exemplifies this clearly. It is interesting to note that there is crosslinguistic variation in how case marking happens inside DP; for example, the possessor inside a noun phrase can have ergative case, or dative case, or a distinctive genitive case. There are also some languages that allow more than one genitive inside a single DP, whereas others allow only one.

The ensuing central question is: is this a case of parametric variation, and if so, what kind? Baker suggests the following original case marking rules: a) If there are two distinct NPs in the same spell-out domain such that NP1 c-commands NP2, then value the case feature of NP2 as accusative; b) If there are two distinct NPs in the same spell-out domain such that NP1 c-commands NP2, then value the case feature of NP1 as ergative. These rules account for both ergative languages and accusative languages with remarkable simplicity and with pleasing symmetry—something that Agree-based theories have always struggled to do. Examples from Sakha, Amharic, Shipibo,

and Burushaski confirm the validity of the rules. It is clear that we do not see here macroparameters in the sense of Baker (1996). So which of the rules (a or b) is selected by a given language simply does not have wide-ranging effects on the grammar of the language. In his contribution, other examples from several languages are offered and discussed.

Finally, Baker tackles the Uniformity Hypothesis, according to which all languages have essentially the same syntax across the board, and all the apparent variation is in the realization of morphology at PF. He questions whether case is assigned in the same way in all languages, but is then spelled out differently in different languages. In a detailed analysis, with rich data and cogent arguments, Baker suggests that we abandon the strong version of the hypothesis—as his comparative analysis of VPs shows—concluding that we get a better fit between theoretical expectations and typological patterns if we assume that languages use different case assigning rules in the syntax, and agreement is sensitive to the results of those rules, that is, not to universal but to covert case distinctions. Considerations on language acquisition do follow (as we see in almost all the contributions to this issue). Baker's suggestion is that children's default assumption is that the case rules do not exist in their language unless they get direct overt evidence that they exist from the distribution of morphologically marked NPs. Therefore, he assumes that this syntactic parameterization is widespread, not just in languages which happen to have case-sensitive agreement. Against the Chomsky-Borer conjecture, Baker concludes that syntactic parameters exist, as well as morphological and lexical differences.

Hagit Borer was not able to send a whole new contribution so we asked her to let us republish one of her previous papers, and to write a fresh new introduction for it. In her introduction, she states that of the five questions which "I-Subjects" set out to answer, the four summarized in (3) continue to be at the forefront of linguistic investigations three decades later:

(3) a. What is the relation, if any, between the empty subject position in unaccusative constructions in null-subject languages and the insertion of overt expletive subjects such as *there* in English and *il* in French?

b. What determines the distribution of expletive subjects?

c. Do sentences have to have subjects (Chomsky's EPP)? And if so, why?

d. "Burzio's generalization" states that all accusative-assigning verbs must have a θ-subject. Is this generalization descriptively adequate? Can it be derived from other principles?

In her present work she rejects altogether the claim that the lexical verb assigns argument roles, or, for that matter, Case, to any of the event arguments occurring in its clause.[4] It is therefore worth noting that the "I-Subjects" system, as it stands, trades exclusively in grammatical features and their transfer, and makes no use of lexically-specified argument selection of any sort. In that sense, it quite possibly anticipates Borer's own increasing reluctance to construct grammatical structures on the basis of information specified in the entries of substantive lexical elements.

Guglielmo Cinque explores the fact that even the most rigid head-final and head-initial languages show inconsistencies and, more crucially, that the very languages which come closest to the ideal types (the "rigid" SOV and the VOS languages) are apparently a minority among the languages of the world, which makes it plausible to explore the possibility of a microparametric approach for what is often taken to be one of the prototypical examples of macroparameter, the "head-initial/head-final parameter."

He offers close (only close, never perfect) examples of the two ideal types, just for ease of exposition. This makes it easier to specify how much and where and why real languages differ from these ideal types.

SOV Japanese, Evenki (Tungusic), Maranungku (Australian) Wolaitta (West Cushidic), Mangghuer (Mongolic), Tsez (Northeast Caucasian), Malagasy (Malayo-Polynesian).

VOS Chol (Mayan), Sakun (Sukur) (Chadic), Tukang Besi (Malayo-Polynesian).

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[4] This is a considerable revision of the famous Borer-Chomsky hypothesis: that all parameters are in the morpho-lexicon. See the contributions by Baker and by Taraldsen for similar "revisionist" considerations.

MIXED Tongan (Oceanic,VSO/VOS)

The property which both the ideal head-final and head-initial word orders have in common is that whatever precedes the V/N/etc., reflects the order of Merge, and whatever follows is in the mirror image of the order of Merge (cf. Baker 1985). This, again, is an idealization based on the most rigid head-final and head-initial languages. The mirror-image order found postverbally and postnominally is however only the prevalent order; other, non-mirror-image, orders being possible.

In reality, actual languages (very possibly, all languages) depart from these ideal types to varying degrees, which are arguably a function of different combinations of the very same types of attraction. VP, NP, and each higher functional projection endowed with the same categorial feature, +V, +N, (in the case of VP the projections of aspectual verbs, auxiliaries, modals, tense, complementizers; in the case of NP the projections of number, diminutive, determiner, Case) are attracted by a corresponding +V,+N feature in the Spec of functional projections activated by each projection that hosts overt material. He goes on to say that in the ideal head-final word order type all higher (functional) heads follow the lexical V/N/etc., in an order which is the reverse of the order of Merge, and phrasal specifiers (arguments, circumstantials, and modifiers) precede V/N/etc., in their order of Merge.

Cinque suggests that harmony across different extended projections also seems to be more strongly influenced by "heads" with respect to their complements than by heads with respect to their phrasal modifiers, resulting in regressive pied-piping in head-final languages, and progressive pied-piping in head-initial ones. As mentioned before, he points out two departures from the ideal types: <u>First</u>, even the most rigid head-final and head-initial languages display a number of inconsistencies; <u>Second</u>, the very languages which come closest to the ideal types (the "rigid" SOV and the VOS languages) are apparently a minority among the languages of the world, which suggests that an absolutely uniform distribution of pied-piping features within and across categories is rare. However, not everything is possible. There are clear tendencies: in particular, there is a much stronger cross-category harmony when heads and their complements are involved (V/O and P/O), compared to situations in which heads and their modifiers are (V/AdvP and N/AP). Similarly, there is a stronger intra-category harmony in the extended projection of a certain lexical

head when heads (V, Modal, Aux; N PL Art) rather than modifiers (V AdvP1 AdvP2; N AP, RelC) are involved.

Tarald Taraldsen argues that whether or not a language has what seems to be a morpheme of a certain kind, it may be the consequence of the setting of some syntactic parameter rather than a matter of arbitrary variation between lexicons. The presence/absence of the clitic *ne* in a Romance language has syntactic consequences that cannot be accounted for simply by assuming that some languages have this kind of morpheme while others don't. Taraldsen also shows that treating *ne* as a morpheme blocks an adequate explanation of the data.

Furthermore, Taraldsen makes an explicit reference to Optimality Theory, in which constraints are violable but ranked, and violation of higher ranked constraints by other competitors makes it irrelevant that the optimal candidate violates a lower ranked constraint. He suggests that parametrization is effected by different rankings of the constraints. The contrast between examples he offers from Spanish, Portuguese, and Romanian, on the one hand, and Italian, French, and Catalan, on the other, do not simply follow from the lack of a morpheme with the properties of *ne* in the former group of languages, as would be consistent with the Borer-Chomsky Conjecture. That is, this conjecture fails to account for the ungrammaticality of the sentences he provides in his article.

Taraldsen's solution is the following: After providing reasons to think that *ne* corresponds to a syntactic phrase containing silent elements, he proposes an account of silent nouns in Spanish based on the idea that ellipsis is licensed in the Specifier-position of a phase head X. Then he outlines an analysis in which the presence of this X blocks the formation of a phrase that would correspond to *ne* in Spanish, Portuguese, and Romanian. Finally, the existence of *ne* in Italian, French, and Catalan is taken to reflect the fact that the relevant X is not a phase head in all syntactic configurations in these languages, and therefore, it is impossible to have a silent noun without *ne*.

Taraldsen suggests, in conclusion, that elements that are routinely analyzed as morphemes may in reality be syntactic phrases of which some ingredients are left unpronounced. Therefore, their absence or presence in a language may reflect syntactic parameters relevant to the formation of those phases.

Sakas, Yang and Berwick still believe that parameters are the best solution for the problem of language acquisition, but the value and benefit of this approach must be demonstrated. These authors aim to move beyond toy grammars and provide a large-scale study of parameter setting in a linguistically complex domain constructed by the research group at The Graduate Center and Hunter College of the City University of New York CUNY-CoLAG (Sakas and Fodor, 2011, 2012).

Sakas, Yang and Berwick show that different computer models of the acquisition process receive "treelets" from 360 real possibilities and the results can be regarded as a vindication of the parameter-based theory and its empirical reach. They suggest that we now have a plausible answer of what such a favorable hypothesis space looks like. It will benefit not only the STL and VL[5] models but all learning models that "modularize" the search for the target grammar along the dimensions specified by the parameters.

These authors conclude that the promise of parameters, in terms of both descriptive and explanatory adequacy, raises questions about their place in a broad theory of language as a biological system. Surely there couldn't have been piecemeal evolution for each of the parameters under current study,[6] and the success of parameters must ultimately be attributed to deeper principles of language and related systems in human cognition—the goals of the minimalist program. A deeper understanding of how children learn, which may well employ mechanisms not specific to a domain but shared across domains and species, will continue to shed light on the direction of linguistic research.

2.2 Part II: Parameters? Maybe not

David Lightfoot argues that children parse the external language they hear (E-language) and postulate specific I-language elements required for certain aspects of the parse, making use of what UG makes available, notably the bottom-up procedures of Merge and Project. The aggregation of those elements constitutes the complete I-language. When E-language shifts, children may parse differently and thus attain a new I-language, as revealed in work on syntactic change. Children discover variable properties of their I-languages

[5] (STL) = The Structural Triggers Learner, (VL) = Variational Learning
[6] Chomsky's perplexity on this issue was verbally expressed to one of us (MPP) in February 2017, during his visit to the University of Arizona. See also footnote 7.

through parsing; there is no evaluation of I-languages and no binary parameters.

Duguine, Irurtzun and Boeckx state that their goal is to provide empirical evidence that parameters are indeed quite problematic, and that alternative ways of capturing cross-linguistic variation are very much needed.

These authors criticize the clustering of properties proposed for certain parameters. For example, a classical argument in favor of the Pro-Drop Parameter comes from the clustering effects observed with other grammatical properties, such as (i) empty non-referential subjects, (ii) free inversion, and (iii) the absence of *that*-trace effects (cf. Rizzi, 1982). That the setting of a single parameter has large-scale consequences for a language is conceptually a virtue, since it provides a way to explain why there are groups of languages in which a set of grammatical aspects works identically.

The authors of this article, however, claim that it is not so. Offering cross-linguistic examples, they conclude that by only accounting for the null subject property (and not even fully accomplishing that), the Pro-Drop Parameter becomes a mere descriptive statement on the optionality of phonological overtness across languages, which makes it largely a theoretical construct with no explanatory power. Cases of Pro-Drop from Basque and from special English registers (diaries, newspaper titles and cooking recipes) are presented and shown that there are too many exceptions.

The overall conclusion in this article is that claims to the effect that Plato's problem has been solved due to parameters is premature. Instead, these authors suggest that it is high time we roll up our sleeves and go back to the drawing board to figure out how it is that children could navigate the vast space of linguistic diversity without domain-specific information of the sort parameters encoded. In sum, not only is Pro-drop not binary, they suggest, but it is not even discrete; there are multiple ways in which languages have an in-between status. In other words, the availability of pro is not language-specific, but rather construction-specific. The cross-linguistic patterns of Pro-drop are therefore far from what we could expect under a macroparametric analysis.

Before we move onto the contribution by Epstein, Obata and Seely and the short special Intro by Chomsky, let us mention Chomsky's present worry about parameters.

He raises the following question: Language emerged too rapidly and too recently to accommodate the notion of many parameters. How can evolution have endowed our brain with all those parameters? He concludes that there is too much stuff, that this abundance creates a real problem, and that Epstein et al's solution is the best we have thus far.

Epstein, Obata and Seely argue that in essence there are no binary switches associated with certain Principles of UG which are set to "on" or "off," where a particular specification of on/off parameter settings yields a particular I-language. Rather, following previous work, and Chomsky's Problems of Projection Extensions, UG contains only invariant, 3rd factor compliant operations—and there are very few of them, perhaps as few as three, or even less. These authors propose that parameters reduce (maybe completely) to cases of underspecification. Properties of the SM interface may require that individual languages must make one or another choice, as in the simple Head Parameter case of underspecification of UG. Their central thesis is that the independently motivated "computationally efficient satisfaction of the interfaces" ("the strong Minimalist thesis") in fact predicts what kind of cross-linguistic variation is allowed in the narrow syntax.

The authors continue by stating that there are different orderings of UG operations. The difference is *within-phase* ordering between Feature Inheritance FI and Agree (which is left unspecified by 3rd factor). That is, if C agrees before FI we get agreement of T with EA [External Argument]; if FI from C to T applies before Agree, then T, given copy invisibility and bearing phi, probes and finds the internal argument IA under minimal search. Thus 3rd factor underspecification leaves within-phase (non-Merge) rule ordering underspecified. Agree preceding FI is optimal, but so is FI preceding Agree. Since both are optimal, both are allowed. Examples from various languages are offered in this article to present the point the authors attempt to make. For example, in African Kilega: there is a "reverse" order in which feature inheritance and T-agreement apply when the shifted wh-object occupies outer spec-vP, so that T agrees with the shifted wh-object. This is a language where T agreeing with a shifted wh-phrase PRECEDES feature inheritance of T from C. Another case is presented from Haitian Creole versus Cape Verde Creole—C agreement after subject raising (in the former), versus C agreement before

subject raising (in the latter). Yet another case is represented by T to C movement in English and D to C movement in Kisongo Maasai.

In English, feature inheritance takes place after a shifted object wh-phrase at outer spec-vP undergoes further Internal Merge to Spec-CP. T inheriting phi from C minimally searches and finds EA at Spec-vP (i.e., subject agreement).

The authors finally raise the following fundamental question: since UG is constrained by 3rd factor, and 3rd factor laws are inviolable, how can there be any LINGUISTIC (i.e., narrow-syntax internal) variation? The key to the answer, the authors suggest, is the recognition that INVIOLABLE and UNIQUE are not the same. Third factor law is of course inviolable, but that does not entail that 3rd factor imposes a unique solution to satisfying the interfaces efficiently.

2.3 Part 3: Formal analyses

Giuseppe Longobardi proposes Modularized Global Parametrization (MGP) as an appropriate compromise between depth and coverage, studying relatively many parameters across relatively many languages in a single module of grammar. A rich dense table is offered: The alternative parameter states are encoded as "+" and "-". The symbol "0" encodes the neutralizing effect of implicational dependencies across parameters, i.e., those cases in which the content of a parameter is entirely predictable, or irrelevant altogether.

The conditions which must hold for each parameter to be relevant (i.e., not neutralized) are indicated in the second column after the name of the parameter itself. They are expressed in Boolean form, i.e., either as simple values of other parameters, or as conjunctions (written ","), disjunctions ("or"), or negation ("¬") thereof.

The author concludes that it becomes unnecessary to suppose that the initial state of the mind consists of highly specific parameters. Rather, it consists of an incomparably more restricted amount of parameter schemata, which combine with the appropriate elements of the lexicon (features and categories) under the relevant triggers in the primary data to both yield the necessary parameters and set their values for each language:[7]

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[7] Possibly, just possibly, another way to assuage Chomsky's evolutionary perplexity.

Siva, Tao and Marcolli [8] propose a model of language change, based on syntactic parameters treated like spin variables in a spin glass model, where the vertices of the underlying graph represent a set of languages, and edges connecting them represent language interaction. A new type of spin glass model is proposed, where entailment relations between syntactic parameters are clearly represented.

This article is based on Longobardi and Guardiano (2009) and Longobardi (this volume): The authors' Method (in bare essence) consists of the following:

(1)   data of syntactic parameters from the SSWL (Syntactic Structures of World Languages) and Terraling databases.

(2)   a measure of language interaction provided by estimates of bilingualism obtained from MIT MediaLab data,

(3)   Statistical Physics methods based on the theory of spin glass models.

Spin glass models simulate evolutions of systems exhibiting phase transitions and a range of behaviors from chaos to ordered phases, depending on a variable temperature parameter. They have also been widely used in the mathematical modeling of neural networks. The typical setting for a spin glass model consists of a network (a graph) where at each node one has a spin variable, while edges connecting nodes carry the interaction between the spins.

A spin is a variable that can take only a finite number of values. Usually it is assumed to be a binary variable, like a switch, that can only take two values, either up or down (the Ising model). However, it is often useful to consider cases where the spin variables can take more than two positions. Such multiplicity (usually limited to three possible values) has also been suggested in Linguistics for some parameters.

The physical model these authors use has two additional variables: a temperature variable T [9] and a coupling constant E, which they

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[8] An interesting example of mathematicians and physicists becoming concerned with linguistic core issues.

[9] The temperature, in this model, measures the intensity and frequency of interaction between languages. There would have been, for instance, high temperature between old French and old English after the Norman conquest. Such exchanges are likely to contribute to a resetting of some parameters.

refer to as "entailment energy," which is absent (equal to zero) in the case of independent syntactic parameters. "Entailment" may be more generally referred to as "inference" or "constraint." They use Strong Deixis and Strong Anaphoricity parameters and the Partial Definiteness and Definiteness Checking parameters.

The complex tables in this article show situations where a configuration of entailed parameters reaches an equilibrium state where parameters of the individual languages have undergone some changes, but have not always converged to a configuration where all the parameters are aligned. While in the first example one obtains complete alignment of all the parameters in the low temperature and low energy regime, in the second example, even in this range, parameters do not fully align. This shows that the presence of entailment between syntactic parameters can have a substantial effect on the dynamics that differs significantly in outcome from the case where one assumes an independence hypothesis on parameters.

Possible applications to language acquisition are mentioned in this article. Some interesting linguistic questions regarding parameters include whether there are default values of (some) parameters that are spontaneously temporarily set either innately or very early in development and that are switched in the presence of evidence enforcing a different value, or else retain their default. Such a hypothesis may be suitable for testing within a spin glass approach to language acquisition, by simulating dynamics under a range of statistically chosen initial conditions, with or without constraints on the values of certain subsets of parameters.

3. A brief conclusion and a caveat

We, the editors, along with the contributors to Part 1, are still convinced that there is something very valuable in the idea of parameters, for reasons of acquisition and of simplicity. Almost all our present authors refer to acquisition as the ultimate bench test, though not much is actually available (maybe a topic for a future issue?).

But we address to ourselves a caveat, a quote from a giant of immunology, immaturely deceased, before he could be awarded a much-deserved Nobel Prize: Charles Janeway (1943-2003). In 1989, opening a Cold Spring Harbor Symposium on immune recognition, he said:

> *I believe that ideas, especially good ideas, can so satisfy our desire to explain what we're studying that they can inhibit our ability to explore and to understand.*

Possibly, just possibly, the idea of parameters could be one of those ideas? Better stay alert.

Works Cited

1. Baker, M. (1985). The Mirror Principle and Morphosyntactic Explanation. *Linguistic Inquiry, 16* (3), 373-415.
2. Baker, M. (1996). *The Polysynthesis Parameter*. New York: Oxford University Press.
3. Baker, M. C. (2015). *Case: Its Principles and Its Parameters*. Cambridge UK: Cambridge University Press.
4. Borer, H. (1981). *Parametric Variations in Clitic Constructions*. Doctoral dissertation, Department of Linguistics and Philosophy, Massachusetts Institute of Technology.
5. Chomsky, N. and H. Lasnik (1995). The Theories of Principles and Parameters. In Chomsky, N. The Minimalist Program. Cambridge, Massachusetts: The MIT Press.
6. Gibson, E and K. Wexler (1994). Triggers. *Linguistic Inquiry* 25:3, 407-454.
7. Longobardi, G., & C. Guardiano. (2009). Evidence for Syntax as a Signal of Historical Relatedness. In J. Narbonne (Ed.), *special issue The Forests behind the Trees Vol 119*. *Lingua*, Issue 11 (pp. 1679-1706).
8. Newmeyer, F. J. (1996). Chomsky's philosophy of language. In E. K. Brown & J. E. Miller (Eds.), *Concise Encyclopedia of Syntactic Theories*. Amsterdam: Elsevier Science, (pp. 45-50).
9. —. (1998). *Language Form and Language Function*. Cambridge Mass.: The MIT press.
10. Pollock, J-Y. (1989). Verb movement, universal grammar, and the structure of IP. *Linguistic Inquiry* 20: 365-424.
11. Riolfi, A. (2017). A History of the Concept of Parameter in Generative Grammar. Unpublished Doctoral dissertation, Universita' Degli Studi di Verona.
12. Rizzi, L. (1978). Violations of the Wh-island constraint in Italian and the Subjacency Condition. In Montreal Working Papers in Linguistics 11, (Eds.), C. Dubission, D. Lightfoot. *Review*, 19, 151-162.

13. —. (1982). Issues in Italian Syntax. Dordrecht: Foris Publications.
14. —. (2014). On the elements of syntactic variation. *Linguistic Variation in the Minimalist Framework*, (Ed.) C. Picallo, 13-35. Oxford: Oxford University Press.
15. Sakas, W. G. and J. Fodor (2011). Generating colag languages using the "supergrammar." Online technical report: www.colag.cs.hunter.cuny.edu.
16. —. (2012). Disambiguating Syntactic Triggers. *Language Acquisition, 19*(2), 83-143. doi:10.1080/10489223.2012.660553
17. Sportiche, D. (1981). Bounding nodes in French. *The Linguistic Review* 1: 219-246.
18. Taraldsen, K. T. (1978). The Scope of Wh Movement in Norwegian. *Linguistic Inquiry, 9* (4), 623-640.